EXHIBIT 1 TO THE DESIGN-BUILD SERVICES AGREEMENT

New Service Center Program
Phase III

San Antonio **Water** System

Design Criteria Package (DCP)
RFP

September 2020

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I. OVERVIEW

A. STANDARD ABBREVIATIONS

B. PROGRAM GOALS

C. ESTABLISHED SPACE PROGRAM

D. FACILITY APPEARANCE/STANDARDS

E. FURNITURE, FIXTURES, AND EQUIPMNET (FF&E)

F. UTILITY SERVICES

G. INTERFACE WITH EXISTING/ONGOING SAWS OPERATIONS

H. PROJECT MANAGEMENT PLAN

II. SUPPORTING REQUIREMENTS

A. NORTHEAST OPERATIONS CENTER (NEOC) SCOPE SHEET

B. NORTHEAST SESRVICE CENTER (NESC) AT SAWS' NACO PUMP STATION

III. DESIGN PERFORMANCE REQUIREMENTS

A. DESIGN NARRATIVES

B. OWNERS MINIMUM REQUIREMENTS

IV. SITE LAYOUT

A. NORTHEAST OPERATIONS CENTER AERIAL IMAGE (NEW FACILITY)
B. NORTHEAST OPERATIONS CENTER AFFINITY DIAGAM (NEW FACILTY)
C. NORTHEAST OPERATIONS CENTER BUBBLE DAIGRAM (NEW FACILITY)
D. NACO PUMP STATION AERIAL IMAGE (EXISTING NESC SITE)

V. GMP BUDGET

A. SAWS PROJECT BUDGET

VI. SUPPORTING DATA

A. PROGRAM OF SPACES
B. ROOM DATA SHEETS
C. NEOC SITE SURVEYY
D. NEOC PRELIMINARY GEOTECHNICAL INVESTIGATIONS
E. NEOC DESKTOP ASSESSMENTS LETTER
F. PHASE I NSOC AS-BUILT DRAWINGS
G. MODIFICATIONS TO NSOC FLOOR PLANS FOR NEW NEOC
H. NEOC SAWS WATER MAIN EXTENSION DRAWINGS
I. NEOC SAWS SANITARY SEWER PROJECT DRAWINGS
J. NESC AS-BUILT DRAWINGS

I. OVERVIEW

This Design Criteria Package, also referred to as the "DCP," sets forth a comprehensive and definitive description of SAWS' design criteria for the Project to be completed in Phase III of SAWS' New Service Center Program. Definitions throughout this DCP shall be as defined in the Design-Build Services Agreement, of which this DCP is an Exhibit.

Please refer to the Supporting Requirements, beginning on page 8, for the criteria describing the Scope of Work for which the successful Design-Build Firm is to prepare its design. This DCP contains sufficient information to specify the criteria SAWS considers necessary to describe the Project, including the legal description of the site (a Preliminary Site Concept), survey information concerning the site, interior space requirements, special material requirements, material quality standards, conceptual criteria for the project, special equipment requirements, cost or budget estimates, time schedules, quality assurance and quality control requirements, site development requirements, applicable codes and ordinances, provisions for utilities, parking requirements, and any other requirements for the Project, as required by the Texas Government Code, Chapter 2269.306. The facility assessment reports, space program, and design performance requirements for each facility are functionality essential to SAWS' operations and must be met by the successful Design-Build Firm.

A. STANDARD ABBREVIATIONS

AR – Architectural Representative
CCB - Change Control Board
CD – Construction Document
DB – Design Build
D&C – SAWS' Distribution and Collections Department
DCP – Design Criteria Package
DD – Design Development
DPOR - Design Professional of Record
ESOC – East Side Operations Center
FF&E – Furniture, Fixtures, and Equipment
GMP - Guaranteed Maximum Price
NEOC – Northeast Operations Center
NESC – SAWS' Existing Northeast Service Center
PMP - Project Management Plan
POV – SAWS' employee Personal Owned Vehicles
SAWS – San Antonio Water System
SD – Schematic Design

B. PROGRAM GOALS/OVERVIEW OF SCOPE

This Project (Phase III of the Service Center Program) includes one (1) new service center site in Bexar County, which is referred to as the New Northeast Operations Center (NEOC). At the completion of all new work at the NEOC site, the selected DB Firm will demolish and remediate Fuel and Pumps, and the old Admin Building (circa 1980) at SAWS existing Northeast Service Center (NESC) at SAWS' Naco Pump Station site on O'Conner Rd. SAWS will award the design and construction for this work in a single contract to one (1) DB firm to design and construct all items at both sites. The location of the New Northeast Operations Center (NEOC) is 18000 Judson Road, just north of Hwy 1604.
The detailed scope of services and work at the NEOC is contained in this document and shall include:

Three new buildings and site work at a green field site. New buildings include: Administration, Fleet, and Supply Buildings. The Administration Building is the only facility in this Project that shall be designed and constructed in accordance with the current USGBC LEED standards to achieve EQUIVALENCY to a LEED Silver rating. In addition to building works, the NEOC site also has civil works in its scope to provide for multiple modes of ingress/egress, primary drive lanes, employee parking (personal owned vehicles-POVs), SAWS Fleet and SAWS Operations parking, outdoor supply areas, Ice and Water refilling station, outdoor bulk material storage and concrete silo pad areas, truck scale, site drainage and fuel areas (for pumps and AGTs), as required.

The detailed scope of services and work for the demolition and remediation at the existing site (Naco pump Station) is contained in this document. In summary this shall include:

At the existing NESC, located at the Naco Pump station at 13655 O'Conner Rd.: Demolition of two below grade diesel UGT tanks in accordance with all codes and TCEQ, and all associated utilities, pumps, diesel fuel island, and the installation of clean backfill and complete replacement of all pavement. Existing unleaded fuel island and UGT have been previously removed and remediated by others. Demolition of existing administration building and all lean to shed structures and canopies adjacent to or connected to the building, and demo of concrete bulk material bins, and complete replacement of all pavement, restoration of any retaining walls that may be compromised during the demo. The installation of guardrails, bollards, railing and any other safety items and associated signage and traffic striping as required, as well as the demo of the existing 2 marquee signs and the installation of a new marquee with signage designating the site as the Naco Pump Station.

As each building or facility at each site is completed, SAWS along with the SAWS' Program Manager Consultant, will coordinate and relocate personnel and equipment from SAWS' other Operation Center sites, as required. This may result in staff being relocated while the DB firm is still onsite completing another building. DB shall accommodate and cooperate with such moves, as well as staff that are currently located at the existing site that will be present throughout construction (Refer to item G. below). The DB firm shall coordinate and update the Project Schedule with the Owner's Program Manager Consultant to provide for tasks related to the relocation and eventual occupancy of the facilities. Relocation of staff and equipment will

provide for a more efficient response of SAWS operations to their customers. Timely completion of each design and construction milestone is important: time is of the essence.

C. ESTABLISHED SPACE PROGRAM

A space program has been developed for each site using standard room sizes and efficiency factors. This space plan has been internally reviewed by SAWS. Therefore, the count and area requirements of each room may not be changed or revisited by the DB firm's Design Professional of Record (DPOR) without review meetings and Approval by SAWS. These are the minimum count and space requirements. SAWS' reserves the right to interchange rooms, area square footages, and spaces during the design phase, as it develops as long as the total square footage is not exceeded.
As the DB firm further develops the design, each site and associated buildings, the Design –Build Firm must ensure that the Project meets the Approved scope, and that the Project Schedule, and GMP are not exceeded, as required by the Design Build Services Agreement.

D. FACILITY TEMPLATE/ PRELIMIMARY SITE CONCEPT

An Operations Center "campus" layout, of 3 buildings and a spine road, as well as the room adjacencies, palette of materials/colors/exteriors has been developed and approved by SAWS. This template was established in the Phase I and Phase 2 Construction Documents for the site concept, arrangement of buildings, egress/parking, general building plan layout, hardware, trim, and a template and color palette established for both the exterior facades and the interior finishes. These previously completed operations centers and the template and concepts developed as part of the Service Center Program, shall be utilized by the DB Firm and their Design Professional of Record (DPOR) for all of the Phase III Project. The goal is to provide a presentable, clean, functional appearance from the street, but one of efficiency and functionality with no excess and is also economical to maintain and operate over time. The DB firm must also provide common finishes, fixtures and product selections to allow SAWS to maintain the buildings efficiently. In order to achieve this goal, the DB firm shall thoroughly investigate the Phase I and Phase 2 facilities and As-Built construction documents, specifications and submittals, as well as all concepts developed to date for the Phase 3 Project, including the Preliminary Site Concept, to familiarize themselves with the previously utilized floorplan and site plan arrangements of spaces, room adjacencies, equipment, materials, and finish selections. The DB Firm may recommend deviations from these, but in doing so any deviations and recommendations shall be clearly communicated to SAWS. While these building standards are in place from previous Phases, the DB firm shall nonetheless, participate in Schematic Design and Design Development Phases in order to adjust floorplans in order to meet SAWS' operational needs for Phase 3. The DB firm must also establish aesthetic review presentations of the exterior facades and interior spaces to ensure that the materials and color palette aligns with the previously specified materials from previous phases, and must present/highlight any deviations from such. These presentations shall include colored site and floor plans, elevations, as well as perspective and 3D renderings and material boards that adequately represent the materials and aesthetics as required to communicate to SAWS.

SAWS intends to use the Phase 1 NSOC building plans as a template with no increase to the square footage and minimal office/usage changes within the footprint of each building. For example, Phase 1 did not have a Fitness Room but instead had

a bullpen area that is not needed for Phase 3, so these rooms have been interchanged for Phase 3. The room counts are listed in the Established Space program.

SAWS intends to provide the CAD and Revit files from the previous Phases of the Service Center Project, to the DB Firm. These files are subject to the language of the Contract regarding use of item provided by SAWS. The Design Build Firm can incorporate and use these files for reference only, and at their own risk. While prior design information may be useful, Design-Build Firm shall exercise its independent professional judgment to fulfill its responsibility to prepare a total and independent design for this Project. The DPOR of the DB firm/team will be required to develop and provide all design deliverables drawings utilizing a BIM model environment, as well as have the ability to convert such BIM models into AutoCAD (*.dwg) format for SAWS' facilities use.

E. FURNITURE, FIXTURES, AND EQUIPMENT (F&FE)

These items are defined within this DCP. Each item is clearly indicated whether it is Owner Furnished Owner Installed (OFOI), Owner Furnished Contractor Installed (OFCI) or Contractor Furnished Contractor Installed (CFCI). The DB firm will coordinate the delivery of these items with the Project Schedule and identify these items on FF&E sheets produced by the DPOR and included in the final set of Construction Documents. The DB firm shall ensure that all drawings have been coordinated with the SAWS furniture vendor. At a minimum this shall include furniture and shelving.

F. UTILITY SERVICES

The DB firm shall confirm adequacy and shall locate all available utilities and shall provide connections to the site accordingly. All utilities must be installed underground. Any and all associated fees must be included within the GMP. The DB firm must also consider and coordinate any impacts to the existing utility conditions and neighboring customers who could be impacted, such as storm water and drainage, electrical, and water and sewer.

G. INTERFACE WITH EXISTING/ONGOING SAWS OPERATIONS

SAWS will continue operations during construction activities at all sites. SAWS Operations is currently using the New NEOC site on Judson Road for pipe supply, material storage, and heavy equipment training. SAWS may continue operations at this site during construction activities.The Naco Pump Station is a significant water Production site in Northeast Bexar County. Remediation of the fuel and demolition of the existing administration building (circa 1980) at this location will only occur after all SAWS staff at this location have been completely relocated to the New Northeast Operation Center on Judson Road. Once the staff has been relocated and the building is vacant, the Naco Pump Station will remain an active water Production site. SAWS production staff may occasionally be present on the pump station side of the site for ongoing pump station activities and operations. The DB firm shall develop and include appropriate staging plans, working in conjunction with SAWS' Project Manager and Program Manager Consultant to finalize an approach that will allow continuing operations. The DB firm shall show access, work zone perimeters, and other site limitations for each stage clearly on work staging drawings on their submittals and shall show milestones in their accompanying Project Schedule showing move-in/out dates with allowances for move and turnover events subject to SAWS acceptance. The DB firm shall also allow for staggered occupancy and partial occupancy where SAWS may

need to occupy a structure and portions of the site that have been completed and accepted, prior to the overall site being complete.

H. PROJECT MANAGEMENT PLAN

The Project Management Plan (PMP) is an overall management plan for the Project, developed by the Program Manager, which describes all protocols, processes and plans Design-Build Firm shall use on this Project. The PMP defines the stakeholders' methods for data transmission and issue communication, as well as the process for change management., which is implemented only by a written Construction Change Directive (CCD) signed by Owner directing a change in the scope of the Services and/or Work, or granting an equitable adjustment to the Project Schedule and/or the GMP following consideration of the Design Build Firm's Proposal Request for such adjustment. .

I. PHASE III PROGRAM SCHEDULE

2021 1st Quarter

- **SAWS staff takes selection of DB Firm and GMP to SAWS Board for approval. Pending Board approval:**
- **Notice to Proceed (NTP) into Design Phase issued (including New NEOC, and Existing NESC items)**

2021 4th Quarter

- **SAWS staff briefs SAWS Board on Project status, schedule:**
- **Notice to Proceed (NTP) into Construction phase issued for the new NEOC**

2022 4th Quarter

- **Notice to Proceed (NTP) into Construction phase Issued for the NESC Demolition/Remediation at the Naco Pump Station Site**

**** Note SAWS reserves the right to adjust proposed schedule in coordination with selected DB Firm, length of procurement process and SAWS' Board available dates**

II. SUPPORTING REQUIREMENTS

The supporting requirements are provided in the following pages of this section.

Northeast Operations Center

SCOPE SHEET

OVERVIEW:

The existing SAWS property will become known as the Northeast Operations Center location and will be a completely new facility. The site is approximately 36 acres and will include a 10,640 SF Administration Building, a 6,862 SF Fleet Building, and a 6,088 SF Supply Building.

DEPARTMENTS:

The following departments will be located at the new NEOC:

- Distribution and Collection Department:
  Twenty (20) four person crews
  Director, Managers, Superintendents, Foremen, Field staff & Inspections
  Tool room technician

- Construction and Maintenance Department:
  Manager, Superintendents, Foremen & Field staff

- Supply Department:
  2 Supply warehouse technicians

- Fleet:
  Manager and up to 4 mechanics
  Parts technician

FACILITY NEEDS:

10,640 SF Admin building
D&C Director, Manager, Superintendent Offices
Training, Safety, and HR
Security, IT, Elec, and Mech
Crew Quarters, Locker Rooms, and Showers
Multi-Purpose Rooms
Fitness room

6,862 SF Fleet (4 bays) + office/ restrooms/tool/supply room/roof will extend to provide outdoor covered area at each end for equipment and wash bay
6,088 SF Supply + office/ restrooms / tool room/ roof will extend to provide outdoor covered storage area

SITE NEEDS:

POV, Ops and Fleet parking (see attached spreadsheet and summary this page)

Primary Spine road
Ice and water refilling building in Ops Parking
Two points of vehicular Ingress and Egress
"Main "entry with:
Lighted monument sign, separate visitor/ employee entry lanes, access pedestals, electric gates, pedestrian gate with card reader, designated area for future guard station with all required utilities at main entry, landscaping, and POV parking in close proximity to main entry (immediately after gate access)

Fuel island with canopy (air, water, grease, DEF, diesel and unleaded) – in close proximity to Fleet and to the Main entry (immediately after gate access)
Area designated as D&C Ops yard with bulk material bins. This area must include water and power and be well lit with a minimum of 1 foot candle in the evening.
Are designated as D&C concrete yard. This area must include water and power provided by thee DB Firm, and be well lit.
The concrete silo in this area will be provided and installed by SAWS.
Truck scale with easy on/off from spine road and visibility to Tool Room office/ window
Area designated for AGTs to include proper spill containment and access for fuel truck delivery – in close proximity to Fleet and to the Main entry (immediately after gate access)
Area designated for trash bins/ dumpsters with access and concrete approach aprons – a minimum of 2 dumpsters located near each building – walkable by Janitorial staff
Area designated for recycle metal containers with access and concrete approach aprons – near Supply and Ops Bulk yard to be well lit and within view of security cameras

NEOC PARKING AND STAFF COUNT

Staff Counts	Totals
Admin building	120
Supply building	4
Fleet Building	5
Total staff	129

SAWS Owned Equipment and Vehicle Parking Counts						
				Space size: 10'x20'	Equip space size: 10'x20'	Space size: 16'x55'
SAWS Primary Operations Parking Area (Ops Parking)				70	6	24
SAWS Fleet garage parking area (for vehicles under repair)				14	0	15
SAWS Supply				6	0	2

Personal Owned Vehicle Parking Counts (POVs)						
				Space size: 9'x 18'	Space size: 3' x 18'	
Employee parking				116		
Visitor parking				5		
Employee motorcycle parking					6	

SAWS Fleet Heavy Equipment Info - TRUCKS	
Description	**Size**
Honey Wagon	69' L w/Trailer
Lo Boy #1	65' L w/Trailer
Lo Boy #2	74' L w/Trailer
Combo	38' L
Pressure cleaner	24'L
10 yard Dump truck	38' - 6" L w/Trailer
7 yard Dump truck	53' - 9" w/Trailer
F550 crew truck	25' 10"

Northeast Service Center at SAWS' Naco Pump Station

SCOPE SHEET

OVERVIEW:

This is the existing Northeast service center at the SAWS Naco Pump Station. The existing admin building and fuel tanks and pumps will be taken out of service and demolished once the new NEOC is complete. The existing Administration Building attached shed/structures, material storage bins, and fuel shall be completely demolished and removed. The fuel facility shall be remediated as required by all AHJ's. Pavements shall be replaced, and installed in the footprint of the Admin Bldg. A new retaining wall and railing shall also be installed in the footprint of the Admin. Bldg. and installation of guardrails, bollards, railing and any other safety items and associated signage and traffic striping as required, as well as the demo of the existing 2 marquee signs and the installation of a new marquee with signage designating the site as the Naco Pump Station.

III. DESIGN PERFORMANCE REQUIREMENTS

A. DESIGN NARRATIVES

GENERAL SITE PLAN NOTES

GENERAL INFORMATION

1. The following preliminary studies and reports have been performed and are included herein for informational purposes for procurement only in accordance with the Design Build Services Agreement. SAWS does not warrant the accuracy of the studies and reports for final engineering design. Design-Build Firm shall perform all surveys, investigations, studies and reports as required under the Design Build Services Agreement.
    a. Topographic Survey performed by Ford Engineering, Inc. dated October 23, 2016.
    b. Geotechnical Engineering Report performed by Professional Service Industries, Inc. (PSI) dated July 26, 2019.
    c. Desktop Threatened and Endangered Species Assessment, Desktop Edwards Aquifer Transition Zone Requirements Assessment & Desktop Cultural Resources Assessment dated August 5, 2019
    d. Wastewater Lift Station 60% Plans – prepared by KCI Technologies dated July 2019
    e. Judson Road Water Main 90% Plans – prepared by Maestas dated April 2019
    f. Affinity Diagram – showing the conceptual relative traffic between different areas of the proposed facility. These drawings are qualitative in nature and may be used by SAWS in review of the proposed site layout.
2. When there is a discrepancy between design criteria stated herein and regulatory/permitting agencies, the stricter design criteria will apply. SAWS shall be notified and allowed to review all solutions prior to any revisions.

PAVING/PARKING/SITE ELEMENTS

3. Fence at perimeter of site to be modified as necessary which could include relocation of a portion of existing fencing and will include adding automatic vehicular access gates at a main entry/exit and at a secondary entry/exit, as well as pedestrian gates with access control card readers tied into the magnetic gate locks, and 2 manual maintenance access gates. All fencing shall be in accordance with SAWS Fencing Standard.
4. Personal Occupancy Vehicle (POV) parking to be separated from SAWS' Fleet parking and Operations' area which may include fencing if required to separate from SAWS fleet parking. Provide concrete mow strip under all fencing as required by SAWS Fencing Standard.
5. Concrete wheel stops at POV parking and at all parking against fences, buildings, ditches or swales, landscaped areas, curbs, light poles, or other site elements.
6. POV standard parking sizes for employees shall be 10 ft x 20ft minimum. All proposed parking layouts shall be reviewed by Owner.

7. SAWS Fleet and equipment parking sizes vary and are as shown in this DCP. Design-Build Firm shall be required to design all lanes, turns, egress, ingress and parking spaces to accommodate the fleet vehicles, equipment, and delivery trucks intended for use at the facility.
8. Primary drive lanes to be concrete pavement with concrete "throats" into asphalt parking areas. Areas surrounding fuel island, AGT basin and tanks, ice/water station, truck scale and dumpster/recycle bin areas shall be concrete. All other yards and parking to be asphaltic pavement. Asphalt designed based on type of vehicles and equipment parked in each respective area
9. Install flush ribbon curb at perimeters of all asphalt paving unless otherwise required for site drainage. All curb conditions to be reviewed by Owner.
10. All routes with the exception of POV areas shall be designed to accommodate AASHTO WB-67 vehicles. Provide turning template exhibits at all driveways, internal circulation areas, turn arounds, and loading docks showing the adequacy of the site design to accommodate the design vehicle. Exhibits shall be generated by use of turning template software (i.e. Autoturn, MSTurn, etc.). Exhibits shall be provided for review at all milestone submittals.
11. All routes to be traversed by heavy vehicles shall have a maximum 6% longitudinal slope. Maximum grade breaks without a vertical curve shall be 4%. Cross slopes of all routes shall be 2% desirable and 4% maximum.
12. Landscape Areas similar to the Phase I NSOC plans. Provide topsoil, plantings and irrigation per specifications.
13. At both the Primary Entry, secondary entry, and pedestrian gates there will be electrically operated gates with two (2) tier pedestals, one for SAWS employee card swipe (card swipe at each tier) and the other with a 4 button intercom (at each tier) for visitor access control. – Refer to specs for gate sizes/details.
14. Pedestrian paths, sidewalks and stripped pavement, to all buildings and as required by applicable code/AHJ's.

GRADING/DRAINAGE/WATER QUALITY

1. All drainage analysis and design shall follow applicable City of San Antonio and SAWS design criteria. All water quality considerations shall comply with applicable City of San Antonio, State of Texas, and Federal guidelines and any other AHJ.
2. Site plan shall be designed such that all flows leaving site are returned to the predeveloped flow rate and character (i.e. sheet flow or point discharge) at each outfall location. Detention ponds with appropriate outlet structures will likely be required and are included in the scope of this project. No channelized discharges will be allowed where there is sheet flow discharge in the existing condition.
3. Minimum slopes for asphalt paving shall be 1.0%.
4. Minimum slopes for concrete paving and curbs shall be 0.5%.
5. It is the intent to balance cut and fill quantities to the maximum extent possible to minimize costs. Refer to GEOTECHNICAL ENGINEERING REPORT provided herein for requirements for use of on-site materials as fill. Side slope protection requirements are as follows:
    a. 4:1 or flatter – revegetate with approved seed mixture
    b. Between 4:1 and 3:1 – revegetate and armor with soil retention blanket equivalent to TxDOT Item 161 Type A
    c. Steeper than 3:1 – Not allowed

13. Site Preparation to include all grading, hauling, landscape, paving, and utilities as per spec.
14. Utilize surface drainage where possible. Small runs of pipe and area drains may be required. Final design shall have positive drainage, no low spots or "birdbaths" and no ponding and no "streams" of water or swales deeper than 6" in a 500-year event.
15. All building finished floor elevations shall be set such that they are high enough above the adjacent surface such that 100-year (Atlas 14) design storms will not enter buildings. Adjacent ground and paving areas shall be graded to drain away from buildings.
16. All on-site inlets and storm sewer systems shall be sized for a minimum 5 year design storm.
17. All point discharge from paved/improved areas shall be to an adequately sized channel with suitable erosion protection. Design plans shall show design flows, velocities and channel capacity calculations. All drainage discharge locations shall be reviewed by Owner.
18. Demolition- Any surface items, abandoned water wells, slabs, fences, or any other structure found within site to be developed.
19. Design-Build Firm shall confirm that the Worksite is located within the TCEQ Edwards Aquifer Transition Zone and the COSA ERZD Overlay District. Site design shall comply with all TCEQ and COSA requirements for water quality BMP's.
20. Construction activities shall comply with the Texas Pollution Discharge Elimination System (TPDES) requirements. This will include any sedimentation basins required if site clearing disturbs 10 acres or more as well as any other BMP's required under the TPDES General Permit. An approved Stormwater Pollution Prevention Plan (SWPPP) and notifications are included in the project scope.
21. Note that the site likely contains potential USACE jurisdictional wetlands and Waters of the US (WOTUS). The scope as shown in this DCP, and conceptual site design is contemplated such that the Design-Build Firm's DPOR shall configure the site layout and civil site design to avoid any impacts to wetlands and WOTUS which would trigger USACE permitting. Should the Design-Build Firm choose to propose a design solution that impacts these areas, any wetlands mitigation and permitting shall the sole responsibility of the Design-Build Firm and shall not cause an increase to the GMP.
22. It is the intent to utilize site grading to provide containment for leaks and spills from petroleum and chemical tanks. All containment areas shall drain to filtration or treatment BMP's as required by regulatory agencies.

SITE UTILITIES

23. Water – Refer to N.E. SERVICE CENTER WATER MAIN EXTENSION plans for water main information. Design-Build Firm's proposal shall include adequate provision to route all project related waterlines to the planned water main at Judson Road. Project pricing shall include all pipe, fittings, valves, connections, thrust blocking, backflow preventers, hydrants, testing, and disinfection to provide a complete connection to the water main extension.
24. Water - Backflow preventer - Installed, as required by code, on all domestic water, dedicated fire protection loops and irrigation lines. Design-Build Firm to install below grade in concrete vault with aluminum lids for the fire protection mains. Design-Build Firm to adhere to all codes and regulations.
25. Fire Line – size as required by the San Antonio Fire Prevention Code and currently adopted edition of the International Fire Code. Design phase shall include a hydraulic analysis and hydrant pressure testing of the fire protection main based on actual residual pressures at the point of connections and anticipated fire flows in accordance with the International Fire Code. In the

event required flows and pressures cannot be achieved with the connection to the system, Design-Build Firm shall either coordinate with SAWS to determine if residual pressure in the area can be increased to meet the requirements OR install booster pumps as necessary to achieve required pressures at buildings and hydrants.

26. Fire hydrants –Refer to COSA and NFPA and verify that every point on exterior of building is within the minimum required by code of hose-lay distance from a hydrant.
27. Sewer – Refer to SAWS NE SERVICE CENTER WW MAIN EXTENSION plans for wastewater connection information. Design-Build Firm's proposal shall include adequate provision to route all project related wastewater to the planned lift station at Judson Road.
28. Vehicle wash down concrete pad with grating and area drain - concrete pad should be formed to drain to the center to contain all flows into a grate inlet submerged precast sludge pit with removable grate for easy cleanout. Should be designed to accommodate cleanout by hand and by compact excavator and by Combo Vac truck. A separate pit with Grate inlet would need to include an oil/water separator and discharge into a sanitary sewer manhole. Grate inlet covers to be easily removable and drain accessible for cleaning.
29. Gas- Extend existing gas line(s) to site from an adjacent structures or R.O.W. Include CPS gas meter fee.
30. Electric- All on-site power to be designed to be underground. All existing to be rerouted accordingly. Allow for Transformer /All CPS Fees as required including to relocate poles to perimeter of site. Provide underground cable/conduit/duct bank. Provide for additional extra conduits for future additional SAWS IT/ Security. No overhead utility lines on site. (Remove existing overhead lines and power poles and relocate as required by CPS). All pull boxes/hand holes/utility vaults shall be above grade and the conduits sealed.
31. Emergency Generator – At the NEOC match the Phase I NSOC design/requirements.
32. Phone service to be brought into building MDF room. Use underground cable/conduit. Demark at building for POTS
33. Cable TV to be brought into building. Use underground cable/conduit.
34. AT&T Fiber Optic Data service to be brought into Admin Bldg. MDF room. 4" steel tube to be mounted at roof of Admin building above MDF room for OFOI Wi-Fi antennae.
35. Tree protection required for any trees to be preserved. Coordinate w/ COSA requirements for any tree to be removed. Minimum of 40' of existing trees (depth) to remain at all perimeters.
36. Signage: Low monument Entry signage – one (1) low stone freestanding flanking sign walls at entry with metal letters, low landscaping and landscape lighting. Include general way finding signage around site and building designations.
37. Bollards at OH door openings and building corners. Provide guardrails at all drainage ditches and culverts.
38. Lighting- Provide pole mounted LED light fixtures at parking and drives to provide a min of 1 foot candle coverage at all affected areas/ areas of parking/ pedestrian walkways.
39. Fuel – Provide fuel service area {diesel and gasoline} with above ground tanks, fuel

island to include DEF, grease station, air and water, signage, and trash cans.

40. Recycle metal bins - Provide concrete pad.
41. Dumpster- Provide concrete dumpster pad.
42. At the NEOC Provide bulk material bins to contain loose materials (sand, aggregate, asphalt) with concrete apron to match the Phase I NSOC design/requirements.
43. Truck Scale – At the NEOC provide a new Truck Scale to match the Phase I NSOC design/requirements.

FUEL ISLAND NOTES

General Notes

1. This project includes the installation of a fueling facility at the NEOC.

NEOC FUEL: Above ground storage tanks (ASTs) for the storage of gasoline and diesel fuel. The gasoline tank will be 12,000 gallons in nominal capacity, and the diesel tank will be 15,000 in nominal capacity. Both ASTs will be UL-2085 listed.

2. All electrical work will be completed in accordance with City of San Antonio codes and regulations, NFPA 30, and the NEC.
3. It shall be the Design-Build Firm's responsibility to submit the Texas Commission on Environmental Quality (TCEQ) 30-day construction notification, to notify the appropriate Fire Marshal having jurisdiction, and to obtain any and all permits for the construction of the system.
4. The NEOC facility is located on the Transition Zone to the Edwards Aquifer. The Design-Build Firm shall be especially careful to prevent the loss of contaminates to the storm water, or into any recharge features, if found. Any recharge features that are found shall be reported to the project superintendent immediately.
5. The Design-Build Firm is solely responsible for the means and methods of construction. OSHA regulations regarding the construction activities, including but not limited to, trenches and excavations, and operations above four feet shall be strictly followed. All Site Supervisors shall be 40-hour OSHA trained.
6. A site specific Health and Safety Plan shall be prepared and kept on site in case of an emergency. All personnel shall be briefed on the plan and know its location.
7. The site will be kept clean of trash and debris. A Storm Water Pollution Prevention Plan (SWP3) has been developed for this site, and its provisions shall be followed by the fuel system Design-Build Firm.
8. The Design-Build Firm installing the fuel systems shall be a TCEQ licensed Design-Build Firm, and this Design-Build Firm shall have a TCEQ licensed on site supervisor on site at all times that construction activities are taking place. The licensed on-site supervisor shall sign all manifests or other documentation as required for record keeping purposes. This documentation includes, but is not limited to, the TCEQ registration form, AST warranty and installation forms, and Red Lined drawings to be used in the development of Record Drawings.
9. Pressure testing of the new piping and other gasoline and diesel system components shall be in accordance with the local Fire Marshal's requirements, or as required by PEI RP-100. In any case, pressure shall be left on all piping (both primary and secondary) until all paving has been placed over all UST system components. Any loss of pressure shall be investigated immediately.
10. An emergency stop switch shall be mounted adjacent to the electrical equipment building as indicated on the plans and specifications. When activated, this switch shall open the circuits and thus shut off all power to the fuel pumps and dispensers. This switch shall require manual resetting before pumping can continue. A sign shall be mounted above the switch, 7 feet above the ground, and shall have 2-inch red letters on a white background stating Emergency Fuel Shut Off. This switch shall be not less than 20 feet from the point of fueling, nor greater than 100 feet.
11. Upon completion of the installation of all equipment and piping, third party precision line tests shall be performed on this system. Copies of these data shall be submitted to the Engineer.
12. A project manual shall be submitted to the Owner in a three-ring binder that includes all maintenance, operations and warranty documents associated with this project. Additionally, any and all test data such as the precision line results shall be included.
13. Veeder Root leak detection systems and EJ Ward Systems fuel management system.

Piping Specifications

1. Piping used on this project shall be UL 971 and 567 listed FRP. This includes all primary and secondary piping and

fittings. One manufacturer shall be used throughout the entire project. Mixing product types is not acceptable. All fittings and glue kits will be of the same manufacturer as the piping.
2. All stainless-steel flex hoses used on this project shall be UL listed for above ground use. Flex hoses UL approved for underground use are not acceptable.
3. No FRP piping shall be visible in dispenser pans or other above ground applications. Only UL approved aboveground steel flex connectors and/or steel piping shall be visible in above ground applications.
4. Pressure testing shall be performed on both the primary and secondary piping systems.
5. Pressure shall remain on all piping until all pavement construction is completed in the vicinity of the piping.
6. The transition and dispenser sumps shall be waterproof and shall be tested to guarantee this fact. The test shall be performed by filling the sumps with water to a point specified by the Engineer, and a mark shall be made at that level.

AST Specifications
1. The ASTs used on this project shall be UL-2085 listed. The gasoline AST shall be a ten-foot nominal diameter 12,000/20,000- gallon nominal capacity tank, and the diesel AST shall be a 15,000/20,000-gallon nominal capacity ten-foot nominal diameter AST. The Design-Build Firm shall request a letter from the tank manufacturer proving that air testing has been successfully completed for both the inner and outer tank during the manufacturing process. This letter must be available for inspection by the Fire Marshall upon arrival of the ASTs to the site, and shall be made a part of the permanent records upon completion of the construction of the systems.
2. Upon arrival at the site, the ASTs shall be carefully inspected for damage. Any damage noted shall be reported to the Engineer immediately. Damaged tanks are not acceptable for use at this facility.
3. The ASTs shall be placed in the containment structure as indicated on the plans. All fittings and equipment necessary to complete the system shall be placed on the ASTs.
4. The Design-Build Firm shall complete all documentation necessary to comply with the TCEQ regulations and to cause the warranty to come into force.
5. A one-inch diameter by eight-foot-long copper clad steel ground rod shall be placed between the two ASTs. A 4/0 copper conductor shall bond the two tanks and provide a common ground plane. This grounding rod shall be in place before the placement of the concrete such that the concrete is placed around the groundingrod forming a tight seal.
Equipment Specifications
1. The pumps to be used on this project shall be Red Jacket AG submersible turbines or prior approved equal in the size specified on each detail. The dispensers to be used are as follows:
A. Double Nozzle - Single Product Dispenser
(a) Remote dispenser, 2 - GasBoy 9150KXTW1 (diesel) and 2 - Gasboy 9853KXTW1 (gasoline) with the following equipment:
1. Internal high flow filter (gasoline)
2. External Hydrosorb diesel filters (diesel)
3. High Hose Retractor
4. Light
5. Mechanical Totalizer
6. Card System Interface
7. 100: 1 VR Pulse Output (4 required per dispenser)
8. Automatic Nozzle
9. Break-away hose coupler
10. Any other equipment necessary to complete the system
2. Double poppet impact valves shall be placed under each remote dispenser. These impact valves shall be mounted such that the shear plane is flush with the surface of the fuel island. The bar on which the impact valves is mounted must be able to resist 650 ft lbs of moment for each impact valve mounted on it.
3. Flame arresting vents shall be used on each fuel tank. These vents shall be at minimum 12 feet above finished grade. A P /V cap shall be used on the gasoline AST and a rain cap shall be used on the diesel tank.
4. An above ground pressure rated overfill prevention valve shall be placed at each fill position. This fill limiter shall stop flow into the AST when the liquid level reaches 90 percent of the total volume.
5. A fuel management system shall be installed to control access and account for the fuel and DEF used at this facility.

The system type shall be specified by the Owner.
6. One DEF system shall be installed as indicated on the plans. This system shall consist of a small enclosure, pump, hose reel, and nozzle. These components shall all be compatible with DEF.
7. One diesel island shall have an air, water, and grease dispenser. The Design-Build Firm shall submit cut sheets with the proposed equipment to be used in this application.

Leak Detection Equipment
1. The Leak detection for the piping, ASTs, and DEF at this facility shall consist of the followingequipment.
a. A Veeder Root TLS-450 Plus console
b. Each AST shall have an interstitial sensor
c. Each AST shall have an in-tank probe to monitor and report fuel levels. Due to diurnal heating, inventory reconciliation cannot be performed in ASTs.
d. Each transition sump shall have a liquid sensing sensor placed in the bottom of the sump.
e. Each dispenser sump shall have a liquid sensing sensor placed in the bottom of the sump.
f. An overfill alarm with acknowledgement switch shall be mounted on the fill connection of each fuel type. This alarm shall be used to alert the truck driver to a near full level.
2. Any liquid sensed by an interstitial monitor or liquid sensor shall cause the fuel pumps to be de-energized, and all dispensers to stop pumping. The pumps shall not be re-energized until the cause of the alarm has been identified and rectified.
3. A current copy of the Veeder Root Inform program that allows remote sensing, monitoring and operation of the system shall be provided to the Owner, placed on the Owner's selected computer, and the program initiated.
4. The system shall not interfere with the fuel management system, and shall perform all functions in conjunction with the fuel management system.

Canopy
1. The canopy column locations are presented on the plan details. These column locations are indicated such that the layout of the fuel station can be completed. If the 14-foot c-c spacing is not acceptable, the Engineer shall be notified so that the fuel station layout can be modified.
2. The Design-Build Firm is responsible for the design of the footings, columns, and other structural components of the canopy. The outline of the canopy and the location of the columns on these plans is for planning purposes only, and does not constitute a canopy design.
3. The canopy shall have LED lighting so that safe fueling operations may continue during darkperiods.
Start Up Once all equipment has been installed, the Design-Build Firm shall perform a complete startup of all equipment. During this start up procedure, all meters shall be calibrated, and tests to ensure the proper operation of all equipment shall be performed. The Veeder Root system shall be programmed to the specified settings, and verification of proper operation shall occur.

Training
Training of select SAWS personnel in the proper operation of all equipment shall take place within 3 business days of startup. This training shall be sufficiently thorough so that SAWS personnel may use the equipment correctly and in compliance with the current tank and line monitoring regulations.

ADMIN BUILDING NOTES

STRUCTURE

1. Concrete reinforced foundation. Base/prep per Geotech.
2. Pre-Engineered metal building structure w/ pre-engineered roofing system components.

EXTERIOR CONSTRUCTION

1. Main Façade: Brick veneer masonry and prefinished Kynar metal panels/trim with metal stud back up, 16" O.C.(l/640). Building envelope shall be designed to meet the minimum standards of the 2018 International Energy Conservation Code. Provide galvanized loose angle lintels at window and door openings.
2. Sides and Back Facade: Prefinished Kynar metal panels/trim on metal stud back up. Building envelope shall be designed to meet the minimum standards of the 2018 International Energy Conservation Code. Provide a 4" high concrete curb at all exterior walls. Brick veneer walls at rear entry to locker-rooms with brick behind exterior sinks.
3. Windows: Windows will consist of punched openings. Window system equal to Kawneer Trifab® 451UT is 4-1/2" deep with a 211 sightline and 1" insulated glass. Glazing is to be tinted with low e coating interior sills return w brake metal
4. Main Entry Doors: Door system equal to Kawneer with electrically operator for ADA accessibility. Door is to have access control system including a camera and voice communication. Provide a structural canopy over the door and entire walkway.
5. Secondary Doors: Provide insulated HM door with vision lite, and frames painted with a canopy over all exterior doors. All exterior doors shall have access control.
6. OH Doors: Provide electrically operated (gear drive) and insulated OH doors w/ security control contact strike plates and canopy over all OH doors.
7. Louvers: louvers to be aluminum kynar finish. Provide insect/bird screens and sub-sill.
8. Roof: Low slope metal roofing panel on 8" roof purlins 4'-0" D.C. equal to Butler MR-24 roof panel with Butler Thermaliner R-23 Insulation System. Roof is to have a single slope towards back wall. Roof drainage is to be gutter and downspouts. Color ?? white at admin – Galv at all others?
10. Exterior lighting is combination of wall mounted fixtures and light poles. Low pedestrian lighting at any pedestrian paths to parking areas-maintain 1-foot candle minimum of lighting.
11. Provide metal canopy at all exterior doors w light.
12. Provide bird netting/control at all exposed exterior metal building structural elements: underside of canopies

INTERIOR GENERAL NOTES

Typical interior partition to be one layer 5/8" gypsum board each side of 3 5/8" metal studs, 22 ga, 16" OC. Provide sound batt insulation at all multi-purpose rooms, conference rooms, fitness rooms, and office spaces. All corridor walls are to go deck above and be rated. Walls around wall multi-purpose rooms, conference rooms, mechanical spaces, fitness room, and restrooms are to go to deck.

FINISH PACKAGE DESCRIPTIONS

FP -1: Multi-Purpose/Crew Quarters/ Spaces

Floor: Diamond Polished Concrete
Base: 4" rubber.
Walls: Painted gypsum board (equal to Georgia Pacific DensArmorPlus).
Ceiling: Painted gyp board and 2 x 2 mineral board lay-in acoustical ceiling, painted steel grid Casework: Chair rail; Plastic laminate with solid surface tops
Specialties: Tack board, Marker board

Room to accommodate monitors and cameras as for go to meetings/training Telephone, computer network and cable TV connections infrastructure Folding wall w/ egress door
Room to accommodate monitors and cameras as for "go to" meetings/training Telephone, computer network and cable TV connections infrastructure. Manual black out roller shades at windows

FP-2: Offices and Associated Support
Spaces Floor: Carpet tiles
Base: 4" Rubber
Walls: Painted gypsum board
Ceiling: 2x2 Lay-in mineral fiber acoustic ceiling panels, painted steel grid
Casework: Plastic laminate with solid surface tops
Specialties: Manual roller shades at all windows.

FP-3: Lobbies/Corridors
Floor: Polished Concrete
Base: 4" rubber.
Walls: Painted gypsum board (equal to Georgia Pacific DensArmor Plus to 4 ft). Chair rail and corner guards.
Base: 4" Rubber coved base
Ceiling: 2 x 2 lay-in mineral fiber acoustic ceiling panels, painted steel grid
Specialties: Directory (lockable) and Tack board in Lobby

FP -4: Restrooms/Lockers/Showers
Floor: Ceramic tile with membrane waterproofing
Base: Coved ceramic tile
Walls: Ceramic tile wainscot to 6ft aff and painted above on CMU back up. At wet wall provide ceramic tile full height. At showers provide ceramic tile full height on CMU walls and on ceiling.
Ceiling: Painted gyp board, semi-gloss finish
Casework: Solid Plastic with solid surface tops
Specialties: Solid surface toilet partitions, floor mounted. Stainless steel toilet accessories recessed, Provide industrial grade vitreous china Fixtures/Lavatories/Water Closets, Urinals

FP-5: Mechanical Rooms
Walls: Painted CMU (Walls to Structure)
Base: NA
Floor: Sealed concrete slope to drains
Ceiling: Exposed Structure
Specialties: Equipment to be on sound isolators

FP-6: Support Spaces for Equipment/Storage
Floor: Sealed concrete
Base: 4" Rubber
Walls: Painted gypsum board
Ceiling: 2x2 mineral board lay-in acoustical ceiling, painted steel grid
Casework: Plastic laminate with solid surface tops

FP-7: IT, Electrical and Storage
Floor: Sealed concrete (anti-static coating at IT), slope to drains
Base: 4" rubber coved base
Walls: Painted gyp board (equal to Georgia Pacific DensArmor Plus) Painted steel deck
Ceiling: 2 x 2 mineral board lay-in acoustical ceiling, painted steel grid.
Specialties: At MDF/IDF rooms provide plywood on walls.

FP -7: Janitor

Floor: Sealed Concrete
Base: 4" rubber coved base
Walls: Painted gyp board, 4 x 4 glazed ceramic tile wainscot to 6ft just at mop sink.
Ceiling: 2 x 2 mineral board lay-in fiber acoustical ceiling panels, painted steel grid.
Casework: SS Shelving and Mop sink with holder

MEP BUILDING SYSTEMS DESCRIPTION

HVAC

1. The building will be air conditioned by a VAV (variable air volume) air handling unit (located within an enclosed Mechanical Equipment Room) with individual zone VAV terminal units (located throughout, above the ceiling). The air handling unit will consist of a chilled water cooling coil, filters, and supply fan. Chilled water will be provided by an outdoor air-cooled packaged chiller. A chilled water pump will distribute chilled water to and from the chiller to the air handling unit via a distribution piping system (Sch. 40 black steel piping, 1.5 inches fiberglass insulation). The ducted supply air distribution system will be insulated sheet metal. The above ceiling space will be utilized as a return air plenum. Outside air will be ducted to the air handling unit via an in-line fan with an electric duct heater to maintain a minimum outdoor air temperature of 55°F entering the air handling unit. The individual VAV terminal units will be fan-powered parallel type with an electric heater. Controls will be direct digital electronic type.
2. The restrooms will be exhausted by a ducted roof-mounted exhaust fan.

PLUMBING

1. The plumbing fixtures within the restrooms will consist of:
2. Wall mounted industrial grade vitreous china water closets with 1.6 gpf flush valves, hands-free sensor operated, electrically powered.
3. Wall mounted industrial grade vitreous china urinals with 0.5 gpf flush valves, hands-free sensor operated, electrically powered.
4. Counter top, undermount, sinks with metered faucet, hands-free sensor operated, electrically powered.
5. Pressure-balanced, thermostatic mixing valve and vandal resistant shower head.
6. Floor drains will be provided in the toilet and shower areas. The floor drains in the toilet areas will have trap primers.
7. A dual height electric water cooler will be provided adjacent to the restrooms. Include Water Bottle filler option.
8. A floor-mounted molded stone mop sink will be provided.
9. Electric hot water heater will provide hot water to the lavatories and mop sink. A thermostatic mixing valve will provide 110 degree F hot water to the lavatories, and 140 degree F will be provided to the mop sink. A re-circulating pump loop will be provided.
10. Domestic water piping shall be Type K copper. Hot water piping shall be insulated.
11. Sanitary waste and vent piping will be hubless cast iron aboveground, hub and spigot type underground.

ELECTRICAL

1. The interior building lighting will consist of recessed parabolic LED fixtures. Lobby lighting LED pendants. Recessed LED cans at soffit at Breakroom, LED Wall sconces and LED cove lighting to accompany recessed parabolic LEDs at locker rooms and restrooms. Exterior lighting – wall sconces at entry, wall packs as specified at perimeter and at exterior doors.
2. Lighting controls will utilize occupancy sensors throughout all occupied spaces, with a lighting relay panel to control the lighting in corridors. Integrate with BMS.
3. Exterior building lighting will consist of architectural grade, LED wall fixtures that are dark sky compliant. The lighting will be controlled through the relay panel with astronomical time clock.
4. The building will include an addressable fire alarm system coordinated w SAWS system.
5. An electronic safety and security system will be provided for the building.
6. A lightning protection system will be provided for the building.
7. A voice/data system will be provided for the building. A cable tray will be routed above the corridor ceiling to provide a raceway path from the individual rooms to a telecommunications room.

AUDIO VISUAL

1. The Crew Quarters and large Multi-Purpose Rooms shall be multi-functional and used for daily crew gathering and deployment, training, and day to day presentations. The rooms shall have floor plugs w power and data and shall have a laptop input from a wall plate at the front of the room, with HDMI, VGA, USB, and audio inputs

    a. The Audio-Visual System shall have a digital switcher and components. The switcher will allow for any input to be sent to the Projector depending on the presentation. It will also provide for future AV expansion if needed.
    b. The displays for the rooms will be one each, Owner Furnished/Owner Installed projector, ceiling mounted, projecting to, Contractor Provided/Contractor Installed, 16:10 ceiling recessed electric screens appropriately sized for the space.
    c. Ceiling recessed speakers will be installed and evenly distributed throughout the both rooms. There shall be a wireless microphone system for voice lift during presentations. The mics can be used in each room individually when the rooms are combined.
    d. A digital control system shall be provided for these rooms. This shall include a wall mounted touch master control panel in which will have a customized interface allowing the end user to select the source selection (laptop, wireless presentation), volume control (program audio and microphone audio), and system on/off.
    e. A lockable wall mounted equipment rack will be installed in the A/V Storage Room.
2. The Small Multi-Purpose Room/Conference Room shall have an, Owner Furnished/Owner Installed, wall mounted flat panel display appropriately sized for the space and used for daily meetings and day to day presentations. There shall be a Cable Cubby installed in the, Owner Furnished/Owner Installed, conference table to all for HDMI, USB, and VGA laptop connectivity. Cables will be stored in the Cable Cubby when not in use.
    a. Audio for the room shall be provided by the on-board speakers in the displays. Control for the system shall be through the display remote.
    b. Cabling shall be run from the table to the Contractor Furnished/Contractor Installed floor box. A Digital Media transmitter shall be installed under the conference table. The Digital Media receiver shall be mounted in the Contractor Furnished/Contractor Installed back box behind the flat panel display.

SUPPLY BUILDING NOTES

STRUCTURE

1. Concrete reinforced foundation. Base/prep per Geotech.
2. Pre-Engineered metal building structure w/ pre-engineered roofing/ system components. Eave height to be coordinated with warehouse storage shelving and racks.

EXTERIOR CONSTRUCTION

1. Exterior Walls: Prefinished kynar metal panels/trim on Building envelope shall be designed to meet the minimum standards of the 2018 International Energy Conservation Code. Metal liner panel to 8ft aff at warehouse and receiving spaces. Provide a 4" high concrete curb at all exterior walls.
2. Windows: Windows will consist of punched openings. Window system equal to Kawneer Trifab® 451UT is 4-1/2" deep with a 2" sightline and 1" insulated glass. Glazing is to be tinted with low e coating.
3. Exterior Doors: Provide insulated HM doors w/view panel and frames painted with a canopy over each door. Each exterior door shall have vision panel and access control.
4. OH Doors: Provide electrically operated and insulated OH doors w/ security control contact strike plates.

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5. Louvers: louvers to be aluminum kynar finish. Provide insect/bird screens and sub-sill.
6. Roof: Low slope metal roofing panel on 8" roof purlins 4'-0" O.C. equal to Butler MR-24 roof panel with Butler Thermaliner R-23 Insulation System. Roof is to have a single slope towards back wall. Roof drainage is to be gutter and downspouts. Provide low parapet wall on front and side walls.

INTERIOR GENERAL NOTES

Typical interior partition to be one layer 5/8" gyp board each side of 3 5/8" metal studs, 22 ga, 16" OC. Provide sound batt insulation at all office spaces. All corridor walls are to go deck above. Walls separating office area from warehouse rooms, mechanical spaces and restrooms to be fully insulated and are to go to deck.

FINISH PACKAGE DESCRIPTIONS

FP -1: Offices and Associated Support

Spaces Floor: Sealed Concrete
Base: 4" rubber
Walls: Painted gyp board
Ceiling: 2 x 2 mineral board lay-in acoustical ceiling, painted steel grid. Casework: Plastic laminate with plastic laminate tops
Specialties: Tack board, Marker board, Manual roller shades at all windows.

FP -2: Corridors

Floor: Sealed
Concrete Base: 4" rubber.
Walls: Painted gypsum board (equal to Georgia Pacific DensArmor Plus to 4 ft). Chair rail and corner guards.
Ceiling: 2 x 2 mineral board lay-in acoustical ceiling, painted steel grid. Specialties: Chair Rail

FP -3: Warehouse/Support

Spaces Floor: Sealed concrete Base: 4" rubber
Walls: Metal liner panel to 8ft aff. Painted gyp board above at partitions. Wire metal cage/doors at Receiving.
Casework: Plastic laminate on plywd with plastic laminate tops, at service counter provide stainless steel counter top.

FP -4: Restrooms

Floor: Ceramic tile with membrane waterproofing Base: Coved ceramic tile
Walls: Ceramic tile wainscot to 4ft aff and painted above on CMU back up. At wet wall provide ceramic tile full height.
Ceiling: Painted gyp board, semi-gloss finish
Casework: Solid Plastic with solid surface tops
Specialties: Solid surface toilet partitions, floor mounted. Stainless steel recessed toilet accessories Provide industrial grade vitreous china Fixtures/Lavatories/Water Closets, Urinals

FP -5: Mechanical Rooms

Floor: Sealed concrete, slope to drains
Base: 4" rubber caved base
Walls: Painted gyp board
Ceiling: 2" duct liner insulation on CMU I gyp board; 2" ductliner insulation
Specialties: Equipment to be on sound isolators

FP -6: IT/Electrical Rooms

Floor: Sealed concrete (anti-static coating at IT), slope to drains
Base: 4" rubber coved base
Walls: Painted gyp board (equal to Georgia Pacific DensArmor Plus) Painted steel deck
Ceiling: 2 x 2 mineral board lay-in acoustical ceiling, painted steel grid.
Specialties: At MDF/IDF rooms provide plywood on walls.

FP -7: Janitor

Floor: Sealed Concrete
Base: 4" rubber coved base
Walls: Painted gyp board, 4 x 4 glazed ceramic tile wainscot to 6ft just at mop sink.
Ceiling: 2 x 2 mineral board lay-in fiber acoustical ceiling panels, painted steel grid.
Casework: SS Shelving and Mop sink with holder

MEP BUILDING SYSTEMS DESCRIPTION

HVAC

1. The Admin. Area will be air conditioned by a split-system DX air conditioning system with a gas furnace and with insulated sheet metal supply, return and outside air intake ductwork.
2. The Toilet/Locker Area will be air conditioned by the same split-system DX air conditioning unit serving the Admin. Area. The area will be exhausted by a ducted roof-mounted exhaust fan.
3. The Storage Room will be heated by gas-fired radiant unit heaters and ventilated by a roof-mounted exhaust fan and intake air wall louver.
4. The Warehouse will be heated by gas-fired radiant unit heaters and ventilated by roof-mounted exhaust fans and intake air wall louvers.
5. The Service Counter area will be air conditioned by a split-system DX air conditioning system with a gas furnace and with insulated sheet metal supply, return and outside air intake ductwork.

PLUMBING

1. The plumbing fixtures within the Toilet/Locker Area will consist of:
2. Wall mounted industrial grade vitreous china water closets with 1.6 gpf flush valves, hands-free sensor operated, electrically powered.
3. Wall mounted industrial grade vitreous china urinals with 0.5 gpf flush valves, hands-free sensor operated, electrically powered.
4. Wall mounted vitreous china lavatories with metered faucet, hands-free sensor operated, electrically powered.
5. Floor drains will be provided in the toilet areas. The floor drains in the toilet areas will have trap primers.
6. A dual height electric water cooler will be provided within the Warehouse space adjacent to the toilet/locker Area.
7. A floor-mounted molded stone mop sink will be provided.
8. An emergency shower/eyewash station is required within the warehouse space adjacent to the Receiving area.
9. A gas-fired hot water heater will provide hot water to the lavatories, shower and mop sink. A thermostatic mixing valve will provide 110 degree F hot water to the lavatories and showers, and 140 degree F will be provided to the mop sink. A re-circulating pump loop will be provided.
10. Domestic water piping shall be Type K copper. Hot water piping shall be insulated.
11. Sanitary waste and vent piping will be hubless cast iron aboveground, hub and spigot type underground.

ELECTRICAL

1. The lighting within the Toilet/Locker Area and the Admin. Area will consist of 2' x 4' recessed parabolic fluorescent fixtures with 28 watt T-8 lamps.
2. The lighting controls for the Toilet/Locker Area and the Admin. Area will utilize occupancy sensors.
3. The lighting in the Warehouse and Storage will consist of suspended fluorescent fixtures with high-output, 54 watt T-5 lamps.
4. The lighting controls for the Warehouse and Storage will utilize integral motion sensors at each individual lighting

fixture.

5. Exterior building lighting will consist of metal halide wall fixtures that are dark-sky compliant. The lighting will be controlled through a relay panel with astronomical timeclock.
6. The building will include an addressable fire alarm system.
7. An electronic safety and security system will be provided for the building.
8. A lightning protection system will be provided for the building.
9. A voice/data system will be provided for the building.

FLEET BUILDING NOTES

STRUCTURE

1. Concrete reinforced foundation. Base/prep per Geotech.
2. Pre-Engineered metal building structure with pre-engineered roofing/ system components. Eave height to be 24ft minimum to provide for required clear height in service bays.

EXTERIOR CONSTRUCTION

1. Exterior Walls: Prefinished Kynar metal panels/trim on wall girts {1/640). Interior side of office and support spaces to be painted gyp bd. (equal to Georgia Pacific DensArmor Plus) on 2 ½"furring stud 16" O.C. Metal liner panel to 8ft aff at Fleet Garage. Provide a 4" high concrete curb below sill plate at all exterior walls.
2. Windows: Windows will consist of punched openings. Window system equal to Kawneer Trifab® 451UT is 4-1/2" deep with a 2" sightline and 1" insulated glass. Glazing is to be tinted with low e coating.
3. Main Entry Door: Door system equal to Kawneer Door. Door shall have access control. Provide a canopy over the door.
4. Secondary Doors: Provide insulated HM door w/vision panel and frames painted with a canopy over each door. Each exterior door is to have access control.
5. OH Doors: Provide electrically operated and insulated OH doors w/ security control contact strike plates.
6. Louvers: louvers to be aluminum Kynar finish. Provide insect/bird screens and sub-sill.
7. Roof: Low slope metal roofing panel on 8" roof purlins 4'-0" O.C. equal to Butler MR-24 roof panel with Butler Thermaliner R-23 Insulation System. Roof is to have a single slope towards back wall. Roof drainage is to be gutter and downspouts. Provide low parapet wall on front and side walls.
8. Exterior Canopy at OH doors at Fleet garage to be minimum 16' clear and coordinated with SAWS Fleet vehicles to assure proper clearance.

INTERIOR GENERAL NOTES

Typical interior partition to be one layer 5/8" gyp board each side of 3 5/8" metal studs, 22 ga, 16" OC. Provide sound batt insulation at all multi-purpose rooms and office spaces. All corridor walls are to go deck above. Wall separating service bays to office and support spaces is to be 8" CMU painted and insulated. Wall at end bay is to be 8" painted CMU to 8ft. For walls separating office areas from service bays, storage rooms, mechanical spaces and restrooms are to go to deck.

FINISH PACKAGE DESCRIPTIONS

FP -1: Offices and Associated Support

Spaces Floor: Sealed Concrete
Base: 4" rubber
Walls: Painted gyp board
Ceiling: 2 x 2 mineral board lay-in acoustical ceiling, painted steel grid.
Casework: Plastic laminate with plastic laminate tops/ Rubberized top

Specialties: Tack board, Marker board, Manual roller shades at all windows.

FP -2: Lobbies/Corridors

Floor: Sealed
Concrete Base: 4"
rubber.
Walls: Painted gypsum board (equal to Georgia Pacific DensArmor Plus to 4 ft). Chair rail and corner guards.
Ceiling: 2 x 2 mineral board lay-in acoustical ceiling, painted steel
grid. Specialties:

FP -3: Restrooms

Floor: Ceramic tile with membrane
waterproofing Base: Coved ceramic tile

Walls: Ceramic tile wainscot to 4ft aff and painted above on CMU back up. At wet wall provide ceramic tile full height.
Ceiling: Painted gyp board, semi-gloss
finish Casework: Solid Plastic with solid
surface tops
Specialties: Solid surface toilet partitions, floor mounted. Stainless steel toilet accessories
Provide industrial grade vitreous china Fixtures/Lavatories/Water Closets, Urinals

FP -4: IT/Electrical Rooms

Floor: Sealed concrete, slope to drains
Base: 4" rubber coved base
Walls: Painted gyp board (equal to Georgia Pacific DensArmor Plus) Painted steel deck
Ceiling: 2 x 2 mineral board lay-in acoustical ceiling, painted steel grid.
Specialties: At MDF/IDF rooms provide plywood on walls.

FP -5: Fleet Garage

Floor: Diamond-Plate Light Reflective concrete and painted safety walk. Slope to trench drains.
Base: 4" rubber
Walls: Metal liner panel to 8ft aff. Painted insulated gyp board above at partitions.

FP -6: Janitor

Floor: Sealed concrete
Base: 4" rubber coved base
Walls: Painted gyp board, 4 x 4 glazed ceramic tile wainscot to 6ft just at mop sink.
Ceiling: 2 x 2 mineral board lay-in fiber acoustical ceiling panels, painted steel grid.
Casework: SS Shelving and Mop sink with holder

MEP BUILDING SYSTEMS DESCRIPTION

HVAC

1. The Admin. Area will be air conditioned by a split-system DX air conditioning system with insulated sheet metal supply, return and outside air intake ductwork.
2. The Toilet/Locker Area will be air conditioned by the same split-system DX air conditioning unit serving the Admin. area. The area will be exhausted by a ducted roof-mounted exhaust fan.
3. The Storage Area will be heated by gas-fired radiant unit heaters and ventilated by roof mounted exhaust fans and intake air wall louvers.
4. The Vehicle/Truck Bays will be heated by gas-fired radiant unit heaters and ventilated by roof mounted exhaust fans. A vehicle tailpipe exhaust system will also be required.

PLUMBING

1. The plumbing fixtures within the Toilet/Locker Area will consist of:
2. Wall mounted industrial grade vitreous china water closets with 1.6 gpf flush valves, hands-free sensor operated, electrically powered.
3. Wall mounted industrial grade vitreous china urinals with 0.5 gpf flush valves, hands-free sensor operated, electrically powered.
4. Wall mounted vitreous china lavatories with metered faucet, hands-free sensor operated, electrically powered.
5. Pressure-balanced, thermostatic mixing valves.
6. Floor drains will be provided in the toilet areas. The floor drains in the toilet areas will have trap primers.
7. A dual height electric water cooler will be provided within the Vehicle Bay adjacent to the toilet/locker area.
8. A floor mounted stainless-steel mop sink will be provided.
9. An emergency shower/eyewash is required within each of the Vehicle Bays and each Truck Bay.
10. A gas-fired hot water heater will provide hot water to the lavatories, shower and mop sink. A thermostatic mixing valve will provide 110 degree F hot water to the lavatories and shower, and 140 degree F will be provided to the mop sink. A re-circulating pump loop will be provided.

11. The Vehicle and Truck Bays will have suspended water and air hose reels, stainless steel with automatic retractable hose operation per Phase I
12. An air compressor with a refrigerated dryer will provide shop air to various air outlet stations (with quick disconnect fittings) at each end of each bay (ie; per Phase I).
13. A continuous trench drain will be provided at the exterior perimeter of the Vehicle and Truck Bays. The trench drains will be piped to an oil/water separator.
14. The Wash Area will be equipped with one high pressure wash station. The drainage from the wash area shall be piped to an underground sedimentation pit with an oil/water separator.
16. Exterior wall hydrants will be provided for the fenced Outdoor Yard.
16. Domestic water piping shall be Type K copper. Hot water piping shall be insulated.
17. Sanitary waste and vent piping will be hubless cast iron aboveground, hub and spigot type underground.

ELECTRICAL

1. The lighting within the Toilet/Locker Area and the Admin. Area will consist of 2' x 4' recessed parabolic fluorescent fixtures with 28 watt T-8lamps.
2. The lighting controls for the Toilet/Locker Area and the Admin. Area will utilize occupancy sensors.
3. The lighting in the Vehicle/Truck Bays and Storage will consist of suspended fluorescent fixtures with high-output 54 watt T-8 lamps.
4. The lighting controls for the Storage Area will utilize integral motion sensors at each individual lighting fixture. The lighting controls for the Vehicle/Truck Bays will be through a lighting relay control panel.
5. Exterior building lighting will consist of wall fixtures that are dark-sky compliant. The lighting will be controlled through the relay panel with astronomical timeclock.
6. The building will include an addressable fire alarm system.
7. An electronic safety and security system will be provided for the building.
8. A lightning protection system will be provided for the building.
9. A voice/data system will be provided for the building.
10. The Covered Wash Area lighting will be similar to that used in the Vehicle/Truck Bays except the fixtures will be designed for wet locations, rain tight, and constructed of PVC.

NORTHEAST SIDE OPERATIONS CENTER

MINIMUM REQUIREMENTS SPECIFICATIONS
September, 2020

Applicable Building Codes

On June 21, 2018, City Council approved the adoption of the 2018 International Code Council (ICC) Building-related, Fire and Property Maintenance codes and local amendments to be effective, October 1, 2018.

The following 2018 ICC Building-related, Fire and Property Maintenance codes and the 2017 National Electrical Code with local amendments, were approved to be effective October 1, 2018:

2018 International Building Code, IBC
2018 International Existing Building Code, IEBC
2018 International Residential Code, IRC
2018 International Fire Code, IFC
2018 International Mechanical Code, IMC
2018 International Plumbing Code, IPC
2018 International Fuel Gas Code, IFGC
2018 International Energy Conservation Code, IECC
2017 National Electrical Code, NEC
2018 San Antonio Property Maintenance Code (based on the 2018 International Property Maintenance Code)

It is the Design Build Firm's responsibility to assure compliance with all of the current Building Codes and Authorities Having Jurisdiction at the time of design.

SPECIFICATION SECTIONS

DIVISION 21 - FIRE SUPPRESSION

SECTION

DIVISION 22 - PLUMBING

DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING

DIVISION 26 - ELECTRICAL

End of Table of Contents

SECTION 00 7346
PREVAILING WAGE RATE SCHEDULE

PART 1 GENERAL

1.1 WAGE SCALE

A. The Contractor agrees to pay and require subcontractors to pay all workers employed on the project in accordance with the requirements of the labor and wage standards as listed in the attached wage scale.
   1. The wage scale is entitled "EXHIBIT 17, PREVAILING WAGE RATE SCHEDULE, General Decision Number: per RFP
   2. The Prevailing Wage Rate Schedule is attached following this page.

B. RELATED REQUIREMENTS
   1. General Conditions

C. ATTACHMENT
   1. "EXHIBIT 17, PREVAILING WAGE RATE SCHEDULE, General Decision Number: per RFP.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 0070
PROVISIONS FOR ACCESSIBILITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification sections, apply to work of this section.

1.2 GENERAL REQUIREMENTS:

A. Provisions for accessibility shall be made in full compliance with the 2010 Standards for Accessible Design of Americans with Disabilities Act (ADA) adopted by the U. S. Department of Justice in September, 2010, AND with the requirements of the 2012 Texas Accessibility Standards (TAS) adopted on November 1, 2011, for the purpose of administering the Architectural Barriers Act, Article 469, Texas Civil Statutes, effective March 15, 2012.

B. Provisions for accessibility are indicated throughout the new construction, but not limited to, toilet stalls, urinals, lavatories, mirrors, and all other accessories in multiple-fixture toilet rooms, and including drinking fountains and other building appurtenances.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 ACCESSIBILITY STANDARDS

A. The following is a partial listing of the accessibility standards which are included in The Requirements.

B. In the event of a discrepancy between any dimensions on the drawings and any dimensions listed herein, the dimensions listed herein shall take precedence. The Contractor shall consult with the Architect upon discovery of any such discrepancy and corrections shall be made at the expense of the Contractor, with no additional cost to the Owner. Except in the event of such a discrepancy, all items shall be installed at the mounting heights indicated on the drawings.

C. Several of the Mounting Heights listed below address the mounting height requirements for children. Disregard heights listed for children at non-elementary/middle school buildings and non-children specific buildings.

3.2 MOUNTING HEIGHTS:

A. Handrails:
   1. Ramps:
      a. Children: 28" maximum.
      b. Standard: 34" - 38" above ramp.
   2. Stairs:
      a. Children: 28" maximum above nosings.
      b. Standard: 34" - 38" above nosings.

B. Drinking Fountains:
   1. Standing height: 27" min. knee space / 38” to 43” maximum to spout.
   2. Wheelchair height: 27" min. knee space / 36" maximum to spout.

C. Hand Dryers and Paper Towel Dispensers:
   1. 15” minimum.
   2. 48" maximum to control over a maximum 10” projection.
   3. 44” maximum to control over a 20” to 25” projection.

D. Water Closets:
   1. Children: 11" - 17" to top of seat.
   2. Standard: 17" - 19" to top of seat.
   3. NOTE: Flush valve handle must be on open side of stall/room.

E. Urinals:
   1. 17" maximum to basin opening.

F. Flush Controls: Water Closets

1. 36" maximum to control.

G. Flush Controls: Urinals:
   1. 44" maximum to control.
H. Grab Bars:
   1. Children: 18" - 27" to top of bar.
   2. Standard: 33" - 36" to top of bar.
   3. Toilet Partition Height:
      a. Children: 12" minimum to bottom.
      b. Standard: 9” minimum to bottom.
I. Lavatories and Sinks:
   1. Children, Ages 6 to 12: 24” min. knee clearance at apron / 31” maximum to top.
   2. Standard: 27" min. knee clearance at apron / 34" maximum to top.
J. Mirrors:
   1. Above a countertop: 40" maximum to bottom of the reflective surface. (Not to the frame bottom.)
   2. Not above a countertop: 35" maximum to bottom of the reflective surface. (Not to the frame bottom.)
K. Toilet Paper Dispenser: 15" minimum to 48” maximum to dispenser outlet.
   1. Locate 8 inches horizontally from front edge of water closet to center line of dispenser.
L. Telephones:
   1. Frontal Approach:
      a. 48" max. to top device.
      b. With TTY device: 34” minimum to keypad.
M. Electrical and Communication Systems Receptacles:
   1. 48" maximum / 15" minimum.
N. Switches, Controls and Alarms:
   1. 48" maximum / 15" minimum.
O. Audio-Visual Fire Alarm Signal: Comply with NFPA-72, 1999 or later.
P. Room Identification Signage: 48” minimum to 60” maximum to base line of tactile characters.
Q. Parking Identification Signage: Graphic symbols 60" minimum above paving.
R. Door Handles, Pulls, Locks, Etc.:
   1. Standard: 34” minimum / 48" maximum.
   2. Swimming pool/spa/hot tub security gates: 34” minimum / 54” maximum.
S. Door Operating Force:
   1. Interior Hinged Doors: 5 pounds of force, maximum.
   2. Sliding or Folding Doors: 5 pounds of force, maximum.
T. Door Threshold:
   1. Height at new doors: 1/2" maximum.
   2. Height at existing or altered doors: 3/4” maximum, with bevel on each side with 1:2 maximum slope.
U. Protruding Objects:
   1. Wall mounted:
      a. 27" - 80" High to bottom; 4" maximum projection
   2. Wall mounted:
      a. Less than 27" High to bottom; No maximum projection.
   3. Post or Pylon mounted:
      a. 27"-80" High to bottom; 12" maximum projection.
   4. Post mounted:
      a. 2 posts, greater than 12" apart; 27" maximum clearance below.
   5. Ceiling mounted:
      a. 80" minimum clearance.
V. Passenger Elevators:
   1. Hall Call Buttons: 48" maximum to center.
   2. Car Control Buttons:
      a. Standard: 15" maximum / 48” maximum.
      b. Children: 20" minimum / 44” maximum.

3. Hall Lanterns: 72" minimum.
4. Raised Floor Designations on Jambs: 48” minimum / 60" maximum to bottom of characters.
5. Obstruction Sensors: 5" - 29" high.
6. Emergency car controls: 35" minimum to center.
7. Emergency Communications Devices:
   a. Children: 20" minimum / 44” maximum.
   b. Standard: 15” minimum / 48" maximum.

W. Platform Lifts:
1. Controls: 15" minimum - 48" maximum above platform.

X. Dining Tables and Work Surfaces:
1. Standard: 27" minimum knee clearance;
   a. 28" minimum - 34" maximum to top.

Y. Bathrooms, Bathing Facilities, and Showers:
1. Bathtubs:
   a. Seat: 17” minimum / 19” maximum to bathroom floor.
   b. Grab Bars: two bars, 8” minimum / 10” maximum above tub, and 33” minimum / 36” maximum above tub.
2. Shower Stalls:
   a. Seat: 17” minimum / 19” maximum high.
   b. Grab Bars:
      1) Children: 18" minimum / 27" maximum above stall floor.
      2) Standard: 33" minimum / 36" maximum above stall floor.
   c. Controls:
      1) Children: 20" minimum / 44” maximum..
      2) Standard: 15” minimum / 48" maximum.

Z. Restaurants and Cafeterias:
1. Service Counter: 36” maximum.
2. Tray Slide: 28” minimum / 34” maximum.
3. Self-Serve Shelves with maximum height of 48".
   a. Minimum 50% of all shelves.
4. Dining Surfaces:
   a. Children: 26” minimum / 30” maximum.
   b. Standard: 28” minimum / 34” maximum.

AA. Business and Mercantile:
1. Sales Counters: 36" maximum.
   a. (x 36" min. length)
2. Dressing Room Benches: 17" - 19" above floor.

AB. Libraries:
1. Card Catalogues: 48" maximum.
2. Book Stacks: 96” maximum.
3. Above a 34” (maximum height) x 10” projection: 48" maximum.
4. Above a 34” (maximum height) x 10” to 24” projection: 46” maximum.

3.3 SLOPES ALONG ROUTES ACCESSIBLE BY THE HANDICAPPED:

A. Walkways:
1. Cross Slope: 1:48 maximum.
2. Running Slope: 1:20 (5.0%) maximum.

B. Landings:
1. Cross Slope: 1:48 maximum.
   a. (Measured in any direction)
2. Running Slope: Level.

C. Ramps:
1. Cross Slope: 1:48 maximum.
2. Running Slope:
   a. 3" Rise (existing facilities only) 1:8 (12.5%) maximum.

b. 6" Rise (existing facilities only) 1:10 (10.0%) maximum.
c. All new construction 1:12 (8.3%) maximum.

3. Rise 30" maximum.
4. Width: 36” minimum clear between handrails.

D. Floor Level Changes:
1. Without Edge Treatment: 1/4" maximum.
2. With Edge Treatment: 1:2 Maximum Slope, 1/2" maximum rise.

E. Carpet Pile Height: 1/2" maximum.

END OF SECTION

SECTION 01 3329.07
PROHIBITED CONTENT INSTALLER CERTIFICATION

PROJECT NAME: SAWS NORTHEAST OPERATIONS CENTERS

USE OF THIS FORM

4.1 Because installers are allowed and directed to choose accessory materials suitable for the applicable installation, there is a possibility that such accessory materials might contain VOC content in excess of that permitted, especially where such materials have not been explicitly specified.

4.2 Contractor is required to obtain and submit this form from each installer of work on this project.

4.3 For each product category listed, circle the correct words in brackets: either [HAS] or [HAS NOT].

4.4 If any of these accessory materials has been used, attach to this form product data and MSDS sheet for each such product.

4.5 VOC content restrictions are specified in Section 01 6116.

PRODUCT CERTIFICATION

6.1 I certify that the installation work of my firm on this project:
- A. [HAS] [HAS NOT] required the use of ADHESIVES.
- B. [HAS] [HAS NOT] required the use of JOINT SEALANTS.
- C. [HAS] [HAS NOT] required the use of PAINTS OR COATINGS.
- D. [HAS] [HAS NOT] required the use of COMPOSITE WOOD or AGRIFIBER PRODUCTS.

6.2

6.3 ___ List of products of these types that were used is attached, with manufacturer and brand name.

6.4 ___ Product data and MSDS sheets for these products:
- A. ___ Are attached.
- B. ___ Were submitted as normal submittals.
- C. ___ Were submitted as sustainable design submittals using the Material Content Form.

CERTIFIED BY: (INSTALLER/MANUFACTURER/SUPPLIER FIRM)

8.1 Firm Name: _____

8.2 Print Name: _____

8.3 Signature: _____

8.4 Title: _____ (officer of company)

8.5 Date: _____

END OF SECTION

SECTION 01 3341
STRUCTURAL ENGINEER: SHOP DRAWINGS/FIELD VISITS

PART 1 - GENERAL

1.1 SCOPE
This section defines and clarifies specific items of Article 4 of the General Conditions of the Contract that are particular to the structural engineer's responsibilities. Refer to Article 4 for overall contractual agreements and to appropriate section of this specification for specifics on shop drawing, product data, and samples submitted.

PART 2 - GENERAL DEFINITIONS

2.1 STRUCTURAL ENGINEER OF RECORD
The engineer responsible for the design of the primary structural system and whose seal/signature appears on the contract structural drawings. Responsibility for any secondary structural and non-structural systems not shown on the structural drawings rests with the prime professional, the architect.

2.2 SPECIALTY ENGINEER
The engineer who is lawfully eligible to seal plans and designs for pre-engineered elements on systems which become part of the overall building.

2.3 SUBMITTALS
Items identified in the contract documents to be submitted by the contractor. Refer to individual sections of the specifications for specific items to be submitted.

2.4 FIELD OBSERVATIONS
Visits to the jobsite by the structural engineer-of-record or his authorized representative to ascertain whether the work is generally in accordance with the structural contract documents. These observations are not exhaustive nor continuous.

PART 3 - PROCEDURAL REQUIREMENTS

3.1 SHOP DRAWINGS
Refer to applicable section for specific requirements for number of copies to be submitted, time for review, etc. All submittals must come by way of the general contractor though the architect. Certain submittals, identified in specific sections of the specifications, generally regarding pre-engineered elements, will require a specialty engineer's seal and signature. Shop drawings not reviewed and stamped by the general contractor will be rejected.

3.2 FIELD OBSERVATIONS
Field observations shall be performed by an independent and accredited testing agency hired by the owner.

3.3 ENGINEER'S ACTIONS
A. SHOP DRAWINGS
1. As per article 4.2.7 of the General Conditions, the structural engineer will review shop drawings for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents. Allow two weeks for engineer’s review.
2. The structural engineer-of-record shall review the submittals and return them to the architect with one of the following statements checked off on the stamp:
NO EXCEPTIONS TAKEN
MAKE CORRECTIONS NOTED
AMEND & RESUBMIT
REJECTED - SEE REMARKS

REVIEW IS FOR GENERAL COMPLIANCE WITH CONTRACT DOCUMENTS. NO RESPONSIBILITY IS ASSUMED FOR CORRECTNESS OF DIMENSIONS OR DETAILS.

DATE
BY

a. "No Exceptions Taken" informs the Architect that the structural engineer takes no exception to the submittal being approved as per an in accordance with AIA Document 201, section 4.2.7.

b. "Make Corrections Noted" informs the Architect that the structural engineer has made corrections on the submittals but otherwise takes no exception to the submittal being approved as per and in accordance with AIA Document 201, section 4.2.7.

c. "Amend & Resubmit" indicates important items must be corrected and resubmitted. Marks on the submittal may not necessarily cover all of the defects of the submittal. This action constitutes the structural engineer's concern and his recommendation to the Architect that the submittal be reviewed and resubmitted as per and in accordance with AIA Document 201, section 4.2.7.

d. "Rejected - See Marks" informs the Architect that the submittal has to be resubmitted per remarks and fabrication should not be performed until resubmittals are approved.

B. SHOP DRAWINGS WITH SPECIALTY ENGINEER'S SEAL AND SIGNATURE
Certain shop drawings may be identified in specific sections of the specifications pertaining to pre-engineered structural elements specified by the structural engineer-of-record and designed by specialty engineers. The structural engineer shall verify that submittals have received prior approvals as required by the contract documents. Submittals shall bear the signature and professional seal of the specialty engineer responsible for the design as required by the contract documents. The structural engineer shall review the submittal for type, position, and connection to other elements within the primary structural system, and for criteria and loads used for their design. Action on these submittals will be the same as for other shop drawings.

3.4 SITE VISITS

A. An independent and accredited testing agency hire by the owner will make site visits at intervals appropriate to the stage of construction and as defined by the contract to visually observe the quality and the progress of the construction work relative to the primary structural system. The general contractor is responsible to notify the independent and accredited testing agency when structural elements are ready for review and prior to their being covered up. Failure to do so may result in key observations not being made, preventing the engineer from recommending acceptance of the work. A written report will be made of each visit listing discrepancies, if any, and describing what was observed. One copy will be given to contractor's representative at the jobsite, and one copy will be mailed to the Architect. If a follow-up visit is necessary it will be so noted on the report.

B. The Structural Engineer of Record (SER) or independent and accredited testing agency performing site visits/field observations shall not have control over or charge of and shall not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work for This Part of the Project, since these are solely the Contractor's responsibility under the Contract for Construction. The SER or independent and accredited testing agency shall not be responsible for the Contractor's or a Subcontractor's schedule or failure to carry out the Work in accordance with the Contract Documents. The SER or independent and accredited testing agency shall not have control over or charge of acts or omissions of the Contractor, Subcontractors, their agents or employees or other persons performing portions of the Work.

END OF SECTION

SECTION 01 4000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. References and standards.
- B. Quality assurance submittals.
- C. Quality Assurance - Experience Level.
- D. Quality Assurance - Shop Drawings.
- E. Mock-ups.
- F. Control of installation.
- G. Tolerances.
- H. Testing and inspection services.
- I. Manufacturers' field services.

1.2 RELATED REQUIREMENTS
- A. Document 00 7200 - General Conditions: Inspections and approvals required by public authorities.
- B. Section 01 2100 - Allowances: Allowance for payment of testing services.
- C. Section 01 3000 - Administrative Requirements: Submittal procedures.
- D. Section 01 6000 - Product Requirements: Requirements for material and product quality.
- E. Contractor's accepted Quality Control Plan.

1.3 REFERENCE STANDARDS
- A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2014).
- B. ASTM C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2014.
- C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2013.
- D. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2014a.
- E. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2013.
- F. ASTM E 548 - Standard Guide for General Criteria used for Evaluating Laboratory Competence; 1994.

1.4 SUBMITTALS
- A. Testing Agency Qualifications:
  1. Prior to start of Work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
  2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
  3. Testing Agency must become thoroughly familiar with the Goetechnical Study including recommendations and caveats.
- B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.
- C. Test Reports: After each test/inspection, promptly submit three copies of report to Program Manager, to Architect, and to Contractor.
  1. Include:
     a. Date issued.
     b. Project title and number.
     c. Name of inspector.
     d. Date and time of sampling or inspection.
     e. Identification of product and specifications section.
     f. Location in the Project.

g. Type of test/inspection.
h. Date of test/inspection.
i. Results of test/inspection.
j. Conformance with Contract Documents.
k. When requested by Architect, provide interpretation of results.

2. Failure to submit reports is cause for rejection of Pay Requests.

D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Program Manager and to Architect, in quantities specified for Product Data.
1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

F. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
1. Submit report in duplicate within 30 days of observation to Architect for information.
2. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

G. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

1.5 QUALITY ASSURANCE - EXPERIENCE LEVEL

A. The work of each section of these specifications shall be executed by an entity with a minimum experience level in the work described as expressed in the section.

B. Where the experience level is not expressed it shall known here that the experience level must be at least five (5) years of documented experience in the work of the specification section. Contractors and subcontractors must be able to show recent examples of their work (up to (3) three) in the local area.

C. Products and fabrications and services shall be made by manufacturers / fabricators / contractors / service providers with a minimum experience level expressed in the specification section.

D. Where the experience level of the manufacturer/fabricator/contractor is not expressed it shall known here that the experience level must be at least five (5) years of documented experience in the product or fabrication or service of the items/work described in the specification section.

E. Upon the Architect/Engineers request, manufacturers / fabricators / contractors / service providers shall provide the names, addresses and phone numbers of a minimum of five (5) references.

1.6 QUALITY ASSURANCE - SHOP DRAWINGS

A. Where Specifications or drawings call for the performance of shop drawings to be designed and prepared under direct supervision of a Professional Engineer, the Engineer must be experienced in the discipline/design of the work specified and licensed in the state where the project resides.

B. Shop Drawings prepared under the supervision of a Professional Engineer must bear the Engineers seal and signature.

C. The Engineer's seal and signature is the only evidence acceptable that the shop drawings were designed and prepared under Engineers supervision.

1.7 MOCK-UPS

A. Full size physical assemblies that are constructed on-site.

B. Mockups are constructed to verify selections made under sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances.
C. Mockups are not Samples.
D. Approved mockups establish the standard by which the Work will be judged, Unless otherwise indicated.
E. Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
    1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
    2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
    3. Demonstrate the proposed range of aesthetic effects and workmanship.
    4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
        a. Allow seven days for initial review and each re-review of each mockup.
    5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
    6. Demolish and remove mockups when directed, unless otherwise indicated.

1.8 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
C. Obtain copies of standards where required by product specification sections.
D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.9 TESTING AND INSPECTION AGENCIES

A. As indicated in individual specification sections, Owner or Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.
B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
C. Contractor Employed Agency:
    1. Testing agency: Comply with requirements of ASTM E 329, ASTM E 543, ASTM C 1021, ASTM C 1077, and ASTM C 1093.
    2. Laboratory: Authorized to operate in State in which Project is located.
    3. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
    4. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
B. Comply with manufacturers' instructions, including each step in sequence.
C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
E. Have Work performed by persons qualified to produce required and specified quality.
F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.2 MOCK-UPS

A. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
C. Accepted mock-ups shall be a comparison standard for the remaining Work.
D. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.3 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
C. Adjust products to appropriate dimensions; position before securing products in place.

3.4 TESTING AND INSPECTION

A. Testing Agency Duties:
    1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
    2. Perform specified sampling and testing of products in accordance with specified standards.
    3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
    4. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
    5. Perform additional tests and inspections required by Architect.
    6. Submit reports of all tests/inspections specified.
B. Limits on Testing/Inspection Agency Authority:
    1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
    2. Agency may not approve or accept any portion of the Work.
    3. Agency may not assume any duties of Contractor.
    4. Agency has no authority to stop the Work.
C. Contractor Responsibilities:
    1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.

2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
3. Provide incidental labor and facilities:
    a. To provide access to Work to be tested/inspected.
    b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
    c. To facilitate tests/inspections.
    d. To provide storage and curing of test samples.
4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

D. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.
E. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

3.5 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment and controls as applicable, and to initiate instructions when necessary.
B. Submit qualifications of observer to Architect 30 days in advance of required observations.
    1. Observer subject to approval of Architect.
C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.6 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.
B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 4523
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES
- A. Testing laboratory services and responsibilities related to those services.

1.2 REFERENCES
- A. ASTM C 1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
- B. ASTM D 3666 - Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials.
- C. ASTM D 3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- D. ASTM E 329 - Standard Specification for Minimum Requirements for Agencies Engaged the Testing and/or Inspection of Materials Used in Construction.
- E. ISO/IEC 17025 - General Requirements for the Competence of Calibration and Testing Laboratories.

1.3 SELECTION AND PAYMENT
- A. SAWS will select, employ, and pay for services of independent testing laboratory to perform inspection and testing for the following construction operations:
  1. Roadway Excavation
  2. Excavation and Backfill for Structures
  3. Excavation and Backfill for Utilities
  4. Drilled Shaft Foundations
  5. Asphaltic Concrete Pavement
  6. Concrete Pavement
  7. Structural Concrete
  8. Masonry
- B. Employment of testing laboratory by SAWS does not relieve the Contractor of obligation to perform the Work in accordance with requirements of Contract Documents.
- C. SAWS deducts minimum 2-hour charge for testing laboratory time from periodic progress payment when operations requiring testing or inspection are canceled without prior notification.
- D. SAWS deducts cost of retesting from periodic progress payment whenever failed work is removed, replaced and retested.
- E. SAWS Program Manager schedules and monitors testing. Provide 24 hours' notice of testing to Program Manager to avoid delay of the Work.

1.4 QUALIFICATION OF LABORATORY
- A. The testing laboratory shall be Professional Services Incorporated as a subcontractor to the Program Manager.
- B. If laboratory subcontracts are part of testing services, such work will be placed with laboratory complying with requirements of this Section.

1.5 LABORATORY REPORTS
- A. Testing laboratory provides and distributes copies of laboratory reports to distribution list provided by Program Manager at preconstruction conference.
- B. Keep one copy of each field and laboratory test report distributed at site field office for duration of project. 30
- C. Laboratory will distribute field and laboratory test reports to recipients on the distribution list provided by Program Manager at preconstruction conference, no later than close of business on working day following test completion and review, reports which indicate failing test results.

1.6 LIMITS ON TESTING LABORATORY AUTHORITY
- A. Laboratory may not release, revoke, alter, or enlarge requirements of Contract.
- B. Laboratory may not approve or accept any portion of the Work.

C. Laboratory may not assume duties of Contractor.
D. Laboratory has no authority to stop the Work.

1.7 CONTRACTOR RESPONSIBILITIES

A. Provide safe access to the Work and to manufacturers' facilities for Program Manager and for testing laboratory personnel.
B. Provide testing laboratory with copy of construction schedule and copy of each update to construction schedule.
C. Notify Program Manager and testing laboratory during normal working hours of day previous to expected time for operations requiring inspection and testing services. When Contractor fails to make timely prior notification, then do not proceed with operations requiring inspection and testing services.
D. Notify Design Consultant 24 hours in advance when Specification requires presence of Design Consultant for sampling or testing.
E. Request and monitor testing as required to provide timely results and avoid delay to the Work. Provide samples to laboratory in sufficient time to allow required test to be performed in accordance with specified test methods before intended use of material.
F. Cooperate with laboratory personnel in collecting samples on site. Provide incidental labor and facilities for safe access to the Work to be tested; to obtain and handle samples at site or at source of products to be tested; and to facilitate tests and inspections including storage and curing of test samples.
G. Arrange with laboratory through Program Manager.
    1. Retesting required for failed tests
    2. Retesting for nonconforming Work
    3. Additional sampling and tests requested beyond specified requirements
    4. Insufficient notification of cancellation of tests for Work scheduled but not performed

1.8 CONDUCTING TESTING

A. Conform laboratory sampling and testing specified in individual Specification sections to latest issues of ASTM standards, TxDOT methods, or other recognized test standards.
B. Requirements of this section also apply to those tests for approval of materials, for mix designs and for quality control of materials as performed by employed testing laboratories.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 01 4533
CODE-REQUIRED SPECIAL INSPECTIONS

PART 1 GENERAL - NOT USED

1.1 SECTION INCLUDES
- A. Code-required special inspections.
- B. Testing services incidental to special inspections.
- C. Submittals.
- D. Manufacturers' field services.
- E. Fabricators' field services.

1.2 RELATED REQUIREMENTS
- A. Document 00 3100 - Available Project Information: Soil investigation data.
- B. Document 00 7200 - General Conditions: Inspections and approvals required by public authorities.
- C. Section 01 2100 - Allowances: Allowance for payment of testing services.
- D. Section 01 3000 - Administrative Requirements: Submittal procedures.
- E. Section 01 4000 - Quality Requirements.
- F. Section 01 4523 - Testing Laboratory Services
- G. Section 01 6000 - Product Requirements: Requirements for material and product quality.

1.3 DEFINITIONS
- A. Code or Building Code: 2018 Edition of the International Building Code and, more specifically, Chapter 17 - Structural Tests and Inspections, of same.
- B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.
- C. Special Inspection:
  1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the AHJ that also require special expertise to ensure compliance with the approved contract documents and the referenced standards.
  2. Special inspections are separate from and independent of tests and inspections conducted by Owner or Contractor for the purposes of quality assurance and contract administration.

1.4 REFERENCE STANDARDS
- A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2019.
- B. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2012a.
- C. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2018.
- D. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2015.
- E. ASTM E605 - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 1993 (Reapproved 2019).
- F. ASTM E736 - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members; 2000 (Reapproved 2017).
- G. ASTM E2570 - Standard Test Methods for Evaluating Water-Resistive Barrier (WRB) Coatings Used under Exterior Insulation and Finish Systems (EIFS) or EIFS with Drainage; 2019.
- H. AWCI 125 - Technical Manual 12-B: Standard Practice for the Testing and Inspection of Field-Applied Thin Film Intumescent Fire-Resistance Materials; 2014.
- I. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; 2018.

1.5 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Special Inspection Agency Qualifications: Prior to the start of work, the Special Inspection Agency shall:
    1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
    2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
    3. Submit certification that Special Inspection Agency is acceptable to AHJ.
C. Testing Agency Qualifications: Prior to the start of work, the Testing Agency shall:
    1. Submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
    2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
    3. Submit certification that Testing Agency is acceptable to AHJ.
D. Smoke Control Testing Agency Qualifications: Prior to the start of work, the Testing Agency shall:
    1. Submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
    2. Submit documentary evidence that agency has appropriate credentials and documented experience in fire protection engineering, mechanical engineering and HVAC air balancing.
    3. Submit certification that Testing Agency is acceptable to AHJ.
E. Manufacturer's Qualification Statement: Manufacturer shall submit documentation of manufacturing capability and quality control procedures. Include documentation of AHJ approval.
F. Fabricator's Qualification Statement: Fabricator shall submit documentation of fabrication facilities and methods as well as quality control procedures. Include documentation of AHJ approval.
G. Special Inspection Reports: After each special inspection, Special Inspector shall promptly submit two copies of report; one to Architect and one to the AHJ.
    1. Include:
        a. Date issued.
        b. Project title and number.
        c. Name of Special Inspector.
        d. Date and time of special inspection.
        e. Identification of product and specifications section.
        f. Location in the Project.
        g. Type of special inspection.
        h. Date of special inspection.
        i. Results of special inspection.
        j. Conformance with Contract Documents.
    2. Final Special Inspection Report: Document special inspections and correction of discrepancies prior to the start of the work.
H. Fabricator Special Inspection Reports: After each special inspection of fabricated items at the Fabricator's facility, Special Inspector shall promptly submit two copies of report; one to Architect and one to AHJ.
    1. Include:
        a. Date issued.
        b. Project title and number.
        c. Name of Special Inspector.
        d. Date and time of special inspection.
        e. Identification of fabricated item and specification section.
        f. Location in the Project.
        g. Results of special inspection.
        h. Verification of fabrication and quality control procedures.

i. Conformance with Contract Documents.
j. Conformance to referenced standard(s).

I. Test Reports: After each test or inspection, promptly submit two copies of report; one to Architect and one to AHJ.
1. Include:
a. Date issued.
b. Project title and number.
c. Name of inspector.
d. Date and time of sampling or inspection.
e. Identification of product and specifications section.
f. Location in the Project.
g. Type of test or inspection.
h. Date of test or inspection.
i. Results of test or inspection.
j. Conformance with Contract Documents.

J. Certificates: When specified in individual special inspection requirements, Special Inspector shall submit certification by the manufacturer, fabricator, and installation subcontractor to Architect and AHJ, in quantities specified for Product Data.
1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect and AHJ.

K. Manufacturer's Field Reports: Submit reports to Architect and AHJ.
1. Submit report in duplicate within 30 days of observation to Architect for information.
2. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

L. Fabricator's Field Reports: Submit reports to Architect and AHJ.
1. Submit report in duplicate within 30 days of observation to Architect for information.
2. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

1.6 SPECIAL INSPECTION AGENCY

A. Owner or Architect will employ services of a Special Inspection Agency to perform inspections and associated testing and sampling in accordance with ASTM E329 and required by the building code.

B. The Special Inspection Agency may employ and pay for services of an independent testing agency to perform testing and sampling associated with special inspections and required by the building code.

C. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.7 TESTING AND INSPECTION AGENCIES

A. Owner or Architect may employ services of an independent testing agency to perform additional testing and sampling associated with special inspections but not required by the building code.

B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.8 QUALITY ASSURANCE

A. Special Inspection Agency Qualifications:
1. Independent firm specializing in performing testing and inspections of the type specified in this section.

B. Testing Agency Qualifications:
1. Independent firm specializing in performing testing and inspections of the type specified in this section.

C. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 SCHEDULE OF SPECIAL INSPECTIONS, GENERAL

A. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.
   1. Continuous Special Inspection: Special Inspection Agency shall be present in the area where the work is being performed and observe the work at all times the work is in progress.
   2. Periodic Special Inspection: Special Inspection Agency shall be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

3.2 SPECIAL INSPECTIONS FOR STEEL CONSTRUCTION

3.3 SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION

A. Reinforcing Steel, Including Prestressing of Tendons and Placement: Verify compliance with approved contract documents and ACI 318, 3.5 and 7.1 through 7.7; periodic.
B. Reinforcing Steel Welding: Verify compliance with AWS D1.4 and ACI 318, 3.5.2; periodic.
C. Design Mix: Verify plastic concrete complies with the design mix in approved contract documents and with ACI 318, Chapter 4 and 5.2; periodic.
D. Specified Curing Temperature and Techniques: Verify compliance with approved contract documents and ACI 318, 5.11 through 5.13; periodic.
E. Concrete Strength in Situ: Verify concrete strength complies with approved contract documents and ACI 318, 6.2, for the following.
F. Formwork Shape, Location and Dimensions: Verify compliance with approved contract documents and ACI 318, 6.1.1; periodic.

3.4 SPECIAL INSPECTIONS FOR MASONRY CONSTRUCTION

3.5 SPECIAL INSPECTIONS FOR PREFABRICATED WOOD CONSTRUCTION

3.6 SPECIAL INSPECTIONS FOR SOILS

A. Materials and Placement: Verify each item below complies with approved construction documents and approved geotechnical report.
   1. Design bearing capacity of material below shallow foundations; periodic.
   2. Design depth of excavations and suitability of material at bottom of excavations; periodic.
   3. Materials, densities, lift thicknesses; placement and compaction of backfill: continuous.
   4. Subgrade, prior to placement of compacted fill; periodic.
B. Testing: Classify and test excavated material; periodic.

3.7 SPECIAL INSPECTIONS FOR CAST-IN-PLACE DEEP FOUNDATIONS

A. Materials, Equipment and Final Placement: Verify each item below complies with approved construction documents and approved geotechnical report.
   1. Element length; continuous.
   2. Element diameters and bell diameters; continuous.
   3. Embedment into bedrock; continuous.
   4. End bearing strata capacity; continuous.
   5. Placement locations and plumbness; continuous.
   6. Type and size of hammer; continuous.
B. Drilling Operations: Observe and maintain complete and accurate records for each element; continuous.
C. Material Volume: Record concrete and grout volumes.
D. Concrete Elements Associated with Cast-in-Place Deep Foundations: Perform additional inspections as required by the Special Inspections for Concrete Construction article of this section.

3.8 SPECIAL INSPECTIONS FOR SPRAYED FIRE RESISTANT MATERIALS

A. Sprayed Fire Resistant Materials, General:

1. Verify compliance of sprayed-fire resistant materials with specific fire-rated assemblies shown in the approved contract documents, and with the applicable requirements of the building code.
2. Perform special inspections after rough installation of electrical, mechanical, plumbing, automatic fire sprinkler and suspension systems for ceilings.

B. Physical and visual tests: Verify compliance with fire resistance rating.
1. Condition of substrates; periodic.
2. Thickness of sprayed fire resistant material; periodic.
3. Density of sprayed fire resistant material in pounds per cubic foot (kg per sq m); periodic.
4. Bond strength (adhesion and cohesion); periodic.
5. Condition of finished application; periodic.

C. Structural member surface conditions:
1. Inspect structural member surfaces before application of sprayed fire resistant materials; periodic.
2. Verify preparation of structural member surfaces complies with approved contract documents and manufacturer's written instructions; periodic.

D. Application:
1. Ensure minimum ambient temperature before and after application complies with the manufacturer's written instructions; periodic.
2. Verify area where sprayed fire resistant material is applied is ventilated as required by the manufacturer's written instructions during and after application; periodic.

E. Thickness: Verify that no more than 10 percent of thickness measurements taken from sprayed fire resistant material are less than thickness required by fire resistance design in approved contract documents. In no case shall the thickness of the sprayed fire resistant material be less than the minimum below.
1. Minimum Allowable Thickness: Tested according to ASTM E605, periodic.
a. Design thickness 1 inch (25 mm) or greater: Design thickness minus 1/4 inch (6.4 mm).
b. Design thickness greater than 1 inch (25 mm): Design thickness minus 25 percent.

F. Density: Verify density of sprayed fire resistant material is no less than density required by the fire resistance design in the approved contract documents.

G. Bond Strength: Verify adhesive and cohesive bond strength of sprayed fire resistant materials is no less than 150 pounds per square foot (7.18 kPa) when in-place samples of the cured material are tested according to ASTM E736 and as described below.

3.9 SPECIAL INSPECTIONS FOR MASTIC AND INTUMESCENT FIRE RESISTANT COATINGS

A. Verify mastic and intumescent fire resistant coatings comply with AWCI 12-B and the fire resistance rating shown on the approved contract documents.

3.10 SPECIAL INSPECTIONS FOR EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS)

A. Verify water resistive barrier coating applied over sheathing complies with ASTM E2570.

3.11 SPECIAL INSPECTIONS FOR SMOKE CONTROL

A. Test smoke control systems as follows:
1. Record device locations and test system for leakage after erection of ductwork but before starting construction that conceals or blocks access to system.
2. Test and record pressure difference, flow measurements, detection function and controls after system is complete and before structure is occupied.

3.12 OTHER SPECIAL INSPECTIONS

A. Provide for special inspection of work that, in the opinion of the AHJ, is unusual in nature.

END OF SECTION

CITY OF SAN ANTONIO
DEVELOPMENT SERVICES DEPARTMENT
P.O.BOX 839966 I SAN ANTONIO TEXAS 78283-3966

ACCREDITED Building Department

TO: Development Services Customers

SUBJECT: **INFORMATION BULLETIN 132**
Program Policies, Procedures & Guidelines, Lists, Notice Forms and Report Forms for Special Inspections

DATE: May 25, 2007
Revised December 21, 2018

CREATED BY: Field Services Division

Purpose:

As a customer service initiative, the Development Services Department (DSD) created this **revised** bulletin to update Information Bulletin 132. Information Bulletin 132 was created to provide a more user friendly tool that DSD customers can use when researching the policies, procedures, guidelines, lists, notice forms and report forms required for the Special Inspections program found in Section 1704 and amended Section 1704.2 of the 2018 *International Building Code.* See Information Bulletin 185 Smoke Control System Submittal Requirements for smoke control analysis report and testing requirements.

All forms required by the Special Inspections program are attached to this bulletin and are available on-line.

Scope:

Please review the program, and its policies and procedures information sheets outlined below in Sections A through F:

- Section A) Owner – Definition and Responsibilities
- Section B) Responsibilities of the Registered Design Professional in Responsible Charge
- Section C) Responsibilities of the Special Inspector
- Section D) Responsibilities of the General Contractor
- Section E) Lists, Notice Forms, and Report Forms for Special Inspections
- Section F) Special Inspection Reviews (SIR)

Should you have any questions on this process regarding Special Inspections, please contact the Development Services Department Administrator at (210) 207-0159 or the Building Inspections Supervisor at (210) 207-8314.

Attachments below:

Special Inspections Program Policies, Procedures & Guidelines
Determination of Required Special Inspections
Report of Required Special Inspections
Notice of Non-compliance
Final Report of Required Special Inspections
Special Inspector Application Form
Special Inspector Qualification Reference Letter
Special Inspection Status Log (Revised)

Summary:

This Information Bulletin is for information purposes only.

Prepared by: Ramiro Carrillo, Chief Building Inspector

Reviewed by: Michael Constantino, DSD Administrator

Authorized by: Amin Tohmaz, PE, Field Services Interim Assistant Director, Development Services

Special Inspections Program Policies, Procedures & Guidelines

IBC2018 Section 1704 Special Inspections

Information Bulletin 132 ***Revised July, 2017***

Index:

A) Responsibilities of the **Owner:**

- Special Inspections are the responsibility of the Owner.
- The Owner is responsible for employing or contracting the RDPiRC.
- The Owner is responsible for immediately contacting the building official, in writing, when there is a change of the RDPiRC.
- The Owner is responsible for the special inspections fees/costs. These fees/costs are not included in any permit or plan review fees.

B) Definition and Responsibilities of the **Registered Design Professional in Responsible Charge** (RDPiRC):

- The RDPiRC is an individual who is a licensed design professional in the State of Texas, implements the special inspections program and is responsible for the Determination of Required Special Inspections, Section 1704.2 of the *International Building Code*.
- The RDPiRC contracts with or is employed by the owner. The RDPiRC and the special inspectors and testing technicians **may not** be in the employ of the general contractor, subcontractors or material suppliers. In the case of an owner/contractor, the building official shall specify who employs the RDPiRC and special inspectors.
- The RDPiRC, as the owner's agent, may employ or contract with the special inspectors.
- The RDPiRC shall assign only qualified special inspectors approved by the Building Official.
- The RDPiRC is responsible for providing the general contractor with a list of all required Special Inspections and the associated special inspectors prior to construction.
- The RDPiRC shall submit associated special inspector field reports to the building official with a copy to the special inspector, owner and general contractor indicating compliance for any NNC items reported and
  advising the building official to allow work to continue.
- RDPiRC is responsible to prepare, sign and submit the Final Report of Required Special Inspections after the general contractor completes his work according to the approved construction documents. The RDPiRC shall prepare the Final Report of Required Special Inspections using the form approved by the building official (attached).
- The employment of the RDPiRC does not relieve the building official of his responsibility for such inspection acceptance or for the other periodic and called for inspections as required by the current building code.
- If at any point during construction the design professional is no longer employed as the RDPiRC of the project, written notification must be immediately submitted to the building official.

C) Definition and Responsibilities of the **Special Inspectors**:

- Each special inspector must be qualified in the area of expertise of special inspection required as well as being registered with the City of San Antonio. (See Qualification form attached).
- Each special inspector contracts with or is employed by the RDPiRC or owner.
- Each special inspector must understand the information provided and evaluate if that information is sufficient to successfully perform the inspection. Each special inspector must make that decision and if some of the required information is not understandable or available, he must obtain the necessary information, in approved form, through the appropriate channels. Each special inspector is responsible to review the plans thoroughly and sufficiently ahead of construction to establish if he can inspect those items entrusted to him. All errors and/or omissions in the approved plans that create any form of doubt or ambiguity for the special inspector shall be resolved through the proper channels. The special inspector shall indicate in his reports that information furnished was sufficiently clear and understandable for him to properly inspect.
- Each special inspector is responsible for verification that those items detailed in the permitted plans and specifications are built into the project.
- Special inspectors shall prepare, sign and submit to the RDPiRC an inspection report for any time spent at a project site. Submit the reports within a reasonable time of the inspection. Include in the report any supporting documentation.
- The special inspector shall bring non-complying items to the immediate attention of the general contractor and the RDPiRC. If correcting the non-complying items is not in a timely manner or ignored, the special inspector is to prepare, sign and submit a Notice of Non-Compliance (NNC) to the RDPiRC with a copy directly to the building official, the general contractor and owner. In receiving the NNC, the building official may suspend all future work in the areas of such non-compliance until the non-compliant items are corrected and the RDPiRC issues a field report to the building official with a copy to the special inspector, owner and general contractor indicating compliance. The special inspector shall prepare the NNC using the NNC form approved by the building official (attached).
- Each special inspector is responsible to prepare, sign and submit to the RDPiRC his Report of Required Special Inspections. This report shall be prepared on the Report of Required Special Inspections form approved by the building official (form attached).
- Each Special Inspector is responsible for any changes to their registration records.
- Each Special Inspector is responsible for updating their certifications with the Development Services Department.
- Each Special Inspector shall be responsible for renewing their ID # annually.

D) Responsibilities of the **General Contractor**:

- The general contractor is responsible for coordinating all testing and inspections, and notifying the RDPiRC and the special inspector of work ready for inspection.
- The general contractor must provide access to and means for safe and proper inspection of such work. Inspections may be denied if safe access is not provided at the job site.
- The general contractor shall keep a special inspections log book readily available for both the special inspectors and the city building inspector. The special inspections log book shall include a copy of the following: 1) Determination Letter of Required Special Inspections, 2) The special inspections log & sign in sheet 3) A copy of all special inspection reports from the special inspector, 4) Any changes that may apply to special inspections on the project.
- The general contractor **shall not** employ the special inspector.

E) Lists, Notice Forms and Report Forms for Special Inspections

- List of Required Special Inspections**:**
  - A complete itemized list according to IBC 2018 Section 1705 submitted by the RDPiRC as part of the permit documents
  - List the RDPiRC name and contact information
  - If the RDPiRC determines that as per Section 1704.2 of the 2018 IBC no special inspections are applicable to the project, the determination letter must be signed and sealed only.

- The RDPiRC shall furnish the required qualifications of the special inspector and frequency of each special inspection upon request.

- Refer to IBC 2018 Section 1705 for special instructions/tables.
- Note any special instructions for performance.
- Sample list attached

- Notice of Non Compliance:
  - Only submit as required by the building code as described under the responsibilities of the special inspector.
  - Sample NNC attached
- Report of Required Special Inspections:
  - Report prepared, signed and submitted by each special inspector to the RDPiRC for the RDPiRC to prepare the Final Report of Required inspections.
  - Submitting this report indicates that inspections and tests performed, either periodically or continuously, represent all the work for the item inspected.
  - Copy to the general contractor.
- Final Report of Required Special Inspections:
  - Report prepared, signed and submitted by the RDPiRC to the owner for the owner to submit to the building official – sample attached
  - Submitted upon completion of all special inspections and resolution of all NNC items.
  - Copy to general contractor and all special inspectors listed in the report.
  - This report is required to be submitted prior to the issuance of a C of O and Temporary C of O

F) Special Inspection Review **(SIR)**

- The Development Services Department building inspectors will generate the Special Inspection Review applicable to each special inspection identified in the approved plans and documents by the RDPiRC for compliance with the Special Inspections Program.
- A log book of all the identified special inspections must be located on the job site and presented to the building inspector for review when requested.
- SIR's are to be scheduled by the inspectors only and are to not be confused with an inspection request.
- Failure of the **general contractor** to provide a log sheet on the job site will result in an immediate issuance of a STOP WORK order by the building inspector.

Registered Design Professional in Responsible Charge Letterhead
Revised July, 2017

[Date]

[Owner]
[Owner address 1]
[Owner address 2]
[CSZ]

Determination of Required Special Inspections Section 1704

Project:[Project Name]
[Project Address]
San Antonio, Texas

Section 1704 of the ***International Building Code***, as amended by the City of San Antonio, has been reviewed. The following is a list of the required special inspections applicable for this project:

2018 IBC Section	Type of Special Inspections and Extent	Applicable	Non Applicable	Continuous or Periodic
1705.1.1	Special Cases	☐	☐	
1705.2	Steel construction	☐	☐	
1705.3	Concrete construction	☐	☐	
1705.4	Masonry construction	☐	☐	
1705.5	Wood construction	☐ ☐	☐ ☐	
1705.6	Soils	☐	☐	
1705.7	Driven deep foundations	☐	☐	
1705.8	Cast-in-place deep foundations	☐	☐	
1705.9	Helical pile foundations	☐	☐	
1705.10	Fabricated items			
1705.11	Special Inspections for wind resistance	☐	☐	
1705.12	Special Inspections for seismic resistance	☐	☐	
1705.13	Testing for seismic resistance	☐	☐	

1705.14	Sprayed fire-resistant materials	☐	☐	
1705.15	Mastic and intumescent fire-resistant coatings	☐	☐	
1705.16	Exterior insulation and finish systems (EIFS)	☐	☐	
1705.17	Fire-resistant penetrations and joints	☐	☐	
1705.18	Testing for smoke control (see IB 185)	☐	☐	
2018 IBC Section	**Type of Special Inspection and Extent**	**Applicable**	**Not Applicable**	**Details**
1706	Design Strengths of Materials	☐	☐	
1707	Alternative Test Procedures	☐	☐	
1708	In-Situ Load Tests	☐	☐	
1709	Preconstruction Load Tests	☐	☐	

At the completion of construction, a final report written by the Registered Design Professional in Responsible Charge that documents all of the special inspections required will be submitted to the building official, via the Owner. It is our understanding that a Certificate of Occupancy will not be issued by the City of San Antonio until this final report is received, indicating that there are no remaining deficiencies.

[RDPiRC Seal]

Respectfully,

[RDPiRC Firm Name]

[Signature of RDPiRC]

_____

[Name of Registered Design Professional in Responsible Charge]

cc: General Contractor

Special Inspector Letterhead

Revised July, 2017

[Date]

[Owner or Registered Design Professional in Responsible Charge (RDPiRC)]
[Address 1]
[Address 2]
[CSZ]

Report of Required Special Inspections

Project:[Project Name]
[Project Address]
San Antonio, Texas

The appropriate design professionals prepared and submitted a list of required inspections (as required by the *International Building Code* Section 1704.2 as amended by the City of San Antonio) on the permit set of drawings submitted for a building permit for this project.

City of San Antonio Permit Number [AP#]

As your special inspector for the specific required inspections listed below for this project during construction, to the best of my information, knowledge and belief, the listed required inspections and tests for this project have been performed and all discovered discrepancies have been resolved.

Inspections and tests performed, either periodically or continuously, represent all the work for the item inspected.

Respectfully,

[Inspector Firm Name]

[Signature of Inspector]

_____

[Name of Inspector]

[Special Inspector's Seal]

(if applicable)

Cc: General Contractor

The following is the list of the required items of construction listed on the permitted construction documents that I inspected:

Inspections Required Special Inspector / Firm

Related Special Inspections

- ☐ Section 1705.1.1 Special Cases:_____
- ☐ Section 1705.2 Steel Construction:_____
- ☐ Section 1705.3 Concrete Construction:_____
- ☐ Section 1705.4 Masonry Construction:_____
- ☐ Section 1705.5 Wood Construction:_____
- ☐ Section 1705.6 Soils:_____
- ☐ Section 1705.7 Driven Deep Foundations:_____
- ☐ Section 1705.8 Cast-in-place Deep Foundations:_____
- ☐ Section 1705.9 Helical Pile Foundations:_____
- ☐ Section 1705.10 Fabricated items:_____
- ☐ Section 1705.11 Special Insp. for Wind Resistance:_____
- ☐ Section 1705.12 Special Insp. for Seismic Resistance:_____
- ☐ Section 1705.13 Testing for Seismic Resistance:_____
- ☐ Section 1705.14 Sprayed Fire-Resistant Materials:_____
- ☐ Section 1705.15 Mastic & Intumescent Fire-Resistant Coatings:_____
- ☐ Section 1705.16 Exterior Insulation and Finish Systems (EIFS):_____
- ☐ Section 1705.17 Fire Resistant Penetrations and Joints:_____
- ☐ Section 1705.18 Special Inspection for Smoke Control (see IB 185):_____

☐ Section 1706 Design Strengths of Materials:_____

☐ Section 1707 Alternative Test Procedures:_____

☐ Section 1708 In-Situ Load Tests:_____

☐ Section 1709 Preconstruction Load Tests:_____

NOTES:

- List includes only the inspections performed by this inspector. Other inspectors for the other required inspections listed on the permitted construction documents will submit other statements.

ADDITIONAL COMMENTS:_____

Special Inspector Letterhead

Revised July, 2017

[Date]

[Owner or Registered Design Professional in Responsible Charge (RDPiRC)]
[Address 1]
[Address 2]
[CSZ]

NOTICE OF NON-COMPLIANCE

Project: [Project Name]
[Project Address]
San Antonio, Texas

City of San Antonio Permit Number [AP#]

According to Section 1704.2.4 of the 2018 *International Building Code*, "discrepancies shall be brought to the attention of the building official and to the registered design professional in responsible charge".

As a special inspector for the specific required special inspections for this project during construction, special inspections performed indicate that the construction of the _____ does not comply with the requirements of the construction documents.

DO NOT COVER OR CONCEAL ANY WORK IN AREAS OF NON-COMPLIANCE UNTIL CORRECTING THE NON-COMPLIANT WORK AND RECEIVING A FIELD REPORT INDICATING THE WORK IS CORRECTED.

Attached are test / inspection reports describing the non-compliant construction.

Respectfully,

[Special Inspector Firm Name]

[Signature of Inspector]

_____
[Name of Inspector]

[Special Inspector's Seal]

(if applicable)

Attachments: _____

CC: Registered Design Professional in Responsible Charge
City Building Official
General Contractor

Registered Design Professional in Responsible Charge Letterhead

Revised July, 2017

[Date]

[Owner]
[Owner address 1]
[Owner address 2]
[CSZ]

FINAL REPORT OF REQUIRED SPECIAL INSPECTIONS

Project:[Project Name]
[Project Address]
Project Building #
San Antonio, Texas

The appropriate design professionals prepared and submitted a list of required special inspections (as required by the *International Building Code* Section 1704.2) on the permit set of construction documents submitted for a building permit for this project.

City of San Antonio Permit Number [AP#]

As the registered design professional in responsible charge for all required inspections for this project during construction, to the best of my information, knowledge and belief the listed required inspections and tests for this project have been performed and all discovered discrepancies have been resolved.

Inspections and tests performed, either periodically or continuously, represent all the work for the item inspected.

Respectfully,

[RDPiRC Firm Name]

[RDPiRC Seal]

[Signature of RDPiRC]

_____
[Name of Registered Design Professional in Responsible Charge]

cc: General Contractor
All Special Inspectors listed below

The following is a complete list of all of the required inspections listed on the permitted construction documents along with the names of each of the inspectors that inspected this project:

Inspection Required		Special Inspector Name/ Firm Name
Geotechnical / Structural Related Inspections		
1) Section 1705.1.1	Special Cases	
2) Section 1705.2	Steel construction	
3) Section 1705.3	Concrete construction	
4) Section 1705.4	Masonry construction	
5) Section 1705.5	Wood construction	
6) Section 1705.6	Soils	
7) Section 1705.7	Driven deep foundations	
8) Section 1705.8	Cast-in-place deep foundations	
9) Section 1705.9	Helical pile foundations	
10) Section 1705.10	Fabricated items	
11) Section 1705.11	Special Insp. for wind resistance	
12) Section 1705.12	Special Insp. for seismic resistance	
13) Section 1705.13	Testing for seismic resistance	
Architectural Related Inspections		
14) Section 1705.14	Sprayed fire-resistant materials	
15) Section 1705.15	Mastic & intumescent fire-resistant coatings	
16) Section 1705.16	EIFS	
17) Section 1705.17	Fire resistant penetrations and joints	
Mechanical Related Inspections		
18) Section 1705.18	Testing for smoke control (see IB 185)	
Tests		
19) Section 1706	Design Strengths of Materials	
20) Section 1707	Alternative test procedures	
21) Section 1708	In-Situ load tests	
22) Section 1709	Pre-construction load tests	

Notes:

- Inspectors for inspections not required for this project are listed as “not required”.
  Inspections not required remain on the list in order to inform the building official that this project does not require the specific inspections.

RDPiRC Final Remarks or Comments:

Attention ALL Special Inspectors

CITY OF SAN ANTONIO

Development Services

New Qualification Requirements for all

Special Inspectors in the City of San Antonio

- All Special Inspectors are required to be approved by the Building Official for the City of San Antonio. Experience and/or Certifications such as the following (ICC, IAS, AWS, AISC, ASCE, ANSI, AWC, AISI, AWCI or any other nationally recognized certifications) shall be submitted to the Department. (See application)
- Registered Design Professionals, Principal Engineers and Architects in the State of Texas are exempt from submitting qualification requirements. Registered Design Professionals, Principal Engineers and Architects acting as the Special Inspector will be required to provide their license number or SI ID# on the Special Inspection Log Sheet.
- Applications are available:
    - On the web: http//sanantonio.gov/dsd
    - In person: 1901 S. Alamo St. San Antonio, Texas 78204, second floor.
    - Phone or Email: Ramiro Carrillo at 210-207-8314 or email Ramiro.carrillo@sanantonio.gov

City of San Antonio Development Services Department
Special Inspector Qualification Reference Letter

I am familiar with the International Building Code and the City of San Antonio Special Inspection Program. As a registered engineer/architect, it is my professional opinion that (**Insert Inspector's Name**) meets the training, experience, and competency requirements of these documents and is qualified to act as a special inspector in accordance with 2018 IBC 1704.2.1 for each of the disciplines checked off from the list below:

Structural

- ☐Wall panels, curtain walls, and veneers
- ☐High strength bolting (steel)
- ☐Welding (steel)
- ☐Structural Cold-formed steel
- ☐Reinforced concrete
- ☐Pre-stressed / pre-cast concrete
- ☐Post-installed structural anchors in concrete
- ☐Masonry construction including veneer
- ☐Wood construction

Geotechnical

- ☐Soils, driven deep foundations, cast-in-place deep foundations, and helical pile foundations

Architectural

- ☐Mastic and intumescent fire-resistant coatings
- ☐Exterior insulation and finish system (EFIS)
- ☐Fire-resistant penetrations and joints
- ☐Special Inspection for Wind Resistance
- ☐Testing for Seismic Resistance
- ☐Spray Fire Resistance materials
- ☐Design Strengths of Materials
- ☐Alternative Test Procedures
- ☐In-Situ Load Tests
- ☐Preconstruction Load Tests

Mechanical

- ☐Smoke control

General Note: * This form must be attached to the Special Inspector Application.

Name: (Engineer/Architect)_____

Address: _____

_____

[Design Professional Seal]

CITY OF SAN ANTONIO
DEVELOPMENT SERVICES DEPARTMENT
P.O.BOX 839966 I SAN ANTONIO TEXAS 78283-3966

ACCREDITED
Building Department

Special Inspector Application

☐ **New** ☐ **Renewal** ☐ **Update**

Company Name: _____

Applicant Name: _____

Mailing Address: _____ City: _____ State: _____

Zip Code: _____ E-Mail: _____

Applicant Telephone: _____ Company Number: _____

All submittals must include a completed application, resume providing minimum experience requirements, copies of required certifications. (or reference letter if applicable)
Special inspection requirements are outlined in the City of San Antonio Development Services Department in IB-132.

Multiple Disciplines

Multiple disciplines can be selected per each application (page 3).

☐ Already an approved City of San Antonio Special Inspector, seeking to add disciplines.

Fees

☐ Every new and renewal application must include a $0.00 registration fee, valid for one (1) years. (This fee will be waived at this time until department deems necessary).

Minimum Experience Requirements

Applicants shall comply with one of the following education and experience requirements:

☐ Professional Engineer, Architect, or Registered Design Professional and a minimum three (3) months of relevant work experience; or

☐ Bachelor of Science Degree in Engineering, Architecture, or Physical Science and a minimum of six (6) months of relevant work experience; or

☐ Two (2) years of verified college or technical school and a minimum of two years of verified relevant work experience; or

☐ High school or equivalent graduate and a minimum of two (2) years of verified relevant work experience; or

☐ A minimum of three (3) years of verified relevant work experience.

For more information or for a copy of this publication in an alternate format, contact Phone or Email: Ramiro Carrillo at 210-207-8314 or email Ramiro.Carrillo@sanantonio.gov

City of San Antonio Development Service Department
Special Inspector Application – Page 1of 3

Required Documentation **Special Inspector Application – Page 2 of 3**

☐ A resume that describes your relevant experience and training for each special inspection discipline included in your application.
☐ A copy of the required third-party certification for each discipline included in your application.

- For first time applicants, only, a reference letter sealed by an Texas Registered

  Professional Engineer or Architect may be submitted in lieu of the required certification.
- This will only be valid for a period of three (3) years, after which the required certifications must be obtained.
- A sample reference letter will be provided upon request.

Please submit applications via email at *dsdspecialinspections@sanantonio.gov* or air mail or drop off in person to:

City of San Antonio Development Services Department
Special Inspections Program
C/o Chief Building Inspector Ramiro Carrillo
1901 S. Alamo St.
P.O. Box 839966
San Antonio, TX. 78283-3966

_____ _____
Printed Name Date

_____ _____
Signature Date

Staff Use Only		
Received	Applicant #	Approved

Required Certifications for Special Inspector – Check each box that you are applying for

	Discipline (Code Section)	Required Inspections	Required Certifications
☐	Structural (1705.1.1)	Special Cases Wall panels, curtain walls and veneers	ICC Commercial Building Inspector or ICC Certified Building Inspector
☐	Structural (1705.2)	Steel High Strength Bolting	ICC Structural Steel and Bolting SI
☐	Structural (1705.2.2.1)	Steel Welding	AWS, CWI or ICC Structural Welding Special Inspector
☐	Structural (1705.2.2.1.1) (1705.2.2.2)	Structural cold-formed steel, cold-formed steel trusses spanning 60' or greater	ICC Commercial Building Inspector or ICC Certified Building Inspector
☐	Structural (1705.3)	Reinforced Concrete	ICC Reinforced Concrete SI or ACI Concrete SI
☐	Structural (1705.3)	Prestressed / Precast Concrete Construction	ICC Reinforced Concrete SI or ACI Concrete SI and ICC Prestressed SI or PTI Level 1&2 Unbonded PT Inspector
☐	Structural (1705.3)	Post-installed structural anchors in concrete	ICC Reinforced Concrete SI or ACI Concrete SI or Manufacturers approved installer
☐	Structural (1705.4)	Masonry construction including veneer	ICC Structural Masonry SI
☐	Structural (1705.5)	Wood Construction	ICC Commercial Building Inspector or ICC Certified Building Inspector
☐	Geotechnical (1705.6) (1705.7) (1705.8) (1705.9)	Soils, Driven deep foundations, Cast-in-place deep foundations, Helical piles foundations	ICC Soils SI or NICET II (geotechnical or construction, or construction material testing or soils)
☐	Architectural (1705.10)	Fabricated Items	ICC Commercial Building Inspector or ICC Certified Building Inspector
☐	Architectural (1705.11)	Special Inspections for Wind Resistance	ICC Commercial Building Inspector or ICC Certified Building Inspector
☐	Architectural (1705.12)	Special Inspections for Seismic Resistance	ICC Commercial Building Inspector or ICC Certified Building Inspector
☐	Architectural (1705.13)	Testing for Seismic Resistance	ICC Commercial Building Inspector or ICC Certified Building Inspector
☐	Architectural (1705.14)	Spray fire-resistant materials	ICC Spray-applied Fireproofing SI or ICC Fire Inspector
☐	Architectural (1705.15)	Mastic and intumescent fire-resistant coatings	ICC Spray-applied Fireproofing SI or ICC Fire Inspector
☐	Architectural (1705.16)	Exterior insulation and finish system (EIFS)	AWCI EIFS Inspector
☐	Architectural (1705.17)	Fire-resistant Penetrations and Joints	UL or FM firestop examination
☐	Structural (1706)	Design Strengths of Materials	ICC Commercial Building Inspector or ICC Certified Building Inspector
☐	Architectural/ Structural (1707)	Alternative Test Procedure	ICC Commercial Building Inspector or ICC Certified Building Inspector
☐	Structural (1708)	In-situ Load Tests	ICC Commercial Building Inspector or ICC Certified Building Inspector
☐	Structural (1709)	Preconstruction Load Tests	ICC Commercial Building Inspector or ICC Certified Building Inspector
☐	Mechanical (1705.18)	Smoke control	Nationally Recognized Certification in air balance, smoke control, life safety or mechanical inspections. Recognized organizations include ICC, IAPMO, AABC, NEBB, TABB, NFPA, OSHA, IFC and CSP. Other organizations will be considered.

CITY OF SAN ANTONIO
DEVELOPMENT SERVICES DEPARTMENT
P.O.BOX 839966 I SAN ANTONIO TEXAS 78283-3966

ACCREDITED Building Department

Special Inspections Type Key

Description of Discipline

Type	Description of Discipline
	Structural
STR-1	Special cases, wall panels, curtain walls and veneers
STR-2	Steel, high strength bolting
STR-3	Steel, welding
STR-4	Cold formed steel, trusses spanning 60’ or greater
STR-5	Reinforced concrete
STR-6	Pre-stressed/Precast Concrete Construction
STR-7	Post-installed structural anchors in concrete
STR-8	Masonry construction including veneer
STR-9	Wood construction
	Geotechnical
GEO-1	Soils, driven deep foundations, cast-in-place deep foundations, helical piles foundations
	Architectural
ARC-1	Spray fire-resistant materials, mastic and intumescent fire-resistant coating
ARC-2	Exterior insulation and finish system
ARC-3	Fire-resistant penetrations and joints
ARC-4	Special Inspection for Wind Resistance
ARC-5	Testing for Seismic Resistance
ARC-6	Spray Fire-Resistant Materials
ARC-7	Design Strength of Materials
ARC-8	Alternative Test Procedures
ARC-9	In-Situ Load Tests
ARC-10	Preconstruction Load Tests
	Mechanical
MEC-1	Smoke control

For more information or for a copy of this publication in an alternate format, contact Phone or Email: Ramiro Carrillo at 210-207-8314 or email Ramiro.Carrillo@sanantonio.gov

Project Name: _____ **AP #:** _____

Registered Design Professional in Responsible Charge (RDPiRC): _____
(Owner, Architect or Engineer)

Special Inspection Status Log

Date	Required Item Inspected or Tested	Area/Location of Inspection	Company, Special Inspector ID #, phone #, P.E. #	Pass/Fail/ Pending	Remarks/Further Action Required

***NOTE*: CONTRACTOR, PLEASE ATTACH A COPY OF THE SPECIAL INSPECTIONS DETERMINATION LETTER TO THIS LOG SHEET.**

REVISED JULY 12, 2017 - FOR COMPLIANCE WITH THE 2018 IBC

1705.1.1 SPECIAL CASES
1705.2 STEEL CONSTRUCTION
1705.3 CONCRETE CONSTRUCTION
1705.4 MASONRY CONSTRUCTION
1705.5 WOOD CONSTRUCTION
1705.6 SOILS
1705.7 DRIVEN DEEP FOUNDATIONS
1705.8 CAST-IN-PLACE DEEP FOUNDATIONS
1705.9 HELICAL PILE FOUNDATIONS
1705.10 FABRICATED ITEMS
1705.11 SPECIAL INSPECTIONS FOR WIND
1705.12 SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE
1705.13 TESTING FOR SEISMIC RESISTANCE
1705.14 SPRAYED FIRE-RESISTANT MATERIALS
1705.15 MASTIC AND INTUMESCENT FIRE-RESISTANT COATINGS
1705.16 EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS)
1705.17 FIRE-RESISTANT PENETRATIONS AND JOINTS
1705.18 TESTING FOR SMOKE CONTROL (see IB 185)
1706 DESIGN STRENGTHS OF MATERIALS
1707 ALTERNATIVE TEST PROCEDURES
1708 IN-SITU LOAD TESTS
1709 PRECONSTRUCTION LOAD TESTS

PAGE___OF ____

SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Temporary utilities.
- B. Temporary telecommunications services.
- C. Temporary sanitary facilities.
- D. Temporary Controls: Barriers, enclosures, and fencing.
- E. Security requirements.
- F. Vehicular access and parking.
- G. Waste removal facilities and services.
- H. Project identification sign.
- I. Field offices.

1.2 RELATED REQUIREMENTS
- A. Section 01 5813 - Temporary Project Signage.

1.3 REFERENCE STANDARDS
- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

1.4 TEMPORARY UTILITIES
- A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.
- B. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.5 TELECOMMUNICATIONS SERVICES
- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
- B. Telecommunications services shall include:
  1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
  2. Telephone Land Lines: One line, minimum; one handset per line.
  3. Internet Connections: Minimum of one; DSL modem or faster.
  4. Email: Account/address reserved for project use.
  5. Facsimile Service: Minimum of one dedicated fax machine/printer, with dedicated phone line.
  6. Facsimile Service: Fax-to-email software on personal computer.
- C. Provide, maintain and pay for facsimile service and a dedicated telephone line to field office at time of project mobilization.
- D. Telephone and facsimile services shall be made available for use by the Owner, Architect, and consultants.

1.6 TEMPORARY SANITARY FACILITIES
- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Use of existing facilities is not permitted.
- C. Maintain daily in clean and sanitary condition.

1.7 BARRIERS
- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
- C. Provide protection for plants designated to remain. Replace damaged plants.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.8 FENCING

A. Construction: Commercial grade chain link fence.
B. Provide eight foot (2.44 m) high fence around construction site; equip with vehicular and pedestrian gates with locks.
C. Provide vision blocking fabric at outside face of perimeter construction fencing and gates.
    1. Fabric: 100% polypropylene - Closed Mesh Commercial Series Polypropylene fence screen provides 95% blockage of wind and light. Constructed of woven polypropylene and treated with UV stabilizers.
        a. Provide accessories required for a complete and secure installation for the duration of the construction of this project.
    2. Products: Closed Mesh Commercial Series Polypropylene fence screen provides 95% blockage of wind and light. Constructed of woven polypropylene and treated with UV stabilizers.
        a. Greenblock Precut Panel, as manufactured by Collins Co., 1375 Weber Industrial Dr., Cumming, GA 30041; Toll-free: (800) 222-4348.
        b. 700 Series Closed Mesh Polypropylene - 95% as manufactured by FenceScreen.com, Lake Forest, CA 92630; Toll Free: (888) 313-6313; T: (949) 215-6313; F: (949) 269-0422; Email: sales@fencescreen.com .
        c. POLYPRO 95 Construction Fence Fabric as manufactured by Midwest Cover, 6463 Waveland Street, Unit A, Hammond, IN 46320; Toll-free: (800) 594-0744; T: (847) 277-1140; F: (847) 277-1137.
        d. Substitutions: See Section 01 6000 - Product Requirements.

1.9 EXTERIOR ENCLOSURES

A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.
B. Insulated to R-11.
C. STC rating of 35 in accordance with ASTM E 90.

1.10 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.
B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:
    1. Insulated to R 11 (RSI 1.94) when work space is unconditioned or is conditioned separately from adjoining Owner ocupied area(s).
    2. Maximum flame spread rating of 75 in accordance with ASTM E84.
    3. Provide full double sheeting at passageways. Each sheet shall be attached together at head and shall be separately attached at opposite jambs.

1.11 SECURITY

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.
B. Coordinate with Owner's security program.

1.12 VEHICULAR ACCESS AND PARKING

A. Coordinate access and haul routes with governing authorities and Owner.
B. Provide and maintain access to fire hydrants, free of obstructions.
C. Provide means of removing mud from vehicle wheels before entering streets.
D. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.13 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
B. Provide containers with lids. Remove trash from site periodically.
C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.14 PROJECT IDENTIFICATION

A. Provide project identification sign of design and construction indicated on Drawings.
B. Erect on site at location indicated.
C. No other signs are allowed without Owner permission except those required by law.

1.15 FIELD OFFICES - See Section 01 5213

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack and drawing display table.
B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.
C. Locate offices a minimum distance of 30 feet (10 m) from existing and new structures.

1.16 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.
B. Remove underground installations to a minimum depth of 2 feet (600 mm). Grade site as indicated.
C. Clean and repair damage caused by installation or use of temporary work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 5713
TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Prevention of erosion due to construction activities.
B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
C. Restoration of areas eroded due to insufficient preventive measures.
D. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.2 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

END OF SECTION

SECTION 01 5721
INDOOR AIR QUALITY CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Construction procedures to promote adequate indoor air quality after construction.
- B. Building flush-out after construction and before occupancy.
- C. Testing indoor air quality after completion of construction.
- D. Testing air change effectiveness after completion of construction.

1.2 PROJECT GOALS
- A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
  1. Cleaning of ductwork is not contemplated under this Contract.
  2. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.
- B. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.
  1. Furnish products meeting the specifications.
  2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

1.3 RELATED REQUIREMENTS
- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 23 0593 - Testing, Adjusting, and Balancing: Testing HVAC systems for proper air flow rates, adjustment of dampers and registers, and settings for equipment.
- C. Section 23 4100 - Air Filters: HVAC filters.

1.4 REFERENCE STANDARDS
- A. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2012.
- B. ASHRAE Std 129 - Measuring Air-Change Effectiveness; 1997 (Reaffirmed 2002).
- C. ASTM D5197 - Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology); 2009.
- D. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; California Department of Public Health; v1.1, 2010.
- E. EPA 600/4-90/010 - Compendium of Methods for the Determination of Air Pollutants in Indoor Air; April 1990.
- F. EPA 625/R-96/010b - Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air; January 1999.
- G. SMACNA (OCC) - IAQ Guideline for Occupied Buildings Under Construction; 2007.

1.5 DEFINITIONS
- A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.
- B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.
- C. Particulates: Dust, dirt, and other airborne solid matter.
- D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

1.6 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Indoor Air Quality Management Plan: Describe in detail measures to be taken to promote adequate indoor air quality upon completion; use SMACNA (OCC) as a guide.
  1. Submit not less than 60 days before enclosure of building.

2. Identify potential sources of odor and dust.
3. Identify construction activities likely to produce odor or dust.
4. Identify areas of project potentially affected, especially occupied areas.
5. Evaluate potential problems by severity and describe methods of control.
6. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, types of filters and schedule for replacement of filters.
7. Describe cleaning and dust control procedures.
8. Describe coordination with commissioning procedures.

C. Interior Finishes Installation Schedule: Identify each interior finish that either generates odors, moisture, or vapors or is susceptible to adsorption of odors and vapors, and indicate air handling zone, sequence of application, and curing times.

D. Duct and Terminal Unit Inspection Report.

E. Air Contaminant Test Plan: Identify:
1. Testing agency qualifications.
2. Locations and scheduling of air sampling.
3. Test procedures, in detail.
4. Test instruments and apparatus.
5. Sampling methods.

F. Air Contaminant Test Reports: Show:
1. Location where each sample was taken, and time.
2. Test values for each air sample; average the values of each set of 3.
3. HVAC operating conditions.
4. Certification of test equipment calibration.
5. Other conditions or discrepancies that might have influenced results.

G. Ventilation Effectiveness Test Plan: Identify:
1. Testing agency qualifications.
2. Description of test spaces, including locations of air sampling.
3. Test procedures, in detail; state whether tracer gas decay or step-up will be used.
4. Test instruments and apparatus; identify tracer gas to be used.
5. Sampling methods.

H. Ventilation Effectiveness Test Reports: Show:
1. Include preliminary tests of instruments and apparatus and of test spaces.
2. Calculation of ventilation effectiveness, E.
3. Location where each sample was taken, and time.
4. Test values for each air sample.
5. HVAC operating conditions.
6. Other information specified in ASHRAE 129.
7. Other conditions or discrepancies that might have influenced results.

PART 2 PRODUCTS

2.1 MATERIALS

A. Low VOC Materials: See Section 01 6116.

B. Low VOC Materials: See other sections for specific requirements for materials with low VOC content.

C. Auxiliary Air Filters: MERV of 8, minimum, when tested in accordance with ASHRAE 52.2.

PART 3 EXECUTION

3.1 CONSTRUCTION PROCEDURES

A. Prevent the absorption of moisture and humidity by adsorptive materials by:
1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
3. Provide sufficient ventilation for drying within reasonable time frame.

B. Begin construction ventilation when building is substantially enclosed.

C. If extremely dusty or dirty work must be conducted inside the building, shut down HVAC systems for the duration; remove dust and dirt completely before restarting systems.
D. Do not store construction materials or waste in mechanical or electrical rooms.
E. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.
    1. Inspect duct intakes, return air grilles, and terminal units for dust.
    2. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.
    3. Clean tops of doors and frames.
    4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
    5. Clean return plenums of air handling units.
    6. Remove intake filters last, after cleaning is complete.
F. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.
G. Use other relevant recommendations of SMACNA (OCC) for avoiding unnecessary contamination due to construction procedures.

3.2 BUILDING FLUSH-OUT

A. Contractor's Option: Either full continuous flush-out OR satisfactory air contaminant testing is required, not both.
B. Perform building flush-out before occupancy.
C. Do not start flush-out until:
    1. All construction is complete.
    2. HVAC systems have been tested, adjusted, and balanced for proper operation.
    3. Cleaning of inside of HVAC ductwork, specified elsewhere, has been completed.
    4. Inspection of inside of return air ducts and terminal units confirms that cleaning is not necessary.
    5. New HVAC filtration media have been installed.
D. Building Flush-Out: Operate all ventilation systems at normal flow rates with 100 percent outside air until a total air volume of 14,000 cubic feet per square foot (4500 cubic meters per square meter) of floor area has been supplied.
    1. Obtain Owner's concurrence that construction is complete enough before beginning flush-out.
    2. Maintain interior temperature of at least 60 degrees F (15 degrees C) and interior relative humidity no higher than 60 percent.
    3. If additional construction involving materials that produce particulates or any of the specified contaminants is conducted during flush-out, start flush-out over.
    4. If interior spaces must be occupied prior to completion of the flush-out, supply a minimum of 25 percent of the total air volume prior to occupancy, and:
        a. Begin ventilation at least three hours prior to daily occupancy.
        b. Continue ventilation during all occupied periods.
        c. Provide minimum outside air volume of 0.30 cfm per square foot (0.0015 cu m/s/sq m) or design minimum outside air rate, whichever is greater.
E. Install new HVAC filtration media after completion of flush-out and before occupancy or further testing.

3.3 AIR CONTAMINANT TESTING

A. Contractor's Option: Either full continuous flush-out OR satisfactory air contaminant testing is required, not both.
B. Perform air contaminant testing before occupancy.
C. Do not start air contaminant testing until:
    1. All construction is complete, including interior finishes.
    2. HVAC systems have been tested, adjusted, and balanced for proper operation.
    3. Cleaning of inside of HVAC ductwork, specified elsewhere, has been completed.
    4. New HVAC filtration media have been installed.
D. Indoor Air Samples: Collect from spaces representative of occupied areas:

1. Collect samples while operable windows and exterior doors are closed, HVAC system is running normally as if occupied, with design minimum outdoor air, but with the building unoccupied.
2. Collect samples from spaces in each contiguous floor area in each air handler zone, but not less than one sample per 25,000 square feet (2300 square meters); take samples from areas having the least ventilation and those having the greatest presumed source strength.
3. Collect samples from height from 36 inches (915 mm) to 72 inches (1830 mm) above floor.
4. Collect samples from same locations on 3 consecutive days during normal business hours; average the results of each set of 3 samples.
5. Exception: Areas with normal very high outside air ventilation rates, such as laboratories, do not need to be tested.
6. When retesting the same building areas, take samples from at least the same locations as in first test.

E. Outdoor Air Samples: Collect samples at outside air intake of each air handler at the same time as indoor samples are taken.
F. Analyze air samples and submit report.
G. Air Contaminant Concentration Limits:
1. Formaldehyde: Not more than 27 parts per billion.
2. PM10 Particulates: Not more than 50 micrograms per cubic meter.
3. Total Volatile Organic Compounds (TVOCs): Not more than 500 micrograms per cubic meter.
4. Chemicals Listed in CAL (CDPH SM) Table 4-1, except Formaldehyde: Allowable concentrations listed in Table 4-1.
5. Carbon Monoxide: Not more than 9 parts per million and not more than 2 parts per million higher than outdoor air.
6. Carbon Dioxide: Measure in ppm, in relation to outdoor air; not more than 700 ppm higher than outdoor air.
7. Airborne Mold and Mildew: Measure in relation to outside air; not higher than outside air.
8. Regulated Pollutants: Measure in relation to outside air; not more than contained in outside air.

H. Air Contaminant Concentration Test Methods:
1. Formaldehyde: ASTM D5197, EPA 625 Method TO-11A, or EPA 600 Method IP-6.
2. Particulates: EPA 600 Method IP-10.
3. Total Volatile Organic Compounds (TVOC): EPA 625 Method TO-1, TO-15, or TO-17; or EPA 600 Method IP-1.
4. Chemicals Listed in CAL (CDPH SM) Table 4-1, except Formaldehyde: ASTM D5197, or EPA 625 Method TO-1, TO-15, or TO-17.
5. Carbon Monoxide: EPA 600 Method IP-3, plus measure outdoor air; measure in ppm; report both indoor and outdoor measurements.

3.4 VENTILATION EFFECTIVENESS TESTING

A. Perform ventilation effectiveness testing before occupancy.
B. Do not begin ventilation effectiveness testing until:
1. HVAC testing, adjusting, and balancing has been satisfactorily completed.
2. Building flush-out or air contaminant testing has been completed satisfactorily.
3. New HVAC filtration media have been installed.

C. Test each air handler zone in accordance with ASHRAE 129.
D. If calculated air change effectiveness for a particular zone is less than 0.9 due to inadequate balancing of the system, adjust, and retest at no cost to Owner.

END OF SECTION

SECTION 01 57 23
TEMPORARY STORM WATER POLLUTION CONTROL

PART 1 GENERAL

1.01 SUMMARY

The work consists of implementing the storm water pollution prevention measures to prevent sediment from entering streams or water bodies as specified in this Section in conformance with the requirements of the Texas Commission on Environmental Quality and the requirements of the National Pollutant Discharge Elimination System (NPDES).

1.02 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D4439	(2011) Geosynthetics
ASTM D4491	(1999a; R 2009) Water Permeability of Geotextiles by Permittivity
ASTM D4533	(2011) Trapezoid Tearing Strength of Geotextiles
ASTM D4632	(2008) Grab Breaking Load and Elongation of Geotextiles
ASTM D4751	(2012) Determining Apparent Opening Size of a Geotextile
ASTM D4873	(2002; R 2009) Identification, Storage, and Handling of Geosynthetic Rolls and Samples

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 832-R-92-005	(1992) Storm Water Management for Construction Activities Developing Pollution Preventions and Plans and Best Management Practices

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 122.26	Storm Water Discharges (Applicable to State NPDES Programs, see section 123.25)

1.03 EROSION AND SEDIMENT CONTROLS

The controls and measures required of the Contractor are described below.

A. Stabilization Practices

The stabilization practices to be implemented include temporary seeding, mulching, geotextiles, sod stabilization, vegetative buffer strips, erosion control matts, protection of trees, preservation of mature vegetation, etc. Maintain a log of construction activities and record the dates when the major grading activities occur, (e.g., clearing and grubbing, excavation, embankment, and grading); when construction activities temporarily or permanently cease on a portion of the site; and when stabilization practices are initiated. Except as provided in paragraphs UNSUITABLE CONDITIONS and NO ACTIVITY FOR LESS THAN 21 DAYS, initiate stabilization practices as soon as practicable, but no more than 14 days, in any portion of the site where construction activities have temporarily or permanently ceased.

1. Unsuitable Conditions
   Where the initiation of stabilization measures by the fourteenth day after construction activity temporarily or permanently ceases or is precluded by unsuitable conditions caused by the weather, initiate stabilization practices as soon as practicable after conditions become suitable.

2. No Activity for Less Than 21 Days
   When the total time period in which construction activity is temporarily ceased on a portion of the site is 21 days minimum, stabilization practices do not have to be initiated on that portion of the site until 14 days have elapsed after construction activity temporarily ceased.

3. Burnoff
   Burnoff of the ground cover is not permitted.

4. Protection of Erodible Soils
   Immediately finish the earthwork brought to a final grade, as indicated or specified, and protect the side slopes and back slopes upon completion of rough grading. Plan and conduct earthwork to minimize the duration of exposure of unprotected soils.

B. Erosion, Sediment and Stormwater Control

a. Submit "Erosion and Sediment Controls" (E&S) (form provided at the pre-construction conference) and Storm Water Inspection Reports for General Permit to the owner within 24 hours of a storm event that produces 0.5 inch or more of rain.

b. NOT USED

c. NOT USED

d. Storm Water Notice of Intent for Construction Activities

e. Submit a Storm Water Notice of Intent for NPDES coverage under the general permit for construction activities to the Texas Commission on Environmental Quality prior to the commencement of work. If the Plan Set does not include one, submit a Storm Water Pollution Prevention Plan (SWPPP) for the project to the Engineer. The SWPPP shall meet the requirements of the applicable regulatory agency general permit for storm water discharges from construction sites. Maintain an approved copy of the SWPPP at the construction on-site office, and continually update as regulations require, to reflect current site conditions. Include within the SWPPP:

   (1) Identify potential sources of pollution which may be reasonably expected to affect the quality of storm water discharge from the site.

   (2) Describe and ensure implementation of practices which will be used to reduce the pollutants in storm water discharge from the site.

   (3) Ensure compliance with terms of the Federal and/or State general permit for storm water discharge.

   (4) Select applicable best management practices from EPA 832-R-92-005.

   (5) Storm Water Pollution Prevention Measures and Notice of Intent 40 CFR 122.26, EPA 832-R-92-005. Provide a "Storm Water Pollution Prevention Plan" (SWPPP) for the project. The SWPPP will meet the requirements of the Federal and / or State general permit for storm water discharges from construction sites. Submit the required Notice of Intents, Notice of Termination, and appropriate permit fees, a minimum of 14 calendar days prior to the start of construction. A copy of the approved SWPPP will be kept at the construction on-site office, and continually updated as regulations require to reflect current site conditions.

(6) Install, inspect, and maintain best management practices (BMPs) as required by the general permit. Prepare Inspection Reports as required by the general permit.

(7) Once construction is complete and the site has been stabilized with a final, sustainable cover, submit the Notice of Termination to the appropriate Federal and/or State agency within 30 days after all land disturbing activities end.

C. Stormwater Drainage
There will be no discharge of excavation ground water to the sanitary sewer, storm drains, or to the river without prior specific authorization. Discharge of hazardous substances will not be permitted under any circumstances. Construction site runoff will be prevented from entering any storm drain or the river directly by the use of straw bales or other suitable methods. Provide erosion protection of the surrounding soils.

D. Structural Practices
Implement structural practices to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Implement structural practices in a timely manner, during the construction process, to minimize erosion and sediment runoff. Include the following devices; Location and details of installation and construction are shown on the drawings.

1. Silt Fences
Provide silt fences, as shown in the plans, as a temporary structural practice to minimize erosion and sediment runoff. Properly install silt fences to effectively retain sediment immediately after completing each phase of work where erosion would occur in the form of sheet and rill erosion (e.g. clearing and grubbing, excavation, embankment, and grading). Install silt fences in the locations indicated on the drawings. Obtain approval from the Engineer prior to final removal of silt fence barriers.

2. Straw Bales
NOT USED

3. Diversion Dikes
NOT USED

E. Sediment Basins
NOT USED

F. Vegetation and Mulch
a. Provide temporary protection on sides and back slopes as soon as rough grading is completed or sufficient soil is exposed to require erosion protection. Protect slopes by accelerated growth of permanent vegetation, temporary vegetation, mulching, or netting. Stabilize slopes by hydroseeding, anchoring mulch in place, covering with anchored netting, sodding, or such combination of these and other methods necessary for effective erosion control.

b. Seeding: Provide new seeding where ground is disturbed. Include topsoil or nutriment during the seeding operation necessary to establish or reestablish a suitable stand of grass. The seeding operation will be as specified in Section 329219 SEEDING.

1.04 SUBMITTALS
Submit the following in accordance with Section 013300 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Storm Water Pollution Prevention Plan Modifications
Storm Water Notice of Intent

SD-06 Test Reports

Storm Water Inspection Reports for General Permit
Erosion and Sediment Controls

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1.05 DELIVERY, STORAGE, AND HANDLING
Identify, store and handle filter fabric in accordance with ASTM D4873.

PART 2 PRODUCTS

2.01 COMPONENTS FOR SILT FENCES

A. Filter Fabric

Provide geotextile that complies with the requirements of ASTM D4439, and consists of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. The filament shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of ester, propylene, or amide, and contains stabilizers and/or inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultraviolet and heat exposure. Provide synthetic filter fabric that contains ultraviolet ray inhibitors and stabilizers to assure a minimum of six months of expected usable construction life at a temperature range of 0 to 120 degrees F. The filter fabric shall meet the following requirements:

FILTER FABRIC FOR SILT SCREEN FENCE		
PHYSICAL PROPERTY	TEST PROCEDURE	STRENGTH REQUIREMENT
Grab Tensile Elongation (percent)	ASTM D4632	100 lbs. min. 30 percent max.
Trapezoid Tear	ASTM D4533	55 lbs. min.
Permittivity	ASTM D4491	0.2 sec-1
AOS (U.S. Std Sieve)	ASTM D4751	20-100

B. Silt Fence Stakes and Posts
Use either wooden stakes or steel posts for fence construction. Wooden stakes utilized for silt fence construction, shall have a minimum cross section of 2 by 2 inches when oak is used and 4 by 4 inches when pine is used, and have a minimum length of 5 feet. Steel posts (standard "U" or "T" section) utilized for silt fence construction, shall have a minimum weight of 1.33 pounds/linear foot and a minimum length of 5 feet.

C. Mill Certificate or Affidavit
Provide a mill certificate or affidavit attesting that the fabric and factory seams meet chemical, physical, and manufacturing requirements specified above. Specify in the mill certificate or affidavit the actual Minimum Average Roll Values and identify the fabric supplied by roll identification numbers. Submit a mill certificate or affidavit signed by a legally authorized official from the company manufacturing the filter fabric.

2.02 COMPONENTS FOR STRAW BALES
NOT USED

PART 3 EXECUTION

3.01 INSTALLATION OF SILT FENCES

Extend silt fences a minimum of 16 inches above the ground surface without exceeding 34 inches above the ground surface. Provide filter fabric from a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are unavoidable, splice together filter fabric at a support post, with a minimum 6 inch overlap, and securely sealed. Excavate trench approximately 4 inches wide and 4 inches deep on the upslope side of the location of the silt fence. The 4 by 4 inch trench shall be backfilled and the soil compacted over the filter fabric. Remove silt fences upon approval by the Engineer.

3.02 INSTALLATION OF STRAW BALES

NOT USED

3.03 FIELD QUALITY CONTROL

Maintain the temporary and permanent vegetation, erosion and sediment control measures, and other protective measures in good and effective operating condition by performing routine inspections to determine condition and effectiveness, by restoration of destroyed vegetative cover, and by repair of erosion and sediment control measures and other protective measures. Use the following procedures to maintain the protective measures.

A. Silt Fence Maintenance

Inspect the silt fences in accordance with paragraph, titled "Inspections," of this section. Any required repairs shall be made promptly. Pay close attention to the repair of damaged silt fence resulting from end runs and undercutting. Should the fabric on a silt fence decompose or become ineffective, and the barrier is still necessary, replace the fabric promptly. Remove sediment deposits when deposits reach one-third of the height of the barrier. Remove a silt fence when it is no longer required. The immediate area occupied by the fence and any sediment deposits shall be shaped to an acceptable grade. The areas disturbed by this shaping shall be seeded in accordance with Section 320533 LANDSCAPE ESTABLISHMENT, except that the coverage requirements in paragraph, titled "Establishment" of this section do not apply.

3.04 INSPECTIONS

A. General

Inspect disturbed areas of the construction site, areas that have not been finally stabilized used for storage of materials exposed to precipitation, stabilization practices, structural practices, other controls, and area where vehicles exit the site at least once every seven (7) calendar days and within 24 hours of the end of any storm that produces 0.5 inches or more rainfall at the site. Conduct inspections at least once every month where sites have been finally stabilized.

B. Inspections Details

Inspect disturbed areas and areas used for material storage that are exposed to precipitation for evidence of, or the potential for, pollutants entering the drainage system. Observe erosion and sediment control measures identified in the Storm Water Pollution Prevention Plan to ensure that they are operating correctly. Inspect discharge locations or points to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters. Inspect locations where vehicles exit the site for evidence of offsite sediment tracking.

C. Inspection Reports

For each inspection conducted, prepare a report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the Storm Water Pollution Prevention Plan, maintenance performed, and actions taken. A copy of the inspection report shall be maintained on the job site.

END OF SECTION 015723

SECTION 01 5813
TEMPORARY PROJECT SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Project identification sign.

1.2 RELATED REQUIREMENTS
- A. Section 01 1000 - Summary: Responsibility to provide signs.

1.3 REFERENCE STANDARDS
- A. FHWA (SHS) - Standard Highway Signs; Federal Highway Administration, U.S. Department of Transportation; 2004.

1.4 QUALITY ASSURANCE
- A. Design sign and structure to withstand 50 miles/hr (80 km/hr) wind velocity.
- B. Sign Painter: Experienced as a professional sign painter for minimum three years.
- C. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

1.5 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawing: Show content, layout, lettering, color, foundation, structure, sizes and grades of members.

PART 2 PRODUCTS

2.1 SIGN MATERIALS - FREE-STANDING, GROUND-BASED SIGN
- A. Structure and Framing: New, wood, structurally adequate.
  1. Back-framing of sign panels (signboard) at perimeter edges and at joints of multiple panels:
     a. No. 2 (or better) 2x4's at horizontal edges and sign panel joints;
     b. No. 2 (or better) 2x6's at vertical edges, sign panel joints and at locations of 4 x 4 posts;
  2. Posts:
     a. No. 2 (or better) 4x4 treated wood;
  3. Foundation - Contractors option:
  4. Bracing - Provide bracing and replacement members as required during the course of the construction up to the Date of Substantial Completion for the final part or phase of the work.
  5. Sign Surfaces (a.k.a. sign panels or signboard): Exterior grade plywood with medium density overlay, minimum 3/4 inch (19 mm) thick, standard large sizes to minimize joints.
     a. Medium Density Overlay - APA M.D. Overlay, Group 1, Exterior, 4' x 8' x 3/4", minimum;
- B. Rough Hardware: Galvanized.
- C. Paint and Primers: Exterior quality, two coats; sign background of White color, unless noted otherwise. Prime and Paint all surfaces of signboard and exposed structure.
- D. Color: Full color. UV resistant for outdoor use.
- E. Lettering: Exterior quality paint, contrasting colors.
- F. Contractors Option for image over sign panel in lieu of painted text & image:
  1. Billboard type printed vinyl sheet wrapped around sign panel.
     a. Vinyl sheet with hemmed reinforced edges all around.
        1) Thirteen ounce vinyl banner material.
        2) Brass grommets at each corner and at twenty four (24) inches on center at perimeter.
     b. Printed custom digital text and image(s), single side.
     c. Color: Full color. UV resistant for indoor and outdoor use.

d. Lettering: Exterior quality media, fade resistant, contrasting colors.
e. Firmly secure vinyl sheet to sign panel.

2.2 SIGN MATERIALS - BANNER SIGN

A. Vinyl sheet with hemmed reinforced edges all around.
   1. Thirteen ounce vinyl banner material.
   2. Brass grommets at each corner and at thirty two inches on center at perimeter.
B. Printed custom digital text and image(s), single side.
C. Color: Full color. UV resistant for indoor and outdoor use.
D. Lettering: Exterior quality media, fade resistant, contrasting colors.

2.3 PROJECT IDENTIFICATION SIGN

A. Locate at on site at area designated by Architect & Owner.
B. Content: Similar to that shown on the attachment.
C. Architect will provide a digital file of the final sign design demonstrating all required information for the sign content, including but not limited to font style and size, names, titles, and other text, Owner logo, Architects logo, other graphics, , colors and overall size.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install project identification sign within 14 days after date of the Notice to Proceed.
B. Erect at designated location.
C. Erect banner sign at location determined at preconstruction meeting.
D. Install sign surface plumb, level and vertically flat. Do not allow to sag. Anchor corners securely with 1/4 inch diameter braided nylon cord. Anchor at intermediate grommets where required.

3.2 MAINTENANCE

A. Maintain signs and supports clean, repair deterioration and damage.

3.3 REMOVAL

A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.
B. Remove signs, and anchoring at Substantial Completion of Project and restore the area.

3.4 ATTACHMENT

A. Refer to "Attachment S1-NSOC" and "Attachment S1-WSOC" for a depiction of the Temporary Project Sign layout.

END OF SECTION

SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 GENERAL

A. Where specific product selection has not been made, is missing, is undetermined, or is unclear, and a determination from the Architect is not available, Contractor shall include an amount sufficient to allow selection(s) from the products highest price group.

1.2 SECTION INCLUDES

A. General product requirements.
B. Re-use of existing products.
C. Transportation, handling, storage and protection.
D. Product option requirements.
E. Substitution limitations and procedures.
F. Procedures for Owner-supplied products.
G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.3 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Lists of products to be removed from existing building.
B. Section 01 3000 - Administrative Requirements: Submittal Schedule and Submittal Procedures.
C. Section 01 4000 - Quality Requirements: Product quality monitoring.
D. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.
E. Section 01 7000 - Execution and Closeout Requirements: Items to be turned over to the Owner.
F. Section 01 7800 - Closeout Submittals: Items to be turned over to the Owner.

1.4 REFERENCE STANDARDS

A. 16 CFR 260 - Guides for the Use of Environmental Marketing Claims; Federal Trade Commission; current edition.
B. ASTM D6866 - Standard Test Methods for Determining the Biobased Content of Solid, Liquid, and Gaseous Samples Using Radiocarbon Analysis; 2012
C. C2C (DIR) - C2C Certified Products Registry; Cradle to Cradle Products Innovation Institute; http://www.c2ccertified.org/products/registry.
D. EN 15804 - Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products; 2012.
E. GreenScreen (LIST) - GreenScreen for Safer Chemicals List Translator; Clean Production Action; www.greenscreenchemicals.org.
F. GreenScreen (METH) - GreenScreen for Safer Chemicals Method v1.2; Clean Production Action; www.greenscreenchemicals.org.
G. ISO 14025 - Environmental labels and declarations -- Type III environmental declarations -- Principles and procedures; 2006.
H. ISO 14040 - Environmental management -- Life cycle assessment -- Principles and framework; 2006.
I. ISO 14044 - Environmental management -- Life cycle assessment -- Requirements and guidelines; 2006.
J. ISO 21930 - Sustainability in building construction -- Environmental declaration of building products; 2007.
K. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.5 SUBMITTALS

A. In general, substitutions will not be accepted, unless noted otherwise. Procedures for approving product substitutions occur during the Bidding period.

1. Refer to the Instructions to Bidders for substitution Procedures.
2. Refer also to Section 01 3000 - Administrative Requirements.

B. Procedures for approving product substitutions after the Bidding period:
1. Refer to Section 01 3000 - Administrative Requirements, Request for substitutes after the Bidding phase.

C. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

D. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

E. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

F. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

1.6 QUALITY ASSURANCE

A. Bio-Based Content: Of vegetable or animal origin, not including products made by killing the animal.
1. Determine percentage of bio-based content in accordance with ASTM D6866.
2. Bio-based content must be sourced from a Sustainable Agriculture Network certified farm.

B. Cradle-to-Cradle Certified: End use product certified Cradle-to-Cradle v2 Basic or Cradle-to-Cradle v3 Bronze, minimum.

C. Environmental Product Declaration (EPD): Publicly available, critically reviewed life cycle analysis having at least a cradle-to-gate scope.
1. Good: Product-specific; compliant with ISO 14044.
2. Better: Industry-wide, generic; compliant with ISO 21930, or with ISO 14044, ISO 14040, ISO 14025, and EN 15804; Type III third-party certification with external verification, in which the manufacturer is recognized as the program operator.
3. Best: Commercial-product-specific; compliant with ISO 21930, or with ISO 14044, ISO 14040, ISO 14025, and EN 15804; Type III third-party certification with external verification, in which the manufacturer is recognized as the program operator.
4. Where demonstration of impact reduction below industry average is required, submit both industry-wide and commercial-product-specific declarations; or submit at least 5 declarations for products of the same type by other manufacturers in the same industry.

D. GreenScreen Chemical Hazard Analysis: All ingredients of 100 parts-per-million or greater evaluated using GreenScreen for Safer Chemicals Method v1.2.
1. Good: GreenScreen List Translator evaluation to identify Benchmark 1 hazards; a Health Product Declaration includes this information.
2. Better: GreenScreen Full Assessment.
3. Best: GreenScreen Full Assessment by GreenScreen Licensed Profiler.
4. Acceptable Evidence: GreenScreen report.

E. Manufacturer's Inventory of Product Content: Publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CAS RN).
1. For ingredients considered a trade secret or intellectual property, the name and CAS RN may be omitted, provided the ingredient's role, amount, and GreenScreen Benchmark are given.

F. Recycled Content: Determine percentage of post-consumer and post-industrial content separately, using the guidelines contained in 16 CFR 260.7(e).
1. Previously used, reused, refurbished, and salvaged products are not considered recycled.
2. Wood fabricated from timber abandoned in transit to original mill is considered reused, not recycled.
3. Determine percentage of recycled content of any item by dividing the weight of recycled content in the item by the total weight of all material in the item.

4. Determine value of recycled content of each item separately, by multiplying the content percentage by the value of the item.
5. Acceptable Evidence:
    a. For percentage of recycled content, information from manufacturer.
    b. For cost, Contractor's cost data.

G. Source Location: Location of harvest, extraction, recovery, or manufacture; where information about source location is required to be submitted, give the postal address:
1. In all cases, indicate the location of final assembly.
2. For harvested products, indicate location of harvest.
3. For extracted (i.e. mined) products, indicate location of extraction.
4. For recovered products, indicate location of recovery.
5. For products involving multiple manufacturing steps, provide a description of the process at each step, with location.
6. Acceptable Evidence:
    a. Manufacturer's certification.
    b. Life cycle analysis (LCA) performed by third-party.

H. Sustainably Harvested Wood: Solid wood, wood chips, and wood fiber certified or labeled by an organization accredited by one of the following:
1. The Forest Stewardship Council, The Principles for Natural Forest Management; for Canada visit http://www.fsccanada.org, for the USA visit http://www.fscus.org.
2. Acceptable Evidence: Copies of invoices bearing the certifying organization's certification numbers.

PART 2 PRODUCTS

2.1 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.
B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.
C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.
D. Reused Products: Reused products include materials and equipment previously used in this or other construction, salvaged and refurbished as specified.

2.2 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.
B. DO NOT USE products having any of the following characteristics:
1. Made using or containing CFC's or HCFC's.
2. Made of wood from newly cut old growth timber.
3. Containing lead, cadmium, asbestos.
4. Not compliant with the regulations requiring adherence to "buy American act" and related laws.

C. Where all other criteria are met, Contractor shall give preference to products that:
1. If used on interior, have lower emissions, as defined in Section 01 6116.
2. If wet-applied, have lower VOC content, as defined in Section 01 6116.
3. Are extracted, harvested, and/or manufactured closer to the location of the project.
4. Have longer documented life span under normal use.
5. Result in less construction waste.
6. Are made of recycled materials.
7. Are Cradle-to-Cradle Certified.
8. Have a published Environmental Product Declaration (EPD).
9. Have a published GreenScreen Chemical Hazard Analysis.

D. Products with Recycled Content:
1. Specific Product Categories: Provide recycled content as specified elsewhere.
2. Calculations: Where information about recycled content is required to be submitted:

a. Determine percentage of post-consumer and post-industrial content separately, using the guidelines contained in 16 CFR 260.7(e).
b. Previously used, reused, refurbished, and salvaged products are not considered recycled.
c. Wood fabricated from timber abandoned in transit to original mill is considered reused, not recycled.
d. Determine percentage of recycled content of any item by dividing the weight of recycled content in the item by the total weight of all material in the item.
e. Determine value of recycled content of each item separately, by multiplying the content percentage by the value of the item.

E. Provide interchangeable components of the same manufacture for components being replaced.
F. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.
G. Cord and Plug: Provide minimum 6 foot (2 m) cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

2.3 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
B. Products Specified by Naming One or More Manufacturers: Use the product specified by the manufacturer specified. Use of a product of one of the other manufacturers named must still receive approval in writting before it is allowed for use on this project. Otherwise no options or substitutions allowed.
   1. Substitutions are not accepted on or after the date of the Agreement, unless noted otherwise.
   2. Refer also to Section 01 3000 Administrative Requirements.
C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.
   1. Substitutions are not accepted on or after the date of the Agreement, unless noted otherwise.
   2. Refer also to Section 01 3000 Administrative Requirements.

2.4 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
B. Deliver to Project site and deliver to designated location; obtain written acknowledgement or receipt prior to final payment.

PART 3 EXECUTION

3.1 SUBSTITUTION PROCEDURES

A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.
   1. Substitutions must be approved in the time frame described in the Instructions to the Bidders and/or in Section 01 3000 - Administrative Requirements. Refer to Section 01 3000 - Administrative Requirements for Pre-Bid and Post-Bid consideration, as applicable. Approval must be in writing from the Architect or Engineer (consultant) with the approval of the Architect.
   2. If any approved substitute changes the requirements of the current design in any way, the changes shall be fully covered by the Contractor at no additional cost to the Owner or Architect.
B. Any product, system or procedure not specifically listed or described in the Contract Documents is subject to rejection.
C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
D. A request for substitution constitutes a representation that the submitter:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
    a. The submitter must provide information and certification in writing showing point for point comparison for the proposed substitute with the specified product, including color selections. The submitter shall provide data from the specified product and manufacturer as well as data from the proposed manufacturer for a comparison, review, and determination of acceptance (approval or disapproval) by the Architect.
        1) Absence of specified manufacturers' data is grounds for disapproval. Approval cannot be made if adequate comparison information is not provided.
2. Will provide the same warranty for the substitution as for the specified product.
3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension that may subsequently become apparent.
5. Will reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals,

3.2 OWNER-SUPPLIED PRODUCTS

A. See Section 01 1000 for identification of Owner-supplied products.
B. Owner's Responsibilities:
    1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
    2. Arrange and pay for product delivery to site.
    3. On delivery, inspect products jointly with Contractor.
    4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
    5. Arrange for manufacturers' warranties, inspections, and service.
C. Contractor's Responsibilities:
    1. Review Owner reviewed shop drawings, product data, and samples.
    2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
    3. Handle, store, install and finish products.
    4. Repair or replace items damaged after receipt.

3.3 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
D. Transport and handle products in accordance with manufacturer's instructions.
E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.4 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.
D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
E. For exterior storage of fabricated products, place on sloped supports above ground.
F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.
    1. Refer to Supplementary Conditions and Section 01 2000 for requirements concerning off-site storage of materials and equipment. The provisions within the referenced document(s) shall prevail over this paragraph and subparagraph.
G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
H. Comply with manufacturer's warranty conditions, if any.
I. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
J. Prevent contact with material that may cause corrosion, discoloration, or staining.
K. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
L. Transportation of stored products is the responsibility of the Contractor.
M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.
N. Extra materials, tools, spare parts, maintenance products, and similar items to be turned over to the Owner at Substantial Completion:
    1. Store items to be turned over to the Owner.
    2. Protect indoors and in weather tight conditions. Store interior materials in climatic conditions similar to normal conditions for which the installed product is to exist. All other materials shall be stored at temperature between 60 and 80 degrees F and humidity shall not exceed 60%.
    3. All items shall be packaged appropriately.
        a. Extra Materials shall be provided unused and in manufactures original unopened packaging clearly marked as to contents and products to be used with. Extra materials must be an exact match of installed materials.
        b. Tools, spare parts, maintenance products, and similar items shall be boxed or packaged ready for storage.
    4. Clearly mark and identify all extra materials, tools, spare parts, maintenance products, and similar items.
        a. Include specification section number and name.
        b. Label with manufacturer's name and model number where applicable.
        c. Plainly identify the use of the item(s).
    5. Refer also to Section 01 7800 - Closeout Submittals.

END OF SECTION

SECTION 01 6116
VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Requirements for VOC-Content-Restricted products.
- B. Requirement for installer certification that they did not use any non-compliant products.
- C. VOC restrictions for product categories listed below under "DEFINITIONS."
- D. All products of each category that are installed in the project must comply; Owner's project goals do not allow for partial compliance.

1.2 RELATED REQUIREMENTS
- A. Section 01 3000 - Administrative Requirements: Submittal procedures.
- B. Section 01 3329.07 - Prohibited Content Installer Certification: Form for certifying that no non-compliant products were used.
- C. Section 01 4000 - Quality Requirements: Procedures for testing and certifications.
- D. Section 01 6000 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.

1.3 DEFINITIONS
- A. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
  1. Interior paints and coatings.
  2. Interior adhesives and sealants, including flooring adhesives.
- B. VOC-Restricted Products: All products of each of the following categories when installed or applied on-site in the building interior:
  1. Adhesives, sealants, and sealer coatings.
  2. Carpet.
  3. Carpet tile.
  4. Resilient floor coverings.
  5. Acoustical ceilings and panels.
  6. Other products when specifically stated in the specifications.
- C. Interior of Building: Anywhere inside the exterior weather barrier.
- D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.
- E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

1.4 REFERENCE STANDARDS
- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; current edition.
- B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2005 (Reapproved 2013).
- C. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; California Department of Public Health; v1.1, 2010.
- D. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2007.
- E. CHPS (HPPD) - High Performance Products Database; Collaborative for High Performance Schools (CHPS); current edition at www.chps.net/.
- F. CRI (GLP) - Green Label Plus Testing Program - Certified Products; Carpet and Rug Institute; Current Edition.
- G. GreenSeal GS-36 - Commercial Adhesives; Green Seal, Inc.; 2011.
- H. SCAQMD 1113 - South Coast Air Quality Management District Rule No.1113; current edition; www.aqmd.gov.

I. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.
J. SCS (CPD) - SCS Certified Products; Scientific Certification Systems; current listings at www.scscertified.com.
K. UL (GGG) - GREENGUARD Gold Certified Products; UL Environment; current listings at http://http://productguide.ulenvironment.com/QuickSearch.aspx.

1.5 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Evidence of Compliance: Submit for each different product in each applicable category.
C. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.
D. Installer Certifications Regarding Prohibited Content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of his products, or 2) that such products used comply with these requirements.

1.6 QUALITY ASSURANCE
A. Indoor Emissions Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.
1. Wet-Applied Products: State amount applied in mass per surface area.
2. Paints and Coatings: Test tinted products, not just tinting bases.
3. Evidence of Compliance: Acceptable types of evidence are the following;
a. Current UL (GGG) certification.
b. Current SCS (CPD) Floorscore certification.
c. Current SCS (CPD) Indoor Advantage Gold certification.
d. Current listing in CHPS (HPPD) as a low-emitting product.
e. Current CRI (GLP) certification.
f. Test report showing compliance and stating exposure scenario used.
4. Product data submittal showing VOC content is NOT acceptable evidence.
5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.
B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
1. Evidence of Compliance: Acceptable types of evidence are:
a. Report of laboratory testing performed in accordance with requirements.
C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.7 QUALITY ASSURANCE
A. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.1 MATERIALS
A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.
B. VOC-Content-Restricted Products: VOC content not greater than required by the following:
1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
2. Joint Sealants: SCAQMD 1168 Rule.
3. Paints and Coatings: Each color; most stringent of the following:
a. 40 CFR 59, Subpart D.
b. SCAQMD 1113 Rule.
c. CARB (SCM).

C. Adhesives and Joint Sealants: Provide only products having volatile organic compound (VOC) content not greater than required by South Coast Air Quality Management District Rule No.1168.
    1. Evidence of Compliance: Acceptable types of evidence are:
        a. Report of laboratory testing performed in accordance with requirements.
        b. Published product data showing compliance with requirements.
D. Aerosol Adhesives: Provide only products having volatile organic compound (VOC) content not greater than required by GreenSeal GS-36.
    1. Evidence of Compliance: Acceptable types of evidence are:
        a. Current GreenSeal Certification.
        b. Published product data showing compliance with requirements.
E. Paints and Coatings: Provide products having VOC content as specified in Section 09 9000.
F. Carpet and Adhesive: Provide products having VOC content not greater than that required for CRI Green Label Plus certification.
    1. Evidence of Compliance: Acceptable types of evidence are:
        a. Current Green Label Plus Certification.
        b. Report of laboratory testing performed in accordance with requirements.
G. Carpet Tile and Adhesive: Provide products having VOC content not greater than that required for CRI Green Label Plus certification.
    1. Evidence of Compliance: Acceptable types of evidence are:
        a. Current Green Label Plus Certification.
        b. Report of laboratory testing performed in accordance with requirements.
H. Other Product Categories: Comply with limitations specified elsewhere.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.
B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION

SECTION 01 7000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.
B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
C. Pre-installation meetings.
D. Cutting and patching.
E. Surveying for laying out the work.
F. Cleaning and protection.
G. Starting of systems and equipment.
H. Demonstration and instruction of Owner personnel.
I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
J. General requirements for maintenance service.

1.2 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
B. Section 01 3000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.
C. Section 01 4000 - Quality Requirements: Testing and inspection procedures.
D. Section 01 5000 - Temporary Facilities and Controls: Temporary exterior enclosures.
E. Section 01 5000 - Temporary Facilities and Controls: Temporary interior partitions.
F. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds. Extra materials, tools, spare parts, maintenance products, and similar items.
G. Section 07 8400 - Firestopping.
H. Individual Product Specification Sections:
    1. Advance notification to other sections of openings required in work of those sections.

1.3 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
    1. On request, submit documentation verifying accuracy of survey work.
    2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in conformance with Contract Documents.
    3. Submit surveys and survey logs for the project record.
C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
    1. Structural integrity of any element of Project.
    2. Integrity of weather exposed or moisture resistant element.
    3. Efficiency, maintenance, or safety of any operational element.
    4. Visual qualities of sight exposed elements.
    5. Work of Owner or separate Contractor.
    6. Include in request:
        a. Identification of Project.
        b. Location and description of affected work.
        c. Necessity for cutting or alteration.
        d. Description of proposed work and products to be used.

e. Effect on work of Owner or separate Contractor.
f. Written permission of affected separate Contractor.
g. Date and time work will be executed.

D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.5 QUALIFICATIONS

A. For survey work, employ a land surveyor registered in TEXAS and acceptable to Architect. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.

1.6 PROJECT CONDITIONS

A. Use of explosives is not permitted.
B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
F. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
    1. Minimize amount of bare soil exposed at one time.
    2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
    3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
    4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
G. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
    1. At All Times: Excessively noisy tools and operations will not be tolerated inside the building at any time of day; excessively noisy includes jackhammers.
    2. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.
H. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.7 COORDINATION

A. See Section 01 1000 for occupancy-related requirements.
B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
C. Notify affected utility companies and comply with their requirements.
D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
G. Coordinate completion and clean-up of work of separate sections.
H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.1 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
C. Examine and verify specific conditions described in individual specification sections.
D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.2 PREPARATION

A. Preparation of new or existing substrate:
    1. New substrates shall be prepared as recommended by manufacturer of new work/ finish(es)/ material(s)/ product(s)/ equipment/ item(s) and/or any other new element(s).
    2. Cut, move, and remove existing finish(es), material(s), product(s), equipment, item(s), and/or other element(s) (hereinafter referred to as “existing element(s)”) and prepare substrate as necessary for application of new work/ finish(es)/ material(s)/ product(s)/ equipment/ item(s) and/or any other new element(s) (hereinafter referred to as “new work”) required for a complete and satisfactory professional installation.
        a. This includes the removal of existing element(s) whenever the existing element(s) is/are not to remain in place or is/are not an appropriate substrate and/or condition for the new work, as determined by the manufacturer or Architect. This includes, but is not limited to, existing flooring, wall elements, and/or other floor, wall, ceiling, and/or other existing element(s) (interior and exterior), unsuitable substrate and/or condition, and/or other material which compromises the new work installation, or is/are not acceptable to the manufacturer of the new work, or voids the warranty of the new work application(s).
    3. Prepare new and existing substrates and surfaces as required to receive new work/ finish(es)/ material(s)/ product(s)/ equipment/ item(s) and/or any other new element(s) application(s).
B. Temporary Removal
    1. Work of the respective specification section for new work over existing construction may include temporary removal of "existing elements", repair and preparation of existing substrate(s) required for a proper, complete and satisfactory professional installation of new work.
    2. Carefully cut, move, or remove other existing elements, to remain, as necessary for access or proper application of alterations and renovation work. Replace and restore in working order at completion to a finished condition indistinguishable from the new work.
C. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished work.

D. Remove debris and abandoned items from area and from concealed spaces.
E. Close openings in exterior surfaces to protect existing work and salvage items from weather and extremes of temperature and humidity. Insulate ducts and piping to prevent condensation in exposed areas.
F. Prepare surfaces and remove surface finishes to provide for proper installation of new work and finishes.
G. Clean substrate surfaces prior to applying next material or substance.
H. Seal cracks or openings of substrate prior to applying next material or substance.
I. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.3 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
B. Require attendance of parties directly affecting, or affected by, work of the specific section.
C. Notify Architect four days in advance of meeting date.
D. Prepare agenda and preside at meeting:
    1. Review conditions of examination, preparation and installation procedures.
    2. Review coordination with related work.
E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.4 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.
B. Promptly notify Architect of any discrepancies discovered.
C. Contractor shall locate and protect survey control and reference points.
D. Control datum for survey is that indicated on Drawings.
E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
F. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
H. Utilize recognized engineering survey practices.
I. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.
J. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
    1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
    2. Grid or axis for structures.
    3. Building foundation, column locations, ground floor elevations, and subsequent levels and locations as required.
K. Periodically verify layouts by same means.
L. Maintain a complete and accurate log of control and survey work as it progresses.
M. On completion of foundation walls and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

3.5 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
E. Make neat transitions between different surfaces, maintaining texture and appearance.
F. Transitions:

1. Transition from existing to new shall not be apparent.
2. When existing finish surfaces are cut such that a smooth unapparent transition is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
3. Transitions (new to new work and/or new to existing work) where a change in plane occurs are not acceptable, unless noted or shown otherwise.
    a. Transitions where change in plane of less than 1/4 inch occur shall be corrected to eliminate the change in plane.
    b. Where change in plane can not be eliminated or change in plane of 1/4 inch or more occurs where new work meets existing work, submit recommendation for providing a smooth transition for Architect review and request instruction.

G. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors walls and ceilings to a smooth flat plane without breaks, steps or bulkheads, unless noted or shown otherwise.
H. Recover and refinish work that exposes mechanical and/or electrical work exposed accidentally or incidentally during the work.

3.6 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
    1. Verify that construction and utility arrangements are as shown.
    2. Report discrepancies to Architect before disturbing existing installation.
    3. Beginning of alterations work constitutes acceptance of existing conditions.
B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
    1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 in locations indicated on drawings.
C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
    1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
    2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.
D. Remove existing work as indicated and as required to accomplish new work.
    1. Remove items indicated on drawings.
    2. Relocate items indicated on drawings.
    3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
    4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
    1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
    2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
    3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
        a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
        b. Provide temporary connections as required to maintain existing systems in service.

4. Verify that abandoned services serve only abandoned facilities.
5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

F. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.
4. Patch as specified for patching new work.

G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
3. Where a change of plane of 1/4 inch (6 mm) or more occurs in existing work, remove work and replace with new if existing can not be repositioned to an acceptable condition as determined by Architect.
4. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.

H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

I. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

J. Clean existing systems and equipment.

K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

L. Do not begin new construction in alterations areas before demolition is complete.

M. Comply with all other applicable requirements of this section.

3.7 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
1. Complete the work.
2. Fit products together to integrate with other work.
3. Provide openings for penetration of mechanical, electrical, and other services.
4. Match work that has been cut to adjacent work.
5. Repair areas adjacent to cuts to required condition.
6. Repair new work damaged by subsequent work.
7. Remove samples of installed work for testing when requested.
8. Remove and replace defective and non-conforming work.

D. Execute cutting and patching including excavation and fill to complete the work, to uncover work in order to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit products together to integrate with other work.

E. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

F. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
G. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
H. Restore work with new products in accordance with requirements of Contract Documents.
I. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
J. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.
K. Patching:
    1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
    2. Match color, texture, and appearance.
    3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.
L. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
M. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new work abuts or aligns with existing, perform a smooth and even transition.
N. Patch or replace surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. Repair substrate prior to patching finish. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

3.8 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.
E. Debris, rubbish, trash, waste and other matter to be disposed of throughout this project shall be handled in a thorough, neat, proper, legal, and expeditious manner.

3.9 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.
B. Provide special protection where specified in individual specification sections.
C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
G. Prohibit traffic from landscaped areas.
H. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

3.10 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.
B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
D. Verify that wiring and support components for equipment are complete and tested.
E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.
B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.
C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of owner personnel.
E. Perform instruction in a classroom environment located at the site. Exact location to be determined.
F. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
G. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

3.12 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.
B. Testing, adjusting, and balancing HVAC systems. See Division 23 section(s) and Section 01 4000.

3.13 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.
    1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.
B. Use cleaning materials that are nonhazardous.
C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
F. Clean filters of operating equipment.
G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, drainage systems, and _____.
H. Clean site; sweep paved areas, rake clean landscaped surfaces.
I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
    1. Provide copies to Architect and Owner.
B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in

accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
F. Contractor shall provide electronic format & mylar reproducible Record Drawings in addition to the original paper edition. Request of the Architect the appropriate electronic files after issuance of the Certificate for Substantial Completion.
G. Complete Record Drawings (original paper edition, electronic format & mylar reproducibles) and submit to Architect.
H. Ensure Record Documents have been completed and are ready for submission as required by Section 01 7800 - Closeout Submittals.
I. Deliver extra materials, tools, spare parts, maintenance products, and similar items to Owner at the time of Substantial Completion.
J. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
K. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
L. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.15 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.
B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
C. Furnish service and maintenance of components indicated in specification sections for one year from date of Substantial Completion.
D. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
E. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
F. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

SECTION 01 7419
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.1 WASTE MANAGEMENT REQUIREMENTS

A. Owner requires that this project generate the least amount of trash and waste possible.
B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
D. Owner may decide to pay for additional recycling, salvage, and/or reuse based on Landfill Alternatives Proposal specified below.
E. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
   1. Aluminum and plastic beverage containers.
   2. Corrugated cardboard.
   3. Wood pallets.
   4. Clean dimensional wood: May be used as blocking or furring.
   5. Land clearing debris, including brush, branches, logs, and stumps; see Section 31 1000 - Site Clearing for use options.
   6. Concrete: May be crushed and used as riprap, aggregate, sub-base material, or fill.
   7. Concrete masonry units: May be used on project if whole, or crushed and used as sub-base material or fill.
   8. Asphalt paving: May be recycled into paving for project.
   9. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
   10. Glass.
   11. Gypsum drywall and plaster.
   12. Plastic buckets.
   13. Carpet, carpet cushion, carpet tile, and carpet remnants, both new and removed: DuPont (http://flooring.dupont.com) and Interface (www.interfaceinc.com) conduct reclamation programs.
   14. Plastic sheeting.
   15. Rigid foam insulation.
   16. Fluorescent lamps (light bulbs).
F. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.
G. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.
H. Methods of trash/waste disposal that are not acceptable are:
   1. Burning on the project site.
   2. Burying on the project site.
   3. Dumping or burying on other property, public or private.
   4. Other illegal dumping or burying.
   5. Incineration, either on- or off-site.
I. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.2 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.
B. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.

C. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
D. Section 01 7000 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.
E. Section 31 1000 - Site Clearing: Handling and disposal of land clearing debris.

1.3 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
I. Return: To give back reusable items or unused products to vendors for credit.
J. Reuse: To reuse a construction waste material in some manner on the project site.
K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Landfill Alternatives Proposal: Within 10 calendar days after receipt of Notice to Proceed, or prior to any trash or waste removal, whichever occurs sooner, submit a projection of trash/waste that will require disposal and alternatives to landfilling, with net costs.
    1. Submit to Architect for Owner's review and approval.
    2. If Owner wishes to implement any cost alternatives, the Contract Price will be adjusted as specified elsewhere.
    3. Include an analysis of trash/waste to be generated and landfill options as specified for Waste Management Plan described below.
    4. Describe as many alternatives to landfilling as possible:
        a. List each material proposed to be salvaged, reused, or recycled.
        b. List the proposed local market for each material.
        c. State the estimated net cost resulting from each alternative, after subtracting revenue from sale of recycled or salvaged materials and landfill tipping fees saved due to diversion of materials from the landfill.
    5. Provide alternatives to landfilling for at least the following materials:
        a. Aluminum and plastic beverage containers.
        b. Corrugated cardboard.
        c. Wood pallets.

d. Clean dimensional wood.
e. Concrete.
f. Bricks.
g. Concrete masonry units.
h. Asphalt paving.
i. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
j. Glass.
k. Gypsum drywall and plaster.
l. Plastic buckets.
m. Carpet, carpet cushion, carpet tile, and carpet remnants, both new and removed: DuPont (http://flooring.dupont.com) and Interface (www.interfaceinc.com) conduct reclamation programs.
n. Plastic sheeting.
o. Rigid foam insulation.
p. Windows, doors, and door hardware.
q. Plumbing fixtures.
r. Fluorescent lamps (light bulbs).
s. Acoustical ceiling tile and panels.

C. Once Owner has determined which of the landfill alternatives addressed in the Proposal above are acceptable, prepare and submit Waste Management Plan; submit within 10 calendar days after notification by Architect.

D. Submit Waste Management Plan within 10 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner; submit projection of all trash and waste that will require disposal and alternatives to landfilling.

E. Waste Management Plan: Include the following information:
1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
a. List each material proposed to be salvaged, reused, or recycled.
b. List the local market for each material.
c. State the estimated net cost, versus landfill disposal.
4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.
7. Recycling Incentives: Describe procedures required to obtain credits, rebates, or similar incentives.

F. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
2. Submit Report on a form acceptable to Owner.
3. Landfill Disposal: Include the following information:
a. Identification of material.

b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project disposed of in landfills.
c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.

4. Recycled and Salvaged Materials: Include the following information for each:
   a. Identification of material, including those retrieved by installer for use on other projects.
   b. Amount, in tons or cubic yards (cubic meters), date removed from the project site, and receiving party.
   c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
   d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
   e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
5. Material Reused on Project: Include the following information for each:
   a. Identification of material and how it was used in the project.
   b. Amount, in tons or cubic yards (cubic meters).
   c. Include weight tickets as evidence of quantity.
6. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

G. Recycling Incentive Programs:
1. Where revenue accrues to Contractor, submit copies of documentation required to qualify for incentive.
2. Where revenue accrues to Owner, submit any additional documentation required by Owner in addition to information provided in periodic Waste Disposal Report.

PART 2 PRODUCTS

2.1 PRODUCT SUBSTITUTIONS

A. See Section 01 6000 - Product Requirements for substitution submission procedures.
B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 01 6000:
1. Relative amount of waste produced, compared to specified product.
2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Price.
3. Proposed disposal method for waste product.
4. Markets for recycled waste product.

PART 3 EXECUTION

3.1 WASTE MANAGEMENT PROCEDURES

A. See Section 01 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
B. See Section 01 5000 for additional requirements related to trash/waste collection and removal facilities and services.
C. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.
D. See Section 01 7000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.2 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.
C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
D. Meetings: Discuss trash/waste management goals and issues at project meetings.
    1. Pre-bid meeting.
    2. Pre-construction meeting.
    3. Regular job-site meetings.
    4. Job safety meetings.
E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
    1. As a minimum, provide:
        a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
        b. Separate dumpsters for each category of recyclable.
        c. Recycling bins at worker lunch area.
    2. Provide containers as required.
    3. Provide temporary enclosures around piles of separated materials to be recycled or salvaged.
    4. Provide materials for barriers and enclosures that are nonhazardous, recyclable, or reusable to the maximum extent possible; reuse project construction waste materials if possible.
    5. Locate enclosures out of the way of construction traffic.
    6. Provide adequate space for pick-up and delivery and convenience to subcontractors.
    7. If an enclosed area is not provided, clearly lay out and label a specific area on-site.
    8. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.
I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

SECTION 01 7800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Project Record Documents.
- B. Record Submittal Set.
- C. Operation and Maintenance Data.
- D. Warranties and bonds.
- E. Extra materials, tools, spare parts, maintenance products, and similar items.

1.2 RELATED REQUIREMENTS
- A. Section 00 7200 - General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.
- B. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- C. Section 01 6000 - Product Requirements: Items to be turned over to the Owner
- D. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.
- E. Individual Product Sections: Specific requirements for operation and maintenance data.
- F. Individual Product Sections: Warranties required for specific products or Work.
- G. Individual Product Sections: Specific requirements for extra materials, tools, spare parts, maintenance products, and similar items to be turned over to the Owner.

1.3 SUBMITTALS
- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
  1. Provide the original paper edition of the Record Drawings.
  2. Provide electronic format Record Drawings as prepared by the Contractor. Format may be a scan of the completed and approved paper Record Drawings executed during the course of the Work.
     a. Provide scans in ".PDF" format.
     b. Submit electronic files on compact discs (CDs).
  3. Provide one set of reproducible completed and approved Record Drawings three mil double matte finish mylar transparencies.
  4. Provide a completed copy of all other Record Documents, including but not limited to the following:
     a. Specifications.
     b. Addenda.
     c. Change Orders.
     d. Architects Supplemental Instructions.
     e. Answered Requests For Information (RFIs).
- B. Complete set of approved Submittals. (Owner's Record Submittal Set.)
  1. Submit to the Owner 1 copy of the approved submittals, with an index and a log, at the final inspection.
- C. Operation and Maintenance Data:
  1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
  2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
  3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
  4. Submit two sets of revised final documents in final form within 10 days after final inspection.
- D. Warranties and Bonds:

1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

E. Extra materials, tools, spare parts, maintenance products, and similar items:
1. Ensure all items are clearly labeled, packaged, and quantified. Refer to Section 01 6000 - Product Requirements.
2. Deliver to location designated by Owner.

1.4 LABEL ALL RECORD DOCUMENTS

A. All Record Documents must be clearly, in bold face, labeled "RECORD DOCUMENT." Electronic/digital format documents must bear the label within each file.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Reviewed shop drawings, product data, and samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.
1. Record Documents shall be maintained on a daily basis and kept current.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
3. Field changes of dimension and detail.
4. Details not on original Contract drawings.
5. Location of capped utilities.

G. Electronic Format Record Drawings provided by Contractor: Legibly mark each item to record actual construction including:
1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
3. Field changes of dimension and detail.
4. Details not on original Contract drawings.
5. Locations of capped utilities.

H. Reproducible transparencies of the completed and approved Record Drawings shall be provided by the Contractor

1. One set of the Record Drawings on three mil double matte finish mylar transparencies.

3.2 RECORD SUBMITTAL SET

A. Reviewed Submittals with Index and Log:
   1. Product Data.
   2. Shop Drawings.
   3. Samples for Selection.
   4. Samples for Verification.
B. Submittals for Information with Index and Log:
   1. Design data.
   2. Certificates.
   3. Test reports.
   4. Inspection reports.
   5. Manufacturer's instructions.
   6. Manufacturer's field reports.
   7. Other types indicated.

3.3 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.4 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.
   2. Information for re-ordering custom manufactured products.
B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
D. Additional information as specified in individual product specification sections.
E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
F. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

3.5 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.
B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
D. Include color coded wiring diagrams as installed.

E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
G. Provide servicing and lubrication schedule, and list of lubricants required.
H. Include manufacturer's printed operation and maintenance instructions.
I. Include sequence of operation by controls manufacturer.
J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
K. Provide control diagrams by controls manufacturer as installed.
L. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
O. Include test and balancing reports.
P. Additional Requirements: As specified in individual product specification sections.

3.6 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
C. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
D. Prepare data in the form of an instructional manual.
E. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
F. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
G. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
H. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
I. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
J. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.
K. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
L. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.
M. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
    1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
    2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
        a. Significant design criteria.
        b. List of equipment.
        c. Parts list for each component.

d. Operating instructions.
e. Maintenance instructions for equipment and systems.
f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.

3. Part 3: Project documents and certificates, including the following:
   a. Shop drawings and product data.
   b. Air and water balance reports.
   c. Certificates.
   d. Photocopies of warranties and bonds.
4. Part 4: Video recordings:
   a. Provide DVD format video recording of all Training, Demonstration, and Instruction sessions.
   b. Identify each session separately and include the information for each session as required by Section 01 7000 - Execution and Closeout Requirements.

N. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

O. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect, Consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

3.7 WARRANTIES AND BONDS

A. Contractor shall correct defective Work within a two year period after Date of Substantial Completion; remove and replace materials concealing defective work at no extra cost to Owner.

B. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

C. Verify that documents are in proper form, contain full information, and are notarized.

D. Co-execute submittals when required.

E. Retain warranties and bonds until time specified for submittal.

F. Manual: Bind in commercial quality 8-1/2 by 11 inch (216 by 279 mm) three D side ring binders with durable plastic covers.

G. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

H. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

I. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

3.8 EXTRA MATERIALS, TOOLS, SPARE PARTS, MAINTENANCE PRODUCT & SIMILAR ITEMS

A. Deliver extra materials, tools, spare parts, maintenance products, and similar items to location(s) designated by Owner at the time of Substantial Completion.

B. Ensure that all items are properly packaged, and clearly marked as described at Section 01 6000 - Product Requirements. Refer also to Section 01 7000 - Execution and Closeout Requirements.

C. Prepare an inventory list of all items and provide multiple copies of this list. Use this as a checklist with the Owner when turning over to Owner's possession. Obtain Owners acknowledgement for receipt of all items.

D. Remaining Materials: Extra materials of value, that remain after completion of associated work, become Owner's property. Dispose of these materials as directed by the Owner.

END OF SECTION

SECTION 01 9113.01
BUILDING SYSTEMS COMMISSIONING

PART 1 GENERAL

1.1 SUMMARY

A. Cleary Zimmermann Engineers, LLC has been selected as the Commissioning Authority (CA).
   1. Cleary Zimmermann Engineers, LLC
   2. 1344 South Flores Suite 201
   3. San Antonio, TX. 78204
   4. 210-447-6100 voice 210-447-6101 fax

1.2 DEFINITIONS AND ABBREVIATIONS

A. Definitions set forth in the General Conditions, AIA Document A201, are applicable to this Section. In addition, the following definitions shall apply to the terms used in this section.
   1. "Acceptance Phase" – Phase of construction after start-up and initial checkout when functional performance tests, O&M documentation review, and training occurs.
   2. "Approval" – Acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the Contract Documents.
   3. "Architect / Engineer (A/E)" – The prime consultant (architect) and sub-consultants who comprise the design team, generally the HVAC mechanical designer / engineer, plumbing designer / engineer, and the electrical designer / engineer.
   4. "Basis of Design" – The basis of design is the documentation of the primary thought processes and assumptions behind design decisions that were made to meet the design intent. The basis of design describes the systems, components, conditions, and methods chosen to meet the design intent.
   5. "Commissioning Authority (CA)" – An independent agent, not otherwise associated with the A/E team members or the Contractor, though he / she may be hired as a subcontractor to them. The CA directs and coordinates the day-to-day commissioning activities. The CA does not take an oversight role like the CM. The CA is part of the Construction Manager (CM) team or shall report directly to the CM.
   6. "Commissioning Plan" – An overall plan, developed before or after bidding, that provides the structure, schedule, and coordination planning for the commissioning process.
   7. "Contract Documents" – The documents binding on parties involved in the construction of this project (drawings, specifications, change orders, amendments, contracts, Cx Plan, etc.).
   8. "Contractor" – The general contractor or authorized representative.
   9. "Control System" – The central building energy management control system.
   10. "Construction Manager (CM)" – The Owner's representative in the day-to-day activities of construction. In general, the construction management services contractor (CM) is hired by the owner to assist the government in the overall management of the project including supervising and on-site managing authority over a project's construction. The General Contractor reports to the CM. The CM is the Owner's on-site representative.
   11. "Data-logging" – Monitoring flows, currents, status, pressures, etc. of equipment using stand-alone data-loggers separate from the control system.
   12. "Deferred Functional Tests" – FPT's that are performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design, or other site conditions that disallow the test from being performed.
   13. "Deficiency" – A condition in the installation or function of a component, piece of equipment, or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not complying with the design intent).
   14. "Design Intent" – A dynamic document that provides the explanation of the ideas, concepts, and criteria that are considered to be very important to the owner. It is initially the outcome of the programming and conceptual design phases.
   15. "Design Narrative" or "Design Documentation" – Sections of either the Design Intent or Basis of Design.

16. “Factory Testing” – Testing of equipment on-site or at the factory by factory personnel with an Owner’s representative present.
17. “Field Installation Verification (FIV)” – Verification of all installed systems for compliance to plans and specification. These inspections are to be described in detail in the commissioning plan. Primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels, gages in place, balancing devices in place, etc.).
18. “Functional Performance Test (FPT)” – Test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system’s sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) must be completed prior to commencing the FPT. TAB’s primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The commissioning authority develops the functional test procedures in a sequential written form, coordinates, oversees, and documents the actual testing, which is usually performed by the installing contractor or vendor. FPT’s are performed after Field Installation Verification (FIV) and Operational Performance Tests (OPT) are complete.
19. “General Contractor (GC)” – The prime contractor for this project. Generally refers to all the GC’s subcontractors as well. Also referred to as the Contractor in some contexts.
20. “Indirect Indicators” – Indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100% closed.
21. “Manual Test” – Using hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the “observation”).
22. “Monitoring” – The recording of parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of control systems.
23. “Non-Compliance” – see Deficiency
24. “Non-Conformance” – see Deficiency
25. “Operational Performance Test (OPT)” – Verification of proper start-up of all equipment and systems to be commissioned. These tests are to be described in detail in the commissioning plan.
26. “Over-written Value” – Writing over a sensor value in the control system to see the response of a system (e.g. changing the outside air temperature value from 50 F to 75 F to verify economizer operation). See also “Simulated Signal.”
27. “Owner-Contracted Test” – Tests paid for by the Owner outside the GC’s contract and for which the CA does not oversee. These tests will not be repeated during the functional performance testing.
28. “Phased Commissioning” – Commissioning that is completed in phases (by floors, for example) due to the size of the structure or other scheduling issues, in order to minimize the total construction time.
29. “Project Manager (PM)” – The contracting and managing authority for the owner over the design and/or construction of the project; a staff position.
30. “Sampling” – Operational or functional testing only a fraction of the total number of identical or near identical pieces of equipment. Refer to Part 3 Execution for details.
31. “Seasonal Performance Tests” – FPT that are deferred until the system(s) will experience conditions closer to their design conditions.
32. “Simulated Condition” – Condition that is created for the purpose of testing the response of a system (e.g. applying a hair blower to a space sensor to see the response in a VAV box.
33. “Simulated Signal” – Disconnecting a sensor and using a signal generator to send an amperage, resistance, or pressure to the transducer and DDC system to simulate a sensor value.

34. “Specifications” – The construction specifications of the Contract Documents.
35. “Startup” – The initial starting or activating of dynamic equipment, including executing OPT’s.
36. “Subs” – The subcontractors to the GC who provide and install building components and systems.
37. “Test Procedures” – the step-by-step process which must be executed to fulfill the test requirements. The test procedures are developed by the CA.
38. “Trending” – Monitoring using the building control system.
39. “Vendor” – Supplier of equipment.
40. “Warranty Period” – Warranty period for entire project, including equipment components. Warranty begins at Substantial Completion and extends for at least one year, unless specifically noted otherwise in the Contract Documents and accepted submittals.

B. Abbreviations. The following are common abbreviations used in the Specifications and in the Commissioning Plan.
1. A/E: Architect and design engineers.
2. CA: Commissioning Authority
3. CC: Controls Contractor
4. CM: Construction Manager (the Owner’s representative)
5. Cx: Commissioning
6. Cx Plan: Commissioning Plan document
7. EC: Electrical Contractor
8. FIV: Field Installation Verification
9. FPT: Functional Performance Test
10. GC: General Contractor (Prime)
11. O & M: Operation and Maintenance
12. MC: Mechanical Contractor
13. OPT: Operational Performance Test
14. PM: Project Manager (of the Owner)
15. Subs: Subcontractors to the General
16. TAB: Test and Balance Contractor

1.3 SYSTEM DESCRIPTION

A. Commissioning:
1. Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the owner’s operational needs. This is achieved by beginning in the design phase and documenting design intent and continuing through construction, acceptance, and the warranty period with actual verification of performance. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment start-up, control system calibration, point-to-point check out, testing and balancing, performance testing, and owner/operator training.
2. Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:
   a. Perform commissioning in accordance with the criteria and requirements set forth in the USGBC LEED v2009 rating system.
   b. Verify that applicable equipment and systems are installed according to the manufacturer’s recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by the installing contractors.
   c. Verify and document proper performance of equipment and systems.
   d. Verify that O&M documentation left on site is complete.
   e. Verify that the owner’s operating personnel are adequately trained.

B. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.

C. Systems to be commissioned: The following systems shall be commissioned in this project.
1. Div 22 – Plumbing
   a. Domestic hot water generation

b. Domestic hot water thermostatic control
c. Pumping, boosting and circulation

2. Div 23 - HVAC
   a. HVAC Air systems
   b. HVAC Hydronic systems
      1) Building Automation System (BAS-Controls)
3. Div 26 Electrical Systems
   a. Interior and exterior lighting systems
   b. Lighting systems controls
4. Renewables, as applicable

1.4 COORDINATION

A. Commissioning Team:
   1. Commissioning Authority (CA)
   2. Owner's Project Manager (PM)
   3. Designated representative of the Owner's Construction Management firm (CM)
   4. General Contractor (GC or Contractor)
   5. Architect
   6. Design Engineers (particularly the mechanical engineer)
   7. Mechanical Contractor (MC)
   8. Electrical Contractor (EC)
   9. TAB representative
   10. Controls Contractor (CC)
   11. Other installing contractors or suppliers of equipment
   12. Owner's building or plant operator/engineer

B. Management. The CA is hired by the owner. The CA directs and coordinates the commissioning activities and the reports to the owner. All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents.

C. Scheduling.
   1. The CA will work with the CM according to established protocols to schedule the commissioning activities. The CA will provide sufficient notice to the CM for scheduling commissioning activities. The GC will integrate all commissioning activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.
   2. The CA will provide the initial schedule of primary commissioning events at the commissioning scoping meeting. As construction progresses more detailed schedules are developed by the CA.

1.5 COMMISSIONING PROCESS

A. Commissioning Plan. A draft Commissioning Plan shall be developed by the CA and will be provided at the scoping meeting. The commissioning plan provides guidance in the execution of the commissioning process. Just after the initial commissioning scoping meeting the CA will update the plan which is then considered the "final" plan, though it will continue to evolve and expand as the project progresses. The final commissioning plan is binding on the Contractor. The Specifications will take precedence over the Commissioning Plan.

B. Commissioning Process. The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.
   1. Commissioning during construction begins with a scoping meeting conducted by the CA where the commissioning process is reviewed with the commissioning team members.
   2. Additional meetings will be required throughout construction, scheduled by the CA with necessary parties attending to plan, scope, coordinate, schedule future activities, and resolve problems.
   3. Equipment documentation is submitted to the CA during normal submittals, including detailed startup procedures.
   4. The CA works with the subs in developing startup plans and startup documentation formats, including providing the subs with FIV and OPT checklists as a reference of items to be verified by the CA.

5. In general, the checkout and performance verifications proceeds from simple to complex; from component level to equipment to systems and intersystem levels with FIV and OPT checklists being completed before functional performance testing. The CA shall provide field installation inspection for each system and subsystem covered in the scope of work for this project and provide an installation observation report weekly to the General Contractor / Construction Manager. The report shall cover any installation deficiencies from plans and specifications.
6. The Subs perform startup and initial checkout. The CA documents that the startup was completed according to the approved plans. This shall include the CA witnessing startup of selected equipment.
7. The CA develops specific equipment and system functional performance test procedures. The Subs review the procedures.
8. The procedures are executed by the Subs under the direction of and documented by the CA.
9. Items of non-compliance in material, installation, or setup are corrected at the Sub's expense and the system retested.
10. The CA reviews the O&M documentation for completeness.
11. Commissioning is completed before Substantial Completion.
12. The CA reviews, pre-approves, and coordinates the training provided by the Subs and verifies that it was completed.

1.6 RESPONSIBILITIES

A. The responsibilities of various parties in the commissioning process are provided in this section. The responsibilities of the mechanical contractor, TAB, and controls contractor(s) are in Division 23 and those of the electrical contractor in Division 26.

B. All Parties
   1. Assist in the development of the Final Commissioning Plan
   2. Follow the Final Commissioning Plan
   3. Attend commissioning scoping meeting and additional meetings as necessary.

C. Architect (of A/E)
   1. Construction and Acceptance Phase
      a. Attend the commissioning scoping meeting and selected commissioning team meetings.
      b. Perform normal submittal review, construction observation, as-built drawing preparation, O&M manual preparation, etc., as contracted.
      c. Provide any design narrative documentation requested by the CA.
      d. Coordinate resolution of system deficiencies identified during commissioning, according to the contract documents.
      e. Prepare and submit final as-built design intent documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.
   2. Warranty Period: coordinate resolution of design non-conformance and design deficiencies identified during warranty period commissioning.

D. Mechanical and Electrical Designers/Engineers (of the A/E)
   1. Construction and Acceptance Phase
      a. Perform normal submittal review, construction observation, as-built drawing preparation, etc., as contracted. One site observation should be completed just prior to system startup.
      b. Provide any design narrative and sequences documentation requested by the CA. The designers shall assist (along with the contractors) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings, or equipment documentation is not sufficient for writing detailed testing procedures.
      c. Attend commissioning scoping meetings and other selected commissioning team meetings.
      d. Participate in the resolution of system deficiencies identified during commissioning according to the contract documents.

e. Prepare and submit the final as-built design intent and operating parameters documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.
f. From the Contractors red line drawings, edit and update one-line diagrams developed as part of the design narrative documentation and those provided by the vendor as shop drawings for the chilled and hot water, condenser water, domestic water, steam, and condensate systems; supply, return, and exhaust air systems, and emergency power system.
g. Review the FIV and OPT checklists for major pieces of equipment for sufficiency prior to their use.
h. Review the FPT procedure forms for major pieces of equipment for sufficiency prior to their use.

2. Warranty Period: Participate in the resolution of non-compliance, non-conformance, and design deficiencies identified during the warranty period commissioning.

E. Commissioning Authority (CA): The CA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CA may assist with problem-solving, non-conformance, or deficiencies, but ultimately that responsibility resides with the GC and the A/E. The primary role of the CA is to develop and coordinate the execution of a testing plan, observe and document the performance – that systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. The Contractors will provide all tools or the use of tools to start, check-out, and functionally test equipment and systems, except for specific testing with portable data loggers, which shall be supplied and installed by the CA.

F. Construction Manager – Owner's Representative (CM)
1. Construction and Acceptance Phase
a. Facilitate the coordination of the commissioning work by the CA, and, with the GC and CA, ensure that commissioning activities are being scheduled into the master schedule.
b. Review the final Commissioning Plan – Construction Phase.
c. Attend commissioning scoping meetings and other selected commissioning team meetings.
d. Perform the normal review of Contractor submittals.
e. Furnish a copy of all construction documents, addenda, change orders, and approved submittals and shop drawings related to commissioned equipment to the CA.
f. Review and approve the functional performance test procedures submitted by the CA prior to testing
g. When necessary, observe and witness FIV, OPT, FPT of selected equipment.
h. Review commissioning progress and deficiency reports.
i. Coordinate the resolution of non-compliance and design deficiencies identified in all phases of commissioning.
j. Assist the CA in coordinating the training of owner personnel.
2. Warranty Period: Assist the CA as necessary in the seasonal or deferred testing and deficiency corrections required by the specifications.

G. Owner's Project Manager (PM)
1. Construction and Acceptance Phase
a. Manage the contract of the A/E and of the GC
b. Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions according to the Commissioning Plan
c. Provide final approval for the completion of the commissioning work.
2. Warranty Period: Ensure that any seasonal or deferred testing and deficiency issues are addressed.

H. General Contractor (GC)
1. Construction and Acceptance Phase

a. Facilitate the coordination of the commissioning work by the CA, and with the GC and CA ensure that commissioning activities are being scheduled into the master schedule.
b. Ensure that all Subs execute their commissioning responsibilities according to the Contract Documents and schedule.
c. A representative shall attend the commissioning scoping meeting and other necessary meetings scheduled by the CA to facilitate the Cx process
d. Coordinate the training of owner personnel.
e. Prepare the O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

2. Warranty Period
a. Ensure that Subs execute seasonal or deferred functional performance testing.
b. Ensure that Subs correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

I. Equipment Supplier
1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
2. Assist in equipment testing per agreements with Subs.
3. Include all special tools, instruments, and software required for testing equipment according to these Contract Documents in the base bid pricing, except for stand-alone data-logging provided by the CA.
4. Review test procedures for equipment installed by factory representatives.
5. Ensure that any seasonal or deferred testing and deficiency issues are addressed during the warranty period.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Division contractor for the equipment being tested. For example, the mechanical contractor of Division 23 shall ultimately be responsible for all standard testing equipment for the HVAC system and DDC system in Division 23, except for equipment specific to and used by TAB in their contractor responsibilities.

B. Special equipment, tools, instruments, software, (only available from vendor specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and left on site, except for stand-alone data-logging equipment that may be used by the CA.

C. Data-logging equipment and software required to test equipment will be provided by the CA, but shall not become the property of the Owner.

D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: temperature sensors and digital thermometers shall have an accuracy of ± 0.7° F with a resolution of 0.1° F. Water Pressure sensors shall have an accuracy of ± 2% of reading. All instruments shall be calibrated annually.

PART 3 EXECUTION

3.1 MEETINGS

A. Scoping Meeting. Within 60 days of commencement of construction, the CA will schedule, plan, and conduct a commissioning scoping meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the CA. Information gathered from this meeting will allow the CA to revise the Draft Commission Plan to its “final” version, which will also be distributed to all parties.

B. Miscellaneous Meetings. Other meetings will be planned and conducted by the CA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular Subs.

3.2 REPORTING

A. The CA will provide regular reports to the CM or PM, depending on the management structure, with increasing frequency as construction and commissioning progresses. Standard forms are provided and referenced in the Commissioning Plan.
B. The CA will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, progress reports, etc.
C. Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.

3.3 SUBMITTALS

A. The CA will provide appropriate contractors with a specific request for the type of submittal documentation that the CA requires to facilitate the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team. At minimum, the request will include the manufacturer and model number, the manufacturer's printed installation and detailed start-up procedures, full sequence of operation, O&M data, performance data, any performance test procedures, control drawings, user interface graphics for each system, and details of owner contracted tests. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the CA. All documentation requested by the CA will be included by the Subs in their O&M manual contributions.
B. The CA will review submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the functional performance of the equipment and adequacy for developing test procedures. This review in intended primarily to aid in the development of functional testing procedures and only secondarily to verify compliance with equipment specifications. The CA will notify the CM, PM, or A/E as requested of items missing or areas that are not in conformance with Contract Documents and which require resubmission.
C. The CA may request additional design narrative from the A/E and Controls Contractor depending on the completeness of the design intent documentation and sequences provided with the specifications.
D. These submittals to the CA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, though the CA will review them.

3.4 FIELD INSTALLATION VERIFICATION AND OPERATIONAL PERFORMANCE TESTS

A. The following procedures apply to all equipment to be commissioned, according to Section 1.3, Systems to be commissioned.
B. General. FIV's and OPT's are important to ensure that the equipment and systems are hooked-up and operational. It ensures that functional performance testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full FIV checkout. No sampling strategies are used. FIV's and OPT's for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.
C. Start-up and Initial Checkout Plan. The CA shall assist the commissioning team members responsible for start-up of any equipment in developing detailed start-up plans for all equipment. The primary role of the CA in this process is to ensure that there is written documentation that each of the manufacturer-recommended procedures have been completed. The contractor is responsible to perform the start-up procedures of selected equipment in the presence of the CA.
    1. The CA develops the FIV and OPT checklists and procedures. These checklists indicate required procedures to be executed as part of start-up and initial checkout of the systems and the party responsible for their execution.
    2. These checklists and tests are provided by the CA to the Contractor for reference during the construction process.
    3. The subcontractor responsible for the purchase of the equipment assists in the development of the full start-up plan by combining (or adding to) the CA's checklists with

the manufacturer's detailed start-up and checkout procedures from the O&M manual and the normally used field checkout sheets. The full start-up plan (at a minimum) shall consist of the following:
    a. The CA's OPT checklist
    b. The manufacturer's standard written start-up procedures copied from the installation manuals.
    c. The manufacturer's normally used filed checkout sheets.
4. The CA reviews and approves the procedures and the format for documenting them, noting any procedures that need to be added.
5. The full start-up procedures and the approval form may be provided to the CM for review and approval, depending on management protocol.

D. Controls System Verification
1. The operation of all control system components shall be verified in the presence of the CA.
2. All procedures used shall be fully documented on the OPT checklists clearly referencing the procedures followed and written documentation of initial, intermediate, and final results.
3. All control point OPT tests shall be verified through the graphic front end software.
4. All sensors and analog inputs shall be calibrated by manufacturer's standard procedures and to project calibration tolerances.
5. All analog outputs, actuators, and valves shall be ranged for correct action to the control signal.

E. Execution of FIV and OPT Procedures.
1. The CA shall perform regular FIV's throughout the construction period.
2. Four weeks prior to start-up, the Subs and vendors schedule start-up and checkout with the CM, GC, and CA. The performance of start-up and checkout are directed and executed by the Sub or vendor in the presence of the CA.
3. The CA shall observe the start-up procedures for each piece of primary equipment.

F. Deficiency issue log.
1. The CA shall provide a periodic commissioning issue log clearly listing any deficiencies or areas of concern from any FIV or OPT.
2. The issue log shall be provided to the CM for distribution to the appropriate parties for review, response, and action. All actions and results will be listed on the issue log for future reference (i.e. nothing is ever deleted).
3. Items left incomplete, which later cause deficiencies or delays during functional testing may result in back charges to the responsible party.

3.5 PHASED COMMISSIONING

A. The project may require start-up and initial checkout to be executed in phases. This phasing will be planned and scheduled in a coordination meeting of the CA, CM, mechanical, TAB, controls, and the GC. Results will be added to the master and commissioning schedules.

3.6 FUNCTIONAL PERFORMANCE TESTING

A. This sub-section applies to all commissioning functional testing for all divisions.
B. The general list of equipment to be commissioned is as specified herein.
1. Objective and Scope
2. The objective of functional performance testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional tests will identify areas of deficient performance so they can be corrected, improving the operation and functioning of the systems.
3. In general, each system should be operated through all modes of operation (seasonal, occupied, un-occupied, warm-up, cool-down, part and full load,) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.

C. Development of Test Procedures

1. Before test procedures are written, the CA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. The CA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Each Sub or vendor responsible to execute a test, shall provide limited assistance to the CA in developing the procedures review (answer questions about equipment, operation, sequences, etc.). Prior to execution, the CA shall provide a copy of the test procedures to the Sub(s) who shall review the tests for feasibility, safety, equipment, and warranty protection. The CA may submit the tests to the A/E for review, if requested.
2. The CA shall review owner-contracted, factory testing or required owner acceptance tests which the CA is not responsible to oversee, including documentation format, and shall determine what further testing or format changes may be required to comply with the Specifications. Redundancy of testing shall be minimized.
3. The purpose of any given specific test is to verify and document compliance with the stated criteria of acceptance given on the test form.

D. Test Methods
1. Functional performance testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities, or by stand-alone data loggers. The CA may substitute specified methods or require an additional method to be executed, other than what was specified, with the approval of the CM. This may require a change order and adjustment in charge to the owner. The CA will determine which method is most appropriate for tests that do not have a method specified.
2. Sampling Multiple identical pieces of non-life-safety or otherwise non-critical equipment with identical factory configured control sequences may be functionally tested using sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference.

E. Coordination and Scheduling
1. The Subs shall provide sufficient notice to the CA regarding their completion schedule for the start-up of all equipment and systems. The CA will schedule functional tests through the CM, GC, and affected Subs. The CA shall direct, witness, and document the functional testing of all equipment and systems. The Subs shall execute the tests.
2. In general, functional testing is conducted after FIV's and OPT's have been satisfactorily completed. The control system is sufficiently tested and approved by the CA before it is used for TAB or to verify performance of other components or systems. The air balancing and water balancing is completed and de-bugged before functional testing of air related or water related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.

F. Test Equipment. Refer to Part 2 – Products for test equipment requirements.

G. Problem Solving. The CA will recommend solutions to problems found, however, the burden of responsibility to solve, correct, and re-test problems is with the GC, Subs, and A/E.

H. Deferred Testing. If any check or test cannot be completed due to the building structure, required occupancy condition, or other deficiency, execution of checklists and functional testing may be delayed upon approval of the PM. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.

3.7 DOCUMENTATION, NON-CONFORMANCE, AND APPROVAL OF TESTS

A. Documentation. The CA shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the CM for review and approval and to the Subs for review. The CA will include the filled out forms in the O&M manuals.

B. Non-Conformance

1. The CA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted and reported to the CM on the standard commissioning issues log.
2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA. In such cases the deficiency and resolution will be documented on the procedure form.
3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the CM.
4. As tests progress and a deficiency is identified, the CA discusses the issue with the executing contractor.
    a. When there is no dispute on the deficiency and the Sub accepts responsibility to correct it:
        1) If the deficiency can be easily corrected it shall be corrected and the commissioning shall proceed.
        2) The CA reschedules the test and the test is repeated.
    b. If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible or the repair will take more than one hour:
        1) The deficiency shall be documented on the issue log or the test check sheet with the Sub's response and a copy given to the CM and to the Sub representative assumed to be responsible.
        2) Resolutions are made at the lowest management level possible.
        3) The CA documents the resolution process.
        4) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CA. The CA reschedules the test and the test is repeated until satisfactory performance is achieved.
5. Cost of re-testing.
    a. The cost for the Sub to re-test a OPT or FPT, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for re-testing costs shall be negotiated with the GC.
    b. For a deficiency identified, not related to any pre-functional checklist or start-up fault, the following shall apply: The CA and CM will direct the re-testing of the equipment once at no charge to the GC for their time. However, the CA's and CM's time for a second re-test will be charged to the GC, who may choose to recover costs from the responsible Sub.
    c. The time for the CA and CM to direct any re-testing required because a specific FIV or OPT item, reported to have been successfully completed, but determined during functional testing to be faulty, will be back charged to the GC, who may choose to recover costs from the party responsible.
6. The contractor shall respond in writing to the CA and CM at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.
7. The CA retains the original non-conformance forms until the end of the project.
8. Any required re-testing by any contractor shall not be considered a justified reason for a claim of delay or for a time extension by the prime contractor.

C. Failure Due to Manufacturer Defect. If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the CM or PM.

D. Approval. The CA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CA and by the CM, if necessary.

The CA recommends acceptance of each test to the CM using a standard form. The CM gives final approval on each test using the same form, providing a signed copy to the CA and the contractor.

3.8 OPERATION AND MAINTENANCE MANUALS

A. Standard O&M Manuals
   1. The specific content and format requirements for the standard O&M manuals are detailed in Section 01 7800. Special requirements for the controls contractor and TAB contractor shall be as specified in Div 23.
   2. CA Review. Prior to substantial completion, the CA shall review the O&M manuals, documentation, and final as-built drawings for systems that were commissioned to verify compliance with the Specifications. The CA will communicate deficiencies in the manuals to the CM, PM, A/E, as requested. Upon a successful review of the corrections, the CA recommends approval and acceptance of these sections of the O&M manuals to the CM, PM, or A/E. The CA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated. This work does not supersede the A/E's review of the O&M manuals according to the A/E's contract.

B. Commissioning Final Report
   1. Final Report Details. The final commissioning report shall include an executive summary, LEED commissioning statement sheet, list of participants, and roles, brief building description, overview of commissioning and testing scope and a general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the FIV, OPT, and FPT completed check sheets. The report shall also include all issue logs and commissioning communication.
   2. Other documentation will be retained by the CA.

3.9 TRAINING OF OWNER PERSONNEL

A. The GC shall be responsible for training coordination and scheduling and ultimately for ensuring that training is completed.

B. The CA shall be responsible for overseeing and reviewing the content and adequacy of the training of Owner personnel for commissioned equipment and systems.
   1. Each Sub and vendor responsible for training will submit a written training plan to the CA for review and approval prior to training. All training methods shall include a classroom lecture and an actual operational demonstration of start-up, tear down, and maintenance procedures, as applicable and appropriate. A sample of elements contained in the plan is as follows:
      a. Equipment covered
      b. Intended audience
      c. Location of training
      d. Objectives
      e. Subjects covered
      f. Duration of training on each subject
      g. Instructor name, company, and qualifications
   2. For the primary HVAC equipment, the Controls Contractor shall provide a short discussion of the control of the equipment during the mechanical or electrical training conducted by others.
   3. 3.
   4. The CA develops an overall training plan and coordinates and schedules, with the GC and CM, the overall training for the commissioned systems. The CA develops criteria for determining that the training was satisfactorily completed, including attending some of the training, etc. The CA recommends approval of the training to the CM using standard form. The CM also signs the approval form.

END OF SECTION

SECTION 02 4100
DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Selective demolition of built site elements.
- B. Dust partitions.

PART 2 PRODUCTS

2.1 MATERIALS

2.2 DUST BARRIERS - "ZIPWALL" - CONTRACTORS OPTION
- A. Dust Partitons
  1. Provide polyethylene barrier floor to ceiling. All seams shall be continuously taped to allow no openings.
  2. Provide continuous tight seal at ceiling, walls and floor at each application.
  3. Accessories
     - a. Supports: ZipWall "ZipPoles" spring loaded poles as manufactured by ZipWall, 37 Broadway, Arlington, MA 02474; T:800.718.2255; F:781.648.8806; www.zipwall.com.
     - b. Slip disks: Provide for use at slippery flooring
     - c. Sealing bars: ZipWall "Foam Rails" for tight ceiling seal
     - d. Provide pass-through with Heavy Duty ZipWall Zipper.
     - e. Manufacturer of above mentioned Products: ZipWall, 37 Broadway, Arlington, MA 02474; T:800.718.2255; F:781.648.8806; www.zipwall.com. Dealers include:
       1) Lynwood Building Materials,
          (a) 1146 West Laurel, San Antonio, TX, 78201; T:(210) 477-3000 & (210) 477-3000; www.lynwoodsa.com.
          (b) 15262 Capital Port, San Antonio, TX, 78249; T:(210) 408-9052.
       2) White Cap Industries,
          (a) 4215 Factory Hill, San Antonio, TX, 78219; T: (210) 212-4880.
          (b) 10500 Broadway Ste. 200, San Antonio, TX, 78217; T: 210-590-9444.
       3) Ram Tool & Supply,
          (a) 610 Lanark Dr. Suite 150, San Antonio, TX, 78218; T: (210) 659-5859; www.ram-tool.com.
       4) Service Products - an Interlink Affiliate;
          (a) 10903 A/B Wye Drive, San Antonio, TX, 78217; T:(210) 590-1622.
- B. Dust barrier doors
  1. Provide polyethylene door barrier at door openings. All seams shall be continuously taped to allow no openings along door frame perimeter.
     - a. Provide ZipWall "ZipDoor"
       1) Standard ZipDoor for doorways up to 3'-0" x 7'-0"
       2) Commercial ZipDoor for doorways up to 4'-0" X 8'-0", flame retardant.

PART 3 EXECUTION

3.1 DEBRIS AND WASTE REMOVAL
- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 03 1100
CONCRETE FORMING

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

Form all Cast-In-Place Concrete indicated on the drawings and subsequently remove all such forms except floor slab corrugated steel forms described in this section.

1.02 RELATED REQUIREMENTS

A. Section 03 2000 Concrete Reinforcing.

B. Section 03 3000 Cast-In-Place Concrete.

C. Concrete formwork included in other sections of these Specifications that is not specifically described shall meet the requirements of this section.

D. Metal sleeves, base plates, anchors, hangers, dovetail anchor slots, and all embedments, furnish and locate by respective trade or by General Contractor. Secure approval of Engineer for installation of all sleeves and conduits in structural members.

1.03 QUALITY ASSURANCE

A. Qualification of Workmen: Provide at least one person who shall be present at all times during the execution of this portion of the Work, who shall be thoroughly familiar with the type of materials being installed, the referenced standards, and the requirements of this Work, and who shall direct all work performed under this section.

B. Codes and Standards:

1. In addition to complying with all pertinent codes and regulations, comply with ACI 301 "Specifications for Structural Concrete for Buildings" and for ACI 318 "Building Code Requirements for Reinforced Concrete"; whichever is more stringent.

2. Where provisions of pertinent codes and standards conflict with the requirements of this section of these Specifications, the more stringent provisions shall govern.

1.04 PRODUCT HANDLING

A. Protection: Use all means necessary to protect formwork materials before, during, and after installation and to protect work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs to the approval of the Engineer and Architect and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

A. Wood Forms: Capable of meeting all requirements described under Form Construction, this section.

B. Unexposed Surfaces: No. 2 common or better, plywood.

C. Exposed Surfaces: New or like-new moisture resistant fir form plywood. Surface must be smooth, completely free from scratches, indentations, unsound surface knots, ripples, etching, prominent grain, depressions, warps or breaks. "Exposed Surfaces" includes concrete surfaces which are to be painted or dash coated.

D. Metal Forms:

1. Steel pan forms shall be in good condition. No twisted, bent, broken, or out of shape pans may be used. Sizes shall be as indicated on drawings. Remove after use. Steel forms in adjacent

bays shall be in exact alignment to provide continuity of the joists throughout the work. Narrower standard form widths may be utilized as required to space joists to maintain other details shown. Adjust spacing so that joists will miss plumbing sleeves.

2. Contractor shall submit shop drawings showing layout of steel pan forms for structural engineer's records.

2.02 MISCELLANEOUS MATERIALS

A. Anchor Slots: Install anchor slots vertically at 32" c-c spacing in all exterior concrete floor or roof beams where masonry or anchored panels go past beams. Install vertically in columns where masonry abuts or is adjacent to columns.

B. Vapor Barrier: At fill supported slabs, unless detailed otherwise.

1. Stego Wrap 15 mil Vapor Barrier by Stego Industries, LLC,
San Juan Capistrano, CA (877) 464-7834 www.stegoindustries.com

2. Barrier Bac VB350 (16 mil) Vapor Retarder by Barrier Bac, Inc.
Calhoun, Georgia (706) 629-4425 www.barrierbac.com

3. W.R. Meadows Premoulded Membrane with Plasmatic Core,
W.R. Meadows, Inc. (800) 342-5976 www.wrmeadows.com

C. Tie and Spreaders: All form ties shall be a type which does not leave an opening through the concrete (regular snap ties) and which permits neat and solid patching of every hole.

PART 3 - EXECUTION

3.01 FORM CONSTRUCTION
All aspects of formwork, including the design, construction, upkeep, maintenance and removal, is the Contractor's responsibility. The Contractor shall provide formwork that is safe and properly designed for the specific method of concrete placement, type of vibration and construction loads which he will employ.

3.02 SURFACES TO BE FORMED
Form both sides and soffit of all grade beams, walls, slabs, joists and all other structural concrete below and above existing or finish grade unless shown otherwise on plans, and remove all such form work prior to backfilling.

3.03 FORMING DETAILS
Construct complete with centering, shores, etc. Conform to shape, lines, grade and dimensions required by drawings; use plywood sheets as large as practical; all surfaces straight, plumb and properly braced; joints accurately matched and mortar-tight. Maintain sufficiently rigid to prevent deformation under load. If adequate foundation for shores cannot be secured, provide trussed supports. For cleaning and inspection in wall and column forms, provide temporary openings. Clean and oil forms before reuse. Forms shall be readily removable without hammering or prying against concrete.

3.04 CONDUIT IN SLABS
See General Notes.

3.05 FORM TIES
Use regular snap ties. No metal shall be within one inch of finished surface when forms are removed. Wire ties not permitted.

3.06 CHAMFER STRIPS
Base at all angles of concrete which are exposed to view, unless shown otherwise.

3.07 SLAB AND BEAMS ON FILL

A. See Structural Drawings for location. Form outside face of all perimeter beams, slabs, turndowns, and any other concrete exposed to view with wood forming to a depth of 12" below finished grade unless shown otherwise on plans, and remove all such formwork prior to backfilling. Form masonry lugs, floor drops and recesses as indicated on plans.

B. Except for wood forming specified above, form beams and slabs with carefully shaped fill material as specified on plans. Clean beam trenches of all loose material.

C. Support reinforcing steel on concrete blocks or bricks spaced at approximately 4'-0" o.c. in each direction.

D. Vapor barrier shall be installed as directed by the manufacturer.

3.08 CONSTRUCTION JOINTS

A. Provide and locate as necessary in Cast-In-Place Concrete.

B. Form keyways as required in Cast-In-Place Concrete for transfer of shear and other forces through the joint.

3.09 BEAM TO WALL CONNECTION

A. Form key seat into wall full size of beam.

3.10 OILING OF FORMS

A. Lightly coat with non-staining form oil for exposed surfaces. Before placing reinforcing, remove surplus oil.

B. Forms for unexposed surfaces may be thoroughly wetted with water in lieu of oiling immediately before placing concrete.

3.11 REMOVAL OF FORMS

A. Side forms of beams, walls and columns may be removed after cumulatively curing at not less than 50 degrees F (10 degrees C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

B. Beam, joist and slab soffits may be removed when all of the following conditions are satisfied.

1. Strength of concrete as shown by standard cylinder test has reached at least 2,500 psi and at least 75% of specified design strength.

2. Concrete has cured at least 7 days (4 days for type 3 cement) or additional time as required if during cold weather.

3. Soffit forms shall not be removed from members that are supporting any load such as construction materials or shoring for floor or roof above unless it can be determined that the member as sufficient strength to support such loading.

END OF SECTION 03 1100

SECTION 03 15 13
EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS

PART 1 GENERAL

1.01 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 111	(2011) Standard Method of Test for Mineral Matter or Ash in Asphalt Materials

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4	(1995; R 2004) Basic Hardboard

ASME INTERNATIONAL (ASME)

ASME BPVC SEC IX	(2010) BPVC Section IX-Welding and Brazing Qualifications

ASTM INTERNATIONAL (ASTM)

ASTM A1011/A1011M	(2012b) Standard Specification for Steel, Sheet, and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability and Ultra-High Strength
ASTM A109/A109M	(2008) Standard Specification for Steel, Strip, Carbon (0.25 Maximum Percent), Cold-Rolled
ASTM A167	(1999; R 2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A480/A480M	(2012) Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
ASTM B152/B152M	(2013) Standard Specification for Copper Sheet, Strip, Plate, and Rolled Bar
ASTM B370	(2012) Standard Specification for Copper Sheet and Strip for Building Construction
ASTM C919	(2012) Use of Sealants in Acoustical Applications
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM D1751	(2004; R 2008) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752	(2004a; R 2008) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion
ASTM D2628	(1991; R 2011) Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements

ASTM D2835	(1989; R 2012) Lubricant for Installation of Preformed Compression Seals in Concrete Pavements
ASTM D4	(1986; R 2010) Bitumen Content
ASTM D412	(2006a; R 2013) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D471	(2012a) Standard Test Method for Rubber Property - Effect of Liquids
ASTM D5249	(2010) Backer Material for Use with Cold-and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints
ASTM D6/D6M	(1995; E 2011; R 2011) Loss on Heating of Oil and Asphaltic Compounds
ASTM D7116	(2005) Standard Specification for Joint Sealants, Hot Applied, Jet Fuel Resistant Types, for Portland Cement Concrete Pavement

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 513	(1974) Corps of Engineers Specifications for Rubber Waterstops
COE CRD-C 572	(1974) Corps of Engineers Specifications for Polyvinylchloride Waterstops

1.03 SUBMITTALS

Submit the following in accordance with Section 013300 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Waterstops

SD-03 Product Data

Preformed Expansion Joint Filler
Sealant
Waterstops

SD-04 Samples

Not Required

1.04 DELIVERY, STORAGE, AND HANDLING

Protect material delivered and placed in storage off the ground from moisture, dirt, and other contaminants. Deliver sealants in the manufacturer's original unopened containers. Remove sealants from the site whose shelf life has expired.

PART 2 PRODUCTS

2.01 CONTRACTION JOINT STRIPS

Contraction joint strips shall be 1/8 inch thick tempered hardboard conforming to AHA A135.4, Class 1. In lieu of hardboard strips, rigid polyvinylchloride (PVC) or high impact polystyrene (HIPS) insert strips

specifically designed to induce controlled cracking in slabs on grade may be used. Such insert strips shall have removable top section.

2.02 PREFORMED EXPANSION JOINT FILLER

Expansion joint filler shall be preformed material conforming to ASTM D1751or ASTM D1752, Type I, or resin impregnated fiberboard conforming to the physical requirements of ASTM D1752. Submit certified manufacturer's test reports for premolded expansion joint filler strips, compression seals and lubricant, and metallic waterstops to verify compliance with applicable specification. Unless otherwise indicated, filler material shall be 3/8 inch thick and of a width applicable for the joint formed. Backer material, when required, shall conform to ASTM D5249.

2.03 SEALANT

Joint sealant shall conform to the following:

A. Preformed Polychloroprene Elastomeric Type
ASTM D2628.

B. Lubricant for Preformed Compression Seals
ASTM D2835.

C. Field-Molded Type
ASTM C920. Sealant shall be Type M, Grade P or NS, Class 25, Use T for horizontal joints. Type M, Grade NS, Class 25, Use NT for vertical joints. Except, the joint sealant that will be submerged underwater for part or all of its service life shall meet the requirements of USE I. Bond breaker material shall be polyethylene tape, coated paper, metal foil or similar type materials. The back-up material shall be compressible, non-shrink, nonreactive with sealant, and non-absorptive material type such as extruded butyl or polychloroprene rubber.

D. Hot-Applied Jet-Fuel Resistant Type
ASTM D7116, Type I

2.04 WATERSTOPS

Shop fabricate intersection and change of direction waterstops. .

A. Flexible Metal
Copper waterstops shall conform to ASTM B152/B152M and ASTM B370, O60 soft anneal temper and 20 oz mass per sq ft sheet thickness. Stainless steel waterstops shall conform to ASTM A167 and ASTM A480/A480M, UNS S30453 (Type 304L), and 0.0375 inch (20 gauge) thick strip.

B. Rigid Metal
Flat steel waterstops shall conform to ASTM A109/A109M, No. 2 (half hard) temper, No. 2 edge, No. 1 (matte or dull) finish or ASTM A1011/A1011M, Grade 40.

C. Non-Metallic Materials`
Non-metallic waterstops shall be manufactured from a prime virgin resin; reclaimed material is not acceptable. The compound shall contain plasticizers, stabilizers, and other additives to meet specified requirements. Rubber waterstops shall conform to COE CRD-C 513. Polyvinylchloride waterstops shall conform to COE CRD-C 572. Thermoplastic elastomeric rubber waterstops shall conform to ASTM D471.

D. Non-Metallic Hydrophilic
Swellable strip type compound of polymer modified chloroprene rubber that swells upon contact with water shall conform to ASTM D412 as follows: Tensile strength 420 psi minimum; ultimate elongation 600 percent minimum. Hardness shall be 50 minimum on the type A durometer and the volumetric expansion ratio in distilled water at 70 degrees F shall be 3 to 1 minimum.

E. Preformed Elastic Adhesive
Produce preformed plastic adhesive waterstops from blends of refined hydrocarbon resins and plasticizing compounds reinforced with inert mineral filler, containing no solvents, asbestos, irritating fumes or obnoxious odors. The compound shall not depend on oxidizing, evaporating, or chemical action for its adhesive or cohesive strength.

1. Chemical Composition
   Meet the chemical composition of the sealing compound requirements shown below:

PERCENT BY WEIGHT			
COMPONENT	MINIMUM	MAXIMUM	TEST
Bitumen (Hydrocarbon plastic)	50	70	ASTM D4
Inert Mineral Filler	30	50	AASHTO T 111
Volatile Matter		2	ASTM D6/D6M

2. Adhesion Under Hydrostatic Pressure
   The sealing compound shall not leak at the joints for a period of 24 hours under a vertical 6 foot head pressure. In a separate test, the sealing compound shall not leak under a horizontal pressure of 10 psi which is reached by slowly applying increments of 2 psi every minute.

3. Sag of Flow Resistance
   Sagging shall not be detected when tested as follows: Fill a wooden form 1 inch wide and 6 inches long flush with sealing compound and place in an oven at 135 degrees F in a vertical position for 5 days.

4. Chemical Resistance
   The sealing compound when immersed separately in a 5 percent solution of caustic potash, a 5 percent solution of hydrochloric acid, 5 percent solution of sulfuric acid and a saturated hydrogen sulfide solution for 30 days at ambient room temperature shall show no visible deterioration.

2.05 TESTS, INSPECTIONS, AND VERIFICATIONS

A. Materials Tests
   Not required

B. Splicing Waterstops
   1. Procedure and Performance Qualifications
      Demonstrate procedure and performance qualifications for splicing waterstops in the presence of the Engineer. Submit procedures for splicing waterstops for approval.

   2. Non-Metallic Waterstops
      Demonstrate procedure and performance qualifications for splicing non-metallic waterstops by the manufacturer at the factory and the Contractor at the job site by each making three spliced samples of each size and type of finished waterstop.

   3. Metal Waterstops
      Demonstrate procedure and performance qualifications for splicing metal waterstops at the job site by the Contractor. The brazing procedure, brazers and brazing operators for splicing copper waterstops shall be qualified in accordance with Part QB (Brazing), Article XI (Brazing, General Requirements), paragraph QB-170 (Peel Tests) and other applicable requirements of Articles XI, XII, and XIII of ASME BPVC SEC IX. The welding procedure and welders for splicing stainless steel waterstops shall be qualified in accordance with the manufacturer's recommendations.

PART 3 EXECUTION

3.01 INSTALLATION
Joint locations and details, including materials and methods of installation of joint fillers and waterstops, shall be as specified and indicated. In no case shall any fixed metal be continuous through an expansion or contraction joint.

A. Contraction Joints

Contraction joints may be constructed by inserting tempered hardboard strips or rigid PVC or HIPS insert strips into the plastic concrete using a steel parting bar, when necessary, or by cutting the concrete with a saw after concrete has set. Make joints 1/8 inch to 3/16 inch wide and extend into the slab one-fourth the slab thickness, minimum, but not less than 1 inch.

1. Joint Strips

   Provide strips of the required dimensions and as long as practicable. After the first floating, groove the concrete with a tool at the joint locations. Insert the strips in the groove and depress them until the top edge of the vertical surface is flush with the surface of the slab. Float and finish the slab as specified. Working of the concrete adjacent to the joint shall be the minimum necessary to fill voids and consolidate the concrete. Where indicated, saw out the top portion of the strip after the curing period to form a recess for sealer. Discard the removable section of PVC or HIPS strips and leave the insert in place. Maintain true alignment of the strips during insertion.

2. Sawed Joints

   Saw joints early enough to prevent uncontrolled cracking in the slab, but late enough that this can be accomplished without appreciable spalling. Cutting shall be started as soon as the concrete has hardened sufficiently to prevent raveling of the edges of the saw cut. Cutting shall be completed before shrinkage stresses become sufficient to produce cracking. Use concrete sawing machines that are adequate in number and power, and with sufficient replacement blades to complete the sawing at the required rate. Cut joints to true alignment and in sequence of concrete placement. Remove sludge and cutting debris. Form reservoir for joint sealant.

3. Bond Breaker

   Coat joints requiring a bond breaker with curing compound or with bituminous paint. Protect waterstops during application of bond breaking material to prevent them from being coated.

B. Expansion Joints

Use preformed expansion joint filler in expansion and isolation joints in slabs around columns and between slabs on grade and vertical surfaces where indicated. Extend the filler to the full slab depth, unless otherwise indicated. neatly finish the edges of the joint with an edging tool of 1/8 inch radius, except where a resilient floor surface will be applied. Where the joint is to receive a sealant, the filler strips shall be installed at the proper level below the finished floor with a slightly tapered, dressed and oiled wood strip temporarily secured to the top to form a recess to the size shown on the drawings. Remove the wood strip after the concrete has set. Contractor may opt to use a removable expansion filler cap designed and fabricated for this purpose in lieu of the wood strip. Thoroughly clean the groove of laitance, curing compound, foreign materials, protrusions of hardened concrete, and any dust. If blowing out the groove use oil-free compressed air.

C. Joint Sealant

Fill sawed contraction joints and expansion joints in slabs with joint sealant, unless otherwise shown. Joint surfaces shall be clean, dry, and free of oil or other foreign material which would adversely affect the bond between sealant and concrete. Apply joint sealant as recommended by the manufacturer of the sealant.

1. Joints With Preformed Compression Seals

   Install compression seals with equipment capable of installing joint seals to the prescribed depth without cutting, nicking, twisting, or otherwise distorting or damaging the seal or concrete and with no more than 5 percent stretching of the seal. Cover the sides of the joint and, if necessary, the sides of the compression seal with a coating of lubricant. Coat butt joints with liberal applications of lubricant.

2. Joints With Field-Molded Sealant

   Do not seal joints when the sealant material, ambient air, or concrete temperature is less than 40 degrees F. When the sealants are meant to reduce the sound transmission characteristics of interior walls, ceilings, and floors the guidance provided in ASTM C919 shall be followed. Coat joints requiring a bond breaker with curing compound or with bituminous paint. Install bond breaker and back-up material where required. Joints shall be primed and filled flush with joint sealant in accordance with the manufacturer's recommendations.

3.02 WATERSTOPS, INSTALLATION AND SPLICES

Install waterstops at the locations shown to form a continuous water-tight diaphragm. Embed the bottom of each waterstop a minimum of 6 inches in firm rock or sealed to other cut-off systems. Make adequate provision to support and completely protect the waterstops during the progress of the work. Repair or replace any waterstop punctured or damaged. Protect exposed waterstops during application of form release agents to avoid being coated. Provide suitable guards to protect exposed projecting edges and ends of partially embedded waterstops from damage when concrete placement has been discontinued. Accomplish splices with certified trained personnel using approved equipment and procedures.

A. Copper And Stainless Steel

Splices in copper waterstops shall be lap joints made by brazing. Splices in stainless steel waterstops shall be welded using a TIG or MIG process utilizing a weld rod to match the stainless. All welds shall not be annealed to maintain physical properties. Do not use carbon flame in the annealing process. Damaged waterstops shall be repaired by removing damaged portions and patching. Patches shall overlap a minimum of 1 inch onto undamaged portion of the waterstop.

B. Flat Steel

Splices in flat steel waterstops shall be properly aligned, butt welded, and cleaned of excessive material.

C. Non-Metallic

Fittings shall be shop made using a machine specifically designed to mechanically weld the waterstop. A miter guide, proper fixturing (profile dependant), and portable power saw shall be used to miter cut the ends to be joined to ensure good alignment and contact between joined surfaces. The splicing of straight lengths shall be done by squaring the ends to be joined. Maintain continuity of the characteristic features of the cross section of the waterstop (ribs, tabular center axis, protrusions, etc.) across the splice.

1. Rubber Waterstop

Splices shall be vulcanized or shall be made using cold bond adhesive as recommended by the manufacturer. Splices for TPE-R shall be as specified for PVC.

2. Polyvinyl Chloride Waterstop

Make splices by heat sealing the adjacent waterstop edges together using a thermoplastic splicing iron utilizing a non-stick surface specifically designed for waterstop welding. Use the correct temperature to sufficiently melt without charring the plastic. Reform waterstops at splices with a remolding iron with ribs or corrugations to match the pattern of the waterstop. The spliced area, when cooled, shall show no signs of separation, holes, or other imperfections when bent by hand in as sharp an angle as possible.

3. Quality Assurance

Edge welding will not be permitted. Compress or close centerbulbs when welding to non-centerbulb type. Waterstop splicing defects which are unacceptable include, but are not limited to the following: 1) Tensile strength less than 80 percent of parent section. 2) Free lap joints. 3) Misalignment of centerbulb, ribs, and end bulbs greater than 1/16 inch. 4) Misalignment which reduces waterstop cross section more than 15 percent. 5) Bond failure at joint deeper than 1/16 inch or 15 percent of material thickness. 6) Misalignment of waterstop splice resulting in misalignment of waterstop in excess of 1/2 inch in 10 feet. 7) Visible porosity in the weld area, including pin holes. 8) Charred or burnt material. 9) Bubbles or inadequate bonding. 10) Visible signs of splice separation when cooled splice is bent by hand at a sharp angle.

D. Non-Metallic Hydrophilic Waterstop Installation

Miter cut ends to be joined with sharp knife or shears. The ends shall be adhered with cyanacryiate (super glue) adhesive. When joining hydrophilic type waterstop to PVC waterstop, the hydrophilic waterstop shall be positioned as shown on the drawings. Apply a liberal amount of a single component hydrophilic sealant to the junction to complete the transition.

E. Preformed Plastic Adhesive Installation

The installation of preformed plastic adhesive waterstops shall be a prime, peel, place and pour procedure. Joint surfaces shall be clean and dry before priming and just prior to placing the sealing strips. The end of each strip shall be spliced to the next strip with a 1 inch overlap; the overlap shall be pressed firmly to release trapped air. During damp or cold conditions the joint surface shall be flashed

with a safe, direct flame to warm and dry the surface adequately; the sealing strips shall be dipped in warm water to soften the material to achieve maximum bond to the concrete surface.

3.03 CONSTRUCTION JOINTS

Treat construction joints coinciding with expansion and contraction joints as expansion or contraction joints as applicable.

END OF SECTION 031513

SECTION 03 2000
CONCRETE REINFORCING

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED
Furnish and install all reinforcement and associated items required and/or indicated on the drawings for all Cast-In-Place Concrete.

1.02 RELATED REQUIREMENTS
Reinforcement of Masonry.

1.03 QUALITY ASSURANCE

A. Qualifications of Workmen: Provide at least one person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the best methods for their installation and who shall direct all work performed under this section.

B. Codes and Standards:

1. In addition to complying with all pertinent codes and regulations, concrete reinforcement, unless otherwise noted, shall meet requirements of ACI 301 "Specifications for Structural Concrete for Buildings" and/or ACI 318 "Building Code Requirements for Reinforced Concrete", whichever is more stringent.

2. Where provisions of pertinent codes and standards conflict with this Specification, the more stringent provisions shall govern.

1.04 SUBMITTALS

A. Shop Drawings:

1. The Contractor shall obtain completely detailed shop drawings showing placement plans, bar bending lists, etc. Include the specific location and size of all accessories, chairs and bar supports. The Contractor shall carefully check these drawings, then submit them to the Architect/Engineer. The Architect/Engineer may conduct limited spot checks aimed solely at determining general comprehension of the design intent, then return them to the Contractor. The Contractor shall then carefully recheck the shop drawings and approve them prior to fabrication.

2. Note: Regardless of the fabricators standard policy or other industry standards of practice, all straight and bent bars shall be tagged with the member mark. If the fabricator elects to use member marks other than those shown on the structural drawings, the members must also be labeled with the original engineer's member marks in addition to those of the fabricator.

3. The Engineer's spot check shall not relieve the Contractor from correcting, at his own expense, any items that may thereafter be found not to comply with the plans and specifications.

B. Certificates: When requested by the Engineer, supplier of reinforcing steel and other embedded materials shall furnish certified evidence that all materials delivered to the project meet the requirements of this section of the Specification.

1.05 PRODUCT HANDLING

A. Protection:

1. Use all means necessary to protect concrete reinforcement before, during, and after installation and to protect the installed work and materials of all other trades.

2. Store in a manner to prevent excessive rusting and fouling with dirt, grease and other bond-breaking coatings.

3. Use all necessary precautions to maintain identification after the bundles are broken.

4. Concrete reinforcement included in other sections of these specifications that is not specifically described shall meet the requirements of this section.

5. Mechanical and electrical equipment, ducts and conduit: Provide adequate reinforcing as approved by Engineer for all required mechanical equipment and all required openings through beams, slabs, joists, walls, roof deck, etc., and for distribution of equipment loads to structural members. See Execution paragraph, this section, for conduit in slabs.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Reinforcing: All reinforcing, unless noted otherwise on plans, shall comply with ASTM A615, Grade 60. ALL REINFORCING STEEL SHALL BE DOMESTIC.

B. Wire Mesh: Comply with ASTM A185, flat sheets only.

C. Spirals: Unless noted otherwise on plans, spirals shall be plain round, hot rolled bars conforming to the strength and elongation requirements of ASTM A615, Grade 60.

D. Metal Accessories:

1. According to latest revision of "Manual of Standard Practice for Detailing Reinforced Concrete Structures" (ACI SP66), except that beam reinforcing larger than #9 shall be supported on individual bar chairs spaced no greater than 2'-0" apart. Accessories resting on forms where underside is left exposed to view, or where plaster, paint, stucco, or dash coat is to be applied shall be galvanized or have plastic leg tips at all points of contact with forms.

2. Accessories fabricated completely from plastic will not be permitted. Accessories for use on cardboard carton forms shall have continuous bottom wire runners or metal sand plates.

3. In the event steel other than of domestic manufacture is contemplated to be used, furnish to Engineer laboratory tests made by a Testing Laboratory approved by the Engineer certifying that said steel meets all requirements.

PART 3 - EXECUTION

3.01 FABRICATION

A. Reinforcing shall be fabricated in accordance with "Manual of Standard Building Code Requirements for Reinforced Concrete" (ACI 318), latest edition. The Contractor shall be responsible for obtaining properly fabricated reinforcing and placing it properly.

B. Reinforcing steel, at the time concrete is placed, shall be free from rust, scale, dried concrete, or other coatings that will destroy or reduce bond.

C. Reinforcing steel shall be accurately bent and placed in position, securely tied or supported to prevent movement during placing of concrete. Field bends will not be permitted without prior approval from Engineer. Spacer bars, supports and accessories are not scheduled but are to be furnished and placed as described under Materials, this section. Raising of reinforcement (including welded wire fabric) during the pour will not be permitted.

3.02 CONCRETE COVER
As shown on Drawings.

3.03 SPLICES
Necessary splices not shown on drawings or otherwise noted shall be in accordance with ACI specifications for bar sizes up to #11 size, but not less than 40 bar diameters. Splices in bars larger than #11 shall be made with approved thermal or mechanical coupling devices. Welding wire fabric shall be lapped 1-1/2 meshes, with a minimum lap of 8".

3.04 SLAB OPENINGS

Unless shown otherwise, at slab openings of 12" or less, spread main reinforcing around opening. At slab openings greater than 12", provide 2 # 4 x 4'-0" bottom placed diagonally at each corner. At sides of openings, provide one full bar for each bar cut at opening. No main bars shall be cut without Engineer's approval.

3.05 CONDUITS IN SLABS

See General Notes.

3.06 BEAM INTERSECTIONS

As shown on Drawings.

3.07 TOPPING REINFORCEMENT

Reinforcement (including welded wire fabric) shall be chaired to proper depth as shown on plans and sections. Raising of reinforcement during pour is not acceptable.

3.08 CONSTRUCTION JOINTS

A. Provide and locate as necessary in Cast-In-Place Concrete section.

B. All reinforcing shall continue through the joint.

C. Add extra reinforcing if so directed by Engineer.

END OF SECTION 03 2000

SECTION 03 3000
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Cast-In-Place Concrete required for this work is indicated on the drawings and includes, but is not limited to:

1. Drilled Footings.
2. Concrete Beams, Slabs and Joists.
3. Slabs on Grade.
4. Exterior Flatwork.

1.02 RELATED REQUIREMENTS

A.	Division 01	Structural Engineer: Shop Drawings/Field Visit.
B.	Division 01	Structural Quality Control and Testing.
C.	Section 03 1100	Concrete Forming.
D.	Section 03 2000	Concrete Reinforcing.

1.03 QUALITY ASSURANCE

A. Qualifications of Workmen: Provide at least one person who shall be present at all times during execution of this portion of the work who shall be thoroughly familiar and experienced in placing the types of concrete specified and who shall direct all work performed under this section. For finishing of exposed surfaces of the concrete, use only thoroughly trained and experienced journeyman concrete finishers.

B. Codes and Standards: In addition to complying with all pertinent codes and regulations, complying with all the requirements of ACI 301, "Specifications for Structural Concrete for Buildings" and/or ACI 318, "Building Code Requirements for Reinforced Concrete". Refer to ACI 302 "Guide for Concrete Floor and Slab Construction."

C. Embedments: Metal sleeves, anchors, hangers, dovetail anchor slots, and all embedments; furnish and locate by respective trade or by General Contractor. Secure approval of Engineer for installation of sleeves and conduits in structural members.

D. Finishes: Refer to Architectural Drawings for all floor finishes, location and dimensions of slab drops and depressions, floor checks, reglets, chamfers, reveals, rustications and special architectural concrete treatment.

E. Mechanical Equipment: Mechanical and electrical equipment, ducts and conduit: provide adequate structural framing and reinforcing as approved by Engineer for all required mechanical equipment and all required openings through beams, slabs, joists, walls, roof deck, etc., and for distribution of equipment loads to structural members.

F. Concrete Quality: The Contractor shall be responsible for all aspects of concrete production, including maintenance and control of the quality of the concrete through batching, mixing, placing and curing of the concrete. He shall take whatever measures he deems necessary to accomplish this. To assure the Owner of the quality of the work, an independent testing laboratory shall be employed to perform certain services as described below. The performance of these services does not relieve the Contractor of his responsibility.

G. Concrete Mix Design: Design the mix proportions for each type of concrete to be used on the project based on aggregate size and cement proportions specified in Part 2 - Products. Laboratory shall go to the designated concrete supplier's batching plant and obtain samples of ingredients which shall be used in determination of compliance with ASTM C33 and in the preparation of confirmatory test specimens.

H. Confirmatory Test Specimens: Using the proposed mix design, the laboratory shall make one set of four test cylinders for each type of concrete. The results of two 7-day compression tests shall be submitted with the proposed mix design prior to placement of concrete on the job. Subsequently, results of two 28-day compression tests shall be submitted and the strength shall be at least 25% greater than the specified minimum strength for concrete placed on the job.

I. Existing Mix Designs: The laboratory may submit data of previously prepared "standard" mix designs provided.

1. The mix design was prepared by the laboratory in strict accordance with the provisions of this section of the project specifications.

2. The mix design shall have been prepared within the preceding six months. Documentation shall not reference any specific construction project.

3. The laboratory shall submit written certification that the materials used in the submitted mix designs are currently stocked at the batching plant.

J. Concrete Testing:

1. Concrete tests shall be performed by a commercial testing laboratory approved by the Owner. All charges for services as set out below shall be paid by the Owner.

2. The Laboratory shall take samples and perform slump and compression tests in accordance with ASTM C39 on concrete placed each day at the rate of one set of four cylinders for each 100 cu. yds. or fraction thereof. Samples shall be taken at the point of deposit in the field and all cylinders shall be accurately marked and referenced to show date, time and exact location in the structure from which they came. Make 7-day test on two cylinders and 28-day test on two cylinders. Reports of tests shall be promptly sent as follows: two to the Architect, one to the Engineer, and one to the Contractor.

K. Below Strength Concrete: If the 28-day cylinder strengths fall below the specified strength, the concrete represented by such test cylinders shall be considered unacceptable and subject to removal. Consideration will be given to the acceptance of such concrete if it can be demonstrated to the satisfaction of the Engineer that the cylinder tests do not accurately represent the strength of the concrete in place, or that the structure is fully capable of carrying the loads for which it was designed. This data may be obtained by a series of non-destructive tests and core tests in accordance with ASTM C42 of the concrete in place, and/or by load testing in accordance with applicable codes. All costs in connection with this additional testing and/or removal and replacement of defective concrete shall be paid by the Contractor.

1.04 SUBMITTALS

A. Materials List: Within 35 days after award of Contract, and before any concrete is delivered to the job site, submit to the Architect in accordance with Division 1 of these Specifications a complete list of all materials proposed to be furnished and installed under this portion of the Work, showing manufacturer's name and catalog number of all items such as admixture and membrane, and the name and address of transit-mix concrete supplier.

B. Transit-Mix Delivery Slips:

1. Keep a record at the job site showing time and place of each pour of concrete together with transit-mix delivery slip certifying contents of the pour.

2. Make the record available to the Architect/Engineer for his inspection upon request.

3. Upon completion of this portion of the Work, deliver the record and the delivery slips to the Architect.

1.05 PRODUCT HANDLING

A. Protection: Use all means necessary to protect Cast-In-Place Concrete materials before, during, and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect/Engineer and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS
When requested by Engineer, supplier of concrete materials shall furnish certified evidence that all materials delivered to the project meet the requirements of specifications.

2.02 PORTLAND CEMENT
Comply with ASTM C150, Type 1.

2.03 FLY ASH
Fly ash may be used as a pozzolan to replace a portion of the Portland Cement in a concrete mix, subject to the approval of the Structural Engineer. Fly ash, when used, shall conform to ASTM C618 Type C. Concrete mixes using fly ash shall be proportioned to account for the properties of the specific fly ash used and to account for the specific properties of the fly ash concrete thus resulting. The ratio of the amount of the fly ash to the total amount of fly ash and cement in the mix shall not exceed 20 percent.

2.04 CONCRETE AGGREGATES
Comply with ASTM C33. Maximum aggregate size is 3/4" for columns and floor slabs; 1-1/2" elsewhere.

2.05 WATER
Clean and free from injurious amount of organic substances.

2.06 REINFORCING
See Concrete Reinforcing Section.

2.07 CURING MATERIAL

A. For all slabs except those on which additional concrete or other toppings are to be bonded, use a water-based acrylic membrane curing compound that has a maximum volatile organic compound (VOC) rating of 350 g/L (3 lbs/gal.) complying with ASTM C309, Type 1, Class B. Available products include VOCOMP-20 (W.R. Meadows, Inc.), MasterKure 100W (Master Builders, Inc.), Dress and Seal WB (L & M Construction Chemicals, Inc.), or approved equal.

B. For slabs having bonded toppings, use "Sisalkraft" paper as manufactured by the American Sisalkraft Company.

2.08 MIXING CONCRETE
Concrete shall be mixed and delivered in accordance with "Standard Specifications for Ready-Mixed Concrete", ASTM C94.

2.09 ANCHOR SLOTS
Dovetails: Galvanized.

2.10 WATERSTOPS

A. Wherever indicated on the drawings and where any construction joint occurs below grade or is subject to moisture penetration, the Contractor shall furnish and install ‘Synkoflex’ waterstop.

B. Care shall be taken to insure correct positioning of the waterstops during installation. The center line of the waterstop shall coincide with the joint interface. Thoroughly work concrete all around waterstop to insure maximum density and complete tight embedment.

2.11 CONCRETE

A. Proportions: Proportions shall be as established by the Testing Laboratory for the various strengths noted on the structural plans. Use the following cement content minimums.

28 Day Strength Specified	Sacks of Cement/ cu.yd. of Concrete
3000 psi, reg. wt., with admixture	5-1/2
4000 psi, reg. wt., with admixture	5-1/2

B. Grout: For setting miscellaneous base plates and other metal items: Equal parts sand and cement. See General Notes, Special Grouts.

C. Concrete Slump: Concrete shall be mixed and delivered in accordance with "Standard Specifications for Ready-Mixed Concrete", ASTM C94. Maximum Slump: 5-1/2”.

PART 3 - EXECUTION

3.01 PLACING CONCRETE

A. Unless otherwise noted, concrete shall be mixed and placed in accordance with ACI 318 "Standard Building Code Requirements for reinforced Concrete", latest edition.

B. Before batching concrete for placement in a given section, the following items shall be completed.

1. All reinforcing, base plates, dowels, etc., shall be completely and securely tied in place for the entire section to be concreted. Anchor bolts and embedded items requiring accurate location shall be positioned and leveled by the use of templates and instruments, and securely held in place so that no movement occurs during the placement of concrete.

2. All forming, bulkheads, construction joints, keyways, sleeves inserts, plates etc., and embedded work of other trades shall be complete for the entire section to be concreted.

3. All materials and equipment for curing and protecting concrete shall be at the job site.

4. Runways shall be provided for wheeled equipment to protect reinforcing steel. Runways and equipment used in mixing, conveying, lifting and depositing the concrete shall be in good condition, adequate to support all construction loads and suitable and safe for the workmen.

5. Water and debris shall be removed from space to be occupied by concrete.

6. See Concrete Forming section for wetting of forms immediately before placing concrete.

3.02 NOTIFICATION OF POURING SCHEDULE

A. Before batching concrete for placement, the Contractor shall see that all applicable provisions of the plans and specification have been complied with for the entire section to be concreted, and he shall notify the Architect/Engineer of this fact. This notification shall be given at least 24 hours prior to the time that the concrete placement is scheduled to begin and no concrete shall be placed until authorized by the Architect/Engineer. The Contractor shall inform himself of possibly unfavorable weather conditions prior to the placement of concrete and shall give due consideration to the weather in scheduling the placement of concrete.

B. Concrete shall not be deposited during rain unless adequately protected and in any case, preparations shall be on hand to protect newly placed concrete from rain until it has hardened sufficiently so that it will not be damaged. In the event rain starts falling during the placement of concrete, the Contractor shall take such measures as are required to assure that the strength of the structure will not be impaired and the surface finishes will be as specified.

3.03 COLD WEATHER PLACING

A. Concrete when deposited shall have a temperature not below 50 degrees F and not above 90 degrees F.

B. When the temperature of the surrounding air is below 40 degrees F suitable means shall be provided for maintaining the concrete at a temperature not below 50 degrees F for 5 days after placing; except when high early strength cement is used, the time may be reduced to 3 days.

C. Preparations for special protection shall be carefully planned and all materials, equipment, etc., shall be at the job site prior to placing of any concrete. In general, these measures may include temporary heaters, coverings, and enclosures. The enclosures, coverings, etc., used in connection with this special protection shall remain in place and intact at least 24 hours after the artificial heating is discontinued so that the temperature change in the concrete will occur gradually.

D. In scheduling forming and shoring removal, Contractor shall take into account the fact that at temperatures below 50 degrees F, concrete gains strength very slowly.

E. Salt or chemicals shall not be mixed with the concrete to prevent freezing.

3.04 HOT WEATHER PLACING

A. Concrete when deposited shall have a temperature not higher than 90 degrees F.

B. Steps shall be taken to reduce concrete temperature and water evaporation by proper attention to ingredients, production methods, handling, placing, protection and curing.

C. Discharge of the concrete shall be completed with one hour after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregates.

3.05 PLACING CONCRETE

Convey continuously until the entire section to be concreted is completed. Partially hardened or initially set concrete shall not be used. Compaction by mechanical vibrating equipment shall be required for all concrete. Place in layers not over 12" deep and compact each layer, supplemented by hand-spading, rodding and tamping.

3.06 CONVEYING

Concrete shall be conveyed from the mixer to the forms as rapidly as practicable by proper methods which will not cause segregation or loss of ingredients. It shall be deposited as nearly as practicable in its final position in the forms. At any point in the conveying, the free vertical drop of the concrete shall not exceed 3 feet. Chuting will be permitted only where the concrete is deposited into a hopper before it is placed in the forms. Chutes shall be constructed of metal or shall be metal lined. Conveying equipment shall be cleaned thoroughly before each run. All concrete shall be deposited as soon as practicable after the forms and the reinforcement have been observed by the Engineer. Concrete which has segregated in conveying shall be removed.

3.07 SURFACE DEFECTS

Patch honeycomb, tie rod holes, and minor defects with one part cement and two parts sand immediately after removing forms and before concrete is thoroughly dry. Remove fins and rough edges. Concrete exposed to view: Refer to Finishes, this section.

3.08 BONDING NEW CONCRETE TO OLD

Clean, roughen, and wet old surface; then coat with neat cement grout. Place new concrete before grout sets.

3.09 CONSTRUCTION JOINTS

A. Locate so as not to impair the strength of the structure, and coordinate the location and details with the Architect/Engineer.

B. Provisions shall be made for transfer of shear and other forces through the joint. Generally this shall consists of forming horizontal keyways at mid-depth, 1-1/2" deep x 1/3 of beam or slab depth and allowing all reinforcing to continue through the joint. Add extra reinforcing if so directed by Engineer.

C. Follow procedure for "Bonding New Concrete to Old", as described herein.

3.10 FINISHES

Carefully work out all finishes to agree with other materials and finishes. Verify all elevations, levels and conditions. Carefully tool all exposed edges.

3.11 FLOORS

Edge forms and intermediate screed strips shall be set accurately to produce the designated elevations and contours of the finished surface, and shall be capable of supporting all screeding operations. Refer to Architectural Drawings for all floor and roof finishes, floor coverings, and dimensions and locations of slab drops, slopes, and depressions. Unless otherwise noted, concrete slab finishes and tolerances including consolidation, floating, troweling, brooming, etc., shall be as described in ACI 301, Chapter 11, for the type of surface indicated on Architectural Drawings.

3.12 FLOOR FLATNESS AND LEVELNESS

A. Flatness and levelness tolerances for floors shall conform to the requirements set forth in ACI 117, "Standard Tolerances for Concrete Construction and Materials", particularly Sections 4.5.6 and 4.5.7. Either of the following specifications is acceptable.

1. Face Floor Profile Numbers (F-Numbers):
   Conventional, Bull-Floated; Flatness F_f = 15 Level F_l = 13
   Conventional Straightedged; Flatness F_f = 20 Level F_l = 15
   Flat, Flatness F_f = 30 Level F_l = 20
   Very Flat; Flatness F_f = 50 Level F_l = 30

2. 10-ft. Straightedge Method:
   Conventional, Bull-Floated; 1/2".
   Conventional, Straightedged; 5/16".
   Flat; 3/16".
   Very Flat; 1/8".

B. Unless noted otherwise, slab surfaces shall conform to the following criteria.

1. Offices, Classrooms, Corridors, etc: Flat.

2. Store Rooms, Equipment Rooms: Straightedged.

3. Sidewalks, Plazas, Pavement: Bull-Floated.

3.13 FINISHES OTHER THAN FLOORS AND SLABS

Concrete exposed to view, both interior and exterior, shall be rubbed with Carborundum bricks and water no sooner than 48 hours and not later than one week after pouring. Plastering such surfaces will not be permitted. Remove all form marks, bulges, and irregularities. Finished surfaces shall be true and uniform in texture.

3.14 CURING AND PROTECTION

A. All concrete shall be protected from premature drying for at least the first 7 days after placement. Curing compound shall be applied in strict accordance with manufacturer's directions just as soon as concrete has taken it's initial set and can receive compound without damaging the finish. All curing materials and equipment shall be on the jobsite before concrete is ordered.

B. At floor areas which are designated to have a permanently exposed concrete surface, use a two-coat application of curing and sealing compound. Apply one coat at the time of finishing and one coat immediately prior to Substantial Completion of project.

C. At floor areas scheduled to receive ordinary floor finishes (except bonded concrete or cementitious materials) apply one coat of specified curing compound in accordance with manufacturer's directions.

D. At floor areas scheduled to receive bonded concrete topping, ceramic tile, terrazzo or other cementitious floor finishes, DO NOT USE CURING COMPOUND. Such areas shall be cured with lapped and taped "Sisalkraft" paper or absorptive mats or fabric kept continuously wet during the entire curing process.

E. Vertical surfaces such as walls, columns, etc., may be cured by loosening the form and allowing water to run down between the concrete and the form, or by keeping the forms continuously wet.

3.15 CONCRETE-FILLED MASONRY LINTELS

Furnish reinforcing and concrete.

3.16 CEMENT WASH

Where required at locations such as vents, grilles, ledgers; provide neatly finished cement wash of one part cement to 2-1/2 parts clean sand.

3.17 TREADS AND RISERS

Equal for any one flight; lines straight and level, angles neatly rounded, or as otherwise detailed.

3.18 WALKS AND OTHER CEMENT WORK

See Site Work Section.

3.19 PRECAST CONCRETE EARTH RETAINERS

A. Install earth retainers against beam faces on a 1:12 batter, lapping side of beam a minimum of 3", to provide a 12" minimum clear air space under beam soffit. Bottom edges of retainers shall be in firm

undisturbed earth or heavily compacted backfill. Wipe all vertical joints and laps at beam or wall with cement grout.

B. All retainers shall be plant or job cast in carefully constructed casting bed, true and square, with plywood bottom, properly oiled.

C. Use 3000 psi concrete with 3/4" aggregate, screed off, wood-float surface, cure with wet burlap or equivalent. Earth retainers not manufactured and installed in accordance with these provisions shall be removed and replaced at Contractor's expense.

3.20 FLOOR HATCH
Install as located on plans. See Miscellaneous Metals Section.

3.21 CLEANING
Clean all concrete work of mortar, plaster, paint, grease, oils, etc. Defective areas shall be replaced or repaired.

END OF SECTION 03 3000

SECTION 03 3511
CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Removal of existing finishes & preparation of existing concrete floor.
- B. Sealed Concrete Floor: Surface treatments for concrete floors and slabs.

1.2 ADMINISTRATIVE REQUIREMENTS
- A. Coordinate work with selective demolition, floor patch & repair and construction sequence,

1.3 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.
- C. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

1.4 MOCK-UP
- A. For coatings, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.
- B. Mock-Up Size: 10 feet (3 m) square.
- C. Locate where directed.
- D. Mock-up may remain as part of the work.

1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver materials in manufacturer's sealed packaging, including application instructions.

1.6 FIELD CONDITIONS
- A. Maintain light level equivalent to a minimum 200 W light source at 8 feet (2.5 m) above the floor surface over each 20 foot (6 m) square area of floor being finished.
- B. Do not finish floors until interior heating system is operational.
- C. Maintain ambient temperature of 50 degrees F (10 degrees C) minimum.

PART 2 PRODUCTS

2.1 DENSIFIERS AND HARDENERS
- A. Liquid Densifier/Hardener: Penetrating chemical compound that reacts with concrete, filling the pores and dustproofing; for application to concrete after set.
  1. Composition: Sodium silicate.
  2. Products:
     - a. ARDEX Engineered Cements; ARDEX PC-50: www.ardexamericas.com.
     - b. Dayton Superior Corporation; Sure Hard™ Densifier J17: www.daytonsuperior.com.
     - c. L.M. Scofield Company; SCOFIELD® Formula One™ Lithium Densifier MP: www.scofield.com.
     - d. Nox-Crete Products Group; Duro-Nox LSC: www.nox-crete.com.
     - e. W.R. Meadows, Inc; Liqui-Hard Ultra: www.wrmeadows.com.
     - f. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.1 CONCRETE FLOOR PREPARATION
- A. Remove existing floor finishes.
- B. Remove all glues, adhesives and other foriegn matter from concrete.
- C. Patch and repair concrete with products compatible with the concrete and the densifier/hardener.
- D. Grind concrete with metal bond diamond abrasives of 40 grit, 80 grit and 150 grit.

3.2 EXAMINATION

A. Verify that floor surfaces are acceptable to receive the work of this section.
B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.3 GENERAL

A. Apply materials in accordance with manufacturer's instructions.

3.4 COATING APPLICATION

A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.
B. Verify that water vapor emission from concrete and relative humidity in concrete are within limits established by coating manufacturer.
C. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.
D. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

END OF SECTION

SECTION 03 3543
DIAMOND POLISHING CONCRETE FLOORS

PART 1 - GENERAL

1.1 SECTION INCLUDES
- A. Products and procedures for diamond polishing concrete floors using multi-step wet/dry mechanical process, and accessories indicated, specified, or required to complete polishing.
  1. Refer to the Room Finsh Schedule and Room Finish Legend, both in the drawings, for locations of stained and non-stained concrete.

1.2 RELATED REQUIREMENTS
- A. Section 03 3000 - Cast-In-Place Concrete.
- B. Section 03 3511 - Concrete Floor Finishes
- C. Section 03 3544 - Diamond-Plate Light Reflective Concrete Floors; metallic floor hardener in a high strength cementitious binder.
- D. Section 03 3900 - Concrete Curing.

1.3 DEFINITIONS
- A. CPAA - Concrete Polishing Association of America - 224A Log Canoe Circle, Stevensville, MD 21666; T: (443) 249-7919; F: (443) 458-0688; Email - info@concretepolishingassociation.com .
- B. Terminology: As defined by CPAA.

1.4 REFERENCE DTANDARDS
- A. ASTM E430 - Standard Test Methods for Measurement of Gloss of High-Gloss Surfaces by Abridged Goniophotometry; 2011
- B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.
- C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2011.
- D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2011.
- E. NFSI 101-A National Floor Safety Institute (NFSI) Standard for Evaluating High-Traction Flooring Materials, Coatings, and Finishes.

1.5 ADMINISTRATIVE REQUIREMENTS
- A. Pre-Installation of Concrete Conference: Prior to placing concrete for areas scheduled for polishing, conduct conference at Project to comply with requirements of applicable Division 01 Sections. Comply with Section 01 3000 Administrative Requirements.
  1. Required Attendees:
     a. Owner.
     b. Architect.
     c. Contractor, including supervisor.
     d. Concrete producer.
     e. Concrete finisher, including supervisor.
     f. Concrete polisher, including supervisor.
     g. Technical representative of liquid applied product manufacturers.
     h. Walkway auditor.
  2. Minimum Agenda: Polisher shall demonstrate understanding of work required by reviewing and discussing procedures for, but not limited to, following:
     a. Tour mock-up and representative areas of required work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, surface preparations, sequence of procedures, and other preparatory work performed by other installers.
     b. Review Contract Document requirements.
     c. Review approved submittals.
     d. Review procedures, including, but not limited to:
        1) Details of each step of grinding, honing, and polishing operations.

2) Application of liquid applied products.
3) Protecting concrete floor surfaces until polishing work begins.
4) Protecting polished concrete floors after polishing work is completed.

3. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

1.6 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required. Include manufacturer's technical data, application instructions, and recommendations.
B. Installer Qualifications: Data for company, principal personnel, experience, and training specified in PART 1 "Quality Assurance" Article.
C. Field Quality Control - Static Coefficient of Friction Test Reports: Reports of testing specified in PART 3 "Field Quality Control" Article.
D. Maintenance Data: For inclusion in maintenance manual required by Division 01.
   1. Include manufacturer's instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
   2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.7 QUALITY ASSURANCE

A. Polisher Qualifications:
   1. Experience: Company experienced in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce specified work.
   2. Supervision: Maintain competent supervisor who is at Project during times specified work is in progress.
      a. Provide list of at least three projects (with owner contact information) within the last two years that were supervised by the supervisor of this project.
   3. Manufacturer Qualification: Approved by manufacturer to apply liquid applied products.
B. Walkway Auditor: Certified by NFSI to test polished floors for static coefficient of friction according to NFSI 101-A.
C. Static Coefficient of Friction: Achieve not less than 0.5 for level floor surfaces as determined by quality control testing according to NFSI 101-A.

1.8 MOCK-UPS

A. Construct mock-ups in accordance with Section 01 4000 - Quality Requirements.
B. Mock-Up Size: 64 ft² (5.95 m²) sample panel at jobsite at location as directed under conditions similar to those which will exist during actual placement.
C. Mock-up will be used to judge workmanship, concrete substrate preparation, operation of equipment, material application, color selection and shine.
D. Allow 24 hours for inspection of mock-up before proceeding with work.
E. When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work. .
F. Field Mock-up for Aesthetic Purposes: Before performing work of this Section, provide as many field mock-ups required to verify selections made under submittals and to demonstrate aesthetic effects of polishing. Approval does not constitute approval of deviations from Contract Documents, unless such deviations are specifically approved by Architect in writing.
   1. Grind, hone, and polish 64 sq. ft. floor area for each finish approved under sample submittals; include edges and joints.
   2. Use same personnel, including supervisors, which will perform work.
   3. Install products and materials according to specified requirements.
   4. Work shall be representative of those to be expected for work.
   5. Finish various components to show maximum variation that will exist in work.
   6. Approval is for following aesthetic qualities:
      a. Compliance with approved submittals.

b. Uniformity of exposed aggregate.
c. Uniformity of sheen.

7. Obtain Architect's approval before starting work on Project.
8. Protect approved field mock-ups from elements with weather resistant covering.
9. Maintain field mock-ups during construction in an undisturbed condition as a standard for judging completed work.
10. Do not demolish, alter, or remove field mock-ups until acceptable to Owner and Architect.

1.9 FIELD CONDITIONS

A. Damage and Stain Prevention: Take precautions to prevent damage and staining of concrete surfaces to be polished.
   1. Prohibit vehicle parking over concrete surfaces to be polished.
   2. Prohibit pipe cutting operations over concrete surfaces to be polished.
   3. Prohibit storage of any items over concrete surfaces to be polished for not less than 28 days after concrete placement.
   4. Prohibit ferrous metals storage over concrete surfaces to be polished.
   5. Protect from petroleum, oil, hydraulic fluid, or other liquid dripping from equipment working over concrete surfaces to be polished.
   6. Protect from acids and acidic detergents contacting concrete surfaces to be polished.
   7. Protect from painting activities over concrete surfaces to be polished.
B. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting liquid applied product application.

PART 2 - PRODUCTS

2.1 LIQUID APPLIED PRODUCTS

A. Liquid Densifier: Odorless, non-hazardous, silicate that penetrates concrete to react with free lime and calcium hydroxide to produce permanent chemical reaction that hardens and densifies concrete surface.
B. Color Finish, at designated areas:
   1. Dyes: Extremely fine molecules of color solvent or dye for mixing with water or acetone that is designed to penetrate and color concrete surface.
C. Polish Guard: Non-film forming, stain resistant, food resistant, chemical stain resistant, impregnating sealant designed to be used on concrete surfaces previously densified.

2.2 ACCESSORIES

A. Patching Compound: Compound composed of 40 percent portland cement, 45 percent limestone, and 15 percent vinyl acetate copolymer, when mixed with dust salvaged from grinding process forms a paste that hardens when surface imperfections are filled.
B. Grout Material: Clear modified silicate sealant, containing no pore clogging latex, when mixed with dust salvaged from grinding process forms a paste that reacts with calcium hydroxide in concrete that hardens when surface imperfections are filled.
C. Protective Cover: Non-woven, puncture and tear resistant, polypropylene fibers laminated with a multi-ply, textured membrane, not less than 18 mils in thickness.

2.3 POLISHING EQUIPMENT

A. Field Grinding and Polishing Equipment:
   1. Variable speed, multiple head, counter-rotating, walk-behind machine with not less than 600 pounds of down pressure on grinding or diamond polishing pads.
   2. If dry grinding, honing, or polishing, use dust extraction equipment with flow rate suitable for dust generated, with squeegee attachments.
B. Edge Grinding and Polishing Equipment: Hand-held or walk-behind machines which produces same results, without noticeable differences, as field grinding and polishing equipment.
C. Burnishing Equipment: High speed walk-behind or ride-on machines capable of generating 1000 to 2000 revolutions per minute and with sufficient head pressure of not less than 20 pounds to raise floor temperature by 20 degrees F.

D. Metal Bonded Pads: Grinding pads with embedded industrial grade diamonds of varying grits fabricated for mounting on equipment.
E. Resin Bonded Pads: Polishing pads with embedded industrial grade diamonds of varying grits fabricated for mounting on equipment.
F. Burnishing Pads: Maintenance pads for use with high speed burnishing equipment.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Acceptance of Surfaces and Conditions:
1. Examine substrates to be polished for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION
A. Cleaning New Concrete Surfaces:
1. Prepare and clean concrete surfaces.
2. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, paint splatter, and other contaminants incompatible with liquid applied products and polishing.

3.3 VAPOR TESTING CONCRETE FLOORS
A. Alkalinity:
1. Test Method: Measure pH according to method indicated in ASTM F 710.
2. Acceptable Results: pH between 8 and 10.
B. Moisture Vapor Transmission Rate:
1. Test Method: Perform anhydrous calcium chloride test according to ASTM F 1869.
2. Acceptable Results: Not more than 5 pounds per 1000 square feet in 24 hours.
C. Relative Humidity:
1. Test Method: Perform relative humidity test using in situ probes according to ASTM F 2170.
2. Acceptable Results: Not more than 75 percent.

3.4 COLORING CONCRETE FLOORS
A. Dye or Pigmented Microstain Application:
1. Apply solution by methods and techniques required by manufacturer to produce finish matching approved mock-ups.
2. Maintain wet edge, working newly applied solution into edges of adjacent wet edges of previously treated surfaces.
3. Maintain consistent saturation throughout application.
4. Avoid splashing, dripping, or puddling of solution on adjacent substrates.
5. When color matches approved mock-ups, neutralize as required by manufacturer.

3.5 POLISHING CONCRETE FLOORS
A. Sequence of Polishing: Perform polishing before interior partitions are erected around area(s) to receive Diamond Polished Finish.
B. Initial Grinding:
1. Use grinding equipment with metal bonded grinding pads.
2. Begin grinding in one direction using sufficient size grit pad.
3. Make sequential passes with each pass perpendicular to previous pass using finer grit pad with each pass, up to 150 grit.
4. Achieve maximum refinement with each pass before proceeding to finer grit pads.
5. Vacuum floor using squeegee vacuum attachment after each pass.
6. Continue grinding until aggregate exposure matches approved field mock-ups.
C. Treating Surface Imperfections:

1. Mix patching compound and grout material with dust created by grinding operations to match color of adjacent concrete surface.
2. Fill surface imperfections including, but not limited to, holes, surface damage, small and micro cracks, air holes, pop-outs, and voids.
3. Work compound and treatment until color differences between concrete surface and filled surface imperfections are not reasonably noticeable when viewed from 10 feet away under lighting conditions that will be present after construction.

D. Liquid Densifier Application: Apply undiluted to point of rejection, remove excess liquid, and allow to cure according to manufacturers instructions.

E. Grout Grinding:
1. Use grinding equipment and appropriate grit grinding pads.
2. While applying fresh grout material prior to, grind concrete in direction perpendicular to initial grinding to remove scratches.
3. Vacuum floor using squeegee vacuum attachment after each pass.

F. Honing:
1. Use grinding equipment with resin bonded grinding pads.
2. Grind concrete in one direction starting with 50 grit pad and make as many sequential passes required to remove scratches, each pass perpendicular to previous pass, up to 400 grit pad reaching maximum refinement with each pass before proceeding to finer grit pads.
3. Auto scrub or vacuum floor using squeegee vacuum attachment after each pass.

G. Polishing:
1. Use polishing equipment with resin bonded polishing and burnishing pads.
2. Begin polishing in one direction starting with 800 grit pad.
3. Make sequential passes with each pass perpendicular to previous pass using finer grit pad with each pass, up to 3000 grit.
4. Achieve maximum refinement with each pass before proceeding to finer grit pads.
5. Auto scrub or vacuum floor using squeegee vacuum attachment after each pass.
6. Continue polishing until gloss appearance, as measured according to ASTM E 430, matches approved field mock-ups.

H. Polish Guard: Uniformly apply and remove excessive liquid according to manufacturer’s instructions.

I. Final Polish: Using burnishing equipment and finest grit burnishing pads, burnish to uniform sheen matching approved mock-up.

J. Final Polished Concrete Floor Finish:
1. Class C - Medium Aggregate: Remove not more than 1/8 inch of concrete surface by grinding and polishing resulting in medium aggregate exposure with little or no large aggregate exposure at random locations.
2. Level 4 - Highly Polished:
   a. Procedure: Not less than 6 steps with full refinement of each diamond pad up to 3000 grit resin bonded pad with one application of densifier.
   b. Gloss Reading: Not less than 80 according to ASTM E 430 before polish guard application.

3.6 FIELD QUALITY CONTROL

A. Field Testing: Engage a qualified walkway auditor to perform field testing according to NFSI 101-A to determine if polished concrete floor finish complies with specified static coefficient of friction.

3.7 CLOSEOUT ACTIVITIES

A. Maintenance Training: Master Craftsman shall train Owner's designated personnel in proper procedures for maintaining polished concrete floor.

3.8 PROTECTION

A. Covering: After completion of polishing, protect polished floors from subsequent construction activities with protective covering.

END OF SECTION

SECTION 03 3900
CONCRETE CURING

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Initial and final curing of horizontal concrete surfaces.

1.2 RELATED REQUIREMENTS
- A. Section 03 3000 - Cast-in-Place Concrete.
- B. Section 03 3544 - Diamond-Plate Light Reflective Concrete Floors.

1.3 REFERENCE STANDARDS
- A. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2010.
- B. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International; 2004 (Errata 2007) .
- C. ACI 308R - Guide to Curing Concrete; American Concrete Institute International; 2001 (Reapproved 2008).
- D. AASHTO M 148 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete, 2005.
- E. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2007.

1.4 ADMINISTRATIVE REQUIREMENTS
- A. Pre-Installation of Concrete Conference: Refer to the requirements of Section 03 3544 - Diamond-Plate Light Reflective Concrete Floors.

1.5 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on curing compounds, including compatibility of different products and limitations.

1.6 QUALITY ASSURANCE
- A. Perform Work in accordance with ACI 301 and ACI 302.1R.
- B. Maintain one copy of each document on project site.

1.7 DELIVERY, STORAGE, AND HANDLING
- A. Deliver curing materials in manufacturer's sealed packaging, including application instructions.

PART 2 PRODUCTS

2.1 MATERIALS
- A. Liquid Membrane forming curing compound formulated from hydrocarbon resins and dissipating agents: ASTM C309, Types 1 and 1D, Class A & B; AASHTO M 148, Types 1 and 1D, Class A & B.
  1. Made with a fugitive dye formulation.
  2. Provide "KUREZ DR VOX" manufactured by The Euclid Chemical Company; T: (216) 531-9222; Toll-free: (800) 321-7628; F: (216) 531-9596; www.euclidchemical.com.
  3. Must be compatible with diamond-plate light reflective concrete floors system and liquid densifier and sealer.
- B. Heavy duty floor cleaner: EUCO CLEAN AND STRIP. Follow manufacturers recommendations

2.2 MANUFACTURER
- A. Manufacturer shall have ISO 9001 Quality Certification. To ensure compatibility all products shall be from the same manufacturer. Refer also to Section 03 3544 - Diamond-Plate Light Reflective Concrete Floors.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to be cured.

3.2 EXECUTION - HORIZONTAL SURFACES

A. Cure floor surfaces in accordance with ACI 308R.

B. Apply curing compound in accordance with manufacturer's instructions in one coat..

3.3 PROTECTION

A. Do not permit traffic over unprotected floor surface.

SECTION 03 3544
DIAMOND-PLATE LIGHT REFLECTIVE CONCRETE FLOORS

PART 1 - GENERAL

1.1 SECTION INCLUDES
- A. Products and procedures for non-oxidizing, light reflective, metallic floor hardener in a high strength cementitious binder.
  1. Designed to be incorporated into fresh concreteslabs, to provide a dense, tough surface capable of withstanding the abrasion and impact loading seen by floors of industrial and manufacturing facilities heavy duty vehicles and equipment.
  2. Product shall give increased reflectivity to improve lighting levels in combination with a non-rusting aggregate for increased abrasion resistance,
- B. Liquid Densifier and Sealer for Concrete.

1.2 RELATED REQUIREMENTS
- A. Section 03 3000 - Cast-In-Place Concrete.
- B. Section 03 3900 - Concrete Curing.

1.3 REFERENCE DTANDARDS
- A. ASTM C779 - Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces; 2012.
- B. NFSI 101-A National Floor Safety Institute (NFSI) Standard for Evaluating High-Traction Flooring Materials, Coatings, and Finishes.

1.4 ADMINISTRATIVE REQUIREMENTS
- A. Pre-Installation of Concrete Conference: Prior to placing concrete for areas scheduled for diamond-plate light reflective concrete floors, conduct conference at Project to comply with requirements of applicable Division 01 Sections. Comply with Section 01 3000 Administrative Requirements.
  1. Required Attendees:
     a. Owner.
     b. Architect.
     c. Contractor, including supervisor.
     d. Concrete producer.
     e. Concrete finisher, including supervisor.
     f. Concrete applicator of work of this section if different than above, including supervisor.
     g. Technical representative of applied product manufacturers. Includes curing compound manufacturer.
     h. Walkway auditor.
  2. Minimum Agenda: Each trade shall demonstrate understanding of work required by reviewing and discussing procedures for, but not limited to, following:
     a. Tour mock-up and representative areas of required work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, surface preparations, sequence of procedures, and other preparatory work performed by other installers.
     b. Review Contract Document requirements.
     c. Review approved submittals.
     d. Review procedures, including, but not limited to:
        1) Details of each step of operations.
        2) Application of applied products.
        3) Protecting concrete floor surfaces until each step of work begins.
        4) Protecting concrete floors after each step of work is completed.
  3. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Manufacturer's technical literature for each product indicated, specified, or required. Include manufacturer's technical data, application instructions, and recommendations.
C. Installer Qualifications: Data for company, principal personnel, experience, and training specified in PART 1 "Quality Assurance" Article.
D. Field Quality Control - Static Coefficient of Friction Test Reports: Reports of testing specified in PART 3 "Field Quality Control" Article.
E. Maintenance Data: For inclusion in maintenance manual required by Division 01.
    1. Include manufacturer's instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
    2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.6 QUALITY ASSURANCE

A. Polisher Qualifications:
    1. Experience: Company experienced in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce specified work.
    2. Supervision: Maintain competent supervisor who is at Project during times specified work is in progress.
        a. Provide list of at least three projects (with owner contact information) within the last two years that were supervised by the supervisor of this project.
    3. Manufacturer Qualification: Approved by manufacturer to apply liquid applied products.
B. Walkway Auditor: Certified by NFSI to test floors for static coefficient of friction according to NFSI 101-A.
C. Static Coefficient of Friction: Achieve not less than 0.5 for level floor surfaces as determined by quality control testing according to NFSI 101-A.

1.7 MOCK-UPS

A. Construct mock-ups in accordance with Section 01 4000 - Quality Requirements.
B. Mock-Up Size: 64 ft² (5.95 m²) sample panel at jobsite at location as directed under conditions similar to those which will exist during actual placement.
C. Mock-up will be used to judge workmanship, concrete substrate preparation, operation of equipment, material application, color selection and shine.
D. Allow 24 hours for inspection of mock-up before proceeding with work.
E. When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work. .
F. Field Mock-up for Aesthetic Purposes: Before performing work of this Section, provide as many field mock-ups required to verify selections made under submittals and to demonstrate aesthetic effects of polishing. Approval does not constitute approval of deviations from Contract Documents, unless such deviations are specifically approved by Architect in writing.
    1. Grind, hone, and polish 64 sq. ft. floor area for each finish approved under sample submittals; include edges and joints.
    2. Use same personnel, including supervisors, which will perform work.
    3. Install products and materials according to specified requirements.
    4. Work shall be representative of those to be expected for work.
    5. Finish various components to show maximum variation that will exist in work.
    6. Approval is for following aesthetic qualities:
        a. Compliance with approved submittals.
        b. Uniformity of exposed aggregate.
        c. Uniformity of sheen.
    7. Obtain Architect's approval before starting work on Project.
    8. Protect approved field mock-ups from elements with weather resistant covering.

9. Maintain field mock-ups during construction in an undisturbed condition as a standard for judging completed work.
10. Do not demolish, alter, or remove field mock-ups until acceptable to Owner and Architect.

1.8 FIELD CONDITIONS

A. Damage and Stain Prevention: Take precautions to prevent damage and staining of concrete surfaces.
   1. Prohibit vehicle parking over concrete surfaces to be treated.
   2. Prohibit pipe cutting operations over concrete surfaces to be treated.
   3. Prohibit storage of any items over concrete surfaces to be treated for not less than 28 days after concrete placement.
   4. Prohibit ferrous metals storage over concrete surfaces to be treated.
   5. Protect from petroleum, oil, hydraulic fluid, or other liquid dripping from equipment working over concrete surfaces to be treated.
   6. Protect from acids and acidic detergents contacting concrete surfaces to be treated.
   7. Protect from painting activities over concrete surfaces to be treated.

B. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting applied product application.

PART 2 - PRODUCTS

2.1 NON-OXIDIZING, LIGHT REFLECTIVE, METALLIC DRY SHAKE FLOOR HARDENER

A. Graded, non-oxidizing metallic aggregate in a high strength cementitious binder providing 6 times the abrasion resistance of plain concrete per ASTM C779.
   1. Product:
      a. Euclid Chemical Company (The); Diamond-Plate Light Reflective, www.euclidchemical.com

2.2 LIQUID DENSIFIER AND SEALER FOR CONCRETE

A. Properly cure concrete per Section 03 3900 - Concrete Curing prior to applying liquid densifier and sealer for concrete.

B. Blend of silicate and siliconate polymers that penetrate concrete surfaces and chemically react to provide an increase in surface density, durability, and abrasion resistance. Treated concrete shall be dust-proof and resist tire marks.
   1. Product: EUCO DIAMOND HARD as manufactured by The Euclid Chemical Company; T: (216) 531-9222; Toll-free: (800) 321-7628; F: (216) 531-9596; www.euclidchemical.com.

2.3 ACCESSORIES

A. Patching compounds, grout materials shall be compatible and approved by the manufacturer of the hardener, densifier and sealer approved for use in this section and related sections.

B. Protective Cover: Only as approved for use by the manufacturer of the hardener, densifier and sealer approved for use in this section and related sections.

2.4 MANUFACTURER

A. Manufacturer shall have ISO 9001 Quality Certification. To ensure compatibility all products shall be from the same manufacturer.

PART 3 - EXECUTION

3.1 CONCRETE PLACEMENT

A. Place and consolidate non-air entrained concrete containing air detrainer if required. Maximum air content shall be 3.0%.

B. Hand or mechanically screed concrete.

C. Mix and use evaporation retarder per manufacturer’s written recommendations after concrete placement or after any floating operation as required to prevent surface from drying out prematurely from hot, dry, or windy jobsite conditions whenever evaporation rate exceeds 0.2 pounds/square foot/hour per nomograph in ACI 305.1.

D. Use bullfloat or highway straightedge to flatten surface and remove imperfections taking care to not close the surface of the concrete.

3.2 SINGLE PASS DRY SHAKE APPLICATION

A. Dry shake shall be applied at a rate of 3.0 pounds or as recommended by menufacturer per square foot by calibrated mechanical spreader except small areas not accessible to mechanical spreader may be hand applied.
B. After dry shake has completely wetted out from below, float it into concrete using walk behind or ride-on power-trowel with float shoes.
C. After dry shake has been worked into concrete and slab has been given time to further “tighten up” begin final troweling operations.

3.3 CURE

A. Cure as specified per Section 03 3900 - Concrete Curing. Properly cure concrete prior to applying liquid densifier and sealer for concrete.

3.4 APPLY LIQUID DENSIFIER AND SEALER FOR CONCRETE

A. Examine substrates to be treated for compliance with requirements and other conditions affecting performance.
B. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
C. Starting work within a particular area will be construed as acceptance of surface conditions.
D. Apply liquid densifier and sealer for concrete per manufacturers written requirements.

3.5 FINISH

A. Finish slab according to specifications, paying close attention not to burnish the surface.

3.6 FIELD QUALITY CONTROL

A. Field Testing: Engage a qualified walkway auditor to perform field testing according to NFSI 101-A to determine if treated concrete floor finish complies with specified static coefficient of friction.

3.7 CLOSEOUT ACTIVITIES

A. Maintenance Training: Master Craftsman shall train Owner's designated personnel in proper procedures for maintaining concrete floor.

3.8 PROTECTION

A. Covering: After completion of each treatment, protect concrete floors from subsequent construction activities with protective covering.

END OF SECTION

SECTION 04 2000
UNIT MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Concrete Block.
- B. Clay Facing Brick.
- C. Mortar and Grout.
- D. Reinforcement and Anchorage.
- E. Flashings.
- F. Lintels.
- G. Accessories.

1.2 RELATED REQUIREMENTS
- A. Section 07 2727 - Fluid-Applied Vapor Permeable Membrane Air Barrier System Assembly, for air barrier and transition membrane.
- B. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.3 REFERENCE STANDARDS
- A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; American Concrete Institute International; 2011.
- B. ASTM A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement; 2007.
- C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- D. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a.
- E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.
- F. ASTM C33 - Standard Specification for Concrete Aggregates; 2013.
- G. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2013.
- H. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2014.
- I. ASTM C140/C140M - Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units; 2014.
- J. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.
- K. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.
- L. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).
- M. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale); 2014.
- N. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.
- O. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.
- P. ASTM C476 - Standard Specification for Grout for Masonry; 2010.
- Q. ASTM C744 - Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units; 2011.
- R. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2010.
- S. ASTM C1148 - Standard Test Method for Measuring the Drying Shrinkage of Masonry Mortar; 1992a (Reapproved 2008) .
- T. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2012.
- U. ASTM C1357 - Standard Test Methods for Evaluating Masonry Bond Strength; 2009.
- V. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2014.

1.4 ADMINISTRATIVE REQUIREMENTS

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
C. Samples: Submit four samples of decorative block units to illustrate color, texture, and extremes of color range.
D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
E. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.
F. Test Reports: Concrete masonry manufacturer's test reports for units with integral water repellent admixture.
G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Section 01 6000 - Product Requirements, for additional provisions.
H. LEED Submittals:
    1. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.6 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.
    1. Maintain one copy of each document on project site.

1.7 MOCK-UP

A. Construct a masonry wall as a mock-up panel sized 8 feet (2.4 m) long by 6 feet (1.8 m) high; include mortar, accessories, structural backup, and flashings (with lap joint, corner, and end dam) in mock-up.
B. Locate where directed.
C. Mock-up may remain as part of the Work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.
B. Store and handle masonry units off the ground, under cover, and in a dry location. If units become wet, do not place until units are in an air dried condition.
C. Handle and store pre-faced concrete block units in protective cartons or trays. Do not remove from protective packaging until ready for installation.

1.9 AVAILABLE MANUFACTURERS

A. Substitutions - The product(s) referenced by the list of manufacturers provided, form the Basis Of Design. The contractor at their option may provide an alternate manufacturer as an equal, however, if an equal is proposed, the Contractor shall provide data from the specified manufacturer & product(s) as well as data from the proposed manufacturer for a comparison, review, and determination of acceptance (approval or disapproval) by the Architect. Approval cannot be made if adequate comparison information is not provided. Absence of specified manufacturers' data is grounds for disapproval.
B. Refer to Section 01 3000 - Administrative Requirements AND Section 01 6000 - Product Requirements for substitution procedures.

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. Manufacturers:

1. Headwater Construction Materials, formerly Southwest Concrete Products, San Antonio Plant & Sales office: 2233 Ackerman Rd., San Antonio, TX 78219; T: (210) 666-4989, Toll-Free: (888) 464-2399; F: (210) 666-8141; www.headwaters.com.
2. Featherlite Corporation, 508 McNeil Rd., Round Rock, TX 78681, TL512) 255-2573; F: (512) 255-2572; E-mail tatwood@brick.com; Web Site: www.featherlitetexas.com.
3. Substitutions: See Section 01 6000 - Product Requirements.
    a. See article in PART 1 above entitled "Available Manufacturers".

B. Concrete Block: Comply with referenced standards and as follows:
1. Size: Standard units with nominal face dimensions of 16 x 8 inches (400 x 200 mm) and nominal depth of 8 inches (200 mm).
2. For all exterior exposed units, provide standard manufacturer's units of dense aggregate (ASTM C33). Dense aggregate units are to include an integral water repellant agent in the mix.
3. On interior applications only, all exposed outside corners in traffic patterns, and at locations as detailed, shall have bull nosed edge, EXCEPT at the starter course, the block shall have a square corner to accommodate preformed rubber base corners, AND at ceiling line, the block shall have a square corner to accommodate the ceiling grid or other ceiling.
4. Load-Bearing Units and Non-Loadbearing Units: ASTM C90, normal weight.
    a. Hollow block, as indicated.
    b. Exposed Faces: Manufacturer's standard color and texture where indicated.
5. Pre-Faced Units: ASTM C90, hollow block, with smooth resinous facing complying with ASTM C744.
    a. Colors and styles: As selected by Architect.
6. Units with Integral Water Repellent: Concrete block units as specified in this section with polymeric liquid admixture added to concrete masonry units at the time of manufacture.
    a. Performance of Units with Integral Water Repellent:
        1) Water Permeance: When tested per ASTM E514/E514M and for a minimum of 72 hours.
            (a) No water visible on back of wall above flashing at the end of 24 hours.
            (b) No flow of water from flashing equal to or greater than 0.032 gallons per hour (0.05 L per hour) at the end of 24 hours.
            (c) No more than 25% of wall area above flashing visibly damp at end of test.
        2) Flexural Bond Strength: ASTM C1357; minimum 10% increase.
        3) Compressive Strength: ASTM C1314; maximum 5% decrease.
        4) Drying Shrinkage: ASTM C1148; maximum 5% increase in shrinkage.
    b. Use only in combination with mortar and grout that also has integral water repellent admixture.
    c. Use water repellent admixtures for masonry units, mortar and grout by a single manufacturer.
7. Regional Materials: CMUs shall be manufactured within 500 miles (800 km) of Project site from aggregates[and cement] that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

C. All block installations shall be subject to visual inspections from a distance of 10 feet from the visible masonry surface.
1. This changes the viewing distance mentioned in ASTM C 90 (Standard Specification for Loadbearing Concrete Masonry Units) "Finish and Appearance" section from 20 feet to 10 feet (3.05 m).
2. This shall apply to both loadbearing and non-loadbearing CMU.
3. Visual acceptance/non-acceptance shall be determined by the Architect.

2.2 BRICK UNITS

A. Manufacturers:
1. Acme Brick Co.: wwwacmebricktileandstone.com
2. Blackson Brick, Co.: www.blacksonbrick.com.
3. Boral Bricks, Inc: www.boralamerica.com/bricks.

4. Substitutions: See section 01 6000 - Product Requirements.

B. Facing Brick: ASTM C216, Type FBS, Grade SW.
   1. Color and texture to match Architect's sample.
   2. Nominal size: As indicated on drawings.
   3. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.

C. Regional Materials: Brick shall be manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

2.3 MORTAR AND GROUT **MATERIALS**

A. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
   1. Not more than 0.60 percent alkali.

B. Hydrated Lime: ASTM C207, Type S.

C. Mortar Aggregate: ASTM C144.

D. Grout Aggregate: ASTM C404.

E. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979.

F. Water: Clean and potable.

G. Integral Water Repellent Admixture for Mortar and Grout: Polymeric liquid admixture added to mortar and grout at the time of manufacture.
   1. Use only in combination with masonry units manufactured with integral water repellent admixture.
   2. Use only water repellent admixture for mortar and grout from the same manufacturer as water repellent admixture in masonry units.
   3. Meet or exceed performance specified for water repellent admixture used in masonry units.

H. Mortar at Interior: cement/lime/sand ASTM C270, Type N.

I. Mortar at Exterior: cement/lime/sand ASTM C270, Type N, with waterproofing and coloring as required; joints slightly concave and tooled slick.

J. Pre-mix Mortar is not allowed. No exceptions.

K. Masonry Cement is not allowed. No exceptions.

L. Lime substitutes are not allowed. No exceptions.

M. Regional Materials: Aggregate for mortar and grout[, cement, and lime] shall be extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site

2.4 REINFORCEMENT AND ANCHORAGE

A. Manufacturers of Joint Reinforcement and Anchors:
   1. Blok-Lok Limited: www.blok-lok.com.
   2. Hohmann & Barnard, Inc (including Dur-O-Wal brand): www.h-b.com.
   3. WIRE-BOND: www.wirebond.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Single Wythe Joint Reinforcement: Truss or ladder type; ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3; 0.1483 inch (3.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; width as required to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage on each exposure.

C. Adjustable Multiple Wythe Joint Reinforcement: Truss type with adjustable ties or tabs spaced at 16 in (406 mm) on center and fabricated with moisture drip; ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/153M, Class B; 0.1875 inch (4.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods and adjustable components of 0.1875 inch (4.8 mm) wire; width of components as required to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage from each masonry face.
   1. Vertical adjustment: Not less than 2 inches (50 mm).
   2. Insulation Clips: Provide clips at tabs or ties designed to secure insulation against outer face of inner wythe of masonry.

D. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage from masonry face.
E. Two-Piece Wall Ties: Formed steel wire, 0.1875 inch (4.8 mm) thick, adjustable, eye and pintle type, hot dip galvanized to ASTM A 153/A 153M, Class B, sized to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage from masonry face and to allow vertical adjustment of up to 1-1/4 in (32 mm).
F. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
    1. Anchor plates: Not less than 0.075 inch (1.91 mm) thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
    2. Wire ties: Manufacturer's standard shape, 0.1875 inch (4.75 mm) thick.
    3. Vertical adjustment: Not less than 3-1/2 inches (89 mm).

2.5 FLASHINGS

A. **Stainless Steel** (SS) Flashing Drainage System - Engineered laminate composite of Stainless Steel, polymer fabric and non-woven drainage fabric.
    1. Recycled content
        a. A minimum of 60% total recycled material; based on 60% Post Industrial Recycled Content.
    2. Performance Characteristics
        a. Tensile Strength: Stainless Steel 100,000 psi, average.
        b. Puncture Resistance: Stainless Steel >2,500 psi average
        c. When tested as manufactured, product resists growth of mold pursuant to test method ASTM D3273.
        d. Flame Spread: 50 or less
        e. Smoke Generation: Less than 450.
        f. Fire Rated: Class A per ASTM E84
    3. Manufactured Products
        a. Stainless Steel metal core flexible flashing with drainage fabric:
            1) Basis of Design & product standard of quality: York Manufacturing, Inc.; York Flash-Vent SS,
            2) Accepted products:
                (a) York Manufacturing, Inc.; York Flash-Vent SS, (www.yorkmfg.com)
                (b) STS Coatings, Inc.; Wall Guardian TWF Stainless Steel (www.stscoatings.com)
            3) Characteristics:
                (a) Type: Engineered system, with high resistant to damage, composite with a stainless steel core with non-asphalt adhesive polymer fabric laminated to one stainless steel face and non-woven drainage fabric laminated to opposing face with non-asphalt adhesive.
                (b) Stainless steel: ASTM A167
                (c) Fabrics:
                    (1) Polymer fabric; laminated back face to metal core.
                    (2) Non-woven drainage fabric: Fabric laminated to front face metal core.
                (d) Size: Manufacturer's standard width rolls.
        b. Accessory products:
            1) Polyether sealant
                (a) STS Coatings; GreatSeal LT-100
                (b) York Manufacturing; UniverSeal US-100
            2) Corner and splice material: York Multi-Flash Stainless Steel pre-manufactured corners and end dams. Splice material Multi-Flash Tape.
        c. Separate cavity Mortar Diverter (e.g. "MortarNet") may be deleted with the use of the flashing/drainage products listed above.
        d. Substitutions: See Section 01 6000 - Product Requirements.

1) See article in PART 1 above entitled "Available Manufacturers".

2.6 ACCESSORIES

A. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
   1. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
      a. Manufacturers:
         1) Mortar Net Solutions; Mortar Net with Insect Barrier: www.mortarnet.com.
         2) Substitutions: See Section 01 6000 - Product Requirements.

B. Weeps: Polyethylene tubing.

C. Cavity Vents/Weeps: Polyester mesh.
   1. Color: As selected by Architect from manufacturers complete color offering.
   2. Manufacturers:
      a. Blok-Lok Limited: www.blok-lok.com.
      b. CavClear/Archovations, Inc: product CavClear Weep Vents www.cavclear.com.
      c. Mortar Net Solutions; Mortar Net Weep Vents: www.mortarnet.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.

D. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.7 LINTELS

A. Refer to the drawings for lintel schedule.
   1. Steel lintels (Hot diped galvanized at exterior).
   2. Masonry lintels where shown and wherever openings of more than 1’-0” are shown without structural steel or other supporting lintels.

2.8 MORTAR AND GROUT **MIXES**

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
   1. Masonry below grade and in contact with earth: Type S.
   2. Exterior, loadbearing masonry: Type N.
   3. Exterior, non-loadbearing masonry: Type N.
   4. Interior, loadbearing masonry: Type N.
   5. Interior, non-loadbearing masonry: Type O.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

C. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches (50 mm) or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches (50 mm).

D. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.

E. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.3 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

3.4 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.
B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
C. Concrete Masonry Units:
    1. Bond: Running.
    2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).
    3. Mortar Joints: Concave.
D. Brick Units:
    1. Bond: Running.
    2. Coursing: Three units and three mortar joints to equal 8 inches (200 mm).
    3. Mortar Joints: Concave.

3.5 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
B. Lay hollow masonry units with face shell bedding on head and bed joints.
C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
D. Remove excess mortar and mortar smears as work progresses.
E. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.
F. Prevent grout or mortar from staining face of masonry to be left exposed or painted. Remove immediately grout or mortar in contact with such masonry. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.
G. Interlock intersections and external corners.
H. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
I. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
J. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.
K. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.
L. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.6 WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at 24 inches (600 mm) on center horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.
B. Install cavity vents in veneer and cavity walls at 32 inches (800 mm) on center horizontally below shelf angles and lintels and near top of walls.

3.7 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.
C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.8 REINFORCEMENT AND ANCHORAGE - GENERAL

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches (400 mm) on center.
B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.
C. Place continuous joint reinforcement in first and second joint below top of walls.
D. Lap joint reinforcement ends minimum 6 inches (150 mm).

E. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 24 inches (600 mm) horizontally and 24 inches (600 mm) vertically.

3.9 REINFORCEMENT AND ANCHORAGE - SINGLE WYTHE MASONRY

A. Install horizontal joint reinforcement 16 inches (400 mm) on center.
B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.
C. Place continuous joint reinforcement in first and second joint below top of walls.
D. Lap joint reinforcement ends minimum 6 inches (150 mm).

3.10 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Install horizontal joint reinforcement 16 inches (400 mm) on center.
B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.
C. Place continuous joint reinforcement in first and second joint below top of walls.
D. Lap joint reinforcement ends minimum 6 inches (150 mm).
E. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches (400 mm) on center vertically and 16 inches (400 mm) on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches (200 mm) on center.
F. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches (400 mm) on center vertically and 16 inches (400 mm) on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches (200 mm) on center.

3.11 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
B. Extend metal flashings through exterior face of masonry and turn down to form drip. Install joint sealer below drip edge to prevent moisture migration under flashing.

3.12 LINTELS

A. Install loose steel lintels over openings.
B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
    1. Openings to 42 inches (1070 mm): Place two, No. 3 (M9) reinforcing bars 1 inch (25 mm) from bottom web.
    2. Openings from 42 inches (1070 mm) to 78 inches (1980 mm): Place two, No. 5 (M16) reinforcing bars 1 inch (25 mm) from bottom web.
    3. Openings over 78 inches (1980 mm): Reinforce openings as detailed.
    4. Do not splice reinforcing bars.
    5. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.
    6. Place and consolidate grout fill without displacing reinforcing.
    7. Allow masonry lintels to attain specified strength before removing temporary supports.
C. Maintain minimum 8 inch (200 mm) bearing on each side of opening.

3.13 GROUTED COMPONENTS

A. Reinforce bond beams with 2, No. 5 (M16) bars, 1 inch (25 mm) from bottom web.
B. Lap splices minimum 24 bar diameters.
C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.
D. Place and consolidate grout fill without displacing reinforcing.
E. At bearing locations, fill masonry cores with grout for a minimum 12 inches (300 mm) either side of opening.

3.14 CONTROL AND EXPANSION JOINTS

A. Control joints on any given wall plane, place vertical joints spaced not to exceed 30'-0" o.c.
B. Do not continue horizontal joint reinforcement through control or expansion joints.
C. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
D. Form expansion joint as detailed on drawings.

3.15 BUILT-IN WORK

A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished under other sections.
B. Install built-in items plumb, level, and true to line.
C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
    1. Fill adjacent masonry cores with grout minimum 12 inches (300 mm) from framed openings.
D. Do not build into masonry construction organic materials that are subject to deterioration.

3.16 TOLERANCES

A. Maximum Variation from Alignment of Columns: 1/4 inch (6 mm).
B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).
C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more.
D. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.
E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm/m) and 1/4 inch in 10 ft (6 mm/3 m); 1/2 inch in 30 ft (13 mm/9 m).
F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch (minus 6.4 mm, plus 9.5 mm).
G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch (6 mm).

3.17 CUTTING AND FITTING

A. Cut and fit for chases. Coordinate with other sections of work to provide correct size, shape, and location.
B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.18 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.
B. Clay Masonry Unit Tests: Test each variety of clay masonry in accordance with ASTM C67 requirements, sampling 5 randomly chosen units for each 50,000 installed.
C. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for conformance to requirements of this specification.

3.19 CLEANING

A. Remove excess mortar and mortar droppings.
B. Replace defective mortar. Match adjacent work.
C. Clean soiled surfaces with cleaning solution.
D. Use non-metallic tools in cleaning operations.

3.20 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 04 7200
CAST STONE MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Architectural cast stone.

1.2 RELATED REQUIREMENTS
- A. Section 04 2000 - Unit Masonry: Installation of cast stone in conjunction with masonry.
- B. Section 07 9200 - Joint Sealants: Sealing joints indicated to be left open for sealant.

1.3 REFERENCE STANDARDS
- A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2011.
- B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2015.
- C. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2009.
- D. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement; 2014.
- E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.
- F. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.
- G. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.
- H. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.
- I. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2013.
- J. ASTM C1364 - Standard Specification for Architectural Cast Stone; 2010b.

1.4 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Test results of cast stone components made previously by the manufacturer.
- C. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.
- D. Verification Samples: Pieces of actual cast stone components not less than 6 inches (152 mm) square, illustrating range of color and texture to be anticipated in components furnished for the project.
- E. Manufacturer's Qualification Data: Documentation showing compliance with specified requirements.
- F. LEED Submittal
  1. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional

1.5 QUALITY ASSURANCE
- A. Manufacturer Qualifications:
  1. A firm with a minimum of 5 years experience producing cast stone of types required for project.
  2. Adequate plant capacity to furnish quality, sizes, and quantity of cast stone required without delaying progress of the work.

1.6 DELIVERY, STORAGE, AND HANDLING
- A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.
- B. Number each piece individually to match shop drawings and schedule.

C. Store cast stone components and installation materials in accordance with manufacturer's instructions.
D. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.
E. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.
F. Store mortar materials where contamination can be avoided.
G. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Architectural Cast Stone:
   1. Continental Cast Stone of Texas, Inc., 101 East Shady Grove Road, Grand Prairie, TX 75050; T: 866-871-7866; F: 972-871-1251.
   2. Pineapple Grove Designs; P.O. Box 1121, Boynton Beach, FL 33426. ASD. Tel: (800) 771-4595, Fax: (561) 586-0845..
   3. Stromberg Architectural Products Inc; PO Box 8036, I-30 West, 4400 Oneal, Greenville, TX 75404. ASD. Tel: (903) 454-0904. Fax: (903) 454-3642. Email: stromberg@koyote.com. www.strombergarchitectural.com..
   4. Continental Cast Stone Manufacturing, Inc., 22001 West 83rd St., Shawnee, KS 66227; T: (800) 989-7866; F: (913) 422-7272; Estimating Fax: 913-422-3680; Email: info@continentalcaststone.com; Website: www.continentalcaststone.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.2 ARCHITECTURAL CAST STONE

A. Cast Stone: Architectural concrete product manufactured to simulate appearance of natural limestone, complying with ASTM C1364.
   1. Compressive Strength: As specified in ASTM C1364; calculate strength of pieces to be field cut at 80 percent of uncut piece.
   2. Freeze-Thaw Resistance: Demonstrated by field experience.
   3. Surface Texture: Fine grained texture, with no bugholes, air voids, or other surface blemishes visible from distance of 20 feet (6 meters).
   4. Color: Selected by Architect from manufacturer's full range.
   5. Remove cement film from exposed surfaces before packaging for shipment.
B. Shapes: Provide shapes indicated on drawings.
   1. Variation from Any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch (3 mm) or length divided by 360, whichever is greater, but not more than 1/4 inch (6 mm).
   2. Unless otherwise indicated on drawings, provide:
      a. Wash or slope of 1:12 on exterior horizontal surfaces.
      b. Drips on projecting components, wherever possible.
      c. Raised fillets at back of sills and at ends to be built in.
C. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI 318.
D. Regional Materials: Cast stone units shall be manufactured within 500 miles (800 km) of Project site from aggregates[and cement] that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

2.3 MATERIALS

A. Portland Cement: ASTM C150.
   1. For Units: Type I, white or gray as required to match Architect 's sample.
   2. For Mortar: Type I or II, except Type III may be used in cold weather.
B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.
C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.
D. Admixtures: ASTM C494/C494M.

E. Water: Potable.
F. Reinforcing Bars: ASTM A615/A615M deformed bars, galvanized.
   1. Galvanized in accordance with ASTM A767/A767M, Class I.
G. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, epoxy coated.
H. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.
I. Mortar: Portland cement-lime, ASTM C270, Type N; do not use masonry cement.
J. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.
K. Regional Materials: Aggregate for mortar[, cement, and lime] shall be manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

PART 3 EXECUTION

3.1 EXAMINATION
A. Examine construction to receive cast stone components. Notify Architect if construction is not acceptable.
B. Do not begin installation until unacceptable conditions have been corrected.

3.2 INSTALLATION
A. Install cast stone components in conjunction with masonry, complying with requirements of Section 04 2000.
B. Mechanically anchor cast stone units indicated; set remainder in mortar.
C. Setting:
   1. Drench cast stone components with clear, running water immediately before installation.
   2. Set units in a full bed of mortar unless otherwise indicated.
   3. Fill vertical joints with mortar.
   4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.
D. Joints: Make all joints 3/8 inch (9.5 mm), except as otherwise detailed.
   1. Rake mortar joints 3/4 inch (19 mm) for pointing.
   2. Remove excess mortar from face of stone before pointing joints.
   3. Point joints with mortar in layers 3/8 inch (9.5 mm) thick and tool to a slight concave profile.
   4. Leave the following joints open for sealant:
      a. Head joints in top courses, including copings, parapets, cornices, sills, and steps.
      b. Joints in projecting units.
      c. Joints between rigidly anchored units, including soffits, panels, and column covers.
      d. Joints below lugged sills and stair treads.
      e. Joints below ledge and relieving angles.
      f. Joints labeled "expansion joint".
E. Installation Tolerances:
   1. Variation from Plumb: Not more than 1/8 inch in 10 feet (3 mm in 3 m) or 1/4 inch in 20 feet (6 mm in 6 m) or more.
   2. Variation from Level: Not more than 1/8 inch in 10 feet (3 mm in 3 m) or 1/4 inch in 20 feet (6 mm in 6 m), or 3/8 inch (9 mm) maximum.
   3. Variation in Joint Width: Not more than 1/8 inch in 36 inches (3 mm in 900 mm) or 1/4 of nominal joint width, whichever is less.
   4. Variation in Plane Between Adjacent Surfaces (Lipping): Not more than 1/16 inch (1.5 mm) difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.
F. Repairs: Repair chips and other surface damage noticeable when viewed in direct daylight at 20 feet (6 m).

1. Repair with matching touchup material provided by the manufacturer and in accordance with manufacturer's instructions.
2. Repair methods and results subject to Architect 's approval.

3.3 ADJUSTING

A. Adjust hinges to locate inswinging doors in partial open position and outswinging oors in closed position when unlatched.
B. Adjust and align hardware to uniform clearance at vertical edge of doors.

3.4 CLEANING

A. Clean completed exposed cast stone after mortar is thoroughly set and cured.
   1. Wet surfaces with water before applying cleaner.
   2. Apply cleaner to cast stone in accordance with manufacturer's instructions.
   3. Remove cleaner promptly by rinsing thoroughly with clear water.
   4. Do not use acidic cleaners.

3.5 PROTECTION

A. Protect completed work from damage.
B. Clean, repair, or restore damaged or mortar-splashed work to condition of new work.

END OF SECTION

SECTION 05 1200
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

Structural steel required for this work is indicated on the drawings and includes, but is not limited to Columns and Beams.

1.02 RELATED REQUIREMENTS

A.	Division 01	Testing Laboratory Services.
B.	Section 03 2000	Concrete Reinforcing.
C.	Section 05 2100	Steel Joist Framing: Open Web Steel Joists.
D.	Section 05 3000	Metal Decking
E.	Section 05 5000	Metal Fabrications.

1.03 QUALITY ASSURANCE

A. Qualifications of Suppliers and Personnel

1. The steel fabricator shall have not less than five years continuous experience in the fabrication of structural steel.

2. The steel erector shall have not less than five years continuous experience in the erection of structural steel.

B. Welder's Qualifications

1. Welds shall be made only by welders and welding operators who have been qualified within the preceding 12 months by tests as prescribed in the "Code for Welding in Building Construction" of the American Welding Society, to perform the type of work required. All welders working on the project shall be assigned an identifying symbol or mark. Each welder will be required to mark his symbol on each weldment completed for identification. The Contractor shall maintain a record of welders employed, date of qualification and symbol or identification mark assigned to each. Testing laboratory shall visually inspect all welds, for size and quality, providing written confirmation of conformance.

2. Full penetration shop or field welds shall be inspected by non-destructive testing methods and the results shall be submitted in writing to the Structural Engineer. Acceptable methods are as follows:

   a. Liquid Penetrant Inspection: ASTM E165.

   b. Magnetic Particle Inspection: ASTM E109; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration not acceptable.

   c. Radiographic Inspection: ASTM E94 and ASTM E142; minimum quality level "2-2T".

   d. Ultrasonic Inspection: ASTM E164.

3. When requested by Engineer, supplier of structural steel shall furnish evidence that all materials delivered to the project meet the requirements of the specifications.

C. Bolting

1. Testing laboratory shall inspect all bolted connections using larger than 2 inch diameter bolts, as required by the Building Code requirements for High Strength Bolting, Section 306.

2. Verify the bolt type for conformance with specifications, check the surfaces being bolted together. Verify the output capacity of the bolt tightening equipment for all bolts including anchor bolts, for bolts larger than 2 inch diameter. Tightening the bolts shall be the turn-of-the-nut method, the minimum fastener tension requirements of the American Institute of Steel Construction (AISC) Specification for Structural Joints. Make spot checks with calibrated torque wrench to verify bolt tightness. As a minimum, test 10 percent of the bolts, minimum of two in each connection in the field.

D. Codes and Standards: In addition to complying with all pertinent codes and regulations, structural steel shall comply with the following.

1. Unless noted otherwise, shall meet the requirements of the "Manual of Steel Construction, Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" as amended to date and the "Code of Standard Practice" latest edition as adopted by the American Institute of Steel Construction.

2. "Code for Welding in Building Construction" of the American Welding Society.

3. "Specifications for Architecturally Exposed Structural Steel" of the American Institute of Steel Construction.

E. Conflicting Requirements: In the event of conflict between pertinent codes and regulations and the requirements of the referenced standards or these Specifications, the provisions of the more stringent shall govern.

1.04 SUBMITTALS

A. Shop Drawings:

1. The Contractor shall obtain completely detailed Shop Drawings showing anchorage placing plans, member placing and erection plans, all member sizes, location, bridging, bracing, connections, methods of assembly, etc. The Contractor shall carefully check these drawings, then submit them to the Architects. The Architect/Engineer may conduct limited spot checks aimed solely at determining general comprehension of the design intent, then return them to the Contractor. The Contractor shall then carefully recheck the shop drawings and approve them prior to fabrication. The structural construction documents shall not be copied by the fabricator for use as erection drawings.

2. The contractor/fabricator shall check and verify the overall assembly of structural framing elements, including connection details, to ensure that proper erection is feasible. Adequate clearance shall be provided at connections to ensure correct fitting of connected elements, taking into account mill tolerance, weld clearance, etc.

3. The Architect's spot check shall not relieve the Contractor from correcting, at his own expense, any items that may thereafter be found not to comply with the plans and specifications.

4. Show all shop and erection details including cuts, copes, connections, holes for threaded fasteners, rivets, and welds.

5. Show all welds, both shop and field, by the currently recommended symbols of the American Welding Society.

B. Proof of Qualification: Within five days after award of Contract, submit to the Architect satisfactory evidence that the steel fabricator and steel erector are qualified for the work in accordance with the requirements of this section of these Specifications.

1.05 PRODUCT HANDLING

A. Protection: Use all means necessary to protect structural steel before, during, and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect/Engineer and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. ALL STRUCTURAL STEEL MATERIALS SPECIFIED FOR THIS PROJECT SHALL BE DOMESTIC. NO EXCEPTIONS.

B. Wide Flange W-Shapes: W-Shapes shall meet the requirements of ASTM A992, low alloy structural steel with minimum yield stress of 50 KSI.

C. Structural Steel and Plates: Steel shapes and plates shall meet the requirements of ASTM A36, Fy = 36,000 psi.

D. Rectangular Tubing: Rectangular tubing shall meet the requirements of ASTM A500, Grade B, Fy = 46,000 psi.

E. Circular Steel Pipe: Steel pipe shall meet the requirements of ASTM A501, Fy = 36,000 psi.

F. Bolts and Nuts:

1. High Strength Bolts: Use high strength bearing type bolts conforming to ASTM A325 for all bolted connections unless otherwise indicated on the drawings.

2. Make bolt holes 1/16 inch larger than nominal bolt diameter.

3. All bolts shall have threads excluded from the shear plane.

G. Headed Concrete Anchors: ASTM A496, Installation AWS 01.1.

H. Primer Paint: All primer paint for structural steel shall be lead-and chromate-free and shall be compatible with the finish coatings described in other sections of these Specifications, and shall be Sherwin-Williams "Kromik", Pittsburgh "Ironhide", Negley "Zinc Chromate Rust-Inhibitive Paint", or equal.

1. All materials exposed to weather shall be galvanized per ASTM A123 specifications.

I. Non-Shrink Grout: The grout shall be non-shrink in the plastic state and show no expansion after set as tested under ASTM C191. The effective bearing area shall be no less than 95%. The grout must not contain any water reducers, fluidifiers, accelerators or other chemicals which cause drying shrinkage, reference ASTM C596.

J. Deck Support:

1. All edges of roof deck must be continuously supported by steel members.

2. At hip-and-valley construction, provide continuous 1/4 x 8 bent plates for deck support, positioned in the plane of the deck.

K. Mechanical Equipment Support: Provide adequate and appropriate structural steel framing, approved by Engineer, to support and mount all mechanical equipment resting on structural steel framing including roof top units. Loads shall be transmitted directly to steel beams, joists, etc., which shall be modified or strengthened to properly support such loading.

L. Other Materials: All other materials, not specifically described, but required for a complete and proper installation of structural steel, shall be new, free from rust, first quality of their respective kinds, and subject to the approval of the Architect. ALL MATERIALS SHALL BE DOMESTIC.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection:

1. Prior to installation of the work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

2. Verify that it is possible for the structural steel to be fabricated and erected in strict accordance with the original design, the approved Shop Drawings, and the referenced standards.

3. After the contractor has properly completed the structural steel framing and verified the final conditions of installation, the Structural Engineer shall be notified to permit observation of the completed work.

3.02 DISCREPANCIES

A. In the event of discrepancy, immediately notify the Architect/Engineer.

B. Do not proceed with fabrication or installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.03 FABRICATION AND ERECTION

A. General: Fabricate all structural steel in strict accordance with the approved Shop Drawings and the referenced standards.

B. Shop Cleaning and Priming: Shop paint all structural steel with one coat of primer, with the exception of:

1. Steel to be encased in concrete.

2. Surfaces to be field welded with full penetration groove welds or fillet welds larger than 3/16" size.

3. Surfaces at welds smaller than 3/16” may be prepared by abrasive paint removal in the field. Touch-up with same paint as used for original shop primer coat.

C. Connections:

1. If beam reactions or connection details are not shown on plans, the connections to be made shall be sufficient to support half the total uniform load capacity tabulated in the table for "Uniform Load Constants" as shown in the AISC Manual for the given shape, span and steel specifications for the beam in question.

2. Beam connections, unless noted otherwise, shall conform to the provisions of "Framed Beam Connections" as shown in AISC Manual. All bolts shall be tightened to the snug-tight condition as defined in AISC Specification on Structural Joints.

3. Connections of members into sides of pipes and tubes, unless noted otherwise, shall be made with plates passing through the pipe or tube as shown in the AISC Manual, Part 4, "Suggested Details-Miscellaneous".

4. Erection bolts used in weld construction shall be tightened and left in place.

5. Provide holes for securing nailers and/or other work to structural steel, and for passage of other work through structural steel. Provide threaded studs welded to framing, and other specialty items as shown to receive other work.

6. Field correcting or altering by "torching", or otherwise, will not be permitted unless prior approval is obtained from the Engineer. This applies to fabrication errors as well as work to accommodate other trades. Any errors which prevent the prior assembly of parts as detailed shall be reported to the fabricator for correction.

7. Splices will be permitted only when indicated. Splices may be omitted and beams furnished continuous in long lengths if desired.

8. The procedure and sequence of all shop and field welding shall be such as will avoid distortion of members and connections.

9. Erect structural steel accurately to lines and levels. Members shall be in final position before permanent connections are made.

10. Provide temporary bracing for accurate plumbing and to resist all wind and construction loads, using cable and/or angle "X" bracing in sufficient quantity to completely brace and stabilize the structure throughout the entire construction period. Erection equipment, shoring, scaffolding, etc., shall be suitable and safe for workmen, and shall be maintained in a safe and stable condition.

D. Special Joist Connection: At all columns not framed by beams in at least two directions, joist closest to the column centerline shall be field bolted to provide lateral stability during construction prior to welding.

E. Anchorage:

1. Furnish anchor bolts, plates, and other connectors required for securing structural steel to foundations and other in-place work. Anchor bars welded to embedded plates, unless noted otherwise, shall be A-36 smooth round bars shop welded to the plate in a manner such that the full tensile strength of the bar will be developed without failure of the weld or surrounding heat affecting metal.

2. Nelson Stud Anchors shall be used where indicated and shall be applied in full compliance with the Manufacturer's instructions.

3. Grout shall completely fill space under base plates.

F. Exposed Steel Members: Exposed Steel members shall be specially selected for uniformity of texture, straightness, and freedom from kinks, twist, warp, pits, and scale. Connections shall be accurately aligned, have close tolerances and neat smooth finishes. Appearance is fully as important as strength and will constitute grounds for rejection even after members are in final position. Refer to Section 10, "Architecturally Exposed Structural Steel" (AESS) of the "Code of Structural Practice for Steel Buildings and Bridges" (adapted 09/01/1986).

END OF SECTION 05 1200

SECTION 05 2100
STEEL JOIST FRAMING

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED
Provide and install all steel joists as shown and specified.

1.02 RELATED REQUIREMENTS

A. Section 05 1200 Structural Steel Framing.

B. Section 05 3000 Metal Decking.

C. Section 05 5000 Metal Fabrications.

1.03 SUBMITTALS

A. Shop Drawings:

1. Furnish detailed drawings and lists showing the mark, number, type, location and spacing of all joists.

2. Show bridging type, mark, methods of attachment of joists and anchorage at the ends.

3. Show all accessories and details as may be required for proper installation of joists.

B. Submit copies of manufacturer's joist.

1.04 REFERENCE STANDARDS

A. Steel Joist Institute: Standard Specifications for Open Web Steel Joists, K-Series.

B. American Welding Society: Structural Welding Code, Steel.

1.05 HANDLING AND STORAGE
Protect joists and accessories from harmful elements when stored at the job site. Store above the ground on platforms, pallets or other supports. Keep joists free of dirt and other foreign matter.

1.06 DAMAGED JOISTS
Repair or replace all damaged joists.

PART 2 - PRODUCTS

2.01 STEEL JOISTS

A. ALL STRUCTURAL STEEL MATERIALS SPECIFIED FOR THIS PROJECT SHALL BE DOMESTIC. NO EXCEPTIONS.

B. Steel joists shall be K Series as noted on the drawings.

C. Provide extended ends and extended bottom chords where shown on the drawings.

D. Bridging: Conform to the requirements of the Standard Specifications as adopted by the Steel Joist Institute for applicable steel joists, unless otherwise indicated on the drawings.

E. Shop paint with alkyd modified red oxide rust-inhibitive primer. Black asphalt is not permitted.

F. Chords shall be angles.

PART 3 - EXECUTION

3.01 ERECTION

A. Place steel joists on supporting work; adjust and align accurately for location and spacing before permanently fastening.

B. Erect steel joists in accordance with the Standard Specifications for steel joists.

C. Welding procedures, welders, and welding operations shall comply with AWS "Standard Qualification Procedure".

1. Certification of welders by the testing laboratory shall not be more than 12 months old at the time of welding in the erection period.

2. Testing laboratory shall inspect welds.

3.02 FIELD TOUCH-UP PAINTING

A. After the erection of joists, and before the erection of covering or concealing materials, touch-up paint field welds, bolt heads, nuts and abrasions in shop coating with the primer specified for shop painting.

END OF SECTION 05 2100

SECTION 05 3000
METAL DECKING

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED
Steel roof deck complete with cover plates, cell closures and flashings and acoustical closures.

1.02 RELATED REQUIREMENTS

A. ASTM A36, Structural Steel.

B. Steel Deck Institute, Basic Design Specifications.

C. ASTM A611, Grade C and ASTM A653 Carbon Steel Sheet.

D. AISI Specification for the Design of Cold-Formed Steel Structural Members.

1.03 SHOP DRAWINGS

A. Submit shop drawings in accordance with Division 01.

B. The Contractor shall obtain completely detailed shop drawings showing type of deck section employed in each area of roof, how they are adapted to special conditions, method of welding deck to supporting members method of reinforcing deck at openings, and location and type of all accessories which are part of the deck proper. The Contractor shall carefully check these drawings, then submit them to the Architect/Engineer. The Architect/Engineer may conduct limited spot checks aimed solely at determining general comprehension of the design intent, then return them to the Contractor. The Contractor shall then carefully recheck the shop drawings and approve them prior to fabrication.

C. The Architect/Engineer's spot check does not relieve the Contractor from correcting, at his own expense, any items that may thereafter be found not to comply with the plans and specifications.

PART 2 - PRODUCTS

2.01 MATERIALS

A. ALL STRUCTURAL STEEL MATERIALS SPECIFIED FOR THIS PROJECT SHALL BE DOMESTIC. NO EXCEPTIONS.

B. Acceptable Manufacturers:

1. Wheeling Corrugating Company or Vulcraft Division of Nucor.

a. Substitutions: Items of same function and performance are acceptable if product data is submitted and approved.

C. Materials and Components:

1. Steel for Galvanized Deck: ASTM A446, Fy = 33,000 psi (minimum).

2. Bearing Plates and Angles: ASTM A36 Type Steel.

3. Anchor Bolts, Required Nuts and Washers: High strength type recommended for structural steel joints; ASTM A325.

4. ALL MATERIAL SHALL BE DOMESTIC.

D. Galvanizing Repair Paint: High zinc-dust content paint for repair of damaged galvanized surfaces complying with Military Specifications MIL-P-21035 (Ships).

E. Welding Materials: Applicable AWS D1.1 type required for materials being welded.

F. Decking and Related Accessories: Roof Decking, minimum 20 gauge sheet steel; 36 inch wide sheet; three span; manufactured by Wheeling or Vulcraft. Refer to plan for specific section properties required.

G. Fabrication: Fabricate metal deck as recommended by the Steel Deck Institute. Fabricate to accommodate maximum working stress of 33,000 psi and maximum deflection of 1/360 of span.

H. Shop Finish: Galvanized steel deck shall be structural Grade C standard black gage coated before fabrication in continuous strip by the Cook-Norteman process. Coating shall conform to ASTM A525 Class G90 or QQ-S-775 Class D or ASTM G01.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Erect metal decking as recommend by the SDI. Properly align and level on structural supports. Deck sheets shall extend over three or more spans, where possible. End laps of sheets shall be a minimum of 2" and shall occur over supports.

B. Allow minimum 1-1/2 inch bearing when supported by structural steel and minimum 4 inch bearing when supported by masonry.

C. Deck shall be anchored by welding directly through the bottom of the ribs to all structural supports, unless noted otherwise on “Steel Framing Notes” on the plans. Welds to supports shall be made at the side ribs and at the center of each sheet and at other ribs so that the spacing between welds across the width of each sheet does not exceed 12 inches. Welds shall be not less than 5/8" diameter fusion welds, and shall be made by competent, experienced welders. When deck spans exceed 5'-0", side laps of adjacent units shall be fastened together at midspan by tack welding, sheet metal screws, or bottom punching. At free edges of deck (entire perimeter of decked area) weld to supports at 12" on center.

D. Refer to Plans for specific instructions on weld patterns necessary for diaphragm action.

E. Exercise care to avoid overloading the supporting structural elements when placing bundles of steel deck or other construction loads on the framing. Do not use deck units for storage or working platforms until permanently fastened in position.

F. Damaged or bent sections, or sections which do not properly mesh together at the side laps, shall not be used.

G. Sloping roofs having a slope of 1/4" per foot or more shall be erected beginning at the low side so that laps are made "shingle" fashion.

H. Minor openings, not shown on the plans or detailed on the shop drawings, shall be neatly cut and trimmed in the field; and shall be reinforced as required to maintain the strength and continuity of the deck.

I. Reinforce openings as shown on Structural Drawings.

J. Install closure strips and angles flashings as required to close openings between deck and walls, columns and openings.

3.02 TOUCH-UP PAINTING

Touch-up galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.

3.03 ACCEPTANCE

Contractor shall notify the testing laboratory when steel deck installation is complete to permit observation prior to placement of insulation or roofing substrate.

END OF SECTION 05 3000

SECTION 05 4000
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Formed steel stud exterior wall and interior wall framing.
- B. Exterior wall sheathing.
- C. Formed steel joist and purlin framing and bridging.
- D. Water-resistive barrier over sheathing.

1.2 RELATED REQUIREMENTS
- A. Section 07 2727 - Fluid-Applied Vapor Permeable Membrane Air Barrier System Assembly, for air barrier.
- B. Section 09 2116 - Gypsum Board Assemblies: Lightweight, non-load bearing metal stud framing.
- C. Section 09 2116 - Gypsum Board Assemblies: Gypsum-based sheathing.
- D. Section 09 2116 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.3 REFERENCE STANDARDS
- A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.
- D. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2009.
- E. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2013.
- F. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2014.
- G. ASTM C955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases; 2011c.
- H. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2011a.
- I. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2011 w/Errata.
- J. SSPC-Paint 15 - Steel Joist Shop Primer; Society for Protective Coatings; 1999 (Ed. 2004).
- K. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

1.4 ADMINISTRATIVE REQUIREMENTS
- A. Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

1.5 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations .
- C. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
  1. Indicate stud layout.
  2. Describe method for securing studs to tracks and for bolted framing connections.
  3. Provide design engineer's stamp on shop drawings.

4. Provide details and calculations for factory-made framing connectors, stamped by a Professional Structural Engineer.

D. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention .

E. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content

1.6 QUALITY ASSURANCE

A. Designer Qualifications: Design framing system under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in TEXAS.
   1. Structural Performance: Engineer where required, and fabricate and erect cold-formed metal framing to withstand design loads within limits and under conditions required.
      a. Design Loads: Wind and other loads as prescribed by the International Building Code, 2012.
   2. Design framing systems to withstand design loads without deflections greater than the following:
      a. Exterior Nonload-Bearing Curtainwall: Lateral deflection of 1/720 of the wall height.
   3. Design framing system to accommodate deflection of primary building structure and construction tolerances, and to maintain clearances at openings.
   4. Design exterior nonload-bearing curtain wall framing to accommodate lateral deflection without regard to contribution of sheathing materials.
   5. Engineering Responsibility: Engage a fabricator who assumes undivided responsibility for engineering cold-formed metal framing by employing a qualified professional engineer to prepare design calculations, shop drawings, and other structural data.

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Metal Framing:
   1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
   2. Marino: www.marinoware.com.
   3. The Steel Network, Inc: www.SteelNetwork.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Framing Connectors and Accessories:
   1. Same manufacturer as metal framing.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.2 FRAMING SYSTEM

A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

B. Shop fabricate framing system to the greatest extent possible.

C. Deliver to site in largest practical sections.

2.3 FRAMING MATERIALS

A. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
   1. Gage and Depth: As required to meet specified performance levels.
   2. Galvanized in accordance with ASTM A653/A653M, G90/Z275 coating.
   3. Provide components fabricated from ASTM A 1008/A 1008M, Designation SS steel.

B. Joists and Purlins: Fabricated from either ASTM A 1008/A 1008M, Designation SS, or ASTM A 1011/A 1011M, Designation SS steel sheet, shop painted.

1. Gage and Depth: As required to meet specified performance levels.
2. Finish: Manufacturer's standard, rust-inhibitive paint.

C. Zee Furring at exterior where indicated on the drawings shall be galvanized and a minimum of 20 gage (33 mils (0.0329 inches) (0.8356 mm)) thick, unless required to be heavier. Galvanized in accordance with ASTM A 653/A 653M G90/Z275 coating.

D. Framing Connectors: Factory-made, formed steel sheet.
1. Material: ASTM A653/A653M SS Grade 33 and 40 (minimum), with G90/Z275 hot dipped galvanized coating for base metal thickness less than 10 gage, 0.1345 inch (3.42 mm), and factory punched holes and slots.
2. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
3. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, shouldered screws or screws and anti-friction or stepped bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings.
   a. Where top of stud wall terminates below structural floor or roof, connect studs to structure in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 1/2 inch (13 mm).
   b. Provide top track with long leg track and head of wall movement connectors; minimum track length of 12 feet (3660 mm).
4. Fixed Connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.
5. Wall Stud Bridging Connections: Provide mechanical load-transferring devices that accommodate wind load torsion and weak axis buckling induced by axial compression loads. Provide bridging connections where indicated on the drawings.

E. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.4 WALL SHEATHING

A. Wall Sheathing: See Section 09 2116.

2.5 ACCESSORIES

A. Sill Gasket on Top of Foundation between the top of the foundation and the galvanized metal floor channel along the exterior perimeter of the building: 3½ ” W x 50’ L x 1/4 inch (6 mm) thick, plate width, closed cell plastic foam from continuous rolls.
1. Dow Chemical Co.; Product - Styrofoam Sill Seal polyethylene gasketing strip: www.dow.com.
2. Owens Corning Corp.; Product - FoamSealR sill plate gasket: www.owenscorning.com.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Sill Sealer on Top of Foundation between the top of the foundation and the sill metal plate (bottom track) along the exterior perimeter of the building: Minimum of two continuous beads of Type GPX sealant. Refer to Section 07 9005 - Joint Sealers.

C. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

D. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

E. Galvanizing Repair: Where galvanized surfaces are damaged, prepare surfaces and repair in accordance with procedures specified in ASTM A780.

F. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

G. Water-Resistive Barrier: 60 minute water-resistive Kraft building paper.

2.6 FASTENERS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.

B. Anchorage Devices: Powder actuated.

C. Welding: In conformance with AWS D1.1/D1.1M.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.
B. Verify field measurements and adjust installation as required.

3.2 INSTALLATION OF STUDS

A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.
B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 24 inches (600 mm) on center. Coordinate installation of sealant with floor and ceiling tracks.
C. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.
D. Install load bearing studs full length in one piece. Splicing of studs is not permitted.
E. Install load bearing studs, brace, and reinforce to develop full strength and achieve design requirements.
F. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.
G. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.
H. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
I. Touch-up field welds and damaged galvanized surfaces with primer.
J. Frame wall openings larger than 2 feet square with double stud at each jamb of frame except where more than 2 are either shown or indicated in manufacturer's instructions. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with stud shoes or by welding1 and space jack studs same as full-height studs of wall. Secure stud system wall opening frame in manner indicated.
K. Frame both sides of expansion and control joints, with separate studs; do not bridge the joint with components of stud system.
L. Install supplementary framing, blocking and bracing in metal framing system wherever walls or partitions are indicated to support fixtures1 equipment, services, casework, heavy trim and furnishings and similar work requiring attachment to the wall or partition. Coordinate blocking requirement with appropriate trades. Where type of supplementary support is not otherwise indicated, comply with stud manufacturer's recommendations and industry standards in each case, considering weight or loading resulting from item supported.

3.3 INSTALLATION OF JOISTS AND PURLINS

A. Install framing components in accordance with manufacturer's instructions.
B. Make provisions for erection stresses. Provide temporary alignment and bracing.
C. Provide web stiffeners at reaction points.
D. Touch-up field welds and damaged primed surfaces with primer.

3.4 WALL SHEATHING

A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using self-tapping screws.
    1. Provide steel diagonal bracing at corners.
    2. Place water-resistive barrier horizontally over wall sheathing, weather lapping edges and ends.

3.5 TOLERANCES

A. Maximum Variation from True Position: 1/4 inch (6 mm).
B. Maximum Variation of any Member from Plane: 1/4 inch (6 mm).

END OF SECTION

SECTION 05 5000
METAL FABRICATIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES
- A. Shop fabricated steel and aluminum items.
- B. Prefabricated ladders and ship ladders.

1.2 RELATED REQUIREMENTS
- A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

1.3 REFERENCE STANDARDS
- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; American Architectural Manufacturers Association; 2012.
- B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels; 2002.
- C. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2008.
- E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2012.
- G. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- H. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2012.
- I. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength; 2010.
- J. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2010.
- K. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2010a.
- L. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2007.
- M. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.
- N. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2012a
- O. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings; 2012.
- P. ASTM B85/85M - Standard Specification for Aluminum-Alloy Die Castings; 2010.
- Q. ASTM B177/B177M - Standard Guide for Engineering Chromium Electroplating; 2011.
- R. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2010.
- S. ASTM B210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2012.
- T. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2012e1.
- U. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2012.
- V. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 2012.
- W. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.
- X. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; American Welding Society; 2008.
- Y. SSPC-Paint 15 - Steel Joist Shop Primer; Society for Protective Coatings; 1999 (Ed. 2004).
- Z. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

AA. SSPC-SP 2 - Hand Tool Cleaning; Society for Protective Coatings; 1982 (Ed. 2004).

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

PART 2 - PRODUCTS

2.1 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.
B. Steel Tubing: ASTM A500, Grade B cold-formed structural tubing.
C. Plates: ASTM A283.
D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
E. Slotted Channel Framing: ASTM A653, Grade 33.
F. Slotted Channel Fittings: ASTM A1011/A1011M.
G. Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, galvanized to ASTM A153/A153M where connecting galvanized components.
H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
I. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
J. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.2 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
B. Sheet Aluminum: ASTM B209 (ASTM B209M), 5052 alloy, H32 or H22 temper.
C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210 (ASTM B210M), 6063 alloy, T6 temper.
D. Aluminum-Alloy Bars: ASTM B211 (ASTM B211M), 6061 alloy, T6 temper.
E. Aluminum-Alloy Sand Castings: ASTM B26.
F. Aluminum-Alloy Die Castings: ASTM B85.
G. Bolts, Nuts, and Washers: Stainless steel.
H. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.3 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.
B. Fabricate items with joints tightly fitted and secured.
C. Continuously seal joined members by intermittent welds and plastic filler.
D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.4 FABRICATED ITEMS

A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.
B. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.
C. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking; prime paint finish.
D. Lintels: As detailed; galvanized finish.
E. Sill Angles for Tempered Glass Railing Assemblies: ASTM A36/A36M steel angles with anchoring devices and sizes as indicated in shop drawings for railing assembly, drilled and tapped for fastener types, sizes, and spacing indicated, prime paint finish.
F. Toilet Partition Suspension Members: Steel channel sections; prime paint finish.
G. Slotted Channel Framing: Fabricate channels and fittings from structural steel complying with the referenced standards; factory-applied, rust-inhibiting thermoset acrylic enamel finish.

2.5 PREFABRICATED LADDERS

A. Prefabricated Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
   1. Components: Manufacturer's standard rails, rungs, treads, handrails. returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
   2. Materials: Carbon steel; ASTM A1011/A1011M, Grade 36 minimum.
B. Prefabricated Ship Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
   1. Components: Manufacturer's standard rails, rungs, treads, handrails. returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
   2. Materials: Carbon steel; ASTM A1011/A1011M, Grade 36 minimum.

2.6 FINISHES - STEEL

A. Prime paint all steel items.
   1. Exceptions: Galvanize items to be embedded in concrete and items to be imbedded in masonry.
   2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
B. Prepare surfaces to be primed in accordance with SSPC-SP2.
C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
D. Prime Painting: One coat.
E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements.
F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.7 FINISHES - ALUMINUM

A. Exterior Aluminum Surfaces: Class I color anodized.
B. Interior Aluminum Surfaces: Class I natural anodized.
C. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.
D. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils (0.018 mm) thick; light bronze.
E. Class I Color Anodized Finish: AAMA 611 AA-M12C22A44 Electrolytically deposited colored anodic coating not less than 0.7 mils (0.018 mm) thick; light bronze.
F. Class II Color Anodized Finish: AAMA 611 AA-M12C22A32 Integrally colored anodic coating not less than 0.4 mils (0.01 mm) thick; light bronze.
G. Class II Color Anodized Finish: AAMA 611 AA-M12C22A34 Electrolytically deposited colored anodic coating not less than 0.4 mils (0.01 mm) thick; light bronze.
H. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

2.8 FABRICATION TOLERANCES

A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.
B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).
C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).
D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).
E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

3.3 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.
B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
C. Field weld components indicated.
D. Perform field welding in accordance with AWS D1.1/D1.1M.
E. Obtain approval prior to site cutting or making adjustments not scheduled.
F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.4 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.
B. Maximum Offset From True Alignment: 1/4 inch (6 mm).
C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

SECTION 05 5100
INTERIOR METAL STAIRS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS
Requirements of Drawings, General and Supplementary Conditions and DIVISION 1 apply to this Section.

1.2 SCOPE
A. Provide all metal stair work including but not necessarily limited to:
   1. Preassembled steel stairs with concrete-filled treads.
   2. Handrails and railings attached to metal stairs.
   3. Handrails attached to walls adjacent to metal stairs.

B. Related Work specified elsewhere:

1.	Cast-in-place concrete	SECTION 033000
2.	VCT treads	SECTION 096500
3.	Wood flooring	SECTION 096400
4.	Painting	SECTION 099100

1.3 PERFORMANCE REQUIREMENTS
A. Structural Performance: Provide metal stairs capable of withstanding the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each component of metal stairs.
   1. Treads and Platforms of Metal Stairs: Capable of withstanding a uniform load of 100 lbf/sq. ft. or a concentrated load of 300 lbf on an area of 4 sq. in., whichever produces the greater stress.
   2. Stair Framing: Capable of withstanding stresses resulting from loads specified above in addition to stresses resulting from railing system loads.
   3. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.

B. Structural Performance of Handrails and Railings: Provide handrails and railings complying with requirements in ASTM E 985 for structural performance, based on testing performed according to ASTM E 894 and ASTM E 935.

C. Structural Performance of Handrails and Railings: Provide handrails and railings capable of withstanding the following structural loads without exceeding the allowable design working stress of materials for handrails, railings, anchors, and connections:
   1. Top Rail of Guards: Capable of withstanding the following loads applied as indicated:

D. Concentrated load of 200 lbf applied at any point and in any direction.

E. Uniform load of 50 lbf/ft. applied horizontally and concurrently with uniform load of 100 lbf/ft. applied vertically downward.

F. Concentrated and uniform loads above need not be assumed to act concurrently.

G. Handrails Not Serving as Top Rails: Capable of withstanding the following loads applied as indicated:

H. Concentrated load of 200 lbf applied at any point and in any direction.

I. Uniform load of 50 lbf/ft. applied in any direction.

J. Concentrated and uniform loads above need not be assumed to act concurrently.
   1. Infill Area of Guards: Capable of withstanding a horizontal concentrated load of 200 lbf applied to 1 sq. ft. at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area.

K. Load above need not be assumed to act concurrently with loads on top rails in determining stress on guards.

1.4 SUBMITTALS

A. Product Data: For metal stairs and the following:
   1. Prefilled metal-pan stair treads.
   2. Extruded nosings.
   3. Paint products.
   4. Grout.

B. Shop Drawings: Show fabrication and installation details for metal stairs. Include plans, elevations, sections, and details of metal stairs and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.
   1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Verification: For the following products. Prepare Samples from the same material to be used for the Work.
   1. Extruded nosings. Refer to drawings.

D. Welding Certificates: Copies of certificates for welding procedures and personnel.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Arrange for metal stairs specified in this Section to be fabricated and installed by the same firm.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in Texas and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal stairs (including handrails and railing systems) that are similar to those indicated for this Project in material, design, and extent.

C. Fabricator Qualifications: A firm experienced in producing metal stairs similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

1.6 COORDINATION

A. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Preassembled Stairs:
      American Stair Corp., Inc.
      Florida Stairs & Rails, Inc.
      National Stair & Rail, Inc.
      Balco/Metalines, Inc.
      American Safety Tread Co., Inc.

Amstep Products.
Armstrong Products, Inc.
Safe-T-Metal Co.
Wooster Products, Inc.

2.2 FERROUS METALS

A. Metal Surfaces, General: Provide metal free from pitting, seam marks, roller marks, and other imperfections where exposed to view on finished units. Do not use steel sheet with variations in flatness exceeding those permitted by referenced standards for stretcher-leveled sheet.
B. Steel Plates, Shapes, and Bars: ASTM A 36.
C. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.
D. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
E. Uncoated, Cold-Rolled Steel Sheet: Commercial quality, complying with ASTM A 366; or structural quality, complying with ASTM A 611, Grade A, unless another grade is required by design loads.
F. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.3 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
C. Machine Screws: ASME B18.6.3.
D. Lag Bolts: ASME B18.2.1.
E. Plain Washers: Round, carbon steel, ASME B18.22.1.
F. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1.
G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
    1. Material: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
    2. Material: Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

2.4 PAINT

A. All painting shall be factory finished. Refer to Section 099100.
B. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664, selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

2.5 GROUT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 CONCRETE FILL AND REINFORCING MATERIALS (INTERIOR STAIRS)

A. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, ready-mixed concrete with a minimum 28-day compressive strength of 3000 psi, unless higher strengths are indicated.

2.7 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, handrails, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
   1. Join components by welding, unless otherwise indicated.

B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
   1. Architectural class, where indicated.

C. Shop Assembly: Preassemble stairs in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

D. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Shear and punch metals cleanly and accurately. Remove sharp or rough areas on exposed surfaces.

E. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

F. Weld connections to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Weld exposed corners and seams continuously, unless otherwise indicated.
   5. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

H. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.8 STEEL-FRAMED STAIRS

A. Stair Framing: Fabricate stringers of structural-steel as indicated on drawings. Provide closures for exposed ends of stringers. Construct platforms of structural-steel and miscellaneous framing members as indicated. Weld headers to stringers; bolt or weld framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
   1. Where stairs are enclosed by gypsum board shaft-wall assemblies, provide hanger rods to support landings from floor construction above. Locate hanger rods within stud space of shaft-wall construction.
   2. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

B. Metal Risers, Subtread Pans, and Subplatforms: Form to configurations shown from steel sheet of thickness necessary to support indicated loads, but not less than 0.0677 inch.
   1. Steel Sheet: Uncoated cold-rolled steel sheet, unless otherwise indicated.
   2. Directly weld metal pans to stringers; locate welds on side of subtreads to be concealed by concrete fill. Do not weld risers to stringers.

3. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
4. Shape metal pans to include nosing integral with riser as indicated.
5. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

C. Smooth Soffit Construction: Construct subplatforms with smooth soffits.
D. Formed-Metal Risers, Treads, and Platforms: Form to configurations shown from steel sheet of thickness necessary to support indicated loads, but not less than 0.0966 inch.
1. Steel Sheet: Uncoated hot-rolled steel sheet, unless otherwise indicated.
2. Directly weld risers and treads to stringers; locate welds on underside of stairs.
3. Provide platforms of configuration indicated or, if not indicated, the same as treads. Weld platforms to platform framing.
E. Steel Floor Plate Platforms: Form to configurations shown from flat floor plate of thickness necessary to support indicated loads, but not less than 1/4 inch at exterior stairs.

2.9 STEEL PIPE AND STEEL BAR HANDRAILS AND RAILINGS

A. General: Fabricate handrails and railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
B. Interconnect members by butt-welding or welding with internal connectors, at fabricator's option, unless otherwise indicated.
1. At tee and cross intersections, cope ends of intersecting members to fit contour of tube to which end is joined, and weld all around.
C. Form changes in direction of handrails and rails as follows:
1. As detailed.
D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
E. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.
F. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting railings and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
1. Connect railing posts to stair framing by direct welding, unless otherwise indicated.
G. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.
H. For non-galvanized handrails and railings, provide non-galvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.

2.10 FINISHES

A. Comply with NAAMM'S "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed products:
1. Interiors (SSPC Zone 1A): SSPC SP 3, "Power Tool Cleaning."
2. Apply shop primer to prepared surfaces of metal stair components, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
3. Do not apply primer to galvanized surfaces.

4. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

F. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

3.2 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of baseplates.

B. Set steel stair baseplates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
   1. Use nonmetallic, non-shrink grout, unless otherwise indicated.
   2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 INSTALLING STEEL PIPE RAILINGS AND HANDRAILS

A. Adjust handrails and railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction.

B. Secure posts and railing ends to building construction as follows:
   1. Anchor posts to steel by welding directly to steel supporting members.
   2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with post installed anchors and bolts.

C. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:
   1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.

2. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
3. For hollow masonry anchorage, use toggle bolts.
4. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed reinforcements using self-tapping screws of size and type required to support structural loads.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section "Painting."

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SECTION 06 1000
ROUGH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Roof-mounted curbs.
- B. Preservative treated wood materials.
- C. Fire retardant treated wood materials.
- D. Miscellaneous framing and sheathing.
- E. Communications and electrical room mounting boards.
- F. Concealed wood blocking, nailers, and supports.
- G. Miscellaneous wood nailers, furring, and grounds.

1.2 RELATED REQUIREMENTS
- A. Section 05 5000 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.
- B. Section 07 2727 - Fluid-Applied Vapor Permeable Membrane Air Barrier System Assembly, for air barrier.
- C. Section 07 6200 - Sheet Metal Flashing and Trim: Sill flashings.
- D. Section 09 2116 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.3 REFERENCE STANDARDS
- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- B. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.
- D. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood Protection Association; 2012.
- E. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology, Department of Commerce; 2010.

1.4 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide technical data on wood preservative materials.
- C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.
- D. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- E. LEED Submittals
  1. Certificates for Credit MR 7: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
  2. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.
  3. Product Data for Credit IEQ 4.4: For composite-wood products, documentation indicating that product contains no urea formaldehyde.

1.5 DELIVERY, STORAGE, AND HANDLING
- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

1.6 WARRANTY
- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a two year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

C. Provide sustainably harvested wood; see Section 01 6000 for requirements.

D. Provide wood harvested within a 500 mile (805 km) radius of the project site.

E. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship" for the following:
   1. Dimension lumber framing.
   2. Miscellaneous lumber.

2.2 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.3 CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

B. Equipment Backing Panels: DOC PS 1, fire-retardant treat in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

C. Use “MDF” and “MR MDF” in lieu of particleboard / particle board when work is in and around interior Millwork, Architectural Wood Casework, cabinets, furniture, and other interior finish locations.
   1. Refer to Section 06 2000 - Finish Carpentry.

2.4 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

B. Sill Flashing: As specified in Section 07 6200.

C. Sill Sealer on Top of Foundation between the top of the foundation and the sill metal plate (bottom track) along the exterior perimeter of the building: Minimum of two continuous beads of Type GPX sealant. Refer to Section 07 9005 - Joint Sealers.

D. Water-Resistive Barrier: As specified in Section 07 2727.

E. Adhesives for Gluing : Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
   1. Adhesives shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:
1. Manufacturers:
a. Arch Wood Protection, Inc: www.wolmanizedwood.com.
b. Hoover Treated Wood Products, Inc: www.frtw.com.
c. Substitutions: See Section 01 6000 - Product Requirements.
2. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
b. Treat all exterior rough carpentry items.
c. Do not use treated wood in direct contact with the ground.

C. Preservative Treatment:
1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative to 0.25 lb/cu ft (4.0 kg/cu m) retention.
a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
b. Treat lumber in contact with roofing, flashing, or waterproofing.
c. Treat lumber in contact with masonry or concrete.
2. Preservative Pressure Treatment of Lumber in Contact with Soil: AWPA U1, Use Category UC4A, Commodity Specification A using waterborne preservative to 0.4 lb/cu ft (6.4 kg/cu m) retention.
a. Preservative for Field Application to Cut Surfaces: As recommended by manufacturer of factory treatment chemicals for brush-application in the field.

PART 3 EXECUTION

3.1 PREPARATION

A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches (100 mm) and seal.

3.2 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.
B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.3 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
B. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
C. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

3.4 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
B. Provide wood curb at all roof openings except where specifically indicated otherwise. Form corners by alternating lapping side members.

3.5 INSTALLATION OF CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.
    1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
    2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
    3. Install adjacent boards without gaps.

3.6 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.
B. Allow preservative to dry prior to erecting members.

3.7 TOLERANCES

A. Framing Members: 1/4 inch (6 mm) from true position, maximum.
B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

3.8 CLEANING

A. Waste Disposal: Comply with the requirements of Section 01 7419.
    1. Comply with applicable regulations.
    2. Do not burn scrap on project site.
    3. Do not burn scraps that have been pressure treated.
    4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.
B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 2000
FINISH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Finish carpentry items.
- B. Work Station Support Brackets for countertops.

1.2 RELATED REQUIREMENTS
- A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 06 4100 - Architectural Wood Casework: Shop fabricated custom cabinet work.
- C. Section 09 9113 - Exterior Painting: Painting and finishing of finish carpentry items.

1.3 REFERENCE STANDARDS
- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
- B. PS 1 - Structural Plywood; 2009.

1.4 ADMINISTRATIVE REQUIREMENTS
- A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

1.5 LEED SUBMITTALS
- A. Product Data for Credit IEQ 4.1: For adhesives and glues used at Project site, documentation including printed statement of VOC content.
- B. Product Data for Credit IEQ 4.4: For composite-wood products, documentation indicating that product contains no urea formaldehyde.

1.6 QUALITY ASSURANCE
- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING
- A. Protect work from moisture damage.

PART 2 PRODUCTS

2.1 MATERIALS, GENERAL
- A. Certified Wood: The following wood products shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":
  1. Interior standing and running trim.
  2. Interior plywood and MDO paneling.
  3. Shelving.
- B. MDF: ANSI A208.2, made with binder containing no urea-formaldehyde resin.
- C. Particle Board: Not allowed.

2.2 FINISH CARPENTRY ITEMS
- A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI/AWMAC/WI (AWS) for Custom Grade.
- B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.
- C. Interior Woodwork Items:
  1. Moldings, Bases, Casings, and Miscellaneous Trim: Clear white pine; prepare for paint finish.
  2. Loose Shelving: Birch plywood; prepare for paint finish.

2.3 WOOD-BASED COMPONENTS
- A. Wood fabricated from old growth timber is not permitted.
- B. Provide sustainably harvested wood, certified or labeled as specified in Section 01 6000.

C. Provide wood harvested within a 500 mile (805 km) radius of the project site.
D. Certified Wood: The following wood products shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":

2.4 SHEET MATERIALS

A. Softwood Plywood Not Exposed to View: Any face species, veneer core; PS 1 Grade A-B; glue type as recommended for application.
B. Particleboard / Particle Board is not allowed. Use MDF or MR MDF in lieu of particleboard.
C. Medium Density Fiberboard (MDF): ANSI A208.2; type as specified in AWI/AWMAC Architectural Woodwork Quality Standards Illustrated; composed of wood fibers pressure bonded with moisture resistant adhesive to suit application; sanded faces; thickness as required.
    1. Use for painted components, concealed components, components indicated on the drawings, and components not indicated as another material.
    2. Use as backing for plastic laminate unless otherwise indicated.
    3. MDF Panels: ANSI A208.2 - 1994, medium density (MDF) class, recommended for INTERIOR use. No added formaldehyde panel.
        a. Products:
            1) "Moncure MDF" by Sierra Pine, Ltd.
            2) "PureBond" by Columbia Forest Products.
            3) Substitutions: See Section 01 6000 - Product Requirements.
        b. Thickness: 1/2 inch nominal.
        c. Density: Minimum 47 lbs/ft³ for board thickness from 1/2" to 3/4".
        d. Internal Bond: 120 lbs/in².
        e. Modulus of Rupture: 4,000 lbs/in².
        f. Modulus of Elasticity: 400,000 lbs/in².
        g. Screw Holding:
            1) Face: 325 lbs. required to pull a 1" no. 10 metal screw.
            2) Edge: 250 lbs. required to pull a 1" no. 10 metal screw.
        h. These panels (regular MDF panels) are NOT for use at wet areas. Use MR MDF.
    4. MR MDF Panels: ANSI A208.2 - 1994, moisture resistant, medium density (MDF) class, recommended for INTERIOR use. No added formaldehyde panel.
        a. Use at sinks, lavatories & other wet areas as backing for plastic laminate unless otherwise indicated.
        b. Products:
            1) "Medex" Moisture Resistant MDF by Sierra Pine, Ltd., 3010 Lava Ridge Ct., Suite 220, Roseville, CA 95661; T: (800) 676-3339; www.sierrapine.com
            2) "Norbord" Moisture Resistant MDF, as manufactured by Norbord, Deposit, NY; T: (800) 367-6338; www.norboard.com.
            3) "UltraStock-MR" Moisture Resistant MDF, as manufactured by Temple-Inland, Mt. Jewett, PA; T: (800) 424-2311; www.templeinland.com.
            4) Substitutions: See Section 01 6000 - Product Requirements.
        c. Thickness: 1/2 inch nominal.
        d. Density: Minimum 47 lbs/ft³ for board thickness from 1/2" to 3/4".
        e. Internal Bond: 120 lbs/in².
        f. Modulus of Rupture: 4,000 lbs/in².
        g. Modulus of Elasticity: 400,000 lbs/in².
        h. Screw Holding:
            1) Face: 270 lbs. required to pull a 1" no. 10 metal screw.
            2) Edge: 250 lbs. required to pull a 1" no. 10 metal screw.
        i. This board shall be used at all wet locations. This is in Toilet Rooms, Rest Rooms, Bath Rooms, Janitor Closets and other locations around sinks, lavatories and other water supply and water bearing elements and equipment.

2.5 CEMENT FIBER BOARD MATERIALS

A. Cement Fiber Board siding, panels, planks: Fiber-cement board pieces.

1. Manufacturers:
    a. Nichiha Fiber Cement, Norcross, GA; Toll-free: (866) 424-4421; T: (770) 805-9466; www.nichiha.com
    b. Cemplank, Inc., Blandon, PA, Phone (800) 236-7526, (610) 926-5533, Fax (610) 916-4916. www.cemplank.com
    c. James Hardie Building Products Inc. Mission Viejo, CA, Phone (800) 542-7343. www.jameshardie.com.

2.6 FASTENINGS

A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.
B. Concealed Joint Fasteners: Threaded steel.

2.7 ACCESSORIES

A. Work Station Support Brackets:
    1. Size: 24" x 24".
    2. Material & Thickness: 11 gauge steel (1/8" thick).
    3. Finish: Powder coat finish or Pre-primed finish .
    4. Color: As selected from manufacturers standard colors.
    5. Verify for Left and Right installation.
    6. Provide blocking in wall for support of countertop and anchorage of Support Bracket.
    7. Product: "Work Station Brackets" by A & M Hardware, Inc., Manheim, PA 17545; T: 888-647-0200; F: 717-664-4582; E-mail: Info@aandmhardware.com.

2.8 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.
B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify adequacy of backing and support framing.

3.2 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.
B. Set and secure materials and components in place, plumb and level.
C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim to conceal larger gaps.

3.3 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch (1.6 mm).
B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.79 mm).

END OF SECTION

SECTION 06 4100
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Specially fabricated cabinet units.
- B. Countertops.
- C. Cabinet hardware.
- D. Factory finishing.
- E. Preparation for installing utilities.

1.2 RELATED REQUIREMENTS
- A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 08 8000 - Glazing: Glass for casework.

1.3 REFERENCE STANDARDS
- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
- B. BHMA A156.9 - American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association; 2010 (ANSI/BHMA A156.9).
- C. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.

1.4 ADMINISTRATIVE REQUIREMENTS
- A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.5 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
  1. Minimum Scale of Detail Drawings: 1-1/2 inch to 1 foot (1:8).
  2. Provide the information required by AWI/AWMAC/WI (AWS).
- C. Product Data: Provide data for hardware accessories.
- D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches (300 mm) square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.
- E. LEED Submittals
  1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
  2. Certificates for Credit MR 7: Chain-of-custody certificates indicating that interior architectural woodwork complies with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
  3. Product Data for Credit IEQ 4.1: For installation adhesives, documentation including printed statement of VOC content.
  4. Product Data for Credit IEQ 4.4: For composite wood products and adhesives, documentation indicating that product contains no urea formaldehyde.

1.6 QUALITY ASSURANCE
- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
  1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.

1.7 MOCK-UP
- A. Provide mock-up of typical base cabinet, wall cabinet, and countertop, including hardware, finishes, and plumbing accessories.

B. Locate where directed.
C. Mock-up may not remain as part of the Work.

1.8 DELIVERY, STORAGE, AND HANDLING
A. Protect units from moisture damage.

1.9 FIELD CONDITIONS
A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

1.10 WARRANTY
A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Contractor shall correct defective Work within a two year period after Date of Substantial Completion; remove and replace materials concealing defective work at no extra cost to Owner.

PART 2 PRODUCTS

2.1 CABINETS
A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI//AWMAC/WI (AWS) for Premium Grade.
B. Plastic Laminate Faced Cabinets: Custom grade.
C. Cabinets at _____:
1. Finish - Exposed Interior Surfaces: Decorative laminate.
2. Finish - Concealed Surfaces: Decorative laminate.
3. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
4. Casework Construction Type: Manufacturer's option.
5. Interface Style for Cabinet and Door: Style 2 - Finish Inset; flush overlay.
6. Layout for Cabinet and Door Fronts: Flush panel.
a. Custom Grade: Doors, drawer fronts and false fronts wood grain to run and match vertically within each cabinet unit.
7. Adjustable Shelf Loading: 50 lbs. per sq. ft..
8. Cabinet Style: Flush overlay.
9. Cabinet Doors and Drawer Fronts: Flush style.
10. Drawer Construction Technique: Dovetail joints.

2.2 WOOD-BASED COMPONENTS
A. Wood fabricated from old growth timber is not permitted.
B. Provide sustainably harvested wood, certified or labeled as specified in Section 01 6000.

2.3 LAMINATE MATERIALS
A. Manufacturers:
1. Formica Corporation: www.formica.com.
2. Wilsonart, LLC; ____: www.wilsonart.com.
3. Substitutions: Not permitted.
B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
C. Provide specific types as scheduled.

2.4 COUNTERTOPS
A. Solid Surfacing - Acceptable materials:
1. "Corian" by DuPont.
2. "Gibraltar" by WilsonArt.
3. "Surrell" by Formica.
4. Substitutions: Not permitted.

2.5 ACCESSORIES
A. Adhesive: Type recommended by fabricator to suit application.
B. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness.

1. Color: As selected by Architect from manufacturer's standard range.

C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

D. Grommets: Standard plastic, painted metal, or rubber grommets for cut-outs, in color to match adjacent surface.

2.6 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch (25 mm) spacing adjustments.

C. Drawer and Door Pulls: "U" shaped wire pull, steel with chrome finish, 4 inch centers ("U" shaped wire pull, steel with chrome finish, 100 mm centers).

D. Catches: Magnetic.

E. Drawer Slides:

1. Type: Extension types as scheduled.
2. Static Load Capacity: Commercial grade.
3. Mounting: Side mounted.
4. Stops: Integral type.
5. Features: Provide self closing/stay closed type.
6. Products:
   a. Accuride International, Inc: www.accuride.com.
   b. Grass America Inc: www.grassusa.com.
   c. Hettich America, LP: www.hettichamerica.com.
   d. Knape & Vogt Manufacturing Company: www.knapeandvogt.com.
   e. Substitutions: See Section 01 6000 - Product Requirements.

F. Hinges: European style concealed self-closing type, steel with polished finish.

1. Products:
   a. Grass America Inc: www.grassusa.com.
   b. Hardware Resources: www.hardwareresources.com.
   c. Hettich America, LP: www.hettichamerica.com.
   d. Julius Blum, Inc: www.blum.com.
   e. Substitutions: See Section 01 6000 - Product Requirements.

G. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.

1. Product: Timberline series manufactured by CompX National.
2. Provide locks for drawers, cabinet doors including strike plates, double door latch, screws, anchors and accessories for complete installation.

2.7 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet (600 mm) from sink cut-outs.

D. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inches (400 mm) on center.

E. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.2 INSTALLATION

A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
B. Use fixture attachments in concealed locations for wall mounted components.
C. Use concealed joint fasteners to align and secure adjoining cabinet units.
D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch (1 mm). Do not use additional overlay trim for this purpose.
E. Secure cabinets to floor using appropriate angles and anchorages.
F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.
G. Site glaze glass materials using the Interior Dry method specified in Section 08 8000.

3.3 ADJUSTING

A. Adjust installed work.
B. Adjust moving or operating parts to function smoothly and correctly.

3.4 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 06 6116
SOLID SURFACE MATERIALS

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Cast plastic counter top.

1.2 REFERENCE STANDARDS
- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

1.3 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate dimensions, thicknesses, required clearances, tolerances, materials, colors, finishes, fabrication details, field jointing, adjacent construction, design load parameters, methods of support, integration of plumbing components, and anchorages.
- C. Samples: Submit two samples representative of counter top, 6 x 6 inch (152 x 152 mm) in size, illustrating color, texture, and finish.
- D. Maintenance Data: Indicate list of approved cleaning materials and procedures required; list of substances that are harmful to the component materials.
  1. Include instructions for stain removal, surface and gloss restoration.
- E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. Maintenance kit for finishes.
- G. LEED Submittals
  1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
  2. Product Data for Credit IEQ 4.4: For adhesives and composite wood products, documentation indicating that product contains no urea formaldehyde.
  3. Adhesives: Do not use adhesives that contain urea formaldehyde.

1.4 QUALITY ASSURANCE
- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.5 WARRANTY
- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide ten year manufacturer warranty for material and labor to repair or replace defective materials..

PART 2 PRODUCTS

2.1 MANUFACTURERS
- A. Cast Plastic Fabrications:
  1. DuPont; Product Corian.
  2. Ralph Wilson Plastics; Product Gibraltar.
  3. Formica; Product Surell.
  4. Substitutions: See Section 01 6000 - Product Requirements.

2.2 MATERIALS
- A. Provide finished products having a maximum flame spread index of 25 and smoke developed index of 25, when tested in accordance with ASTM E84 in thickness of 3/4 inch (19 mm).

2.3 FINISH
- A. Color: Color as selected.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that joint preparation and affected dimensions are acceptable.

3.2 PREPARATION

A. Provide anchoring devices for installation and embedding.
B. Provide templates and rough-in measurements.

3.3 INSTALLATION

A. Install components in accordance with shop drawings and manufacturer's instructions.
B. Align work plumb and level.
C. Rigidly anchor to substrate to prevent misalignment.
D. Provide back and sidewall splashes. Extend splash along back and sides of countertops where there is an abutting wall.

3.4 TOLERANCES

A. Maximum Variation From True Dimension: 1/8 inch (3 mm).

3.5 CLEANING

A. Clean and polish surfaces in accordance with manufacturer's instructions.

3.6 PROTECTION

A. Do not permit construction near unprotected surfaces.

END OF SECTION

SECTION 07 2100
THERMAL INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Board insulation and integral vapor retarder at cavity wall construction, perimeter foundation wall, underside of floor slabs, over roof deck, over roof sheathing, and exterior wall behind _____ wall finish.
- B. Batt insulation and vapor retarder in exterior wall, ceiling, and roof construction.

1.2 RELATED REQUIREMENTS
- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 05 4000 - Cold-Formed Metal Framing: Board insulation as wall sheathing.
- C. Section 06 1000 - Rough Carpentry: Installation requirements for board insulation over steep slope roof sheathing or roof structure.
- D. Section 07 2727 - Fluid-Applied Vapor Permeable Membrane Air Barrier System Assembly, for air barrier.
- E. Section 07 8400 - Firestopping: Insulation as part of fire-rated through-penetration assemblies.
- F. Section 09 2116 - Gypsum Board Assemblies: Acoustic insulation inside walls and partitions.

1.3 REFERENCE STANDARDS
- A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2014.
- B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.
- C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2014.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.
- E. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2012.
- F. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2012.

1.4 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. LEED Submittals:
  1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

1.5 FIELD CONDITIONS
- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.1 APPLICATIONS
- A. Insulation Inside Masonry Cavity Walls: Extruded polystyrene board.
- B. Insulation Inside Prefabricated Metal Wall Panels: Polyisocyanurate board with both sides foil faced.
- C. Insulation in Metal Framed Walls: Batt insulation with integral vapor retarder.

2.2 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene Board Insulation: Extruded polystyrene board; ASTM C578; with either natural skin or cut cell surfaces, and the following characteristics:
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
   3. R-value (RSI-value); 1 inch (25 mm) of material at 72 degrees F (22 C): 5 (0.88), minimum.
   4. Complies with fire resistance requirements shown on the drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
   5. Board Size: 48 x 96 inch (1220 x 2440 mm).
   6. Board Thickness: 2 inches (50 mm).
   7. Board Edges: Square.
   8. Thermal Resistance: R-value of 4.6 per 1 inch (25.4 mm) at 75 degrees F (24 degrees C) mean temperature.
   9. Compressive Resistance: 25 psi (173 kPa).
   10. Board Density: 1.60 lb/cu ft (26 kg/cu m).
   11. Water Absorption, Maximum: 0.3 percent, by volume.
   12. Manufacturers:
      a. Dow Chemical Co: www.dow.com.
      b. Owens Corning Corp: www.owenscorning.com.

B. Polyisocyanurate Board Insulation with Facers Both Sides: Rigid cellular foam, complying with ASTM C1289; Type I, aluminum foil both faces; Class 1, non-reinforced foam core. THIS INSULATION SHALL BE USED EXCLUSIVELY WITH ALL METAL VENEERS AT WALLS.
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
   3. Complies with fire resistance requirements shown on the drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
   4. Compressive Strength: 25 psi (172 kPa)
   5. Board Size: 48 x 96 inch (1220 x 2440 mm).
   6. Board Thickness: 2 inch (50 mm).
   7. Board Edges: Square.
   8. Manufacturers:
      a. Carlisle Coatings & Waterproofing, Inc; R2+ Matte: www.carlisle-ccw.com.
      b. Dow Chemical Co; Thermax (ci): www.dow.com.
      c. Firestone Enverge CI Foil: www.firestone.com
      d. Hunter Panels, LLC; Xci Class A Foil: www.hunterxci.com.
      e. Johns Manville; AP Foil-Faced: www.jm.com.
      f. Rmax Inc.; ECOMAXci: www.rmax.com.

2.3 BATT INSULATION MATERIALS

A. Where batt insulation is indicated, either glass fiber or mineral fiber batt insulation may be used, at Contractor's option.

B. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
   3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
   4. Formaldehyde Content: Zero.
   5. Facing: Aluminum foil, flame spread 25 rated; one side.
   6. Manufacturers:
      a. CertainTeed Corporation: www.certainteed.com.
      b. Johns Manville: www.jm.com.
      c. Owens Corning Corp: www.owenscorning.com.

C. Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
   1. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.

PART 3 EXECUTION

3.1 EXAMINATION
- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.2 BOARD INSTALLATION AT FOUNDATION PERIMETER
- A. Install boards horizontally on foundation perimeter.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.3 BOARD INSTALLATION AT EXTERIOR WALLS
- A. Adhere a 6 inch (150 mm) wide strip of polyethylene sheet over expansion joints with double beads of adhesive each side of joint.
  1. Tape seal joints between sheets.
- B. Install boards horizontally on walls.
- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.4 BOARD INSTALLATION AT CAVITY WALLS
- A. Install boards to fit snugly between wall ties.
- B. Install boards horizontally on walls.
- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.5 BOARD INSTALLATION UNDER CONCRETE SLABS
- A. Place insulation under slabs on grade after base for slab has been compacted.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.6 BOARD INSTALLATION OVER LOW SLOPE ROOF DECK

3.7 BOARD INSTALLATION OVER STEEP SLOPE ROOF SHEATHING OR ROOF STRUCTURE
- A. Installation of board insulation over steep slope roof structure or roof sheathing is specified in Section 06 1000.

3.8 BATT INSTALLATION
- A. Install insulation and vapor retarder in accordance with manufacturer's instructions.
- B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- E. At metal framing, place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over member face.
- F. Tape seal tears or cuts in vapor retarder.
- G. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane. Tape seal in place.

3.9 PROTECTION
- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 2616
UNDER SLAB VAPOR RETARDERS & BARRIERS

PART 1 - GENERAL

1.1 SECTION INCLUDES
- A. Surface preparation.
- B. Application of an under slab vapor retarder over compacted structural fill.

1.2 RELATED SECTIONS
- A. Section 03 3000 - Cast-In-Place Concrete.
- B. Section 33 4600 – Subdrainage.

1.3 REFERENCES
- A. ACI 302.1R.17 - Guide for Concrete Floor and Slab Construction.
- B. American Railway Engineering & Maintenance of Way Association (AREMA) Specification Chapter 29 - Waterproofing.
- C. ASTM C836 - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.
- D. ASTM D412-06: Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.
- E. ASTM D882: Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
- F. ASTM D903: Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
- G. ASTM D1709 - 09 Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
- H. ASTM D1970-01 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
- I. ASTM D5385-93: Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes.
- J. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
- K. ASTM E154 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs.
- L. ASTM E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- M. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
- N. ASTM F1249-01 Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.
- O. ASTM F2130: Standard Test Method for Measuring Repellency, Retention, and Penetration of Liquid Pesticide Formulation Through Protective Clothing Materials.
- P. GSA-PBS 07115: General Services Administration, Public Building Service - Guide Specification for Elastomeric Waterproofing.
- Q. Texas A&M Method Resistance to Penetration by Termites.

1.4 SUBMITTALS
- A. Comply with Section 01 3300- Submittal Procedures.
- B. Product Data: Provide data on material characteristics.
- C. Shop Drawings: Provide drawings of special joint conditions.
- D. Manufacturer's Installation Instructions: Indicate preparation.

1.5 QUALITY ASSURANCE
- A. Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of the vapor retarder.
- B. Obtain vapor retarder materials from a single manufacturer regularly engaged in manufacturing the product.
- C. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

1.6 PRECONSTRUCTION MEETING

A. Pre-Construction Meeting: Convene one week prior to installation of underslab vapor retarder. Attendees to be as follows: - Architect, Engineer, General Contractor, Vapor Retarder Installer, and Vapor Retarder Manufacturer to discuss the application in detail.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels
B. Store materials in a clean, dry area in accordance with manufacturer's instructions.
C. Protect materials during handling and application to prevent damage or contamination.
D. Ensure membrane is stamped with manufacturer's name, product name, and membrane thickness at intervals of no more than 85" (220 cm).

1.8 ENVIRONMENTAL REQUIREMENTS

A. Product not intended for uses subject to abuse or permanent exposure to the elements.
B. Do not apply on frozen ground.

1.9 AVAILABLE MANUFACTURERS

A. Substitutions - The product(s) referenced by the manufacturer listed, forms the basis of design. The contractor at their option may provide an alternate manufacturer as an equal, however, if an equal is proposed, the Contractor shall provide data from the specified manufacturer & product(s) as well as data from the proposed manufacturer for a comparison, review, and determination of acceptance (approval or disapproval) by the Architect. Approval cannot be made if adequate comparison information is not provided. Absence of specified manufacturers' data is grounds for disapproval.
B. Refer to Section 01 3000 - Administrative Requirements AND Section 01 6000 - Product Requirements for substitution procedures.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. W. R. MEADOWS, INC., PO Box 338, Hampshire, Illinois 60140-0338. (800) 342-5976. (847) 683-4500. Fax (847) 683-4544. Web Site www.wrmeadows.com.
B. Substitutions: See Section 01 6000 - Product Requirements.
    1. See article in PART 1 above entitled "Available Manufacturers".

2.2 MATERIALS - OVER COMPACTED STRUCTURAL FILL

A. Plastic Vapor Retarder
    1. Performance-Based Specification: Vapor retarder membrane shall be manufactured from virgin polyolefin resins, and when tested according to all requirements of ASTM E1745, shall meet the following minimum performance requirements:
        a. Maximum Water Vapor Permeance (ASTM E154 Sections 7, 8, 11, 12, 13, by ASTM E96, Method B or ASTM F1249)
            1) As received: 0.0063 perms.
            2) After Wetting and Drying: 0.0052 perms.
            3) Resistance to Plastic Flow and Temperature: 0.0057 perms.
            4) Effect Low Temperature and Flexibility: 0.0052 perms
            5) Resistance to Deterioration from Organisms and Substances in Contacting Soil: 0.0052 perms.
        b. Puncture Resistance (ASTM D1709): >3,200 grams.
        c. Tensile Strength ASTM E154, Section 9: 72 Lb. Force/Inch
    2. Basis of Design Product:
        a. PERMINATOR 15 mil by W. R. MEADOWS.
    3. Other acceptable products
        a. Raven Vaporblock VB15.
        b. Griffolyn 15 Mil Green.
        c. Stego Wrap 15.
        d. Husky Yellow Guard 15 Mil.
        e. Barrier-Bac VB-350 (16 mil) Vapor Retarder.

2.3 ACCESSORIES FOR PLASTIC VAPOR RETARDER - OVER COMPACTED STRUCTURAL FILL

A. Use only Accessories recommended by the manufacturer of the actual Plastic Vapor Retarder used for this project.
B. Seam Tape
    1. High Density Polyethylene Tape with pressure sensitive adhesive. Minimum width 4” (100 mm).
        a. Perminator Tape by W.R. Meadows.
C. Pipe Collars
    1. Construct pipe collars from vapor retarder material and pressure sensitive tape per manufacturer’s instructions.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Inspect all surfaces for any conditions detrimental to the proper completion of the work.
B. Ensures surfaces are structurally sound.
C. Remove debris or any other foreign material that could damage the membrane.
D. Prepare surfaces in accordance with manufacturer’s instructions.
E. Level, tamp, or roll earth or granular material beneath the slab base.

3.2 EXAMINATION

A. Examine surfaces to receive membrane. Notify architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.3 APPLICATION FOR PLASTIC VAPOR RETARDER - OVER COMPACTED STRUCTURAL FILL

A. Install the vapor retarder membrane in accordance with manufacturer’s instructions and ASTM E 1643-98.
B. Unroll vapor retarder with the longest dimension parallel with the direction of the pour.
C. Lap vapor retarder over footings and seal to foundation walls.
D. Overlap joints 6” (152 mm) and seal with manufacturer’s tape.
E. Seal all penetrations (including pipes) with manufacturer’s pipe boot.
F. No penetration of the vapor retarder is allowed except for reinforcing steel and permanent utilities.
G. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6” (152 mm) and taping all four sides with tape.

3.4 PROTECTION

A. Ensure membrane is not damaged prior to concrete pour.
B. Ensure concrete is poured within 60 days of membrane application.

END OF SECTION

SECTION 07 2727
FLUID-APPLIED VAPOR PERMEABLE MEMBRANE AIR BARRIER SYSTEM ASSEMBLY

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Materials and installation methods supplementing a one-component vapor permeable, liquid applied elastic air and water barrier, vapor retarder materials and assemblies.
   1. This product is also referred to as “Air/Water Barrier and Vapor Retarder.”or "Vapor Permeable Air/Water Barrier."

B. Materials and installation to bridge and seal the following air leakage pathways and gaps:
   1. Connections of the walls to the roof air barrier.
   2. Connections of the walls to the foundations.
   3. Expansion joints.
   4. Openings and penetrations of window frames, store front, curtain wall.
   5. Barrier precast concrete and other envelope assembly.
   6. Door frames.
   7. Piping, conduit, duct and similar penetrations.
   8. Masonry ties, screws, bolts and similar penetrations.
   9. All other air leakage pathways in the building envelope.
   10. Sealing flashing to wall surface.

1.2 RELATE SECTIONS

A. Section 04 2000 - Unit Masonry: Flexible through wall flashing membrane. Sealing flashing to wall surface.
B. Section 07 7200 - Cast Stone Masonry.
C. Section 07 9005 - Joint Sealers: Sealants.
D. Section 09 2116 - Gypsum Board Assemblies: Installing air barrier membrane over glass-faced gypsum sheathing, structural roof decking and roof board.

1.3 PERFORMANCE REFERENCES

A. AATCC 127 Water Resistance
B. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension; 2006a (2013).
C. ASTM D1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection: 2013. Self Sealability.
D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials, 2013. Standard Test Method for Surface Burning.
E. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials; 2012. Water Vapor Transmission of Materials, Procedure B
F. ASTM E283-91 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 1991.
G. CODE MANDATED ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 00 (2009).
H. ASTM E2178 - Standard Test for Determining the Air Permeability of Building Materials; 2001.
I. ASTM E2357, Standard Test Method for Determining Air Leakage of Air Barrier Assembly; 2011, (Full Scale Wall Testing of the Air Barrier System). Ensure tests were conducted on steel stud frame walls with penetrations (Specimen 2) as some air barrier assembly are not tested in that critical mode.
J. ICC-ES AC212, Freeze Thaw, Crack Bridging
   1. ICC-ES AC 212 - Acceptance Criteria for Water-Resistive Coatings used as Water-Resistive Barriers on Exterior Sheathing.
K. CODE MANDATED Fire Testing: Air Barrier, as a component of a wall assembly, shall have passed a NFPA 285 complete wall fire test.

1. NFPS 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2012.

L. Listed as an evaluated system by Air Barrier Association of America at www.airbarriers.org

1.4 PERFORMANCE REQUIREMENTS

A. Provide an air barrier system constructed to perform as a continuous elastic air barrier, and as a liquid water drainage plane flashed to discharge to the exterior any incidental condensation or water penetration. Membrane shall accommodate movements of building materials by providing expansion and control joints as required, with accessory air seal materials at such locations, changes in substrate and perimeter conditions.

1. The air barrier shall have the following characteristics:
    a. It must be continuous, with all joints made air-tight.
    b. It shall be capable of withstanding positive and negative combined design wind, fan and stack pressures on the envelope without damage or displacement, and shall transfer the load to the structure. It shall not displace adjacent materials under full load. The air barrier shall be joined in an airtight and flexible manner to the air barrier material of adjacent assembly, allowing for the relative movement of assembly due to thermal and moisture variations and creep. Connection shall be made between:
        1) Foundation and walls.
        2) Walls and windows or doors.
        3) Different wall assembly.
        4) Wall and roof.
        5) Wall and roof over unconditioned space.
        6) Walls, floor and roof across construction, control and expansion joints.
        7) Walls, floors and roof to utility, pipe and duct penetrations.
        8) Flashing to wall surface.
2. All penetrations of the air barrier and paths of air infiltration/exfiltration shall be made air-tight.
3. Air Permeability: Maximum 0.04 cfm/sq.ft. @ 10.5 psf per ASTM E283.
4. Air Permeability: @ delta P of 0.3 inches water...0.002 CFM/ft² per ASTM E2178
5. ASTM E2357, Full Scale Wall Testing of the Air Barrier System
    a. System Air Leakage, Requirement - 0.0008 CFM/ft² maximum
    b. Penetration Check, Requirement - 0.00088 CFM/ft² maximum
6. ASTM E96 Water Vapor Permeance:10-20 Perms per Procedure B
7. ASTM E331, Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference - 10 psf for 2 hours.
8. Elongation: Minimum 50% per ASTM D412.
9. AATC 127 Water Resistance - Pass
10. ASTM D1970 Self Sealability - Pass
11. ICC-ES AC212, Freeze Thaw, Crack Bridging - Pass
12. Fire Testing: Air Barrier, as a component of a wall assembly, shall have passed a NFPA 285 complete wall fire test.
13. ASTM E84 Class A Fire Resistant
14. Listed as an evaluated assembly by the Air Barrier Association at www.airbarriers.org www.airbarriers.org.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Prior to commencing the Work, submit manufacturer’s independent Laboratory Report for the Air Barrier Assembly testing on ASTM E2357 tested on a steel stud frame wall, results are to be based on Specimen 2 testing only.

C. Prior to commencing the Work, submit documentation certifying that the air barrier system has been tested independently, indicating compliance with the performance requirements of the Air Barrier Association of Association.

D. Prior to commencing the Work, submit copies of manufacturers' literature for the system, membrane, primers, sealants, adhesives and associated auxiliary materials shall be included as parts of the system that is listed by the Air Barrier Association of America evaluation.
E. Prior to commencing the Work, submit references clearly indicating that the materials proposed have been installed for not less than three years on projects of similar scope and nature.
F. Prior to commencing the Work, submit manufacturers' complete set of standard details for air barrier/vapor retarders. The manufacturer's representative shall review the contract drawings and note any modifications required to make the system air and water tight.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Provide primary products, including each component of the air barrier membrane system, which has been commercially available for a minimum of 3 years.
B. Submit in writing, a document stating that the applicator of the primary air barrier membrane specified in this section is recognized by the manufacturer as suitable for the execution of the Work.
C. Perform Work in accordance with the printed requirements of the air barrier manufacturer and this specification.
D. Maintain one copy of manufacturer instructions on site.
E. At the beginning of the Work and at all times during the execution of the Work, allow access to Work site by the air barrier membrane manufacturer's representative.
F. Components used in this section shall be sourced from one manufacturer, including sheet membrane, air barrier sealants, primers, mastics, tapes and adhesives as listed as an evaluated air barrier assembly by the Air Barrier Association of America.
G. In lieu of above mentioned certifications, the building shall be tested and pass the ASTM E 2357, Specimen 2, Full Scale Wall Testing of the Air Barrier System to be compatible with the results of ABAA certifications, +/- 5%.

1.7 MOCK-UP

A. Construct mock-up in accordance with Section 01 4000 - Quality Requirements: Requirements for a mock-up.
B. Provide mock-up of air barrier materials under provisions of Section 04 2019 - Veneer Unit Masonry.
C. Items to be incorporated in mock-up include:
    1. Where directed by Architect, construct typical exterior wall panel, 8'-0" long by 8'-0" high, incorporating masonry veneer system, through wall flexible flashing, glass-faced gypsum sheathing, wall ties, board insulation, metal studs, aluminum curtain wall frame, aluminium window frame, showing air barrier membrane application details and transition membranes.
    2. Where directed by Architect, construct typical exterior wall panel, 8'-0" long by 8'-0"high, incorporating masonry veneer system, concrete masonry backup, wall ties, through wall flexible flashing, board insulation, aluminium window frame, showing air barrier membrane application details and transition membranes.
D. Allow 24 hours for inspection of mock-up by Architect before proceeding with air barrier work.

1.8 PRE-INSTALLATION CONFERENCE

A. Convene four weeks prior to commencing work of this section, under provisions of Section 01 3000 - Administrative Requirements: Pre-Installation Meeting. Attendance by the manufacturer's representative along with the installer is mandatory.
B. DO NOT PROCEED WITH THE INSTALLATION OF THE AIR BARRIER MEMBRANE AND THE THROUGH WALL FLASHING MEMBRANE PRIOR TO THE PRE-INSTALLATION CONFERENCE.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the job site in undamaged and original packaging indicating the name of the manufacturer and product.
B. All pail goods shall bear the ABAA Evaluated Air Barrier label.
C. Store roll materials on end in original packaging.

1. Keep all products stored at above 40°F. Apply to a substrate with a surface T°F of 40°F and rising. DO NOT ALLOW PRODUCT TO FREEZE.

D. Protect rolls from direct sunlight until ready for use.
E. Do not double stack pail goods.

1.10 COORDINATION

A. Ensure continuity of the air seal throughout the scope of this section.

1.11 AVAILABLE MANUFACTURERS

A. Substitutions - The product(s) referenced by the manufacturer listed, forms the basis of design. The contractor at their option may provide an alternate manufacturer as an equal, however, if an equal is proposed, the Contractor shall provide data from the specified manufacturer & product(s) as well as data from the proposed manufacturer for a comparison, review, and determination of acceptance (approval or disapproval) by the Architect. Approval cannot be made if adequate comparison information is not provided. Absence of specified manufacturers' data is grounds for disapproval.
B. Refer to Section 01 3000 - Administrative Requirements AND Section 01 6000 - Product Requirements for substitution procedures.

PART 2 - PRODUCTS

2.1 MEMBRANES

A. Liquid air barrier: One component elastomeric membrane, spray, trowel or brush applied, having the following characteristics and have passed all evaluations by the Air Barrier Association of America (ABAA) and be listed on their web site as having passed all the evaluations :
   1. Air permeability:
      a. Air Leakage Thru Cured Films: <0.04 cfm/ft2 @ 10.5 lbs/ ft2 or <0.005 L/sm2 @ 75 Pa to ASTM E283 (Modified) 24 hours, +/- 10%.
      b. Air Leakage per ASTM E2178, dry film, delta P of 0.3 inches of water, 0.002 +/- 10%
   2. Air Barrier System Test on Full Scale Wall Assembly, ASTM E2357
      a. System Air Leakage, 0.0008 CFM/ft² +/- 10%
      b. Penetrations Check, MUST PASS ASTM E2357 requirements
   3. Water Vapor permeance: (704 ng/Pa.m2.s.) 10 to 20 perms, ASTM E96 Method B. NOTE: The material specified is VAPOR PERMEABLE.
   4. Elongation (ASTM D412: >50%)
   5. Low temperature flexibility and crack bridging: Pass - ICC-ES AC212
   6. ASTM D1970, Self Sealability - Pass
   7. AATCC 127 Water Resistance - Pass
   8. ASTM E84, Class A Fire Resistant
   9. Recycle content >20%
B. Acceptable Manufacturers
   1. STS Coatings, Wall Guardian, 830-995-5177, www.wallguardian.com, a Certified Texas HUB
      a. FW-100A, a non-asphaltic product
   2. W.R. Meadows Air Shield LMP
      a. www.wrmeadows.com, T:(800) 342-5976
   3. Grace Construction Products, Perm-A-Barrier VP a non-asphaltic product.
   4. Sikagard 530 Liquid Applied Vapor Permeable Air Barrier (Acrylic-based).
   5. DuPont Tyvek Fluid Applied WB.
   6. Substitutions: See Section 01 6000 - Product Requirements.
C. Transition Membrane, Self-Adhering: Polymer-based, sheet membrane complete with polyester facing, and having the following physical properties:
   1. Thickness: 35 mils (0.5 mm) min.
   2. Vapor permeance: <0.1
   3. Low temperature flexibility: -20 F to CGSB 37-GP-56M;
   4. Elongation: >90% to ASTM D412-modifed

5. ASTM E331, 10 psf for 2 hours
    a. Acceptable material:
        1) UT-40 by STS Coatings for use with the FW-100 system.
        2) Substitutions: See Section 01 6000 - Product Requirements.
            (a) See article in PART 1 above entitled "Available Manufacturers".

D. Approved Applicators
1. Alamo Waterproofing, San Antonio, TX 210-648-2100
2. Alpha Insulation & Waterproofing, all offices in TX, 210-599-3333
3. Aquatech, Austin, TX, 512-251-2724
4. Diversified Thermal, Austin, TX, 512-267-1532
5. Kin Seal, Austin, TX, 512-252-8461
6. Turner Roofing Co., San Antonio, TX, 210-496-2256

2.2 PRIMER

A. Primer for self-adhering membranes: Synthetic polymer-based adhesive type, quick setting, having the following characteristics:
1. Acceptable material: As manufactured and/or recommended by the Air Barrier System manufacturer. Note: Primer shall be compatible with specified glass faced gypsum sheathing.
2. Verify compatibility of self-adhering membranes with preservative treated materials specified in Section 06 1000. Prime preservative treated materials as required using primer recommended by self-adhering membrane manufacturer or use the non-chemical thermally modified wood known as EcoPrem.

2.3 SEALANTS

A. Sealants shall be compatible with air barrier assembly and shall be approved by the air barrier manufacturer.
B. Products:
1. STS Coatings LT-100 Liquid Tape for concealed applications only and Great Seal PE-150 for concealed and exposed applications.
C. Primers: As recommended by manufacturer for surfaces to be sealed.
D. Backer Rods: As recommended by sealant manufacturer.
E. Substitutions: See Section 01 6000 - Product Requirements.
1. See article in PART 1 above entitled "Available Manufacturers".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the Work of this section. Notify Architect in writing of any discrepancies. Commencement of the work or any parts thereof shall mean acceptance of the prepared substrate.

3.2 PREPARATION

A. All surfaces must be sound, dry, clean and free of oil, grease, dirt, excess mortar or other contaminants. Fill spalled areas in substrates to provide an even plane.
B. Mortar joints in concrete block and form tie holes/voids in poured concrete shall be filled flush and smooth and allowed to be cured for a minimum of 24 hours.
C. All joints between gypsum sheathing, roof board, masonry and concrete and other substrate joints up to 1/4” wide shall be treated:
1. STS Coatings LT-100 Liquid Tape, www.stscoatings.com.
2. York Manufacturing, US-100, www,yorkmfg.com
3. Substitutions: See Section 01 6000 - Product Requirements.
4. Others as recommended by manufacturer
D. All joints between gypsum sheathing, roof board, masonry and concrete and other substrates wider than 1/4” shall be sealed with:
1. UT-40, overlapping each side of joint a minimum of 3 inches
2. Substitutions: See Section 01 6000 - Product Requirements.

3. Others as recommended by manufacturer

E. Install backer rod and sealant at the following joints:
   1. All expansion/control/erection joints between concrete wall panels.
   2. All expansion/control joints in concrete block back-up.
   3. All joints between concrete wall panels and concrete block back-up.

3.3 PRIMER FOR TRANSITION MEMBRANE (Self-Adhering Type only)

A. Apply primer for self-adhering membranes at rate recommended by manufacturer.
B. Apply primer to all areas to receive transition sheet membrane as indicated in Drawings by roller or spray and allow minimum 30 minute open time. Primed surfaces not covered by transition membrane during the same working day must be re-primed.

3.4 TRANSITION MEMBRANE (Self-Adhering Type)

A. Align and position self-adhering transition membrane, remove protective film and press firmly into place. Ensure minimum 2 inch overlap at all end and side laps unless otherwise noted.
B. Tie-in to roofing system and at the interface of dissimilar materials as indicated in Drawings.
C. Promptly roll all laps and membrane with a counter top roller to affect seal.
D. Ensure all preparatory work is complete prior to applying liquid membrane.

3.5 PRIMARY AIR BARRIER

A. Apply by spray or roller, a complete and continuous unbroken film at a temperature of 40°F and rising with less than a 30% chance of rain in the next 18 hours and apply at the same rate as listed in the Air Barrier Association of America evaluation
   1. Exterior Gypsum Sheathing, Plywood or OSB
      a. Wall Guardian FW-100A at a minimum of 2.5 gallons per 100 ft² (40 ft²/gallon) (40 wet mils)
      b. Substitutions: See Section 01 6000 - Product Requirements.
      c. Others meeting stated requirements
      d. Spray around all projections, including masonry veneer anchors, ensuring a complete and continuous air seal.
   2. Concrete Masonry Unit (CMU), Concrete
      a. Wall Guardian FW-100A at a minimum of 2.5 gallons per 100 ft² (40 ft²/gallon) (equal to 40 wet mils on a smooth surface)
      b. Substitutions: See Section 01 6000 - Product Requirements.
      c. Others meeting stated requirements
      d. Spray around all projections including masonry veneer anchors ensuring a complete and continuous air seal.

3.6 INSPECTION

A. Notify Architect when sections of work are complete so as to allow for review prior to installing insulation. The manufacturer's representative shall be on site to review the installation along with the Architect.

3.7 PROTECTION OF FINISHED WORK

A. Liquid membranes are not designed for permanent exposure. Cover the liquid membrane, as recommended by the manufacturer, within the following time frames. Contractor shall verify the number of calendar days with the air barrier manufacturer:
B. Cover the Wall Guardian material within 180 calendar days after installation. The nature of this product is such that some surface weathering may become apparent during exposure. This is a surface effect only and does not impact air barrier system performance.
C. Transition membranes shall be covered within 180 days after installation
D. Prepare, treat and seal vertical and horizontal surfaces at terminations and penetrations through the air barrier and at protrusions according to air barrier manufacturer's written instructions.

3.8 SCHEDULE

A. Install liquid membrane system over the entire surface of the glass faced sheathing in the following area. Seal any masonry anchor penetrations air tight.

1. In the masonry cavity wall.

B. Install liquid membrane system over the entire surface of the outer surface of the inner wythe of masonry. Seal any masonry anchor penetrations air tight.

C. Install liquid membrane system over the entire surface of the outer surface of the concrete wall panels. Seal any masonry anchor penetrations air tight.

D. Install liquid membrane system over the entire surface of the glass faced gypsum sheathing and/or roof board in the following area:
   1. Behind the metal parapet panels.
   2. Behind the metal wall and soffit panels.

E. Hollow Metal Door Frames: Seal door frame to wall surface with transition membrane.

F. Wall and Roof Junction: Seal wall to roof with transition membrane.

G. Seal joints in glass-faced sheathing with tape in the following areas:
   1. Cement plaster soffit.

H. Seal the top of sheathing to the underside of the roof assembly with foam or LT-100.

I. Openings: Seal around the perimeter of all openings with transition membrane.

J. Perimeter wood nailers at wall openings: Cover all exposed surfaces of wood nailers with transition membrane. Extend membrane over sheathing, masonry and metal framing as shown.

K. Aluminum window frames with nailing flanges: Seal the nailing flanges to the wall surface with transition membrane.

L. Aluminum window frames without nailing flanges: Seal frames to the wall surface with transition membrane.

M. Aluminum storefront frames: Seal frames to the wall surface with transition membrane.

N. Aluminum curtain wall frames: Seal frames to wall surface with transition membrane.

END OF SECTION

SECTION 07 4113
METAL ROOF PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Structural roofing system of preformed steel panels.
B. Thermal roof insulation.
C. Fastening system.
D. Factory finishing.
E. Accessories and miscellaneous components.

1.2 RELATED REQUIREMENTS

A. Section 07 4213 - Metal Wall Panels: Preformed wall panels.

1.3 REFERENCE STANDARDS

A. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2010.
B. ASTM C1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus; 2011.
C. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference; 2005 (Reapproved 2012).

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Manufacturer's data sheets on each product to be used, including:
    1. Storage and handling requirements and recommendations.
    2. Installation methods.
    3. Specimen warranty.
C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
    1. Show work to be field-fabricated or field-assembled.
    2. Include structural analysis signed and sealed by qualified structural engineer, indicating conformance of roofing system to specified loading conditions.
D. Test Reports: Indicate compliance of metal roofing system to specified requirements.
E. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.
F. LEED Submittals
    1. Product Test Reports for Credit SS 7.2: For roof panels, documentation indicating that panels comply with Solar Reflectance Index requirement.
    2. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in the manufacture of roofing systems similar to those required for this project.
    1. Not less than 5 years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.
B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.7 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Finish Warranty: Provide manufacturer’s special warranty covering failure of factory-applied exterior finish on metal roof panels and agreeing to repair or replace panels that show evidence

of finish degradation, including significant fading, chalking, cracking, or peeling within specified warranty period of 20 year period from date of Substantial Completion.

C. Waterproofing Warranty: Provide manufacturer's warranty for weathertightness of roofing system, including agreement to repair or replace roofing that fails to keep out water within specified warranty period of 20 years from date of Substantial Completion.

D. Contractor shall correct defective Work within a two year period after Date of Substantial Completion; remove and replace materials concealing defective work at no extra cost to Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Design is based on _____, manufactured by _____.

B. Metal Roof Panels:
   1. Berridge Manufacturing Co: www.berridge.com.
   2. Butler Manufacturing: www.butlermfg.com..

C. Substitutions: See Section 01 6000 - Product Requirements.

2.2 STRUCTURAL METAL ROOF PANELS

A. Structural Metal Roofing: Provide complete roofing assemblies, including roof panels, clips, fasteners, connectors, and miscellaneous accessories, tested for conformance to the following minimum standards:
   1. Structural Design Criteria: Provide panel assemblies designed to safely support design loads at support spacing indicated, with deflection not to exceed 1/180 of the span when tested in accordance with ASTM E1592.
      a. Live Loads: As indicated on drawings.
   2. Overall: Complete weathertight system tested and approved in accordance with ASTM E1592.
   3. Thermal Movement: Design system to accommodate without deformation anticipated thermal movement over ambient temperature range of 100 degrees F (56 degrees C).
   4. Thermal Performance: Provide thermal resistance through entire system, R-value (RSI-value) of 15 deg F hr sq ft/BTU; 2 inch thick (2.6 K sq m /W; 50.8 mm thick), when tested in accordance with ASTM C1363.

B. Metal Panels: Factory-formed panels with factory-applied finish.
   1. Type: Double skin, factory-assembled with foamed-in-place urethane insulation.
   2. Steel Panels:
      a. Aluminum-zinc alloy-coated SS (structural steel) sheet conforming to ASTM A792/A792M; minimum AZ55 (AZM165) coating.
      b. Steel Thickness: Minimum 24 gage (0.024 inch) (0.61 mm).
   3. Profile: Standing seam, with minimum 2.0 inch (51 mm) seam height; concealed fastener system for field seaming with special tool.
   4. Texture: Smooth.
   5. Width: Maximum panel coverage of 24 inches (610 mm).

2.3 PERFORMANCE REQUIREMENTS

A. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

2.4 PANEL MATERIALS

A. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

B. Recycled Content of Steel Sheet: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.5 ATTACHMENT SYSTEM

A. Concealed System: Provide manufacturer's standard stainless steel or nylon-coated aluminum concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

2.6 PANEL FINISH

A. Fluoropolymer Coating System: Manufacturer's standard multi-coat thermocured coating system, including minimum 70 percent fluoropolymer color topcoat with minimum total dry film thickness of 0.9 mil (0.023 mm); color and gloss to match sample.

2.7 ACCESSORIES AND MISCELLANEOUS ITEMS

A. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.
B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam.
C. Sealants:
    1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
    2. Concealed Sealant: Non-curing butyl sealant or tape sealant.

2.8 FABRICATION

A. Panels: Fabricate panels and accessory items at factory, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.

PART 3 EXECUTION

3.1 PREPARATION

A. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to assure that the completed roof will be free of leaks.
B. Remove protective film from surface of roof panels immediately prior to installation. Strip film carefully, to avoid damage to prefinished surfaces.
C. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by roof panel manufacturer.
D. Where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.2 INSTALLATION

A. Overall: Install roofing system in accordance with approved shop drawings and panel manufacturer's instructions and recommendations, as applicable to specific project conditions. Anchor all components of roofing system securely in place while allowing for thermal and structural movement.
    1. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.
    2. Minimize field cutting of panels. Where field cutting is absolutely required, use methods that will not distort panel profiles. Use of torches for field cutting is absolutely prohibited.
B. Accessories: Install all components required for a complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, rib closures, ridge closures, and similar roof accessory items.
C. Roof Panels: Install panels in strict accordance with manufacturer's instructions, minimizing transverse joints except at junction with penetrations.
    1. Form weathertight standing seams incorporating concealed clips, using an automatic mechanical seaming device approved by the panel manufacturer.

3.3 PROTECTION

A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.
B. Touch-up, repair, or replace damaged roof panels or accessories before date of Substantial Completion.

END OF SECTION

SECTION 07 4213
METAL WALL PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Manufactured metal panels for walls and soffits, with insulation, liners, related flashings, and accessory components.

1.2 RELATED REQUIREMENTS
- A. Section 13 3419 - Metal Building Systems.

1.3 REFERENCE STANDARDS
- A. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2010.

1.4 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate dimensions, layout, joints, construction details, methods of anchorage.
- C. Samples: Submit two samples of wall panel and soffit panel, 12 inch (300 mm) by 24 inch (600 mm) in size illustrating finish color, sheen, and texture.
- D. LEED Submittals
  1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

1.5 QUALITY ASSURANCE
- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in installing the products specified in this section with minimum three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING
- A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- B. Store prefinished material off ground and protected from weather. Prevent twisting, bending, or abrasion, and provide ventilation to stored materials. Slope metal sheets to ensure drainage.
- C. Prevent contact with materials that may cause discoloration or staining of products.

1.7 WARRANTY
- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion for degradation of panel finish, including color fading caused by exposure to weather.
- C. Correct defective Work within a five year period after Date of Substantial Completion, including defects in water tightness and integrity of seals.

PART 2 PRODUCTS

2.1 MANUFACTURERS
- A. MBCI .
- B. Other Acceptable Manufacturers:
  1. Substitutions: See Section 01 6000 - Product Requirements.

2.2 MANUFACTURED METAL PANELS
- A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
  1. Provide exterior panels, interior liner panels, soffit panels, and subgirt framing assembly.
  2. Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall.
  3. Design Pressure: In accordance with applicable codes.

4. Maximum Allowable Deflection of Panel: 1/90 of span.
5. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement within system; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
6. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
7. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
8. Corners: Factory-fabricated in one continuous piece with minimum 18 inch (450 mm) returns.
9. Exterior Finish: Panel manufacturer's standard polyvinylidene fluoride (PVDF) coating, top coat over epoxy primer.
10. Exterior Panel Back Coating: Panel manufacturer's standard polyester wash coat.
11. Interior Panel Finish: Panel manufacturer's standard polyester coating, top coat over recommended primer.

B. Exterior Panels:
1. Profile: Vertical and horizontal, as indicated.
2. Styles:
a. MBCI 7.2 Wall Panels-Metal Prefinished 36 inch
b. MBCI 7.2 Panel LTD – High Strength Fiberglass, White 36 inch translucent
c. MBCI PBU 0.024 aluminum, clear perforated 36 inch
1) Holes: Approx. 1/8’ diam. On .3274 staggered centers
2) Sheet: Approx. 13% open, 87% solid
d. MBCI Corrugated Galvalume 24 inches wide
e. MBCI Special Order 16 inches wide
3. Side Seams: Double-interlocked, tight-fitting, sealed with continuous gaskets.
4. Panel Width: 16, 24 and 36 inches (___ mm).
5. Color: As indicated on drawings.

C. Liner Panels:
1. Profile: Vertical; style as indicated.
2. Side Seams: Interlocking, sealed with continuous bead of sealant.
3. Panel Width: ___ inch (___ mm).

D. Soffit Panels:
1. Profile: MBCI Artisan Soffit Panels 12 inches.
2. Color: As indicated on drawings.

E. Subgirts:

F. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.

G. Expansion Joints: Same material, thickness and finish as exterior sheets; thickness as recommended by manufacturer; manufacturer's standard brake formed type, of profile to suit system.

H. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

I. Anchors: Galvanized steel.

2.3 MATERIALS

A. Precoated Steel Sheet: Aluminum-zinc alloy-coated steel sheet, ASTM A792/A792M, Commercial Steel (CS)) or Forming Steel (FS), with AZ50/AZM150 coating; continuous-coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

B. Recycled Content of Steel Sheet: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.4 ACCESSORIES

A. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant.

B. Sealants:

1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
2. Concealed Sealant: Non-curing butyl sealant or tape sealant.

C. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, steel, hot dip galvanized. Fastener cap same color as exterior panel.
D. Bituminous Paint: Asphalt base.

PART 3 EXECUTION

3.1 EXAMINATION
A. Verify that building framing members are ready to receive panels.
B. Verify that water-resistive barrier has been installed over substrate completely and correctly.

3.2 PREPARATION
A. Install subgirts perpendicular to panel length, securely fastened to substrates and shimmed and leveled to uniform plane. Space at intervals indicated.

3.3 INSTALLATION
A. Install panels on walls and soffits in accordance with manufacturer's instructions.
B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.
C. Fasten panels to structural supports; aligned, level, and plumb.
D. Locate joints over supports. Lap panel ends minimum 2 inches (50 mm).
E. Provide expansion joints where indicated.
F. Use concealed fasteners unless otherwise approved by Architect.
G. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.4 TOLERANCES
A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch (1.6 mm).
B. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch (6 mm).

3.5 CLEANING
A. Remove site cuttings from finish surfaces.
B. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

END OF SECTION

SECTION 07 6200
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Fabricated sheet metal items, including flashings and counterflashings.
- B. Sealants for joints within sheet metal fabrications.

1.2 REFERENCE STANDARDS
- A. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.
- B. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012)e1.

1.3 ADMINISTRATIVE REQUIREMENTS
- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.4 QUALITY ASSURANCE
- A. Perform work in accordance with SMACNA 1793 and CDA A4050 requirements and standard details, except as otherwise indicated.

1.5 WARRANTY
- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Contractor shall correct defective Work within a two year period after Date of Substantial Completion; remove and replace materials concealing defective work at no extra cost to Owner.

PART 2 PRODUCTS

2.1 SHEET MATERIALS
- A. Galvalume: ASTM A 792/A 792 M-97a, Standard Specification for Sheet Steel, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; A coating of 55% Al-Zn on steel sheet.
- B. Acrylic Coated Galvalume: ASTM A 792/A 792 M-97a, Standard Specification for Sheet Steel, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; A coating of 55% Al-Zn on steel sheet with a rolled, uniform, thin film of a water-base acrylic solution onto both surfaces of the sheet which is then heated to dry the film.
- C. Prefinished Color Coat Galvalume: ASTM A 792/A 792 M-97a, Standard Specification for Sheet Steel, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; A coating of 55% Al-Zn on steel base sheet, shop pre-coated with PVDF coating.
  1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; Color as selected by Architect from manufacturer's complete line of colors, including premium colors.

2.2 ACCESSORIES
- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Primer: Zinc chromate type.
- C. Protective Backing Paint: Zinc molybdate alkyd.
- D. Sealant to be Concealed in Completed Work: Non-curing butyl sealant.
- E. Sealant to be Exposed in Completed Work: ASTM C920; elastomeric sealant, 100 percent silicone with minimum movement capability of plus/minus 25 percent and recommended by manufacturer for substrates to be sealed; clear.
- F. Plastic Cement: ASTM D4586, Type I.

2.3 FABRICATION
- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18 inch (450 mm) long legs; seam for rigidity, seal with sealant.
F. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

PART 3 EXECUTION

3.1 EXAMINATION
A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION
A. Install starter and edge strips, and cleats before starting installation.
B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).

3.3 INSTALLATION
A. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.
B. Apply plastic cement compound between metal flashings and felt flashings.
C. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

3.4 FIELD QUALITY CONTROL
A. See Section 01 4000 - Quality Requirements, for field inspection requirements.
B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION

SECTION 07 9005
JOINT SEALERS

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Sealants and joint backing.
- B. Precompressed foam sealers.

1.2 RELATED REQUIREMENTS
- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 07 2727 - Fluid-Applied Vapor Permeable Membrane Air Barrier System Assembly, for air barrier and transition membrane sealer around all wall penetrations.
- C. Section 07 8400 - Firestopping: Firestopping sealants.

1.3 REFERENCE STANDARDS
- A. ASTM C834 - Standard Specification for Latex Sealants; 2014.
- B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.
- C. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

1.4 ADMINISTRATIVE REQUIREMENTS
- A. Coordinate the work with other sections referencing this section.

1.5 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating sealant chemical characteristics.
- C. LEED Report: Submit VOC content documentation for all non-preformed sealants and primers.
  1. Product Data for Credit IEQ 4.1: For sealants and sealant primers used inside the weatherproofing system, documentation including printed statement of VOC content.

1.6 QUALITY ASSURANCE
- A. Maintain one copy of each referenced document covering installation requirements on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- C. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.7 FIELD CONDITIONS
- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.8 WARRANTY
- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.1 SEALANT CLASSIFICATION
- A. Sealants are classified according to ASTM C 920, Standard Specification for Elastomeric Joint Sealants. They are classified as to **Type**, **Grade**, **Class**, and **Use** as follows:
  1. Type S - A single component sealant;
  2. Type M - A Multicomponent Sealant;
  3. Grade P - A pourable or selfleveling sealant. Used on horizontal surfaces;
  4. Grade NS - Nonsag or gunnable sealant that permits vertical application.
  5. Class 25 - Sealant which can withstand increase and decrease in joint width of at least 25%.

6. Class 12 1/2 - Sealant which can withstand increase and decrease in joint width of at least 12.5%.
7. Use T - A sealant designed for use for joints in pedestrian and vehicular traffic areas.
8. Use NT - A sealant designed for use in nontraffic areas.
9. Use I - Sealant for use in joints submerged continuously in a liquid.
10. Use M - Sealant that meets requirements when tested on Mortar specimens.
11. Use G - Sealant that meets requirements when tested on Glass specimens.
12. Use A - Sealant that meets requirements when tested on Aluminum specimens.
13. Use O - Sealant that meets requirements when tested on Other than the standard substratess (M, G, and A).

B. Sealants are classified according to ASTM C 834, Standard Specification for Latex Sealants. They are classified as to **Type** and **Grade** as follows:
1. Type OP - an opaque sealant containing color pigments or extender pigments, or both, that has no more than 30% volume shrinkage. (According to Test Method ASTM C 1241.)
2. Type C - A clear or transluscent sealant that has no more than 50% volume shrinkage. (According to Test Method ASTM C 1241.)
3. Grade -18°C - A sealant that meets the requirements for low temperature flexibility when tested at -18°C (0°F).
4. Grade 0°C - A sealant that meets the requirements for low temperature flexibility when tested at 0°C (32°F).
5. Grade NF - A sealant that does not meet the requirements for low temperature flexibility of Grade 0°C (above).

2.2 SEALANTS, GENERAL

A. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

2.3 SEALANTS

A. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

B. Type GPX - General Purpose Exterior Sealant: Polyether; ASTM C920, Type S, (Type M for specific color required) Grade NS, Class 25, Uses M, G, and A; single component.
1. Color: To be selected by Architect from manufacturer's standard range.
2. Applications: Use for:
   a. Control, expansion, and soft joints in masonry.
   b. Joints between concrete and other materials.
   c. Joints between metal frames and other materials.
   d. Other exterior joints for which no other sealant is indicated.
3. Polyether Products:
   a. Sonolastic 150 Tint Base manufactured by Sonneborn. (Multi-component, 400+ colors available)
   b. Sonolastic 150 VLM manufactured by Sonneborn. (For use with EIFS materials)
   c. Substitutions: See Section 01 6000 - Product Requirements.

C. Type XEJFM - Exterior Expansion Joint Sealer: Silicone facing over Precompressed foam sealer; silicone and impregnated foam; water-repellent; For use at vehicular traffic.
1. Face color: Gray.
2. Size as required to provide watertight seal when installed.
3. Product: DSM System manufactured by EMSEAL.
4. Applications: Use for:
   a. Exterior wall expansion joints.
5. Substitutions: See Section 01 6000 - Product Requirements.

D. Type FFEF - Exterior Factory-Faced Expanding Foam (Joint) Sealant System: Laminated layers of open cell polyurethane foam impregnated with a water-based, stabilized, polymer-

modified acrylic with a factory-applied silicone external and color weather facing over the laminations.

1. Color: As selectd by Architect from manufacturers complete line of colors, including premium priced colors.
2. Change color of facing material where it bridges across dissimilar materials
3. Size as required to provide weathertight and watertight seal when installed. Verify recommended size with manufacturer.
4. Product: Colorseal at building; DSM System at parking decks manufactured by Emseal.
5. Applications: Use for:
    a. Exterior wall panel joints at building exterior and precast concrete.

E. Type EJMS - Exterior Expansion Joint Material Strip: A continuous elastomeric strip with polyester fleece embedded in each selvage edge on both sides (no fleece on the actual expanding center section).

1. Color: Manufacturers standard color.
2. Size as required to provide weathertight and watertight seal when installed. Verify recommended size with manufacturer.
3. Product: RedLine 20 manufactured by Situra, Inc..
4. Applications: Use for:
    a. Expansion joints on outside face (within cavity) of back-up wall.

F. Type LAP - Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, nondrying, nonskinning, noncuring.

1. Applications: Use for:
    a. Concealed sealant bead in sheet metal work.
    b. Concealed sealant bead in siding overlaps.

G. Type GPI - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.

1. Color: To be selected by Architect from manufacturer's standard range.
2. Applications: Use for:
    a. Interior wall and ceiling control joints.
    b. Joints between door and window frames and wall surfaces.
    c. Other interior joints for which no other type of sealant is indicated.
3. Products:
    a. Pecora Corporation; AC-20 + Silicone Acrylic Latex Caulking Compound: www.pecora.com.
    b. Sherwin-Williams Company; White Lightning 3006 Siliconized Acrylic Latex Caulk: www.sherwin-williams.com.
    c. Sherwin-Williams Company; 950A Siliconized Acrylic Latex Caulk: www.sherwin-williams.com.
    d. Substitutions: See Section 01 6000 - Product Requirements.

H. Type BTT - Bathtub/Tile Sealant: White silicone; ASTM C920, Uses I, M and A; single component, mildew resistant.

1. Applications: Use for:
    a. Joints between plumbing fixtures and floor and wall surfaces.
    b. Joints between kitchen and bath countertops and wall surfaces.

I. Type ___ - Acoustical Sealant for Concealed Locations:

1. Composition: Acrylic latex emulsion sealant.
2. Applications: Use for concealed locations only:
    a. Sealant bead between top stud runner and structure and between bottom stud track and floor.

J. Type IFJT - Interior Floor Joint Sealant: Polyurethane, self-leveling; ASTM C920, Grade P, Class 25, Uses T, M and A; single component.

1. Color: To be selected by Architect from manufacturer's standard range.
2. Applications: Use for:
    a. Expansion joints in floors.

K. Type PAV - Concrete Paving Joint Sealant: Polyurethane, self-leveling; ASTM C920, Class 25, Uses T, I, M and A; single component.

1. Applications: Use for:
    a. Joints in sidewalks and vehicular paving.
2. Products:
    a. Pecora Corporation; NR-201 Self-Leveling Traffic and Loop Sealant: www.pecora.com.
    b. Sherwin-Williams Company; Stampede 2SL Polyurethane Sealant: www.sherwin-williams.com.
    c. Substitutions: See Section 01 6000 - Product Requirements.

L. Type ___ - Silicone Sealant: ASTM C920, Grade NS, Class 25 minimum; Uses NT, A, G, M, O; single component, neutral curing, non-sagging, non-staining, fungus resistant, non-bleeding.
1. Color: To be selected by Architect from manufacturer's standard range.
2. Movement Capability: Plus and minus 25 percent.
3. Service Temperature Range: -65 to 180 degrees F (-54 to 82 degrees C).
4. Shore A Hardness Range: 15 to 35.

2.4 SEMI-RIGID JOINT FILLER - POLYUREA

A. Type SRJFP - Semi-rigid joint filler, fast setting polyurea, two-component, interior, full depth,
1. Color: As determined by Architect from manufacturers full color selection.
2. Product:
    a. EUCO Quickjoint 200 as manufactured by Euclid Chemical Company. TF: (800) 321-7628; T: (216) 531-9222; F: (216) 531-9596; Email: info@euclidchemical.com; www.tamms.com.
        1) Tensil Strength: >800 psi (>5.52 MPa) per ASTM D638.
        2) Elongation: 200 to 250%, per ASTM D412.
        3) Tensile Modulus: 800 psi (>5.52 MPa) per ASTM D412.
        4) Shore D Hardness: 32 to 38, per ASTM D2240.
        5) Shore A Hardness: 88 to 90 per ASTM D2240.
        6) Complies with ACI 302 performance recommendations regarding control and construction joint fillers.
        7) Complies with USDA and Canadian Food Inspection Agency.

2.5 SEMI-RIGID JOINT FILLER - EPOXY

A. Type SRJFE - Epoxy joint filler, semi-rigid joint filler, low shrink, moisture insensitive, two-component, interior, full depth,
1. Color: As determined by Architect from manufacturers full color selection.
2. Product:
    a. EUCO 700 as manufactured by Euclid Chemical Company. TF: (800) 321-7628; T: (216) 531-9222; F: (216) 531-9596; Email: info@euclidchemical.com; www.tamms.com.
        1) Compressive Strength: @72 hours 3000 psi (20.7 MPa) per ASTM D695.
        2) Tensil Strength: 7 days 690 psi (4.6 MPa) per ASTM D638.
        3) Elongation: 7 days 55%, per ASTM D638.
        4) Water Absorption: 72 hour immersion 1.1% per ASTM D570.
        5) Shore D Hardness: 7 days 55, per ASTM D2240.
        6) Shore A Hardness: >100.
    b. ((Insert next product here)) x

END OF SECTION

SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Non-fire-rated steel doors and frames.
- B. Steel frames for wood doors.
- C. Fire-rated steel doors and frames.
- D. Thermally insulated steel doors.
- E. Sound-rated steel doors and frames.
- F. Steel glazing frames.

1.2 RELATED REQUIREMENTS
- A. Section 08 7100 - Door Hardware.
- B. Section 08 8000 - Glazing: Glass for doors and borrowed lites.
- C. Section 09 9113 - Exterior Painting: Field painting.

1.3 REFERENCE STANDARDS
- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.
- E. ASTM C1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus; 2011.
- F. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.
- G. ASTM E413 - Classification for Rating Sound Insulation; 2010.
- H. ICC A117.1 - Accessible and Usable Buildings and Facilities; International Code Council; 2009 (ANSI).
- I. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; The National Association of Architectural Metal Manufacturers; 2007.
- J. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2013.
- K. TAS - Texas Accessibility Standards: Required compliance for handicapped accessibility in Texas.
- L. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.
- M. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.4 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.
- D. Samples: Submit two samples of metal, 2 x 2 inches (50 x 50 mm) in size showing factory finishes, colors, and surface texture.
- E. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
- F. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE
- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Maintain at the project site a copy of all reference standards dealing with installation.

1.6 DELIVERY, STORAGE, AND HANDLING
- A. Store in accordance with NAAMM HMMA 840.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

1.7 AVAILABLE MANUFACTURERS
- A. Substitutions: The product(s) referenced by the list of manufacturers provided, form the basis of design. The contractor at their option may provide an alternate manufacturer as an equal, however, if an equal is proposed, the Contractor shall provide data from one of the specified manufacturers as well as data from the proposed manufacturer for a comparison, review, and determination of acceptance (approval or disapproval) by the Architect. Approval cannot be made if adequate comparison information is not provided. Absence of specified manufacturers' data is grounds for disapproval.
- B. Refer to Section 01 3000 - Administrative Requirements AND Section 01 6000 - Product Requirements for substitution procedures.

1.8 WARRANTY
- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Contractor shall correct defective Work within a two year period after Date of Substantial Completion; remove and replace materials concealing defective work at no extra cost to Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS
- A. Steel Doors and Frames:
  1. Assa Abloy Ceco, Curries, or Fleming: www.assaabloydss.com.
  2. Republic Doors: www.republicdoor.com.
  3. Steelcraft, an Allegion brand: www.allegion.com/us.
  4. Technical Glass Products; SteelBuilt Window & Door Systems: www.tgpamerica.com.
  5. Substitutions: See Section 01 6000 - Product Requirements.
     a. See article in PART 1 above entitled "Available Manufacturers".

2.2 DOORS AND FRAMES
- A. Requirements for All Doors and Frames:
  1. Accessibility: Comply with ICC A117.1 and ADA Standards.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.3 STEEL DOORS
- A. Exterior Doors:
  1. Grade: ANSI/SDI A250.8 (SDI-100); Level 1 - Standard-Duty, Physical Performance Level C, Model 1 - Full Flush.
  2. Core: Polystyrene.
  3. Thickness: 1-3/4 inch (44.5 mm).
  4. Top Closures for Outswinging Doors: Flush with top of faces and edges.
  5. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
  6. Texture: Smooth faces.
  7. Insulating Value: U-value of 0.50, when tested in accordance with ASTM C1363.
  8. Weatherstripping: Separate, see Section 08 7100.
  9. Finish: Factory primed, and field finished.
- B. Interior Doors, Non-Fire-Rated:
  1. Grade: ANSI/SDI A250.8 (SDI-100); Level 1 - Standard-Duty, Physical Performance Level C, Model 1 - Full Flush.
  2. Core: Polystyrene.
  3. Thickness: 1-3/4 inch (44.5 mm).

4. Texture: Smooth faces.
5. Finish: Factory primed, for field finishing.

C. Interior Doors, Fire-Rated:
1. Grade: ANSI/SDI A250.8 (SDI-100); Level 1 - Standard-Duty, Physical Performance Level C, Model 1 - Full Flush.
2. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with UL 10C ("positive pressure").
a. Provide units listed and labeled by UL (Underwriters Laboratories) - UL (BMD).
b. Attach fire rating label to each fire rated unit.
3. Core: Mineral board.
4. Thickness: 1-3/4 inch (44.5 mm).
5. Texture: Smooth faces.
6. Finish: Factory primed, for field finishing.

D. Interior Doors, Sound-Rated:
1. Grade: ANSI/SDI A250.8 (SDI-100); Level 1 - Standard-Duty, Physical Performance Level C, Model 2 - Seamless.
2. Acoustic Rating of Assembled Door, Frame, and Seals: STC of 45, calculated in accordance with ASTM E413, tested in accordance with ASTM E90.
3. Core: Polyurethane.
4. Texture: Smooth faces.
5. Finish: Factory primed, for field finishing.
6. Sound Seals: Integral, concealed in door and/or frame.
7. Force to Open and Close and Latch: Not more than 5 lbs (22.2 N).

2.4 STEEL FRAMES

A. General:
1. Comply with the requirements of grade specified for corresponding door.
a. ANSI/SDI A250.8 (SDI-100), Level 2 and 3 Door Frames: 14 gage, 0.067 inch (1.7 mm), minimum thickness.
b. Frames for Wood Doors: Comply with frame requirements in accordance with ANSI/SDI A250.8 (SDI-100), Level 1, 18 gage, 0.042 inch (1.0 mm), minimum thickness.
c. Frames for Sound-Rated Wood Doors: Comply with frame requirements in accordance with ANSI/SDI A250.8 (SDI-100), Level 1, 18 gage, 0.042 inch (1.0 mm), minimum thickness.

B. Exterior Door Frames: Face welded, seamless with joints filled.
1. Weatherstripping: Separate, see Section 08 7100.

C. Interior Door Frames, Non-Fire-Rated: Knockdown type.

D. Interior Door Frames, Fire-Rated: Knockdown type.
1. Fire Rating: Same as door, labeled.

E. Sound-Rated Door Frames: Knockdown type.

F. Frames for Interior Glazing or Borrowed Lights: Construction and face dimensions to match door frames, and as indicated on drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

3.2 INSTALLATION

A. Install in accordance with the requirements of the specified door grade standard and NAAMM HMMA 840.

B. In addition, install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Coordinate installation of hardware.

E. Coordinate installation of glazing.

3.3 TOLERANCES

A. Clearances Between Door and Frame: As indicated in ANSI/SDI A250.8 (SDI-100).

B. Maximum Diagonal Distortion: 1/16 in (1.5 mm) measured with straight edge, corner to corner.

3.4 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Adjust sound control doors so that seals are fully engaged when door is closed.

END OF SECTION

SECTION 08 1416
FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Flush wood doors; flush configuration; fire rated, non-rated, and acoustical.

1.2 RELATED REQUIREMENTS
- A. Section 08 1213 - Hollow Metal Frames.
- B. Section 08 7100 - Door Hardware.
- C. Section 08 8000 - Glazing.
- D. Section 09 2116 - Gypsum Board Assemblies: Bullet-resistant sheathing and wallboard for bullet-resistant partitions and walls.
- E. Section 09 9000 - Painting and Coating: Field finishing of doors and frames wuth Special Coating..

1.3 REFERENCE STANDARDS
- A. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.
- B. ASTM E413 - Classification for Rating Sound Insulation; 2010.
- C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
- D. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2013.
- E. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association; 2012.
- F. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.4 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
- D. Specimen warranty.
- E. Test Reports: Show compliance with specified requirements for the following:
  1. Sound-retardant doors and frames; sealed panel tests are not acceptable.
- F. Samples: Submit two samples of door construction, 8 x 10 inch (200 x 250 mm) in size cut from top corner of door.
- G. Samples: Submit two samples of door veneer, 8 x 10 inch (200 x 250 mm) in size illustrating wood grain, stain color, and sheen.
- H. Manufacturer's Installation Instructions: Indicate special installation instructions.
- I. Warranty, executed in Owner's name.
- J. LEED Submittals
  1. Certificates for Credit MR 6: Chain-of-custody certificates indicating that flush wood doors comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
  2. Product Data for Credit IEQ 4.4: For adhesives and composite wood products, documentation indicating that product contains no urea formaldehyde

1.5 QUALITY ASSURANCE
- A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
  1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.

2. A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body

C. Installed Fire Rated Door and Transom Panel Assembly: Conform to NFPA 80 for fire rated class as indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.
B. Accept doors on site in manufacturer's packaging. Inspect for damage.
C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.7 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.
D. Contractor shall correct defective Work within a two year period after Date of Substantial Completion; remove and replace materials concealing defective work at no extra cost to Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Wood Veneer Faced Doors:
1. V-T Industries: www.vtindustries.com
2. Eggers Industries: www.eggersindustries.com.
3. Graham Wood Doors: www.grahamdoors.com.
4. Haley Brothers: www.haleybros.com.
5. Marshfield DoorSystems, Inc: www.marshfielddoors.com.
6. Substitutions: See Section 01 6000 - Product Requirements.

2.2 DOOR CONSTRUCTION, GENERAL

A. Certified Wood: Fabricate doors with wood products produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
B. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.

2.3 DOORS AND PANELS

A. All Doors: See drawings for locations and additional requirements.
1. Quality Level: Premium Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS).
2. Wood Veneer Faced Doors: 7-ply unless otherwise indicated.
B. Exterior Doors: Flush solid core construction and water repellent treated.
1. Thickness: 1-3/4 inches (44 mm), unless otherwise indicated.
C. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
1. Provide solid core doors at all locations.
2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with NFPA 252 or UL 10B - Negative (Neutral) Pressure; Underwriters Laboratories Inc. (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
a. Construction: Manufacturer’s standard core construction as required to provide fire resistance rating indicated, and top rail blocking as required to allow installation of surface mounted closers without the use of sex bolts. Provide 5-inch mid-rail blocking at doors with exit devices, and blocking for locks. Provide 5-inch minimum bottom-rail blocking for doors indicated for kick, mop or armor plates.
3. Sound Retardant Doors: Minimum STC of 45, calculated in accordance with ASTM E413, tested in accordance with ASTM E90.
4. Wood veneer facing for field transparent finish where indicated on drawings.

2.4 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.
B. Fire Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.
C. Sound Resistant Doors: Equivalent to Type particleboard core (PC) construction with core as required to achieve STC rating specified; plies and faces as indicated.

2.5 DOOR FACINGS

A. Veneer Facing for Transparent Finish: White oak, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
    1. Vertical Edges: Same species as face veneer.
    2. Matching: Slip match between veneer leaves; balance match within door face.

2.6 ACCESSORIES

A. Glazing: As specified in Section 08 8000.
B. Glazing Stops: Wood with metal clips for rated doors, butted corners; prepared for countersink style tamper proof screws.

2.7 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.
B. Cores Constructed with stiles and rails:
    1. Provide solid blocks at lock edge and top of door for closer for hardware reinforcement.
C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
    1. Exception: Doors to be field finished.
E. Provide edge clearances in accordance with the quality standard specified.

2.8 FACTORY FINISHING - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
    1. Transparent:
        a. System - 11, Polyurethane, Catalyzed.
        b. Stain: As selected by Architect.
        c. Sheen: Satin.
B. Factory finish doors in accordance with approved sample.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify that opening sizes and tolerances are acceptable.
C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
    1. Install fire-rated doors in accordance with NFPA 80 requirements.
B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
C. Use machine tools to cut or drill for hardware.
D. Coordinate installation of doors with installation of frames and hardware.
E. Coordinate installation of glazing.

3.3 TOLERANCES

A. Conform to specified quality standard for fit and clearance tolerances.
B. Conform to specified quality standard for telegraphing, warp, and squareness.

3.4 ADJUSTING

A. Adjust doors for smooth and balanced door movement.
B. Adjust closers for full closure.

3.5 SCHEDULE - See Drawings

END OF SECTION

SECTION 08 3100
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Wall access door and frame units.
- B. Ceiling access door and frame units.

1.2 RELATED REQUIREMENTS
- A. Section 09 9113 - Exterior Painting: Field paint finish.
- B. Division 22 Plumbing Sections for components requiring access.
- C. Division 23 HVAC Sections for Mechanical components requiring access and access doors in ductwork.
- D. Division 26 Electrical Sections for Electrical components requiring access

1.3 REFERENCE STANDARDS
- A. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.
- B. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.4 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

1.5 WARRANTY
- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Contractor shall correct defective Work within a two year period after Date of Substantial Completion; remove and replace materials concealing defective work at no extra cost to Owner.

PART 2 PRODUCTS

2.1 ACCESS DOOR AND PANEL APPLICATIONS
- A. Walls, Unless Otherwise Indicated:
  1. Size: 12 by 12 inch (305 by 305 mm), unless otherwise indicated.
  2. Standard duty, hinged door.
  3. Tool-operated spring or cam lock; no handle.
  4. In All Wall Types: Surface mounted face frame and door surface flush with frame surface.
  5. In Gypsum Board: Drywall bead frame with door surface flush with wall surface.
  6. In Masonry: Surface mounted frame with door surface flush with frame surface.
- B. Walls in Wet Areas:
  1. Material: Stainless steel, Type 304.
  2. Size: 12 by 12 inch (305 by 305 mm), unless otherwise indicated.
  3. Standard duty, hinged door.
  4. Tool-operated spring or cam lock; no handle.
  5. In All Wall Types: Surface mounted face frame and door surface flush with frame surface.
  6. In Gypsum Board: Drywall bead frame with door surface flush with wall surface.
  7. In Masonry: Surface mounted frame with door surface flush with frame surface.
- C. Fire Rated Walls: See drawings for wall fire ratings.
  1. Size: 12 by 12 inch (305 by 305 mm), unless otherwise indicated.
  2. Provide rated door(s) to match the above two applications as required.
- D. Ceilings, Unless Otherwise Indicated: Same type as for walls.
  1. Material: Steel. Stainless Steel, type 304 at
  2. Size in Lay-in Grid Ceilings: To match grid module.
  3. Size in Other Ceilings: 12 by 12 inch (305 by 305 mm), unless otherwise indicated.
  4. Standard duty, hinged door.
  5. Tool-operated spring or cam lock; no handle.

2.2 WALL AND CEILING UNITS

A. Manufacturers:
   1. ACUDOR Products Inc: www.acudor.com.
   2. Babcock-Davis: www.babcockdavis.com.
   3. Karp Associates, Inc; ____: www.karpinc.com.
   4. Milcor by Commercial Products Group of Hart & Cooley, Inc; ____: www.milcorinc.com.

B. Access Doors: Factory fabricated door and frame units, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies that units are to be installed in.
   1. Style: As indicated on drawings.
   2. Style: Exposed frame with door surface flush with frame surface.
      a. In Gypsum Board: Use drywall bead type frame.
   3. Door Style: Single thickness with rolled or turned in edges.
   4. Frames: 16 gage, 0.0598 inch (1.52 mm), minimum.
   5. Single Thickness Steel Door Panels: 1/16 inch (1.6 mm), minimum.
   6. Units in Fire Rated Assemblies: Fire rating as required by applicable code for the fire rated assembly that access doors are being installed.
   7. Steel Finish: Primed. Polyester powder coat; manufacturer's standard color.
   8. Stainless Steel Finish: No. 4 brushed finish.
   9. Hardware:
      a. Hardware for Fire Rated Units: As required for listing.
      b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
      c. Latch/Lock: Tamperproof tool-operated cam latch.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that rough openings are correctly sized and located.

3.2 INSTALLATION

A. Install units in accordance with manufacturer's instructions.
B. Install frames plumb and level in openings. Secure rigidly in place.
C. Position units to provide convenient access to the concealed work requiring access.

END OF SECTION

SECTION 08 3323
OVERHEAD COILING DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Overhead coiling doors and shutters, operating hardware, fire-rated, non-fire-rated, and exterior, manual and electric operation.
- B. Wiring from electric circuit disconnect to operator to control station.

1.2 RELATED REQUIREMENTS
- A. Section _____-_____: Support framing.
- B. Section 08 7100 - Door Hardware: Cylinder cores and keys.
- C. Section 26 0534 - Conduit: Conduit from electric circuit to operator and from operator to control station.
- D. Section 26 2717 - Equipment Wiring: Power to disconnect.

1.3 REFERENCE STANDARDS
- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2013.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2014.
- E. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; National Electrical Manufacturers Association; 2000 (R2005), with errata, 2008.
- F. UL (EAUED) - Electrical Appliance and Utilization Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.4 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide general construction, electrical equipment, and component connections and details.
- C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.
- D. Samples: Submit two slats, 6 inch (150 mm) in size illustrating shape, color and finish texture.
- E. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.

1.5 QUALITY ASSURANCE
- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 WARRANTY
- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Contractor shall correct defective Work within a two year period after Date of Substantial Completion; remove and replace materials concealing defective work at no extra cost to Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS
- A. Overhead Coiling Doors:
  1. BASIS OF DESIGN - Overhead Door Corporation, 625 Series Stormtite Insulated Service Doors: www.overheaddoor.com.
  2. Alpine Overhead Doors, Inc: www.alpinedoors.com.
  3. Clopay Corporation: www.clopaydoor.com.

4. Cornell Iron Works, Inc: www.cornelliron.com.
5. Overhead Door Corporation, 625 Series Stormtite Insulated Service Doors: www.overheaddoor.com.
6. Wayne-Dalton, a Division of Overhead Door Corporation: www.wayne-dalton.com.
7. Substitutions: See Section 01 6000 - Product Requirements.

2.2 COILING DOORS

A. Exterior Coiling Doors: Steel slat curtain.
   1. Capable of withstanding positive and negative wind loads of 20 psf (940 Pa), without undue deflection or damage to components.
   2. Sandwich slat construction with insulated core of foamed-in-place polyurethane insulation; minimum R-value of 8.1 (RSI-value of 1.43).
   3. Sandwich slat construction with insulated core of CFC-free foamed-in-place polyurethane type insulation; insulation (U-value): 0.13 BTU/hr sq ft deg F.
   4. Nominal Slat Size: 2 inches (50 mm) wide x required length.
   5. Finish: Galvanized.
   6. Finish: See "MATERIALS" article below for finishes.
   7. Guides: Angles; galvanized steel.
   8. Hood Enclosure: Manufacturer's standard; primed steel.
   9. Electric operation.
   10. Mounting: Within framed opening.
   11. Exterior lock and latch handle.
B. Non-Fire-Rated Interior Coiling Doors: Steel slat curtain.

2.3 MATERIALS

A. Curtain Construction: Interlocking slats.
   1. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
   2. Curtain Bottom: Fitted with angles to provide reinforcement and positive contact in closed position.
   3. Weatherstripping: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.
B. Steel Slats: Minimum thickness, 22 gage, .0336 inch (.853 mm); ASTM A653/A653M galvanized steel sheet.
   1. Galvanizing: Minimum G90/Z275 coating.
C. Steel Slats:
   1. Flat profile type F-265i.
   2. Front slat fabricated of 22 gauge galvanized steel.
   3. Back slat fabricated of 24 gauge galvanized steel.
D. Finish:
   1. Galvanized Steel: Slats and hood galvanized in accordance with ASTM A653 and receive rust-inhibitive, roll coating process, including 0.2 mils thick backed-on prime paint, and 0.6 mils thick baked-on polyester (powder coat) top coat.
   2. Non-galvanized exposed ferrous surfaces shall receive one coat of rust-inhibitive primer.
E. Guide Construction: Continuous, of profile to retain door in place with snap-on trim, mounting brackets of same metal.
F. Steel Guides: ASTM A36/A36M steel angles, size as indicated, hot-dip galvanized per ASTM A123/A123M.
G. Hood Enclosure: Internally reinforced to maintain rigidity and shape.
   1. Minimum thickness; 24 gage, .0239 inch (.607 mm).
H. Hardware:
   1. Lock Cylinders: Specified in Section 08 7100.
   2. Latch Handle: Interior and exterior handle.
I. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb (10 kg) nominal force to operate.

2.4 ELECTRIC OPERATION

A. Electric Operators:
   1. Motor Rating: size as recommended by manufacturer to move door in either direction at specified speed. Size motor for continuous duty.
   2. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
   3. Controller Enclosure: NEMA 250, Type 1.
   4. Opening Speed: 12 inches per second (300 mm/s).
   5. Brake: Adjustable friction clutch type, activated by motor controller.
   6. Manual override in case of power failure.

B. Control Station: Standard three button (OPEN-STOP-CLOSE) momentary control for each operator.
   1. 24 volt circuit.

C. Safety Edge: Located at bottom of curtain, full width, electro-mechanical sensitized type, wired to stop operator upon striking object, hollow neoprene covered.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that opening sizes, tolerances and conditions are acceptable.

3.2 INSTALLATION

A. Install units in accordance with manufacturer's instructions.
B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
E. Coordinate installation of electrical service with Section 26 2717.
F. Complete wiring from disconnect to unit components.

3.3 TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work.
B. Maximum Variation From Plumb: 1/16 inch (1.5 mm).
C. Maximum Variation From Level: 1/16 inch (1.5 mm).
D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft (3 mm per 3 m) straight edge.

3.4 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

3.5 CLEANING

A. Clean installed components.
B. Remove labels and visible markings.

END OF SECTION

SECTION 08 3613
SECTIONAL OVERHEAD DOORS

PART 1 - GENERAL

1.1 SECTION INCLUDES
- A. Insulated Sectional Overhead Doors.
- B. Electric Operators and Controls.
- C. Operating Hardware, tracks, and support.

1.2 RELATED SECTIONS
- A. Section 03 3000 - Cast-In-Place Concrete: Prepared opening in concrete. Execution requirements for placement of anchors in concrete wall construction.
- B. Section 04 2000 - Unit Masonry Assemblies: Prepared opening in masonry. Execution requirements for placement of anchors in masonry wall construction.
- C. Section 05 5000 - Metal Fabrications: Steel frame and supports.
- D. Section 06 1000 - Rough Carpentry, wood framing and blocking for door opening.
- E. Section 07 9005 - Joint Sealers: Perimeter sealant and backup materials.
- F. Section 08 7100 - Door Hardware: Cylinder locks.
- G. Section 09 9000 - Paints and Coatings: Field painting.
- H. Division 26 Electrical Sections for raceway, boxes, empty conduit from control station to door operator.
- I. Division 26 Electrical Sections for wiring connections, electrical service to door operator.

1.3 REFERENCES
- A. ANSI/DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.
- C. ASTM C1036 - Standard Specification for Flat Glass; 2011e1.
- D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.
- E. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2011.
- F. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.4 DESIGN / PERFORMANCE REQUIREMENTS
- A. Wind Loads: Design and size components to withstand loads caused by pressure and suction of wind acting normal to plane of wall as calculated in accordance with applicable code.
  1. Design pressure of 30 lb./sq.ft. (1.44 kPa).
- B. Wiring Connections: Requirements for electrical characteristics.
  1. 230 volts, single phase, 60 Hz.
- C. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

1.5 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  1. Preparation instructions and recommendations.
  2. Storage and handling requirements and recommendations.
  3. Installation methods.

C. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, installation details, and plan and elevation of each opening.
D. Shop Drawings: Indicate plans and elevations including opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
E. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
F. Operation and Maintenance Data.

1.6 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.
B. Installer Qualifications: Authorized representative of the manufacturer with minimum five years documented experience.
C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

1.7 DELIVERY, STORAGE, AND HANDLING
A. Store products in manufacturer's unopened labeled packaging until ready for installation.
B. Protect materials from exposure to moisture until ready for installation.
C. Store materials in a dry, ventilated weathertight location.

1.8 PROJECT CONDITIONS
A. Pre-Installation Conference: Convene a pre-installation conference just prior to commencement of field operations, to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

1.9 WARRANTY
A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Contractor shall correct defective Work within a two year period after Date of Substantial Completion; remove and replace materials concealing defective work at no extra cost to Owner.

1.10 AVAILABLE MANUFACTURERS
A. Substitutions: The product(s) referenced by the manufacturer listed, forms the basis of design. The contractor at their option may provide an alternate manufacturer as an equal, however, if an equal is proposed, the Contractor shall provide data from the specified manufacturer & product(s) as well as data from the proposed manufacturer for a comparison, review, and determination of acceptance (approval or disapproval) by the Architect. Approval cannot be made if adequate comparison information is not provided. Absence of specified manufacturers' data is grounds for disapproval.
B. Refer to Section 01 3000 - Administrative Requirements AND Section 01 6000 - Product Requirements for substitution procedures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. BASIS OF DESIGN Manufacturer: Overhead Door Corp., 2501 S. State Hwy. 121, Suite 200, Lewisville, TX 75067. ASD. Tel. Toll Free: (800) 275-3290. Phone: (469) 549-7100. Fax: (972) 906-1499. Web Site: www.overheaddoor.com. E-mail: sales@overheaddoor.com.
B. Substitutions: See Section 01 6000 - Product Requirements.
1. See article in PART 1 above entitled "Available Manufacturers".

2.2 INSULATED SECTIONAL OVERHEAD DOORS
A. Insulated Steel Sectional Overhead Doors: 418 Series Insulated Steel Doors by Overhead Door Corporation. Units shall have the following characteristics:
1. Door Assembly: Insulated steel door assembly with rabbeted meeting rails to form weathertight joints and provide full-width interlocking structural rigidity.
a. Panel Thickness: 2 inches (51 mm).
b. Exterior Surface: Flush.

c. Exterior Steel: 16 gauge, hot-dip galvanized.
d. Back Cover:
    1) 26 gauge steel.
e. Center and End Stiles: 16 gauge steel.
f. Springs:
    1) 100,000 cycles.
g. Insulation: Polystyrene.
h. Thermal Values:
    1) Polystyrene - R-value of 7.35; U-Value of 0.136.
i. Full Glazed Aluminum Sash Panels:
    1) Insulated double strength glass.

2. Finish and Color: Two coat baked-on polyester with white exterior and white interior color.
3. Windload Design: Provide to meet the Design/Performance requirements specified.
4. Hardware: Galvanized steel hinges and fixtures. Ball bearing rollers with hardened steel races.
5. Lock:
    a. Keyed lock with interlock switch for automatic operator.
6. Weatherstripping:
    a. Flexible bulb-type strip at bottom section.
    b. Flexible Jamb seals.
    c. Flexible Header seal.
7. Track: Provide track as recommended by manufacturer to suit loading required and clearances available.
8. Electric Motor Operation: Provide UL listed electric operator, size and type as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second. Operator shall meet UL325/2010 requirements for continuous monitoring of safety devices.
    a. Entrapment Protection: Required for momentary contact, includes radio control operation.
        1) Photoelectric sensors monitored to meet UL 325/2010.
    b. Operator Controls:
        1) Push-button and key operated control stations with open, close, and stop buttons.
        2) Flush mounting.
        3) Interior location.
    c. Special Operation:
        1) Vehicle detector operation.
        2) Commercial light package.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until openings have been properly prepared.
B. Verify wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.
C. Verify electric power is available and of correct characteristics.
D. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install overhead doors and track in accordance with approved shop drawings and the manufacturer’s printed instructions.

B. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.
C. Anchor assembly to wall construction and building framing without distortion or stress.
D. Securely brace door tracks suspended from structure. Secure tracks to structural members only.
E. Fit and align door assembly including hardware.
F. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

3.4 CLEANING AND ADJUSTING

A. Adjust door assembly to smooth operation and in full contact with weatherstripping.
B. Clean doors, frames and glass.
C. Remove temporary labels and visible markings.

3.5 PROTECTION

A. Do not permit construction traffic through overhead door openings after adjustment and cleaning.
B. Protect installed products until completion of project.
C. Touch-up, damaged coatings and finishes and repair minor damage before Substantial Completion.

END OF SECTION

SECTION 08 4313
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Aluminum-framed storefront, with vision glass.
- B. Aluminum doors and frames.
- C. Weatherstripping.
- D. Door hardware.

1.2 RELATED REQUIREMENTS
- A. Section 05 1200 - Structural Steel Framing: Steel attachment members.
- B. Section 05 5000 - Metal Fabrications: Steel attachment devices.
- C. Section 07 2727 - Fluid-Applied Vapor Permeable Membrane Air Barrier System Assembly: Air barrier.
- D. Section 07 8400 - Firestopping: Firestop at system junction with structure.
- E. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.
- F. Section 08 8000 - Glazing: Glass and glazing accessories.

1.3 REFERENCE STANDARDS
- A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; American Architectural Manufacturers Association; 2012.
- B. AAMA 501.2 - Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage; American Architectural Manufacturers Association; 2009 (part of AAMA 501).
- C. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; American Society of Civil Engineers; 2011.
- D. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- E. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.
- F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2013.
- G. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.
- H. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).
- I. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.
- J. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

1.4 ADMINISTRATIVE REQUIREMENTS
- A. Coordinate with installation of other components that comprise the exterior enclosure.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.5 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details and _____.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.
- D. Samples: Submit two samples 12 x 12 inches (305 x 305 mm) in size illustrating finished aluminum surface, glass, infill panels, glazing materials.
- E. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

F. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.
G. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
H. Report of field testing for water leakage.
I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
J. LEED Submittals:
    1. Product Data for Credit IEQ 4.1: For adhesives and sealants used inside of the weatherproofing system, documentation including printed statement of VOC content

1.6 QUALITY ASSURANCE
A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at TEXAS.
B. Manufacturer and Installer Qualifications: Company specializing in manufacturing aluminum glazing systems with minimum three years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING
A. Handle products of this section in accordance with AAMA CW-10.
B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.8 WARRANTY
A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Correct defective Work within a five year period after Date of Substantial Completion.
C. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.1 MANUFACTURERS
A. Aluminum-Framed Storefront and Doors:
    1. Kawneer North America : www.kawneer.com.
    2. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com.
    3. United States Aluminum Corp : www.usalum.com.
    4. YKK AP America: www.ykkap.com
    5. Substitutions: See Section 01 6000 - Product Requirements.

2.2 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING (Exterior Storefront)
A. Center-Set Style, Thermally-Broken:

2.3 BASIS OF DESIGN -- FRAMING FOR MONOLITHIC GLAZING (Interior Storefront)
A. Center-Set Style:

2.4 STOREFRONT
A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
    1. Finish: Class I natural anodized.
        a. Factory finish all surfaces that will be exposed in completed assemblies.
    2. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
    3. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
    4. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

5. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
6. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
7. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

B. Performance Requirements:
1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
a. Design Wind Loads: Comply with requirements of ASCE 7.
b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
2. Water Penetration Resistance: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8.00 lbf/sq ft (390 Pa).
3. Air Leakage: Maximum of 0.06 cu ft/min/sq ft (0.3 L/s/sq m) of wall area, when tested in accordance with ASTM E283 at 6.24 pounds per square foot (300 Pa) pressure differential across assembly.

2.5 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
1. Glazing stops: Flush.

B. Glazing: As specified in Section 08 8000.

C. Swing Doors: Glazed aluminum.

2.6 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209 (ASTM B209M).

C. Fasteners: Stainless steel.

D. Exposed Flashings: Aluminum sheet, 20 gage, 0.032 inch (0.81 mm) minimum thickness; finish to match framing members.

E. Concealed Flashings: Sheet aluminum, 26 gage, 0.017 inch (0.43 mm) minimum thickness.

F. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

G. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.
1. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

H. Glazing Accessories: As specified in Section 08 8000.

2.7 HARDWARE

A. For each door, include weatherstripping, sill sweep strip, and threshold.

B. Other Door Hardware: Storefront manufacturer's standard type to suit application.
1. Finish on Hand-Contacted Items: Polished stainless steel.
2. For each door, include butt hinges, pivots, push handle, pull handle, exit device, narrow stile handle latch, and closer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.2 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.
B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
C. Provide alignment attachments and shims to permanently fasten system to building structure.
D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
E. Provide thermal isolation where components penetrate or disrupt building insulation.
F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
I. Set thresholds in bed of sealant and secure.
J. Install hardware using templates provided.
K. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.3 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft (1.5 mm/m) non-cumulative or 1/16 inches per 10 ft (1.5 mm/3 m), whichever is less.
B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

3.4 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for independent testing and inspection requirements. Inspection will monitor quality of installation and glazing.
B. Test installed storefront for water leakage in accordance with AAMA 501.2.

3.5 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.6 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

3.7 PROTECTION

A. Protect installed products from damage during subsequent construction.

END OF SECTION

SECTION 08 7100
DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Furnish and deliver all hardware necessary for all doors, also hardware as specified herein and as enumerated in "Set Numbers " and as indicated and required by actual conditions at the project. The hardware shall include the furnishing of all necessary screws, special screws, bolts, special bolts, expansion shields and all other devices necessary for the proper application of hardware to insure a complete and thorough project.

B. Related Sections

1. Section 08 1113 - Hollow Metal Door And Frames
2. Section 08 1416 - Flush Wood Door
3. Section 08 3323 - Overhead Coiling Doors
4. Section 09 3613 - Sectional Overhead Doors
5. Section 08 4313 - Aluminum-Framed Storefront
6. Section 10 2213 - Wire Mesh Partitions
7. Section 10 4116 - Emergency Key Cabinets - Knox Box
8. Division 26 Electrical Sections
9. Division 28 Electronic, Safety and Security Sections

C. Installation of Door, Cabinet and other Owner sensitive Hardware.

1. This requirement shall be for any product or unit that will require installation of all door hardware and locks that are to receive a core with the San Antonio Water System (SAWS) keyway.
2. Door Hardware, Cabinet locks and other Owner sensitive hardware shall be installed by the hardware supplier, except where the hardware is traditionally provided to other suppliers such as storefront manufacturers and other manufacturers requiring their installation. Hardware supplier shall provide experienced factory trained personnel who have completed installations similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance. Hardware installation shall be under the direction and control of an Architectural Hardware Consultant (AHC). Self-installation by General Contractor or any other contractor shall not be allowed. Prior to Substantial Completion, hardware supplier and supervising Architectural Hardware Consultant (AHC) shall perform a final inspection of installed door hardware and state in written report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

1.2 REFERENCES

A. NFPA Life Safety 2010
B. NFPA 80 Fire Doors /Fire Windows 2010
C. NFPA 105 Smoke Door Assemblies
D. Hardware For Labeled Doors 1993
E. Americans with Disabilities Act
F. ANSI 117.1 Accessible & Usable Buildings & Facilities
G. DHI Recommended Locations for Architectural Hardware
H. IBC 2008
I. TAS - Texas Accessibility Standards: Required compliance for handicapped accessibility in Texas.

1.3 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Hardware schedule to be detailed in quantity, type, function and special mounting conditions so that all openings are complete. Submit 6 copies for review.

C. Product Data - Provide A detailed drawing of every item of hardware used in schedule shall be submitted with schedule marked with corresponding item numbers.
D. Samples - Furnish sample of each item proposed for project as required by architect. All samples returned in perfect condition may be incorporated into scope of work
E. Templates - After architectural review, supplier to furnish product templates to contractor for distribution to door, frame and electrical supplier as required for fabrication of material.
F. Keying Schedule
    1. A detailed keying schedule will be required to be submitted to architect showing how owners keying requirements have been completed.
G. Wiring Diagrams
    1. A complete wiring diagram and riser diagram shall be provided for every opening involving electrical components. A jobsite meeting between owner, architect, contractor, electrical contractor, installer and hardware supplier shall be held upon approval of these drawings so that the intent of this hardware is satisfied.
H. Operations/Maintenance Data
    1. Supplier to provide parts manuals for locks, closers and exit devices.

1.4 QUALITY ASSURANCE
A. Substitutes
    1. All requests for substitution will be in accordance with Division 01 Section 01 6000. Manufacturers numbers found in article 2.2, below, are to be used to obtain a level of quality, function, and design.
B. Supplier Qualification
    1. Hardware supplier to have been furnishing projects of this type for a period of 2 years prior to this project. Supplier shall also maintain in his/her employ a Certified Hardware Consultant, who shall be available for project visits whenever necessary to assure proper installation and function of hardware.

1.5 DELIVERY, STORAGE & HANDLING
A. Marking & Packaging
    1. All products to be in original manufacturer's package with manufacturers number clearly written. Supplier to mark all products with item number and door number so as not to cause confusion as to their placement.
B. Delivery
    1. All hardware shall be delivered to jobsite within requested timeframe .Any item required for fabrication of doors or frames shall be delivered to manufacturer when requested so as to prevent project delay.
C. Storage
    1. All hardware shall be stored in a cool, dry space with shelving provided for organization of similar products. Contractor to provide a secured area to prevent loss due to theft.

1.6 WARRANTY
A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Contractor shall correct defective Work within a two year period, unless noted for a longer time period, after Date of Substantial Completion; remove and replace materials concealing defective work at no extra cost to Owner.

1.7 MAINTENANCE
A. Maintenance Service
    1. Any special tools required for installation shall be turned over to owner at project closeout in duplicate. Security or electrical products shall be covered by maintenance contracts previously arranged with owner.
B. Extra Materials
    1. Any products which remain after substantial completion shall be turned over to owner.

1.8 AVAILABLE MANUFACTURERS
A. Substitutions: The product(s) referenced by the manufacturer listed, forms the basis of design. The contractor at their option may provide an alternate manufacturer as an equal, however, if

an equal is proposed, the Contractor shall provide data from the specified manufacturer & product(s) as well as data from the proposed manufacturer for a comparison, review, and determination of acceptance (approval or disapproval) by the Architect. Approval cannot be made if adequate comparison information is not provided. Absence of specified manufacturers' data is grounds for disapproval.

B. Refer to Section 01 3000 - Administrative Requirements AND Section 01 6000 - Product Requirements for substitution procedures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Hinges - Hager, Stanley, Mckinney
   1. Continuous Hinges - Markar, Ives, Abh
B. Pivots/Floor Closer - Rixson,Dor-O-Matic,
C. Locks - Schlage, Primus, No Substitution
D. Exit Devices - Von Duprin, Sargent
E. Door Closers - Lcn,Sargent
F. Flat Goods - Ives, Hager, Trimco, Rockwood
G. Stops - Ives, Hager, Trimco, Rockwood
H. Overhead Stops - Rixson, Abh, Glynn-Johnson
I. Threshold/Weatherstriping - Pemko, Ngp, Zero
J. Electrical Items - Von Duprin, Locknetics, Sdc
K. Misc - Ives, Hager, Trimco, Rockwood
L. Substitutions: See Section 01 6000 - Product Requirements.
   1. See article in PART 1 above entitled "Available Manufacturers".

2.2 MATERIALS

A. Screws/Fasteners
   1. All screws, nuts, bolts and fasteners shall be those provided with hardware by manufacturer.
   2. Installer is to drill and tap fasteners provided in lieu of self tapping screws.
B. Hinges
   1. Exterior- all exterior doors to receive brass/bronze hinges
      a. All outswinging exterior doors to have non removable pins
   2. Interior -steel based hinges
   3. Continuous hinges- where specified
C. Hinge Sizes
   1.

Hinge Height	Thickness of door	Width of door
31/2-4"	1-3/8"	to 32"
4- 41/2"	1-3/4"	to 36"
*41/2"	1-3/4"	to 36"
*5"	1-3/4"	over 36"- 48"
*6"	1-3/4"	over 48"
5" heavy wt	2",2-1/4",21/2"	36" to 42"
6" heavy wt	2",2-1/4",21/2"	over 42"

   2. *Heavy weight hinges should be provided for heavy doors and doors where high frequency service is expected.
   3. Hinge Width
      a. All hinges shall be of the smallest width necessary to clear all trim conditions
      b. BASIC RULE- Two times the door thickness, add the thickness of the trim then subtract 1/2"(for two times the hinge backset)
   4. Hinge Spacing
      a.

Door Height	Quantity
Less than 60"	2 hinges
61" to 90"	3 hinges
91" to 120"	4 hinges

      1 hinge for each additional 30"

5. Fire Rated Doors
    a. Steel based hinges in accordance with NFPA80 chart 2-8A

D. Pivots/Floor Closers
1. Double acting- as specified
2. Single acting -as specified
3. Fire Labeled -where required

E. Flushbolts
1. Automatic/self-latching or combination
2. Manual -only on not normally occupied rooms ie mechanical closets
3. Fire Labeled -where required

F. Coordinators
1. Bar type with brackets as required by parallel arm closers

G. Locksets/Latchsets
1. Mortise type series 1000 grade 1- L9000 series
2. Section trim 07A design

H. Exit Devices
1. Narrow style doors -33 series
2. Basic -99 series

I. Surface Closers
1. regular arm. parallel arm as required
2. ies 281 series

J. Push/Pull Plates
1. 4" x16"
2. .050 ga beveled 4 sides
3. 6" center to center bar pulls

K. Protective Plates
1. .050 ga, beveled 4 sides
2. Sizes
    a. mop plates-4" height
    b. kickplates-1/2" less than bottom stile or 8"
    c. armor plate-36" height
3. Width
    a. 2" less than door width on push side
    b. 1" less than door width on pull side
    c. 1" less than door width on both sides of pairs of doors

L. Door Stops & Holders
1. Overhead holders - surface mounted heavy duty steel
2. Wall Stops
    a. Contractor to provide wall bracing
3. Floor stops- only where wall stops or overhead stops are not applicable

M. Thresholds/Weatherstriping
1. Thresholds-2" longer than door width cut to fit
2. Weatherstriping -width of head plus two pieces length of jamb
3. Door Bottoms- automatic or sweep as specified- width of door

2.3 FINISHES

A.	Hinges - Exterior	626
	1. Interior	652
B.	Locks	626
C.	Exit Devices	626
D.	Closers	689
E.	Flat goods	630
F.	Misc	630
G.	Threshold	Aluminum
H.	Weatherstrip	Aluminum

2.4 KEYING

A. Existing “PRIMUS” system as required by owner for consistency with current buildings. Construction masterkey all locks during construction period. Interchangeable core system required. Installation of permanent cores will not require the disassembly of lockset. Owner/Architect will advise keying requirements prior to the ordering of locksets.

2.5 KEY CONTROL

A. Provide key cabinet complete with labels and 50% expansion over current requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine door frames and related items for conditions that would prevent proper application of finish hardware.
B. Do not proceed until defects are corrected.

3.2 INSTALLATION

A. Securely install finish hardware items in accordance with schedule and templates furnished with hardware
B. Install mortised items flush with adjacent surfaces
C. Install locksets, closers, and trim after finish painting
D. Locate items in accordance with DHI" recommended Locations for Builders Hardware" unless otherwise directed by architect.
E. Test and adjust all hardware for quiet, smooth operation, free from sticking, binding, or rattling. Adjust closers after balancing of HVAC system. Adjust closers to meet required opening force criteria as set forth by handicapped codes.

3.3 FIELD QUALITY CONTROL

A. After installation, provide the services of a qualified hardware consultant to determine the proper application of hardware according to the approved hardware and keying schedule.
B. Also check the adjustment and operation of all hardware items.

3.4 ADJUSTMENT AND CLEANING

A. At final completion hardware should be left clean and free from disfigurement. Replace
    1. or repair any hardware in poor condition.

3.5 PROTECTION

A. Provide for the proper protection of all items of hardware until the owner accepts the project as complete.

3.6 HARDWARE SETS

A. Refer to the WEST Side Operations Center (WSOC) Hardware Set List, et al, attached after this section.
B. Refer to the NORTH Side Operations Center (NSOC) Hardware Set List, et al, attached after this section.

END OF SECTION

SECTION 08 8000
GLAZING

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Glass.
- B. Glazing compounds and accessories.

1.2 RELATED REQUIREMENTS
- A. Section 06 4100 - Architectural Wood Casework: Cabinets with requirements for glass shelves .
- B. Section 08 1113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
- C. Section 08 1416 - Flush Wood Doors: Glazed lites in doors.
- D. Section 08 3613 - Sectional Doors: Glazed lites in doors.

1.3 REFERENCE STANDARDS
- A. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.
- B. ASTM C1036 - Standard Specification for Flat Glass; 2011e1.
- C. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.
- D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.
- E. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.
- F. GANA (GM) - GANA Glazing Manual; Glass Association of North America; 2009.
- G. GANA (SM) - GANA Sealant Manual; Glass Association of North America; 2008.

1.4 ADMINISTRATIVE REQUIREMENTS
- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.5 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
- C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
- D. Manufacturer's Certificate: Certify that _____ glass meets or exceeds specified requirements.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. See Section 01 6000 - Product Requirements, for additional provisions.
  2. Extra Insulating Glass Units: One of each glass size and each glass type.
- F. LEED Submittals
  1. Product Data for Credit IEQ 4.1: For glazing sealants used inside the weatherproofing system, documentation including printed statement of VOC content.

1.6 QUALITY ASSURANCE
- A. Perform Work in accordance with GANA Glazing Manual and GANA Sealant Manual for glazing installation methods.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.7 FIELD CONDITIONS
- A. Do not install glazing when ambient temperature is less than 50 degrees F (10 degrees C).
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.8 WARRANTY
- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Sealed Insulating Glass Units: Provide a five (5) year warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.
C. Contractor shall correct defective Work within a two year period after Date of Substantial Completion; remove and replace materials concealing defective work at no extra cost to Owner.

PART 2 PRODUCTS

2.1 INSULATING GLASS UNITS
A. Type IG-1 - Sealed Insulating Glass Units: Vision glass, double glazed.
1. Application: All exterior glazing unless otherwise indicated.
2. Outboard Lite: Annealed float glass, 1/4 inch (6 mm) thick, minimum. (Safety Glass as required by code or regulation.)
a. Tint: Clear.
b. Coating: Low-E (passive type), on #2 surface.
3. Inboard Lite: Annealed float glass, 1/4 inch (6 mm) thick, minimum.
a. Tint: Clear.
4. Total Thickness: 1 inch (25 mm).
5. Total Visible Light Transmittance: 64 percent, nominal.
6. Total Solar Heat Gain Coefficient: 0.27 percent, nominal.
7. Glazing Method: Gasket glazing.
8. Basis of Design: PPG Industries, Inc: www.ppgideascapes.com.
a. Outboard Lite: Annealed float glass, 1/4 inch (6 mm) thick, minimum. (Safety Glass as required by code or regulation.)
1) Coating: PPG Solarban 70 on #2 surface, no coating on #3 surface.
B. Type IG-2 - Sealed Insulating Glass Units: Spandrel glazing.
1. Application: Exterior glazing where indicated.
2. Outboard Lite: Annealed float glass, 1/4 inch (6 mm) thick, minimum. (Safety Glass as required by code or regulation.)
a. Tint: Clear.
b. Coating: Same as on vision units, on #2 surface.
3. Inboard Lite: Heat-strengthened float glass, 1/4 inch (6 mm) thick.
a. Tint: Clear.
b. Opacifier: Ceramic frit, on #4 surface.
c. Opacifier Color: As selected by Architect.
4. Total Thickness: 1 inch (25 mm).
5. Glazing Method: Gasket glazing.

2.2 EXTERIOR GLAZING ASSEMBLIES
A. Performance Criteria: Select type and thickness of glass to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of glass.
1. Glass thicknesses listed are minimum.

2.3 GLASS MATERIALS
A. Float Glass: Provide float glass based glazing unless noted otherwise.
1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality-Q3.
2. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and Kind FT.
3. Tinted Types: ASTM C1036, Class 2 - Tinted, color and performance characteristics as indicated.
4. Thicknesses: As indicated; for exterior glazing comply with requirements indicated for wind load design regardless of thickness indicated.

2.4 SEALED INSULATING GLASS UNITS
A. Sealed Insulating Glass Units: Types as indicated.
1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
2. Edge Spacers: Aluminum, bent and soldered corners.
3. Edge Seal: Glass to elastomer with supplementary silicone sealant.
4. Purge interpane space with dry hermetic air.

2.5 GLAZING COMPOUNDS

A. Silicone Sealant, Type Sil: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.
B. Sealants used inside the weatherproofing system, shall have a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 GLAZING ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) x width of glazing rabbet space minus 1/16 inch (1.5 mm) x height to suit glazing method and pane weight and area.
B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch (75 mm) long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.
C. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; Black color.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance.
B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.2 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.
B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
C. Prime surfaces scheduled to receive sealant.
D. Install sealants in accordance with ASTM C1193 and GANA Sealant Manual.
E. Install sealants in accordance with manufacturer's instructions.

3.3 INSTALLATION - EXTERIOR/INTERIOR DRY METHOD (GASKET GLAZING)

A. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.
B. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
C. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.4 FIELD QUALITY CONTROL

A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.
B. Monitor and report installation procedures and unacceptable conditions.

3.5 CLEANING

A. Remove glazing materials from finish surfaces.
B. Remove labels after Work is complete.
C. Clean glass and adjacent surfaces.

3.6 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

END OF SECTION

SECTION 08 9100
LOUVERS

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Louvers, frames, and accessories.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS
- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; American Architectural Manufacturers Association; 2012.
- B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; Air Movement and Control Association International, Inc.; 2012.
- C. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices; 2013.

1.4 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.
- C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, tolerances; head, jamb and sill details; blade configuration, screens, blankout areas required, and frames.
- D. Samples: Submit two samples 2 by 2 inches (50 by 50 mm) in size illustrating finish and color of exterior and interior surfaces.
- E. Test Reports: Independent agency reports showing compliance with specified performance criteria.
- F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

1.6 WARRANTY
- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Contractor shall correct defective Work within a two year period after Date of Substantial Completion; remove and replace materials concealing defective work at no extra cost to Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS
- A. Wall Louvers:
  1. Ruskin Co., Kansas City, MO: www.ruskin.com.
     a. Area Rep: Texas Air Products, San Antonio, TX; (210) 495-8100; www.txap.com
  2. All-Lite Architectural Products, Fort Worth, TX 76106; www.alllite.com.
     a. Area Rep: Dalton Architectural Systems, Inc., Cypress, TX 77433; (281) 304-7180.
  3. Architectural Louvers, Cincinati, OH 45232; Toll-free (888) 568-8371; www.archlouvers.com.
     a. Drainable Blades: E2DS
  4. Substitutions: See Section 01 6000 - Product Requirements.

2.2 LOUVERS
- A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.
  1. Wind Load Resistance: Design to resist positive and negative wind load as required by code without damage or permanent deformation.
  2. Intake Louvers: Design to allow maximum of 0.01 oz/sq ft (3.1 g/sq m) water penetration at calculated intake design velocity based on design air flow and actual free area, when tested in accordance with AMCA 500-L.

3. Drainable Blades: Continuous rain stop at front or rear of blade aligned with vertical gutter recessed into both jambs of frame.
4. Screens: Provide insect screens at intake louvers and bird screens at exhaust louvers.

B. Stationary Louvers : Horizontal blade, extruded aluminum construction, with intermediate mullions matching frame.
1. Free Area: 50 percent, minimum.
2. Blades: Drainable.
3. Frame: 4 inches (100 mm) deep, channel profile; corner joints mitered and, with continuous recessed caulking channel each side.
4. Aluminum Thickness: Frame 12 gage, 0.0808 inch (2.05 mm) minimum; blades 12 gage, 0.0808 inch (2.05 mm) minimum.
5. Aluminum Finish: Class II natural anodized; finish welded units after fabrication.

2.3 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), .

2.4 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

2.5 ACCESSORIES

A. Blank-Off Panels: Same material as louver, painted black on exterior side; provide where duct connected to louver is smaller than louver frame, sealing off louver area outside duct.
B. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.
C. Fasteners and Anchors: Stainless steel.
D. Flashings: Of same material as louver frame, formed to required shape, single length in one piece per location.
E. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that prepared openings and flashings are ready to receive work and opening dimensions are as indicated on shop drawings.

3.2 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.
B. Install louvers level and plumb.
C. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
D. Secure louver frames in openings with concealed fasteners.
E. Coordinate with installation of mechanical ductwork.
F. Coordinate with installation of other wall materials.

3.3 CLEANING

A. Strip protective finish coverings.
B. Clean surfaces and components.

END OF SECTION

SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Performance criteria for gypsum board assemblies.
- B. Metal stud wall framing.
- C. Metal channel ceiling framing.
- D. Acoustic insulation.
- E. Gypsum sheathing.
- F. Cementitious backing board.
- G. Gypsum wallboard.
- H. Joint treatment and accessories.

1.2 RELATED REQUIREMENTS
- A. Section 04 2000 - Unit Masonry, for through wall flashing.
- B. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.
- C. Section 07 2727 - Fluid-Applied Vapor Permeable Membrane Air Barrier System Assembly, for Air Barrier and for sealing around all penetrations.

1.3 REFERENCE STANDARDS
- A. ANSI A108.11 - American National Standard for Interior Installation of Cementitious Backer Units; 2013.1.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.
- C. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2012.
- D. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.
- E. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.
- F. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2011.
- G. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.
- H. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2011.
- I. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.
- J. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2013.
- K. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing; 2013.
- L. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.
- M. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2013.
- N. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.
- O. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.
- P. ASTM E413 - Classification for Rating Sound Insulation; 2010.
- Q. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association; 2013.
- R. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.4 LEED SUBMITTALS
- A. Product Data: Provide data on metal framing, gypsum board, glass mat faced gypsum board, tile backer board, accessories, and joint finishing system. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

B. Samples: Submit two samples of approved substitutions by any material or item different than specified. Gypsum board samples shall be 12 by 12 inches (300 by 300 mm) in size, and shall illustrate finish color and texture.
C. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled. Include statement indicating cost for each product having recycled content.
   2. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.

1.5 QUALITY ASSURANCE
A. Installer Qualifications: Company specializing in performing gypsum board application and finishing, with minimum 5 years of documented experience.

1.6 AVAILABLE MANUFACTURERS
A. Substitutions - The product(s) referenced by the manufacturer listed, forms the basis of design. The contractor at their option may provide an alternate manufacturer as an equal, however, if an equal is proposed, the Contractor shall provide data from the specified manufacturer & product(s) as well as data from the proposed manufacturer for a comparison, review, and determination of acceptance (approval or disapproval) by the Architect. Approval cannot be made if adequate comparison information is not provided. Absence of specified manufacturers' data is grounds for disapproval.
B. Refer to Section 01 3000 - Administrative Requirements AND Section 01 6000 - Product Requirements for substitution procedures.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES
A. Provide completed assemblies complying with ASTM C840 and GA-216.
B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
C. Fire Rated Assemblies: Provide completed assemblies with the following characteristics:
   1. Fire Rated Partitions: UL listed assembly No. U419; 1 hour rating.
   2. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.2 METAL FRAMING MATERIALS
A. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf (240 Pa).
   1. Studs: "C" shaped with flat or formed webs with knurled faces.
   2. Runners: U shaped, sized to match studs.
   3. Ceiling Channels: C-shaped.
B. Metal Studs at ceramic & porcelain tile walls and other "wet walls" (walls with water pipe or drain pipe penetrations) shall be galvanized and a minimum of 20 gage (33 mil) thick, unless required to be heavier. Galvanized in accordance with ASTM A 653/A 653M G90/Z275 coating.
C. Zee Furring at exterior where indicated on the drawings shall be galvanized and a minimum of 18 gage (44 mil) thick, unless required to be heavier. Zee furring shall be solid sheet material. No perforation permitted. Galvanized in accordance with ASTM A 653/A 653M G90/Z275 coating.
D. All exterior studs, furring and any related members and parts shall be galvanized in accordance with ASTM A 653/A 653M G90/Z275 coating.
E. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.

1. Recycled Content of Steel: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent

F. Sill Gasket (Sealer) on Top of Foundation between the top of the foundation and the galvanized metal floor channel along the exterior perimeter of the building: 1/4 inch (6 mm) thick, match plate (floor channel) width, closed cell plastic foam from continuous rolls.
   1. Dow Chemical Co.; Product - Styrofoam Sill Seal polyethylene gasketing strip: www.dow.com.
   2. Owens Corning Corp.; Product - FoamSealR sill plate gasket: www.owenscorning.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

G. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

H. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.

I. Zee Furring at exterior where indicated on the drawings shall be galvanized and a minimum of 20 gage (33 mils (0.0329 inches) (0.8356 mm)) thick, unless required to be heavier. Galvanized in accordance with ASTM A653/A653M G90/Z275 coating.

J. Drywall Ceiling Grid System: Suspended Grid structure comprising of Main Runners and Cross Tees, including Wall Moldings and Transition Trims, as per manufacturer's instructions may be used in lieu of other metal framing. Provide engineering data with structural engineers seal and signature when requested by authority having jurisdiction.
   1. Armstrong Drywall Grid Systems; www.armstrong.com.
   2. USG Drywall Suspension Systems (United States Gypsum Company (USG), Chicago, IL.); www.usg.com;
   3. Rockfon (Chicago Metallic) Concealed Grid Ceilings; 4849 S. Austin Ave., Chicago, IL 60638 USA; T: (800) 323-7164; F (-800) 222-3744; Email. cs@rockfon.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.3 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. Georgia-Pacific Gypsum; ____: www.gpgypsum.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Glass mat faced gypsum panels as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
   3. Thickness:
      a. Vertical Surfaces: 5/8 inch (16 mm). Type X.

C. Abuse Resistant Wallboard:
   1. Application: Install up to 4'-0" AFF at Corridors, Multi-Purpose and Crew Quarters at Admin Bldg and at Elec & IT for all buildings.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Type: Fire resistance rated Type X, UL or WH listed.
   4. Thickness: 5/8 inch (16 mm).
   5. Edges: Tapered.
   6. Products:
      a. Georgia-Pacific Gypsum; DensArmor Plus Abuse-Resistant.
      b. Substitutions: See Section 01 6000 - Product Requirements.

D. Backing Board For Wet Areas: One of the following products:
   1. Application: Surfaces behind tile in wet areas including tub and shower surrounds, shower ceilings, and _____.
   2. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.

E. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
   1. Application: Exterior sheathing, unless otherwise indicated.
   2. Edges: Square, for vertical application.

2.4 ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: __ inch (____ mm).
B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
C. Sill Gasket on Top of Foundation between the top of the foundation and the galvanized metal floor channel along the exterior perimeter of the building: 3½ ” W x 50’ L x 1/4 inch (6 mm) thick, plate width, closed cell plastic foam from continuous rolls.
    1. Dow Chemical Co.; Product - Styrofoam Sill Seal polyethylene gasketing strip: www.dow.com.
    2. Owens Corning Corp.; Product - FoamSealR sill plate gasket: www.owenscorning.com.
    3. Substitutions: See Section 01 6000 - Product Requirements.
D. Water-Resistive Barrier: As specified in Section 07 2500.
E. Partition Closures & Sound Blocking, Flanking Path Filler -
    1. Resilient block closures coated on two faces and is ideal for gaps between opaque or solid partitions or walls The coating can be the same color on both faces or different on each face to coordinate with wall coverings.
        a. Product - QuietJoint-SHH as manufactured by Emseasl Joint Systems Ltd., 25 Bridle Lane, Westborough, MA 01581; Toll-free (800) 526-8365; T: (508) 836-0280 -- techinfo@emseal.com -- Fax: 508-836-0281.
    2. Resilient block closures coated on three faces and is typically used to fill gaps between the glass of curtainwall or windows on one side and solid substrates on the other. The third coating aesthetically covers the foam core so that the foam is not visible through the glass. The coating can be the same color on all three faces or different on each face to coordinate with wall coverings
        a. Product - QuietJoint-SHG as manufactured by Emseasl Joint Systems Ltd., 25 Bridle Lane, Westborough, MA 01581; Toll-free (800) 526-8365; T: (508) 836-0280 -- techinfo@emseal.com -- Fax: 508-836-0281.
    3. Substitutions: See Section 01 6000 - Product Requirements.
F. Joint Materials: ASTM C475 and as recommended by gypsum board manufacturer for project conditions.
    1. Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
    2. Chemical hardening type compound.
G. Screws for Attachment to Steel Members Less Than 0.033 inch (0.84 mm) In Thickness, to Wood Members, and to Gypsum Board: ASTM C1002; self-piercing tapping type; cadmium plated for exterior locations.
H. Screws for Attachment to Steel Members From 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws for application of gypsum board to loadbearing steel studs.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.2 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
    1. Level ceiling system to a tolerance of 1/1200.
    2. Laterally brace entire suspension system.
C. Studs: Space studs at 16 inches on center (at 406 mm on center).
    1. Extend partition framing to structure where indicated and to ceiling in other locations.
    2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

3. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Blocking: Install wood blocking for support of:
   1. Framed openings.
   2. Wall mounted cabinets.
   3. Plumbing fixtures.
   4. Toilet partitions.
   5. Toilet accessories.
   6. Wall mounted door hardware.

3.3 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place continuous bead at perimeter of each layer of gypsum board.
   2. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.4 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

C. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
   1. Seal joints, cut edges, and holes with water-resistant sealant.

D. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

E. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of non-rated double-layer assemblies, which may be installed by means of adhesive lamination.

3.5 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.

B. Corner Beads: Install at external corners, using longest practical lengths.

3.6 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, bedded and finished with chemical hardening type joint compound.

B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
   2. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.

C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).

D. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.7 TREATMENT OF “COATED GLASS MAT WATER-RESISTANT GYPSUM BACKING PANELS”

A. Finishing of all joints and entire exposed surface of “coated glass mat water-resistant gypsum backing panels” at surfaces not covered by tile:
   1. Skim coat entire surface of interior coated fiberglass mat faced gypsum backing panels as recommended by board manufacturer. Surface shall be smooth, and free of tool marks,

ridges, and fiberglass fiber texture. Skim coat shall be equal to a Level 5 finish for untextured surfaces. Surfaces with light textures may be equal to a Level 4 finish. Finish Levels shall be according to the latest edition of Gypsum Association publication GA-214 “Recommended Levels of Gypsum Board Finish.”

3.8 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

END OF SECTION

SECTION 09 3000
TILING

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Coated glass mat backer board as tile substrate.

1.2 RELATED REQUIREMENTS
- A. Section 07 9005 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- B. Section 09 2116 - Gypsum Board Assemblies: Tile backer board.
- C. Division 22 for Plumbing Fixtures.

1.3 REFERENCE STANDARDS
- A. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile - Version; 2013.1.
- B. ANSI A108.1A - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2013.1.
- C. ANSI A108.1B - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar; 2013.1.
- D. ANSI A108.1C - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement Mortar; 2013.1.
- E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2013.1.
- F. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 2013.1.
- G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 2013.1.
- H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 2013.1.
- I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 2013.1.
- J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 2013.1.
- K. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2013.1.
- L. ANSI A108.12 - American National Standard Specifications for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar; 2013.1.
- M. ANSI A108.13 - American National Standard Specifications for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2013.1.
- N. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2013.1.
- O. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2013.1.
- P. ANSI A137.1 - American National Standard Specifications for Ceramic Tile - Version; 2013.1.
- Q. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2013.
- R. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation - Version; 2013.1.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.5 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.
B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
D. Samples: Mount tile and apply grout on two plywood panels, minimum 18 x 18 inches (450 x 450 mm) in size illustrating pattern, color variations, and grout joint size variations.
E. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.
F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Section 01 6000 - Product Requirements, for additional provisions.
    2. Extra Tile: 10 square feet (1 square meters) of each size, color, and surface finish combination.

1.6 QUALITY ASSURANCE

A. Maintain one copy of and ANSI A108/A118/A136.1 and TCNA (HB) on site.
B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum 5 years of documented experience.
C. Installer Qualifications: Company specializing in performing tile installation, with minimum of 5 years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.8 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.
B. Maintain ambient and substrate temperature of 50 degrees F (10 degrees C) during installation of mortar materials.

1.9 AVAILABLE MANUFACTURERS

A. Substitutions: The product(s) referenced by the manufacturer listed, forms the basis of design. The contractor at their option may provide an alternate manufacturer as an equal, however, if an equal is proposed, the Contractor shall provide data from the specified manufacturer & product(s) as well as data from the proposed manufacturer for a comparison, review, and determination of acceptance (approval or disapproval) by the Architect. Approval cannot be made if adequate comparison information is not provided. Absence of specified manufacturers' data is grounds for disapproval.
B. Refer to Section 01 3000 - Administrative Requirements AND Section 01 6000 - Product Requirements for substitution procedures.

1.10 WARRANTY

A. Contractor shall correct defective Work within a two year period after Date of Substantial Completion; remove and replace materials concealing defective work at no extra cost to Owner.

PART 2 PRODUCTS

2.1 TILE

A. Ceramic Mosaic Tile, Type FT-1 and FT-2: ANSI A137.1, and as follows:
    1. Moisture Absorption: 0 to 0.5 percent.
    2. Size and Shape: 1 inch square (25 mm square).
    3. Edges: Square.
    4. Surface Finish: Unglazed.

5. Color(s): Refer to the Finish Legend in the Drawings.
6. Mounted Sheet Size: 1 x 1 inches (25 x 25 mm).
7. Products: Refer to the Finish Legend in the Drawings.
    a. Substitutions: See Section 01 6000 - Product Requirements.
        1) See article in PART 1 above entitled "Available Manufacturers".

B. Matte Glazed Wall Tile, Type WT-1 and WT-2 and Matte Glazed Surface Bull Nose Type WT-3 and WT-4: ANSI A137.1, and as follows:
1. Moisture Absorption: 3.0 to 7.0 percent.
2. Size and Shape: 4-1/4 inch (108 mm) square.
3. Edges: Cushioned.
4. Surface Finish: Matte glaze.
5. Color(s): Refer to the Finish Legend in the Drawings.
6. Trim Units: Matching surface bullnose shapes in sizes coordinated with field tile.
7. Products: Refer to the Finish Legend in the Drawings
    a. Substitutions: See Section 01 6000 - Product Requirements.
        1) See article in PART 1 above entitled "Available Manufacturers".

C. Matte Glazed Wall Tile, Type WT-5: ANSI A137.1, and as follows:
1. Moisture Absorption: 3.0 to 7.0 percent.
2. Size and Shape: 3 x 6 inches (75 x 150 mm).
3. Edges: Cushioned.
4. Surface Finish: Matte glaze.
5. Color(s): Refer to the Finish Legend in the Drawings.
6. Trim Units: Matching surface bullnose shapes in sizes coordinated with field tile.
7. Products: Refer to the Finish Legend in the Drawings
    a. Substitutions: See Section 01 6000 - Product Requirements.
        1) See article in PART 1 above entitled "Available Manufacturers".

D. Matte Glazed Cove Base Tile, Type BT-1 and BT-2: ANSI A137.1, and as follows:
1. Moisture Absorption: 3.0 to 7.0 percent.
2. Size and Shape: 4-1/4 inch (108 mm) square.
3. Edges: Cushioned.
4. Surface Finish: Matte glaze.
5. Color(s): Refer to the Finish Legend in the Drawings.
6. Trim Units: Matching cove shapes in sizes coordinated with field tile.
7. Products: Refer to the Finish Legend in the Drawings
    a. Substitutions: See Section 01 6000 - Product Requirements.
        1) See article in PART 1 above entitled "Available Manufacturers".

2.2 SETTING MATERIALS

A. Epoxy Adhesive and Mortar Bond Coat: ANSI A118.3.
1. Applications: At all tile locations and where indicated on drawings.
2. Products:
    a. LATICRETE International, Inc; LATICRETE LATAPOXY 300 Adhesive: www.laticrete.com.
    b. Substitutions: See Section 01 6000 - Product Requirements.
        1) See article in PART 1 above entitled "Available Manufacturers".

2.3 GROUTS

A. Manufacturers:
1. ARDEX Engineered Cements; _____: www.ardexamericas.com.
    a. Product: Ardex "WA" Epoxy Grout and Adhesive.
2. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com.

B. Epoxy Grout at fine joints less than 1/8 inch wide: ANSI A118.5 chemical resistant and water-cleanable epoxy grout.
1. Applications: Where indicated.
2. Color(s): As selected by Architect from manufacturer's full line, including premium priced colors.
3. Products:

a. Ardex WA Epoxy Grout and Adhesive
b. LATICRETE International, Inc; LATICRETE SpectraLOCK 2000 IG: www.laticrete.com.
c. Substitutions: See Section 01 6000 - Product Requirements.
1) See article in PART 1 above entitled "Available Manufacturers".

2.4 ACCESSORY MATERIALS

A. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
B. Waterproofing Membrane at ALL tiled surfaces - walls, floors, including at Showers and Tiled Tubs: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
1. Type: Fluid-applied.
2. Products:
C. Backer Board: Coated glass mat type complying with ASTM C1178/C1178M; inorganic fiberglass mat on both surfaces and integral acrylic coating vapor retarder.
D. Mesh Tape: 2-inch (50 mm) wide self-adhesive fiberglass mesh tape.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.
D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.
E. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Protect surrounding work from damage.
B. Vacuum clean surfaces and damp clean.
C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
D. Where applicable, Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.
E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.3 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1A thru A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
E. Form internal angles square and external angles bullnosed.
F. Sound tile after setting. Replace hollow sounding units.
G. Keep control and expansion joints free of mortar, grout, and adhesive.
H. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
I. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

J. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.4 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F131, with epoxy grout.
   1. Where epoxy bond coat and grout are indicated, install in accordance with TCNA (HB) Method F131.

3.5 INSTALLATION - WALL TILE

A. On exterior walls install in accordance with TCNA (HB) Method W202, thin-set over concrete and masonry with waterproofing membrane.
B. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

3.6 CLEANING

A. Clean tile and grout surfaces.

3.7 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 09 5100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Suspended metal grid ceiling system.
- B. Acoustical units.

1.2 RELATED REQUIREMENTS
- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 21 1300 - Fire Suppression Sprinklers: Sprinkler heads in ceiling system.
- C. Section 23 3700 - Air Outlets and Inlets: Air diffusion devices in ceiling.
- D. Section 26 5100 - Interior Lighting: Light fixtures in ceiling system.

1.3 REFERENCE STANDARDS
- A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.
- B. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

1.4 ADMINISTRATIVE REQUIREMENTS
- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

1.5 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning.
- C. Product Data: Provide data on suspension system components.
- D. Samples: Submit two samples ____by____ inch (____by____ mm) in size illustrating material and finish of acoustical units.
- E. Samples: Submit two samples each, 6 inches (152 mm) long, of suspension system main runner.
- F. Manufacturer's Installation Instructions: Indicate special procedures.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. See Section 01 6000 - Product Requirements, for additional provisions.
  2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.
- H. LEED Submittals:
  1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content

1.6 QUALITY ASSURANCE
- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.7 FIELD CONDITIONS
- A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.8 AVAILABLE MANUFACTURERS
- A. Substitutions - The product(s) referenced by the manufacturer listed, forms the basis of design. The contractor at their option may provide an alternate manufacturer as an equal, however, if an equal is proposed, the Contractor shall provide data from the specified manufacturer & product(s) as well as data from the proposed manufacturer for a comparison, review, and determination of acceptance (approval or disapproval) by the Architect. Approval cannot be

made if adequate comparison information is not provided. Absence of specified manufacturers' data is grounds for disapproval.

B. Refer to Section 01 3000 - Administrative Requirements AND Section 01 6000 - Product Requirements for substitution procedures.

PART 2 PRODUCTS

2.1 ACOUSTICAL UNITS

A. Manufacturers:
   1. Armstrong World Industries, Inc: www.armstrong.com.

B. Acoustical Units - General: ASTM E1264, Class A.

C. Low-Emitting Materials: Acoustical tile ceilings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Acoustical Tile Type SAT-1: Painted mineral fiber, ASTM E1264 Type III, with the following characteristics:
   1. VOC Content: As specified in Section 01 6116.
   2. Recycled Content: Provide acoustical panels with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 50 percent by weight.
   3. Size: 12 by 12 inches (300 by 300 mm).
   4. Thickness: 5/8 inches (15.9 mm).
   5. Composition: Water felted.
   6. Weight: 1.05 lbs./sf
   7. Light Reflectance: 85 percent, determined in accordance with ASTM E1264.
   8. NRC:.55, determined in accordance with ASTM E1264.
   9. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
   10. Edge: Square.
   11. Surface Color: White.
   12. Surface Pattern: Non-directional fissured.
   13. Products:
      a. Fine Fissured, Item #1831 manufactured by Armstrong..

E. Acoustical Panels Type SAT-2: Plastic faced mineral fiber, ASTM E1264 Type IV, with the following characteristics:
   1. VOC Content: As specified in Section 01 6116.
   2. Recycled Content: Provide acoustical panels with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 50 percent by weight.
   3. Size: 12 by 24 inches (300 by 600 mm).
   4. Thickness: 5/8 inches (15 mm).
   5. Composition: Wet felted.
   6. Vinyl-faced membrane.
   7. Weight: 1.10 lbs./sf.
   8. Light Reflectance: 78%.
   9. NRC: 0.55.
   10. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
   11. Edge: Square.
   12. Surface Pattern: Perforated, small holes.
   13. Suspension System: Exposed grid.
   14. Products:
      a. Clean Room VL Perforated, Item #869, as manufactured by Armstrong.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.2 SUSPENSION SYSTEM(S)

A. Manufacturers:
   1. Same as for acoustical units.

B. Suspension Systems - General: Complying with ASTM C635; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.
C. Exposed Steel Suspension System: Formed steel, commercial quality cold rolled; intermediate-duty.
   1. Profile: Tee; 15/16 inch (24 mm) wide face.
   2. Construction: Double web.
   3. Finish: White painted.
   4. Recycled Content: Provide products with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
   5. Products:
      a. Prelude by Armstrong.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.3 ACCESSORIES
A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
B. Light fixture securement:
   1. Extra hanging wires: Provide four hanging wires at all locations of light fixtures within grid for hanging of light fixtures by light fixture installer. Locate one wire at each corner of each light fixture. Required by code.
   2. Provide Hold-down clip near each corner of light fixtures to secure fixture to suspension system grid.
   3. Refer also to Section 26 5100 - Interior Lighting for additional requirements
C. Perimeter Moldings: Same material and finish as grid.
   1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.
D. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.1 EXAMINATION
A. Verify existing conditions before starting work.
B. Verify that layout of hangers will not interfere with other work.

3.2 INSTALLATION - SUSPENSION SYSTEM
A. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
B. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
C. Hang suspension system independent of walls, columns, ducts, pipes, light fixtures and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
D. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
E. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
F. Support fixture loads using supplementary hangers located within 6 inches (150 mm) of each corner, or support components independently.
G. Do not eccentrically load system or induce rotation of runners.
H. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.
   2. Overlap and rivet corners.
I. Form expansion joints as detailed. Form to accommodate plus or minus 1 inch (25 mm) movement. Maintain visual closure.

J. Prep for interior light fixture:
    1. Install extra hanging wires for light fixtures. One wire for each corner of each light fixture. Four wires typically for each fixture. Provide more wires where necessary.
    2. Provide hold-down clips, one for each corner of light fixtures.
    3. Refer also to Section 26 5100 - Interior Lighting.

3.3 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.
B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
C. Fit border trim neatly against abutting surfaces.
D. Install units after above-ceiling work is complete.
E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
F. Cutting Acoustical Units:
    1. Cut to fit irregular grid and perimeter edge trim.
    2. Make field cut edges of same profile as factory edges.
G. Where round obstructions occur, provide preformed closures to match perimeter molding.
H. Install hold-down clips on panels within 20 ft (6 m) of an exterior door.

3.4 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).
B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09 6500
RESILIENT FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Resilient base.
- B. Installation accessories.

1.2 RELATED REQUIREMENTS
- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.3 REFERENCE STANDARDS
- A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2014c.
- B. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008 (Reapproved 2012)e1.
- C. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; National Fire Protection Association; 2011.

1.4 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- D. Verification Samples: Submit two samples, ____by____ inch (____by____ mm) in size illustrating color and pattern for each resilient flooring product specified.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. See Section 01 6000 - Product Requirements, for additional provisions.
  2. Extra Wall Base: 100 linear feet (30.5 linear meters) of each type and color.
- F. LEED Submittals:
  1. Product Data for Credit IEQ 4.3: For adhesives and chemical-bonding compounds, documentation including printed statement of VOC content.

1.5 DELIVERY, STORAGE, AND HANDLING
- A. Protect roll materials from damage by storing on end.

1.6 FIELD CONDITIONS
- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

1.7 WARRANTY
- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Contractor shall correct defective Work within a two year period after Date of Substantial Completion; remove and replace materials concealing defective work at no extra cost to Owner.

PART 2 PRODUCTS

2.1 RESILIENT BASE
- A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style A, Straight, toeless; Style B, Cove, standard toe, and as follows:
  1. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
  2. SCS FloorScore Certified.
  3. Height: 4 inch (100 mm).
  4. Thickness: 0.125 inch (3.2 mm) thick.
  5. Finish: Satin.
  6. Color: Color as selected from manufacturer's standards.

7. Accessories: Premolded external corners and end stops.
8. Manufacturers:
    a. Johnsonite, a Tarkett Company; _____: www.johnsonite.com.
    b. Roppe Corp; _____: www.roppe.com.
    c. Flexco Floors; Product "Wallflowers"; www.flexcofloors.com
    d. Mannington Commercial; Product "Optimum Edge"; www.mannington.com.
    e. Substitutions: See Section 01 6000 - Product Requirements.

2.2 ACCESSORIES

A. Primers, Adhesives, and Seaming Materials: Waterproof; types recommended by flooring manufacturer.
B. Filler for Coved Base: Plastic.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

3.2 PREPARATION

A. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.3 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.
B. Install in accordance with manufacturer's instructions.
C. Spread only enough adhesive to permit installation of materials before initial set.
D. Fit joints tightly.
E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

3.4 RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 60 inches (1525 mm) between joints.
B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
C. Install base on solid backing. Bond tightly to wall and floor surfaces.
D. Scribe and fit to door frames and other interruptions.

3.5 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.
B. Clean in accordance with manufacturer's instructions.

END OF SECTION

SECTION 09 6516
RESILIENT ROLL AND TILE FLOORING

PART 1 - GENERAL

1.1 SECTION INCLUDES
- A. Resilient Roll Flooring
  1. Material used for countertop surfacing.

1.2 RELATED REQUIREMENTS
- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.3 REFERENCE STANDARDS
- A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.

1.4 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- D. Verification Samples: Submit two samples, 6 inch (152 mm) in size illustrating color and pattern for each resilient flooring product specified.
- E. Provide manufacturers written installation instructions.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. See Section 01 6000 - Product Requirements, for additional provisions.
  2. Extra Flooring Material: 30 square feet (2.787 square meters) of each type and color.
- G. LEED Submittals:
  1. Product Data for Credit IEQ 4.1: For adhesives and chemical-bonding compounds, documentation including printed statement of VOC content.
  2. Product Data for Credit IEQ 4.3: For adhesives and chemical-bonding compounds, documentation including printed statement of VOC content.
  3. Product Data for Credit IEQ 4.3: For resilient sheet flooring (used as countertop surfacing), documentation from an independent testing agency indicating compliance with the FloorScore Standard.

1.5 WARRANTY
- A. Re-Tire is warranted for ten (10) years for material or manufacture defects.

1.6 AVAILABLE MANUFACTURERS
- A. Substitutions: The product(s) referenced by the manufacturer listed, forms the basis of design. The contractor at their option may provide an alternate manufacturer as an equal, however, if an equal is proposed, the Contractor shall provide data from the specified manufacturer & product(s) as well as data from the proposed manufacturer for a comparison, review, and determination of acceptance (approval or disapproval) by the Architect. Approval cannot be made if adequate comparison information is not provided. Absence of specified manufacturers' data is grounds for disapproval.
- B. Refer to Section 01 3000 - Administrative Requirements AND Section 01 6000 - Product Requirements for substitution procedures.

PART 2 - PRODUCT

2.1 MANUFACTURER
- A. Distributor: Capri Cork, 209 Bucky Drive, Lititz, PA 17543; Toll-free: (800) 492-2613
- B. Product - RE-TIRE recycled rubber rolls and tiles
  1. Product Description
     a. Resilient Roll Flooring material used as countertop surfacing

b. Reference manufacturers Document RT403 for specific test results as the individual colors have different test results

2. Construction
   a. Re-Tire is a blend of SBR tire waste and EPDM rubber.
      1) Proportions of each vary according to color.
      2) Re-Tire is available in 50 standard colors.
3. Physical Characteristics
   a. Sheet thickness: 9 mm thickness.
   b. Standard roll sizes: 48” wide.

C. Substitutions: See Section 01 6000 - Product Requirements.
   1. See article in PART 1 above entitled "Available Manufacturers".

2.2 ADHESIVES

A. Capri recommends Capri AR4000 and WAKOL PU 225 adhesives. All adhesives are available from Capri.

B. Adhesives: Water-resistant type recommended by manufacturer to suit floor covering and substrate conditions indicated.
   1. Adhesives shall have a VOC content of not more than 60 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 PREPARATION

A. Jobsite Conditions and Material Acclimation
   1. All trades must be out of the area before installation begins. After installation is complete and if other trades will work in the area, appropriate protective cover shall be placed on the floor prior to any work.
   2. Area where flooring is to be installed shall be temperature controlled between 65° and 75° F for 72 hours prior to, during and after installation. Re-Tire and adhesive must be placed in the area where it will be installed 72 hours before starting installation.

3.2 INSTALLATION

A. Substrate preparation
   1. All substrates shall be cleaned, dry, smooth, flat and structurally sound.
   2. Substrate shall be free of dust, solvent, paint, wax, oil, grease, sealers, old adhesives or other materials according to ASTM F710.
   3. Before installing any materials make sure that the area is completely dry and level 3/16” in 10 feet; do calcium chloride and/or relative humidity testing and check for pH level.
   4. Moisture should not exceed 3 lbs/ 1000 sq. ft. and/or relative humidity should be less than 75% and pH level should be 7-10.
   5. If moisture exceeds the requirement, DO NOT PROCEED with installation without contacting the Capri technical department. Capri can offer solutions for moisture problems.
   6. Substrate Type(s)
      a. Concrete floors, if uneven must be leveled and patched (use only Portland based patching compounds). If floor is new, be sure it is completely dry (several months curing is preferred). Sweep area clean. Slab shall adhere to ASTM F1869 for water vapor emissions. Cracks, expansion joints and uneven area shall be filled with a material intended for that purpose.
      b. Wood substrates shall be double layer construction with a minimum total thickness of one inch (1”) suspended at least 18 inches (457 mm) above the ground or above a concrete slab, with adequate cross ventilation. Crawl spaces shall be insulated and protected by a vapor barrier. If needed, floor may be covered with ¼” or thicker” A.P.A. approved underlayment plywood.
      c. An adhesive bond test shall be completed in several locations across the floor. Glue down a tile of material with recommended adhesive and trowel and let sit for 48 hours

before trying to remove. It shall be relatively difficult to pull the tile up and there shall be adhesive on the floor and the tile.

B. Installation of Re-Tire
   1. Please refer to the Installation Instruction documents RT405R (roll installation) available at capricork.com or by calling (800) 492-2613.
   2. Spread adhesive according to directions on adhesive pail and installation instructions provided by Capri, paying close attention to spread rate, open time and working time. Environmental conditions (i.e. temperature, humidity, direct sunlight) will affect open and working time.
   3. Adhesive on tiles or seams must be removed when adhesive is still wet. Removal of dry adhesive might cause damage to Re-Tire.
   4. Restrict foot traffic on the floor for 24 hours. Do not clean floor for 24 hours.

3.3 APPLICATION OF FLOOR FINISH

A. Re-Tire Basics, Kaleidoscope and Medley colors require finish coats.
B. Finish coats for Shades of Black are optional. When Shades of Black is installed in sports facilities where spikes or skates will be worn, finish shall not be applied.
C. In fitness areas with free weights, weights dropped on floor may mar the finish.
D. Only Capri approved finishes shall be used. There are 2 approved finishes for Re-Tire. Refer to document RT406FO for approved finishes.

3.4 MAINTENANCE

A. The initial cleaning of a new floor is very important. This cleaning is done to remove any dirt and grit from job site conditions.
   1. INITIAL CLEANING SHALL NOT TAKE PLACE UNTIL 24 Hours AFTER INSTALLATION. To avoid possible damage to the flooring, the following shall never be used on the floor: steel wool or abrasive brushes, abrasive or alkaline cleaners, solvents of any type.
B. Thoroughly sweep or vacuum flooring to remove all loose dirt and grit. The floor shall be cleaned with a neutral cleaner. Re-Tire maintenance instructions (RT406) are available at capricork.com or by calling 800.492.2613.

3.5 REGULAR MAINTENANCE PROGRAM

A. A regular maintenance program is extremely important and will increase the life of the floor and finish. The frequency of cleaning will depend on the amount of foot traffic on the floor. Sweep or vacuum the floor regularly. Clean the floor with a neutral cleaner.
B. Re-Tire maintenance instructions (RT406) are available at capricork.com or by calling (800) 492-2613.

END OF SECTION

SECTION 09 6813
TILE CARPETING

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Carpet tile, fully adhered.

1.2 RELATED REQUIREMENTS
- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.

1.3 REFERENCE STANDARDS
- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2006 (Reapproved 2011).
- B. CRI (CIS) - Carpet Installation Standard; Carpet and Rug Institute; 2011.

1.4 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.
- D. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. See Section 01 6000 - Product Requirements, for additional provisions.
  2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.5 QUALITY ASSURANCE
- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.6 WARRANTY
- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Contractor shall correct defective Work within a two year period after Date of Substantial Completion; remove and replace materials concealing defective work at no extra cost to Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS
- A. Tile Carpeting:
  1. Shaw Contract Group: www.shawcontractgroup.com
  2. Mannington: www.mannington.com
  3. Substitutions: See Section 01 6000 - Product Requirements.

2.2 MATERIALS
- A. Tile Carpeting, Type _____: Tufted, manufactured in one color dye lot.
  1. Tile Size: 19.7 x 19.7 inch (500 x 500 mm), nominal.
  2. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
  3. VOC Content: Comply with Section 01 6116.
  4. Max. Electrostatic Charge: 3 Kv. at 20 percent relative humidity.
  5. Gage: 1/8 inch (____ mm).
  6. Stitches: 10.3 per inch (____ per cm).
  7. Light Fastness: > 4.0 at 80 hours.

8. Total Weight: 95 oz/sq yd (3,221 g/sq m).

2.3 ACCESSORIES

A. Sub-Floor Filler: White premix latex; type recommended by flooring material manufacturer.
B. Edge Strips: Embossed aluminum, _____ color.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
B. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and pH.
    1. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.2 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.
B. Install carpet tile in accordance with manufacturer's instructions and CRI (CIS).
C. Blend carpet from different cartons to ensure minimal variation in color match.
D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.
F. Fully adhere carpet tile to substrate.
G. Trim carpet tile neatly at walls and around interruptions.
H. Complete installation of edge strips, concealing exposed edges.

3.3 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 9000
PAINTING AND COATING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.
B. Field application of paints, stains, varnishes, and other coatings.
C. Materials for backpriming woodwork.
D. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Exposed surfaces of steel lintels and ledge angles.
   3. Prime surfaces to receive wall coverings.
E. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Stainless steel, anodized aluminum, bronze, terne, and lead items.
   6. Marble, granite, slate, and other natural stones.
   7. Floors, unless specifically so indicated.
   8. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
   9. Glass.
   10. Acoustical materials, unless specifically so indicated.
   11. Concealed pipes, ducts, and conduits.

1.2 RELATED REQUIREMENTS

A. Section 05 1213 - Architecturally Exposed Structural Steel (AESS).
B. Section 05 5000 - Metal Fabrications: Shop-primed items.

1.3 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
B. ASTM D 823 - Standard Practices for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products on Test Panels; 95(2007).
C. ASTM D 2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine; 2011.
D. ASTM D 3363 - Standard Test Method for Film Hardness by Pencil Test; 05(2011)e1.
E. ASTM D 3964 - Standard Practice for Selection of Coating Specimens for Appearance Measurements; 2010.
F. ASTM D 4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.
G. SSPC (PM1) - Good Painting Practice: SSPC Painting Manual, Vol. 1; Society for Protective Coatings; Fourth Edition.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Paint and Coatings: 1 gallon (4 L) of each color; store where directed.
   3. Label each container with color in addition to the manufacturer's label.
C. Product Data: Provide complete list of all products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
2. Manufacturer's installation instructions. Indicate special surface preparation procedures.

D. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
1. Where sheen is specified, submit samples in only that sheen.
2. Where sheen is not specified, submit each color in each sheen available.

E. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and coated surfaces, and color samples of each color and finish used.

F. LEED Submittals:
1. Product Data for Credit EQ 4.2: For paints and coatings, including printed statement of VOC content.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.7 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 45 degrees F (7 degrees C) for interiors; 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.

E. Minimum Application Temperature for Varnish Finishes: 65 degrees F (18 degrees C) for interior or exterior, unless required otherwise by manufacturer's instructions.

F. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer; except as noted.

B. Paints:
1. Base Manufacturer: Sherwin-Williams Company: www.sherwin-williams.com. (SW or S-W)
2. Glidden Professional: www.gliddenprofessional.com. (GL)
3. Kwal Paint, a Comex Group company: www.kwalpaint.com. (Kwl)
4. Benjamin Moore & Co: www.benjaminmoore.com. (BM or Benj. Moore)
5. PPG Architectural Finishes, Inc: www.ppgaf.com. (PPG)
6. Pratt & Lambert Paints: www.prattandlambert.com. (P&L)

C. Substitutions: See Section 01 6000 - Product Requirements.

2.2 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
   1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Supply each coating material in quantity required to complete entire project's work from a single production run.
   3. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Volatile Organic Compound (VOC) Content:
   1. Provide coatings that comply with the most stringent requirements specified in the following:
      a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
   2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

2.3 SPECIAL COATINGS - EXTERIOR and INTERIOR

A. Use products of the same manufacturer.

B. Exterior Special Coating: Advanced Thermoset Solution Fluoropolymer coating ME-OP-3X/F (Fluoronar) on exposed steel, including guardrails & handrails and steel doors & steel door frames. Tnemec Series 1070 Fluoronar, Gloss (topcoats); includes metallic color coatings.
   1. Surface Preparation: SSPC SP7 Brush Off Blast.
   2. Surface Preparation for Galvanized surfaces: Mechanically abrade uniformly and thoroughly as per ASTM D 6386.
   3. Prime Coat: Inorganic Hybrid Water-Based Epoxy. Product - Tnemec Series 27WB Typoxy, over prepared surface:
      a. Minimum Dry Film Thickness (DFT) per coat (Primer): 4.0 mils.
      b. Volume Solids: Theoretical 90% (mixed).
      c. VOC: 0.10 lbs/gal (11 g/L) (unthinned).
      d. HAPs: 0 lbs/gal (0.000 kg/L solids.
   4. Finish Coats: Advanced Thermoset Solution Fluoropolymer coating. Product - Tnemec Series 1070 Fluoronar, Two coats, Gloss:
      a. Minimum Dry Film Thickness (DFT) per coat: 2.0 mils (50 microns) per coat.
      b. Volume Solids: Minimum 58% (mixed, may vary with color).
      c. VOC: 2.93 lbs/gal (351 g/L) (unthinned).
      d. HAPs: 4.1 lbs/gal (0.4913 kg/L) solids (unthinned).
      e. Color fade and chalk resistant.
   5. Finish Coats: Sherwin Williams Hi-Solids Polyurethane 100

C. Catwalk Exterior Special Coating: Aliphatic Polyester Polyurethane coating, ME-OP-3X/APP-290 (Aliphatic Polyester Polyurethane) on exposed steel on Catwalk, all surfaces. Product - Tnemec Strata Shield CRU, Series 290 (topcoat).
   1. Primer: Polyamide Epoxy. Product - Tnemec Hi-Build Epoxoline, Series 66.
      a. Recommended Dry Film Thickness (DFT) per coat (Primer): 2.0 to 6.0 mils as recommended by manufacturer.
      b. Minimum 54% Volume Solids.
      c. VOC Unthinned, 5% thinned, 10% thinned: 362, 384, 404 g/L; 3.02, 3.20, 3.37 lb/gal, respectively.
   2. Finish coats: Aliphatic Polyester Polyurethane; Two coats, over manufacturer recommended primer. Product - Tnemec Strata Shield CRU, Series 290.
      a. Recommended Dry Film Thickness (DFT) per coat: 2.0 to 3.0 mils as recommended by manufacturer.

b. Volume Solids: 65% minimum, mixed.
c. VOC Unthinned: 288 g/L; 2.41 lb/gal.
d. HAPS : 0.16 lbs/gal solids (19.172 g/L or 0.0191 kg/L).
e. Sheen: Semi-gloss.
f. Pencil Hardness: 2H.
g. Color fade and chalk resistant.

3. Added Coat (fourth coat) with Anti-Slip Additive at walk surfaces (treads and deck). Tnemec CRU, Series 290 with Anti-Slip Additive. Product - Tnemec Glass Beads 212.
   a. Slip Resistance shall be minimum of 0.6 as determined by ASTM D 2047.

D. Exterior Special Coating (Paint ZE-OP-1C) - Hot-Dipped Galvanized Surface Repair Coating, Liquid organic zinc compound, 1 coat, or as noted herein:
1. Prepare surface per manufacturer recommendation.
2. One coat of Zinc-rich compound. Product - ZRC Galvite Galvanizing Compound.
   a. Minimum Dry Film Thickness (DFT) per coat: 1.5 mils.
   b. Volume Solids: 52% per ASTM D 2832.
   c. VOC : 385 g/L; 3.3 lb/gal. Per ASTM D 1475.
   d. Pencil hardness: 2H per ASTM D 3363
   e. Sheen: Metallic low-gloss.
3. Separate Finish Coat(s) not required on items and surfaces on which the galvanized coating is the finish coat.
4. Finish Coats:
   a. Match prime and finish coats of Exterior Special Coating - Gloss, exterior Prime Coat and Finish Coats listed above. IMPORTANT - Verify compatibility.
   b. DO NOT USE alkyd, alkyd-modified acrylic, or lacquer type products.

E. Interior Special Coating - Gloss: Low VOC Hybrid Aliphatic Polyurethane, MI-OP-3X/AP-740 (Low VOC Hybrid Aliphatic Polyurethane) on interior exposed steel, including guardrails & handrails, steel doors & steel door frames, and at interior locations identified in Section 05 1213 - Architecturally Exposed Structural Steel (AESS). Product - Tnemec Endura-Shield, Series 740, Gloss (topcoats); includes metallic color coatings.
1. Surface Preparation: SSPC SP7 Brush Off Blast.
2. Prime Coat: Inorganic Hybrid Water-Based Epoxy, over prepared surface. Product - Tnemec Series 27WB Typoxy:
   a. Minimum Dry Film Thickness (DFT) per coat (Primer): 4.0 mils.
   b. Volume Solids: Theoretical 90% (mixed).
   c. VOC Unthinned: 0.10 lbs/gal (11 g/L).
   d. HAPS: 0 lbs/gal solids.
3. Finish coats: Low VOC Hybrid Aliphatic Polyurethane, Two coats, Gloss, over manufacturer recommended primer. Product - Tnemec Series 740 Endura-Shield:
   a. Minimum Dry Film Thickness (DFT) per coat: 3.0 mils (75 microns) per coat.
   b. Volume Solids: Minimum 71% (mixed).
   c. VOC Unthinned: 0.77 lbs/gal (92 g/L).
   d. Hazardous Air Pollutants (HAPs): 0 lbs/gal solids (unthinned).
   e. VOC : _ g/L; _ lb/gal.
   f. Hazardous Air Pollutants (HAPs): N/A.
   g. Color fade and chalk resistant.

F. Interior Special Coating (Paint ZI-OP-3C) - Hot-Dipped Galvanized Surface Repair Coating, Liquid organic zinc compound, 1 coat, or as noted herein:
1. Prepare surface per manufacturer recommendation.
2. One coat of Zinc-rich compound. Product - ZRC 221 Galvanizing Compound.
   a. Minimum Dry Film Thickness (DFT) per coat: 1.5 mils.
   b. Volume Solids: 56%.
   c. VOC Unthinned: 221 g/L; 1.84 lb/gal. Per ASTM D 3960.
   d. Minimum Thickness: _ mils wet; _ mils dry per coat.
   e. Minimum _% Volume Solids.
   f. Sheen: Metallic low-gloss.

3. Separate Finish Coat(s) not required on items on which the galvanized coating is the finish coat.
4. Finish Coats:
    a. Match prime and finish coats of Interior Special Coating - Gloss, Interior Prime Coat and Finish Coats listed above. IMPORTANT - Verify compatibility.
    b. DO NOT USE alkyd, alkyd-modified acrylic, or lacquer type products.

G. Powder Coating:
1. Remove existing coating(s) to bare metal.
2. Clean thoroughly and allow to dry.
3. Dip item(s) in Iron Phosphate Coating.
4. Provide finished powdercoat of a Polyester powder.

H. Digital Theater Paint Special Coating (Paint POSI-OP-3C) - Wall paint to provide projection screen type surface on wall; primer and spray-on top coat(s).
1. Prepare surface per manufacturer recommendation.
2. One coat of latex primer sealer; SW PrepRite Classic Interior Latex Primer. Flat white.
    a. Minimum Thickness: 4 mils wet, 1.6 mils dry.
    b. Minimum 38% Volume Solids.
    c. VOC : 91 grams/liter; 0.76 lbs/gal.
3. Two spray-on coats digital theater paint. Product "3D HD Silver Screen" oil based, product number G3D, as manufactured by Paint On Screen. T: (800) 236-8015. NOTE: Must use HPLV gun to spray the oil based product.
    a. Minimum WET Thickness per coat: 3 mils wet. Verify with manufacturer.
    b. Minimum DRY Thickness per coat: 1.5 mils dry. Verify with manufacturer.
    c. VOC : 350 grams/liter; 2.92 lbs/gal. (11/4/2010)
    d. 1 Gallon coverage = 170 sq. ft. / 240 inch diagonal.
    e. Gain: 2.6 to 4.0. Verify requirements for this application.
    f. Viscosity 115+ cSt for oil based coating.
    g. Viewing Angle (cone): 110 to 160 degrees.
4. Substitutions: NOT permitted. No Exceptions.

2.4 CONCRETE CURE AND SEALER

A. Verify that all products and procedures are compatible.
1. Coordinate and verify treatment of concrete slab curing and sealing with respective trade(s). Cure and seal procedures and products shall be compatible with flooring products used throughout this project. All affected trades shall make coordinated plans, preparations, product selection, and properly execute curing and sealing to be compatible for satisfactory flooring applications including areas that may need different types of preparation, product, and execution.
2. Products listed below shall be verified by all parties involved in the construction to be compatible with all other products, procedures, and finishes used for this project.

B. Cure and Sealers for all locations:
1. Euclid Chemical Company:
    a. Super Aqua-Cure VOX.
2. L. M. Scofield Company:
    a. Clear finish coat over new concrete, waterborne sealer: Semi-gloss Scofield Clearcoat.
3. Dayton Superior Safe Cure and Seal (J-18).
4. L & M Dress & Seal WB.
5. UNITEX 12-34.
6. Substitutions: See Section 01600 - Product Requirements.

2.5 PAINT SYSTEMS - EXTERIOR

A. Paint WE-OP-3L - Wood, Opaque, Latex, 3 Coat:
1. One coat of oil-based primer sealer. SW Exterior Oil-Based Wood Primer Y24W08020.
    a. Minimum Thickness: 4 mils wet; 2.3 mils dry per coat.
    b. Minimum 57% Volume Solids.
    c. VOC (less exempt solvents): 319 g/L; 2.66 lb/gal.

d. Hazardous Air Pollutants (HAPs): 0.03 lbs/gal 0.003 kg/L of solids.

2. Satin: Two Coats acrylic coating: SW Duration Exterior Latex Satin Coating, K33 Series.
   a. Minimum Thickness: 5.3 mils wet; 2.2 mils dry per coat.
   b. Minimum 39% Volume Solids.
   c. VOC (less exempt solvents): 113 g/L; 0.94 lb/gal.
   d. Hazardous Air Pollutants (HAPs): 0.49 lbs/gal (0.059 kg/L) of solids.

B. Paint WE-TR-VS - Wood, Transparent, Varnish, Stain:
   1. Two coats of wood basecoat stain; Sikkens Cetol 1, exterior wood basecoat.
      a. Sheen: Satin
      b. Minimum Thickness: No Surface film.
      c. Minimum 31.8% Volume Solids.
      d. VOC : 550 g/L; 4.59 lb/gal.
      e. Color: As selected by Architect.
   2. Satin: Two coats of varnish; Sikkens Cetol 23.
      a. Color: Clear Amber.
      b. Minimum Thickness: 4 mils wet; 1.4 mils dry per coat.
      c. Minimum 32% Volume Solids.
      d. VOC : 490 g/L; 4.08 lb/gal.
      e. Color: Clear.

C. Paint BE-OP-3L - Fiber Cement Board, Opaque, Acrylic/Latex, 3 Coat:
   1. One coat of latex primer sealer. SW Loxon Concrete & Masonry Primer, Interior/Exterior Latex, series A24W8300 (formerly “Loxon Acrylic Primer”).
      a. Minimum Thickness: 5.3 mils wet; 2.1 mils dry, per coat.
      b. Minimum 38% Volume Solids.
      c. VOC (less exempt solvents): 96 g/L; 0,80 lb/gal.
      d. Hazardous Air Pollutants (HAPs): 0.0 lbs/gal (0.0 kg/L) of solids.
   2. Flat: Two Coats acrylic coating: SW Duration Exterior Latex Flat Coating, K32 Series.
      a. Minimum Thickness: 5.3 mils wet; 2.2 mils dry per coat.
      b. Minimum 39% Volume Solids.
      c. VOC (less exempt solvents): 86 g/L; 0.72 lb/gal.
      d. Hazardous Air Pollutants (HAPs): 0.36 lbs/gal (0.043 kg/L) of solids.

D. Paint CE-OP-3L - Masonry/Concrete, Opaque, Acrylic/Latex, 3 Coat:
   1. Primer/Filler for CMU only: One coat SW High-Build Heavy Duty Block Filler B42WJ446 (Do NOT use on Concrete).
      a. Minimum Thickness: 16 mils wet; 8 mils dry per coat.
      b. Minimum 58% Volume Solids.
      c. VOC (EPA Method #24): 66 g/L; 0.55 lb/gal.
      d. Hazardous Air Pollutants (HAPs): 0.0 lbs/gal (0.0 kg/L) of solids.
   2. Primer for Concrete: One coat primer; SW Loxon® Exterior Acrylic Masonry Primer, A24W300 (Do NOT use on CMU).
      a. Minimum Thickness: 5.3 mils wet; 2.1 mils dry per coat.
      b. Minimum 38% Volume Solids.
      c. VOC (less exempt solvents): 96 g/L; 0.80 lb/gal.
      d. Hazardous Air Pollutants (HAPs): 0.0 lbs/gal (0.0 kg/L) of solids.
   3. Semi-gloss: Two coats of acrylic; SW Pro Industrial™ Zero VOC Semi-Gloss Acrylic, B66-650 Series.
      a. Minimum Thickness: 6.0 mils wet; 2.5 mils dry per coat.
      b. Minimum 33% Volume Solids.
      c. VOC (EPA Method #24): 0 grams/liter; Trace.
      d. Hazardous Air Pollutants (HAPs): 0.0 lbs/gal (0.0 kg/L) of solids.

E. Paint GE-OP-3L - Gypsum Board and Plaster, Opaque, Latex, 3 Coat:
   1. One coat of latex primer sealer. SW Loxon Concrete & Masonry Primer, Interior/Exterior Latex, series A24W8300 (formerly “Loxon Acrylic Primer”).
      a. Minimum Thickness: 5.3 mils wet; 2.1 mils dry, per coat.
      b. Minimum 38% Volume Solids.
      c. VOC (less exempt solvents): 96 g/L; 0,80 lb/gal.

d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal (0.000 kg/L) of solids.

2. Flat: Two coats of latex; SW Duration Exterior Latex Flat Coating, K32 Series..
   a. Minimum Thickness: 5.3 mils wet; 2.2 mils dry per coat.
   b. Minimum 39% Volume Solids.
   c. VOC (less exempt solvents): 86 g/L; 0.72 lb/gal.
   d. Hazardous Air Pollutants (HAPs): 0.36 lbs/gal (0.043 kg/L) of solids.

F. Paint ME-OP-3L - Ferrous Metals, Unprimed, Latex, 3 Coat:
   1. Not for use at exterior exposed structural steel, guardrails, handrails, steel doors, and steel door frames. See Special Coatings - Exterior and Interior.
   2. One coat of acrylic primer. SW Pro Industrial™ Pro-Cryl Universal Primer, B66-310 Series.
      a. Minimum Thickness: 5 mils wet; 2 mils dry per coat.
      b. Minimum 37% Volume Solids.
      c. VOC (EPA Method #24): <100 g/L; <0.83 lb/gal.
      d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal (0.000 kg/L) of solids.
   3. Gloss: Two coats of latex enamel; SW Pro Industrial™ Zero VOC Gloss Acrylic, B66-600 Series.
      a. For use ONLY at _____.
      b. NOT for use at exterior exposed structural steel, guardrails, handrails, steel doors, steel door frames, ____, and ____.
      c. Minimum Thickness: 6.0 mils wet; 2.5 mils dry per coat.
      d. Minimum 33% Volume Solids.
      e. VOC (EPA Method #24): 0 g/L; Trace. Unreduced.
      f. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal (0.000 kg/L) of solids.
   4. Semi-gloss: Two coats of latex enamel; SW Pro Industrial™ Zero VOC Semi-Gloss Acrylic, B66-650 Series.
      a. For use ONLY at _____.
      b. NOT for use at exterior exposed structural steel, guardrails, handrails, steel doors, steel door frames, ____, and ____.
      c. Minimum Thickness: 6.0 mils wet; 2.5 mils dry per coat.
      d. Minimum 33% Volume Solids.
      e. VOC (EPA Method #24): 0 g/L; Trace. Unreduced.
      f. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal (0.000 kg/L) of solids.
   5. Egg Shell: Two coats of latex enamel; SW Pro Industrial™ Zero VOC Eg-Shel Acrylic, B66-660 Series.
      a. For use ONLY at _____.
      b. NOT for use at exterior exposed structural steel, guardrails, handrails, steel doors, steel door frames, ____, and ____.
      c. Minimum Thickness: 6.0 mils wet; 2.5 mils dry per coat.
      d. Minimum 33% Volume Solids.
      e. VOC (EPA Method #24): 0 g/L; Trace. Unreduced.
      f. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal (0.000 kg/L) of solids.

G. Paint MgE-OP-3L - Galvanized Metals, Acrylic, 3 Coat:
   1. One coat acrylic primer. SW Pro Industrial™ Pro-Cryl Universal Primer, B66-310 Series.
      a. Minimum Thickness: 5 mils wet; 2 mils dry per coat.
      b. Minimum 37% Volume Solids.
      c. VOC (EPA Method #24): <100 g/L; <0.83 lb/gal.
      d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal (0.000 kg/L) of solids.
   2. Gloss: Two coats of Acrylic coating; SW Pro Industrial™ Zero VOC Gloss Acrylic, B66-600 Series.
      a. Minimum Thickness: 6.0 mils wet; 2.5 mils dry per coat.
      b. Minimum 33% Volume Solids.
      c. VOC (EPA Method #24): 0 g/L; Trace. Unreduced.
      d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal (0.000 kg/L) of solids.
   3. Semi-gloss: Two coats of Acrylic coating; SW Pro Industrial™ Zero VOC Semi-Gloss Acrylic, B66-650 Series.

a. Minimum Thickness: 6.0 mils wet; 2.5 mils dry per coat.
b. Minimum 33% Volume Solids.
c. VOC (EPA Method #24): 0 g/L; Trace. Unreduced.
d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal (0.000 kg/L) of solids.

4. Egg Shell: Two coats of Acrylic coating; SW Pro Industrial™ Zero VOC Eg-Shel Acrylic, B66-660 Series.
   a. For use ONLY at _____.
   b. NOT for use at exterior exposed structural steel, guardrails, handrails, steel doors, steel door frames, ____, and ____.
   c. Minimum Thickness: 6.0 mils wet; 2.5 mils dry per coat.
   d. Minimum 33% Volume Solids.
   e. VOC (EPA Method #24): 0 g/L; Trace. Unreduced.
   f. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal (0.000 kg/L) of solids.

H. Paint MaE-OP-3L - Aluminum , Unprimed, Acrylic, 3 Coat:
1. One coat acrylic primer. SW Pro Industrial™ Pro-Cryl Universal Primer, B66-310 Series.
   a. Minimum Thickness: 5 mils wet; 2 mils dry per coat.
   b. Minimum 37% Volume Solids.
   c. VOC (EPA Method #24): <100 g/L; <0.83 lb/gal.
   d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal (0.000 kg/L) of solids.
2. Gloss: Two coats of Acrylic coating; SW Pro Industrial™ Zero VOC Gloss Acrylic, B66-600 Series.
   a. Minimum Thickness: 6.0 mils wet; 2.5 mils dry per coat.
   b. Minimum 33% Volume Solids.
   c. VOC (EPA Method #24): 0 g/L; Trace. Unreduced.
   d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal (0.000 kg/L) of solids.
   e. <<< ===== XvX ===== >>>.
3. Semi-gloss: Two coats of Acrylic coating; SW Pro Industrial™ Zero VOC Semi-Gloss Acrylic, B66-650 Series.
   a. Minimum Thickness: 6.0 mils wet; 2.5 mils dry per coat.
   b. Minimum 33% Volume Solids.
   c. VOC (EPA Method #24): 0 g/L; Trace. Unreduced.
   d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal (0.000 kg/L) of solids.
4. Egg Shell: Two coats of Acrylic coating; SW Pro Industrial™ Zero VOC Eg-Shel Acrylic, B66-660 Series.
   a. For use ONLY at _____.
   b. NOT for use at exterior exposed structural steel, guardrails, handrails, steel doors, steel door frames, ____, and ____.
   c. Minimum Thickness: 6.0 mils wet; 2.5 mils dry per coat.
   d. Minimum 33% Volume Solids.
   e. VOC (EPA Method #24): 0 g/L; Trace. Unreduced.
   f. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal (0.000 kg/L) of solids.

I. Paint E-Pav - Pavement Marking Paint:
1. White: One coat, ; Traffic Marking Paint.
   a. Minimum Thickness: 15 mils wet; 9 mils dry per coat.
   b. Minimum 60% Volume Solids.
   c. VOC (less exempt solvents): 87 g/L; 0.72 lb/gal.
2. Products:
   a. Sherwin-Williams Hotline Fast Dry Latex Traffic Marking Paint, White (TT-P-1952D).
   b. 3M All Weather Paint. high-build waterborne traffic paint EHB-R1.
   c. SA-SO Rubberized Traffic Marking Paint.
   d. SA-SO Speed-Kote Traffic Paint.
   e. Emedco Traffic Marking Paint.
   f. Franklin Hydrophast Waterborne Traffic Paint.
   g. Franklin 1952B Waterborne Traffic Paint
3. Manufacturer/Suppliers:
   a. Sherwin-Williams Company: www.sherwin-williams.com. (SW).

b. 3M Company, St. Paul, MN; T: (888) 364-3577
c. SA-SO Company, Dallas, TX; T: (800) 527-2450.
d. Emedco; T: (800) 442-3633.
e. Franklin Paint Co. Inc., Franklin MA; T: (800) 486-0304.

2.6 PAINT SYSTEMS - INTERIOR

A. Paint WI-OP-3L - Wood, Opaque, Latex, 3 Coat:
1. Semi-gloss: Two coats of vinyl acrylic finish; SW ProMar 200 Zero VOC Interior Latex Semi-Gloss B31-2600 Series .
a. Greenguard Indoor Air Quality Certified.
b. Minimum Thickness: 4 mils wet; 1.7 mils dry per coat.
c. Minimum 37% Volume Solids.
d. VOC : 0 g/L; 0.0 lb/gal.
e. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal 0.000 kg/L of solids.
2. Eggshell: Two coats of vinyl acrylic finish; SW ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-2600 Series.
a. Greenguard Indoor Air Quality Certified.
b. Minimum Thickness: 4 mils wet; 1.7 mils dry per coat.
c. Minimum 40% Volume Solids.
d. VOC (less exempt solvents): 0 g/L; 0.0 lb/gal.
e. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal 0.000 kg/L of solids.
f. <<< ===== XvX ===== >>>.
3. Low Sheen: Two coats of vinyl acrylic finish; SW ProMar 200 Zero VOC Interior Latex Low Sheen B24-2600 Series.
a. Greenguard Indoor Air Quality Certified.
b. Minimum Thickness: 4 mils wet; 1.6 mils dry per coat.
c. Minimum 39% Volume Solids.
d. VOC (less exempt solvents): 0 g/L; 0.0 lb/gal.
e. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal 0.000 kg/L of solids.
f. <<< ===== XvX ===== >>>.
4. Flat: Two coats of vinyl acrylic finish; SW ProMar 200 Zero VOC Interior Latex Flat B30-2600 Series.
a. Greenguard Indoor Air Quality Certified.
b. Minimum Thickness: 4 mils wet; 1.6 mils dry per coat.
c. Minimum 39% Volume Solids.
d. VOC (less exempt solvents): 0 g/L; 0.0 lb/gal.
e. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal 0.000 kg/L of solids.
f. <<< ===== XvX ===== >>>.

B. Paint WI-TR-V - Wood, Transparent, Varnish, No Stain:
1. One coat sealer. SW Wood Classics Fast Dry Sanding Sealer, B26V43.
a. Minimum Thickness: 3.5 mils wet; 1.0 mils dry per coat.
b. Minimum 29% Volume Solids.
c. VOC (less exempt solvents): 522 g/L; 4.36 lb/gal.
d. Hazardous Air Pollutants (HAPs): 0.59 lbs/gal 0.071 kg/L of solids.
e. Vehicle Type: Linseed Vinyl Toluene Alkyd.
2. Satin: Two coats of varnish; SW Wood Classics Waterborne Polyurethane Varnish, Satin A68F90 series.
a. Minimum Thickness: 3.2 mils wet; 0.8 mils dry per coat.
b. Minimum 25% Volume Solids.
c. VOC : 308 g/L; 2.57 lb/gal.
d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal 0.000 kg/L of solids.
e. Vehicle Type: Polyurethane Acrylic.

C. Paint WI-TR-VS - Wood, Transparent, Varnish, Stain:
1. Two coats of stain; SW Wood Classics Interior Oil Stain 250 VOC A49-800 Series.
a. Minimum Thickness: 3.0 mils wet; (No dry surface film) per coat.
b. Minimum 73% Volume Solids.

c. VOC (less exempt solvents): 202 g/L; 1.68 lb/gal.
d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal 0.000 kg/L of solids.
e. Vehicle Type: Alkyd.

2. Satin: Two coats of varnish; SW Wood Classics Waterborne Polyurethane Varnish, Satin A68F90 series.
a. Minimum Thickness: 3.2 mils wet; 0.8 mils dry per coat.
b. Minimum 25% Volume Solids.
c. VOC : 308 g/L; 2.57 lb/gal.
d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal 0.000 kg/L of solids.
e. Vehicle Type: Polyurethane Acrylic.

D. Paint CI-OP-3L - Concrete/Masonry, Opaque, Latex, 3 Coat:
1. Primer/Filler for CMU only: One coat SW High-Build Heavy Duty Block Filler B42WJ446 (Do NOT use on Concrete).
a. Minimum Thickness: 16 mils wet; 8 mils dry per coat.
b. Minimum 58% Volume Solids.
c. VOC (EPA Method #24): 66 g/L; 0.55 lb/gal.
d. Hazardous Air Pollutants (HAPs): 0.0 lbs/gal (0.0 kg/L) of solids.

2. Primer for Concrete: One coat primer; SW Loxon® Exterior Acrylic Masonry Primer, A24W300 (Do NOT use on CMU).
a. Minimum Thickness: 5.3 mils wet; 2.1 mils dry per coat.
b. Minimum 38% Volume Solids.
c. VOC (less exempt solvents): 96 g/L; 0.80 lb/gal.
d. Hazardous Air Pollutants (HAPs): 0.0 lbs/gal (0.0 kg/L) of solids.

3. Semi-gloss: Two coats of acrylic; SW Pro Industrial™ Zero VOC Semi-Gloss Acrylic, B66-650 Series.
a. Greenguard Indoor Air Quality Certified.
b. Minimum Thickness: 6.0 mils wet; 2.5 mils dry per coat.
c. Minimum 33% Volume Solids.
d. VOC (EPA Method #24): 0 grams/liter; Trace.
e. Hazardous Air Pollutants (HAPs): 0.0 lbs/gal (0.0 kg/L) of solids.
f. Pencil Hardness: 2B (ASTM D 3363)

4. Egg-Shell: Two coats of acrylic; SW Pro Industrial™ Zero VOC Eg-Shel Acrylic, B66-660 Series.
a. Greenguard Indoor Air Quality Certified.
b. Minimum Thickness: 6.0 mils wet; 2.5 mils dry per coat.
c. Minimum 33% Volume Solids.
d. VOC (EPA Method #24): 0 grams/liter; Trace.
e. Hazardous Air Pollutants (HAPs): 0.0 lbs/gal (0.0 kg/L) of solids.
f. Pencil Hardness: 2B (ASTM D 3363)

E. Paint MI-OP-3aL - Ferrous Metals, Unprimed, Latex, 3 Coat:
1. One coat of acrylic primer. SW Pro Industrial™ Pro-Cryl Universal Primer, B66-310 Series.
a. Minimum Thickness: 5 mils wet; 2 mils dry per coat.
b. Minimum 37% Volume Solids.
c. VOC (EPA Method #24): <100 g/L; <0.83 lb/gal.
d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal (0.000 kg/L) of solids.

2. Gloss: Two coats of latex enamel; SW Pro Industrial™ Zero VOC Gloss Acrylic, B66-600 Series.
a. Minimum Thickness: 6.0 mils wet; 2.5 mils dry per coat.
b. Minimum 33% Volume Solids.
c. VOC (EPA Method #24): 0 g/L; Trace. Unreduced.
d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal (0.000 kg/L) of solids.

3. Semi-gloss: Two coats of latex enamel; SW Pro Industrial™ Zero VOC Semi-Gloss Acrylic, B66-650 Series.
a. Minimum Thickness: 6.0 mils wet; 2.5 mils dry per coat.
b. Minimum 33% Volume Solids.

c. VOC (EPA Method #24): 0 g/L; Trace. Unreduced.
d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal (0.000 kg/L) of solids.

4. Egg Shell: Two coats of latex enamel; SW Pro Industrial™ Zero VOC Eg-Shel Acrylic, B66-660 Series.
   a. Minimum Thickness: 6.0 mils wet; 2.5 mils dry per coat.
   b. Minimum 33% Volume Solids.
   c. VOC (EPA Method #24): 0 g/L; Trace. Unreduced.
   d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal (0.000 kg/L) of solids.

F. Paint GI-OP-3L - Gypsum Board/Plaster, Acrylic Latex, 3 Coat:
   1. For use at Toilet Rooms, Storage Rooms/Closets, and Janitor Closets.
   2. One coat of Latex primer sealer; SW ProMar 200 Zero VOC Interior Latex Primer B28W02600.
      a. Minimum Thickness: 4 mils wet; 1.5 mils dry per coat.
      b. Minimum 24% Volume Solids.
      c. VOC (EPA Method #24): 0 g/L; 0 lb/gal.
      d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal 0.000 kg/L of solids.
      e. Vehicle Type: Vinyl Acrylic.
   3. Semi-gloss: Two coats of latex enamel; SW Pro Industrial Zero VOC Acrylic.
      a. Minimum Thickness: 6.0 mils wet; 2.5 mils dry per coat.
      b. Minimum 33% Volume Solids.
      c. VOC (EPA Method #24): 0 g/L; 0 lb/gal.
      d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal 0.000 kg/L of solids.
      e. Vehicle Type: Ambient cured, single component Acrylic.
      f. <<< ===== XvX ===== >>>.

G. Paint GI-OP-3LA - Gypsum Board/Plaster, Latex-Acrylic, 3 Coat:
   1. One coat of latex primer sealer, SW ProMar 200 Zero VOC Interior Latex Primer B28W02600.
      a. Minimum Thickness: 4 mils wet; 1.5 mils dry per coat.
      b. Minimum 24% Volume Solids.
      c. VOC (EPA Method #24): 0 g/L; 0 lb/gal.
      d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal 0.000 kg/L of solids.
      e. Vehicle Type: Vinyl Acrylic.
   2. Eggshell: Two coats of latex-acrylic enamel; SW ProMar 200 Zero VOC, Interior Latex Eg-Shel, B20-2600 Series.
      a. Minimum Thickness: 4 mils wet; 1.7 mils dry per coat.
      b. Minimum 40% Volume Solids.
      c. VOC (less exempt solvents): 0 g/L; 0.0 lb/gal.
      d. Hazardous Air Pollutants (HAPs): 0.00 lbs/gal 0.000 kg/L of solids.
      e. Vehicle Type: Vinyl Acrylic.

2.7 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.
B. Patching Material: Latex filler.
C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin application of coatings until substrates have been properly prepared.
B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
D. Test shop-applied primer for compatibility with subsequent cover materials.
E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Gypsum Wallboard: 12 percent.
2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.2 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating application.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
D. Seal surfaces that might cause bleed through or staining of topcoat.
E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
F. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.
G. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-SP 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).
H. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.
I. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
J. Interior Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
K. Interior Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.
L. Exterior Wood to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior calking compound after sealer has been applied. Prime concealed surfaces.
M. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.
N. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.
O. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.3 APPLICATION

A. Apply products in accordance with manufacturer's instructions.
B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
C. Apply each coat to uniform appearance.
D. Sand wood and metal surfaces lightly between coats to achieve required finish.
E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
F. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.
B. Architect and Owner will provide field inspection.

3.5 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.6 PROTECTION

A. Protect finished coatings until completion of project.

B. Touch-up damaged coatings after Substantial Completion.

END OF SECTION

SECTION 10 1150
FIXED MARKERBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fixed, magnetic, glass, dry-erase markerboards.

1.2 SUBMITTALS

A. Submit under provisions of Section 01 3000.
B. Product Data: Submit manufacturer's product data, including installation instructions.
C. Samples: Submit manufacturer's sample of markerboards, minimum 8 inches by 12 inches.
D. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.
E. Cleaning Instructions: Submit manufacturer's cleaning instructions.
F. Warranty Documentation: Submit manufacturer's standard warranty.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage and Handling Requirements:
1. Store and handle materials in accordance with manufacturer's instructions.
2. Keep materials in manufacturer's original, unopened containers and packaging until installation.
3. Store materials in clean, dry area indoors.
4. Protect materials during storage, handling, and installation to prevent damage.

1.4 WARRANTY

A. Warranty Period: Lifetime surface warranty.

PART 2 PRODUCTS

2.1 FIXED MARKERBOARDS

A. Fixed, Magnetic, Glass, Dry-Erase Markerboards
1. Steel laminated to glass.
2. Frameless
3. Components (back to front):
a. Steel: 0.024-inch-thick steel plate.
b. Adhesive: Acrylic adhesive sheet.
c. Coating: White enamel baked-on coating.
d. Glass: 6-mm-thick, tempered, low-iron glass
with 1-inch bevel edges and radius corners
Surface: Does not absorb inks or stains, eliminates ghosting.
4. Shop fabricated. (NO SUBSTITUTIONS)

ACCESSORIES

The following accessories are to be included with each markerboard.

A. Set of 4 dry-erase marker pens (black, red, blue, and green) and eraser with magnetic organizer.
B. Magnet Indicators: Four, round, magnets.
C. Markerboard Cleaner: glass cleaner.
D. Mounting Hardware:
    1 Edge Grips: Four, round, brushed stainless steel.
    2 3/16-inch toggle bolts.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine walls to receive markerboards.
B. Notify Architect of conditions that would adversely affect installation or subsequent use.
C. Do not begin installation until unacceptable conditions are corrected.

3.2 INSTALLATION

A. Install markerboards in accordance with manufacturer's instructions at locations indicated on the Drawings.
B. Install markerboards plumb, level, and square.
C. Mount markerboards securely in place to supports using mounting hardware supplied by markerboard manufacturer.

3.3 CLEANING

A. Clean markerboards promptly after installation in accordance with manufacturer's instructions.
B. Do not use harsh cleaning materials or methods that could damage surface.

3.4 PROTECTION

A. Protect installed markerboards from damage during construction.

END OF SECTION

SECTION 10 1400
SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Room and door signs.
- B. Building identification signs.
- C. Exterior signage.

1.2 REFERENCE STANDARDS
- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. TAS - Texas Accessibility Standards; 2012.

1.3 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
  1. When room numbers to appear on signs differ from those on the drawings, include the drawing room number on schedule.
  2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
  3. Submit for approval by Owner through Architect prior to fabrication.
- D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
- F. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.4 QUALITY ASSURANCE
- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING
- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.

PART 2 PRODUCTS

2.1 MANUFACTURERS
- A. Flat Signs:
  1. ASI: www.asisignage.com.
  2. Best Sign Systems, Inc: www.bestsigns.com.
  3. Cosco Industries (ADA signs): www.coscoarchitecturalsigns.com.
  4. Mohawk Sign Systems, Inc: www.mohawksign.com.
  5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Dimensional Letter Signs:
  1. ASI: www.asisignage.com.
  2. Cosco Industries: www.coscoarchitecturalsigns.com.
  3. The Southwell Company: www.southwellco.com.
- C. Other Signs:
  1. ASI: www.asisignage.com.

2. Substitutions: See Section 01 6000 - Product Requirements.

2.2 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with Texas Accessibility Standards and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
   1. Sign Type: Flat signs with applied character panel media as specified.
   2. Provide "tactile" signage, with letters raised minimum 1/32 inch (0.8 mm) and Grade 2 braille placed directly below last line of letters or numbers.
   3. Character Height: 1 inch (25 mm).
   4. Sign Height: 3 inches (75 mm), unless otherwise indicated.
      a. Signs with pictograms and/or multiple lines of text shall have an increased height as required.
   5. Office Doors: Identify with the room names and numbers as shown on the Room Signage Schedule on the drawings; in addition, provide "window" section for replaceable occupant name. Sign Height: 6 inches.
   6. Conference and Meeting Rooms: Identify with the room names and numbers as shown on the Room Signage Schedule on the drawings .
   7. Service Rooms: Identify with the room names and numbers as shown on the Room Signage Schedule on the drawings.
   8. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers as shown on the Room Signage Schedule on the drawings.

C. Exterior Signage: Wall-mounted, painted aluminum signs.

D. Building Identification Signs:
   1. Use individual metal letters.
   2. Mount on outside wall in location shown on drawings.

2.3 TACTILE SIGNAGE MEDIA (interior room and door signs)

A. Flat Interior Signs: Signage media without frame.
   1. Edges: Bevelled.
   2. Corners: Radiused.
   3. Wall Mounting of One-Sided Signs: Tape adhesive.

B. Applied Character Panels: Matte-finished, integrally colored, opaque acrylic plastic base, with applied acrylic plastic letters and braille.
   1. Total Thickness: 1/4 inch (6 mm).
   2. Raised Copy: Machine-cut copy characters from matte-finished opaque acrylic sheet and chemically welded onto the acrylic sheet forming sign panel face. Produce precisely formed characters with square cut edges free from burrs and cut marks.
   3. Letter Thickness: 1/8 inch (3 mm).

C. Color and Font: Unless otherwise indicated:
   1. Character Font: Helvetica, Arial, or other sans serif font.
   2. Character Case: Upper case only.
   3. Background Color: to be selected by Architect from manufacturer's full range of colors.
   4. Character Color: White color.

2.4 NON-TACTILE SIGNAGE MEDIA (exterior signage)

A. Aluminum sheet: 0.080" aluminum sheet.

B. Sizes: 6" tall x 2'-3".

C. Painted Surface Treatment Finish: Manufacturer's standard two-phase finishing process. Colors as selected from manufacturer's standard colors.
   1. Phase One: Priming with 2u depth layer for optimum surface coat adhesion and weatherability.
   2. Phase Two: Painting process employing two component, UV resistant, acrylic polyurethane coating of 20-30u depth.

D. Text: Refer to Exterior Signage Types schedule on the drawings.

2.5 DIMENSIONAL LETTERS (building identification)

A. Metal Letters:
   1. Metal: 0.125" aluminum sheet, formed. All seams to be fully-welded and smooth and seamless. Sign pan internally reinforced as required.
   2. Sizes: Nominal 18" and 48" tall, 2-1/2" deep pan.
   3. Letter style: Arial, numbers and upper and lower case letters.
   4. Finish: Satin finish, clear anodized..
   5. Mounting: Letters to be mounted 1/2" off the surface of the wall surface. Stainless steel concealed anchors. No hardware to be visible on sign face.

B. Text: Verify.

C. Refer to the exterior elevations on the drawings.

2.6 ACCESSORIES

A. Concealed Anchors (exterior signage): Stainless steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs where indicated:
   1. Room and Door Signs: Locate on wall at latch side of door with centerline of sign at 60 inches (1525 mm) above finished floor.
   2. If no location is indicated obtain Owner's instructions.

D. Protect from damage until Substantial Completion; repair or replace damage items.

END OF SECTION

SECTION 10 2116
SOLID PLASTIC TOILET PARTITIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES
- A. Solid plastic toilet compartments and urinal screens.
- B. All anchors, hardware, and accessories required for a complete installation.,

1.2 RELATED REQUIREMENTS
- A. Section 01 3000 - Administrative Requirements: Submittal procedures, project meetings, progress schedules and documentation, reports, coordination.
- B. Section 06 1000 - Rough Carpentry: Blocking and supports.
- C. Section 10 2800 - Toilet, Bath, and Laundry Accessories.

1.3 REFERENCE STANDARDS
- A. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. National Fire Protection Association (NFPA) 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.
- E. TAS - Texas Accessibility Standards: Required compliance for handicapped accessibility in Texas.

1.4 SYSTEM DESCRIPTION
- A. Compartment Configurations:
  1. Toilet partitions: Floor mounted, overhead braced.
  2. Urinal screens: Wall mounted.

1.5 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Submittals for Review:
  1. Shop Drawings: Include dimensioned layout, elevations, trim, closures, and accessories.
  2. Product Data: Manufacturer's descriptive data for panels, hardware, and accessories.
  3. Samples: 6 x 6 inch samples showing available colors.
- C. Sustainable Design Submittals:
  1. Recycled Content: Certify percentages of post-consumer and pre-consumer recycled content.
  2. Regional Materials: Certify distance between manufacturer and Project and between manufacturer and extraction or harvest point in miles.

1.6 QUALITY ASSURANCE
- A. Manufacturer Qualifications: Minimum 5 years' experience in manufacture of solid plastic toilet compartments with products in satisfactory use under similar service conditions.
- B. Installer Qualifications: Minimum 5 years' experience in work of this Section.

1.7 DELIVERY, STORAGE, AND HANDLING
- A. Deliver no components to project site until areas are ready for installation.
- B. Store components indoors prior to installation.
- C. Handle materials to prevent damage to finished surfaces.
  1. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.8 WARRANTIES
- A. Provide manufacturer's 25 year warranty against breakage, corrosion, and delamination under normal conditions.

1.9 AVAILABLE MANUFACTURERS

A. Substitutions: The product(s) referenced by the manufacturer listed, forms the basis of design. The contractor at their option may provide an alternate manufacturer as an equal, however, if an equal is proposed, the Contractor shall provide data from the specified manufacturer & product(s) as well as data from the proposed manufacturer for a comparison, review, and determination of acceptance (approval or disapproval) by the Architect. Approval cannot be made if adequate comparison information is not provided. Absence of specified manufacturers' data is grounds for disapproval.

B. Refer to Section 01 3000 - Administrative Requirements AND Section 01 6000 - Product Requirements for substitution procedures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Scranton Products are the basis of design. www.scrantonproducts.com

B. Substitutions: See Section 01 6000 - Product Requirements.

1. See article in PART 1 above entitled "Available Manufacturers".

2.2 MATERIALS

A. Doors, Panels and Pilasters:

1. High density polyethylene (HDPE), fabricated from polymer resins compounded under high pressure, forming single thickness panel.
2. Waterproof and nonabsorbent, with self-lubricating surface, resistant to marks by pens, pencils, markers, and other writing instruments.
3. 1 inch thick with edges rounded to 1/4 inch radius.
4. Recycled content: Minimum 25 percent.

B. Fire hazard classification: Pass NFPA 286.

C. Color: Refer to the drawings.

D. Aluminum Extrusions: ASTM B221, 6463-T5 alloy and temper.

E. Stainless Steel: ASTM A167, Type 304.

2.3 HARDWARE

A. Hinges:

1. 8 inches long, fabricated from heavy-duty extruded aluminum with bright dip anodized finish, wrap-around flanges, adjustable on 30-degree increments, through bolted to doors and pilasters with stainless steel, Torx head sex bolts.
2. Hinges operate on field-adjustable nylon cams, field adjustable in 30 degree increments.

B. Door Strike and Keeper:

1. 6 inches long, fabricate from heavy-duty extruded aluminum with bright dip anodized finish, with wrap-around flanges secured to pilasters with stainless steel tamper resistant Torx head sex bolts.
2. Bumper: Extruded black vinyl.

C. Latch and Housing:

1. Heavy-duty extruded aluminum.
2. Latch housing: Bright dip anodized finish.
3. Slide bolt and button: Black anodized finish.

D. Coat Hook/Bumper:

1. Combination type, chrome plated Zamak.
2. Equip outswing handicapped doors with second door pull and door stop.

E. Door Pulls: Chrome plated Zamak.

2.4 COMPONENTS

A. Doors and Dividing Panels: 55 inches high, mounted 14 inches above finished floor, with aluminum heat-sinc fastened to bottom edges.

B. Pilasters: 82 inches high, fastened to pilaster sleeves with stainless steel tamper resistant Torx head sex bolt.

C. Pilaster Sleeves: 3 inches high, one-piece molded HDPE secured to pilaster with stainless steel tamper resistant Torx head sex bolt.
D. Wall Brackets: 54 inches long, heavy-duty aluminum, bright dip anodized finish fastened to pilasters and panels with stainless steel tamper resistant Torx head sex bolts.
E. Headrail: Heavy-duty extruded aluminum, anti-grip design, clear anodized finish, fastened to headrail bracket with stainless steel tamper resistant Torx head sex bolt and at top of pilaster with stainless steel tamper resistant Torx head screws.
F. Headrail Brackets: 20 gage stainless steel, satin finish, secured to wall with stainless steel tamper resistant Torx head screws.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances, and other conditions affecting performance of work.
1. Verify that field measurements are as indicated.
2. Verify correct spacing of and between plumbing fixtures.
3. Verify correct location of built-in framing, anchorage, and bracing.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION
A. Install compartments in accordance with manufacturer's instructions and approved Shop Drawings.
B. Install rigid, straight, plumb, and level.
C. Locate bottom edge of doors and panels 14 inches above finished floor.
D. Provide uniform, maximum 3/8 inch vertical clearance at doors.
E. Not Acceptable: Evidence of cutting, drilling, or patching.
F. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.3 TOLERANCES
A. Maximum Variation From True Position: 1/4 inch (6 mm).
B. Maximum Variation From Plumb: 1/8 inch (3 mm).

3.4 ADJUSTING
A. Adjust doors and latches to operate correctly.

END OF SECTION

SECTION 10 2213
WIRE MESH PARTITIONS

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Wire mesh system for walls and ceilings.

1.2 RELATED REQUIREMENTS
- A. Section 08 7100 - Door Hardware: Cylinders for locksets.

1.3 REFERENCE STANDARDS
- A. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.
- B. ASTM A510/A510M - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel; 2013.
- C. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2011 w/Errata.
- D. SSPC-Paint 15 - Steel Joist Shop Primer; Society for Protective Coatings; 1999 (Ed. 2004).

1.4 DESIGN REQUIREMENTS
- A. Design partition system to provide for movement of components without damage, undue stress on fasteners or other detrimental effects, when subject to design loads.
- B. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

1.5 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for screen materials, finishes, and other specified features.
- C. Shop Drawings: Indicate plan and vertical dimensions, elevations, component details; head, jamb, and sill details; location of hardware. Provide component details, anchorage, and type and location of fasteners.
  1. Show field measurements on shop drawings.
- D. Samples: Submit two _____, ____by____ inch (____by____ mm) in size, illustrating screen material. Submit samples of hinge and latchset illustrating style, color, and finish. Incorporate sample into the work.
- E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.6 QUALITY ASSURANCE
- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.7 WARRANTY
- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Contractor shall correct defective Work within a two year period after Date of Substantial Completion; remove and replace materials concealing defective work at no extra cost to Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS
- A. Wire Mesh Partitions:
  1. Folding Guard, L&P Guarding, LLP; Product - Saf-T-Fence Partitions: www.foldingguard.com
  2. Acorn Wire and Iron Works, Inc; ____: www.acornwire.com.
  3. The G-S Company; ____: www.g-sco.com.
  4. Miller Wire Works, Inc; ____: www.millerwireworks.com.
  5. Substitutions: See Section 01 6000 - Product Requirements.

2.2 WIRE MESH PARTITIONS

A. Wire Mesh Partitions: Factory-fabricated modular assemblies of wall panels, doors, anchors, and accessories as required to provide a complete system and as indicated.
   1. Installed Wall Assembly: Resist a lateral load of 50 lbs (222.41 N) without damage or permanent set.
   2. Hinged Door and Panel in Open Position: Resist a downward load of _____ lbs (_____ N) without damage or permanent set.

B. Partitions shall be full height continuous from floor to soffit of deck above.

2.3 MATERIALS

A. Framing Members: ASTM A500/A500M, Grade B cold-formed steel tubing, square and rectangular shaped.

B. Woven Screen Wire: ASTM A510/A510M uncoated crimped steel wire; conforming to the following:
   1. Warp and Fill Wire Size: 10 gage, 0.1019 inch (2.59 mm).
   2. Mesh Size: 2 by 2 inch (50 by 50 mm).
   3. Mesh Weave Design: Plain weave, double crimp design.

C. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

2.4 FASTENERS

A. Bolts, Nuts and Washers: Hot dip galvanized.

B. Anchorage Devices: Provide power driven, powder actuated, and drilled expansion bolts.

C. Exposed Mechanical Fastenings: Flush countersunk screws or bolts, unobtrusively located, consistent with design of structure.

2.5 ACCESSORIES

A. Bracing: Formed sheet steel, thickness determined for conditions encountered, manufacturer's standard shapes, same finish as framing members.

B. Plates, Gussets, Clips: Formed sheet steel, thickness determined for conditions encountered, manufacturer's standard shapes, same finish as framing members.

C. Post Caps: Manufacturer's standard.

D. Floor Base: Manufacturer's standard.

E. Shop and Touch-Up Primer:
   1. Ferrous Surfaces: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.6 HARDWARE

A. Manufacturer standard heavy duty hardware.

B. Cylinders for Locksets: Specified in Section 08 7100.

2.7 COMPONENTS

A. Corner Posts and Intermediate Posts: 2 x 2 inch (51 x 51 mm) size x 16 gage, 0.0598 inch (1.52 mm) wall thickness.

B. Intermediate Horizontal Members: Manufacturers standard.

C. Wire panels: 10 gauge welded wire mesh framed with 14 gauge, 1-1/2 x 1-1/2 inch (38 x 38 mm) steel angle.

D. Cross Bracing: manufacturers standard.

2.8 FABRICATION

A. Fit and assemble in largest practical sections for delivery to site, ready for installation.

B. Make exposed joints flush or tight.

C. Provide components required for anchorage to adjacent construction.

2.9 FINISHES

A. Powder coated in color selected from manufacturers standard colors.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that substrate surfaces and required openings are ready to receive work.

3.2 PREPARATION

A. Clean substrate surfaces.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install items plumb and level, accurately fitted, free from distortion or defects.

3.4 TOLERANCES

A. Maximum Variation From Plumb or Level: 1/4 inch (6 mm).

B. Maximum Misalignment From True Position: 1/4 inch (6 mm).

3.5 ADJUSTING

A. Adjust hinged doors to achieve free movement.

3.6 CLEANING

A. Remove temporary protection to prefinished surfaces.

END OF SECTION

SECTION 10 2227
OPERABLE PARTITIONS

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Paired panel partitions, 3 inch (76 mm) thick panels.

1.2 RELATED SECTIONS
- A. Section 03 3000 - Cast-In-Place Concrete; concrete tolerances required.
- B. Section 05 5000 - Metal Fabrications; primary structural support, including pre punching of support members by steel supplier in accordance with template supplied by operable partition suppliers template.
- C. Section 06 1000 - Rough Carpentry; wood framing and supports, and blocking at head and jambs as required.
- D. Section 09 2116 - Gypsum Board Assemblies; metal framing and gypsum board wall systems adjacent to operable partitions, including blocking and insulation.
- E. Section 09 2116 - Gypsum Board Assemblies; wall and ceiling framing at head and jambs.

1.3 REFERENCES
- A. ASTM E 90 (UL 723) - Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- B. ASTM E 413 - Classification for Rating Sound Insulation.
- C. ASTM E 557 - Standard Practice for the Installation of Operable Partitions.
- D. ASCE 7 - Minimum Design Loads of Buildings and Other Structures
- E. CAN/ULC-S102M - Flame Spread Rating of a Ceiling Material.
- F. NFPA 70 - National Electrical Code.
- G. UL 508A - Industrial Control Panels.

1.4 SUBMITTALS
- A. Submit under provisions of Section 01 3000.
- B. Product Data: Material descriptions, construction details, finishes, installation details, and operating instructions for each type of operable partition, component, and accessory specified.
- C. Shop Drawings: Show location and extent of operable partitions. Include plans, elevations, sections, details, attachments to other construction, and accessories. Indicate dimensions, weights, conditions at openings, and at storage areas, and required installation, storage, and operating clearances. Indicate location and installation requirements for hardware and track, including floor tolerances required and direction of travel. Indicate blocking to be provided by others.
- D. Setting Drawings: Show imbedded items and cutouts required in other work, including support beam punching template.
- E. Samples: Color samples demonstrating full range of finishes available. Verification samples shall be available in same thickness and material indicated for the work.
- F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- G. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic checking and maintenance of all components.

1.5 QUALITY ASSURANCE
- A. Installer Qualifications: Experienced installer, certified by the operable partition manufacturer, as qualified to install the manufacturer's partition systems for work similar in material, design, and extent to that indicated for this Project.
- B. Acoustical Performance: Test operable partitions in accordance with ASTM E 90 test procedure to attain no less than the STC rating specified. Provide a complete and unedited written test report by the testing laboratory upon request.
- C. Preparation of Opening: Conform to ASTM E 557.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Clearly mark packages and panels with numbering systems used on Shop Drawings. Do not use permanent markings on panels.

B. Protect panels during delivery, storage, and handling to comply with manufacturer's instructions and as required to prevent damage.

1.7 WARRANTY

A. Provide operable partition manufacturer's written warranty agreeing to repair or replace components with manufacturing defects for a period of two years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Modernfold, Inc., which is located at: 215 W. New Rd.; Greenfield, IN 46140; Toll Free Tel: 800-869-9685; Tel: 317-468-6700; Fax: 866-410-5016; Email:request info (info@modernfold.com)

B. Requests for substitutions will be considered in accordance with provisions of Section 01 6000.

2.2 PAIRED PANEL PARTITIONS, THREE INCH (76 MM) THICK PANELS

A. Product: Acousti-Seal 932 Operable Partition by Modernfold, Inc., manually operated paired flat panels, top supported with operable floor seals.
   1. Final closure:
      a. Enclose

B. Panel Construction and STC Rating: Nominal 3 inch (76 mm) thick in manufacturer's standard 48 inch (1220 mm) width by height required, with horizontal and vertical framing elements fabricated from 18 gage formed steel with overlapped and welded corners; reinforced top channel to support suspension system components; frame with concealed formed steel at vertical edges.
   1. Panel Skin: 1/2 inch (12.7 mm) tackable gypsum board, class A rated single material or composite layers continuously bonded to panel frame with minimum STC as follows:
      a. STC 47.
   2. Hinges for Closure Panels, Pass Doors and Pocket Doors: Full leaf butt hinges, attached directly to the panel frame with welded hinge anchor plates within panel to further support hinge mounting to frame. Hinges mounted into panel edge or vertical astragal are not acceptable.
   3. Panel Trim: No vertical trim required or allowed on vertical edges of panels; minimal groove appearance at panel joints.
   4. Panel Weight: As standard with manufacturer for STC selected, 6.5 to 8.5 lbs/SF.

C. Panel Finish and Exposed Trim: Factory applied as follows:
   1. Panel Finish: Plastic laminate finish.
   2. Exposed Panel Trim Color: Natural Choice.

D. Sound Seals and Bottom Seals:
   1. Vertical Interlocking Sound Seals Between Panels: Roll-formed steel astragals, with reversible tongue and groove configuration in each panel edge for universal panel operation. Rigid plastic or aluminum astragals or astragals in only one panel edge are not acceptable.
   2. Horizontal Top Seals: Continuous contact extruded vinyl bulb shape with pairs of non-contacting vinyl fingers to prevent distortion without the need for mechanically operated parts.
   3. Horizontal Bottom Floor Seals: Modernfold IA2 Bottom Seal. Automatic operable seals providing nominal 2 inches (51 mm) operating clearance with an operating range of plus 1/2 inch (12.7 mm) to minus 1-1/2 inches (38 mm) which automatically drop as panels are positioned without the need for tools or cranks.

E. Suspension System:
   1. Suspension System: Modernfold No. 17 Suspension System:
      a. Track: Nominal 11 gage formed steel track, suitable for either direct mounting to wood header or supported by adjustable steel hanger brackets, supporting the load-

bearing surface of the track, connected to structural support by pairs of 3/8 inch (9.52 mm) diameter threaded rods.

b. Exposed Track Soffit: Steel, integral to the track and pre-painted off-white. Wood or aluminum soffits are not acceptable.

c. Carriers: One all-steel trolley with steel tired ball-bearing wheels for all panels except hinged panels. Non-steel tires are not acceptable.

F. Special Components:

1. Finished End Caps: Finished end caps at 90 degrees and 135 degrees.
2. Partition Interface: Intersecting partition interface.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until supports and substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions and ASTM E 557 installation procedures. Test for proper operation and make necessary adjustments until satisfactory results are obtained.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 10 2601
WALL AND CORNER GUARDS

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Chair Rails.
- B. Corner guards.

1.2 RELATED REQUIREMENTS
- A. Section 05 5000 - Metal Fabrications: Anchors for attachment of work of this section, concealed in wall.
- B. Section 06 1000 - Rough Carpentry Blocking for wall and corner guard anchors.

1.3 REFERENCE STANDARDS
- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

1.4 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate physical dimensions, features, anchorage details, and rough-in measurements.
- C. Samples: Submit two sections of bumper rail, 24 inch (600 mm) long, illustrating component design, configuration, color and finish.
- D. LEED Submittals
  1. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.

1.5 WARRANTY
- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Contractor shall correct defective Work within a two year period after Date of Substantial Completion; remove and replace materials concealing defective work at no extra cost to Owner.

1.6 AVAILABLE MANUFACTURERS
- A. Substitutions: The product(s) referenced by the manufacturer listed, forms the basis of design. The contractor at their option may provide an alternate manufacturer as an equal, however, if an equal is proposed, the Contractor shall provide data from the specified manufacturer & product(s) as well as data from the proposed manufacturer for a comparison, review, and determination of acceptance (approval or disapproval) by the Architect. Approval cannot be made if adequate comparison information is not provided. Absence of specified manufacturers' data is grounds for disapproval.
- B. Refer to Section 01 3000 - Administrative Requirements AND Section 01 6000 - Product Requirements for substitution procedures.

PART 2 PRODUCTS

2.1 MANUFACTURERS
- A. Wall and Corner Guards:
  1. Koroseal Wall Protection Systems, A Division of RJF International Corporation.
  2. Substitutions: See Section 01 6000 - Product Requirements.
     - a. See article in PART 1 above entitled "Available Manufacturers".

2.2 COMPONENTS
- A. Chair Rails: Factory- or shop-fabricated, with preformed end caps and internal and external corners:
  1. Dimensions:
     - a. Height: 2-1/8" (54mm).
     - b. Width: 1-1/8" (28.6mm).
     - c. Clearance from Wall: Flush with wall.

2. Profile: High-impact vinyl acrylic profile locked in place, nominal 0.060" (1.5mm) thick. Class A fire rating, tested in accordance with ASTM E 84.
3. Profile Finish: Pebble grain.
4. Retainer: Continuous retainer along entire length of Chair Rail, nominal 0.080" (2mm) thick.
5. End Caps: Color and texture similar to that of rail.
6. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
7. Mounting: Surface.
8. Projection From Wall to Outside of Rail: 1-1/8 inch (47.63 mm).
9. Product:
    a. Koroseal “Korogard” CH20 Chair Rail. Chair Rail mounted over continuous retainer. Exposed surfaces shall be free of wrinkling, chipping, discoloration, or other imperfections.
    b. Substitutions: See Section 01 6000 - Product Requirements.
        1) See article in PART 1 above entitled "Available Manufacturers".

B. Corner Guards - Surface Mounted: Extruded one-piece unit without splices, installed with adhesive.
1. 1. Dimensions
    a. Leg length: 2-1/2" (63.5mm) - G825
    b. Angle: 90°.
    c. Begin Corner Guards immediately above base.
    d. Height above base: 8 feet
2. Profile: High-impact vinyl acrylic extrusion, nominal .078" (1.98mm) thick. Class A fire rating, when tested in accordance with ASTM E 84.
3. Extrusion: Pebble grain finish. Contains EPA registered Micro-Chek antimicrobial agent.
4. Adhesion: Manufacturer recommended contact cement.
5. Color: Refer to the Finish Legend in the drawings.
6. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
7. Products:
    a. Koroseal “Korogard” Series G825: Extruded Corner Guard adhered to substrate corner with glue or tape. Exposed surfaces shall be free of wrinkling, chipping, discoloration, or other imperfections.
    b. Substitutions: See Section 01 6000 - Product Requirements.
        1) See article in PART 1 above entitled "Available Manufacturers".

2.3 MATERIALS
A. Adhesive: As recommended by impact-resistant plastic wall protection manufacturer and with a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 FABRICATION
A. Fabricate components with tight joints, corners and seams.

PART 3 EXECUTION

3.1 EXAMINATION
A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

3.2 INSTALLATION
A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to wall framing members only.
B. Position top of Chair rail is indicated on the drawings.
C. Terminate Chair rails 6 inches (152 mm) short of door opening.

3.3 TOLERANCES

A. Maximum Variation From Required Height: 1/4 inch (6 mm).

B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch (6 mm).

END OF SECTION

SECTION 10 2800
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Accessories for toilet rooms, showers, and utility rooms.
- B. Grab bars.

1.2 RELATED REQUIREMENTS
- A. Section 01 0070 - Provisions for Accessibility: Mounting heights and clearances for accessories.
- B. Section 06 1000 - Rough Carpentry: Concealed supports for accessories, including in wall framing and plates.
- C. Section 10 2116 - Solid Plastic Toilet Partitions.

1.3 REFERENCE STANDARDS
- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2014e1.
- C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- D. ASTM C1036 - Standard Specification for Flat Glass; 2011e1.
- E. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2008 (Reapproved 2013).
- F. TAS - Texas Accessibility Standards: Required compliance for handicapped accessibility in Texas.

1.4 ADMINISTRATIVE REQUIREMENTS
- A. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

1.5 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

1.6 WARRANTY
- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Contractor shall correct defective Work within a two year period after Date of Substantial Completion; remove and replace materials concealing defective work at no extra cost to Owner.

1.7 NON-PROPRIETARY NOTE
- A. The inclusion of specific manufacturer(s) and product(s) in Part 2 Products of this specification section is to describe the general characteristics and features of the design that are required. It is not intended as an exclusive proprietary specification. Similar and equal products and manufacturers may be incorporated into this project following the procedures for Substitutions. Refer to Section 01300 - Administrative Requirements AND Section 01600 - Product Requirements for substitution procedures.

PART 2 PRODUCTS

2.1 MANUFACTURERS
- A. Basis of Design: Bobrick Washroom Equipment, Inc.: www.bobrick.com.
- B. All items of each type to be made by the same manufacturer.
- C. Product numbers indicated on Toilet Accessory Schedule on the drawings.
- D. Substitutions: Section 01 6000 - Product Requirements.

2.2 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
   1. Grind welded joints smooth.
   2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.
B. Keys: Provide two (2) keys for each accessory to Owner; master key lockable accessories.
C. Stainless Steel Sheet: ASTM A666, Type 304.
D. Stainless Steel Tubing: ASTM A269/A269M, Type 304 or 316.
E. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
F. Adhesive: Two component epoxy type, waterproof.
G. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.3 FINISHES

A. Stainless Steel: No. 4 Brushed finish, unless otherwise noted.
B. Back paint components where contact is made with building finishes to prevent electrolysis.

2.4 TOILET ROOM ACCESSORIES

A. Recessed Seat-Cover Dispenser, Sanitary Napkin Disposal, and Toilet Tissue Dispenser (TA-1): Double roll, recessed, stainless steel unit with full-length piano hinge, tumbler locks keyed like other washroom accessories. Disposal panel with spring-loaded, full-length piano hinge, and 0.8 gal. leak-proof molded polyethylene waste receptacle. Secured toilet seat-cover dispenser holds 500 paper covers.
B. Partition-Mounted Seat-Cover Dispenser, Sanitary Napkin Disposal, and Toilet Tissue Dispenser (TA-1A): Double roll, dual side-by-side partition mounting, stainless steel unit with full-length piano hinge, tumbler locks keyed like other washroom accessories. Disposal panel with spring-loaded, full-length piano hinge, and 0.8 gal. leak-proof molded polyethylene waste receptacle. Secured toilet seat-cover dispenser holds 500 paper covers.
C. Grab Bars (TA-2, TA-3, TA-4): Stainless steel, nonslip grasping surface finish.
   1. Standard Duty Grab Bars:
      a. Push/Pull Point Load: 250 pound-force (1112 N), minimum.
      b. Dimensions: 1-1/4 inch (32 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, concealed flange mounting with stainless steel flange covers, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.
      c. Length and Configuration: As indicated on drawings.
      d. Product: B-5806 series manufactured by Bobrick.
D. Mirrors (TA-5, TA-5A): Stainless steel framed, no. 1 quality, 1/4" (6 mm) thick select float glass mirror.
   1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503. Mirror guaranteed for 15 years against silver spoilage.
   2. Size: As indicated on drawings.
   3. Frame: 0.05 inch (1.3 mm) angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; No.4 finish.
   4. Backing: Full-mirror sized, minimum 0.03 inch (0.8 mm) galvanized steel sheet and full-size, shock-absorbing, nonabsorptive filler material.
E. Soap Dispenser (TA-9): Soap lather dispenser, wall-mounted, surface, with battery-operated touch-free delivery. Refill level and battery life indicators.
   1. Approximate Capacity: 2,750 hand washes per refill.
   2. Manufacturer: Rubbermaid Commercial Products.
F. Combination Towel Dispenser/Waste Receptacle (TA-10): Recessed with projecting waste receptacle, stainless steel; seamless wall flanges, continuous piano hinges, tumbler locks on upper and lower doors keyed like other washroom accessories.
   1. Touch-free roll towel dispenser: dispenses one 12" length of paper towel per pull and operates smoothly and quietly. User only touches the paper.
   2. Towel dispenser capacity: Accepts standard-core rolls up to 8" wide, 8" diameter, 800 ft. long..

3. Waste receptacle capacity: 12 gallons (45 liters) with accessory to accommodate disposable trash liners.

G. Convertible Combination Towel Dispenser/Waste Receptacle (TA-10A): Surface-mounted with projecting waste receptacle, stainless steel; seamless wall flanges, continuous piano hinges, tumbler locks on upper and lower doors keyed like other washroom accessories.
   1. Touch-free roll towel dispenser (module for convertible unit): dispenses one 12" length of paper towel per pull and operates smoothly and quietly. User only touches the paper.
   2. Towel dispenser capacity: Accepts standard-core rolls up to 8" wide, 8" diameter, 800 ft. long..
   3. Waste receptacle capacity: 12 gallons (45 liters) with accessory to accommodate disposable trash liners.

H. Roll Towel Dispenser (TA-11): Surface-mounted, stainless steel; all-welded construction, continuous piano hinge, tumbler lock keyed like other washroom accessories.
   1. Touch-free roll towel dispenser: dispenses one 12" length of paper towel per pull and operates smoothly and quietly. User only touches the paper.
   2. Towel dispenser capacity: Accepts standard-core rolls up to 8" wide, 8" diameter, 800 ft. long..

2.5 SHOWER AND TUB ACCESSORIES

A. Shower Curtain Rod (TA-7, TA-7A): Stainless steel tube, 1 inch (25 mm) outside diameter, 0.04 inch (1.0 mm) wall thickness, satin-finished, with 2-9/16 inch square, minimum 0.04 inch (1.0 mm) thick satin-finished stainless steel flanges with 3/4 inch return, for installation with exposed fasteners.

B. Shower Curtain (TA-8, TA-8A):
   1. Material: Opaque vinyl, 0.008 inch (0.2 mm) thick, matte finish, with antibacterial treatment, flameproof and stain-resistant.
   2. Size: 36 by 72 inches (914 by 1830 mm) and 48 x 72 inches (1219 x 1830 mm), hemmed edges.
   3. Grommets: nickel-plated brass; pierced through top hem on 6 inch (150 mm) centers.
   4. Color: White.
   5. Shower curtain hooks: Stainless steel spring wire designed for snap closure.

C. Folding Shower Seat (TA-): Wall-mounted surface; welded tubular seat frame, structural support members, hinges and mechanical fasteners of Type 304 stainless steel, L-shaped, right hand and L-shaped, left hand seat.
   1. Seat: Phenolic or polymeric composite one-piece seat with integral slots for water drainage, of ivory color.
   2. Size: TAS compliant.

D. Towel Pin (TA-12): Stainless steel, 3 inch (75 mm) extension from wall; rectangular-shaped bracket and backplate for concealed attachment, satin finish.

2.6 UTILITY ROOM ACCESSORIES

A. Combination Utility Shelf/Mop and Broom Holder (TA-6): 0.05 inch (1.3 mm) thick stainless steel, Type 304, with 1/2 inch (12 mm) returned edges, 0.06 inch (1.6 mm) steel wall brackets.
   1. Drying rod: Stainless steel, 1/4 inch (6 mm) diameter.
   2. Hooks: 2, 0.06 inch (1.6 mm) stainless steel rag hooks at shelf front.
   3. Mop/broom holders: 3 spring-loaded rubber cam holders at shelf front.
   4. Length: Manufacturer's standard length for number of holders/hooks.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify exact location of accessories for installation.
C. See Section 06 1000 for installation of blocking, reinforcing plates, and concealed anchors in walls.

3.2 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.
B. Provide templates and rough-in measurements as required.

3.3 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on the drawings.
B. Install plumb and level, securely and rigidly anchored to substrate.
C. Mounting Heights: As required by TAS accessibility regulations, unless otherwise indicated.
    1. Refer to Section 01 0070.

END OF SECTION

SECTION 10 4116
EMERGENCY KEY CABINETS - KNOX BOX

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Recess mounted Emergency Key Cabinets (boxes).
  1. Provide one box for each building.
- B. Fire Department, Emergency Medical Service, Police (first responders) high security key box(es).
  1. Box for commercial businesses, schools, government and public buildings.

1.2 RELATED REQUIREMENTS
- A. Section 04 2000 - Unit Masonry, coordinate location and anchorage of recessed mounting kit box and Emergency Key Cabinet.
- B. Section 05 5000 - Metal Fabrications, metal plate in a thin or hollow wall to secure key box. 3/8" steel plate fastened to solid studs or other material on both sides.
- C. Section 08 7100 - Door Hardware
- D. Section 28 1300 - Access Control : Electronic access control devices.
- E. Section 28 3100 - Fire Alarm System Equipment: Electrical connection to Fire alarm system.
- F. Refer to Civil drawings and specifications for box at gate.

1.3 REFERENCE STANDARDS
- A. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 ADMINISTRATIVE REQUIREMENTS
- A. Coordination: Coordinate the installation of box with size, location and installation of service utilities.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.5 SUBMITTALS
- A. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project.
- B. Certificate: Certify that products of this section meet or exceed specified requirements.
- C. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and templates.
- D. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
- E. Project Record Documents: Record actual locations of every box.

1.6 QUALITY ASSURANCE
- A. Fabricator Qualifications: Company approved by the City of San Antonio Fire Department.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum ten years of experience.
- C. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.7 DELIVERY, STORAGE, AND HANDLING
- A. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

1.8 WARRANTY

1.9 AVAILABLE MANUFACTURERS
- A. Substitutions: The product(s) referenced by the manufacturer listed, forms the basis of design. The contractor at their option may provide an alternate manufacturer as an equal, however, if

an equal is proposed, the Contractor shall provide data from the specified manufacturer & product(s) as well as data from the proposed manufacturer for a comparison, review, and determination of acceptance (approval or disapproval) by the Architect. Approval cannot be made if adequate comparison information is not provided. Absence of specified manufacturers' data is grounds for disapproval.

B. Refer to Section 01 3000 - Administrative Requirements AND Section 01 6000 - Product Requirements for substitution procedures.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. KNOX COMPANY, 1601 W. Deer Valley Road, Phoenix, AZ 85027; Toll-free: (800) 552-5669; T: (623) 687-2300; F: (623) 687-2299; Web: www.knoxbox.com; E-mail: info@knoxbox.com

B. Substitutions: See Section 01 6000 - Product Requirements.

1. See article in PART 1 above entitled "Available Manufacturers".

2.2 PRODUCTS

A. Knox Box 3200 Series Hinged Door Model. Recessed mount with hinged door, with/without UL Listed tamper switches. 1/4" plate steel housing, 1/2" thick steel door with interior gasket seal and stainless steel door hinge. Box and lock UL Listed. Lock has 1/8" thick stainless steel dust cover with tamper seal mounting capability. Holds up to 10 keys and access cards in interior compartment.

1. Exterior Dimensions: Recessed mount flange- 7"H x 7"W
2. Lock: UL Listed. Double-action rotating tumblers and hardened steel pins accessed by a biased cut key.
3. Finish: Knox-Coat® proprietary finishing process.
4. Colors: Black.
5. Weight - Recessed mount: 9 lbs.
6. Recessed Mounting Kit (RMK) for recessed models only for use in new concrete or in masonry. Rough-in Dimensions: 6-1/2"H x 6-1/2"W x 5"D.

PART 3 EXECUTION

3.1 INSTALLERS

A. Installation of this product should be performed only by individuals skilled in the use of the tools and equipment necessary for installation.

3.2 EXAMINATION

A. Verify that wall(s) is(are) ready to receive work; installations into fire-rated walls shall be such that the fire-rated construction is maintained, and dimensions are as indicated on shop drawings.

B. Where electric power and/or alarm wiring is required verify that electric power and/or alarm wiring is available to serve operated devices and of the correct characteristics.

3.3 INSTALLATION

A. Install key cabinets in accordance with manufacturer's instructions and applicable codes.

1. Recess models are designed for flush mounting. Do not mount face down from ceiling or overhang area. Units can be adapted to fit a variety of solid walls cored to a 6" diameter approximately 3 1/2" deep. A Recessed Mounting Kit (RMK) is for new concrete or masonry walls under construction. Do not over tighten mounting bolts as this will distort the flange.

B. At masonry where recessed units are requitred provide a Recessed Mounting Kit (RMK) in accordance with manufacturer's instructions.

C. For Hinged Door Models: CAUTION! Be extremely careful when handling this KNOX-BOX prior to installation. When not mounted, the door will be OPEN. Always hold box and door securely to prevent door closing on fingers and causing injury.

D. Tamper Switch: Remove the tamper switch assembly and set aside for installation after the box is mounted.

1. Install the tamper switch assembly after the box is mounted. Pull wiring tight so that any attempts to force the box out of the wall will break the wire or pull the terminals loose. A qualified alarm installer should perform alarm wiring, testing and adjusting.

E. Always mount your KNOX-BOX to a secure, solid wall, beam or post.
F. Use a small level to plumb the box square.
G. Mount the KNOX-BOX so the small moisture drain hole inside of the vault is on the bottom.
H. Use at least four (4) Grade 5 or Grade 8 fasteners (carriage bolts, etc.) of 3/8” diameter. Units may also be welded into place. Mounting to solid beams or steel supports is best. Mounting face down from ceiling or overhang area may cause contents to jam lock.
   1. If installing the box on a thin or hollow wall, use a solid backing, for example a 3/8" steel plate fastened to solid studs or other material on both sides. See Section 05 5000.
I. For proper weatherproofing, caulk the back of box across top and down each side. Leave the bottom open for drainage. Sealant type GPX
J. Use of a professional locksmith or alarm products installer is highly recommended.
K. Interface With Other Work:
   1. Verify that Tamper Switch properly works with alarm system

3.4 TOLERANCES
A. Maximum Variation From True Position: 1/8 inch.
B. Maximum Offset From True Alignment: 1/8 inch.

3.5 CLEANING
A. Clean all exposed surfaces of Emergency Key Cabinet.

3.6 CLOSEOUT ACTIVITIES
A. Box Lock Up
   1. When your KNOX-BOX is for fire department use, contact your local fire department after installation to inform them that the box is ready for lock up. They have the only key.

SECTION 10 4400
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

1.2 RELATED REQUIREMENTS
- A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

1.3 REFERENCE STANDARDS
- A. FM - FM Global: Product certification and testing through FM Approvals.
- B. NFPA 10 - Standard for Portable Fire Extinguishers; 2013.
- C. TAS - Texas Accessibility Standards; 2012.
- D. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.4 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate cabinet physical dimensions.
- C. Product Data: Provide extinguisher operational features.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.5 FIELD CONDITIONS
- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

1.6 WARRANTY
- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Contractor shall correct defective Work within a two year period after Date of Substantial Completion; remove and replace materials concealing defective work at no extra cost to Owner.

1.7 AVAILABLE MANUFACTURERS
- A. Substitutions - The product(s) referenced by the manufacturer listed, forms the basis of design. The contractor at their option may provide an alternate manufacturer as an equal, however, if an equal is proposed, the Contractor shall provide data from the specified manufacturer & product(s) as well as data from the proposed manufacturer for a comparison, review, and determination of acceptance (approval or disapproval) by the Architect. Approval cannot be made if adequate comparison information is not provided. Absense of specified manufacturer's data is grounds for disapproval.

PART 2 PRODUCTS

2.1 MANUFACTURERS
- A. Fire Extinguishers:
- B. Amerex; Model No. B456: www.amerex-fire.com.
  1. Substitutions: See Section 01 6000 - Product Requirements.
     a. See article in PART 1 above entitled "Available Manufacturers".
- C. Fire Extinguisher Cabinets and Accessories:
  1. JL Industries, Inc; _____: www.jlindustries.com.
  2. Larsen's Manufacturing Co; _____: www.larsensmfg.com.
  3. Potter-Roemer; _____: www.potterroemer.com.
  4. Substitutions: See Section 01 6000 - Product Requirements.

2.2 PERFORMANCE REQUIREMENTS

A. Conform to NFPA 10.
B. Provide extinguishers classified and labeled by FM for the purpose specified and indicated. No exceptions.

2.3 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
    1. Provide extinguishers labeled by FM for the purpose specified and indicated.
B. Dry Chemical Type Fire Extinguishers: Aluminum tank, with pressure gage.
    1. Class: A:B:C.
    2. Size: 10 pound (4.54 kg).
    3. Finish: Baked polyester powder coat, Red color.

2.4 FIRE EXTINGUISHER CABINETS

A. Cabinets shall be fire rated cabinets at fire rated walls. Cabinet rating shall be equivalent to the rating of the wall.
B. Metal: Formed primed steel sheet; 0.036 inch (0.9 mm) thick base metal.
C. Cabinet Configuration: Semi-recessed type.
    1. Sized to accommodate accessories.
    2. Trim: Returned to wall surface, with 1-1/2 inch projection (verify), 1-1/2 inch wide face.
    3. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim and door stiles.
D. Door: Manufacturer recommended thickness, reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with two butt hinge. Provide nylon catch.
E. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.
F. Weld, fill, and grind components smooth.
G. Finish of Cabinet Exterior Trim and Door: Baked enamel, White color.
H. Finish of Cabinet Interior: Baked enamel, white color.

2.5 ACCESSORIES

A. Cabinet Signage: "Fire Extinguisher" in vertical letters.
B. Graphic Identification: "Fire Extinguisher" sign, White letters on red background, Size 10"w. x 14" h., stick-on vinyl, SA-SO (T: 800-527-2450) item #23912.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install cabinets plumb and level in wall openings, mount cabinets compliant with TAS requirements.
C. Secure rigidly in place.
D. Place extinguishers in cabinets.
E. Position cabinet signage at door as described above.

END OF SECTION

SECTION 10 5100
LOCKERS

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Metal lockers.
  - 1. Refer to the drawings for locations of each locker type.
- B. Locker benches.

1.2 REFERENCE STANDARDS
- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.

1.3 WARRANTY
- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Contractor shall correct defective Work within a five year period after Date of Substantial Completion; remove and replace materials concealing defective work at no extra cost to Owner.

1.4 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on locker construction, sizes and accessories.
- C. Shop Drawings: Indicate locker plan layout, numbering plan and combination lock code.
- D. Color Samples: Submit two samples 4 x 4 inches (100 x 100 mm) in size, of each color scheduled.
- E. Manufacturer's Installation Instructions: Indicate component installation assembly.

PART 2 PRODUCTS

2.1 LOCKER APPLICATIONS
- A. Type 1: Two tier metal, vented lockers, free-standing with matching closed base.
  - 1. Width: 15 inches (375 mm).
  - 2. Depth: 18 inches (450 mm).
  - 3. Height, Overall: 66 inches (1676 m).
  - 4. Locking: Padlock hasps, for padlocks provided by others.
  - 5. Provide knock out panel in back.
  - 6. Refer to the Locker Legend In the drawings.
- B. Type 2: Single tier metal, vented lockers, free-standing with matching closed base.
  - 1. Width: 12 inches (300 mm).
  - 2. Depth: 18 inches (450 mm).
  - 3. Height: 72 inches (1829 m).
  - 4. Locking: Padlock hasps, for padlocks provided by others.
  - 5. Refer to the Locker Legend In the drawings.
- C. Type 3: Two tier metal, vented lockers, free-standing with matching closed base.
  - 1. Width: 24 inches (610 mm).
  - 2. Depth: 24 inches (610 mm).
  - 3. Height: 66 inches (1676 m).
  - 4. Locking: Padlock hasps, for padlocks provided by others.
  - 5. Refer to the Locker Legend In the drawings.
- D. Type 4: Two tier metal lockers, free-standing with matching closed base.
  - 1. Width: 12 inches (300 mm).
  - 2. Depth: 18 inches (450 mm).
  - 3. Height, Overall: 66 inches (1676 m).
  - 4. Locking: Padlock hasps, for padlocks provided by others.
  - 5. Refer to the Locker Legend In the drawings.
- E. Locker Benches: Stationary type, including ADA type; bench top of 1-1/4" laminated maple or birch; painted steel pedestals.

1. Height: 17" minimum - 19" maximum for ADA type.
2. Length: 42"-48".
3. Depth: 20"-24".
4. Finish: Two-coat catalyzed finish.
5. Bench Edges: Provide radius on all sides and corners for comfort.

2.2 METAL LOCKERS

A. Lockers: Factory assembled, made of formed sheet steel, ASTM A653/A653M SS Grade 33/230, with G60/Z180 coating, stretcher leveled; metal edges finished smooth without burrs; baked enamel finished inside and out.
   1. Where ends or sides are exposed, provide flush panel closures.
   2. Color: Refer to locker finish color in the "Locker Legend" on the drawings.
B. Locker Body: Formed and flanged; with steel stiffener ribs; electric spot welded.
   1. Body and Shelves: 16 gage, 0.0598 inch (1.52 mm).
C. Frames: Formed channel shape, welded and ground flush, welded to body, resilient gaskets and latching for quiet operation.
   1. Door Frame: 16 gage, 0.0598 inch (1.52 mm), minimum.
D. Doors: Hollow channel edge construction, 1-3/16 inch (30 mm) thick; welded construction, channel reinforced top and bottom with intermediate stiffener ribs, grind and finish edges smooth.
   1. Door Outer Face: 18 gage, 0.0478 inch (1.21 mm), minimum.
   2. Full channel shape on the lock side to fully conceal the lock bar.
   3. Form recess for operating handle and locking device.
   4. Provide louvers in door face, top and bottom, for ventilation.
E. Doors at vented lockers: Formed from one piece 14 gauge cold rolled sheet steel. Formations shall consist of a full channel shape on the lock side of adequate depth to fully conceal the lock bar, channel formation on the hinge side and right angle formations across the top and bottom. Doors shall have diamond shaped perforations 3/4" wide by 1-1/2" high to provide free airflow while leaving sufficient metal for rigidity and strength.
   1. Door Outer Face: 14 gage, 0.0747 inch (1.897 mm), minimum.
   2. Door Inner Face: 20 gage, 0.0359 inch (0.91 mm), minimum.
   3. Full channel shape on the lock side to fully conceal the lock bar.
   4. Form recess for operating handle and locking device.
F. Hinges: Two for doors under 42 inches (1 050 mm) high; three for doors over 42 inches (1 050 mm) high; weld securely to locker body and door.
   1. Hinge Thickness: 14 gage, 0.0747 inch (1.90 mm).
G. Coat Hooks: Stainless steel or zinc-plated steel.
H. Number Plates: Provide rectangular shaped aluminum plates. Form numbers 1 inch (25 mm) high of block font style with ADA designation, in contrasting color.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install lockers plumb and square.
C. Place and secure on prepared base.
D. Bolt adjoining locker units together to provide rigid installation.
E. Install end panels, filler panels, and sloped tops.
F. Install accessories.
G. Replace components that do not operate smoothly.

3.2 CLEANING

A. Clean locker interiors and exterior surfaces.

END OF SECTION

SECTION 12 2400
WINDOW SHADES

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Window shades and accessories.
  - 1. Manual operation.

1.2 RELATED REQUIREMENTS
- A. Section 06 1000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.
- B. Section 09 2116 - Gypsum Board Assemblies: Substrate for window shade systems.

1.3 REFERENCE STANDARDS
- A. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2010.

1.4 ADMINISTRATIVE REQUIREMENTS
- A. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of all affected installers.
- B. Sequencing:
  - 1. Do not fabricate shades until field dimensions for each opening have been taken.
  - 2. Do not install shades until final surface finishes and painting are complete.

1.5 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
- C. Certificates: Manufacturer's documentation that line voltage components are UL listed or UL recognized.
- D. Source Quality Control Submittals: Provide test reports indicating compliance with specified fabric properties.
- E. Selection Samples: Include fabric samples in full range of available colors and patterns.
- F. Verification Samples: Minimum size 6 inches (150 mm) square, representing actual materials, color and pattern.
- G. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- H. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.
- I. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE
- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING
- A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.
- B. Handle and store shades in accordance with manufacturer's recommendations.

1.8 WARRANTY
- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Contractor shall correct defective Work within a two year period after Date of Substantial Completion; remove and replace materials concealing defective work at no extra cost to Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manually Operated Roller Shades:
   1. Draper, Inc; Manual Lightbloc: www.draperinc.com.
   2. Lutron Electronics Co., Inc: www.lutron.com.
   3. Hunter Douglas: www.hunterdouglas.com.
   4. MechoShade System as manufactured by MechoSystems: www.mechoshade.com
   5. Solarfective Products, Ltd., available through J.C. Mowrey, Inc., Boerne, TX; Tel (210) 244-3566.

B. Shade Fabric:
   1. As provided by manufacturer.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.2 WINDOW SHADE APPLICATIONS

A. Shades: Blackout shades.
   1. Type: Roller shades.
   2. Color: As selected by Architect from manufacturer’s full range of colors.
   3. Mounting: Inside (between jambs).
   4. Operation: Manual.

2.3 ROLLER SHADES

A. Roller Shades: Fabric roller shades complete with mounting brackets, roller tubes, hembars, hardware and accessories; fully factory-assembled.
   1. Drop: Regular roll.
   2. Size: As indicated on drawings.

B. Fabric: Non-flammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation; PVC-free; 100 percent recycled.
   1. Blackout Shades: Block virtually all the light; Openness Factor equal to zero (0).
   2. Flammability: Pass NFPA 701 large and small tests.

C. Roller Tube: As required for type of operation, extruded aluminum with end caps.
   1. Dimensions: Manufacturer's standard, selected for suitability for installation conditions, span, and weight of shades.
   2. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge.

D. Hembars and Hembar Pockets: Wall thickness designed for weight requirements and adaptation to uneven surfaces, to maintain bottom of shade straight and flat.
   1. Blackout Shades: Provide a slot in bottom bar with manufacturers recommended light seal.

E. Manual Operation: Clutch operated continuous loop; beaded ball chain.

2.4 ACCESSORIES

A. Fascias: Size as required to conceal shade mounting.
   1. Style: As selected by Architect from shade manufacturer’s full selection.

B. Brackets and Mounting Hardware: As recommended by manufacturer for mounting configuration and span indicated.

C. Ball chain retainer.

D. Fasteners: Non-corrosive, and as recommended by shade manufacturer.

2.5 FABRICATION

A. Field measure finished openings prior to ordering or fabrication.

B. Fabricate shades to fit openings within specified tolerances.
   1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch (13 mm) space between bottom bar and window stool.
   2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.

C. Dimensional Tolerances: As recommended in writing by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.
B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
C. Start of installation shall be considered acceptance of substrates.

3.2 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
B. Coordinate with window installation and placement of concealed blocking to support shades.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
B. Installation Tolerances:
    1. Inside Mounting: Maximum space between shade and jamb when closed of 1/16 inch (1.5 mm).
    2. Maximum Offset From Level: 1/16 inch (1.5 mm).
C. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.
D. Adjust level, projection and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.4 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.
B. Replace shades that cannot be cleaned to "like new" condition.

3.5 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
B. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.

3.6 PROTECTION

A. Protect installed installed products from subsequent construction operations.
B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 12 9313
BICYCLE RACKS

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Bicycle racks.

1.2 RELATED REQUIREMENTS
- A. Section 03 3000 - Cast-in-Place Concrete: Mounting surface for bicycle racks.

1.3 REFERENCE STANDARDS
- A. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

1.4 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  1. Preparation instructions and recommendations.
  2. Storage and handling requirements and recommendations.
  3. Installation methods.
- C. Shop Drawings: Indicate size, shape, and dimensions, including clearances from adjacent walls, doors, and obstructions.
- D. LEED Submittals:
  1. Product Data for Credit MR 4: Documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

1.5 DELIVERY, STORAGE, AND HANDLING
- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Handle racks with sufficient care to prevent scratches and other damage to the finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS
- A. Outdoor Bicycle Racks:
  1. Columbia Cascade Company; CycLoops 2170: www.timberform.com.
  2. Highland Products Group, LLC; Heavy Duty Wave: www.highlandproductsgroup.com.
  3. Huntco Supply, LLC; BR Series: www.huntco.com.
  4. Substitutions: See Section 01 6000 - Product Requirements.

2.2 BICYCLE RACKS
- A. Exterior Bicycle Racks: Device allows user provided lock to simultaneously secure one wheel and part of the frame on each bicycle parked or racked.
  1. Style: Serpentine rack formed from a continuous round pipe.
  2. Capacity: 7 bicycles.
  3. Mounting, Ground: Surface flange.
  4. Finish: Hot-dipped galvanized, maintenance-free and weather-resistant.
  5. Accessories: Surface flange cover.
- B. Materials:
  1. Pipe: Carbon steel, ASTM A53/A53M, Schedule 40; Heavy-duty 2-3/8" O.D.

PART 3 EXECUTION

3.1 EXAMINATION
- A. Examine surfaces to receive bicycle racks.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Do not begin installation until unsatisfactory substrates have been properly repaired.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install bicycle racks level, plumb, square, and correctly located as indicated on the drawings.
C. Surface Flange Installation: Anchor bicycle racks securely in place with 1/2 inch (13 mm) by 4 inch (101 mm) anchor bolts through flange holes.

3.3 CLEANING

A. Clean installed work to like-new condition. Do not use cleaning materials or methods that could damage finish.

3.4 PROTECTION

A. Protect installed products until completion of project.
B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 13 3419
METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED:

A. Single-story, pre-engineered, steel rigid-frame-type metal building with metal building type purlins. Building size of the nominal length, width, eave height, and roof pitch indicated. NOTE: Certain dimensions are critical and must be maintained. These dimensions are indicated on the drawings.

1. All exterior metal wall panels and metal soffit panels and associated flashing, trim, subgirts, sealants, and fasteners necessary to form the exterior metal wall panel system as shown on the Contract Drawings.

1.02 RELATED REQUIREMENTS:

A. Section 05 1200 Structural Steel Framing.

B. Section 07 4113 Metal Roof Panels: Roof panels, gutters and downspouts.

C. Section 07 9200 Joint Sealants.

1.03 SYSTEM PERFORMANCE REQUIREMENTS:

A. General: Engineer, design, fabricate and erect the pre-engineered metal building system to withstand loads from winds, gravity, structural movement including movement thermally induced, and to resist in-service use conditions that the building will experience, including exposure to the weather, without failure.

1. Design each member, including the anchor bolts, to withstand stresses resulting from combinations of loads that produce the maximum allowable stresses in that member as prescribed in MBMA's "Design Practices Manual".

B. Design Loads: The metal building manufacturer shall design for basic design loads as well as collateral loads. It shall be the sole responsibility of the manufacturer to determine basic loads and collateral loads. Note: Roof live load reductions are not permitted on this project.

1. Basic design loads include live load and wind load, in addition to the dead load.

2. Collateral loads include additional dead loads over and above the weight of the metal building system such as plumbing, mechanical systems and athletic equipment.

C. Deflection limitations are specified on the Structural Drawings, General Notes.

D. Structural Framing: Design primary and secondary structural members for applicable loads and combinations of loads in accordance with the Metal Building Manufacturers Association's (MBMA) "Design Practices Manual".

1. Structural Steel: Comply with the American Institute of Steel Construction's (AISC) "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" for design requirements and allowable stresses, Ninth Edition.
2. Light Gage Steel: Comply with the American Iron and Steel Institute's (AISI) "Specification for the Design of Cold Formed Steel Structural Members" and "Design of Light Gage Steel Diaphragms" for design requirements and allowable stresses.
3. Welded Connections: Comply with the American Welding Society's (AWS) "Standard Code for Arc and Gas Welding in Building Construction" for welding procedures.

1.04 SUBMITTALS:

A. General: Submit in accordance with Conditions of the Contract and Division 01 Specification Sections.

B. Product data consisting of metal building system manufacturer's product information for building components and accessories.

C. Shop drawings for metal building structural framing system, roofing and other metal building system components and accessories.

1. Structural Framing: Furnish complete erection drawings prepared by or under the supervision of a Professional Engineer legally authorized to practice in the State of Texas. Include details showing fabrication and assembly of the metal building system. Show anchor bolt size, anchor bolt setting plan, sidewall, endwall and roof framing. Include transverse cross-sections.

D. Samples for initial selection purposes in form of manufacturer's color charts or chips showing full range of colors, textures, and patterns available for metal roofing and siding panels with factory-applied finishes.

E. Installer certificates signed by metal building manufacturer written certification certifying that the installer complies with requirements included under the "Quality Assurance" Article.

F. Professional Engineer's letter prepared and signed by a Professional Engineer, legally authorized to practice in the State of Texas, verifying that the structural framing and covering panels meet indicated loading requirements and codes of authorities having jurisdiction.

1.05 QUALITY ASSURANCE:

A. Installer Qualifications: Engage an experienced Installer to erect the pre-engineered metal building who has specialized in the erection and installation of types of metal building systems similar to that required for this project and who is certified in writing by the metal building system manufacturer as qualified for erection of the manufacturer's products.

B. Manufacturer's Qualifications: Provide pre-engineered metal buildings manufactured by a firm experienced in manufacturing metal building systems that are similar to those indicated for this project and have a record of successful in-service performance.

C. Single-Source Responsibility: Obtain the metal building system components, wall, roof covering, and accessory components, from one source from a single manufacturer.

D. Design Criteria: The drawings indicate sizes, profiles and dimensional requirements of the pre-engineered metal building system. Metal building systems having equal performance characteristics with deviations from indicated dimensions and profiles may be considered, provided deviations do not change the design concept, intended performance or dimensional requirements as indicated on the drawings. The burden of proof of equality is on the proposer.

1.06 DELIVERY, STORAGE AND HANDLING
Deliver prefabricated components and other manufactured items so they will not be damaged or deformed. Package wall and roof panels for protection against transportation damage.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:
Subject to compliance with specified requirements.

2.02 MATERIALS:

A. Hot-Rolled Structural Steel Shapes: Comply with ASTM A36 or ASTM A529.

B. Steel Tubing or Pipe: Comply with ASTM A500, Grade B, ASTM A501 or ASTM A53.

C. Steel Members Fabricated from Plate or Bar Stock: Provide 42,000 psi minimum yield strength. Comply with ASTM A529, ASTM A570 or ASTM A572.

D. Steel Members Fabricated by Cold Forming: Comply with ASTM A607, Grade 50.

E. Cold-Rolled Carbon Steel Sheet: Comply with requirements of ASTM A366 or ASTM A569.

F. Hot-Rolled Carbon Steel Sheet: Comply with requirements of ASTM A568 or ASTM A569.

G. Bolts for Structural Framing: Comply with ASTM A307 or ASTM A325 as necessary for design loads and connection details.

H. Paint and Coating Materials:

1. Shop Primer for Ferrous Metal: Fast-curing, lead-free, universal primer, selected by the manufacturer for resistance to normal atmospheric corrosion, compatibility with finish paint systems and capability to provide a sound foundation for field applied top-coats despite prolonged exposure.

2.03 STRUCTURAL FRAMING:

A. Rigid Frames: Fabricate from hot-rolled structural steel shapes. Provide factory-welded, shop-painted, built-up "I-beam" shape frames consisting of tapered parallel flange beams and straight leg columns. Furnish frames with attachment plates, bearing plates and splice members. Factory drill for field-bolted assembly.

1. Provide length of span and spacing of frames indicated.

B. Secondary Framing: Provide the following secondary framing members.
1. Roof Purlins and Girts: "C"- or "Z"- shaped sections fabricated from shop-painted roll-formed steel with a minimum 16 gage thickness (0.0598 inch).
2. Eave Struts: Unequal flange "C"-shaped sections formed to provide adequate backup for both wall and roof panels. Fabricate from shop-painted roll-formed steel with a minimum 16 gage thickness (0.0598 inch).

C. Wind Bracing:
Reference Structural Drawings, General Notes.

D. Bolts: Provide shop-painted bolts except when structural framing components are in direct contact with roofing and siding panels. Provide zinc-plated or cadium-plated bolts when structural framing components are in direct contact with roofing and siding panels. Provide anchor bolts and setting templates for installation into foundation.
NOTE: Building manufacturer shall design the anchor bolts.

E. Shop Painting: Clean surfaces to be primed of loose mill scale, rust, dirt, oil, grease and other matter precluding paint bond. Follow procedures of SSPC-SP3 for power tool cleaning, SSPC-SP7 for brush-off blast cleaning, and SSPC-SP1 for solvent cleaning.

1. Prime structural steel primary and secondary framing members with the manufacturer's standard rust-inhibitive primer.

2.04 METAL WALL SYSTEM:

A. Exterior Metal Wall System: Manufacturer’s standard wall panel profile.

B. Wall System Design: Design wall panels in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members.

C. Wall Panels:

1. Roll-formed panels, 3 feet wide with 4 major corrugations, 1-7/16 inches high, 12 inches on center, with 2 minor corrugations between each of the major corrugations entire length of panel.

2. One piece from base to building eave.

3. Each Panel Corrugation: Fastener alignment groove to center fastener within corrugation.

4. Exposed Panel Side Laps: Hemmed to eliminate raw cut panel edge.

5. Upper End of Panels: Fabricate with mitered cut to match corrugations of “Butlerib®II” roof panels of 1/2 inch to 12 inches and square cut for all other roof panels and slopes.

6. Factory punch or field drill wall panels at panel ends and match factory-punched or field-drilled holes in structural members for proper alignment.

7. Panel Material and Finish:

a. 24-gauge painted Galvalume aluminum-zinc alloy (approximately 55 percent aluminum, 45 percent zinc), ASTM A792.

b. Paint with exterior colors of , full-strength, 70 percent “Kynar 500” or “Hylar 5000” fluoropolymer (PVDF) coating.

c. PVDF Coating Warranty: Metal building system manufacturer shall warrant coating for 25 years for the following.

1) Not to peel, crack, or chip.

2) Chalking: Not to exceed ASTM D4214, #8 rating.

3) Fading: Not more than 5 color-difference units, ASTM D2244.

D. Fasteners:

1. Wall Panel-to-Structural Connections: Torx-head “Scrubolt™” or Torx-head self-drilling screws.

2. Wall Panel-to-Panel Connections: Torx-head self-drilling screws.

3. Fastener Locations: Indicated on erection drawings furnished by metal building system manufacturer.

4. Exposed Fasteners: Factory painted to match wall color.

E. Accessories:

1. Accessories (i.e., Doors, Windows, Louvers): Standard with metal building system manufacturer, unless otherwise noted and furnished as specified.

2. Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.

PART 3 - EXECUTION

3.01 ERECTION:

A. Framing: Erect framing true to line, level, plumb, rigid and secure. Level base plates to a true even plane with full bearing to support structures, set with double-nutted anchor bolts. Use a non-shrinking grout to obtain uniform bearing and to maintain an even base line elevation.

B. Purlins and Girts: Provide members with tight-fitting closure channels and fascias. Locate and space wall girts to suit door and window arrangements and heights. Maintain straight line during erection to ensure straightness.

C. Bracing: Reference Structural Drawings.

D. Framed Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed. Securely attach to building structural frame.

3.02 METAL WALL SYSTEM INSTALLATION:

A. Install wall system in accordance with metal building system manufacturer’s instructions at locations indicated on the drawings.

B. Install wall system weathertight.

C. Verify structural system is plumb before wall panels are attached.

D. Align and attach wall panels in accordance with erection drawings furnished by metal building system manufacturer.

E. Install side laps with minimum of 1 full corrugation.

F. Seal wall panels at base with metal trim.

G. Exterior Trim: Apply same finish as exterior color of wall panels, except the following:

1. Eave Trim, Gable Trim, Door-Side Flashings, and Header Flashings: Paint with exterior colors of finish system, full-strength, 70 percent “Kynar 500” or “Hylar 5000” fluoropolymer (PVDF) coating in standard color of metal building system manufacturer.

2. Flashings, Trim, Closures, and Similar Items: Install as indicated on erection drawings furnished by metal building system manufacturer.

END OF SECTION

SECTION 14 4500
HEAVY DUTY VEHICLE LIFTS (ROTARY)

PART 1 - GENERAL

1.1 SECTION INCLUDES
- A. Vehicle lifts including safety equipment, controls and accessories of the following types:
  1. 30,000 lb. four post surface mounted drive on general service lifts SM30S - SM30L - SM30EL series.

1.2 RELATED SECTIONS
- A. Section 15050 - Basic Mechanical Materials and Methods: Hydraulic lines, fittings, and related accessories.
- B. Section 16050 - Basic Electrical Materials and Methods: Service, circuiting, wiring, and connections for power and controls.

1.3 REFERENCES
- A. ALI: Automotive Lift Institute.
- B. ANSI/ALI ALCTV: Safety Requirements for the Construction, Testing, and Validation of Automotive Lifts.
- C. International Standards Organization (ISO): ISO 9001 Quality management systems - Requirements.
- D. Underwriters Laboratories Inc. (UL): UL201 - These requirements cover garage equipment, rated not more than 600 volts, for use in accordance with the National Electrical Code, NFPA 70.

1.4 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  1. Preparation instructions and recommendations.
  2. Storage and handling requirements and recommendations.
  3. Installation manual.
  4. Operations manual.
  5. Maintenance manual.
  6. Safety manual.
- C. Shop Drawings: Template drawings and load reactions for lift application.

1.5 QUALITY ASSURANCE
- A. Installer Qualifications: Factory trained authorized company, company insured for completed operations of installing lift.
- B. In addition to the other requirements outlined herein, the lift or lifts, shall comply with all applicable requirements of ANSI standards. "Safety Requirements for the Construction, Care and Use of Automotive Lifts" as published by the American national Standards Institute. The lift company Quality Management System shall be ISO9001 certified.

1.6 PROJECT CONDITIONS
- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.7 WARRANTY
- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Contractor shall correct defective Work within a two year period after Date of Substantial Completion; remove and replace materials concealing defective work at no extra cost to Owner.
- C. Provide five year manufacturer warranty for structural parts, two years for functional parts.

1.8 AVAILABLE MANUFACTURERS
- A. Substitutions: The product(s) referenced by the manufacturer listed, forms the basis of design. The contractor at their option may provide an alternate manufacturer as an equal, however, if

an equal is proposed, the Contractor shall provide data from the specified manufacturer & product(s) as well as data from the proposed manufacturer for a comparison, review, and determination of acceptance (approval or disapproval) by the Architect. Approval cannot be made if adequate comparison information is not provided. Absence of specified manufacturers' data is grounds for disapproval.

B. Refer to Section 01 3000 - Administrative Requirements AND Section 01 6000 - Product Requirements for substitution procedures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Rotary Lift, which is located at: 2700 Lanier Dr. ; Madison, IN 47250; Toll Free Tel: 800-640-5438; Tel: 812-273-1622; Fax: 800-578-5438; Email: request info (lkendall@vsgdover.com); Web: www.rotarylift.com

B. Substitutions: See Section 01 6000 - Product Requirements.
   1. See article in PART 1 above entitled "Available Manufacturers".

2.2 30,000 LB. FOUR POST SURFACE MOUNTED DRIVE ON GENERAL SERVICE LIFTS SM30S/SM30L/SM30EL SERIES

A. Capacity: 30,000 lb (13600 kg); 15,000 lb (6804 kg) per runway.

B. SM30S/SM30L/SM30EL Series Single Point Manual Controls - Pneumatic 100 psi - 120 psi Air Required, Lock Release Electric Power Unit, UL201 Compliant, Over Hydraulic Cylinder Drive: All models bio-fluid compatible.
   1. 4hp 208-230V 1 phase Motor 60Hz.
   2. 4hp 208-480V 3 phase Motor 50/60Hz.
   3. 4hp 575V 3 phase Motor 60Hz.

C. Minimum Bay Requirements:
   1. SM30S: Floor space 16 feet x 30 feet (4877mm x 9144 mm).
   2. SM30L: Floor space 16 feet x 33 feet (4877mm x 10059 mm).
   3. SM30EL: Floor space 16 feet x 36 feet (4877mm x 10973 mm).
   4. Floor slab concrete 3000 psi - 4-1/4 inch (108 mm) minimum; 5 inch - 6 inch (127 mm - 152 mm).

D. Rise: 68 inches (1727 mm) from floor to top of runway.

E. Overall Length:
   1. SM30S: 25 feet 8-1/8 inches (9677 mm).
   2. SM30L: 28 feet 8-1/8 inches (10592 mm).
   3. SM30EL: 31 feet 8-1/8 inches (11506 mm).

F. Overall Width: 12 feet 4-13/16 inches (4877 mm).

G. Inside of Columns: 132 inches (3353 mm).

H. Between Front and Rear Columns:
   1. SM30S: 249 inches (6325 mm).
   2. SM30L: 285 inches (7239 mm).
   3. SM30EL: 321 inches (8153 mm).

I. Height of Columns: 7 feet 3/4 inch (4039 mm).

J. Width of Runways: 24 inches (610 mm).

K. Height of Runways: 8-3/8 inches (213 mm).

L. Width Between Runways: 41 inches to 48 inches (1041 mm to 1219 mm).

M. Maximum Wheelbase:
   1. SM30S: 235 inches (5969 mm).
   2. SM30L: 271 inches (6883 mm).
   3. SM30EL: 307 inches (7798 mm).

N. Finishes:
   1. Blue, Standard RAL5005.
   2. Red, RAL3002.
   3. Yellow, RAL1023.
   4. Gray, RAL7040.
   5. Black, RAL9005.

O. Optional Accessories:
   1. FC5710: Rolling Jacks 15,000 LB (6804 kg) capacity (each) 100 psi minimum - 120 psi maximum required.
   2. Internal Air Line Kit 100 psi minimum - 120 psi maximum required.
   3. Four-Wheel Alignment Kit.
   4. Oil Drain Pan.
   5. Air/Electric Utility Box.
   6. Ramp Kits for drive-thru bays two each extended length available.
   7. Removable Work Steps.

P. Lift shall be 3rd party certified by ETL testing laboratory and labeled with the ETL/Automotive Lift Institute (ALI) label that affirms the lifts meet conformance to all applicable provisions of American National Standard ANSI/ALI ALCTV and in compliance with IBC chapter 30 section 3001.2.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until supporting structures have been properly prepared.
B. If supporting structure preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

A. Install in strict accordance with manufacturer instructions and in proper relationship with adjacent construction. Test for proper operation and retest if necessary until satisfactory results are achieved.

3.3 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
B. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Location: At project site.
C. Maintenance: Provide

3.4 PROTECTION

A. Protect installed products until completion of project.
B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 21 13 00
FIRE SPRINKLER SYSTEMS

PART 1. GENERAL

1.01 CONDITIONS:

A. The Contractor, Subcontractors, Trade Contractors, and Suppliers are responsible for understanding the requirements of the General Conditions, the Supplementary General Conditions, all Specification Sections, all Drawings, and all Bid Documents that govern or may otherwise impact their Work.

B. The Contractor, Subcontractors, Trade Contractors, and Suppliers shall compare the requirements of the Specifications to the requirements of the Drawings as part of the bidding process and report any discrepancies to the Architect prior to bidding.

C. The Contractor, Subcontractors, Trade Contractors, and Suppliers shall bid fully operational systems that represent, to the best of their understanding, the intent of the system installation and operation for the system being proposed and installed.

D. Additionally, all Work performed under this Section of the Specifications shall be in strict accordance with the provisions found in the Basic Materials and Methods Sections of Divisions 22, 26 and 28.

1.02 SUMMARY

A. This is a specification for the design and installation of new automatic sprinkler systems and for the SAWS North West Operations Center and the SAWS East Side Operations Center

B. The system design shall be performed by the FPE. The Contractor is responsible for all permitting, labor, materials, and equipment for the following:

1. A new combined automatic wet sprinkler system protecting the conditioned spaces inside the building and a new dry system protecting the exterior canopies and overhangs as required and as indicated and described herein.
2. Submittals to, and final approvals and permits from the Authorities Having Jurisdiction (AHJ). Contractor shall provide the FPE with a complete submittal for review and written approval prior to submitting for an installation permit.
3. Verification of all conditions pertinent to the scope of this work before submitting a bid proposal.
4. As-Built drawings of the entire system after final approval and commissioning testing by the AHJ.
5. The design and installation must consider methods which are aesthetically pleasing while adhering to the referenced codes, standards, and the manufacturer's listings. Sprinklers installed in areas with lay-in ceilings shall be located in the center-of-tile. Sprinklers installed in areas with hard ceilings shall be spaced symmetrically and located in-line with other sprinklers, fixtures, or architectural features wherever possible.

1.03 DEFINITIONS

A. Owner shall mean the SAWS.

B. Contractor is a licensed fire sprinkler contractor in the State of Texas qualified to design, install, and test fire sprinkler systems.

C. NICET shall mean National Institute for Certification in Engineering Technologies.

D. CAD based drawings (where requested) shall be provided in ".dwg" format and shall be compatible with AutoCAD release 2010.

E. Authority Having Jurisdiction, or AHJ shall mean:

1. The City of San Antonio Fire Department,
2. Property Insurance Carrier, and
3. Owner.

1.04 REFERENCES

A. National Fire Protection Association (NFPA):

1. NFPA 13, Installation of Sprinkler Systems, 2010 edition.
2. NFPA 14, Standpipe and Hose Systems, 2010 edition.
3. NFPA 24, Installation of Private Fire Service Mains and Their Appurtenances, 2010 edition.
4. NFPA 25, Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, 2011 edition

B. InternationalCode Council (ICC):
   1. International Building Code (IBC),2012 with San Antonio amendments
   2. International Fire Code (IFC), 2012 with San Antonio amendments

C. State LicensingRegulations:
   1. Texas Insurance Code, Chapter 6003 (formerly Article 5.43-3), Fire Protection Sprinkler System Service and Installation & 28 TAC §§ 34.700 the Fire Sprinkler Rules, current edition.

D. EquipmentListings:
   1. Underwriter's Laboratories Inc. (UL) Fire Protection Equipment Directory, current edition.
   2. FM Global (FM) Fire Protection Approval Guide, current edition.
   3. Other Nationally Recognized Testing Laboratory (NRTL).

E. CodeConflicts:
   1. Any conflicts between the referenced codes and this specification shall be brought to the attention of the FPE for interpretation.

1.05 DESIGN AND INSTALLATION CRITERIA

A. Above Ground Piping – Wet-Pipe Sprinkler System
   1. Branch lines shall be designed to be as typical and symmetrical as possible to reduce the cost of fabrication and facilitate ease of installation.
   2. Piping shall penetrate walls and ceilings so as to minimize the damage to the materials.
   3. System riser drains shall terminate to the exterior of the building. Care shall be taken so as to minimize drain discharge from staining concrete sidewalks and the building exterior..
   4. All wet system piping shall be Schedule 10 or Schedule 40 black steel.
   5. All interior dry system piping shall be Schedule 10 or Schedule 40 black Steel pipe.
   6. All exterior dry system piping shall be Schedule 10 or Schedule 40 galvanized Steel pipe.

B. Hydraulic Calculations
   1. All calculations shall be performed in accordance with the hydraulic calculation procedures per Section 22.4.4, Hydraulic Calculation Procedures of NFPA 13.
   2. All hydraulic calculations shall be based a flow test performed less than one year prior to the date plans are submitted to CoSA.
   3. Dry sprinkler systems shall be hydraulically calculated based on the flow test above.

1.06 SUBMITTALS, PERMITS, AND APPROVALS

All submittals must be reviewed and approved by the project FPE prior to submitting for a permit. Electronic submittals are preferred. Submit the following in accordance with NFPA 13 and this specification:

A. The Submittals shall include the following documentation:
   1. Equipment books – A clearly annotated document that includes complete manufacturer's information on every component proposed to be utilized.
   2. Shop drawings – Shop drawings shall be drawn to an indicated scale on sheets of uniform size with a plan of each floor and shall show those items listed in NFPA 13 Paragraphs 22.1, Working Plans and 22.2, Water Supply that pertain to the design of these systems.
   3. Hydraulic calculations – Hydraulic calculations shall be prepared on form sheets that include a summary sheet, detailed worksheets, and a graph sheet in conformance with NFPA 13 Paragraph 22.3, Hydraulic Calculation Forms.
   4. Final As-Constructed Documents: In addition to any requirements stated in the project's Uniform General / Supplemental General and Additional Conditions, provide at completion of installation a record set of shop drawings, Autocad format, that includes all changes made during the installation and with locations of all drains clearly marked (if applicable). Provide all Autocad drawings in electronic .dwg file format readable by AutoCAD 2010, or latest version used by Owner. Autocad package shall be created using the "eTransmit" utility to include all necessary support files. Additionally, provide pdf's of the complete set, created at full size. Provide these files to the owner within 30 days of Substantial Completion, one electronic copy on CD.
   5. Provide copies of all testing reports to include hydro testing, contractor testing, and third party testing (if applicable).

6. Additionally, provide copies of all overhead inspection reports related to sprinkler installation with date's comments made as well as dates corrected (can be supplied electronicallyor in hard copies).

1.07 QUALITY ASSURANCE

A. Qualifications

1. Work shall be performed by an automatic fire sprinkler contractor holding a current Sprinkler Certificate of Registration (SCR) with the Texas Department of Insurance.
2. Design shall be performed by a Fire Protection Engineer licensed in Texas or under the supervision of a current Responsible Managing Employee-General (RME-G) license with the Texas Department of Insurance.
3. The contractor shall be fully responsible for all designs to meet project requirements, including related items not specifically illustrated or mentioned in the contract documents.

B. Pre-Work Plan

1. Prior to commencement of work, the contractor shall submit to the General Contractor for approval, a Work Plan describing the means and methods which will be utilized to perform all installation services. The plan shall detail the equipment and methods intended to achieve the installation goals.

C. Pre-Installation Conference

1. Prior to installation, the contractor shall arrange a pre-installation conference with the General Contractor and all affected subcontractors to address potential installation issues and conflicts.

1.08 DELIVERY, STORAGE, AND HANDLING

A. AcceptanceAt Site

1. Contractor shall inspect all material upon arrival at the site. Any defective or damaged material shall be immediately removed from site and replaced with properly operating and serviceable equipment.

B. Storage And Protection

1. Contractor shall provide for secure storage on the site at a location approved by the General Contractor.

1.09 SCHEDULING AND SEQUENCING

A. All sequencing and scheduling of installation, inspections, testing, and placing system in full operation shall be coordinated with the General Contractorand FPE. Submit a schedule for completion of all work.

1.010 WARRANTY

A. Contractor shall warrant all new components for a period of one year. Warranties of greater length provided by suppliers shall be passed on to the Owner.

PART 2. PRODUCTS

2.01 SYSTEM COMPONENTS

A. Automatic Sprinklers

1. Sprinklers that utilize rubber/silicon o-ring seal technology are prohibited.
2. Sprinklers shall be FM approved and supplied by a company that regularly manufactures fire sprinklers. Sprinklers shall be matched to the occupancy hazard and other conditions for all protected areas.

B. Control Valve Assembly (FCVA)

1. Provide listed or approved control valve assemblies located as indicated. Each assembly shall consist of the following:
   a. Listed check valve,
   b. Listed indicating control valve with tamper switch,
   c. Listed water flow switch,
   d. Pressure gauges as required by NFPA 13.

C. Fire Department Connection (FDC)

1. Wall mounted Fire Department Connections shall be provided for each system. One 2-1/2" inlet shall be provided for every 250 gpm or fraction of system capacity. FDC caps shall be 2-1/2 plugs with chains. Proper drainage shall be provided to eliminate any potential for freezing.

D. Tamper Switches

1. Sprinkler supervisory switches shall be furnished and installed under this contract. Switches shall have single-pole double-throw (SPDT), normally closed contacts. The entire assembly shall be tamper-proof and shall be contained in a weather-proof housing (connection to fire alarm system made by others).

E. Outside Sprinkler Alarm

1. Shall be an electric bell utilizing line voltage from the buildings. Bell shall be located in the vicinity of the FDC

F. Water Flow Switch

1. Water flow switches shall be vane type and have two sets of SPDT (Form C) contacts rated, and have a 250 psi pressure rating. Connection to fire alarm system made by others.

G. Aboveground Pipe and Fittings

1. Pipe shall be ferrous as allowed by Section 6.3.1 of NFPA 13.
2. Steel pipe shall have a UL corrosion resistance ratio (CRR) of not less than 1.00.
3. Fittings shall be roll-grooved or threaded as listed by the manufacturer.
4. Black steel Schedule 10 or Schedule 40.
5. Galvanized steel Schedule 10 or Schedule 40.
6. Mechanical tee type fittings are prohibited.
7. Pipe 1-inch and smaller shall be threaded.
8. Malleable and cast iron fittings shall be permitted for above ground piping installation.
9. Socket fittings (e.g., Victaulic FIT, etc.) are prohibited.
    a. Chrome split plates shall be installed at all pipe penetrations through the interior walls. Cast iron galvanized plates shall be installed for exterior wall penetrations.

H. Valves

1. All valves shall be listed for their intended purpose and shall comply with Section 6.7 of NFPA 13.
2. OS&Y indicating valves 2 inch and smaller – Brass body, stem and seat. Include tamper switches listed for use with OS&Y valves.
3. Butterfly valves – provide with NEMA 1 enclosure, tamper resistant switch, indicating type.
4. OS&Y indicating valves 2½-inch and larger – Iron body, brass seats, discs and stems, flanged or roll-grooved. Include tamper switches listed for use with OS&Y indicating valves.
5. Indicating type control valves and drain/test valves shall be 175-psi water, oil, or gas (WOG).
6. Check valves shall be approved 175-psi WOG horizontal swing check, wafer check, or other approved type as allowed by referenced standards. Check valves 2½-inch and larger shall be iron body with cast brass hinge, rod and brass faced discs. Check valves 2-inch and smaller shall be brass body and all brass fitted.

I. Signage (Identification)

1. Valves shall be identified in accordance with Paragraph 6.7.4 in NFPA 13.
2. Hydraulic design information for the sprinkler system shall be posted on the main system riser. The signs shall be located in accordance with NFPA 13 Paragraph 24.5 and shall include information as listed therein and shown in NFPA 13 Figure A.24.5.
3. An approved laminated valve chart, framed with plexiglass cover, showing the location and use of each valve, shall be provided. The chart shall be wall-mounted above the fire alarm annunciator panel.
4. Upon acceptance by the AHJ, installation tags shall be affixed to the sprinkler riser in accordance with the Texas Insurance Code, Chapter 6003.

J. Hangers

1. Shall be provided as described by NFPA 13, Chapter 9.

K. Stock Of Spare Sprinklers

1. Provide a supply of spare sprinklers as described in NFPA 13 Paragraph 6.2.9 and subparagraphs, and locate the spare heads in close proximity to the sprinkler riser. Spare heads shall be stored in a sprinkler head box.

PART 3. EXECUTION

3.01 INSTALLATION

A. GENERAL PRACTICE AND PROCEDURES

B. The contractor shall comply with all applicable practices and procedures as required per the referenced codes, standards, and AHJ to ensure the proper installation of a fully operational, compliant system.

C. Prior to commencing any work, the contractor shall inspect all areas where work is to be performed. The contractor shall comply with all appropriate safety guidelines and precautions to accomplish the work without injury to personnel or damage to any building components or contents.

3.02 SYSTEM INSTALLATION

A. Install the new risers and system components as shown on the Contract drawings.

B. The contractor must coordinate all piping locations with the other trades. The plane of installation shall be coordinated with other trades for possible obstructions.

C. The wet and dry pipe automatic sprinkler system shall meet the following installation criteria:

1. The sprinkler system geometry shall meet the criteria as indicated.
2. All exposed piping in finished areas must be coordinated with General Contractorto be aesthetically pleasing to the Owner.
3. Pipe and fittings shall be located as close as possible to the structural elements while adhering to the prescription of NFPA 13 and the manufacturer’s listing for head installation.
4. Route the discharge piping of the main drains to the outside of the building. Care shall be taken to minimize drain discharge from staining the sidewalks and building exterior.
5. Field welding is prohibited for the installation of this system.
6. Piping for the dry system shall be Schedule 10 or Schedule 40 black steel when installed in the conditioned (minimum 40° F at all times) spaces inside the building.
7. Piping for the dry system shall be Schedule 10 or Schedule 40 black steel when installed in the conditioned spaces inside the building.
8. Piping for the dry system shall be Schedule 10 or Schedule 40 galvanized steel when installed outside of the conditioned spaces inside the building.

3.03 PAINTING AND PATCHING

A. Wall or floor penetrations shall be neatly patched. Coordinate materials and method of sealing new openings for sprinkler pipe in partitions and floors.

B. Penetrations through fire rated walls shall be sealed with approved fire resistive materials and/or assemblies. Material and assemblies shall be suitable for the hourly rating of the penetrated construction element.

C. All piping shall be free of rust and debris inside and out.

D. All exposed pipe shall be painted to match the surroundings or the color shall be as otherwise determined by the Owner. The color samples shall be provided by the Owner.

3.04 SYSTEM ACCEPTANCE

A. The contractor shall be completely responsible for the sprinkler systems described in this specification meeting the requirements found in NFPA 13 Chapter 24, *Systems Acceptance*, and as herein described. A digital water pressure gauge shall be used for all hydrostatic testing. Drop in pressure shall not be permitted during the duration of the final test.

B. PROGRESS INSPECTIONS

1. Rough-in: Contractor shall contact the General Contractor and FPE at the rough-in stage to coordinate a progress inspection.

2. Heads Installed: Contractor shall contact the General Contractorand FPE when all sprinkler heads have been installed, but prior to piping cover-up for a second progress inspection.
3. Final Testing: Contractor shall contact the General Contractorand FPE when the system has been fully installed and is ready for final inspection and testing. The Owner shall be notified of all testing and shall observe any and all testing.

C. FINAL INSPECTION AND TESTING

1. Contractor shall be responsible for coordinating final inspection and testing with the AHJ. The FPE shall be notified in writing seven (7) days prior to all test dates, including hydrostatic tests. As-built drawings, testing and inspection certificates shall be furnished prior to or during this event.

D. CLOSE OUT DOCUMENTATION

1. The owner shall be provided the following documents:
   a. Three (3) complete sets of as-built drawings; one (1) set shall be on a reproducible medium.
   b. AutoCAD based drawings on Windows formatted CD-ROM.
   c. Two (2) complete operation and maintenance manuals. The data shall include all literature and instructions provided by the manufacturers describing proper operation and maintenance of any equipment and devices installed.
   d. Original test certificates and approval documents issued by the AHJ.
   e. One copy of NFPA 25.

END OF SECTION

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SECTION 22 02 00
BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all Work herein.

B. The Contract Drawings indicate the extent and general arrangement of the systems. If any departure from the Contract Drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore, shall be submitted to the Architect for approval as soon as practicable. No such departures shall be made without the prior written approval of the Architect.

C. Notwithstanding any reference in the Specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number, such reference shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgment of the Architect, expressed in writing, is equal to that specified.

D. The Building Systems Commissioning for this project shall be by an independent agency employed by the owner. There are requirements of Div 1 that shall apply to work in Division 1 & 22. Division 1 & 22 contractors shall review Division 1 so that the proper planning can be applied relative to the interactive requirements in completing the Building Systems Commissioning of this project.

1.02 SCOPE OF WORK

A. The Work included under this Contract consists of the furnishing and installation of all equipment and material necessary and required to form the complete and functioning systems in all of its various phases, all as shown on the accompanying Drawings and/or described in these Specifications. The contractor shall review all pertinent drawings, including those of other contracts prior to commencement of Work.

B. This Division requires the furnishing and installing of all items Specified herein, indicated on the Drawings or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, transportation, storage, equipment, utilities, all required permits, licenses and inspections. All work performed under this Section shall be in accordance with the Project Manual, Drawings and Specifications and is subject to the terms and conditions of the Contract.

C. The approximate locations of Plumbing items are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of outlets, apparatus, etc. Exact locations are to be determined by actual measurements at the building, and will in all cases be subject to the Review of the Owner or Engineer, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

D. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

E. All discrepancies between the Contract Documents and actual job-site conditions shall be reported to the Owner or Engineer so that they will be resolved prior to the bidding, where this cannot be done at least 7 working days prior to bid; the greater or more costly of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

F. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and fully operating system in cooperation with other trades.

G. It is the intent of the above "Scope" to give the Contractor a general outline of the extent of the Work involved; however, it is not intended to include each and every item required for the Work. Anything omitted from the "Scope" but shown on the Drawings, or specified later, or necessary for a complete and functioning heating, ventilating and air conditioning system shall be considered a part of the overall "Scope".

H. The Contractor shall rough-in fixtures and equipment furnished by others from rough-in and placement drawings furnished by others. The Contractor shall make final connection to fixtures and equipment furnished by others.

I. The Contractor shall participate in the commissioning process as required. Including, but not limited to meeting attendance, completion of checklists and participation in functional testing.

1.03 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

A. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the approved shop drawings.

B. All piping or equipment locations as indicated on the documents do not indicate every transition, offset, or exact location. All transitions, offsets clearances and exact locations shall be established by actual field measurements, coordination with the structural, architectural and reflected ceiling plans, and other trades. Submit shop drawings for approval.

C. All transitions, offsets and relocations as required by actual field conditions shall be performed by the contractor at no additional cost to the owner.

D. Additional coordination with electrical contractor may be required to allow adequate clearances of electrical equipment, fixtures and associated appurtenances. Contractor to notify Architect and Engineer of unresolved clearances, conflicts or equipment locations.

1.04 SITE VISIT AND FAMILIARIZATION

A. Before submitting a bid, it will be necessary for each Contractor whose work is involved to visit the site and ascertain for himself the conditions to be met therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.

B. Understand the existing utilities from which services will be supplied; verify locations of utility services, and determine requirements for connections.

C. Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.05 WORK SPECIFIED IN OTHER SECTIONS

A. Finish painting is specified. Prime and protective painting are included in the work of this Division.

B. Owner and General Contractor furnished equipment shall be properly connected to Plumbing systems.

C. Furnishing and installing all required Plumbing equipment control relays and electrical interlock devices, conduit, wire and J-boxes are included in the Work of this Division.

1.06 PERMITS, TESTS, INSPECTIONS

A. Arrange and pay for all permits, fees, tests, and all inspections as required by governmental authorities.

1.07 DATE OF FINAL ACCEPTANCE

A. The date of final acceptance shall be the date of owner occupancy, or the date all punch list items have been completed or final payment has been received. Refer to Division 01 for additional requirements.

B. The date of final acceptance shall be documented in writing and signed by the architect, owner and contractor.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Deliver products to the project at such time as the project is ready to receive the equipment, pipe or valves properly protected from incidental damage and weather damage.

C. Damaged equipment, valves or pipe shall be promptly removed from the site and new, undamaged equipment, pipe and valves shall be installed in its place promptly with no additional charge to the Owner.

1.09 NOISE AND VIBRATION

A. The pumping systems and the component parts thereof, shall be guaranteed to operate without objectionable noise and vibration.

B. Provide foundations, supports and isolators as specified or indicated, properly adjusted to prevent transmission of vibration to the Building structure, piping and other items.

C. Carefully fabricate pipe and fittings with smooth interior finish to prevent turbulence and generation or regeneration of noise.

D. All equipment shall be selected to operate with minimum of noise and vibration. If, in the opinion of the Architect, objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping or other parts of the Work, the Contractor shall rectify such conditions without extra cost to the Owner.

1.10 APPLICABLE CODES

A. Obtain all required permits and inspections for all work required by the Contract Documents and pay all required fees in connection thereof.

B. Arrange with the serving utility companies for the connection of all required utilities and pay all charges, meter charges, connection fees and inspection fees, if required.

C. Comply with all applicable codes, specifications, local ordinances, industry standards, utility company regulations and the applicable requirements of the following nationally accepted codes and standards:

1. American Society of Plumbing Engineers, ASPE.
2. American Standards Association, ASA.
3. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., ASHRAE.
4. American Society of Mechanical Engineers, ASME.
5. American Society of Plumbing Engineers, ASPE.
6. American Society of Testing Materials, ASTM.
7. American Water Works Association, AWWA.
8. National Fire Protection Association, NFPA.
9. Underwriters' Laboratories, Inc., UL.
10. International Energy Conservation Code, IECC.

D. Where differences existing between the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards, the more stringent or costly application shall govern. Promptly notify the Engineer in writing of all differences.

E. When directed in writing by the Engineer, remove all work installed that does not comply with the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards, correct the deficiencies, and complete the work at no additional cost to the Owner.

1.11 DEFINITIONS AND SYMBOLS

A. General Explanation: A substantial amount of construction and Specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic and schematic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article, unless defined otherwise in Division 01.

B. Definitions and explanations of this Section are not necessarily either complete or exclusive, but are general for work to the extent not stated more explicitly in another provision of the Contract Documents.

C. Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications and to similar means of recording requirements in Contract Documents. Where such terms as "Shown", "Noted", "Scheduled", "Specified" and" Detailed" are used in lieu of "Indicated", it is for the purpose of helping the reader locate cross-reference material, and no limitation of location is intended except as specifically shown.

D. Directed: Where not otherwise explained, terms such as "Directed", "Requested", "Accepted", and "Permitted" mean by the Architect or Engineer. However, no such implied meaning will be interpreted to extend the Architect's or Engineer's responsibility into the Contractor's area of construction supervision.

E. Reviewed: Where used in conjunction with the Engineer's response to submittals, requests for information, applications, inquiries, reports and claims by the Contractor the meaning of the term "Reviewed" will be held to limitations of Architect's and Engineer's responsibilities and duties as specified in the General and Supplemental Conditions. In no case will "Reviewed" by Engineer be interpreted as a release of the Contractor from responsibility to fulfill the terms and requirements of the Contract Documents.

F. Furnish: Except as otherwise defined in greater detail, the term "Furnish" is used to mean supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

G. Install: Except as otherwise defined in greater detail, the term "Install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.

H. Provide: Except as otherwise defined in greater detail, the term "Provide" is used to mean "Furnish and Install", complete and ready for intended use, as applicable in each instance.

I. Installer: Entity (person or firm) engaged by the Contractor or its subcontractor or Sub-contractor for performance of a particular unit of work at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.

J. Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading

at certain locations, contrasting subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or when so noted by other identified installers or entities.

K. Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended as minimum quality level or quantity of work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable tolerance limits. In complying with requirements, indicated or scheduled numeric values are either minimums or maximums as noted or as appropriate for the context of the requirements. Refer instances of uncertainty to Owner or Engineer via a request for information (RFI) for decision before proceeding.

L. Abbreviations and Symbols: The language of Specifications and other Contract Documents including Drawings is of an abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in text of Specifications and Drawings. Specific abbreviations and symbols have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of Specification requirements with notations on Drawings and in Schedules. These are frequently defined in Section at first instance of use or on a Legend and Symbol Drawing. Trade and industry association names and titles of generally recognized industry standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicate. Except as otherwise indicated, graphic symbols and abbreviations used on Drawings and in Specifications are those recognized in construction industry for indicated purposes. Where not otherwise noted symbols and abbreviations are defined by ASME and ASPE published standards.

1.12 DRAWINGS AND SPECIFICATIONS

A. These Specifications are intended to supplement the Drawings and it will not be the province of the Specifications to mention any part of the work which the Drawings are competent to fully explain in every particular and such omission is not to relieve the Contractor from carrying out portions indicated on the Drawings only.

B. Should items be required by these Specifications and not indicated on the Drawings, they are to be supplied even if of such nature that they could have been indicated thereon. In case of disagreement between Drawings and Specifications, or within either Drawings or Specifications, the better quality or greater quantity of work shall be estimated and the matter referred to the Architect or Engineer for review with a request for information and clarification at least 7 working days prior to bid opening date for issuance of an addendum.

C. The listing of product manufacturers, materials and methods in the various sections of the Specifications, and indicated on the Drawings, is intended to establish a standard of quality only. It is not the intention of the Owner or Engineer to discriminate against any product, material or method that is equal to the standards as indicated and/or specified, nor is it intended to preclude open, competitive bidding. The fact that a specific manufacturer is listed as an acceptable manufacturer should not be interpreted to mean that the manufacturers' standard product will meet the requirements of the project design, Drawings, Specifications and space constraints.

D. The Architect or Engineer and Owner shall be the sole judge of quality and equivalence of equipment, materials and methods.

E. Products by other reliable manufacturers, other materials, and other methods, will be accepted as outlined, provided they have equal capacity, construction, and performance. However, under no circumstances shall any substitution by made without the written permission of the Architect or Engineer and Owner. Request for prior approval must be made in writing 10 days prior to the bid date without fail.

F. Wherever a definite product, material or method is specified and there is not a statement that another product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method is the only one that shall be used without prior approval.

G. Wherever a definite material or manufacturer's product is specified and the Specification states that products of similar design and equal construction from the specified list of manufacturers may be substituted, it is the intention of the Owner or Engineer that products of manufacturers that are specified are the only products that will be acceptable and that products of other manufacturers will not be considered for substitution without approval.

H. Wherever a definite product, material or method is specified and there is a statement that "OR EQUAL" product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method or an "OR EQUAL" product, material or method may be used if it complies with the specifications and is submitted for review to the Engineer as outline herein.

I. Where permission to use substituted or alternative equipment on the project is granted by the Owner or Engineer in writing, it shall be the responsibility of the Contractor or Subcontractor involved to verify that the equipment will fit in the space available which includes allowances for all required Code and maintenance clearances, and to coordinate all equipment structural support, plumbing and electrical requirements and provisions with the Plumbing Design Documents and all other trades, including Divisions 23 and 26.

J. Changes in architectural, structural, electrical, mechanical, and plumbing requirements for the substitution shall be the responsibility of the bidder wishing to make the substitution. This shall include the cost of redesign by the affected designer(s).Any additional cost incurred by affected subcontractors shall be the responsibility of this bidder and not the owner.

K. If any request for a substitution of product, material or method is rejected, the Contractor will automatically be required to furnish the product, material or method named in the Specifications. Repetitive requests for substitutions will not be considered.

L. The Owner or Engineer will investigate all requests for substitutions when submitted in accordance with above and if accepted, will issue a letter allowing the substitutions.

M. Where equipment other than that used in the design as specified or shown on the Drawings is substituted (either from an approved manufacturers list or by submittal review), it shall be the responsibility of the substituting Contractor to coordinate space requirements, building provisions and connection requirements with his trades and all other trades and pay all additional costs to other trades, the Owner, the Architect or Engineer, if any, due to the substitutions.

1.13 SUBMITTALS

A. Coordinate with Division 01 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded the Contractor shall submit a minimum of eight (8) complete bound sets of shop drawings and complete data covering each item of equipment or material. The first submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive shop drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain one (1) copy each of all shop drawings for their files. Where full size drawings are involved, submit one (1) print and one (1) digital file in lieu of eight (8) sets. All literature pertaining to an item subject to Shop Drawing submittal shall be submitted at one time. A submittal shall not contain information from more than one Specification section, but may have a section subdivided into items or equipment as listed in each section. The Contractor may elect to submit each item or type of equipment separately. Each submittal shall include the following items enclosed in a suitable binder:

1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.
2. An index page with a listing of all data included in the Submittal.
3. A list of variations page with a listing all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then this page shall state "NO VARIATIONS”. Where variations affect the work of other Contractors, then the Contractor

shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.

4. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.
5. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.
6. Identification of each item of material or equipment matching that indicated on the Drawings.
7. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.
8. Additional information as required in other Sections of this Division.
9. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "REVISE AND RESUBMIT".

B. Refer to Division 01 for additional information on shop drawings and submittals.

C. Equipment and materials submittals and shop drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of shop drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.

D. Where shop drawings and submittals are marked "REVIEWED", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.

E. Shop drawings shall be reviewed and returned to the Contractor with one of the following categories indicated:

1. REVIEWED: Contractor need take no further submittal action, shall include this submittal in the OM manual and may order the equipment submitted on.
2. REVIEWED AS NOTED: Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the O&M manual. The contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted.
3. NOT APPROVED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is not approved, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.
4. REVISE AND RESUBMIT: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous shop drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.
5. CONTRACTOR’S CERTIFICATION REQUIRED: Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor’s stamp is required stating the submittal meets all conditions of the contract documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all shop drawings.
6. MANUFACTURER NOT AS SPECIFIED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked

manufacturer not as specified, the Contractor will automatically be required to furnish the product, material or method named in the specifications. Contractor shall not order equipment where submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.

F. Materials and equipment which are purchased or installed without shop drawing review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.

G. Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.

H. Submittals are required for, but not limited to, the following items:

1. Basic Materials.
2. Plumbing Fixture and Valves.
3. Support and Carriers.
4. Floor Drain and Cleanouts.
5. Water Heaters
6. Backflow Preventers.
7. Plumbing Piping.
8. Noise and Vibration Controls.
9. Pipe Hanger and Equipment Supports.
10. Plumbing Specialties.
11. Water Filters.
12. Test, Adjust and Balance Reports.
13. Testing, Adjusting and Balancing Contractor Qualifications.
14. Coordination Drawings.

I. Provide samples of actual materials and/or equipment to be used on the Project upon request of the Owner or Engineer.

1.14 COORDINATION DRAWINGS

A. Prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of pipe, equipment, and other materials. Include the following:
   a. Wall and type locations.
   b. Clearances for installing and maintaining insulation.
   c. Locations of light fixtures and sprinkler heads.
   d. Clearances for servicing and maintaining equipment, including tube removal and space for equipment disassembly required for periodic maintenance.
   e. Equipment connections and support details.
   f. Exterior wall and foundation penetrations.
   g. Routing of storm, sanitary sewer piping and plumbing piping.
   h. Fire-rated wall and floor penetrations.
   i. Sizes and location of required concrete pads and bases.
   j. Valve stems movement.
   k. Structural floor, wall and roof opening sizes and details.
2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

B. This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

C. By submitting shop drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

1.15 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Special Project Requirements, in addition to the requirements specified in Division 23, indicate the following installed conditions:

1. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, tanks, etc.).Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping.
2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
4. Contract Modifications, actual equipment and materials installed.

B. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified herein to record the locations and invert elevations of underground installations.

C. The Contractor shall maintain a set of clearly marked black line record "AS-BUILT" prints on the job site on which he shall mark all work details, alterations to meet site conditions and changes made by "Change Order" notices. These shall be kept available for inspection by the Owner, Architect or Engineer at all times.

D. Refer to Division 01 for additional requirements concerning record drawings. If the Contractor does not keep an accurate set of as-built drawings, the pay request may be altered or delayed at the request of the Architect. Mark the drawings with a colored pencil. Delivery of as-built prints and reproducibles is a condition of final acceptance.

E. The record prints shall be updated on a daily basis and shall indicate accurate dimensions for all buried or concealed work, precise locations of all concealed pipe or duct, locations of all concealed valves, controls and devices and any deviations from the work shown on the Construction Documents which are required for coordination. All dimensions shall include at least two dimensions to permanent structure points.

F. Submit three prints of the tracings for approval. Make corrections to tracings as directed and delivered "Auto Positive Tracings" to the architect. “As-Built" drawings shall be furnished in addition to shop drawings.

G. When the option described in paragraph F., above is not exercised then upon completion of the work, the Contractor shall transfer all marks from the submit a set of clear concise set of reproducible record "AS-BUILT" drawings and shall submit the reproducible drawings with corrections made by a competent draftsman and three (3) sets of black line prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The reproducible record "AS-BUILT" drawings shall have the Engineers Name and Seal removed or blanked out and shall be clearly marked and signed on each sheet as follows:

CERTIFIED RECORD DRAWINGS

DATE:

(NAME OF GENERAL CONTRACTOR)

BY:_____
(SIGNATURE)

(NAME OF SUBCONTRACTOR)

BY:_____
(SIGNATURE)

1.16 OPERATING MANUALS

A. Prepare maintenance manuals in accordance with Division 01 and in addition to the requirements specified in Division 01, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

1.17 CERTIFICATIONS AND TEST REPORTS

A. Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and schedule date for each test. This detailed completion and test schedule shall be submittal at least 90 days before the projected Project completion date.

B. Test result reporting forms shall be submitted for review no later than the date of the detailed schedule submitted.

C. Submit 4 copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

D. Certifications and test reports to be submitted shall include, but not be limited to those items outlined in Section of Division 22.

1.18 MAINTENANCE MANUALS

A. Coordinate with Division 01 for maintenance manual requirements, unless noted otherwise bind together in “D ring type” binders by National model no. 79-883 or equal, binders shall be large enough to allow ¼” of spare capacity. Three (3) sets of all approved shop drawing submittals, fabrication drawings, bulletins, maintenance instructions, operating instructions and parts exploded views and lists for each and every piece of equipment furnished under this Specification. All sections shall be typed and indexed into sections and labeled for easy reference and shall utilize the individual specification section numbers shown in the Plumbing Specifications as an organization guideline. Bulletins containing information about equipment that is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 22 shall be clearly and legibly set forth in memoranda that shall, likewise, be bound with bulletins.

B. Prepare maintenance manuals in accordance with Special Project Conditions, in addition to the requirements specified in Division 22, include the following information for equipment items:

1. Identifying names, name tags designations and locations for all equipment.
2. Valve tag lists with valve number, type, color coding, location and function.
3. Reviewed shop drawing submittals with exceptions noted compliance letter.
4. Fabrication drawings.
5. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable, i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts.
6. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
7. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions, servicing instructions and lubrication charts and schedules.
8. Equipment and motor name plate data.
9. Wiring diagrams.
10. Exploded parts views and parts lists for all equipment and devices.
11. Color coding charts for all painted equipment and conduit.
12. Location and listing of all spare parts and special keys and tools furnished to the Owner.
13. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.

C. Refer to Division 1 for additional information on Operating and Maintenance Manuals.

D. Operating and Maintenance Manuals shall be turned over to the Owner or Engineer a minimum of 14 working days prior to the beginning of the operator training period.

1.19 OPERATOR TRAINING

A. The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include 12 hours of onsite training in three 4 hour shifts.

B. Before proceeding with the instruction of Owner Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

C. Refer to other Division 22 Sections for additional Operator Training requirements.

1.20 FINAL COMPLETION

A. At the completion of the work, all equipment and systems shall be tested and faulty equipment and material shall be repaired or replaced. Refer to Sections of Division 26 for additional requirements.

B. Clean and adjust all valves and operational devices and replace faulty parts immediately prior to final acceptance.

C. Touch up and/or refinish all scratched equipment and devices immediately prior to final acceptance.

1.21 CONTRACTOR'S GUARANTEE

A. Use of the Plumbing systems to provide temporary service during construction period will not be allowed without permission from the Owner in writing and if granted shall not be cause warranty period to start, except as defined below.

B. Contractor shall guarantee to keep the entire installation in repair and perfect working order for a period of two years after its completion and final acceptance, and shall furnish free of additional

cost to the Owner all materials and labor necessary to comply with the above guarantee throughout the years beginning from the date of issue of Substantial Completion, Beneficial Occupancy by the Owner or the Certificate of Final Payment as agreed upon by all parties.

C. This guarantee shall not include cleaning or changing equipment except as required by testing, adjusting and balancing.

D. All air compressors shall have parts and labor guarantees for a period of not less than 5 years beyond the date of final acceptance.

E. Refer to Sections in Division 22 for additional guarantee or warranty requirements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide materials and equipment manufactured by a domestic United States manufacturer.

B. Access Doors: Provide access doors as required for access to equipment, valves, controls, cleanouts and other apparatus where concealed. Access doors shall have concealed hinges and screw driver cam locks.

C. All access panels located in wet areas such as restrooms, locker rooms, shower rooms, kitchen and any other wet areas shall be constructed of stainless steel.

D. Access Doors: shall be as follows:

1. Plastic Surfaces: Milcor Style K.
2. Ceramic Tile Surface: Milcor Style M.
3. Drywall Surfaces: Milcor Style DW.
4. Install panels only in locations approved by the Architect.

PART 3 - EXECUTION

3.01 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected via reviewed submittals.

B. Refer to equipment specifications in Division 22 for additional rough-in requirements.

3.02 PLUMBING INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of plumbing and fire systems, materials, and equipment. Comply with the following requirements:

1. Coordinate plumbing systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for plumbing installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of plumbing materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Coordinate connection of plumbing systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

8. Install systems, materials, and equipment to conform with architectural action markings on submittal, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, resolve conflicts and route proposed solution to the Architect for review.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location and label.
11. Install access panel or doors where valves and equipment are concealed behind finished surfaces. Access panels and doors are specified.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
13. Provide roof curbs for all roof mounted equipment. Coordinate with roof construction for pitched roof. Provide roof curb to match roof slope. Refer to architectural drawings and details.
14. The equipment to be furnished under this Specification shall be essentially the standard product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer; however, the component parts of the system need not be the product of the same manufacturer.
15. The architectural and structural features of the building and the space limitations shall be considered in selection of all equipment. No equipment shall be furnished which will not suit the arrangement and space limitations indicated.
16. Lubrication: Prior to start-up, check and properly lubricate all bearings as recommended by the manufacturer.
17. Where the word "Concealed" is used in these Specifications in connection with insulating, painting, piping, ducts, etc., it shall be understood to mean hidden from sight as in chases, furred spaces or suspended ceilings. “Exposed" shall be understood to mean the opposite of concealed.
18. Identification of Plumbing Equipment:
    a. Plumbing equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal. Shop drawings shall include dimensions and lettering format for approval. Attachments shall be with escutcheon pins, self-tapping screws, or machine screws.
    b. Tags shall be attached to all valves, including control valves, with nonferrous chain. Tags shall be brass and at least 1-1/2 inches in diameter. Nameplate and tag symbols shall correspond to the identification symbols on the temperature control submittal and the "as-built" drawings.

3.03 CUTTING AND PATCHING

A. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, fitting, and patching of plumbing equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed Work.
2. Remove and replace defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing.
5. Install equipment and materials in existing structures.
6. Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer/Owner's observation of concealed Work, without additional cost to the Owner.
7. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers; refer to the materials and methods required for the surface and building components being patched; Refer to Section "DEFINITIONS" for definition of "Installer."

C. Cut, remove and legally dispose of selected plumbing equipment, components, and materials as indicated, including but not limited to removal of plumbing piping, equipment, plumbing fixtures and trim, and other plumbing items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.04 WORK SEQUENCE, TIMING, COORDINATION WITH OWNER

A. The Owner will cooperate with the Contractor, however, the following provisions must be observed:
1. A meeting will be held at the project site, prior to any construction, between the Owner's Representative, the General Contractor, the Sub-Contractors and the Engineer to discuss Contractor's employee parking space, access, storage of equipment or materials, and use of the Owner's facilities or utilities. The Owner's decisions regarding such matters shall be final.
2. During the construction of this project, normal facility activities will continue in existing buildings until renovated areas are completed. Plumbing, fire protection, lighting, electrical, communications, heating, air conditioning, and ventilation systems will have to be maintained in service within the occupied spaces of the existing building.

END OF SECTION

SECTION 22 05 16
EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Flexible pipe connections.

B. Expansion joints and compensators

C. Pipe loops, offsets, and swing joints.

1.02 RELATED WORK

A. Section 22 05 29–Hangers and Support for Plumbing Piping and Equipment.

B. Section 22 10 00 – Plumbing Piping.

1.03 PERFORMANCE REQUIREMENTS

A. Provide structural work and equipment required to control expansion and contraction of piping.Verify that anchors, guides, and expansion joints provided, adequately protect system.

B. Expansion Calculations:

1. Installation Temperature: 50 degrees F (10 degrees C).
2. Hot Water Heating: 210 degrees F (99 degrees C).
3. Domestic Hot Water: 140 degrees F (60 degrees C).
4. Safety Factor: 30 percent.

C. Pipe sizes indicated are to establish a minimum quality of compensator.Refer to manufacturers' literature for model series for different pipe sizes.

1.04 SUBMITTALS

A. Submit shop drawings under provisions of Division One.

B. Product Data:

1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot (meter) and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

C. Design Data: Indicate selection calculations.

D. Manufacturer's Installation Instructions: Indicate special procedures, and external controls.

1.05 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division One.

B. Record actual locations of flexible pipe connectors, expansion joints, anchor, and guides.

1.06 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Maintenance Data: Include adjustment instructions.

1.07 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

B. Design expansion compensation system under direct supervision of a Professional Engineer experienced in design of this work and licensed in the state where the project is located.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, project and handle products to site under provisions of Division One.

B. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact.Inspect for damage.

C. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.09 WARRANTY

A. Provide five year warranty under provisions of Division One.

B. Warranty: Include coverage for leak free performance of packed expansion joints.

1.10 EXTRA MATERIALS

A. Furnish under provisions of Division One.

PART 2 - PRODUCTS

2.01 FLEXIBLE PIPE CONNECTORS

A. Steel Piping (Based on 2" Pipe):

1. Manufacturers:
   a. Amber/Booth Metal-Flex, Model Type SS-PM or FW
   b. Triplex, Model Flexonics Series 400M
   c. Mercer Rubber Company, Model BSS-EM (Mason Industries)
2. Inner Hose: Type 321, stainless steel, corrugated metal.
3. Exterior Sleeve: Type 321, single braided stainless steel.
4. Pressure Rating: 350 psig WOG and 70 degrees F.For 4 inch pipe - 200 psig WOG and 70 degrees F.
5. Joint: Schedule 40 steel, threaded with male nipple and hex boss each end and Union.Flanged joints for pipe sizes 2½ inch and larger.
6. Size: Use pipe sized units.
7. Maximum offset: 1/2 inch on each side of installed center line.
8. Application: Air handling units cooling and heating coils.

B. Copper Piping (Based on 2" Pipe):

1. Manufacturers:
   a. Amber/Booth Metal-Flex, Model Type BR-SM
   b. Triplex, Model Flexonics Series 300
   c. Mercer Rubber Company, Type BFF (Mason Industries)
2. Inner Hose:Corrugated Bronze
3. Exterior Sleeve: Braided bronze.
4. Pressure Rating: 250 psig WOG and 70 degrees F.
5. Joint: Threaded with male nipple and hex boss each end with Union.Flanged joints for pipe sizes 2½ inch and larger.
6. Size: Use pipe sized units.
7. Maximum offset: 1/2 inch on each side of installed center line.
8. Application: Air handling units cooling and heating coils.

2.02 EXPANSION JOINTS

A. Bellows Type (Based on 4" Pipe):

1. Manufacturers:
   a. Amber/Booth, Style EB
   b. Triplex, Model Resistoflex R6905
   c. Mercer Rubber Company, Style 803 or 805 (Mason Industries)
2. Body: Monel wire reinforced molded TFE teflon bellows, multiple arch.
3. Pressure Rating: 70 psig WSP and 250 degrees F (66 degrees C).
4. Maximum Compression: 1 inch.
5. Maximum Extension: 1 inch.
6. Maximum Offset: 1/2 inch.
7. Joint: ASA standard ductile iron flanges, integral molded gasket.
8. Size: Use pipe sized units.
9. Accessories: Control rod limit bolts.
10. Application: Steel piping 8 inch and under.

2.03 ACCESSORIES

A. Pipe Alignment Guides to Direct Axial Movement:

1. Manufacturers:
   a. Triplex, Model Flexonics
   b. Metraflex, Style II
2. Two piece welded steel with shop paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inch travel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Construct spool pieces to exact size of flexible connection for future insertion.

C. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation.Provided line size flexible connectors.

D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end.Install in horizontal plane unless indicated otherwise.

E. Provide miscellaneous metals to rigidly anchor pipe to building structure.Provide pipe guides so that movement takes place along axis of pipe only.Erect piping such that strain and weight is not on cast connections or apparatus.

F. Provide support and equipment required to control expansion and contraction of piping.Provide loops, pipe offsets, and swing joints, or expansion joints where required.

3.2 MANUFACTURER'S FIELD SERVICES

A. Prepare and start systems under provisions of Division One.

B. Provide inspection services by flexible pipe manufacturer's representative for final installing and certify installation is in accordance with manufacturer's recommendations and connectors are performing satisfactorily.

END OF SECTION

SECTION 22 05 29
HANGERS AND SUPPORT FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Pipe, and equipment hangers, supports, and associated anchors.

B. Sleeves and seals.

C. Flashing and sealing equipment and pipe stacks.

1.02 RELATED WORK

A. Section 22 05 29-Hangers and Support for Plumbing Piping and Equipment.

B. Section 22 07 19-Plumbing Piping Insulation.

C. Section 22 07 16-Plumbing Equipment Insulation.

D. Section 22 30 00 - Plumbing Equipment.

1.03 REFERENCES

A. ANSI/ASME B31.1 - Power Piping.

1.04 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Indicate hanger and support framing and attachment methods.

PART 2 - PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch Malleable iron, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 2 to 4 Inches Carbon steel, adjustable, clevis.

C. Hangers for Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger.

D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods; cast iron roll and stand for pipe sizes 6 inches and over.

E. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

F. Wall Support for Pipe Sizes 4 Inches and Over: adjustable steel yoke and cast iron roll.

G. Vertical Support: Steel riser clamp.

H. Floor Support for Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

I. Floor Support for Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.

J. Copper Pipe Support and Hangers: Electro-galvanized with thermoplastic elastomer cushions; Unistrut “Cush-A-Clamp” or equal.Hangers: Plastic coated; Unistrut or equal.

K. For installation of protective shields refer to specification section 22 07 19 -3.03.

L. Shields for Vertical Copper Pipe Risers: Sheet lead.

M. Pipe Rough-In Supports in Walls/Chases: Provide preformed plastic pipe supports, Sioux Chief “Pipe Titan” hold rite or equal.

2.02 HANGER RODS

A. Galvanized Hanger Rods: Threaded both ends, threaded one end, or continuous threaded.

2.03 INSERTS

A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.04 FLASHING

A. Metal Flashing: 20 gage galvanized steel.

B. Lead Flashing: 4 lb./sq. ft. sheet lead for waterproofing; 1 lb./sq. ft. sheet lead for soundproofing.

C. Caps: Steel, 20 gage minimum; 16 gage at fire resistant elements.

D. Coordinate with roofing contractor/architect for type of flashing on metal roofs.

2.05 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: Form with 18 gage galvanized steel, tack welded to form a uniform sleeve.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Form with steel pipe, schedule 40.

C. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fireproofing: Prefabricated fire rated steel sleeves including seals, UL listed.

D. Fire Stopping Insulation: Glass fiber type, non-combustible, U.L. listed.

E. Caulk: Paintable 25-year acrylic sealant.

2.06 FABRICATION

A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

B. Design hangers without disengagement of supported pipe.

2.07 FINISH

A. Prime coat exposed steel hangers and supports. Hangers and supports located above suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.01 INSERTS

A. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams. Coordinate with structural engineer for placement of inserts.

B. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

C. Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.

D. Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab. Verify with structural engineer prior to start of work.

3.02 PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as follows:

PIPE SIZE	MAX. HANGER SPACING	HANGER DIAMETER
(Steel Pipe)		
1/2 to 1-1/4 inch	7'-0"	3/8"
1-1/2 to 3 inch	10'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"
(Copper Pipe)		
1/2 to 1-1/4 inch	5'-0"	3/8"
1-1/2 to 2-1/2 inch	8'-0"	3/8"
3 to 4 inch	10'-0"	3/8"
6 to 8 inch	10'-0"	1/2"
(Cast Iron)		
2 to 3 inch	5'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"
(PVC Pipe)		
1-1/2 to 4 inch	4'-0"	3/8"
6 to 8 inch	4'-0"	1/2"
10 and over	4'-0"	5/8"

B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

C. Place a hanger within 12 inches of each horizontal elbow and at the vertical horizontal transition.

D. Use hangers with 1-1/2 inch minimum vertical adjustment.

E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

H. Support riser piping independently of connected horizontal piping.

I. Install hangers with nut at base and above hanger; tighten upper nut to hanger after final installation adjustments.

3.03 Insulated Piping: Comply with the following installation requirements.

A. Clamps: Attach galvanized clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.

B. Saddles: Install galvanized protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.

C. Shields: Install protective shields MSS Type 40 on cold and chilled water piping that has vapor barrier. Shields shall span an arc of 180 degrees and shall have dimensions in inches not less than the following:

NPS	LENGTH	THICKNESS
1/4 THROUGH 3-1/2	12	0.048
4	12	0.060
5 & 6	18	0.060
8 THROUGH 14	24	0.075
16 THROUGH 24	24	0.105

D. Piping 2” and larger provide galvanized sheet metal shields with calcium silicate at hangers/supports.

E. Insert material shall be at least as long as the protective shield.

F. Thermal Hanger Shields: Install where indicated, with insulation of same thickness as piping.

3.04 EQUIPMENT BASES AND SUPPORTS

A. Provide equipment bases of concrete.

B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct support of steel members. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.05 FLASHING

A. Provide flexible flashing and metal counter flashing where piping penetrate weather or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes projecting 8 inches minimum above finished roof surface with lead worked one inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter flash and seal.

C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.

D. Seal floor shower mop sink and all other drains watertight to adjacent materials.

3.06 SLEEVES

A. Set sleeves in position in formwork. Provide reinforcing around sleeves.

B. Extend sleeves through floors minimum one inch above finished floor level. Caulk sleeves full depth with fire rated thermfiber and 3M caulking and provide floor plate.

C. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with U.L. listed fire stopping insulation and caulk seal air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

END OF SECTION

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

1.03 Refer to Architectural Sections for additional requirements.

PART 2 - PRODUCTS

2.01 VALVE AND PIPE IDENTIFICATION

A. Valves:

1. All valves shall be identified with a 1-1/2" diameter brass disc wired onto the handle. The disc shall be stamped with 1/2" high depressed black filled identifying numbers. These numbers shall be numerically sequenced for all valves on the job.
2. The number and description indicating make, size, model number and service of each valve shall be listed in proper operational sequence, properly typewritten. Three copies to be turned over to Owner at completion.
3. Tags shall be fastened with approved meter seal and 4 ply 0.018 smooth copper wire. Tags and fastenings shall be manufactured by the Seton Name Plate Company or approved equal.
4. All valves shall be numbered serially with all valves of any one system and/or trade grouped together.

B. Pipe Marking:

1. All interior visible piping located in accessible spaces such as above accessible ceilings, equipment rooms, attic space, under floor spaces, etc., shall be identified with all temperature pipe markers as manufactured by W.H. Brady Company, 431 West Rock Ave., New Haven, Connecticut, or approved equal.
2. All exterior visible piping shall be identified with UV and acid resistant outdoor grade acrylic plastic markers as manufactured by Set Mark distributed by Seton nameplate company. Factory location 20 Thompson Road, Branford, Connecticut, or approved equal.
3. Generally, markers shall be located on each side of each partition, on each side of each tee, on each side of each valve and/or valve group, on each side of each piece of equipment, and, for straight runs, at equally spaced intervals not to exceed 75 feet. In congested area, marks shall be placed on each pipe at the points where it enters and leaves the area and at the point of connection of each piece of equipment and automatic control valve. All markers shall have directional arrows.
4. Markers shall be installed after final painting of all piping and equipment and in such a manner that they are visible from the normal maintenance position. Manufacturer's installation instructions shall be closely followed.

5. Markers shall be colored as indicated below per ANSI/OSHA Standards:

SYSTEM	COLOR	LEGEND
Sanitary Sewer	Green	Vent Sanitary Sewer
Storm Drain	Green	Storm Drain
Domestic Water	Green	Domestic Water
Domestic Hot Water Supply	Yellow	Domestic Hot Water Supply
Domestic Hot Water Recirculating	Yellow	Domestic Hot Water Return

C. Pipe Painting:

1. All piping exposed to view shall be painted as indicated or as directed by the Architect in the field. Confirm all color selections with Architect prior to installation.
2. All piping located in mechanical rooms and exterior piping shall be painted as indicated below:

System	Color
Storm Sewer	White
Sanitary Sewer Waste and Vent	Light Gray
Domestic Cold Water	Dark Blue
Domestic Hot Water Supply and Return	Orange

PART 3 - EXECUTION

3.01 All labeling equipment shall be installed as per manufacturers printed installation instructions.

3.02 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractor’s price shall include all items required as per manufacturers' requirements.

3.03 All piping shall be cleaned of rust, dirt, oil and all other contaminants prior to painting. Install primer and a quality latex paint over all surfaces of pipe.

END OF SECTION

SECTION 22 07 16
PLUMBING EQUIPMENT INSULATION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

B. Work specified elsewhere.

1. Basic materials and methods.
2. Piping systems.

1.03 WARRANTY

A. Warrant the Work specified herein for two years against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:

1. Mildewing.
2. Peeling, cracking, and blistering.
3. Condensation on exterior surfaces.

1.04 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

1.05 DELIVERY AND STORAGE

A. DELIVERY: Deliver undamaged materials in the manufacturer's unopened containers clearly labeled with flame and smoke ratings.

PART 2 - PRODUCTS

2.01 It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.

2.02 The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and approved before any insulation is installed.

2.03 A sample quantity of each type insulation and each type application shall be installed and approval secured

prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.

2.04 Glass fiber materials as manufactured by Owens/Corning, PPG, CSG, or Johns Manville will be acceptable, if they comply with the specifications.

2.05 All insulation shall have composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) fire and smoke hazard as tested by Procedure ASTM E084, NFPA 255 and UL 723 not exceeding:

Flame Spread 25
Smoke Developed 50

2.06 Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above.

2.07 All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

PART 3 - EXECUTION

3.01 All insulation shall be installed in accordance with the manufacturers recommendations and printed installation instructions.

3.02 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturers requirements.

END OF SECTION

SECTION 22 07 19
PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

B. Furnish and install piping insulation to:

1. Interior domestic hot and cold water piping.
2. Exterior domestic cold water piping.
3. Condensate drainage piping.
4. All pipes subject to freezing conditions shall be insulated.

C. Work specified elsewhere.

1. Painting.
2. Pipe hangers and supports.

D. For insulation purpose piping is defined as the complete piping system including supplies and returns, pipes, valves, automatic control valve bodies, fittings, flanges, strainers, thermometer well and unions.

1.03 WARRANTY

A. Warrant the Work specified herein for two years against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.

B. Defects shall include, but not be limited to, the following:

1. Mildewing.
2. Peeling, cracking, and blistering.
3. Condensation on exterior surfaces.

1.04 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, project variations, and accessories.

1.05 DELIVERY AND STORAGE

A. DELIVERY: Deliver undamaged materials in the manufacturer's unopened containers. Containers shall be clearly labeled with the insulation's flame and smoke ratings.

PART 2 - PRODUCTS

2.01 It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.

2.02 The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and approved prior to installation.

2.03 A sample quantity of each type of insulation and each type application shall be installed and approval secured prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.

2.04 All insulation shall have composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) fire and smoke hazard as tested by Procedure ASTM E084, NFPA 255 and UL 723 not exceeding:

Flame Spread 25
Smoke Developed 50

2.05 Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above.

2.06 All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

2.07 APPROVED MANUFACTURERS

A. Glass fiber materials shall be as manufactured by Johns Manville or Owens-Corning and shall have the same thermal properties, density, fire rating, vapor barrier, etc., as the types specified herein, subject to review by the Engineer.

B. Adhesives shall be as manufactured by Childers, Foster, HB Fuller or Armstrong, and shall have the same adhesive properties, fire rating, vapor seal, etc., as the types specified herein, subject to review by the Engineer.

C. Armaflex elastomeric cellular thermal insulation by Armstrong.

D. Phenolic foam insulation shall be as manufactured by Kooltherm Insulation (Koolphen).

E. Metal jacketing and fitting covers shall be as manufactured by Childers or RPR Products.

2.08 MATERIALS

A. INTERIOR DOMESTIC WATER PIPE: provide fiberglass pipe insulation with all service jackets with self sealing lap joint.

B. EXTERIOR DOMESTIC WATER PIPE: Provide elastomeric cellular thermal, or preformed phenolic foam pipe insulation with secured metal jacketing.

C. CONDENSATE DRAINAGE PIPING: Fire resistant fiberglass insulation.

D. METAL JACKETING: Utilize Childers “Strap-On” jacketing. Provide preformed fitting covers for all elbows and tees.

PART 3 - EXECUTION

3.01 All insulation shall be installed in accordance with the manufacturers' recommendations and printed installation instructions, including high density inserts at all hangers and pipe supports to prevent compression of insulation.

3.02 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturers requirements.

3.03 Pipes located outdoors shall be insulated same as concealed piping; and in addition shall have a jacket of 0.016 inch thick, smooth aluminum with longitudinal modified Pittsburg Z-Lock seam and 2 inch overlap. Jacketing shall be easily removed and replaced without damage. All butt joints shall be sealed with gray silicone. Galvanized banding is not acceptable.

3.04 WATER PIPE INSULATION INSTALLATION

A. The insulation shall be applied to clean, dry pipes with all joints firmly butted together. Where piping is interrupted by fittings, flanges, valves or hangers and at intervals not to exceed 25 feet on straight runs, an isolating seal shall be formed between the vapor barrier jacket and the bare pipe. The seal shall be by the applications of adhesive to the exposed insulation joint faces, carried continuously down to and along 4 inches of pipe and up to and along 2 inches of jacket.

B. Pipe fittings and valves shall be insulated with pre-molded or shop fabricated glass fiber covers finished with two brush coats of vapor barrier mastic reinforced with glass fabric.

C. All under lap surfaces shall be clean and free of dust, etc. before the SSL is sealed. These laps shall be firmly rubbed to insure a positive seal. A brush coat of vapor retarder shall be applied to all edges of the vapor barrier jacket.

D. At hangers and supports, provide a high density foam insulation insert that extends 2" beyond the shield on each side and a protective shield/saddle to prevent compression/damage. Secure shield/saddle to insulation using mastic or strapping tape.

3.05 FIRE RATED INSULATION

A. All pipe penetrations through walls and concrete floors shall be fire rated by applying USG Thermafiber in the space between the concrete and the pipe.

B. The fire rating shall be additionally sealed by using 3M brand model CP 25 or 303 fire barrier caulk and putty.

C. All fire rating material shall be insulated in accordance with manufacturer's printed instructions.

PART 4 - SCHEDULES

4.01 LOW TEMPERATURE SURFACES	MINIMUM INSULATION THICKNESS
A. Interior domestic cold water pipe exposed to freezing temperatures:	1 inch
B. Condensate drain lines:	¾ inch
C. Drains receiving condensate:	1 inch

4.02 HIGH TEMPERATURE SURFACES	MINIMUM INSULATION THICKNESS
A. Hot Water Piping:	
1. Operating temperature 105°F or less:	1 inch
2. Operating temperature higher than 105°F and pipe size 1½ inch or smaller	1 inch

	3.	Operating temperature higher than 105°F and pipe size more than 1½ inch	2 inch
B.	Domestic Hot Water and Hot Water Circulating Piping		1 inch

END OF SECTION

SECTION 22 08 00
COMMISSIONING OF PLUMBING

PART 1 - GENERAL

1.01 SUMMARY

A. The purpose of this guideline is to describe the technical requirements for the application of the Commissioning Process that will verify the Plumbing System, achieves the Owner's Project Requirements and are compliant with the Basis of Design.

B. Section Includes:
1. Plumbing commissioning description.
2. Plumbing commissioning responsibilities.

1.02 REFERENCES

A. International Plumbing Code

1.03 COMMISSIONING DESCRIPTION

A. Plumbing commissioning process includes the following tasks:
1. Testing and startup of Plumbing equipment and systems.
2. Equipment and system readiness checklists.
3. Provide qualified personnel to assist in commissioning tests, including seasonal testing.
4. Complete and endorse functional performance test checklists provided by Commissioning Authority to assure equipment and systems are fully operational and ready for functional performance testing.
5. Provide equipment, materials, and labor necessary to correct deficiencies found during commissioning process to fulfill contract and warranty requirements.
6. Provide operation and maintenance information and record drawings to Commissioning Authority for review verification and organization, prior to distribution.
7. Provide assistance to Commissioning Authority to develop, edit, and document system operation descriptions.
8. Provide training for systems specified in this Section with coordination by Commissioning Authority.

B. Equipment and Systems to Be Commissioned:

1. Domestic heating water systems.

1.04 COMMISSIONING SUBMITTALS

A. Test Reports: Indicate data on system verification form for each piece of equipment and system as specified.

B. Field Reports: Indicate deficiencies preventing completion of equipment or system verification checks equipment or system to achieve specified performance.

1.05 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record revisions to equipment and system documentation necessitated by commissioning.

B. Operation and Maintenance Data: Submit revisions to operation and maintenance manuals when necessary revisions are discovered during commissioning.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with all governing codes as specified in the contract documents.

1.07 COMMISSIONING RESPONSIBILITIES

A. Equipment or System Installer Commissioning Responsibilities:
1. Attend commissioning meetings.
2. Provide instructions and demonstrations for Owner's personnel.
3. Ensure subcontractors perform assigned commissioning responsibilities.
4. Ensure participation of equipment manufacturers in appropriate startup, testing, and training activities when required by individual equipment specifications.
5. Develop startup and initial checkout plan using manufacturer’s startup procedures and functional performance checklists for equipment and systems to be commissioned.
6. Installation Contractor, under the direction of the Construction Manager (CM), with the Commissioning Authority (CxA) observing and documenting the results, will execute the Functional Performance Testing procedures for the various
7. systems and pieces of equipment associated with the requirements for the plumbing system
8. During verification check and startup process, execute plumbing related portions of checklists for equipment and systems to be commissioned.
9. Perform and document completed startup and system operational checkout procedures, providing copy to Commissioning Authority.
10. Provide manufacturer’s representatives to execute starting of equipment. Ensure representatives are available and present during agreed upon schedules and are in attendance for duration to complete tests, adjustments and problem-solving.
11. Coordinate with equipment manufacturers to determine specific requirements to maintain validity of warranties.
12. Provide personnel to assist Commissioning Authority during equipment or System Readiness Checks (SRC’s) and Functional Performance Tests (FPT’s).
13. Prior to FPT’s, review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during tests.
14. Prior to startup, inspect, check, and verify correct and complete installation of equipment and system components for verification checks included in commissioning plan. When deficient or incomplete work is discovered, ensure corrective action is taken and re-check until equipment or system is ready for startup.
15. Provide factory supervised startup services for equipment and systems. Coordinate work with manufacturer and Commissioning Authority.
16. Perform verification checks and startup on equipment and systems as specified.
17. Assist Commissioning Authority in performing FPT’s on equipment and systems as specified.
18. Perform operation and maintenance training sessions scheduled by Commissioning Authority.
19. Conduct plumbing system orientation and inspection.
20. Perform training sessions to instruct Owner's personnel in hardware operation, programming, and application in accordance with commissioning plan and specifications.
21. Demonstrate system performance and operation to Commissioning Authority during functional performance tests including each mode of operation.
22. Assist in performing operation and maintenance training sessions scheduled by Commissioning Authority.

1.08 COMMISSIONING MEETINGS

A. Attend initial commissioning meeting and progress commissioning meetings as required by Commissioning Authority.

1.09 SCHEDULING

B. Prepare schedule indicating anticipated start dates for the following:
1. Domestic water system.
2. Waste water system.

3. Plumbing system orientation and inspections.
4. Operation and maintenance manual submittals.
5. Training sessions.

C. Schedule occupancy sensitive tests of equipment and systems during conditions of both minimum and maximum occupancy or use.

1.10 COORDINATION

D. Notify Commissioning Authority minimum of 5 days in advance of the following:
1. Scheduled equipment and system startups.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Place plumbing systems and equipment into full operation and continue operation during each working day of commissioning.

3.02 COMMISSIONING

A. Be responsible to participate in initial and alternate peak season test of systems required to demonstrate performance.

B. Occupancy Sensitive Functional Performance Tests:
1. Test equipment and systems affected by occupancy variations at minimum and peak loads to observe system performance.
2. Participate in testing delayed beyond final completion to test performance with actual occupancy conditions.

END OF SECTION

SECTION 22 30 00
PLUMBING EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Water Heaters.

B. In-line circulator pumps.

1.02 RELATED SECTIONS

A. Section 22 05 29 – Hangers and Support for Plumbing Piping and Equipment.

B. Section 22 05 48 – Vibration and Seismic Controls for Plumbing Equipment.

C. Section 22 10 00 - Plumbing Piping.

D. Section 22 11 19 - Plumbing Specialties.

1.03 REFERENCES

A. ANSI/ASHRAE 90A - Energy Conservation in New Building Design.

B. ASME Section VIIID - Pressure Vessels; Boiler and Pressure Vessel Codes.

C. ANSI/NFPA 70 - National Electrical Code.

D. ANSI/UL 1453 - Electric Booster and Commercial Storage Tank Water Heaters.

1.04 SUBMITTALS

A. Submit under provisions of Division One.

B. Shop Drawings:

1. Include water heater dimensions. size of tappings, and performance data.
2. Include dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

C. Product Data:

1. Include dimension drawings of water heaters indicating components and connections to other equipment and piping.
2. Indicate pump type, capacity, power requirements, and affected adjacent construction.
3. Submit certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
4. Provide electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions.

1.05 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 22.

B. Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with authorities having jurisdiction.

B. Provide pumps with manufacturer's name, model number, and rating/capacity identified.

C. Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:
   1. National Sanitation Foundation (NSF).
   2. American Society of Mechanical Engineers (ASME).
   3. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
   4. National Electrical Manufacturers' Association (NEMA).
   5. Underwriters Laboratories (UL).
   6. American Society of Plumbing Engineers (ASPE)

D. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.07 REGULATORY REQUIREMENTS

A. Conform to NSF, ANSI/NFPA 70, and ANSI/UL 1453 requirements for water heaters.

B. Conform to ASME Section VIIID for manufacture of pressure vessels for heat exchangers.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section Division One.

B. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.09 WARRANTY

A. Provide five year warranty under provisions of Division One.

B. Warranty: Include coverage of domestic water heaters, water storage tanks, and packaged water heating systems.

1.10 EXTRA MATERIALS

A. Furnish under provisions of Division One.

B. Provide two sets of electric heater elements.

1.11 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner’s operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

   1. Purpose of equipment.
   2. Principle of how the equipment works
   3. Important parts and assemblies
   4. How the equipment achieves its purpose and necessary operating conditions
   5. Most likely failure modes, causes and corrections
   6. On site demonstration

PART 2 - PRODUCTS

2.01 COMMERCIAL ELECTRIC WATER HEATERS

A. Manufacturers:
   1. A.O. Smith
   2. Other acceptable manufacturers offering equivalent products.

a. State
b. Rheem.
c. Bradford White.
d. Bock.

B. Type: Factory-assembled and wired, electric, vertical storage.

C. Tank: Glass lined welded steel; 4 inch diameter inspection port (when applicable), thermally insulated with minimum 2 inches glass fiber encased in corrosion-resistant steel jacket; baked-on enamel finish.

D. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60 to 180 degrees F (16 to 82 degrees C), flanged or screw-in nichrome elements, high temperature limit thermostat.

E. Accessories: Brass water connections and dip tube, drain valve, high-density magnesium anode, and ASME rated temperature and pressure relief valve.

F. Provide training per 1.11.

2.02 DIAPHRAGM-TYPE COMPRESSION TANKS

A. Manufacturer:

1. Taco.
2. Other acceptable manufacturers offering equivalent products.
   a. Watts.
   b. Bell and Gossett.

B. Construction: Welded steel, tested and stamped in accordance with Section 8D of ASME Code; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.

C. Accessories: Pressure gage and air-charging fitting, tank drain; pre-charge to 12 psig.

2.03 IN-LINE CIRCULATOR PUMPS

A. Manufacturers:

1. Bell & Gossett.
2. Other acceptable manufacturers offering equivalent products.
   a. TACO.
   b. Grundfos.

B. Casing: Bronze, rated for 125 psig working pressure.

C. Impeller: Bronze.

D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.

E. Seal: Carbon rotating against a stationary ceramic seat.

F. Drive: Flexible coupling.

PART 3 - EXECUTION

3.01 WATER HEATER INSTALLATION

A. Install water heaters in accordance with manufacturer's instructions and to NSF and UL requirements.

B. Coordinate with plumbing piping and related work to achieve operating system.

3.02 PUMP INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.

C. Support piping adjacent to pump such that no weight is carried on pump casings.

D. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

END OF SECTION

SECTION 22 40 00
PLUMBING FIXTURES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

A. WORK INCLUDED: Include the following Work in addition to items normally part of this Section:

1. Plumbing fixtures.
2. Drains and cleanouts.

B. WORK SPECIFIED ELSEWHERE:

1. Piping systems.
2. Pipe valves and fittings.
3. Plumbing systems testing.

1.03 WARRANTY

A. Warrant the Work specified herein for two years against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:

1. Noisy operation.
2. Noticeable deterioration of finish.
3. Leakage of water.

1.04 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

C. OPERATION AND MAINTENANCE INSTRUCTIONS: Provide pre-printed operating and maintenance instructions for each item specified. Instruct and demonstrate the proper operation and maintenance to the Owner's designated representative.

1.05 DELIVERY AND STORAGE

A. DELIVERY: Deliver clearly labeled, undamaged materials in the manufacturers' unopened containers.

B. TIMING AND COORDINATION: Deliver materials to allow for minimum storage time at the project site. Coordinate delivery with the scheduled time of installation.

C. STORAGE: Store materials in a clean, dry location, protected from weather and abuse.

1.06 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

B. Confirm and field coordinate that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

PART 2 - PRODUCTS

2.01 MATERIALS

A. PLUMBING FIXTURES:

1. GENERAL: Provide plumbing fixtures as specified on drawings. The approved equal products manufacturers are as follows:
   a. Water closet, urinals, lavatories and showers: American Standard, Kohler, Eljer.
   b. Stainless steel sinks: Elkay, Just and Moen.
   c. Mop sinks: Stern-Williams, Fiat
   d. Faucets: American Standard, Kohler, Eljer.
   e. Faucets: Chicago, T&S Brass, Zurn
   f. Faucets: Moen, Delta Commercial, Speakman
   g. Shower valves: Powers, Symmons, Chicago, Speakman.
   h. Shower Systems: Bradley, Acorn
   i. Flush Valves: Sloan “Royal”
   j. Flush Valves: Sloan “Regal Pro”, Zurn “AquaVantage”
   k. Flush Valves: Sloan “Regal”, Zurn “AquaFlush”
   l. Drinking fountains: Halsey Taylor, Elkay, Haws, Oasis and Sunroc.With Water Bottle Fillers.
   m. Floor drains: Zurn, J.R. Smith, Mifab, Josam and Wade.
   n. Emergency Fixtures: Bradley, Chicago, Haws, Speakman and Encon
   o. Trap Primers: PPP Inc. (All brass construction). Sioux Chief.
2. CHAIR CARRIERS: ANSI/ASME A112.6.1.; Adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers. As manufactured by Zurn, J. R. Smith, Josam or Wade.
3. DRINKING FOUNTAIN & URINAL WALL SUPPORTS: ANSI/ASME A112.6.1; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs. As manufactured by Zurn, J. R. Smith, Josam or Wade.
4. TRAPS, STOPS AND RISERS: Heavy pattern as manufactured by McGuire, Chicago or Zurn.

B. CLEANOUTS:

1. GENERAL: Provide cleanouts as shown on Drawings and as required by the city building code.
2. ACCEPTABLE MANUFACTURERS: Zurn, J. R. Smith, Mifab, Josam and Wade.
3. TYPES:
   a. FINISHED FLOOR CLEANOUTS: Provide cast iron, adjustable floor level assembly with round nickel bronze top and gasket cover.
   b. RESILIENT OR TILE FINISHED FLOOR CLEANOUTS: Provide cast iron, adjustable assembly with round nickel-bronze top with gasketed water tight cover and depressed top to receive flooring finish material.
   c. DRY WALL CLEANOUTS: Provide cast iron tee and counter sink bronze plug with square nickel bronze frame and stainless steel cover.
   d. Provide membrane clamp rings for slab on grade cleanouts.
   e. All cleanouts shall have tapered bronze plugs.
   f. All cleanouts outside of building on grade shall be set in a 18" x 18" x 4" thick concrete pad.

PART 3 - EXECUTION

3.01 PREPARATION

A. EXAMINATION OF CONDITIONS: Examine conditions affecting this Work. Report unsatisfactory conditions to the proper authority and do not proceed until those conditions have been corrected. Commencing Work implies acceptance of existing conditions as satisfactory to the outcome of this Work.

3.02 INSTALLATION

A. Install fixtures in locations and heights as shown on Drawings or as directed by the Architect.

B. Install materials plumb, level, securely, and in accordance with manufacturer's recommendations.

C. All rough-in pipe openings, for final connections with all supply waste soil and vent systems shall be closed with caps or plugs during early stages of construction and installation. Tape shall not be considered sufficient protection.

D. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

E. Provide ball valves in piping serving batteries of fixtures. Label stops "Hot" and "Cold." Valves to be located above accessible ceiling. If ceiling are not accessible, provide access panels of adequate size to make valves fully accessible.

F. Plumbing fixtures shall be supported by a concealed chair carrier where required to properly support the fixture specified. All carriers to be securely mounted, bolted and checked prior to concealment.

G. Caulk around fixtures with best grade white silicone caulking. Do not use grout.

H. All handles on supply and drainage fittings or other brass items shall be properly lined up and adjusted. Fittings shall not be left in any haphazard manner.

I. All fixtures shall have individual chrome plated loose key cutoff stops on supply lines. Where same are not specified as a part of the fixture trim, they shall be installed as close to fixtures as possible in the hot and cold water supply.

J. Install each fixture with trap, easily removable for servicing and cleaning.

K. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.

L. The contractor shall install water hammer arrestors. Water hammer arrestors shall be PDI Certified and sized and placed as recommended by manufacture. Provide an accessible isolation valve and proper access to arrestor for replacement.

3.03 INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.04 ADJUSTING

A. Adjust work under provisions of Division One.

B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.05 CLEANING

A. Clean work under provisions of Division One.

B. At completion clean plumbing fixtures and equipment.

3.06 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Division One.

B. Do not permit use of fixtures.

3.07 ADA ACCESSIBLE FIXTURES

A. Install fixtures to heights, indicated on architectural drawings.

B. Handicapped fixtures shall be installed to required heights, shall be of types suitable for, and supplied with controls properly installed, to comply with requirements as directed by ADA Accessibility of Federal Registry, Part III, Department of Justice 28 CFR 36 and comply with all state and local ADA Code requirements.

C. Exposed accessible sink or lavatory p-trap and angle valve assemblies shall be insulated with the fully molded, Truebro, Handi Lav-guard insulation kit. Provide the proper model for fixtures specified. All kits shall be White or as selected by Architect.

D. Wall mounted drinking fountains and coolers which protrude into passages or corridor space, whether single or paired with adjacent accessible fixture, shall be supplied with skirt or apron to lower the underside clearance of non-accessible fixture equal to that required for accessible fixture.

END OF SECTION

SECTION 23 02 00
BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all Work herein.

B. The Contract Drawings indicate the extent and general arrangement of the systems. If any departure from the Contract Drawings is deemed necessary by the Contractor, details of such departures and the reasons therefore, shall be submitted to the Architect/Engineer for review as soon as practicable. No such departures shall be made without the prior written approval of the Architect/Engineer.

C. Notwithstanding any reference in the Specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number, such reference shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgment of the Architect/Engineer, expressed in writing, is the equivalent of that specified.

D. The Building Systems Commissioning for this project shall be by an independent agency employed by the owner. There are requirements of Div 1 that shall apply to work in Division 1 & 23. Division 1 & 23 contractor's shall review Division 1 so that the proper planning can be applied relative to the interactive requirements in completing the Building Systems Commissioning of this project.

1.02 SCOPE OF WORK

A. The Work included under this Contract consists of the furnishing and installation of all equipment and material necessary and required to form complete and functioning systems in all of their various phases, all as shown on the accompanying Drawings and/or described in these Specifications. The Contractor shall review all pertinent drawings, including those of other contracts, prior to commencement of Work.

B. This Division requires the furnishing and installing of all items as specified herein, indicated on the Drawings or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, transportation, storage, equipment, utilities, all required permits, licenses and inspections. All work performed under this Section shall be in accordance with the Project Manual, Drawings and Specifications and is subject to the terms and conditions of the Contract.

C. The approximate locations of Mechanical (HVAC) items are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of outlets, apparatus, etc. Exact locations are to be determined by actual measurements at the building, and will in all cases be subject to the review of the Owner or Engineer, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

D. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

E. All discrepancies between the Contract Documents and actual job-site conditions shall be reported to the Owner or Engineer so that they will be resolved prior to bidding. Where this cannot be done at least 7 working days prior to bid; the greater or more costly of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

F. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and fully operating system in cooperation with other trades.

G. It is the intent of the above "Scope" to give the Contractor a general outline of the extent of the Work involved; however, it is not intended to include each and every item required for the Work. Anything omitted from the "Scope" but shown on the Drawings, or specified later, or necessary for a complete and functioning heating, ventilating and air conditioning system shall be considered a part of the overall "Scope".

H. The Contractor shall rough-in equipment furnished by others from rough-in and placement drawings furnished by others. The Contractor shall make final connection to equipment furnished by others.

I. The Contractor shall participate in the commissioning process as required; including, but not limited to, meeting attendance, completion of checklists, and participation in functional testing.

1.03 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

A. The Contract Documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the reviewed shop drawings.

B. All duct or pipe or equipment locations as indicated on the documents do not indicate every transition, offset, or exact location. All transitions, offsets, clearances and exact locations shall be established by actual field measurements, coordination with the structural, architectural and reflected ceiling plans, and other trades. Submit shop drawings for review.

C. All transitions, offsets and relocations as required by actual field conditions shall be performed by the Contractor at no additional cost to the Owner.

D. Additional coordination with electrical contractor may be required to allow adequate clearances of electrical equipment, fixtures and associated appurtenances. Contractor to notify Architect and Engineer of unresolved clearances, conflicts or equipment locations.

1.04 SITE VISIT AND FAMILIARIZATION

A. Before submitting a bid, it will be necessary for each Contractor whose work is involved to visit the site and ascertain for himself the conditions to be met therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.

B. Understand the existing utilities from which services will be supplied; verify locations of utility services, and determine requirements for connections.

C. Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.05 WORK SPECIFIED IN OTHER SECTIONS

A. Finish painting is specified. Prime and protective painting are included in the work of this Division.

B. Owner and General Contractor furnished equipment shall be properly connected to Mechanical (HVAC) systems.

C. Furnishing and installing all required Mechanical (HVAC) equipment control relays and electrical interlock devices, conduit, wire and J-boxes are included in the Work of this Division.

1.06 PERMITS, TESTS, INSPECTIONS

A. Arrange and pay for all permits, fees, tests, and all inspections as required by governmental authorities.

1.07 DATE OF FINAL ACCEPTANCE

A. The date of final acceptance shall be the date of Owner occupancy, or the date all punch list items have been completed, or the date final payment has been received. Refer to Division One for additional requirements.

B. The date of final acceptance shall be documented in writing and signed by the Architect, Owner and Contractor.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Deliver products to the project at such time as the project is ready to receive the equipment, pipe or duct - properly protected from incidental damage and weather damage.

C. Damaged equipment, duct or pipe shall be promptly removed from the site and new, undamaged equipment, pipe or duct shall be installed in its place promptly with no additional charge to the Owner.

1.09 NOISE AND VIBRATION

A. The heating, ventilating and air conditioning systems, and the component parts thereof, shall be guaranteed to operate without objectionable noise and vibration.

B. Provide foundations, supports and isolators as specified or indicated, properly adjusted to prevent transmission of vibration to the building structure, piping and other items.

C. Carefully fabricate ductwork and fittings with smooth interior finish to prevent turbulence and generation or regeneration of noise.

D. All equipment shall be selected to operate with minimum of noise and vibration. If, in the opinion of the Architect, objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of the Work, the Contractor shall rectify such conditions without extra cost to the Owner.

1.10 APPLICABLE CODES

A. Obtain all required permits and inspections for all work required by the Contract Documents and pay all required fees in connection thereof.

B. Arrange with the serving utility companies for the connection of all required utilities and pay all charges, meter charges, connection fees and inspection fees, if required.

C. Comply with all applicable codes, specifications, local ordinances, industry standards, utility company regulations and the applicable requirements which includes and is not limited to the following nationally accepted codes and standards:

1. Air Moving & Conditioning Association, AMCA.
2. American Standards Association, ASA.
3. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., ASHRAE.
4. American Society of Mechanical Engineers, ASME.
5. American Society of Testing Materials, ASTM.
6. National Bureau of Standards, NBS.
7. National Fire Protection Association, NFPA.

8. Sheet Metal & Air Conditioning Contractors' National Association, SMACNA.
9. Underwriters' Laboratories, Inc., UL.
10. International Energy Conservation Code, IECC.
11. International Fire Code.

D. Where differences existing between the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the nationally accepted codes and standards, the more stringent or costly application shall govern. Promptly notify the Engineer in writing of all differences.

E. When directed in writing by the Engineer, remove all work installed that does not comply with the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards, correct the deficiencies, and complete the work at no additional cost to the Owner.

1.11 DEFINITIONS AND SYMBOLS

A. General Explanation: A substantial amount of construction and Specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic and schematic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article, unless defined otherwise in Division 01.

B. Definitions and explanations of this Section are not necessarily either complete or exclusive, but are general for work to the extent not stated more explicitly in another provision of the Contract Documents.

C. Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications and to similar means of recording requirements in Contract Documents. Where such terms as "Shown", "Noted", "Scheduled", "Specified" and "Detailed" are used in lieu of "Indicated", it is for the purpose of helping the reader locate cross-reference material, and no limitation of location is intended except as specifically shown.

D. Directed: Where not otherwise explained, terms such as "Directed", "Requested", "Accepted", and "Permitted" mean by the Architect or Engineer. However, no such implied meaning will be interpreted to extend the Architect's or Engineer's responsibility into the Contractor's area of construction supervision.

E. Reviewed: Where used in conjunction with the Engineer's response to submittals, requests for information, applications, inquiries, reports and claims by the Contractor the meaning of the term "Reviewed" will be held to limitations of Architect's and Engineer's responsibilities and duties as specified in the General and Supplemental Conditions. In no case will "Reviewed" by Engineer be interpreted as a release of the Contractor from responsibility to fulfill the terms and requirements of the Contract Documents.

F. Furnish: Except as otherwise defined in greater detail, the term "Furnish" is used to mean supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

G. Install: Except as otherwise defined in greater detail, the term "Install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.

H. Provide: Except as otherwise defined in greater detail, the term "Provide" is used to mean "Furnish and Install", complete and ready for intended use, as applicable in each instance.

I. Installer: Entity (person or firm) engaged by the Contractor, or its Subcontractor or Sub-subcontractor for performance of a particular unit of work at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension,

finishing, curing, protection, cleaning and similar operations, as applicable in each instance. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.

J. Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor or, when so noted, by other identified installers or entities.

K. Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended as minimum quality level or quantity of work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable tolerance limits. In complying with requirements, indicated or scheduled numeric values are either minimums or maximums as noted or as appropriate for the context of the requirements. Refer instances of uncertainty to Owner or Engineer via a request for information (RFI) for decision before proceeding.

L. Abbreviations and Symbols: The language of Specifications and other Contract Documents including Drawings is of an abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self explanatory nature have been included in text of Specifications and Drawings. Specific abbreviations and symbols have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of Specification requirements with notations on Drawings and in Schedules. These are frequently defined in Section at first instance of use or on a Legend and Symbol Drawing. Trade and industry association names and titles of generally recognized industry standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicate. Except as otherwise indicated, graphic symbols and abbreviations used on Drawings and in Specifications are those recognized in construction industry for indicated purposes. Where not otherwise noted symbols and abbreviations are defined by the latest ASHRAE Fundamentals Handbook, chapter 34 "Abbreviations and Symbols".

1.12 DRAWINGS AND SPECIFICATIONS

A. These Specifications are intended to supplement the Drawings and it will not be the province of the Specifications to mention any part of the Work which the Drawings are competent to fully explain in every particular and such omission is not to relieve the Contractor from carrying out portions indicated on the Drawings only.

B. Should items be required by these Specifications and not indicated on the Drawings, they are to be supplied even if of such nature that they could have been indicated thereon. In case of disagreement between Drawings and Specifications, or within either Drawings or Specifications, the better quality or greater quantity of work shall be estimated and the matter referred to the Architect or Engineer for review with a request for information and clarification at least 7 working days prior to bid opening date for issuance of an addendum.

C. The listing of product manufacturers, materials and methods in the various sections of the Specifications, and indicated on the Drawings, is intended to establish a standard of quality only. It is not the intention of the Owner or Engineer to discriminate against any product, material or method that is the equivalent of the standards as indicated and/or specified, nor is it intended to preclude open, competitive bidding. The fact that a specific manufacturer is listed as an acceptable manufacturer should not be interpreted to mean that the manufacturer’s standard product will meet the requirements of the project design, Drawings, Specifications and space constraints.

D. The Architect or Engineer and Owner shall be the sole judge of quality and equivalence of equipment, materials and methods.

E. Products by other reliable manufacturers, other materials, and other methods, will be accepted as outlined, provided they have equivalent capacity, construction, and performance. However, under no circumstances shall any substitution be made without the written permission of the Architect or Engineer and Owner. Request for prior approval must be made in writing 10 days prior to the bid date without fail.

F. Wherever a definite product, material or method is specified and there is not a statement that another product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method is the only one that shall be used without prior approval.

G. Wherever a definite material or manufacturer's product is specified and the Specification states that products of similar design and equivalent construction from the specified list of manufacturers may be substituted, it is the intention of the Owner or Engineer that products of manufacturers that are specified are the only products that will be acceptable and that products of other manufacturers will not be considered for substitution without approval.

H. Wherever a definite product, material or method is specified and there is a statement that "OR EQUIVALENT" product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method or an "OR EQUIVALENT" product, material or method may be used if it complies with the Specifications and is submitted for review to the Engineer as outline herein.

I. Where permission to use substituted or alternative equipment on the project is granted by the Owner or Engineer in writing, it shall be the responsibility of the Contractor or Subcontractor involved to verify that the equipment will fit in the space available which includes allowances for all required Code and maintenance clearances, and to coordinate all equipment structural support, plumbing and electrical requirements and provisions with the Mechanical (HVAC) Design Documents and all other trades, including Division 26.

J. Changes in architectural, structural, electrical, mechanical, and plumbing requirements for the substitution shall be the responsibility of the bidder wishing to make the substitution. This shall include the cost of redesign by the affected designer(s). Any additional cost incurred by affected Subcontractors shall be the responsibility of this bidder and not the Owner.

K. If any request for a substitution of product, material or method is rejected, the Contractor will automatically be required to furnish the product, material or method named in the Specifications. Repetitive requests for substitutions will not be considered.

L. The Owner or Engineer will investigate all requests for substitutions when submitted in accordance with the requirements listed above; and if accepted, will issue a letter allowing the substitutions.

M. Where equipment other than that used in the design as specified or shown on the Drawings is substituted (either from an approved manufacturers list or by submittal review), it shall be the responsibility of the substituting Contractor to coordinate space requirements, building provisions and connection requirements with his trades and all other trades; and to pay all additional costs to other trades, the Owner, the Architect or Engineer, if any, due to the substitutions.

1.13 SUBMITTALS

A. Coordinate with Division 01 for submittal timetable requirements. Within thirty (30) days, unless noted otherwise, after the Contract is awarded the Contractor shall submit a minimum of eight (8) complete bound sets of shop drawings and complete data covering each item of equipment or material. The first submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive shop drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain one (1) copy each of all shop drawings for their files. Where full size drawings are involved, submit one (1) print and one (1) reproducible sepia or mylar in lieu of eight (8) sets. All literature pertaining to an item subject to Shop Drawing submittal shall be submitted at one time. A submittal shall not contain information from more than one Specification section, but may have a section subdivided into items or equipment as listed in each section. The Contractor may elect to submit each item or type of equipment separately. Each submittal shall include the following items enclosed in a suitable binder:

1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.
2. An index page with a listing of all data included in the Submittal.
3. A list of variations page with a listing of all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then this page shall state "NO VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.
4. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.
5. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.
6. Identification of each item of material or equipment matching that indicated on the Drawings.
7. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.
8. Additional information as required in other Sections of this Division.
9. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "REVISE AND RESUBMIT".

B. Refer to Division 00 and Division 01 for additional information on shop drawings and submittals.

C. Equipment and materials submittals and shop drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of shop drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.

D. Where shop drawings and submittals are marked "REVIEWED", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.

E. Shop drawings shall be reviewed and returned to the Contractor with one of the following categories indicated:

1. REVIEWED: Contractor need take no further submittal action, shall include this submittal in the O&M manual and may order the equipment submitted on.
2. REVIEWED AS NOTED: Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the O&M manual. The contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted.
3. NOT APPROVED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is not approved. The Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or Drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.
4. REVISE AND RESUBMIT: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and re-submit. The Contractor will automatically be required to furnish the product, material or

method named in the Specifications and/or provide as noted on previous shop drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.

5. CONTRACTOR'S CERTIFICATION REQUIRED: Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor's stamp is required stating that the submittal meets all conditions of the Contract Documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all shop drawings.
6. MANUFACTURER NOT AS SPECIFIED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified. The Contractor will automatically be required to furnish the product, material or method named in the Specifications. Contractor shall not order equipment when submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.

F. Materials and equipment which are purchased or installed without submittal review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.

G. Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.

H. Submittals are required for, but not limited to, the following items:

1. Pipe Material and Specialties.
2. Pipe Fabrication Drawings.
3. Basic Materials.
4. Variable Air Volume Boxes.
5. Air Handling Units.
6. Chillers.
7. Air Cooled Condensing Units.
8. Water Treatment.
9. Variable Frequency Drives.
10. Noise and Vibration Controls.
11. HVAC Pipe and Duct Insulation.
12. Hydronic Valves.
13. Hydronic Piping and Accessories.
14. Hydronic Pumps.
15. Pipe Hangers and Equipment Supports.
16. Duct Specialties.
17. Duct Fabrication Drawings.
18. Air Distribution Devices.
19. Fan Coil Units.
20. Filters.
21. Fans.
22. Unit Heaters.
23. DX Mini-Split Systems
24. Fire Dampers and Fire Smoke Dampers.
25. Temperature Controls and Control Sequences.
26. Test, Adjust and Balance Reports.
27. Testing, Adjusting and Balancing Contractor Qualifications.
28. Coordination Drawings.

I. Refer to other Division 23 sections for additional submittal requirements. Provide samples of actual materials and/or equipment to be used on the Project upon request of the Owner or Engineer.

1.14 COORDINATION DRAWINGS

A. Prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements,

components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access, and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:
   a. Wall and type locations.
   b. Clearances for installing and maintaining insulation.
   c. Locations of light fixtures and sprinkler heads.
   d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
   e. Equipment connections and support details.
   f. Exterior wall and foundation penetrations.
   g. Routing of storm and sanitary sewer piping.
   h. Fire-rated wall and floor penetrations.
   i. Sizes and location of required concrete pads and bases.
   j. Valve stem movement.
   k. Structural floor, wall and roof opening sizes and details.
2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling-mounted items.

B. This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

C. By submitting coordination drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

1.15 RECORD DOCUMENTS

A. Prepare Record Documents in accordance with the requirements in Special Project Requirements, in addition to the requirements specified in Division 23, indicate the following installed conditions:

1. Duct mains and branches, size and location, for both exterior and interior; locations of dampers, fire dampers, duct access panels, and other control devices; filters, unit heaters, fan coils, condensing units, VAV terminal units, fans, and A/C units, requiring periodic maintenance or repair.
2. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, tanks, etc.). Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping.
3. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
4. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
5. Contract Modifications, actual equipment and materials installed.

B. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified herein to record the locations and invert elevations of underground installations.

C. The Contractor shall maintain a set of clearly marked black line record "AS-BUILT" prints on the job site on which he shall mark all work details, alterations to meet site conditions and changes made by "Change Order" notices. These shall be kept available for inspection by the Owner, Architect or Engineer at all times.

D. Refer to Division 00 and Division 01 for additional requirements concerning Record Drawings. If the Contractor does not keep an accurate set of as-built drawings, the pay request may be altered or delayed at the request of the Architect. Mark the drawings with a colored pencil. Delivery of as-built prints and reproducibles is a condition of substantial completion.

E. The record prints shall be updated on a daily basis and shall indicate accurate dimensions for all buried or concealed work, precise locations of all concealed pipe or duct, locations of all concealed valves, controls and devices and any deviations from the work shown on the Construction Documents which are required for coordination. All dimensions shall include at least two dimensions to permanent structure points.

F. Submit three prints of the tracings for review. Make corrections to tracings as directed and deliver "Auto Positive Tracings" to the Architect. "As-Built" drawings shall be furnished in addition to submittals.

G. When the option described in paragraph F above is not exercised, then upon completion of the Work, the Contractor shall transfer all marks from the tracings and submit a set of clear concise reproducible record "AS-BUILT" drawings and shall submit the reproducible drawings with corrections made by a competent draftsman and three (3) sets of black line prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the Work. The reproducible record "AS-BUILT" drawings shall have the Engineer’s Name and Seal removed or blanked out and shall be clearly marked and signed on each sheet as follows:

CERTIFIED RECORD DRAWINGS

DATE:

(NAME OF GENERAL CONTRACTOR)

BY:_____
(SIGNATURE)

(NAME OF SUBCONTRACTOR)

BY:_____
(SIGNATURE)

1.16 OPERATING AND MAINTENANCE MANUALS

A. Prepare operating and maintenance manuals in accordance with Division 00 and Division 01 and, in addition to the requirements specified in those Divisions, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

1.17 CERTIFICATIONS AND TEST REPORTS

A. Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and scheduled date for

each test. This detailed completion and test schedule shall be submitted at least 90 days before the projected substantial completion date.

B. Test result reporting forms shall be submitted for review no later than the date of the detailed schedule.

C. Submit 4 copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of substantial completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

D. Certifications and test reports to be submitted shall include, but not be limited to, those items outlined in Section 23 02 00.

1.18 OPERATING AND MAINTENANCE MANUALS

A. Coordinate with Division 00 and Division 01 for operating and maintenance manual requirements. Unless noted otherwise, bind together in “D ring type” binders (National model no. 79-883 or equal). Binders shall be large enough to allow ¼” of spare capacity. Three (3) sets of all reviewed submittals, fabrication drawings, bulletins, maintenance instructions, operating instructions and parts exploded views and lists for each and every piece of equipment furnished under these Specifications. All sections shall be typed and indexed into sections and labeled for easy reference and shall utilize the individual specification section numbers shown in the Mechanical Specifications as an organization guideline. Bulletins containing information about equipment that is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 23 shall be clearly and legibly set forth in memoranda that shall, likewise, be bound with bulletins.

B. Prepare maintenance manuals in accordance with Special Project Conditions. In addition to the requirements specified in Division 23, include the following information for equipment items:

1. Identifying names, name tag designations and locations for all equipment.
2. Valve tag lists with valve number, type, color coding, location and function.
3. Reviewed submittals with exceptions noted compliance letter.
4. Fabrication drawings.
5. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable (i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts).
6. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
7. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions, servicing instructions and lubrication charts and schedules.
8. Equipment and motor name plate data.
9. Wiring diagrams.
10. Exploded parts views and parts lists for all equipment and devices.
11. Color coding charts for all painted equipment and piping.
12. Location and listing of all spare parts and special keys and tools furnished to the Owner.
13. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.

C. Refer to Division 00 and Division 01 for additional information on Operating and Maintenance Manuals.

D. Operating and Maintenance Manuals shall be turned over to the Owner or Engineer for review a minimum of 14 working days prior to the beginning of the operator training period.

1.19 OPERATOR TRAINING

A. The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include a minimum of 12 hours of onsite training in three 4 hour shifts.

B. Before proceeding with the instruction of Owner Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period, obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

C. Refer to other Division 23 Sections for additional Operator Training requirements.

1.20 FINAL COMPLETION

A. At the completion of the Work, all equipment and systems shall be tested and faulty equipment and material shall be repaired or replaced. Refer to Sections of Division 23 for additional requirements.

B. Clean and adjust all air distribution devices and replace all air filters immediately prior to Substantial Completion.

C. Touch up and/or refinish all scratched equipment and devices immediately prior to Substantial Completion.

1.21 CONTRACTOR'S GUARANTEE

A. Use of the HVAC systems to provide temporary service during construction period will not be allowed without permission from the Owner in writing; and, if granted, shall not cause the warranty period to start, except as defined below.

B. Contractor shall guarantee to keep the entire installation in repair and perfect working order for a period of two years after the date of the Substantial Completion, and shall furnish (free of additional cost to the Owner) all materials and labor necessary to comply with the above guarantee throughout the years beginning from the date of Substantial Completion, Beneficial Occupancy by the Owner, or the Certificate of Final Payment as agreed upon by all parties.

C. This guarantee shall not include cleaning or changing filters except as required by testing, adjusting and balancing.

D. All air conditioning compressors shall have parts and labor guarantees for a period of not less than 5 years beyond the date of Substantial Completion.

E. Refer to Sections in Division 23 for additional guarantee or warranty requirements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide materials and equipment manufactured by a domestic United States manufacturer and assembled in the United States for all local and Federal Government projects. These materials and equipment shall comply with “Buy American Act.”

B. Access Doors: Provide access doors as required for access to equipment, valves, controls, cleanouts and other apparatus where concealed. Access doors shall have concealed hinges and screw driver cam locks.

C. All access doors located in wet areas such as restrooms, locker rooms, shower rooms, kitchen and any other wet areas shall be constructed of stainless steel.

D. Access Doors: shall be as follows:

1. Plastic Surfaces: Milcor Style K.
2. Ceramic Tile Surface: Milcor Style M.
3. Drywall Surfaces: Milcor Style DW.
4. Install doors only in locations approved by the Architect.

2.02 EQUIPMENT PADS (See 2.04 in Section 26 02 00)

PART 3 - EXECUTION

3.01 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected via reviewed submittals.

B. Refer to equipment specifications in Divisions 2 through 48 for additional rough-in requirements.

3.02 MECHANICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate mechanical systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
8. Install systems, materials, and equipment to conform with architectural action markings on submittal, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, resolve conflicts and submit proposed solution to the Architect for review.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as possible, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location and label.
11. Install access doors where units are concealed behind finished surfaces. Refer to paragraph 2.01 in this section and architect for access doors specifications and location.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
13. Provide roof curbs for all roof mounted equipment. Coordinate with roof construction for pitched roof. Provide roof curbs which match the roof slope and provides a level top for equipment installation. Refer to Architectural drawings and details.
14. The equipment to be furnished under these Specifications shall be essentially the standard product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer; however, the component parts of the system need not be the product of the same manufacturer.

15. The Architectural and Structural features of the building and the space limitations shall be considered in selection of all equipment. No equipment shall be furnished which will not suit the arrangement and space limitations indicated.
16. Lubrication: Prior to start-up, check and properly lubricate all bearings as recommended by the manufacturer.
17. Where the word "Concealed" is used in these Specifications in connection with insulating, painting, piping, ducts, etc., it shall be understood to mean hidden from sight as in chases, furred spaces or suspended ceilings. "Exposed" shall be understood to mean the opposite of concealed.
18. Identification of Mechanical Equipment:
    a. Mechanical equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal. Submittals shall include dimensions and lettering format for approval. Attachment shall be with escutcheon pins, self-tapping screws, or machine screws.
    b. Tags shall be attached to all valves, including control valves, with nonferrous chain. Tags shall be brass and at least 1-1/2 inches in diameter. Nameplate and tag symbols shall correspond to the identification symbols on the temperature control submittal and the "as-built" drawings.
19. Provide construction filters for all air handling units, fain coil unit, VAV boxes, and all other air handling equipment during the entire construction period.

3.03 CUTTING AND PATCHING

A. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed Work.
2. Remove and replace defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing.
5. Install equipment and materials in existing structures.
6. Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer/Owner's observation of concealed Work, without additional cost to the Owner.
7. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers; refer to the materials and methods required for the surface and building components being patched; Refer to Paragraph 1.11 I for definition of "Installer."

C. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, mechanical ducts and HVAC units, and other mechanical items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.04 WORK SEQUENCE, TIMING, COORDINATION WITH OWNER, ARCHITECT AND ENGINEER

A. The Owner will cooperate with the Contractor, however, the following provisions must be observed:

1. A meeting will be held at the project site, prior to any construction, between the Owner's Representative, the General Contractor, the Sub-Contractors and the Engineer to discuss Contractor's employee parking space, access, storage of equipment or materials, and use of the Owner's facilities or utilities. The Owner's decisions regarding such matters shall be final.
2. During the construction of this project, normal facility activities will continue in existing buildings until renovated areas are completed. Plumbing, fire protection, lighting,

electrical, communications, heating, air conditioning, and ventilation systems shall be maintained in service within the occupied spaces of the existing building.

3. Contractor shall not start-up any of the HVAC equipment unless the Owner, Architect and Engineer are signed off.
4. Start-up for major HVAC equipment such as chillers, variable frequency drives shall be performed by a factory technician. The start-up shall include a written report signed off by Contractor, Engineer and Owner.

END OF SECTION

SECTION 23 05 13
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 23 02 00, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

B. WORK SPECIFIED ELSEWHERE:

1. Painting
2. Automatic temperature controls.
3. Power control wiring to motors and equipment.

1.03 WARRANTY

Warrant the Work specified herein for two years and motors for five years beginning on the date of substantial completion against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

1.04 SUBMITTALS

A. SHOP DRAWINGS: Indicate size material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures variations, and accessories.

C. MOTOR NAMEPLATE INFORMATION: Manufacturer's name, address, utility and operating data.

D. Refer to Division One for additional information.

1.05 DELIVERY AND STORAGE

A. DELIVERY: Deliver clearly labeled, undamaged materials in the manufacturers' unopened containers.

B. TIME AND COORDINATION: Deliver materials to allow for minimum storage time at the project site. Coordinate delivery with the scheduled time of installation.

C. STORAGE: Store materials in a clean, dry location, protected from weather and abuse.

PART 2 - PRODUCTS

2.01 ELECTRIC MOTORS

A. APPROVED MANUFACTURERS: Provide motors by a single manufacturer as much as possible.

1. Baldor
2. Marathon
3. Siemens-Allis
4. General Electric

5. U.S. Motor

B. TEMPERATURE RATING: Provide insulation as follows:

1. CLASS B: 40 degrees C maximum.
2. CLASS F:
   a. Between 40 degrees C and 65 degrees C maximum.
   b. Totally enclosed motors.

C. STARTING CAPABILITY: As required for service indicated five starts minimum per hour.

D. PHASES AND CURRENT: Verify electrical service compatibility with motors to be used.

1. UP TO 1/2 HP: Provide permanent split, capacitor-start single phase with inherent overload protection.
2. 3/4 HP AND LARGER: Provide squirrel-cage induction polyphone.
3. Provide two separate windings on 2-speed polyphone motors.
4. Name plate voltage shall be the same as the circuit's normal voltage, serving the motor.

E. SERVICE FACTOR: 1.15 for polyphase; 1.35 for single phase.

F. FRAMES: U-frames 1.5 hp. and larger.

G. BEARINGS: Provide sealed re-greasable ball bearings; with top mounted zerc lubrication fittings and bottom side drains minimum average life 100,000 hours typically, and others as follows:

1. Design for thrust where applicable.
2. PERMANENTLY SEALED: Where not accessible for greasing.
3. SLEEVE-TYPE WITH OIL CUPS: Light duty fractional hp. motors or polyphase requiring minimum noise level.

H. ENCLOSURE TYPE: Provide enclosures as follows:

1. CONCEALED INDOOR: Open drip proof.
2. EXPOSED INDOOR: Guarded.
3. OUTDOOR TYPICAL: Type II. TEC.
4. OUTDOOR WEATHER PROTECTED: Type I. TEA.

I. OVERLOAD PROTECTION: Built-in sensing device for stopping motor in all phase legs and signaling where indicated for fractional horse power motors.

J. NOISE RATING: "Quiet" except where otherwise indicated.

K. EFFICIENCY: Minimum full load efficiency listed in the following table, when tested in accordance with IEEE Test Procedure 112A, Method B, including stray load loss measure.

Motor Horsepower	NEMA Efficiency INDEX Letter	Minimum Efficiency %
	1800 RPM Synchronous Speed	
7.5-10	F	89.5
15-20	E	91.0
25-30	E	92.4
40	D	93.0
50	C	93.0
60	C	93.6
75	C	94.1
100-125	B	94.5
150-200	B	95.0

1200 RPM Synchronous Speed		
3-5	G	87.5
7.5	G	89.5
10	F	89.5
15	F	90.2
20	E	90.2
25-30	E	91.7
40-50	D	93.0
60	D	93.6
75	C	93.6
100-125	C	94.1
150-200	B	95.0

2.02 MOTOR CONTROLLERS (STARTERS)

A. All motor controllers (for equipment furnished under Division 23) shall be furnished under Division 23 and installed under Division 26 unless otherwise noted on the plans.

1. Starters shall be provided for 3 phase motors 3/4 horsepower and greater.

B. Motor starters shall be furnished as follows.

1. GENERAL: Motor starters shall be Square D Company Class 8536 across-the-line magnetic type, full-voltage, non-reversing (FAVOR) starter. All starters shall be constructed and tested in accordance with the latest NEMA standards, sizes and horsepower. ICE sizes are not acceptable. Starters shall be mounted in a general purpose dead front, painted steel enclosure and surface-mounted. Provide size and number of poles as shown and required by equipment served. Provide two speed, two winding or two speed, single winding motor starter as required for two speed motors.
2. CONTACTS: Magnetic starter contacts shall be double break solid silver alloy. All contacts shall be replaceable without removing power wiring or removing starter from panel. The starter shall have straight-through wiring.
3. OPERATING COILS: Operating coils shall be 120 volts and shall be of molded construction. When the coil fails, the starter shall open and shall not lock in the closed position.
4. OVERLOAD RELAYS: Provide manual reset, trip-free Class 20 overload relays in each phase conductor in of all starters. Overload relays shall be melting alloy type with visual trip indication. All 3 phase and single phase starters shall have one overload relay in each underground conductor. Relay shall not be field adjustable from manual to automatic reset. Provide 6 overload relays for two speed motor starters.
5. PILOT LIGHTS: Provide a red running pilot light for all motor starters. Pilot lights shall be mounted in the starter enclosure cover. Pilot lights shall be operated from an interlock on the motor starter and shall not be wired across the operating coil.
6. CONTROLS: Provide starters with HAND-OFF-AUTOMATIC switches. Coordinate additional motor starter controls with the requirements of Division 23. Motor starter controls shall be mounted in the starter enclosure cover.
7. CONTROL POWER TRANSFORMER: Provide a single-phase 480 volt control power transformer with each starter for 120 volt control power. Connect the primary side to the line side of the motor starter. The primary side shall be protected by a fuse for each conductor. The secondary side shall have one leg fused and one leg grounded. Arrange transformer terminals so that wiring to terminals will not be located above the transformer.
8. AUXILIARY CONTACTS: Each starter shall have one normally open and one normally closed convertible auxiliary contact in addition to the number of contacts required for the "holding interlock", remote monitoring, and control wiring. In addition, it shall be possible to field-install three more additional auxiliary contacts without removing existing wiring or removing the starter from its enclosure.
9. UNIT WIRING: Unit shall be completely pre-wired to terminals to eliminate any interior field wiring except for line and load power wiring and HVAC control wiring.
10. ENCLOSURES: All motor starter enclosures shall be NEMA 1, general purpose enclosures or NEMA-3R if mounted exposed to high moisture conditions. Provide NEMA 4X when located by cooling towers.

11. POWER MONITOR: Provide a square "D" 8430 MPS phase failure and under-voltage relay, base and wiring required for starters serving all 3 phase motors. Set the under-voltage setting according to minimum voltage required for the motor to operate within its range.

C. APPROVED MANUFACTURERS: Controller numbers are based on first named manufacturer. Provide one of the following manufacturer's.

1. Siemens.
2. Square D.
3. General Electric.
4. Eaton.

2.03 COMBINATION MOTOR STARTERS

A. GENERAL: Combination motor starters shall consist of a magnetic starter and a fusible or non-fusible disconnect switch in a dead front, painted steel NEMA 1 enclosure unless otherwise noted and shall be surface-mounted. Size and number of poles shall as shown and required by equipment served. Combination motor starters shall be as specified for motor starters in Paragraph 2.01/B, except as modified herein.

B. DISCONNECT SWITCH: Disconnect switches shall be as specified in Section 26 28 16.

C. APPROVED MANUFACTURERS: Controller numbers are based on first named manufacturer. Provide one of the following manufacturer's.

1. Siemens.
2. Square D.
3. General Electric.

PART 3 - EXECUTION

3.01 All equipment shall be installed in accordance with the manufacturers' recommendations and printed installation instructions.

3.02 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractors' price shall include all items required as per manufacturers' requirements.

3.03 INSTALLATION

A. GENERAL: Install in a professional manner. Any part or parts not meeting this requirement shall be replaced or rebuilt without extra expense to Owner.

B. Install rotating equipment in static and dynamic balance.

C. Provide foundations, supports, and isolators properly adjusted to allow minimum vibration transmission within the building.

D. Correct objectionable noise or vibration transmission in order to operate equipment satisfactorily as determined by the Engineer.

END OF SECTION

SECTION 23 05 26
VARIABLE FREQUENCY MOTOR SPEED CONTROL FOR HVAC EQUIPMENT

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

A. Section 1.01 A in Section 23 05 13

B. Section 1.01 B in Section 23 05 13

C. Furnish and install a complete adjustable frequency motor speed control for the following item:

1. Variable volume air handling units

1.02 RELATED SECTIONS

A. Section 23 02 00 – Basic Materials and Methods

B. Section 23 05 13 – Common Motor Requirements for HVAC Equipment

C. Section 23 05 93 – Testing, Adjusting and Balancing

D. Section 23 09 63 – Automatic Temperature Controls

E. Section 23 73 13 – Modular Indoor Central Station Air Handling Units

1.03 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Certified noise data shall be submitted by drive manufacturer. Noise generated by variable frequency motor speed control drive shall not exceed preferred “RC” as listed in 1995 ASHRAE HVAC Applications, Chapter 43 Sound and Vibration Control, Table 2 Criteria For Acceptable HVAC Noise in Unoccupied Rooms.

1.04 WARRANTY

A. Warranty shall be 24 months from the date of certified start-up, not to exceed 30 months from the date of shipment. The warranty shall include all parts, labor, travel time and expenses. There shall be 365/24 support available via a toll free phone number.

1.05 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be stored and handled per manufacturer’s instructions.

1.6 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner’s operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. ABB

B. Yaskawa/Magnetek

2.02 ADJUSTABLE FREQUENCY INVERTER

A. The AFD package as specified herein shall be enclosed in a NEMA 12 enclosure for interior applications and NEMA 4X stainless steel for exterior applications; completely assembled and tested by the manufacturer in an ISO9001 facility. The AFD shall operate from a line of +30% over nominal, and the under voltage trip level shall be 35% under the nominal voltage as a minimum.

B. The fused input shall utilize fast acting current limiting type per manufacturer recommendations.

C. The variable frequency power and logic unit shall be completely solid state. The unit shall transform 480 volt, 3 phase, 60 hertz input power into frequency and voltage controlled, 3 phase output power suitable to provide positive speed and torque control to the fan motor. The speed control shall be step-less throughout the speed range under variable torque load on a continuous basis. The adjustable frequency control shall be of a pulse width modulated type utilizing a full wave diode bridge rectifier; and shall have a power factor of 0.95 or better at all motor loads.

D. All AFD's shall have the same customer interface, including a backlit LCD two line digital display, and keypad, regardless of horsepower rating. The keypad is to be used for local control, for setting all parameters, and for stepping through the displays and menus. The keypad shall be removable, capable of remote mounting, and shall have it's own non-volatile memory. The keypad shall allow for uploading and downloading of parameter settings as an aid for the start-up of multiple AFD's. The keypad shall include Hand-Off-Auto membrane selections. When in "Hand", the AFD will be started and the speed will be controlled from the up/down arrows. When in "Off", the AFD will be stopped. When in "Auto", the AFD will start via an external contact closure and the AFD speed will be controlled via an external speed reference.

E. The adjustable frequency inverter shall conduct no radio frequency interference (RFI) back to the input power line.

F. The AFD shall have an integral 5% impedance line reactor to reduce the harmonics to the power line and to add protection from AC line transients. The inverter/reactor shall be a single wiring point.

2.03 SELF PROTECTION

A. The following features for self-protection shall be included:

1. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes. The minimum FLA rating shall meet or exceed the values in the NEC/UL Table 430-150 for 4-pole motors.
2. Limit the output current in under 50 microseconds due to phase to phase short circuits or severe overload conditions.
3. Protect the inverter due to non-momentary power or phase loss. The under voltage trip shall activate automatically when the line voltage drops 15% below rated input voltage.
4. Protect the inverter due to voltage levels in excess of its rating. The overvoltage trip shall activate automatically when the DC bus in the controller exceeds 1000 VDC.
5. Protect the inverter from elevated temperatures in excess of its rating. An indicating light that begins flashing within 10 degrees C of the trip shall be provided to alert the operator to the increasing temperature condition. When the over temperature trip point is reached, this light shall be continuously illuminated.
6. The inverter shall be equipped such that a trip condition resulting from overcurrent, under voltage, overvoltage or over temperature shall be automatically reset, and the inverter shall be automatically reset, and the inverter shall automatically restart upon removal, or correction of the faulty condition.

7. Status lights for indication of conditions described above shall be provided. A SPDT contact for remote indication shall be provided. Additionally, status lights to show power on, zero speed, and drive enabled shall be provided. All status lights shall be self-contained in the front panel of the unit and shall be duplicated for ease of troubleshooting on the inside of the unit.
8. Current and voltage signals shall be isolated from logic circuitry.
9. Drive logic shall be microprocessor based.
10. In the event of a sustained power loss, the control shall shut down safely without component failure. Upon return of power, the system shall automatically return to normal operation if the start is in the “On” condition.
11. In the event of a momentary power loss, the control shall be shut down safely without component failure. Upon return of power, the system shall automatically return to normal operation (if the start is in the “On” position) being able to restart into a rotating motor regaining positive speed control without shutdown or component failure.
12. In the event of a phase to phase short circuit, the control shall shut down safely without component failure.
13. In the event that an input power contactor is opened or closed while the control is activated, no damage shall result.
14. To facilitate startup and troubleshooting, the control shall operate without a motor or any other equipment connected to the inverter output.

2.04 ELECTRICAL CONSTANT SPEED BYPASS

A. Provide all components and circuitry necessary to provide manual full bypass of the inverter. The bypass package shall be mounted in a cabinet common with the inverter and shall be constructed in such as manner that the inverter can be removed for repair while still operating the motor in the “bypass” mode. Fast-acting semi-conductor with a fuse block shall be provided to isolate the drive for service. Bypass designs that have no such fuses must have a lockable disconnect that isolates the drive while running in bypass mode. The Contractor device shall be NEC approved. A common start/stop signal shall be used for both the variable frequency drive mode and bypass mode. Manual bypass shall contain the following:
   1. Two contactors mechanically interlocked via a three position through the door selector switch or keypad to provide the following controls:
      a. “Inverter” mode connects the motor to the output of the inverter.
      b. “Bypass” mode connects the motor to the input since wave power. Transfer must occur with input disconnect open. Motor is protected via electronic overload.
      c. “Off” mode disconnects motor from all input power.
      d. A molded case circuit breaker with door interlocked handle (lock out type) that interrupts input power to both the bypass circuitry and the drive.
      e. Customer Interlock Terminal Strip – provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is Hand, Auto, or Bypass mode. The remote start/stop contact shall operate in AFD and bypass modes.
      f. An electronic overload selectable for class 20 or 30 shall provide protection of the motor in Bypass mode.
   2. The following indicating lights (LED type) shall be provided. A test mode or push to test feature shall be provided.
      a. Power on
      b. External fault
      c. Drive mode selected
      d. Bypass mode selected
      e. Drive running
      f. Bypass running
      g. Drive fault
      h. Bypass fault
      i. Bypass-H-O-A mode
      j. Automatic transfer to bypass selected
   3. The following relay (form C) outputs from the bypass shall be provided:
      a. System started
      b. System running
      c. Bypass override enabled

d. Drive fault
e. Bypass fault (motor overload or under load (broken belt))
f. Bypass H-O-A position

4. The AFD shall include a “run permissive circuit” that will provide a normally open contact any time a run command is provided (local or remote start command in AFD or bypass mode). The AFD system (AFD or bypass) shall not operate the motor until it receives a dry contact closure from a damper or valve end-switch). When the AFD systems safety interlock (fire detector, freeze stat, high static pressure switch, etc) opens, the motor shall coast to a stop and the run permissive contact shall open, closing the damper or valve.
5. There shall be an internal switch to select manual or automatic bypass.
6. There shall be an adjustable current sensing circuit for the bypass to provide loss of load indication when in the bypass mode.
7. The bypass mode must include a under voltage and phase loss relay to protect the motor from single phase power and under voltage conditions.
   a. Bypass shall be UL listed.
   b. Bypass shall carry a UL 508 label.

2.05 FEATURES AND SPECIFICATIONS

A. Output frequency shall not vary with load or with any input frequency variations. Output frequency shall not vary within +/-10% input voltage changes. Output frequency shall not vary with temperature changes within the ambient specification.

B. No auxiliary equipment shall be required. The output frequency shall be adjusted in proportion to 4-20 m.A. signal.

C. A zero to five volt DC signal shall be provided for remote indication. This 0 to 5 volt DC signal shall vary in direct proportion to the controller speed.

D. The controller shall be started or stopped by a contact closure or through serial communications.

E. A single pole, double throw contact shall be provided for remote indication. Contact will change state when any trip condition has occurred. (contact rated for 12-250 VAC-2 AMPS).

F. A second single pole, double throw contact shall be provided for remote indication. Contact will state when the VFD receives a run command (contact rated for 12-250 VAC-24 AMPS).

G. PID Setpoint controller shall be standard in the drive, allowing a pressure or flow signal to be connected to the AFD, using the microprocessor in the AFD for the closed loop control. The AFD shall have 250 ma of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The PID setpoint shall be adjustable from the AFD keypad, analog inputs, or over the communications bus.

H. Unit to operate from a 4 to 20 m.A. VDC input signal and shall have hand-off-auto switch and door mounted potentiometer controls for manual speed selection.

I. Acceleration and deceleration times shall be adjustable from 30 to 300 seconds.

J. The drive shall have the ability to invert the speed signal input, as well as having offset and gain controls for speed signal conditioning.

K. Minimum and maximum speeds shall be adjustable in automatic and manual modes.

L. Hazard inputs shall be provided, capable of up to two inputs (fire, freeze). These shall each be capable of safely shutting down the inverter and illuminating a front panel hazard light depicting that a hazard condition turned the inverter off.

M. The inverter shall be a starter, containing a door interlocked input disconnect switch and manual reset motor electronic overloads, with accessible reset on front door, when a bypass is not specified.

N. Solid state ground fault interrupt circuit.

O. The LED display shall monitor and display four parameters on a single display (i.e. frequency command, output frequency, output current, and torque).

P. A N.O. auxiliary run-time contact shall be provided for control signaling to auxiliary equipment. Contact shall close when the pump is brought on line and open when the pump is taken off line. Contact shall be rated 20 amps at 120 volts.

Q. Inverter shall be UL listed.

R. Certified factory start-up shall be provided for each drive by a factory authorized service center. A certified start-up form shall be filled out for each drive with a copy provided to the Owner, and a copy kept on file at the manufacturer

S. Factory trained application engineering and service personnel that are thoroughly familiar with the AFD products offered shall be locally available at both the specifying and installation locations. A 24/365 technical support line shall be available on a toll-free line.

A computer based training CD or 8-hour professionally generated video (VCR format) shall be provided to the Owner at the time of Substantial Completion. The training shall include installation, programming and operation of the AFD, bypass and serial communication..

T. Provide a motor end surge control voltage suppressive filter if the VFD manufacturer can not limit their voltage surges to under 1000 volt at 100 feet.

U. Provide a motor acoustic noise reduction filter capable of approximately 12 dBA attenuation, if the VFD raises the dBa level above 3 dBa at a distance of 3 feet from the motor.

V. Provide each unit with a 3% reactor which is mounted on both the positive and negative DC bus. The reactor shall be a single wiring point and mounted internally to the drive.

PART 3 – INSTALLATION

3.01 Install units in accordance with manufacturer's published installation instructions. Variable frequency speed control shall be located so that wiring to motor does not exceed 100 feet.

END OF SECTION

SECTION 23 05 29
HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT - HVAC

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods is included as a part of this Section as though written in full in this document.

1.02 WORK INCLUDED

A. Pipe, and equipment hangers, supports and associated anchors.

B. Sleeves and seals.

C. Flashing and sealing equipment and pipe stacks.

1.03 RELATED WORK

A. Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment.

B. Section 23 07 16 – HVAC Equipment Insulation.

C. Section 23 07 19 – HVAC Piping Insulation.

D. Section 23 21 13 – Above Ground Hydronic Piping.

E. Section 23 21 19 – Hydronic Specialties.

F. 23 31 13 – Metal Ductwork.

G. 23 36 19 – Parallel Fan Powered Terminal Unit

H. 23 55.00 – Electric Unit Heater

I. 23 34 00 – HVAC Fan.

1.04 REFERENCES

A. ANSI/ASME B31.1 - Power Piping.

1.05 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Indicate hanger and support framing and attachment methods.

PART 2 - PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.

C. Hangers for Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roller, double hanger.

D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods; cast iron roller and stand for pipe sizes 6 inches and over.

E. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

F. Wall Support for Pipe Sizes 4 Inches and over: adjustable steel yoke and cast iron roller.

G. Vertical Support: Steel riser clamp.

H. Floor Support for Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

I. Floor Support for Pipe Sizes 6 Inches and Over: Adjustable cast iron roller and stand, steel screws, and concrete pier or steel support.

J. Copper Pipe Support and Hangers: Electro-galvanized with thermoplastic elastomer cushions; Unistrut “Cush-A-Clamp” or equal. Hangers: Plastic coated; Unistrut or equal.

K. For installation of protective shields refer to Section 22 05 29.

L. Shields for Vertical Copper Pipe Risers: Sheet lead.

2.02 HANGER RODS

A. Galvanized Hanger Rods: Threaded both ends, threaded one end, or continuous threaded.

2.03 INSERTS

A. Inserts: Malleable iron case with galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.04 FLASHING

A. Metal Flashing: 20 gage galvanized steel.

B. Caps: Steel, 20 gage minimum; 16 gage at fire resistant elements.

C. Coordinate with roofing contractor/Architect for type of flashing on metal roofs.

2.05 EQUIPMENT CURBS

A. Fabricate curbs of hot dipped galvanized steel.

B. For metal roof construction, roof curbs shall be made of aluminum or stainless steel. Coordinate with Architectural Drawings and details.

2.06 SLEEVES

A. Sleeves for Pipes through Non-fire Rated Floors: Form with 18 gage galvanized steel, tack welded to form a uniform sleeve.

B. Sleeves for Pipes through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Form with steel pipe, Schedule 40.

C. Sleeves for Pipes through Fire Rated and Fire Resistive Floors and Walls, and Fireproofing: Prefabricated fire rated steel sleeves including seals, UL listed.

D. Sleeves for Round Ductwork: Form with galvanized steel.

E. Sleeves for Rectangular Ductwork: Form with galvanized steel.

F. Fire Stopping Insulation: Glass fiber type, non-combustible, U.L. listed.

G. Caulk: Paintable 25-year acrylic sealant.

2.07 FABRICATION

A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

B. Design hangers without disengagement of supported pipe.

2.08 FINISH

A. Prime coat exposed steel hangers and supports. Hangers and supports located above suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.01 INSERTS

A. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams. Coordinate with Structural Engineer for placement of inserts.

B. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

C. Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.

D. Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab. Verify with Structural Engineer prior to start of work.

3.02 PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as follows:

PIPE SIZE	MAX. HANGER SPACING	HANGER DIAMETER
(Steel Pipe)		
1/2 to 1-1/4 inch	7’-0”	3/8"
1-1/2 to 3 inch	10'-0"	3/8"
PIPE SIZE	MAX. HANGER SPACING	HANGER DIAMETER
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"
(Copper Pipe)		
1/2 to 1-1/4 inch	5'-0"	3/8"
1-1/2 to 2-1/2 inch	8'-0"	3/8"
3 to 4 inch	10'-0"	3/8"
6 to 8 inch	10'-0"	1/2"

B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

C. Place a hanger within 12 inches of each horizontal elbow, and at the vertical to horizontal transition.

D. Use hangers with 1-1/2 inch minimum vertical adjustment.

E. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

F. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

G. Support riser piping independently of connected horizontal piping.

H. Install hangers with nut at base and above hanger; tighten upper nut to hanger after final installation adjustments.

I. Distances between supports are maximum distance. Supports shall be provided to carry the pipe/equipment load.

3.03 Insulated Piping: Comply with the following installation requirements.

A. Clamps: Attach galvanized clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.

B. Saddles: Install galvanized protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.

C. Shields: Install protective shields MSS Type 40 on cold and chilled water piping that has vapor barrier. Shields shall span an arc of 180 degrees and shall have dimensions in inches not less than the following:

NPS	LENGTH	THICKNESS
1/4 THROUGH 3-1/2	12	0.048
4	12	0.060
5 & 6	18	0.060
8 THROUGH 14	24	0.075
16 THROUGH 24	24	0.105

D. Piping 2” and larger: provide galvanized sheet metal shields with calcium silicate insulation at hangers/supports.

E. Insert material shall be at least as long as the protective shield.

F. Thermal Hanger Shields: Install where indicated, with insulation of same thickness as piping.

3.04 EQUIPMENT BASES AND SUPPORTS

A. Provide equipment bases of concrete.

B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct support of steel members. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.05 FLASHING

A. Provide flexible flashing and metal counter flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Provide curbs for mechanical roof installations 8 inches minimum high above roofing surface. Contact Architect for all flashing details and roof construction. Seal penetrations watertight.

3.06 SLEEVES

A. Set sleeves in position in formwork. Provide reinforcing around sleeves.

B. Extend sleeves through floors minimum one inch above finished floor level. Caulk sleeves full depth with fire rated thermfiber and 3M caulking and provide floor plate.

C. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with U.L. listed fire stopping insulation and caulk seal air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

END OF SECTION

SECTION 23 05 48
VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. This Section and Section 23 02 00 – Basic Materials and Methods are part of each Division 23 Section which references the vibration control products specified herein.

1.02 WORK INCLUDED

A. Vibration and sound control products.

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of vibration control products of type, size, and capacity required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Vibration and sound control products shall conform to ASHRAE criteria for average noise criteria curves for all equipment at full load conditions.

C. Unless otherwise indicated, sound and vibration control products shall be provided by a single manufacturer.

1.04 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Amber/Booth Company, Inc.

B. Mason Industries, Inc.

C. Noise Control, Inc.

2.02 GENERAL

A. Provide vibration isolation supports for equipment, piping and ductwork, to prevent transmission of vibration and noise to the building structure that may cause discomfort to the occupants.

B. Model numbers of Amber/Booth products are included for identification. Products of the additional manufacturers will be acceptable provided they comply with all of the requirements of this specification.

2.03 FLOOR MOUNTED AIR HANDLING UNITS

A. Provide Amber/Booth XLW-2, style C aluminum housed isolators sized for 2" static deflection. Cast iron or steel housings may be used provided they are hot-dip galvanized after fabrication

B. If floor mounted air handling units are furnished with internal vibration isolation option, provide 2"

thick Amber/Booth type NRC ribbed neoprene pads to address high frequency breakout and afford additional unit elevation for condensate drains. Ribbed neoprene pads shall be located in accordance with the air handling unit manufacturer's recommendations.

2.04 SUSPENDED FANS AND FAN COIL UNITS

A. Provide Amber/Booth type BSS spring hangers sized for 1'' static deflection.

2.05 BASE MOUNTED CHILLERS

A. Amber/Booth type SP-NR style E flexplate pad isolators consisting of two layers of 3/8'' thick alternate ribbed neoprene pad bonded to a 16 gage galvanized steel separator plate.

B. Pads shall be sized for approximately 40 PSI loading and 1/8'' deflection.

2.6 PIPING

A. Provide spring and rubber-in-shear hangers, Amber/Booth type BSR in mechanical equipment rooms, for a minimum distance of 50 feet from isolated equipment for all chilled water and hot water piping 1-1/2'' diameter and larger. Springs shall be sized for 1'' deflection.

B. Floor supported piping is required to be isolated with Amber/Booth type SW-1 open springs sized for 1'' deflection.

C. Furnish line size flexible connectors at supply and return of pumps, Amber/Booth style 2800 single sphere EPDM construction, connector shall include 150 lb. cadmium plated carbon steel floating flanges.

2.7 CORROSION PROTECTION

A. All vibration isolators shall be designed and treated for resistance to corrosion.

B. Steel components: PVC coated or phosphated and painted with industrial grade enamel. Nuts, bolts, and washers: zinc-electroplated.

PART 3 - EXECUTION

3.01 All equipment shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

3.02 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

3.03 If internal isolation option is used on air handling units, the mechanical contractor shall verify proper adjustment and operation of isolators prior to start-up. All shipping brackets and temporary restraint devices shall be removed.

3.04 The vibration isolation supplier shall certify in writing that he has inspected the installation and that all external isolation materials and devices are installed correctly and functioning properly.

END OF SECTION

SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 – Basic Materials and Methods is included as a part of this Section as though written in full in this document.

1.02 SCOPE

Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

1.03 Refer to Architectural Sections for additional requirements.

PART 2 - PRODUCTS

2.01 VALVE AND PIPE IDENTIFICATION

A. Valves:

1. All valves shall be identified with a 1-1/2" diameter brass disc wired onto the handle. The disc shall be stamped with 1/2" high depressed black filled identifying numbers. These numbers shall be numerically sequenced for all valves on the job.
2. The number and description indicating make, size, model number and service of each valve shall be listed in proper operational sequence, properly typewritten. Three copies to be turned over to Owner at completion.
3. Tags shall be fastened with approved meter seal and 4 ply 0.018 smooth copper wire. Tags and fastenings shall be manufactured by the Seton Name Plate Company or approved equal.
4. All valves shall be numbered serially with all valves of any one system and/or trade grouped together.

B. Pipe Marking:

1. All interior visible piping located in accessible spaces such as above accessible ceilings, equipment rooms, attic space, under floor spaces, etc., shall be identified with all temperature pipe markers as manufactured by W.H. Brady Company, 431 West Rock Ave., New Haven, Connecticut, or approved equal.
2. All exterior visible piping shall be identified with UV and acid resistant outdoor grade acrylic plastic markers as manufactured by Set Mark distributed by Seton (Name plate Company Factory location 20 Thompson Road, Branford, Connecticut) or approved equal.
3. Generally, markers shall be located on each side of each and every partition, on each side of every tee, on each side of every valve and/or valve group, on each side of every piece of equipment, and, for straight runs, at equally spaced intervals not to exceed 75 feet. In congested area, marks shall be placed on each pipe at the points where it enters and leaves the area and at the point of connection of each piece of equipment and automatic control valve. All markers shall have directional arrows.
4. Markers shall be installed after final painting of all piping and equipment and in such a manner that they are visible from the normal maintenance position. Manufacturer's installation instructions shall be closely followed.

5. Markers shall be colored as indicated below per ANSI/OSHA Standards:

SYSTEM	COLOR	LEGEND
Chilled Water	Green	Chilled Water Supply Chilled Water Return

C. Pipe Painting:

1. All piping exposed to view shall be painted as indicated or as directed by the Architect in the field. Confirm all color selections with Architect prior to installation.
2. All piping located in mechanical rooms and exterior piping shall be painted as indicated below:

System	Color
Chilled Water Supply and Return	Light Blue

PART 3 - EXECUTION

3.01 All labeling equipment shall be installed as per manufacturer's printed installation instructions.

3.02 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractors price shall include all items required as per manufacturer's requirements.

3.03 All piping shall be cleaned of rust, dirt, oil and all other contaminants prior to painting. Refer to Division 9 for Architect's required paint system(s).

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 – Basic Materials and Methods is included as a part of this Section as though written in full in this document.

1.02 RELATED DOCUMENTS

Approved submittal date on equipment installed, to accomplish the test procedures, outlined under paragraph 3.01 of this Section, will be provided by the Contractor.

1.03 DESCRIPTION

A. The TAB of the air conditioning systems shall be performed by an impartial technical firm hired by the Design Build Firm whose operations are limited only to the field of professional TAB. The TAB work will be done under the direct supervision of a qualified engineer employed by the TAB firm.

B. The TAB firm will be responsible for inspecting, adjusting, balancing, and logging the date on the performance of fans, dampers in the duct system, and air distribution devices. The Contractor and the various Subcontractors of the equipment installed shall cooperate with the TAB firm to furnish necessary data on the design and proper applications of the system components and provide labor and material required to eliminate deficiencies or malperformance.

1.04 QUALITY ASSURANCE

A. QUALIFICATIONS OF CONTRACTOR PERSONNEL: Submit evidence to show that the personnel who shall be in charge of correcting deficiencies for balancing the systems are qualified. The Owner and Engineer reserve the right to require that the originally approved personnel be replaced with other qualified personnel if, in the Owner and Engineer's opinion, the original personnel are not qualified to properly place the system in condition for balancing.

B. QUALIFICATIONS OF TAB FIRM PERSONNEL:
1. A minimum of one registered Professional Engineer licensed in the State, is required to be in permanent employment of the firm.
2. Personnel used on the jobsite shall be either Professional Engineers or technicians, who shall have been permanent, full time employees of the firm for a minimum of six months prior to the start of Work for that specified project.
3. Evidence shall be submitted to show that the personnel who actually balance the systems are qualified. Evidence showing that the personnel have passed the tests required by the Associated Air Balance Council (AABC) shall be required.

C. CALIBRATION LIST: Submit to the Engineer for approval, a list of the gauges, thermometers, velometer, and other balancing devices to be used in balancing the system. Submit evidence to show that the balancing devices are properly calibrated before proceeding with system balancing.

1.05 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner’s operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:
1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.

5. Most likely failure modes, causes and corrections.
6. On site demonstration.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 SERVICES OF THE CONTRACTOR

A. The Drawings and Specifications have indicated valves, dampers, and miscellaneous adjustment devices for the purpose of adjustment to obtain optimum operating conditions. Install these devices in a manner that leaves them accessible, and provide access as requested by the TAB firm.

B. Have systems complete and in operational readiness prior to notifying the TAB firm that the project is ready for their services, and certify in writing to the Architect and Owner that such a condition exists.

C. As a part of the Work of this Section, make changes in the sheaves, belts, and dampers or the addition of dampers required for correct balance of the new work as required by the TAB firm, at no additional cost to the Owner.

D. Fully examine the system to be balanced, to determine whether or not sufficient volume dampers, balancing valves, thermometers, gauges, pressure and temperature taps, means of reading static pressure and total pressure in duct systems, means of determining water flow, and other means of taking data needed for proper water and air balancing are existing. Submit to the Engineer in writing a listing of omitted items considered necessary to balance existing systems. Submit the list and proposal as a cost add item.

E. Verify that fresh air louvers are free of blockage, coils are clean and fresh air ducts to each air handling unit have individually adjustable volume regulating dampers.

F. Provide, correct, repair, or replace deficient items or conditions found during the testing, adjusting, and balancing period.

G. In order that systems may be properly tested, balanced, and adjusted as specified, operate the systems at no expense to the Owner for the length of time necessary to properly verify their completion and readiness for TAB period.

H. Project construction schedules shall provide time to permit the successful completion of TAB services prior to Substantial Completion. Complete, operational readiness, prior to commencement of TAB services, shall include the following services of the Contractor:

1. Construction status of building shall permit the closing of doors, windows, ceilings installed and penetrations complete, to obtain project operating conditions.
2. AIR DISTRIBUTION SYSTEMS:
    a. Verify installation for conformity to design. Supply, return, and exhaust ducts terminated and pressure tested for leakage as specified.
    b. Volume and fire dampers properly located and functional. Dampers serving requirements of minimum and maximum outside air, return and relief shall provide tight closure and full opening, smooth and free operation.
    c. Supply, return, exhaust and transfer grilles, registers and diffusers shall be installed.
    d. Air handling systems, units and associated apparatus, such as heating and cooling coils, filter sections, access doors, etc., shall be blanked and sealed to eliminate excessive bypass or leakage of air.
    e. Fans (supply and exhaust) operating and verified for freedom from vibrations, proper fan rotation and belt tension; overload heater elements shall be of proper size and rating; record motor amperage and voltage and verify that these functions do not exceed nameplate ratings.
    f. Furnish or revise fan drives or motors as necessary to attain the specified air volumes.

3. WATER CIRCULATING SYSTEMS:
   a. Position valves pertinent to system design and require operation to permit full flow of water through system components. Operate hydronic systems under full flow conditions until circulating water is clean. Remove and clean strainers as required during this cycle of operation.
   b. Record each pump motor amperage and voltage. Readings shall not exceed nameplate rating.
   c. Verify, on new equipment, electrical starter overload heater elements to be of proper size and rating.
   d. Ensure that water circulating systems shall be full of water and free of air; expansion tanks set for proper water level, and air vents installed at high points of systems and operating freely. Advise Engineer of deficiencies.
   e. Check and set operating temperatures of heat exchangers to design requirements.
   f. The various existing water circulating systems shall be cleaned, filled, purged of air, and put into operation before hydronic balancing.
4. AUTOMATIC CONTROLS:
   a. Verify that control components are installed in accordance with project documents and functional, electrical interlocks, damper sequences, air and water resets, fire and freeze stats.
   b. Controlling instruments shall be functional and set for design operating conditions. Factory precalibration of room thermostats and pneumatic equipment will not be acceptable.
   c. The temperature regulation shall be adjusted for proper relationship between the controlling instruments and calibrated by the TAB Contractor. Advise Engineer of deficiencies or malfunctions.

I. Contractor shall repair any insulation removed from piping system by TAB Contractor during water balancing.

3.02 SERVICES OF THE TAB FIRM

A. The TAB firm will act as liaison between the Owner, Engineer, and the Contractor and inspect the installation of mechanical piping system, sheet metal work, temperature controls and other component parts of the heating, air conditioning and ventilating systems being retrofitted, repaired, or added under this Contract. The reinspection of the Work will cover that part related to proper arrangement and adequate provision for the testing and balancing and will be done when the Work is 80 percent complete.

B. Upon completion of the installation and start-up of the mechanical equipment, to check, adjust, and balance system components to obtain optimum conditions in each conditioned space in the building. Prepare and submit to the Engineer complete reports on the balance and operations of the systems.

C. Measurements and recorded readings of air, water, and electricity that appear in the reports will be done by the permanently employed technicians or engineers of the TAB firm.

D. Make an inspection in the building during the opposite season from that in which the initial adjustments were made. At the time, make necessary modifications to the initial adjustments required to produce optimum operation of system components to affect the proper conditions as indicated on the Drawings. At time of opposite season check-out, the Owner's representative will be notified before readings or adjustments are made.

E. In fan systems, the air quantities indicated on the Drawings may be varied as required to secure a maximum temperature variation of two degrees within each separately controlled space, but the total air quantity indicated for each zone must be obtained. It shall be the obligation of the Contractor to furnish or revise fan drive and motors if necessary, without cost to the Owner, to attain the specified air volumes.

3.03 PROFESSIONAL REPORT

A. Before the final acceptance of the report is made, the TAB firm will furnish the Engineer the following data to be approved by the Owner and Engineer:

1. Summary of main supply, return and exhaust duct pitot tube traverses and fan settings indicating minimum value required to achieve specified air volumes.
2. A listing of the measured air quantities at each outlet corresponding to the temperature tabulation as developed by the Engineer and TAB firm.
3. Air quantities at each return and exhaust air handling device.
4. Static pressure readings entering and leaving each supply fan, exhaust fan, filter, coil, balancing dampers and other components of the systems. Including the retrofit Work. These readings will be related to performance curves in terms of the CFM handled if available.
5. Motor current readings at each equipment motor on load side of capacitors. The voltages at the time of the reading shall be listed.
6. The final report shall certify test methods and instrumentation used, final velocity reading obtained, temperatures, pressure drops, RPM of equipment, amperage of motors, air balancing problems encountered, recommendations and uncompleted punch list items. The test results will be recorded on standard forms.
7. A summary of actual operating conditions shall be included with each system outlining normal and ventilation cycles of operation. the final report will act as a reference of actual operating conditions for the Owner's operating personnel.

3.04 BALANCING AIR CONDITIONING SYSTEM

A. GENERAL:

1. Place all equipment into full operation, and continue operating during each working day of balancing and testing. If the air conditioning system is balanced during Off-Peak cooling season Contractor shall return to rebalance air side system as required to put system in proper balance at that season.
2. The Contractor shall submit detailed balancing and recording forms for approval. After approval by the Engineer, prepare complete set of forms for recording test data on each system. All Work shall be done under the supervision of a Registered Professional Engineer. All instruments used shall be accurately calibrated to within 1% of scale and maintained in good working order.
3. Upon completion of the balancing and testing, the TAB Contractor shall compile the test data in report forms, and forward five copies to the Engineer for evaluation.
4. The final report shall contain logged results of all tests, including such data as:
   a. Tabulation of air volume at each outlet.
   b. Outside dry bulb and wet bulb temperature.
   c. Inside dry bulb and wet bulb temperatures in each conditioned space room or area.
   d. Actual fan capacities and static pressures. Motor current and voltage readings at each fan.

B. AIR SYSTEMS: Perform the following operations as applicable to balance and test systems:

1. Check fan rotation.
2. Check filters (balancing shall be done with clean filters).
3. Test and adjust blower rpm to design requirements.
4. Test and record motor full load amperes.
5. Test and record system static pressures, suction and discharge.
6. Test and adjust system for design cfm, return air and outside air (±2%). Change-out fan sheaves as required to balance system.
7. Test and record entering air temperatures, db and wb.
8. Test and record leaving air temperatures, db and wb.
9. Adjust all zones to design cfm (±2%).
10. Test and adjust each diffuser, grille, and register to within 5% of design.

C. AIR DUCT LEAKAGE: (From SMACNA Duct Standards latest edition) Test all ductwork (designed to handle over 1000 CFM) as follows:

1. Test apparatus
   The test apparatus shall consist of:
   a. A source of high pressure air--a portable rotary blower or a tank type vacuum cleaner.
   b. A flow measuring device consisting of straightening vanes and an orifice plate mounted in a straight tube with properly located pressure taps. Each orifice assembly shall be accurately calibrated with its own calibration curve. Pressure and flow readings shall be taken with U-tube manometers.
2. Test Procedures
   a. Test for audible leaks as follows:
      1) Close off and seal all openings in the duct section to be tested. Connect the test apparatus to the duct by means of a section of flexible duct.
      2) Start the blower with its control damper closed.
      3) Gradually open the inlet damper until the duct pressure reaches 1.2 times the standard designed duct operating pressure.
      4) Survey all joints for audible leaks. Mark each leak and repair after shutting down blower. Do not apply a retest until sealants have set.
   b. After all audible leaks have been sealed, the remaining leakage should be measured with the orifice section of the test apparatus as follows:
      1) Start blower and open damper until pressure in duct reaches 25% in excess of designed duct operating pressure.
      2) Read the pressure differential across the orifice on manometer No. 2. If there is no leakage, the pressure differential will be zero.
      3) Total allowable leakage shall not exceed one (1) percent of the total system design air flow rate. When partial sections of the duct system are tested, the summation of the leakage for all sections shall not exceed the total allowable leakage.
      4) Even though a system may pass the measured leakage test, a concentration of leakage at one point may result in a noisy leak which must be corrected.

D. DX SYSTEMS:

1. Test and record suction and discharge pressures at each compressor and record ambient air temperature entering the condensing coils.
2. Test and record unit full load amps and voltage.
3. Test and record staging and unloading of unit required by sequence of operation or drawing schedule.

E. Automatic temperature controls shall be calibrated; and all thermostats and dampers adjusted so that the control system is in proper operating condition, subject to the approval of the Engineer/Owner.

F. The TAB Contractor shall report to Engineer all air distribution devices or other equipment that operate noisily so that corrective measures may be implemented by the Contractor at no additional cost to the Owner or Architect/Engineer.

END OF SECTION

SECTION 23 07 13
DUCT INSULATION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods is included as a part of this Section as though written in full in this document.

1.02 WORK INCLUDED

A. Ductwork system insulation.

1.03 RELATED SECTIONS

A. Section 23 02 13 – Basic Materials and Methods

B. Section 23 31 13 – Metal Ductwork

1.04 QUALITY ASSURANCE

A. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.

B. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.
   1. Exception: Outdoor mechanical insulation may have flame spread index of 75 and smoke developed index of 150.

C. Duct and plenum insulation shall comply with minimum R-value requirements of 2015 International Energy Conservation Code.

D. Adhesive and other material shall comply with NFPA and NBFU Standards No. 90A and 90B.

1.05 WARRANTY

A. Warrant the Work specified herein for two years against becoming unserviceable or causing an objectionable appearance resulting from either defective, or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:
   1. Mildewing.
   2. Peeling, cracking, and blistering.
   3. Condensation on exterior surfaces.

1.06 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in unopened containers with manufacturer's stamp, clearly labeled with flame and smoke rating, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove such from project site.

PART 2 - PRODUCTS

2.01 GENERAL DESCRIPTION

A. The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and approved before any insulation is installed.

B. A sample quantity of each type of insulation and each type of application shall be installed and approval secured prior to proceeding with the main body of the Work.

2.02 ACCEPTABLE MANUFACTURERS

A. Glass fiber materials shall be as manufactured by Knauf, Certain-Teed, Johns-Manville or Owens-Corning and shall have the same thermal properties, density, fire rating, vapor barrier, etc., as the types specified herein, subject to review by the Engineer.

B. Adhesives shall be as manufactured by Minnesota Mining, Arabol, Benjamin-Foster, Armstrong or Insulmastic, Inc., and shall have the same adhesive properties, fire rating, vapor seal, etc., as the types specified herein, subject to review by the Engineer.

PART 3 - EXECUTION

3.01 GENERAL

A. All insulation shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

3.02 EXTERNAL DUCT INSULATION

A. Fasten all longitudinal and circumferential laps with outward clinching staples 3" on center. On rectangular ducts over 24" wide apply as above and hold insulation in place on bottom side with mechanical pins and clips on 12" centers.

B. Seal all joints, fastener penetrations and other breaks in vapor barrier with 3 inch wide strips of white glass fabric embedded between two coats of vapor barrier mastic, Childers CP-30 or approved equal.

C. All external duct insulation shall be Johns Manville Microlite EQ or Microlite XG fiberglass duct wrap insulation with reinforced aluminum facing or approved equal.

D. External duct wrap is required on all outside air ducts, supply and return air ducts that are not internally insulated. Duct wrap shall be provided as follows:

1. 1½” thick, 1.0 PCF density minimum when ducts are located in conditioned spaces.
2. 2” thick with a minimum installed R-value of 6 when ducts are located in unconditioned spaces, such as ceiling plenum space.

3.03 EXPOSED DUCTWORK LOCATED INDOORS

A. Duct routed exposed in occupied spaces shall be externally insulated with ASTM C612, Type 1A or 1B, rigid glass fiber with factory-applied all service facing meeting ASTM C1136, Type II, with thickness as required in 3.2.D.

B. Round duct routed exposed shall be double wall with perforated inner liner and 1'' thick layer of fiberglass insulation as manufactured by United McGill Company model no. Acousti-27 or approved equal. Insulation density shall be a minimum of 1.0 PCF.

3.04 AIR DEVICE AND MISCELLANEOUS DUCT INSULATION

A. The backside of all supply air devices shall be insulated with taped and sealed 1½ inch thick external duct wrap.

B. The contractor shall install an additional layer of 1½ inch thick external fiberglass duct wrap on any portion of the supply air, return air, outside air, or exhaust air system that has condensation forming during any period of operation. The insulation shall be taped and sealed and located until all evidence of the condensation has been eliminated, at no additional cost to the Owner.

END OF SECTION

SECTION 23 07 16
HVAC EQUIPMENT INSULATION

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 – Basic Materials and Methods is included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for Owner's use.

B. Work specified elsewhere.

1. Basic materials and methods.
2. Piping systems.
3. Air distribution equipment.

1.3 WARRANTY

A. Warrant the Work specified herein for two years against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:

1. Mildewing.
2. Peeling, cracking, and blistering.
3. Condensation on exterior surfaces.

1.4 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

1.5 DELIVERY AND STORAGE

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in unopened containers with manufacturer’s stamp, clearly labeled with flame and smoke rating, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove such from project site.

PART 2 – PRODUCTS

2.1 It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.

2.2 The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and reviewed before any insulation is installed.

2.3 A sample quantity of each type of insulation and each type application shall be installed and reviewed prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.

2.4 Glass fiber materials as manufactured by Owens/Corning, PPG, CSG, or Johns Manville will be acceptable, if they comply with the specifications.

2.5 All insulation shall have composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) fire and smoke hazard as tested by Procedure ASTM E084, NFPA 255 and UL 723 not exceeding:

Flame Spread 25
Smoke Developed 50

2.6 Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above.

2.7 All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

PART 3 – EXECUTION

3.1 All insulation shall be installed in accordance with the manufacturer’s recommendations and printed installation instructions.

3.2 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer’s requirements.

3.3 CHILLED WATER PUMPS

A. Shall be insulated with Certain-Teed IB-600 rigid insulation board, 2" thick, cut and formed into a box and secured in place with 3/4" wide x .020 galvanized bands spaced on 9" centers. Bands shall be pulled snug over sheets of insulation board. All joints shall be well and neatly fitted and so arranged that the assembly may be dismantled with ease permitting access to the pump. All voids on the interior of box shall be filled with glass fiber blanket insulation. Exterior shall be finished with a trowel coat of Foster's 30-35 vapor barrier mastic, a layer of 1" mesh galvanized wire, and a coat of J.M. #352 cement. Final finish shall be an eight ounce canvas jacket, pasted and sealed in place with Foster's 30-36 Seafas.

B. Pipe insulation shall be extended over all cold parts of chilled water pumps not directly over drainage basin of pump base.

END OF SECTION

SECTION 23 07 19
HVAC PIPING INSULATION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 – Basic Materials and Methods is included as a part of this Section as though written in full in this document.

1.02 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for Owner's use.

B. Furnish and install piping insulation to:

1. Chilled water and heating hot water piping.
2. Condensate drain piping.
3. Refrigerant piping.
4. All pipes subject to freezing conditions shall be insulated.

C. Work specified elsewhere.

1. Painting.
2. Pipe hangers and supports.

D. For insulation purpose piping is defined as the complete piping system including supplies and returns, pipes, valves, automatic control valve bodies, fittings, flanges, strainers, thermometer well, unions, reducing stations, and orifice assemblies.

1.03 WARRANTY

A. Warrant the Work specified herein for two years against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.

B. Defects shall include, but not be limited to, the following:

1. Mildewing.
2. Peeling, cracking, and blistering.
3. Condensation on exterior surfaces.

1.04 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, project variations, and accessories.

1.05 DELIVERY AND STORAGE

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in unopened containers with manufacturer's stamp, clearly labeled with flame and smoke rating, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove such from project site.

PART 2 - PRODUCTS

2.01 It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.

2.02 The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and reviewed prior to installation.

2.03 A sample quantity of each type of insulation and each type application shall be installed and accepted prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.

2.04 All insulation shall have composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) fire and smoke hazard as tested by Procedure ASTM E084, NFPA 255 and UL 723 not exceeding:

Flame Spread 25
Smoke Developed 50

2.05 Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above.

2.06 All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

2.07 APPROVED MANUFACTURERS

A. Glass fiber materials shall be as manufactured by Johns Manville or Owens-Corning and shall have the same thermal properties, density, fire rating, vapor barrier, etc., as the types specified herein, subject to review by the Engineer.

B. Adhesives shall be as manufactured by Childers, Foster, HB Fuller or Armstrong, and shall have the same adhesive properties, fire rating, vapor seal, etc., as the types specified herein, subject to review by the Engineer.

C. Armaflex elastomeric cellular thermal insulation by Armstrong.

D. Metal jacketing and fitting covers shall be as manufactured by Childers or RPR Products.

2.08 MATERIALS

A. CHILLED WATER: Provide fiberglass pipe insulation with ASJ-SSL jacket or phenolic foam with ASJ and all joints sealed.

B. CONDENSATE DRAINAGE PIPING: Fire resistant fiberglass insulation; insulation not required when piping is exposed on roof.

C. REFRIGERANT PIPING: Refrigerant pipe insulation shall be model "AP-2000", fire rated for use in environmental air plenums. Apply manufacturers recommended finish and sealant for exterior applications.

D. METAL JACKETING: Utilize Childers "Strap-On" jacketing. Provide preformed fitting covers for all elbows and tees.

PART 3 - EXECUTION

3.01 All insulation shall be installed in accordance with the manufacturer's recommendations and printed installation instructions, including high density inserts at all hangers and pipe supports to prevent compression of insulation.

3.02 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

3.03 Pipes located outdoors shall be insulated same as concealed piping; and in addition shall have a jacket of 0.016 inch thick, smooth aluminum with longitudinal modified Pittsburg Z-Lock seam and 2 inch overlap. Jacketing shall be easily removed and replaced without damage. All insulation butt joints shall be sealed with gray silicone. Galvanized banding is not acceptable.

3.04 All insulated piping located over driveways shall have an aluminum shield permanently banded over insulation to protect it from damage from car antennas.

3.05 WATER PIPE INSULATION INSTALLATION

A. The insulation shall be applied to clean, dry pipes with all joints firmly butted together. Where piping is interrupted by fittings, flanges, valves or hangers and at intervals not to exceed 25 feet on straight runs, an isolating seal shall be formed between the vapor barrier jacket and the bare pipe. The seal shall be by the applications of adhesive to the exposed insulation joint faces, carried continuously down to and along 4 inches of pipe and up to and along 2 inches of jacket.

B. Pipe fittings and valves shall be insulated with pre-molded or shop fabricated glass fiber covers finished with two brush coats of vapor barrier mastic reinforced with glass fabric.

C. All under lap surfaces shall be clean and free of dust, etc. before the Joint is sealed. These laps shall be firmly rubbed to insure a positive seal. A brush coat of vapor retarder shall be applied to all edges of the vapor barrier jacket.

3.06 FIRE RATED INSULATION

A. All pipe penetrations through walls and concrete floors shall be fire rated by applying USG Thermafiber in the space between the concrete and the pipe.

B. The penetration shall be additionally sealed by using 3M brand model CP 25 or 303 fire barrier caulk and putty.

C. All fire rating material shall be insulated in accordance with manufacturer's printed instructions.

PART 4 - SCHEDULES

4.01 LOW TEMPERATURE SURFACES			MINIMUM INSULATION THICKNESS
A.	Condensate drain lines:		¾ inch
B.	Chilled Water Piping:		
	1.	Located outdoors:	2 inch
	2.	Located indoors:	
		a. 4 inch and smaller:	1½ inch
		b. Larger than 4 inch:	2 inch
C.	Refrigerant Piping		
	1.	1½" and smaller	1 inch
	2.	Larger than 1½ inch	1½ inch

END OF SECTION

SECTION 23 08 00
COMMISSIONING OF HVAC

PART 1 - GENERAL

1.01. SUMMARY

A. Section Includes:
1. HVAC commissioning description.
2. HVAC commissioning responsibilities.

1.02. REFERENCES

A. Associated Air Balance Council:
1. AABC - AABC Commissioning Guideline.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
1. ASHRAE Guideline 1 - The HVAC Commissioning Process.

C. National Environmental Balancing Bureau:
1. NEBB - Procedural Standards for Building Systems Commissioning.

1.03. COMMISSIONING DESCRIPTION

A. HVAC commissioning process includes the following tasks:
1. Testing and startup of HVAC equipment and systems.
2. Equipment and system readiness checklists.
3. Assistance in functional performance testing to verify testing and balancing, and equipment and system performance.
4. Provide qualified personnel to assist in commissioning tests, including seasonal testing.
5. Complete and endorse functional performance test checklists provided by Commissioning Authority to assure equipment and systems are fully operational and ready for functional performance testing.
6. Provide equipment, materials, and labor necessary to correct deficiencies found during commissioning process to fulfill contract and warranty requirements.
7. Provide operation and maintenance information and record drawings to Commissioning Authority for review verification and organization, prior to distribution.
8. Provide assistance to Commissioning Authority to develop, edit, and document system operation descriptions.
9. Provide training for systems specified in this Section with coordination by Commissioning Authority.

B. Equipment and Systems to Be Commissioned:

1. Fans.
2. Unit Heaters
3. DX Mini-Split Systems.
4. Air Handling Units.
5. Fan Coil Units.
6. Condensing Units.
7. Pumps.
8. Chillers.
9. Chilled Water System.

C. Perform seasonal function performance tests for the following equipment and systems:
1. HVAC.
2. BAS.

1.04. COMMISSIONING SUBMITTALS

A. Test Reports: Indicate data on system verification form for each piece of equipment and system as specified.

B. Field Reports: Indicate deficiencies preventing completion of equipment or system verification checks equipment or system to achieve specified performance.

1.05. CLOSEOUT SUBMITTALS

A. Project Record Documents: Record revisions to equipment and system documentation necessitated by commissioning.

B. Operation and Maintenance Data: Submit revisions to operation and maintenance manuals when necessary revisions are discovered during commissioning.

1.06. QUALITY ASSURANCE

A. Perform Work in accordance with AABC.

B. Perform Work in accordance with all governing building codes as specified in the contract documents.

1.07. COMMISSIONING RESPONSIBILITIES

A. Equipment or System Installer Commissioning Responsibilities:
1. Attend commissioning meetings.
2. Ensure temperature controls installer performs assigned commissioning responsibilities as specified below.
3. Ensure testing, adjusting, and balancing agency performs assigned commissioning responsibilities as specified.
4. Provide instructions and demonstrations for Owner's personnel.
5. Ensure subcontractors perform assigned commissioning responsibilities.
6. Installation Contractor, under the direction of the Construction Manager (CM), with the Commissioning Authority (CxA) observing and documenting the results, will execute the Functional Performance Testing procedures for the various
7. systems and pieces of equipment associated with the requirements for the electrical system.
8. Ensure participation of equipment manufacturers in appropriate startup, testing, and training activities when required by individual equipment specifications.
9. Develop startup and initial checkout plan using manufacturer's startup procedures and functional performance checklists for equipment and systems to be commissioned.
10. During verification check and startup process, execute HVAC related portions of checklists for equipment and systems to be commissioned.
11. Perform and document completed startup and system operational checkout procedures, providing copy to Commissioning Authority.
12. Provide manufacturer's representatives to execute starting of equipment. Ensure representatives are available and present during agreed upon schedules and are in attendance for duration to complete tests, adjustments and problem-solving.
13. Coordinate with equipment manufacturers to determine specific requirements to maintain validity of warranties.
14. Provide personnel to assist Commissioning Authority during equipment or System Readiness Checks (SRC's) and Functional Performance Tests (FPT's).
15. Prior to FPT's, review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during tests.
16. Prior to startup, inspect, check, and verify correct and complete installation of equipment and system components for verification checks included in commissioning plan. When deficient or incomplete work is discovered, ensure corrective action is taken and re-check until equipment or system is ready for startup.
17. Provide factory supervised startup services for equipment and systems. Coordinate work with manufacturer and Commissioning Authority.

18. Perform verification checks and startup on equipment and systems as specified.
19. Assist Commissioning Authority in performing FPT's on equipment and systems as specified.
20. Perform operation and maintenance training sessions scheduled by Commissioning Authority.
21. Conduct HVAC system orientation and inspection.

B. Temperature Controls Installer Commissioning Responsibilities:
1. Attend commissioning meetings.
2. Review design for ability of systems to be controlled including the following:
   a. Confirm proper hardware requirements exists to perform functional performance testing.
   b. Confirm proper safeties and interlocks are included in design.
   c. Confirm proper sizing of system control valves and actuators and control valve operation will result capacity control identified in Contract Documents.
   d. Confirm proper sizing of system control dampers and actuators and damper operation will result in proper damper positioning.
   e. Confirm sensors selected are within device ranges.
   f. Review sequences of operation and obtain clarification from Architect/Engineer.
   g. Indicate delineation of control between packaged controls and building automation system, listing BAS monitor points and BAS adjustable control points.
3. Inspect, check, and confirm proper operation and performance of control hardware and software provided in other HVAC sections.
4. Submit proposed procedures for performing automatic temperature control system point-to-point checks to Commissioning Authority and Architect/Engineer.
5. Inspect check and confirm correct installation and operation of automatic temperature control system input and output device operation through point-to-point checks.
6. Perform training sessions to instruct Owner's personnel in hardware operation, software operation, programming, and application in accordance with commissioning plan and specifications.
7. Demonstrate system performance and operation to Commissioning Authority during functional performance tests including each mode of operation.
8. Provide control system technician to assist during Commissioning Authority verification check and functional performance testing.
9. Provide control system technician to assist testing, adjusting, and balancing agency during performance of testing, adjusting, and balancing work.
10. Assist in performing operation and maintenance training sessions scheduled by Commissioning Authority.

C. Testing, Adjusting, and Balancing Agency Commissioning Responsibilities:
1. Attend commissioning meetings.
2. Participate in verification of testing, adjusting, and balancing report for verification or diagnostic purposes. Repeat sample of 25 percent of measurements contained in testing, adjusting, and balancing report as selected by Commissioning Authority.
3. Assist in performing operation and maintenance training sessions scheduled by Commissioning Authority.

1.8. COMMISSIONING MEETINGS

A. Attend initial commissioning meeting and progress commissioning meetings as required by Commissioning Authority.

1.9. SCHEDULING

A. Prepare schedule indicating anticipated start dates for the following:
1. Piping system pressure testing.
2. Piping system flushing and cleaning.
3. Ductwork cleaning.
4. Ductwork pressure testing.
5. Equipment and system startups.
6. Automatic temperature control system checkout.

7. Testing, adjusting, and balancing.
8. HVAC system orientation and inspections.
9. Operation and maintenance manual submittals.
10. Training sessions.

B. Schedule seasonal tests of equipment and systems during peak weather conditions to observe full-load performance.

C. Schedule occupancy sensitive tests of equipment and systems during conditions of both minimum and maximum occupancy or use.

1.10. COORDINATION

A. Notify Commissioning Authority minimum of 5 days in advance of the following:
1. Scheduled equipment and system startups.
2. Scheduled automatic temperature control system checkout.
3. Scheduled start of testing, adjusting, and balancing work.

B. Coordinate programming of automatic temperature control system with construction and commissioning schedules.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install additional balancing dampers, balancing valves, access doors, test ports, and pressure and temperature taps required by Commissioning Authority.

B. Place HVAC systems and equipment into full operation and continue operation during each working day of commissioning.

C. Install replacement sheaves and belts to obtain system performance, as requested by Commissioning Authority.

D. Install test holes in ductwork and plenums as requested by Commissioning Authority for taking air measurements.

E. Prior to start of functional performance test, install replacement filters in equipment.

3.02 COMMISSIONING

A. Seasonal Sensitive Functional Performance Tests:
1. Test heating equipment at winter design temperatures.
2. Test cooling equipment at summer design temperatures.
3. Participate in testing delayed beyond final completion to test performance at peak seasonal conditions.

B. Be responsible to participate in initial and alternate peak season test of systems required to demonstrate performance.

C. Occupancy Sensitive Functional Performance Tests:
1. Test equipment and systems affected by occupancy variations at minimum and peak loads to observe system performance.

2. Participate in testing delayed beyond final completion to test performance with actual occupancy conditions.

END OF SECTION

SECTION 23 09 63
AUTOMATIC TEMPERATURE CONTROLS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK TO BE PERFORMED

This section covers automatic temperature control systems and equipment.
This project involves the installation of a new Computrols CBAS system including new TCP/IP Internet Ready DDC equipment, software, programming, controls, and field devices where needed. The new DDC panels shall be connected to an existing workstation. The new DDC system shall include the specified equipment as a minimum (see section 2.03 DDC SYSTEM for specifications).

1.02 RELATED WORK

A. This section includes the furnishing and installation of controls and wiring for automatic controls, electric or pneumatic damper and valve actuators, air handling unit controls, boiler controls, pump controls, cooling tower controls, interlocks, starting circuits, and wiring to all power consuming devices.
   1. The new control system shall incorporate control of all points on the existing system.
   2. The Owner shall provide the necessary ISP connection.

1.03 QUALITY ASSURANCE

A. Installation shall be by mechanics and technicians trained by the automatic temperature control system manufacturer.

B. DDC system layout and performance: The DDC system shall be engineered and equipment selected by the manufacturer as required to meet the performance specified herein. The location and quantity of DDC panels shall be as determined by the DDC system manufacturer.

1.04 COMPLIANCE ASSURANCE

A. Each contractor is responsible for submitting a written compliance statement to the Owner specifically acknowledging complete compliance with this specification. Systems that require exceptions to this specification will be disqualified from the bid.

1.05 PROJECT CONDITIONS

A. Contractor shall visit the Project prior to bidding, and make a survey of existing control instruments. The contractor is responsible for all equipment, devices, and labor required to accomplish the general intent of this specification.

1.06PRICE GUARANTEE

A. Contractor shall guarantee the DDC controller price for a period of five (5) years

1.07WARRANTY

A. Contractor shall warranty installed materials for two (2) years after Project completion

B. Contractor shall warranty existing temperature sensors for two (2) years after Project completion

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Computrols, Inc.

2.02 DDC SYSTEM

A. GENERAL

A building automation system shall be provided including all associated equipment and appurtenances.
The building automation system installed must control and manage HVAC, and lighting control systems under one system computer and one software package. Systems which merely interface to other systems or use separate computers, software, and/or control equipment for the HVAC and lighting control systems are unacceptable.
The communication transmission network shall allow global sharing and exchange of information with other like controllers and field devices. The building automation system's control logic programs and its associated controller's logic programs shall be adjustable and changeable from the new building automation system head-end or any client connection via the World Wide Web. Systems that require a separate Internet gateway or separate utility program are not acceptable. All components of the total system shall be Internet ready and of the electronic DDC type.

B. INTERNET CONNECTIVITY

All new DDC controllers must have the ability to communicate to other controllers (peer-to-peer) and to the building automation software using standard TCP/IP communication.

C. REQUIRED SYSTEM EQUIPMENT

The building automation system head-end equipment shall include no less than the following:

1. Graphic Workstation
   - Server case (black) includes backplane and drive bays for 4 serial ATA hard drives with locking faceplate
   - Motherboard with video, dual gigabit Ethernet, 4 port serial ATA raid, and dual-channel DDR support
   - 350W switching power supply
   - Black floppy disk drive
   - Intel Pentium 4 processor 2.80GHz, 533 front side bus
   - 1GB of DDR Ram (2x512MB PC2700)
   - 80 GB of SATA hard drive space (2x80 GB Seagate 7200 RPM hard drive in a RAID 1 (mirroring) configuration)
   - Plextor CD burner (52/24/52)
   - Creative sound card
   - Creative 56K V.92 modem
   - Windows 7 with SP1 and the latest updates
   - Symantec PCAnywhere 11 Host and Remote
   - Norton AntiVirus 2004
   - Belkin UPS Power Monitoring software
   - Winzip 9.0
   - CBAS 2005 (latest version or predetermined by job)
   - 17" flat panel LCD monitor (black)
   - Standard keyboard (black)
   - PS2/USB optical mouse
   - Belkin® 650 VA uninterrupted power supply (UPS)
   - Set of speakers (black)
2. System Printer – Hewlett Packard HP952c
3. DDC controllers
   a. Points
      Each DDC system panel shall provide a minimum of eight (8) 4-in-1 software configurable points such that every point on the board can be individually software configured for any of the following types:
      - Analog Input – 10K ohm TYPE III thermistor, 0-10 VDC input, 4-20 mA input
      - Analog Output – 0-10 VDC output
      - Binary Input – contact open or close
      - Binary Output – 24 VDC 100 mA output

b. Communication
- All controllers shall use Internet standard TCP/IP communications.
- All controllers shall have additional communication ports to interface with secondary communication devices such that additional hardware (i.e. Gateways, translators, routers, etc.) is not needed for common third party interfaces (Modbus-RTU, BACnet MS/TP, OPTO-22, N2, etc).

c. Communication Ports

Controllers shall have at a minimum the following ports:
- 10 MB CAT 5 TCP/IP port
- 1 MB multi-drop port for #18 twisted pair cabling
- RS-485 port non-polarity conscious up to 38.4 KBAUD
- Software selectable RS-485 / RS-232 port

d. Software
- Each controller shall be capable of networking with the building automation system without the use of separate utility software.
- Global points may be shared across the network (peer-to-peer). Global points, or any shared network information, shall not include scheduling functions.
- Closed loop control functions shall include automatic PID tuning for proportional, proportional plus integral, proportional plus integral plus derivative, incremental, and floating control.

e. Communication Wiring

Communications wiring for controllers shall utilize a category 5 type cable.

f. Hardware
- The controller shall be a separate entity such that it may be detached from its respective terminal strip without removing any field wiring from the terminal strip.
- All DDC Controllers shall be guaranteed under normal use for the life of the building.
- The controller shall have a onboard 24 volt DC power supply
- All DDC Controllers shall have an example wire schematic affixed

g. Environmental
- Controllers and associated control panel devices shall function properly between 32 and 122 degrees Fahrenheit.
- Controllers and associated control panel devices shall function properly between 0 and 95 percent relative humidity (noncondensing).
- Storage conditions for the controller shall be between -4 and +140 degrees Fahrenheit.
- Storage conditions for the controller shall be between 0 and 95 percent relative humidity (noncondensing).

h. Lifetime Warranty

All DDC controllers that fail under normal working conditions shall be guaranteed

i. Backwards Compatible

Must be nonproprietary with backwards capability for software and hardware

4. UNI-B controllers

a. Points

Each UNI-B controller shall have the following points at a minimum:
- Analog Input – Four configurable inputs for either 10K Type 3 thermistors or 0-10 volts DC input
- Analog Out – Two selectable voltage source output as 0-10 volt DC @ 20mA max analog outputs
- Binary Output – Eight 24 volt AC triac controlled outputs
- Damper Output – Two 24 volt AC triac controlled damper outputs

b. Communication
- All UNI-B controllers shall use RS485 communication
- Wiring for UNI-B controller shall utilize 18 gauge, 2 conductor type cable

c. Software
- Each UNI-B controller shall be capable of networking with the building automation system without the use of separate utility software.

- Global points may be shared across the network (peer-to-peer). Global points, or any shared network information, shall not include scheduling functions.
- Closed loop control functions shall include automatic PID tuning for proportional, proportional plus integral, proportional plus integral plus derivative, incremental, and floating control.

d. Hardware
- The UNI-B controller shall be a separate entity such that its respective terminal strip may be detached without removing any field wiring from the terminal strip.
- All UNI-B controllers shall have an example wire schematic affixed

e. Environmental
- UNI-B controllers shall function properly between 32 and 158 degrees Fahrenheit.
- UNI-B controllers shall function properly between 0 and 95 percent relative humidity (non-condensing).
- Storage conditions for the UNI-B controller shall be between -40 and +160 degrees Fahrenheit.

f. Backwards Compatible
Must be nonproprietary with backwards capability for software and hardware

D. SYSTEM SOFTWARE

1. Software Platform:
   a. The building automation software shall run on the Microsoft Windows 7 Professional operating system.
   b. Interconnectivity between all workstations shall be achieved through the same protocol as the Internet, TCP/IP.
2. General features that must be provided:
   a. The software shall provide a graphical user interface.
   b. All points shall be programmable from a text view, hardware view, and graphics view.
   c. English language point descriptors (systems which use point numbers with descriptors attached are not acceptable)
   d. Event programming
   e. English "IF/THEN" logic programming (systems which use ladder type logic, graphic programming languages, or programs which must be compiled are not acceptable)
      Example English logic programming statement:
      "**IF** COND WATER TEMP is less than **85 DEG AND** CHILLER 1 is **ON THEN ON** COOLING TOWER FAN"
   f. User-defined calculations
   g. Run-time calculations
   h. Customized password protection for individual features (systems which use levels of passwords are not acceptable) Software must provide protection from and rights to specific features for every operator.
   i. Continuous historical data logging and charting for all points. Historical data shall be recorded after a pre-specified time passes or in the event of a pre-specified change in value.
   j. Field hardware troubleshooting utility
   k. The downloading of any and all field panels shall be accomplished through the building automation system program at the head-end computer. Downloading of the field panels shall be accomplished while the building automation system program is running from the head-end computer. Systems which require exiting the building management program at the head-end computer to download DDC programs are unacceptable. Systems which require the use of separate utility programs to download DDC programs are unacceptable. Systems which require the use of laptop computers or other equipment other than the head-end computer to download DDC programs are unacceptable.
   l. All DDC programs shall be stored in the individual controller's memory. Systems with HVAC controllers which rely on the use of one or more network control units to store control logic programs are not considered stand-alone$_1$ and are deemed

unacceptable. Systems with HVAC controllers that rely on pre-configured or "canned" control logic programs to operate as stand-alone$_1$ are unacceptable.

m. Changes to existing setpoints or control logic shall be accomplished through the energy management system program at the head-end

E. ENERGY MANAGEMENT FEATURES

1. PID loop control
   a. Automatic PID loop tuning
      (i) Automatic PID loop tuning, to be initiated at any workstation. The tuning should be achieved through the use of sound mathematical principles, and not a rule-based inference engine.
      (ii) The automatic tuning must not require the supervision of an operator, and the software must be capable of tuning at least 10 PID loops simultaneously.
      (iii) The operation of the building automation software should not be in any way impeded when tuning PID loops automatically, and it must be possible for the operator to continue the use of the software as normal during automatic tuning.
      (iv) An operator can override the tuning at any point in time, in a well-defined and transparent manner.
      (v) Automatic PID tuning must not be the only means of setting the PID parameters. A manual tuning method must also be provided that provides a graphical real-time feedback of the system's response.
   b. All PID loops have the capacity for gain scheduling; i.e. the controller parameters change automatically based on measured operating conditions.
   c. PID loop performance tracking must be provided for at least one week, storing information pertinent to fault diagnosis, including standard deviation and average absolute error.
2. Time of day scheduling
3. Holiday scheduling
4. Overtime scheduling
5. Discharge/supply temperature reset
6. Night setback/morning warm-up
7. Automatic computer restart after power failure. Software shall provide equipment start-up queue with delay to minimize start-up electrical demand
8. Enthalpy Control

F. GRAPHICS

1. Must support VGA and Super VGA graphic resolutions, at least 1024x768 with at least 256 colors
2. Must support scanned and video captured images
3. All graphics must be dynamically updated
4. All point statuses, colors, and graphic objects must be user-definable
5. Definable graphic objects must include:
   - Live status displays
   - Color fills for areas/zones
   - Variable bar graphs for analog data
   - Regions to link to other graphics
6. Must support Microsoft Visio file format (.vsd)

G. INFORMATION SORTING

The software must sort points by:

1. Units (degrees F, % Open, Dry, On, etc.) such that any point type with the selected unit type will populate the list
2. Alarms, Alarm Condition (in alarm, disabled, normal, etc.)
3. User-defined groups
4. Attributes; including if the point is part of a PID, has a schedule, or has logic programmed in it.

H. REPORTS

1. System activity tracking-commands, edits, alarms, etc.
2. Historical data reports-recall past point statuses

3. Custom scheduled reports-user definable for weekly, monthly, and yearly averages, totals, degree-days, etc.
4. Hardware report-logically organized summary of field equipment, which may be printed in panel-specific sheets suitable for mounting on a panel enclosure.
5. Current status report-sort groups of points for current status listings
6. All reports must have the capability to be routed to the screen for quick browsing, to a configured printer, or to a file
7. Reports must have the capability to be exported as ASCII delimited fields an for use with various other programs
8. It must be possible to export reports directly to:
   a. The World-Wide-Web (i.e. HTML)
   b. Microsoft Excel
   c. Microsoft Word

2.03 MATERIALS

A. Space temperature sensors
   1. Sensing element – 10,000 ohm TYPE III thermistor
   2. Accuracy - ±0.36 ^{O}F
   3. Range - 35 ^{O}F to 140 ^{O}F
   4. Temperature response - Negative temperature coefficient
   5. Stability - 0.24 ^{O}F over 5 years
   6. Connections – Screw terminals

B. Duct mounted temperature sensors
   1. Sensing element - 10,000 ohm thermistor with 306 stainless steel probe
   2. Accuracy - ±0.36^{O}F
   3. Range - 35 ^{O}F to 140 ^{O}F
   4. Temperature response - Negative temperature coefficient
   5. Stability - 0.24 ^{O}F over 5 years
   6. Connections - 8' OF 22 AWG pigtails pre-stripped inside of factory installed metallic handibox

C. Duct mounted carbon dioxide sensors
   1. Operating principle – non-dispersive infrared (NDIR)
   2. Accuracy - ±5% of reading or ±75PPM, whichever is greater
   3. Range – 0-2000 ppm CO2
   4. Response time – less than 1 minute
   5. Connections – screw terminals

D. Non-Spring return, direct coupled actuators
   1. Acceptable Manufacturer – Belimo
   2. Overload Protection – electronic throughout 0 to 95 degrees rotation
   3. Operating Range – 2 to 10 volt DC or 4 to 20 mA
   4. Torque – 90 in-lb
   5. Running Time – 95 seconds, constant independent of load
   6. Servicing – maintenance free
   7. Noise level – <45dB(A)

E. Full featured relays
   1. Operating Range – 85% to 100% of rated voltage
   2. Drop-out Voltage Threshold – 15% of rated voltage
   3. Operating Time – 20 ms typical
   4. Dielectric Strength – 1500 VAC (RMS)

PART 3 – EXECUTION

Not used.

END OF SECTION

SECTION 23 21 13
ABOVE GROUND HYDRONIC PIPING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods is included as a part of this Section as though written in full in this document.

1.02 WORK INCLUDED

A. Pipe and pipe fittings.

B. Valves.

C. Chilled water piping system.

D. Condensate drain piping.

1.03 RELATED WORK

A. Section 23 05 29 – Hangers and Supports for Piping and Equipment HVAC.

B. Section 23 05 48 – Vibration for HVAC Piping and Equipment.

C. Section 23 05 53 – Identification for HVAC Piping and Equipment.

D. Section 23 07 19 – HVAC Piping Insulation.

E. Section 23 21 19 – Hydronic Specialties.

1.04 REFERENCES

A. ANSI/ASME Sec 9 - Welding and Brazing Qualifications.

B. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings Class 150 and 300.

C. ANSI/ASME B31.9 - Building Services Piping.

D. ANSI/AWS A5.8 - Brazing Filler Metal.

E. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

F. ASTM A120 - Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses.

1.05 REGULATORY REQUIREMENTS

A. Conform to ANSI/ASME B31.9.

1.06 QUALITY ASSURANCE

A. Foreign made pipes, valves and fittings will not be acceptable.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Conform to ANSI/ASME SEC 9. and applicable state labor regulations.

D. Welder's Certification: In accordance with ANSI/ASME SEC 9.

1.07 SUBMITTALS

A. Submit product data under provisions of Division One.

B. Include data on pipe materials, pipe fittings, valves, and accessories.

C. Include welder's certification of compliance with ANSI/ASME SEC 9.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division One.

B. Store and protect products under provisions of Division One.

C. Deliver and store valves in shipping containers with labeling in place.

PART 2 - PRODUCTS

2.01 CHILLED PIPING

A. Steel Pipe: ASTM A53 or A120, Schedule 40, black steel piping.

1. Fittings: ANSI/ASTM B16.3, malleable iron or ASTM A234, forged steel welding type fittings.
2. Joints: Screwed, or ANSI/AWS D1.1, welded.

2.02 EQUIPMENT DRAINS AND OVERFLOWS

A. Steel Pipe: ASTM A53 or A120, Schedule 40 galvanized.

1. Fittings: Galvanized cast iron, or ANSI/ASTM B16.3 malleable iron.
2. Joints: Screwed, or grooved mechanical couplings.

2.03 FLANGES, UNIONS, AND COUPLINGS

A. Pipe Size 2 Inches and Under: 150 psig malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.

B. Pipe Size Over 2 Inches: 150 psig forged steel slip-on flanges for ferrous piping; bronze flanges for copper piping; 1/16 inch thick preformed neoprene bonded gasket.

C. Grooved mechanical pipe couplings, fittings, valves and other grooved components may be used as an option to welding, threading or flanged methods. All grooved components shall be of one manufacturer, and conform to local code approval and/or is listed by ANSI-B-31.1, B-31.3, B-31.9, ASME, UL/ULC. FM, IAPMO or BOCA. Grooved end manufacturer to be ISO-9001 certified. Grooved couplings shall meet the requirements of ASTM F-1476. Manufacturer shall be Victaulic or approved equal. Can be utilized only in mechanical rooms or cooling tower areas.

2.04 ACCEPTABLE MANUFACTURERS - GATE VALVES

A. Milwaukee.

B. Crane.

C. Dezurik.

D. Nibco.

E. Substitutions: Under provisions of Division One.

2.05 GATE VALVES

A. Up to 2 Inches: Bronze body, bronze trim, rising stem, handwheel, inside screw, single wedge or disc, threaded ends.

B. Over 2 Inches: Iron body, bronze trim, rising stem, handwheel, OS&Y, single wedge, flanged ends.

2.06 ACCEPTABLE MANUFACTURERS - BALL VALVES

A. Milwaukee.

B. Nibco.

C. Jamesbury.

D. Dezurik.

E. Kitz.

F. Victaulic (For grooved systems only)

2.07 BALL VALVES

A. Up to 2 Inches: Bronze two piece body, 600 PSI full port, stainless steel ball and stem, teflon seats and stuffing box ring, lever handle, and balancing stops, threaded ends.

B. Over 2 Inches: Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle, or gear drive hand wheel for sizes 10 inches (250 mm) and over, flanged.

C. Ball valves installed in insulated lines shall have stem extensions compatible with up to 2" of insulation. Extensions shall be non-metallic equal to Nibco "nib-seal".

2.08 ACCEPTABLE MANUFACTURERS - BUTTERFLY VALVES

A. Milwaukee.

B. Nibco.

C. WECO.

D. Dezurik.

E. Victaulic (For grooved systems only)

F. Substitutions: Under provisions of Division One.

2.09 BUTTERFLY VALVES

A. Iron body, aluminum bronze disc, resilient replaceable seat for service to 180 degrees F lug or grooved ends, extended neck, hand wheel and gear drive. Valve shall be rated at full working pressure with downstream flange removed in either direction.

2.10 ACCEPTABLE MANUFACTURERS - SWING CHECK VALVES

A. Milwaukee.

B. Nibco.

C. Stockham.

D. Dezurik.

E. Victaulic (For grooved systems only)

F. Substitutions: Under provisions of Division One.

2.11 SWING CHECK VALVES

A. Up to 2 Inches: Bronze 45 degree swing disc, screwed ends.

B. Over 2 Inches Iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged or grooved ends.

2.12 ACCEPTABLE MANUFACTURERS - SPRING LOADED CHECK VALVES

A. Milwaukee.

B. Nibco.

C. Mueller.

D. Dezurik.

E. Victaulic (For grooved systems only)

F. Substitutions: Under provisions of Division One.

2.13 SPRING LOADED CHECK VALVES

A. Iron body, bronze trim, stainless steel spring, aluminum bronze disc, screwed, grooved, wafer or flanged ends.

2.14 ACCEPTABLE MANUFACTURERS - RELIEF VALVES

A. Nibco.

B. Jenkins.

C. Dezurik.

D. Milwaukee.

E. Substitutions: Under provisions of Division One.

PART 3 - EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. After completion, fill, clean, and treat systems.

E. Provide extended necks for all vents, thermometer wells, pressure gauge wells, pet cocks and pete's plugs.

3.02 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure, and maintain gradient.

B. Install piping to conserve building space, and not interfere with use of space and other work.

C. Group piping whenever practical at common elevations.

D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.

E. Provide clearance for installation of insulation, and access to valves and fittings.

F. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Division 8.

G. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

H. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

I. Prepare pipe, fittings, supports, and accessories for finish painting. Refer to Division 9.

J. Install valves with stems upright or horizontal, not inverted.

K. All grooved components (couplings, fittings, valves, gaskets, and specialties) shall be of one manufacturer.

L. Grooved manufacturer shall provide on-site training for contractor's field personnel by a factory trained representative in the proper use of grooving tools, application of groove, and the product installation. Factory trained representative shall periodically visit the job site and inspect installation. Contractor shall remove and replace any improperly installed products.

3.03 APPLICATION

A. Use grooved mechanical couplings and fasteners only in accessible locations.

B. Install unions downstream of valves, and at equipment or apparatus connections.

C. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.

D. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

E. Provide spring loaded check valves on discharge of condenser and chilled water pumps.

F. Use plug cocks for throttling service. Use non-lubricated plug cocks only when shut-off or isolating valves are also provided.

G. Use lug end butterfly valves to isolate equipment.

H. Provide chain operated butterfly valve for installations at 12 feet or higher.

I. Provide 3/4 inch ball (drain) valves equal to Nibco T-585-70-HC at main shut-off valves, low points of piping, bases of vertical risers, and at equipment and pipe to nearest drain.

J. Provide automatic air vents at all high points and air pockets in the system.

3.04 CONDENSATE DRAIN PIPING

A. Drain piping from each unit shall be extended to the nearest floor drain or condensate drainage system. Drains shall be of the size indicated but not less than the full size of the drain pan connections.

B. Use plugged tees in lieu of elbows.

C. Pipe shall be Schedule 40 galvanized with malleable iron screwed or type "L" copper fittings.

D. Slope all drain lines 1/8" per foot, minimum.

E. Provide auxiliary drain pan on all AHU's above ceiling with auxiliary drain line routed to discharge in visually prominent area. Discharge location shall be coordinated with Architect.

3.05 PIPE FABRICATION AND INSTALLATION

A. All pipes shall be cut accurately to measurements established at the site and shall be worked into place without springing or forcing.

B. Piping layout and installation shall be made in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance from other work. Particular attention shall be given to piping in the vicinity of equipment; layout shall be made in such manner as to preserve maximum access to the various equipment parts for maintenance.

C. All changes in directions shall be made with fittings; field bending and mitering of pipe is prohibited.

D. Air vents and air chambers shall be installed as hereinafter specified.

3.06 OFFSETS AND FITTINGS

A. Due to the small scale of the Drawings, it is not possible to indicate all offsets, fittings, etc. which may be required. The Contractor shall carefully investigate structural and finish conditions affecting the Work, and shall take such steps as may be required to meet such conditions at no additional cost to the Owner.

B. All piping shall be installed close to walls, ceilings and columns, (consistent with the proper space for covering, removal of pipe and special clearances), so as to occupy the minimum of space, and all offsets, fittings, etc., required shall be provided at no additional cost to the Owner.

3.07 SECURING AND SUPPORTING

A. All piping shall be adequately supported to line and grade, with due provisions for expansion and contraction.

B. Piping shall be supported on approved clevis type, split ring, or trapeze type hangers properly connected to the structural members of the building.

C. All insulated piping shall be fitted with suitable steel protection saddles.

D. Perforated bar hangers, straps, wire or chains will not be permitted.

3.08 ISOLATION VALVES

A. All piping systems shall be provided with line size shut-off valves located at risers, at branch connections to mains, and at other locations as indicated and required.

3.09 TESTING OF PIPING SYSTEMS

A. During the progress of the Work and upon completion, tests shall be made as specified herein and as required by Authorities Having Jurisdiction, including Inspectors, Owner or Engineer. The Engineer or duly authorized Construction Inspector shall be notified in writing at least 2 working days prior to each test or other Specification requirement which requires action on the part of the Construction Inspector.

B. Tests shall be conducted as part of this Work and shall include all necessary instruments, equipment, apparatus, and service as required to perform the tests with qualified personnel. Submit proposed test procedures, recording forms, and test equipment for approval prior to the execution of testing.

C. Tests shall be performed before piping of various systems have been covered or furred-in. For insulated piping systems, testing shall be accomplished prior to the application of any insulation.

D. All piping systems shall be tested and proved absolutely tight for a period of not less than 2 hours at a pressure of 150 psi(g) or 150% of design pressure, whichever is greater. Tests shall be witnessed by the Engineer or an authorized representative and pronounced satisfactory before pressure is removed or any water drawn off.

E. Leaks, damage or defects discovered or resulting from test shall be repaired or replaced to a like new condition. Leaking pipe joints, or defective pipe, shall be removed and replaced with acceptable materials. Test shall be repeated after repairs are completed and shall continue until such time as the entire test period expires without the discovery of any leaks, damage, or defects.

F. Wherever conditions permit, each piping system shall thereafter be subjected to its normal operating pressure and temperature for a period of no less than five 5 days. During that period, it shall be kept under the most careful observation. The piping systems must demonstrate the propriety of their installation by remaining absolutely tight during this period.

3.10 PIPE CLEANING, FLUSHING AND PURGING REQUIREMENTS AND PROCEDURES

The hydronic system shall be flushed and purged by contractor:

All mains, branches and zones shall be cleaned and treated per steps indicated below. Owner/Engineer shall be given 72 hour notice prior to each step being performed.

A. Pre-flush requirements: Purpose is to get system ready for flushing and purging:

a. Piping must pass all required pressure testing and visual inspection for leaks.
b. All pumps shall be tested for rotation and properly aligned and lubricated.
c. Chemicals planning on being used must have certificate of assurance and product cut sheets presented to the owner/engineer prior to being used. All chemicals must: be approved by the state prior to being added to the system, FDA approved and meet ASTM-1384. Automotive grade chemicals are not allowed.
d. Bypass all terminal units and coils by connecting the supply and return piping together.
e. Fill entire system with clean fresh potable water.

B. The flush requirements: Purpose is to completely remove all debris, dirt and air from hydronic system.

a. Add system cleaner that contains detergent and emulsifying agents to properly remove grease, grime and other debris for steel pipe. Volume of cleaner used shall be about 10% of total volume.
b. System shall be circulated for a minimum of 48 hours with water velocities of a minimum of 5 ft/sec or greater. After completed all strainers shall be removed and cleaned thoroughly. House pumps are acceptable to circulate water.
c. The system shall be entirely drained and flushed out to remove all of the cleaner from the system as quickly as possible after cleaning to prevent debris from settling. All strainers shall be removed and thoroughly cleaned after no more dirt and cleaner is visible in the flushing water as it leaves the system.

C. Final fill:

a. All air vents shall be opened to allow air to escape during filling.
b. Reconnect all flex connections to equipment.
c. System shall be drained and filled with a local domestic/softened water mixture as required by chemical treatment supplier. System shall be filled with pressure reducing valve at the specified fill pressure.

D. Purging: Purpose is to remove all air from the system:

a. System shall be circulated for a minimum of one hour with water velocities of a minimum of 5 ft/sec or greater until all visible air is removed.

E. Final chemical addition: Purpose is to install chemicals during inhibitor as required:

a. After the above final fill and purging has been completed and accepted by the engineer/owner the final chemical addition can be done.
b. Chemical treatment shall be added to the system after thoroughly mixing water according to the manufacturer recommendations. Chemical treatment shall include inhibitors. Quantities and concentrations of inhibitor/chemicals should be applied according to manufacturer specifications and approval submittals.
c. System water shall be tested for chemical inhibitor concentrations, reserve alkalinity and PH. Reports shall be submitted to engineer/owner.
d. All records and documentation shall be kept and given to the owner upon completion.

END OF SECTION

SECTION 23 21 16
UNDERGROUND HYDRONIC PIPING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods is included as a part of this Section as though written in full in this document.

1.02 WORK INCLUDED

A. Pipe and pipe fittings.

B. Valves.

C. Chilled water piping system.

1.03 RELATED SECTIONS

A. Section 23 05 53 – Identification for HVAC Piping and Equipment

B. Section 23 21 19 – Hydronic Specialties

1.04 REFERENCES

A. ANSI/ASME Sec 9 - Welding and Brazing Qualifications.

B. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings Class 150 and 300.

C. ANSI/ASME B31.9 - Building Services Piping.

D. ANSI/AWS A5.8 - Brazing Filler Metal.

E. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

F. ASTM A120 - Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses.

G. ASTM B32 - Solder Metal.

H. ASTM B88 - Seamless Copper Water Tube.

1.05 REGULATORY REQUIREMENTS

A. Conform to ANSI/ASME B31.9.

1.06 QUALITY ASSURANCE

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. Welding Materials and Procedures: Conform to ANSI/ASME SEC 9. and applicable state labor regulations.

C. Welders Certification: In accordance with ANSI/ASME SEC 9.

1.07 SUBMITTALS

A. Submit product data under provisions of Division One.

B. Include data on pipe materials, pipe fittings, valves, and accessories.

C. Include welders certification of compliance with ANSI/ASME SEC 9.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division One.

B. Store and protect products under provisions of Division One.

C. Deliver and store valves in shipping containers with labeling in place.

PART 2 - PRODUCTS

2.01 PRE-INSULATED PIPE

A. Pipe shall be the pre-insulated type, as manufactured by Thermacor Process Inc. Perma Pipe, or "approved equal." All sections shall be factory fabricated to job dimensions with all fittings, anchors, and other accessories.

B. Polyurethane foam insulation shall be injected into the annular space between carrier pipe and jacket with one shot to the thicknesses shown for the specific pipe size. Insulation shall be rigid, 90-95% closed cell polyurethane with a 2.5 to 3.5 pounds per cubic foot density and a coefficient of thermal conductivity (K Factor) of .14 at 50 degree F or .17 at 75 degree F and conform to HH-I-1751/4.

C. Jackets for preinsulated piping, including fittings, shall be HDPE in accordance with ASTM D1248, Type 3, Class C. For systems where the entire surface of the factory applied pipe insulation can be visually inspected prior to the application of the jacket, the minimum thickness of the jacket shall be 80 mils for pipe sizes 6" and below, 100 mils for sizes 8"-12", 102 mils for 14"-20", and 150 mils 24" and larger. For systems manufactured by injection of urethane foam into the annulus between the carrier pipe and jacket, thereby not allowing visual inspection of the entire insulation surface, jacket thickness shall be 50% greater than the above minimums.

MIN. INSULATION THICKNESS R - VALUE

Pipe Size (in.)		
	Chilled Water	Hot Water
≤1.5"	3.7	3.7
>1.5"-4"	5.6	7.4
>4"	7.4	7.4

D. Carrier pipe shall be standard weight, carbon steel, seamless or ERW, ASTM A-106, ASTM A-53, Grade B. All joints shall be butt-welded for 2 ½" and greater, and socket or butt-welded for 2" and below. Pipe fittings shall be forged, long radius bends, beveled for butt welding, having a wall thickness equal to the pipe.

E. Anchors shall be pre-insulated and jacketed at the factory and provided at locations shown on the Contract Drawings. Factory anchors shall be encased in concrete, according to the manufacturer's recommendations, keyed into undisturbed soil. Manufacturer shall provide expansion pillows at expansion bends and include details of thickness, length, and location in data submitted for approval. Expansion pillows and anchors are not required for chilled water systems.

F. Fittings shall be field insulated with liquid urethane foam insulation, jacketed with a PVC fitting cover and wrapped with polyethylene backed, pressure sensitive butyl rubber tape, or pressure sensitive PVC tape.

G. Underground systems shall be buried in a trench not less than two (2) feet deeper than the top of the pipe and not less than twelve inches wider than the combined O.D. of all piping systems. All backfill material shall be clean bank sand to a minimum thickness of 24 inches over the top of the jacket to meet H-20 highway loading. All piping will be pressure tested for 150 psi for 48 hours prior to cover-up.

H. A representative of the manufacturer shall be present during critical periods of installation and testing, to verify that the installation is being made in accordance with the manufacturer's recommendations.

PART 3 - EXECUTION

3.01 All pipes shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

3.02 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractor's price shall include all items required as per manufacturer's requirements.

3.03 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. After completion, fill, clean, and treat systems.

E. Provide access for valves located underground. Coordinate size and location of access doors with Division 8.

F. Install valves with stems upright only, not inverted.

3.04 PIPE FABRICATION

A. All pipes shall be cut accurately to measurements established at the site and shall be worked into place without springing or forcing. Piping layout and installation shall be made in the most advantageous manner possible with respect to valve access and clearance from other work.

B. All changes in directions shall be made with fittings; field bending and mitering of pipe is prohibited.

C. Piping shall be carefully sloped so as to eliminate traps and pockets.

D. Where pipes change size eccentric fittings shall be used to prevent the pocketing of air.

E. Group piping whenever practical at common elevations.

3.05 OFFSETS AND FITTINGS

Due to the small scale of the Drawings, it is not possible to indicate all offsets, fittings, etc. which may be required. The Contractor shall carefully investigate the site and conditions affecting the work, and shall take such steps as may be required to meet such conditions.

3.06 PIPE SLEEVES

A. All pipes passing through masonry and concrete construction shall be fitted with sleeves.

B. Each sleeve shall extend through the respective wall and shall project 3 inches on both sides. Sleeves shall be two pipe sizes larger. Sleeves shall be made of galvanized steel pipe.

3.07 ISOLATION VALVES

All piping systems shall be provided with line size shut-off valves located at branch connections to mains and at other locations as indicated and required.

3.08 AUTOMATIC VENT VALVES

Automatic vent valves shall be installed at high points and at any other air pockets of all closed circulating piping systems.

3.09 TESTING OF PIPING SYSTEMS

A. During the progress of the Work and upon completion, tests shall be made as specified herein and as required by Authorities Having Jurisdiction, including Inspectors, Owner or Architect. The Architect or duly authorized Construction Inspector shall be notified in writing at least 2 working days prior to each test or other Specification requirement which requires action on the part of the Construction Inspector.

B. Tests shall be conducted as part of this Work and shall include all necessary instruments, equipment, apparatus, and service as required to perform the tests with qualified personnel. Submit proposed test procedures, recording forms, and test equipment for approval prior to the execution of testing.

C. Tests shall be performed before piping of various systems have been covered or furred-in. For insulated piping systems, testing shall be accomplished prior to the application of insulation.

D. All piping systems shall be tested and proved absolutely tight for a period of not less than 2 hours at a pressure of 150 psi(g) or 150% of design pressure, whichever is greater. Tests shall be witnessed by the Engineer or an authorized representative and pronounced satisfactory before pressure is removed or any water drawn off.

E. Leaks, damage or defects discovered or resulting from test shall be repaired or replaced to a like new condition. Leaking pipe joints, or defective pipe, shall be removed and replaced with acceptable materials. Test shall be repeated after repairs are completed and shall continue until such time as the entire test period expires without the discovery of any leaks, damage, or defects.

3.10 PIPE CLEANING AND STERILIZATION

A. After piping systems have been pressure tested and approved for tightness, they shall be thoroughly cleaned and flushed using an approved pipe cleaning compound.

B. All temporary connections required for cleaning, purging and circulating are included in this Section. Provide suitable pipe bypasses at each coil and heat exchanger during this cleaning operation. All air vents, gauges, strainers, etc., valved connections in piping systems shall be blown clean after cleaning operation is completed.

C. After cleaning, drain the system, fill with fresh water and flush thoroughly until clear water is obtained. Purge all air from the system with the installed manual and automatic air vents.

END OF SECTION

SECTION 23 21 19
HYDRONIC SPECIALTIES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods is included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. Expansion tanks.

B. Air vents.

C. Air separators.

D. Strainers.

E. Pump suction fittings.

F. Combination fittings.

G. Flow indicators, controls, meters.

1.3 RELATED SECTIONS

A. Section 23 21 23 – Hydronic Pumps.

B. Section 23 21 13 – Underground Hydronic Piping.

1.4 REGULATORY REQUIREMENTS

A. Conform to ANSI/ASME Boilers and Pressure Vessels Code Section 8D for manufacture of tanks.

1.5 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by same manufacturer throughout.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Division One.

B. Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division One.

B. Store and protect products under provisions of Division One.

1.09 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - EXPANSION TANKS

A. Bell and Gossett.

B. TACO.

C. Wessels Co.

D. John Wood

2.2 EXPANSION TANKS

A. Construction: Closed, welded steel, tested and stamped in accordance with Section 8D of ANSI/ASME Code; 125 psi rating; cleaned, prime coated, and supplied with steel support saddles; with tappings for installation of accessories.

B. Gage Glass Set: Brass compression stops, guard, and 3/4 inch red line glass, maximum 24 inches length, long enough to cover tank for 2 inches above bottom to 2 inches below top.

C. Quick Connect Air Inlet: Automotive tire valve type, manual air vent, tank drain, and pressure relief valve.

D. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure double check backflow preventer, test cocks, strainer, vacuum breaker, and valved by-pass.

E. Chilled Water System: Set expansion tank pressure relief valve at 25 psi maximum and pressure reducing valve at 12 psi.

2.3 ACCEPTABLE MANUFACTURERS - DIAPHRAGM-TYPE COMPRESSION TANKS

A. Bell and Gossett.

B. TACO.

C. Wessels Co.

D. John Wood

2.4 DIAPHRAGM-TYPE COMPRESSION TANKS

A. Construction: Welded steel, tested and stamped in accordance with Section 8D of ANSI/ASME Code; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.

B. Accessories: Pressure gage and air-charging fitting, tank drain; pre-charge to 12 psig.

2.5 ACCEPTABLE MANUFACTURERS - AIR VENTS

A. Armstrong.

B. ITT.

C. Bell and Gossett.

2.6 AIR VENTS

A. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

B. Float Type: Brass or semi-steel body, copper float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

C. Washer Type: Brass with hydroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

2.7 ACCEPTABLE MANUFACTURERS - AIR SEPARATORS

A. Bell and Gossett.

B. McDonald Miller.

C. TACO.

2.8 AIR SEPARATORS

A. Dip Tube Fitting: For 125 psig operating pressure; to prevent free air from rising into system.

B. Combination Air Separators/Strainers: Steel, tested and stamped in accordance with Section 8D of ANSI/ASME Code, for 125 psig operating pressure, with galvanized steel integral strainer with 3/16 inch perforations, tangential inlet and outlet connections, and internal stainless steel air collector tube.

2.9 ACCEPTABLE MANUFACTURERS - STRAINERS

A. Armstrong.

B. Bell and Gossett.

C. Mueller Steam Specialty.

D. Victaulic (For grooved systems only)

2.10 STRAINERS

A. Size 2 inch and Under: Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

B. Size 2-1/2 inch to 4 inch: Flanged or grooved iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

C. Size 6 inch and Larger: Flanged or grooved iron body for 175 psig working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

2.11 ACCEPTABLE MANUFACTURERS - PUMP SUCTION FITTINGS

A. Bell and Gossett.

B. TACO.

C. Victaulic (For grooved systems only)

2.12 SUCTION FITTINGS

A. Fitting: Angle pattern, cast-iron body, threaded for 2 inch and smaller, flanged or grooved for 2-1/2 inch and larger, rated for 175 psig working pressure, with inlet vanes, cylinder strainer with 3/16

inch diameter openings, disposable fine mesh strainer to fit over cylinder strainer, and permanent magnet located in flow stream and removable for cleaning.

B. Accessories: Adjustable foot support, blowdown tapping in bottom, gauge tapping in side.

2.13 ACCEPTABLE MANUFACTURERS - COMBINATION PUMP DISCHARGE VALVES

A. Bell and Gossett.

B. TACO.

C. Victaulic (For grooved systems only)

2.14 COMBINATION PUMP DISCHARGE VALVES

A. Valves: Straight or angle pattern, flanged cast-iron valve body with bolt-on bonnet for 175 psig operating pressure, non-slam check valve with spring- loaded bronze disc and seat, stainless steel stem, and calibrated adjustment permitting flow regulation.

2.15 ACCEPTABLE MANUFACTURERS - FLOW INDICATORS

A. Bell and Gossett.

B. Watson McDaniel.

2.16 FLOW INDICATORS

A. Brass construction, threaded for insertion into piping system, packless, with paddle with removable segments, vapor proof electrical compartment with switches.

2.17 ACCEPTABLE MANUFACTURERS - FLOW CONTROLS

A. Bell and Gossett.

B. ITT Hoffman.

C. TACO.

D. Victaulic/TA

2.18 FLOW CONTROLS

A. Construction: Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet, and outlet, blowdown/backflush drain.

B. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control.

C. Control Mechanism: Stainless steel or nickel plated brass piston or regulator cup, operating against stainless steel helical or wave formed spring.

D. Accessories: In-line strainer on inlet, and ball valve on outlet.

2.19 ACCEPTABLE MANUFACTURERS - FLOW METERS

A. Bell and Gossett.

B. ITT Hoffman.

C. TACO.

D. Victaulic/TA

2.20 FLOW METERS

A. Orifice principle by-pass circuit with direct reading gauge, soldered, or flanged piping connections for 125 psig working pressure, with shut off valves, and drain and vent connections.

B. Cast iron, wafer type, orifice insert flow meter for 250 psig working pressure, with read-out valves equipped with integral check valves with gasketed caps.

C. Calibrated, plug type balance valve with precision machined orifice, readout valves equipped with integral check valves and gasketed caps, calibrated nameplate and indicating pointer.

D. Cast iron or bronze, globe style, balance valve with handwheel with vernier type ring setting and memory stop, drain connection, readout valves equipped with integral check valves and gasketed caps.

E. Portable meter consisting of case containing two, 3 percent accuracy pressure gauges with 0-135 inches and 0-60 feet pressure ranges for 500 psig maximum working pressure, color coded hoses for low and high pressure connections, and connectors suitable for connection to read-out valves.

2.21 ACCEPTABLE MANUFACTURERS - RELIEF VALVES

A. Bell and Gossett.

B. McDonnell-Miller.

C. TACO.

2.22 RELIEF VALVES

A. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

PART 3 - EXECUTION

3.1 INSTALLATION AND APPLICATION

A. Install specialties in accordance with manufacturer's instructions to permit intended performance.

B. Support tanks inside building from building structure in accordance with manufacturer's instructions.

C. Where large air quantities can accumulate, provide enlarged air collection standpipes.

D. Provide manual air vents at system high points and as indicated on details and drawings.

E. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

F. Provide air separator on suction side of system circulation pump and connect to expansion tank.

G. Provide valved drain and hose connection on strainer blow down connection.

H. Provide pump suction fitting on suction side of base mounted centrifugal pumps. Remove temporary strainers after cleaning systems.

I. Provide combination pump discharge valve on discharge side of base mounted centrifugal pumps.

J. Support pump fittings with floor mounted pipe and flange supports.

K. Provide relief valves on pressure tanks; and on low pressure side of reducing valves, heat exchangers, and expansion tanks.

L. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

M. Pipe relief valve outlet to nearest floor drain.

N. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

END OF SECTION

SECTION 23 21 23
HYDRONIC PUMPS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods is included as a part of this Section as though written in full in this document.

1.02 WORK INCLUDED

A. In-line circulators.

1.03 RELATED SECTIONS

A. Section 23 05 13 - Common Motor Requirements for HVAC Equipment.

B. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

C. Section 23 07 16 - HVAC Equipment Insulation.

1.04 REFERENCES

A. ANSI/UL 778 - Motor Operated Water Pumps.

1.05 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacture, assembly, and field performance of pumps with minimum five years' experience.

B. Alignment: Base mounted pumps shall be aligned by qualified millwright and alignment certified.

C. Impellers: All impellers shall be dynamically balanced.

D. The Mechanical Contractor shall be responsible for accurately checking all pumping heads, based upon the actual piping and equipment installation. The Contractor shall be responsible for furnishing pumps and motors of proper sizes suitable for the actual installation. Do not provide pumps with capacities less than the amount indicated on the Drawings.

1.06 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Submit certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.

C. Submit manufacturer's installation instructions under provisions of Division One.

1.07 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Division One.

B. Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division One.

B. Store and protect products under provisions of Division One.

1.09 EXTRA PARTS

A. Provide one set of replacement mechanical seals for each size of pump. After the pumps are in operation for ninety days, the Contractor shall check the seals and replace any that are defective. If the replacement seals are not used during the 90 day operational period, they shall be delivered to the Owner.

1.10 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Taco.

B. Aurora.

C. Bell and Gossett.

D. Armstrong

E. Grundfos/Paco.

2.02 GENERAL CONSTRUCTION REQUIREMENTS

A. Balance: Rotating parts, statically and dynamically.

B. Construction: To permit servicing without breaking piping or motor connections.

C. Pump Motors: Operate at 1750 rpm unless specified otherwise. Provide totally enclosed motors when mounted outdoors. Refer to Section 23 05 13.

D. Pump Connections: Flanged, for pipe size two inches and larger. Provide union for pipe sizes less than two inches.

E. Critical speed of each pump shall be at least 115% of the running speed listed in the schedule.

2.03 IN-LINE CIRCULATORS

A. Type: Horizontal shaft, single stage, direct connected, with resiliently mounted motor for in-line mounting, oil lubricated, for 125 psig maximum working pressure.

B. Casing: Cast iron.

C. Impeller: Brass or bronze, keyed to shaft.

D. Bearings: Two, oil lubricated bronze sleeves.

E. Shaft: Stainless steel with stainless steel sleeve, integral thrust collar.

F. Seal: Carbon rotating against a stationary ceramic seat viton fitted, 225 degrees F maximum continuous operating temperature.

G. Drive: Flexible coupling.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install pumps in accordance with manufacturer's instructions.

B. Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer.

C. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

D. Pumps shall be free of flashing and cavitation at all flow rates from 25% to 125% of design flow under the suction conditions of the pump installation.

E. The impeller selected for compliance with design requirements shall not exceed 85% of cutwater diameter for the selected pump casing size. This shall be clearly certified on the Shop Drawing submittal.

F. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge lines.

G. Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve and balancing valve on pump discharge.

H. Provide air cock and drain connection on horizontal pump casings.

I. Provide drains for bases and seals, piped to and discharging into floor drains.

J. Lubricate pumps before start-up.

K. Qualified millwright shall check, align, and certify base mounted pumps prior to start-up.

END OF SECTION

SECTION 23 23 00
REFRIGERANT PIPING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 – Basic Materials and Methods is included as a part of this Section as though written in full in this document.

1.02 SCOPE

Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for Owner's use.

PART 2 - PRODUCTS

2.01 GENERAL

Provide for the systems as shown. Submit shop drawings of piping systems showing all traps, pipe sizes, and accessories; drawing to be marked "Approved", and signed by a representative of the Application Engineering Department of the condensing unit manufacturer. Pipe sizes shall be as recommended by unit manufacturer. Refer to piping schematic on Drawings.

2.02 MATERIAL

A. PIPE: Copper ACR hard-drawn tubing.

B. FITTINGS: Wrought copper streamlined sweat fitting.

C. SOLDER: Sil-Fos; except on valves use solder recommended by valve manufacturer.

2.03 ACCESSORIES

All accessories shall be UL listed and rated in accordance with ARI Standard 710.

A. On systems 7-1/2 tons and larger, each separate refrigerant circuit shall have a separate filter dryer. Each filter dryer shall have a replaceable core and a three valve bypass. The filter drier shall be full line size and installed in the refrigerant liquid line. The filter shall have a minimum 4-3/4 inches diameter shell with removable flange and gasket. Flange shall be tapped for 1/4 inch FPT access valve. Size filter-drier for maximum 2.0 psi pressure drop at evaporator operating temperature. Similar to Mueller Brass Company model Drymaster micro-guard refillable filter series SD-485 through SD19217 or Sporlan catch-all.

B. On systems less than 7-1/2 tons, the filter dryer shall be the sealed type; sizes as above. One drier per refrigerant circuit.

C. Liquid-Moisture Indicator shall be installed in liquid refrigerant line; full line size similar to Mueller Brass Company model "Vuemaster" with soldered ends.

D. Thermostatic expansion valve shall have adjustable super heat and be as manufactured by Sporlan.

2.04 EVACUATION

Evacuate moisture completely by applying a commercial vacuum pump for a minimum of 24 hours. Moisture indicator shall indicate a completely moisture-free condition at time of final inspection. The vacuum pump shall run until the system indicates a maximum of 35 degrees FDB. The system shall be flushed with the operating refrigerant and the vacuum pump connected and rerun to repeat the evacuation. Evaluation

shall be performed under supervision of the Engineer.

2.05 REFRIGERANT AND OIL

A. Contractor shall leave the refrigeration system with a full charge of refrigerant and oil and shall be responsible for the maintenance of a full charge of refrigerant and oil in the systems for a period of two years from date of Substantial Completion.

B. Should any leaks in the refrigeration system occur during the guarantee period, the Contractor shall eliminate such leaks and recharge system to a full charge of refrigerant and oil at no cost to the Owner.

PART 3 - EXECUTION

3.01 All equipment and piping shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

3.02 All items required for a complete and proper installation are not necessarily indicated on the Drawings or in the Specifications. Provide all items required as per manufacturer's requirements.

END OF SECTION

SECTION 23 25 13
WATER TREATMENT FOR CLOSED LOOP HYDRONIC SYSTEMS

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 – Basic Materials and Methods is included as a part of this Section as though written in this document.

1.02 SCOPE

Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for Owner's use.

1.03 DESCRIPTION OF WORK

A. Work Included: Perform water analysis and provide all water treatment products, equipment and labor for testing, cleaning, flushing and dispensing products to control water quality for each system specified hereinafter as follows:

1. Chilled Water System.

B. Chemicals: Provide, at no additional cost to the Owner, all chemicals required for operating and testing all water treatment systems prior to and for two (2) years after Substantial Completion.

C. Instructions: Provide operating and maintenance instructions for each water treatment system; include one set in each Owner's Manual and deliver one set to Owner's operating personnel.

D. Testing Equipment and Reagents: Furnish suitable water treatment testing equipment for each system, complete with apparatus and reagents necessary for operation prior to and for three (3) months after Substantial Completion.

Service Representative:

1. Cleaning and Flushing test required verifying satisfactory completion of pipe cleaning.
2. Provide water analysis report quarterly on each operating system.
3. Annually perform microbiological culture study on the system to monitor bacteria.

E. Replacement and Rework: Replace defective or nonconforming materials and equipment with new materials and equipment at no additional cost to Owner for two (2) year after Substantial Completion; monthly reports shall be provided to the Owner and Architect/Engineer.

1. Guarantee: Provide system produced by manufacturer who is willing to execute the required guarantee.
2. Agreement to Maintain: Provide system produced by manufacturer who is willing to execute (with the Owner) the required agreement for continued maintenance of the system.

1.04 QUALITY ASSURANCE

A. Qualifications: The Water Treatment Contractor for work under this Section shall have:

1. Research and development facilities.
2. Regional laboratories capable of making a water analysis.
3. A service department and qualified technical service representative located within a reasonable distance of the project site.
4. Service representatives who are Registered Engineers or factory-certified technicians with not less than five (5) years of water treatment experience with the water treatment system

manufacturer. A Certified Water Technologist (CWT) qualified professional is preferred.

B. Packaging and Labeling: Water treatment chemicals will be supplied in a container suitable for product, and will be in accordance with DOT shipping standards.

C. Electrical Standards: Provide electrical products which have been tested, listed and labeled by Underwriters Laboratories (UL) and which comply with National Electrical Manufacturers' Association (NEMA) standards.

D. Chemical Standards: Provide chemical products acceptable under state and local pollution control or other governing regulations.

1.05 SUBMITTALS

A. Test reports: Submit test reports certified by an officer of the firm, on water treatment company letterheads, of samples of each treated water system specified. Comply with ASTM D 596 for reporting. Indicate the ASTM best methods for each test. Tests will included by are not limited to conductivity, pH, chemical residual, iron, copper, and bacteria count.

B. Shop Drawings: Submit shop drawings for each water treatment system. Show wiring, pumps, piping and tubing sizes, fittings, accessories, valves and connections and monitoring equipment.

C. Guarantee: Submit written guarantee, signed by the Manufacturer and countersigned by the Installer and Contractor, agreeing to adjust or replace the chemicals in the systems as required to achieve the required performance, during a two (2) year period following the final start-up or the continued operation of the systems.

D. Agreement to Maintain: Prior to the time of final acceptance, the Manufacturer of the chilled water treating system shall submit four (4) copies of an "Agreement for Continued Service and the Owner's Possible Acceptance." Offer terms and conditions for furnishing chemical and providing continued testing and equipment for a two (2) year period with option for renewal of the Agreement by Owner.

1.6 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

PART 2 – PRODUCTS

2.01 GENERAL

A. Water Analysis: Determine which chemicals to use from the results of a water sample analysis taken from the building site by the system manufacturer. Provide ingredients necessary to achieve the desired water conditions.

B. Pre-Treatment: Treat water piping systems with chemicals to remove and permit flushing of mill scale, oil, grease and other foreign matter.

C. FDA and USDA Approval: Use only FDA and USDA approved products in system with direct connection to domestic water systems.

D. Governing Laws: Ensure that neither products, waste, blow-down nor other effluents violate local, state, EPA, or other agency regulations in effect in the project area.

2.02 APPROVED WATER TREATMENT SERVICE

A. Water Treatment Services

B. ChemCal (Div. of U.S. Water Services)

C. Chem Treat

D. Nalco

E. Garratt Callahan

2.03 CHILLED WATER SYSTEMS

A. Chemicals: Provide water treatment products which contain inhibitors that perform the following:

1. Form a protective film to prevent corrosion and scale formation;
2. Scavenge oxygen and protect against scale;
3. Remain stable throughout operating temperature range, and;
4. Are compatible with pump seals and other elements in the system.
5. Corrosion inhibitor chemical – chill loop. This product must be in liquid form and impart the following active ingredients at the following dosages when fed in CHILL LOOP water: 1) nitrite (as NO2) = 400-800 ppm, 2) borate = 200-400 ppm, 3) azole = 20-60 ppm. The resulting bulk water pH range should be 9.0-10.5.

B. Equipment: For each system, provide a 5-gallon filter feeder constructed of materials which are impervious to the products dispensed. Feeder shall be designed for not less than 200-psig operating pressure. Filter feeder shall be as manufactured by Vector Industries model FA-900 or approved equal. Provide flow indicator meter on discharge of filter feeder.

C. Test Kit: Provide test kit and reagents for determining proper water conditions. Test kit should be capable of testing presence of corrosion inhibitor and pH. A handheld connectivity/TDS meter shall be part of the test kit package.

D. Treatment: Treat initial water charge to water system, after system has been flushed and prepped, to achieve a water quality as specified. Test report required to verify cleaning.

E. Reports: Prepare certified test report for each required water performance characteristic. Comply with the following ASTM standard, where applicable:

1. D1067 – Tests for Acidity or Alkalinity of Water.
2. D1068 – Tests for Iron in Water and Waste Water.
3. D1126 – Tests for Hardness in Water.
4. D1128 – Identification of Types of Microorganisms and Microscopic Matter in Water and Waste Water.
5. D3370 – Sampling Water.

PART 3 – EXECUTION

3.01 THE WATER TREATMENT CONTRACTOR

A. General: After piping systems are erected pressure tested and proven free of leaks, administer chemicals required for preparation treatment and flushing. Apply chemicals for the time period and in the concentration recommended by the water treatment manufacturer for this portion of the work. Flushing must be for a minimum of 24 continuous hours.

B. Testing: After completion of 24 continuous hours of flushing, perform test procedures and submit a written report of test conditions and results to the Engineer. If test results are unsatisfactory, repeat preparation treatment as necessary to achieve test results approved by the Owner's insurance

carrier and the Engineer.

PART 4 – MECHANICAL CONTRACTOR

4.01 SERVICES OF MECHANICAL CONTRACTOR

A. Piping systems shall be pressure tested and approved for tightness, they shall be thoroughly cleaned and flushed using and approved pipe cleaning.

B. After initial chemical treatment has been added, the systems must be circulated for 48 hours with all valves opened; then the automated building system can be initiated.

4.02 PIPE CLEANING, STERILIZATION, AND FLUSHING

A. Additions/Renovations: When connecting existing lines to newly installed lines, provide wire strainer with fine mesh screens.

B. All connections required for cleaning, purging and circulating shall be included as permanent installation with valves. Provide permanent pipe bypasses at each coil and heat exchanger during this cleaning operation and for future flushing. All air vents, gauges, strainers, etc., valved connections in piping systems shall be blown clean during and after cleaning operation is completed and during.

C. After cleaning, drain the system, fill with fresh water and flush thoroughly for a minimum of 24 hours on a system that is not greater than 3,000 gallons. Systems greater than 3,000 gallons should be flushed thoroughly for a minimum of 48 hours or as recommended by Engineer.

D. All flushing, cleaning, and initial chemical treatment shall be complete and witnessed by Owner prior to starting systems.

E. Start-up procedures: During water system start-up, operate water treating system (after changing with specified chemicals) to maintain the required steady-state characteristics of water. Demonstrate system operation to Owner's operating personnel.

PART 5 – ADDITIONAL REQUIREMENT FOR THE WATER TREATMENT CONTRACTOR

5.01 Vendor shall warrant the chemicals used in the water treatment program, and will have no detrimental effects on the metallic or non-metallic materials in the equipment being treated; if applied according to Vendor's instructions.

A. All testing of the Owner's systems are to be completed on-site and discussed with Owner's HVAC personnel with a copy of the report given to him/her for signature.

B. All work shall be performed in cooperation with Owner's HVAC personnel.

C. Periodic de-scaling with inhibited acids will not be considered as meeting this specification.

D. Sulfuric acid or other inhibited acids shall not be used in the chemical treatment program of Owner.

E. The Contractor shall provide a biocide program consisting of both an oxidizing biocide and bio-dispersant if required.

5.02 PERSONNEL TRAINING

A. Operator Training: Train Owner's personnel in use and operation of heating water, chilled water treating systems. A Program Administration Manual shall be furnished encompassing all systems in this section of the Specifications.

B. Provide two (2) hours in use and operation of water treating systems.

END OF SECTION

SECTION 23 31 13
METAL DUCTWORK

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Low pressure ductwork.

B. Medium pressure ductwork.

C. Duct cleaning.

1.02 RELATED SECTIONS

Division 9 - Finishes: Weld priming, weather resistant, paint or coating.

A. Section 23 02 00 - Basic Material and Methods.

B. Section 23 05 29 – Hangers and Support for Piping and Equipment HVAC.

C. Section 23 05 93 - Testing, Adjusting and Balancing.

D. Section 23 07 13 - Duct Insulation.

E. Section 23 33 00 - Ductwork Accessories.

F. Section 23 37 13 - Air Distribution Devices.

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of metal ductwork products of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firms with least 3 years of successful installation experience on projects with metal ductwork systems similar to that required for project.

C. Codes and Standards:

1. SMACNA Standards: Comply with latest SMACNA's "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of metal ductwork.
2. ASHRAE Standards: Comply with ASHRAE Handbook, Equipment Volume, Chapter 1 "Duct Construction", for fabrication and installation of metal ductwork.
3. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems", NFPA 90B "Standard for the Installation of Warm Air Heating and Air Conditioning Systems", and NFPA 96 Standard.
4. IECC 2000: Comply with 2000 International Energy Conservation Code.

1.04 GENERAL DESCRIPTION

A. Extent of metal ductwork is indicated on drawings and in schedules, and by requirements of this section.

1.05 SUBMITTALS

A. Submit shop drawings, duct fabrication standards and product data under provisions of Division One.

B. Indicate duct fittings, particulars such as gauges, sizes, welds, and configuration prior to start of work.

C. The contract documents are schematic in nature and are to be used only for design intent. The contractor shall prepare sheet metal shop drawings, fully detailed and drawn to scale, indicating all structural conditions, all plumbing pipe and light fixture coordination, and all offsets and transitions as required to permit the duct to fit in the space allocated and built. All duct revisions required as a result of the contractor not preparing fully detailed shop drawings will be performed at no additional cost.

1.06 DEFINITIONS

A. Duct Sizes: Inside clear dimensions. For lined ducts, maintain indicated clear size inside lining. Where offsets or transitions are required, the duct shall be the equivalent size based on constant friction rate.

B. Low Pressure: Low pressure ductwork shall be rated for an operating pressure of 2". Low pressure ductwork shall be defined as all return, exhaust, and outside air ducts, all supply ductwork associated with constant volume air handling units with a scheduled external static pressure of less than 2", and all supply ductwork downstream of terminal units in variable volume systems.

C. Medium Pressure: Medium pressure ductwork shall be rated for an operating pressure of 4". Medium pressure ductwork shall be defined as all supply ductwork extending from variable volume air handling units to terminal units in variable volume systems with air handling units having a scheduled external static pressure of less than 4". The supply ductwork of constant volume air handling units having a scheduled external static pressure greater than 2" and less than 4" shall be rated for medium pressure.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protection: Protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings, use sheet metal end caps on any lined duct exposed to the weather.

B. Storage: Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.01 DUCTWORK MATERIALS

A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, stains and discolorations, and other imperfections, including those which would impair painting.

B. Sheet Metal.: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A 527, lockforming quality, with G 90 zinc coating in accordance with ASTM A 525; and mill phosphatized for exposed locations.

C. Stainless Steel Sheet: Where indicated, provide stainless steel complying with ASTM A167; Type 316; with No. 4 finish where exposed to view in occupied spaces, No. 1 finish elsewhere. Protect finished surfaces with mill-applied adhesive protective paper, maintained through fabrication and installation.

2.02 MISCELLANEOUS DUCTWORK MATERIALS

A. General: Non combustible and conforming to UL 181, Class 1 air duct materials.

B. Flexible Ducts: Flexmaster U.S.A., Inc. Type 3M or approved equal, corrosive resistant galvanized steel formed and mechanically locked to inner fabric with 1" thick insulation when flexible ducts are located in conditioned spaces and with R-5 insulation when located in unconditioned spaces. Flexible duct shall have reinforced metalized outer jacket comply with UL 181, Class 1 air duct.

C. Sealants: Hard-Cast "iron grip" or approved equal, non-hardening, water resistant, fire resistive and shall not be a solvent curing product. Sealants shall be compatible with mating materials, liquid used alone or with tape or heavy mastic.

D. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

1. For exposed stainless steel ductwork, provide matching stainless steel support materials.
2. For aluminum ductwork, provide aluminum support materials.

2.03 LOW PRESSURE DUCTWORK

A. Fabricate and support in accordance with latest SMACNA Duct Construction Standards and ASHRAE handbooks, except as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

B. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by approved shop drawings. Obtain engineer's approval prior to using round duct in lieu of rectangular duct.

C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide airfoil-turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

E. Use crimp joints with bead for joining round duct sizes 6 inch smaller with crimp in direction of airflow.

F. Use double nuts and lock washers on threaded rod supports.

2.04 MEDIUM PRESSURE DUCTS

A. Fabricate and support in accordance with SMACNA Duct Construction Standards and ASHRAE handbooks, except as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

B. Construct T's, bends, and elbows with radius of not less than 1½ times width of duct on centerline. Where not possible and where rectangular elbows are used, provide airfoil-turning vanes. Where acoustical lining is required, provide turning vanes of perforated metal with glass fiber insulation. Weld in place.

C. Transform duct sizes gradually, not exceeding 15 degrees divergence and 30 degrees convergence.

D. Fabricate continuously welded medium and high pressure round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

E. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Obtain manufacturer's inspection and acceptance of fabrication and installation of ductwork at beginning of installation.

B. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

C. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

D. Connect terminal units to medium pressure ducts with four feet maximum length of flexible duct. Do not use flexible duct to change direction.

E. Connect diffusers to low pressure ducts with 6 feet maximum, 4 feet minimum, length of flexible duct. Hold in place with strap or clamp.

F. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

G. The interior surface of all ductwork shall be smooth. No sheet metal parts, tabs, angles, or anything else may project into the ducts for any reason, except as specified to be so. All seams and joints shall be external.

H. Where ducts pass through floors, provide structural angles for duct support. Where ducts pass through walls in exposed areas, install suitable sheet metal escutcheons as closers.

I. All angles shall be carried around all four sides of the duct or group of ducts. Angles shall overlap corners and be welded or riveted.

J. All ductwork shall be fabricated in a manner to prevent the seams or joints being cut for the installation of grilles, registers, or ceiling outlets.

K. All duct hangers shall be attached to building structure. Cutting slots in roof or floor decking for hanger straps to be cast in concrete is not acceptable.

3.02 INSTALLATION OF FLEXIBLE DUCTS

A. Maximum Length: For any duct run using flexible ductwork, do not exceed 6'-0" extended length.

B. Installation: Install in accordance with Section III of SMACNA's, "HVAC Duct Construction Standards, Metal and Flexible".

3.03 DUCTWORK APPLICATION SCHEDULE

AIR SYSTEM	MATERIAL
Low Pressure Supply	Galvanized Steel, Aluminum
Medium Pressure Supply	Galvanized Steel
Return and Relief	Galvanized Steel, Aluminum
General Exhaust	Galvanized Steel, Aluminum
Shower/Locker Room/ Dryer Vent/ Exhaust	Stainless Steel, Carbon Steel
Outside Air Intake	Steel

3.04 DUCTWORK HANGERS AND SUPPORTS

A. All ductwork shall be properly suspended or supported from the building structure. Hangers shall be galvanized steel straps or hot-dipped galvanized rod with threads pointed after installation. Strap hanger shall be attached to the bottom of the ductwork, provide a minimum of two screws one at the bottom and one in the side of each strap on metal ductwork. The spacing, size and installation of hangers shall be in accordance with the recommendations of the latest SMACNA edition.

B. All duct risers shall be supported by angles or channels secured to the sides of the ducts at each floor with sheet metal screws or rivets. The floor supports may also be secured to ducts by rods, angles or flat bar to the duct joint or reinforcing. Structural steel supports for duct risers shall be provided under this Division.

3.05 AIR DUCT LEAKAGE: (From SMACNA Duct Standards Latest Edition) Test all ductwork (designed to handle over 1000 CFM) as follows:

A. Test apparatus

The test apparatus shall consist of:

1. A source of high pressure air--a portable rotary blower or a tank type vacuum cleaner.
2. A flow measuring device consisting of straightening vanes and an orifice plate mounted in a straight tube with properly located pressure taps. Each orifice assembly shall be accurately calibrated with its own calibration curve. Pressure and flow readings shall be taken with U-tube manometers.

B. Test Procedures

1. Test for audible leaks as follows:
2. Close off and seal all openings in the duct section to be tested. Connect the test apparatus to the duct by means of a section of flexible duct.
   a. Start the blower with its control damper closed.
   b. Gradually open the inlet damper until the duct pressure reaches 1.5 times the standard designed duct operating pressure.
   c. Survey all joint for audible leaks. Mark each leak and repair after shutting down blower. Do not apply a retest until sealants have set.
3. After all audible leaks have been sealed, the remaining leakage should be measured with the orifice section of the test apparatus as follows:
   a. Start blower and open damper until pressure in duct reaches 50% in excess of designed duct operating pressure.
   b. Read the pressure differential across the orifice on manometer No. 2. If there is no leakage, the pressure differential will be zero.
   c. Total allowable leakage shall not exceed one (1) percent of the total system design air flow rate. When partial sections of the duct system are tested, the summation of the leakage for all sections shall not exceed the total allowable leakage.
   d. Even though a system may pass the measured leakage test, a concentration of leakage at one point may result in a noisy leak which, must be corrected.
4. Test Witness
   a. Air duct leakage test shall be witnessed by Owner/Engineer.
   b. The Architect or duly authorized construction inspector shall be notified in writing at least 2 working days prior to each test.

3.06 DUCT SYSTEM CLEANING

A. Duct system cleaning shall be performed in accordance with the current published standards of ASHRAE and NADCA.

B. Duct system cleaning method used shall incorporate the use of vacuum collection devices that are operated continuously during cleaning. A vacuum device shall be connected to the downstream end of the section being cleaned through a predetermined opening. The vacuum collection device

must be of sufficient power to render all areas being cleaned under negative pressure, such that containment of debris and the protection of the indoor environment is assured.

C. All vacuum devices exhausting air inside the building shall be equipped with HEPA filters (minimum efficiency), including hand-held vacuums and wet-vacuums.

D. All vacuum devices exhausting air outside the facility shall be equipped with Particulate Collection including adequate filtration to contain debris removed from the HVAC system. Such devices shall exhaust in a manner that will not allow contaminants to re-enter the facility. Release of debris outdoors must not violate any outdoor environmental standards, codes or regulations.

E. Fibrous glass thermal or acoustical insulation elements present in any equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment, while the HVAC system is under constant negative pressure, and not permitted to get wet in accordance with applicable NADCA and NAIMA standards and recommendations.

F. Duct cleaning method used shall not damage the integrity of the ductwork, nor damage porous surface materials such as liners inside the ductwork or system components.

G. Replace the fiberglass material if there is any evidence of damage, deterioration, delamination, friable material, mold or fungus growth, or moisture such that fibrous glass materials cannot be restored by cleaning or resurfacing with an acceptable insulation repair coating.

H. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

I. Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.

J. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.

K. Cleaning Report: Contractor shall provide a report to the Owner indicating the completion of duct cleaning per specification and areas of the duct system found to be damaged and/or in need of repair.

3.07 DUCT JOINTS AND SEAMS

A. Seal all non-welded duct joints with duct sealant as indicated.

END OF SECTION

SECTION 23 33 00
DUCTWORK ACCESSORIES

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Volume control dampers.

B. Round Duct Taps.

C. Fire dampers.

D. Combination fire and smoke dampers.

E. Back draft dampers.

F. Air turning devices.

G. Flexible duct connections.

H. Duct access doors.

I. Duct test holes.

1.02 RELATED WORK

A. Section 23 31 13 - Metal Ductwork.

1.03 REFERENCES

A. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

B. SMACNA - Low Pressure Duct Construction Standards.

C. UL 33 - Heat Responsive Links for Fire-Protection Service.

D. UL 555 - Fire Dampers and Ceiling Dampers.

1.04 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Provide shop drawings for shop fabricated assemblies indicated, including volume control dampers duct access doors duct test holes. Provide product data for hardware used.

C. Submit manufacturer's installation instructions under provisions of Division 1, for fire dampers and combination fire and smoke dampers.

PART 2 - PRODUCTS

2.01 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA Low Pressure Duct Construction Standards, and as indicated.

B. Fabricate splitter dampers of material same gauge as duct to 24 inches size in either direction, and two gauges heavier for sizes over 24 inches.

C. Fabricate splitter dampers of double thickness sheet metal to streamline shape. Secure blade with continuous hinge or rod. Operate with minimum 1/2 inch diameter rod in self aligning, universal joint, action flanged bushing, with set screw.

D. Fabricate single blade dampers for duct sizes to 9-1/2 x 24 inch.

E. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 12 x 72 inch.

1. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
2. On outside air, return air, and all other dampers required to be low leakage type, provide galvanized blades and frames, seven inches wide maximum, with replaceable vinyl, EPDM, silicone rubber seals on blade edges and stainless steel side seals. Provide blades in a double sheet corrugated type construction for extra strength. Provide hat channel shape frames for strength and blade linkage enclosure to keep linkage out of the air stream. Construction leakage not to exceed 1/2%, based on 2,000 fpm and 4 inch static pressure.

F. Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

G. Provide locking, indicating quadrant regulators on single and multi-blade dampers. Where rod lengths exceed 30 inches provide regulator at both ends.

H. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

2.02 ROUND DUCT TAPS

A. Taps to trunk duct for round flexible duct shall be spin-in fitting with locking quadrant butterfly damper, model no. FLD-B03 by Flexmaster or approved equal.

2.03 ACCEPTABLE MANUFACTURERS - FIRE DAMPERS AND COMBINATION FIRE AND SMOKE DAMPERS

A. Greenheck.

B. Louvers and Dampers Inc.

C. Ruskin.

D. Nailor Industries.

E. Pottorff

2.04 FIRE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

B. Provide curtain type dampers of galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream.

C. Fabricate multiple blade fire dampers per U.L. with 16 gauge minimum galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

D. Fusible links, UL 33, shall separate at 160 degrees F. Provide adjustable link straps for combination fire/balancing dampers.

2.05 COMBINATION FIRE AND SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

B. Provide factory sleeve for each damper. Install damper operator on exterior of sleeve and link to damper operating shaft.

C. Fabricate with multiple blades with 16 gauge galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.

1. Operators shall be spring return electric type suitable to operate on 120 V AC, 60 cycle.
2. Operators shall be UL listed and labeled.

2.06 ACCEPTABLE MANUFACTURERS – BACKDRAFT DAMPERS

A. Greenheck

B. American Warming and Vent.

C. Louvers and Dampers Inc.

D. Ruskin.

E. Pottorff

F. Substitutions: Under provisions of Division One.

2.07 BACKDRAFT DAMPERS

A. Gravity back draft dampers, size 18 x 18 inches or smaller, furnished with air moving equipment, may be air moving equipment manufacturers standard construction.

B. Fabricate multi-blade, parallel action gravity balanced back draft dampers of 16 gauge galvanized steel, or extruded aluminum, with blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.08 ACCEPTABLE MANUFACTURERS – AIR TURNING DEVICES

A. Young Regulator.

B. Titus.

C. Tuttle and Bailey.

D. Substitutions: Under provisions of Division One.

2.09 AIR TURNING DEVICES

A. On duct sizes less than 12 x 12, multi-blade device with blades aligned in short dimension; steel or aluminum construction; with individually adjustable blades, mounting straps.

B. Multi-blade device with radius blades attached to pivoting frame and bracket, steel or aluminum construction, with worm drive mechanism with 18 inch long removable key operator.

2.10 ACCEPTABLE MANUFACTURERS – FLEXIBLE DUCT CONNECTIONS

A. Metaledge.

B. Ventglass.

C. Substitutions: Under provisions of Division One.

2.11 FLEXIBLE DUCT CONNECTIONS TO AIR MOVING EQUIPMENT

A. Fabricate in accordance with SMACNA Low Pressure Duct Construction Standards, and as indicated.

B. UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 20 oz per sq yd, approximately 6 inches wide, crimped into metal edging strip.

2.12 ACCEPTABLE MANUFACTURERS – DUCT ACCESS DOORS

A. Greenheck.

B. American Warming and Vent.

C. Ruskin.

D. Titus.

E. Substitutions: Under provisions of Division One.

2.13 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA Low Pressure Duct Construction Standards and as indicated.

B. Review locations prior to fabrication.

C. Fabricate rigid and close-fitting doors of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum one inch thick insulation with sheet metal cover. Insulation shall be replaceable without field cutting or patching.

D. Access doors smaller than 12 inches square may be secured with sash locks.

E. Provide two hinges and two sash locks for sizes up to 18 inches square, three hinges and two compression latches with outside and inside handles for sizes up to 24 x 48 inches. Provide an additional hinge for larger sizes.

F. Access doors with sheet metal screw fasteners are not acceptable.

2.14 DUCT TEST HOLES

A. Cut or drill temporary test holes in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent test holes shall be factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions.

B. Balancing Dampers

1. Provide at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts and as required for air balancing. Use splitter dampers only where indicated.
2. All regulators mounted on externally insulated ductwork shall have 16 gauge elevated platforms at least 1/8 inch higher than the thickness of the insulation. Damper shaft shall have Ventlock No. 607 bearing mounted on ductwork within elevated platform. If duct is inaccessible the operating handle shall be extended and the regulator installed on the face of the wall or ceiling. Where regulators are exposed in finished parts of the building, they shall be flush type, Ventlock No. 666. All regulators shall be manufactured by Ventlock, or approved equal.

3. All dampers in lined ductwork shall have bushing to prevent damper damage to liner.

C. Provide fire dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

D. Demonstrate re-setting of fire dampers to authorities having jurisdiction and Owner's representative.

E. Provide back draft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

F. Provide flexible duct connections immediately adjacent to equipment in ducts associated with fans and motorized equipment. Provide at least one inch slack at all flexible duct connections.

G. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated.

H. Provide duct test holes where indicated and required for testing and balancing purposes.

END OF SECTION

SECTION 23 34 00
HVAC FANS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods is included as a part of this Section as though written in full in this document.

1.02 WORK INCLUDED

A. Centrifugal roof ventilators.

1.03 RELATED SECTIONS

A. Section 23 05 13 – Common Motor Requirements for HVAC Equipment

B. Section 23 05 29 – Hangers and Support for Piping and Equipment HVAC

C. Section 23 09 63 – Automatic Temperature Controls

D. Section 23 05 93 – Testing, Adjusting and Balancing

1.04 QUALITY ASSURANCE

A. UL Compliance: Fans shall be designed, manufactured, and tested in accordance with UL 705 "Power Ventilators."

B. UL Compliance: Fans and components shall be UL listed and labeled.

C. Nationally Recognized Testing Laboratory Compliance (NRTL): Fans and components shall be NRTL listed and labeled. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.

D. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

E. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

F. Sound Power Level Ratings: Comply with AMCA Standard 301 "Method for Calculating Fan Sound Ratings From Laboratory Test Data." Test fans in accordance with AMCA Standard 300 "Test Code for Sound Rating." Fans shall be licensed to bear the AMCA Certified Sound Ratings Seal.

G. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings in accordance with AMCA Standard 210/ASHRAE Standard 51 - Laboratory Methods of Testing Fans for Rating.

1.05 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

B. Product data for selected models, including specialties, accessories, and the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound power ratings.
3. Motor ratings and electrical characteristics plus motor and fan accessories.
4. Materials, gages and finishes, include color charts.
5. Dampers, including housings, linkages, and operators.
6. Full color paint samples.

C. Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, required clearances, components, and location and size of field connections.

D. Coordination drawings, in accordance with Division 23, Section "Basic Materials and Methods", for roof penetration requirements and for reflected ceiling plans drawn accurately to scale and coordinating penetrations and units mounted above ceiling. Show the following:

1. Roof framing and support members relative to duct penetrations.
2. Ceiling suspension members.
3. Method of attaching hangers to building structure.

F. Wiring diagrams that detail power, signal, and control wiring. Differentiate between manufacturer installed wiring and field installed wiring.

G. Product certificates, signed by manufacturer, certifying that their products comply with specified requirements.

H. Maintenance data for inclusion in Operating and Maintenance Manual specified in Division 1 and Division 23, Section "Basic Materials and Methods".

1.06 DELIVERY, STORAGE, AND HANDLING

A. Fans shall be stored and handled in accordance with the unit manufacturer's instructions.

B. Lift and support units with the manufacturer's designated lifting or supporting points.

C. Disassemble and reassemble units as required for movement into the final location following manufacturer's written instructions.

D. Deliver fan units as a factory-assembled unit to the extent allowable by shipping limitations, with protective crating and covering.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.08 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Penn Barry

B. Loren Cook Company

C. Greenheck Fan Corporation

D. ACME

E. Twin City Fan and Blower

2.02 GENERAL DESCRIPTION

A. Provide fans that are factory fabricated and assembled, factory tested, and factory finished with indicated capacities and characteristics.

B. Fans and Shafts shall be statically and dynamically balanced and designed for continuous operation at the maximum rated fan speed and motor horsepower.

C. Provide factory baked-enamel finish coat after assembly. Color for roof mounted fans shall be chosen by Architect during the submittal process.

2.03 CENTRIFUGAL ROOF VENTILATORS

A. Fan shall be a spun aluminum, centrifugal, roof mounted, direct driven or belt driven as indicated.

B. Fan shall be listed by Underwriters Laboratories (UL 705). Fan shall bear the AMCA certified ratings seal for sound and air performance.

C. The fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16 gauge marine alloy aluminum, bolted to a rigid aluminum support structure.

The aluminum base shall have continuously welded curb cap corners for maximum leak protection. A discharge baffle conduit chase shall be provided through the curb cap and into the motor compartment to facilitate wiring connections.

The motor, bearings and drives shall be mounted on a minimum 14 gauge steel power assembly, isolated from the unit structure with rubber vibration isolators. These components shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. Unit shall bear an engraved aluminum nameplate and shall be shipped in transit tested packaging.

D. Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA standard 204-96, balance quality and vibration levels for fans.

E. Motor shall be heavy duty type with permanently lubricated sealed ball bearings.

F. Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty regreasable ball type in a cast iron housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.

G. Accessories: The following accessories are required.

1. Disconnect Switch: Nonfusible type, with thermal overload protection, mounted inside fan housing, factory-wired through an internal aluminum conduit.
2. Bird Screens: Removable ½ inch mesh, 16 gauge, aluminum or brass wire.
3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base, factory set to close when fan stops.
4. Dampers: Motor-operated, parallel-blade, volume control dampers mounted in curb base.
5. Roof Curbs: Prefabricated, 12 inch high, heavy-gauge, galvanized steel; mitered and welded corners; 2 inch thick, rigid, fiberglass insulation adhered to inside walls; built-in cant and mounting flange for flat roof decks; and 2 inch wood nailer. Size as required to suit roof opening and fan base. Roof curb shall match roof slope so that the curb is level.

PART 3 – EXECUTION

3.01 Install in accordance with manufacturer's instructions.

3.02 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

END OF SECTION

SECTION 23 36 19
PARALLEL FAN-POWERED TERMINAL UNIT

PART 1 - GENERAL

1.01 WORK INCLUDED

Parallel type fan-powered terminal unit.

1.02 RELATED SECTIONS

Section 23 02 00 - Basic Materials And Methods

Section 23 05 13 - Common Motor Requirements For HVAC Equipment

Section 23 05 48 - Vibration For HVAC Piping And Equipment

Section 23 05 93 - Testing, Adjusting And Balancing

Section 23 80 00 - Commissioning of HVAC Systems

Section 23 31 13 - Metal Ductwork

Section 23 31 19 - Ductwork Accessories

1.03 QUALITY ASSURANCE

Terminal Units shall be certified under the AHRI Standard 880-98 and carry the AHRI Seal.

The terminal units shall be designed, built and tested as a single unit including fan motor and fan assembly, primary air damper assembly, water or electric heating coils and accessories.

The entire terminal unit and all electrical components shall be UL listed and installed in accordance with the National Electric Code.

1.04 GENERAL DESCRIPTIONS

Furnish, and install fan powered terminal units of the sizes and capacities shown on the plans.

Terminal Unit shall ship as a complete assembly requiring no field assembly (including accessories). Terminal unit manufacture shall factory mount EMCS controls, provided by Section 23 09 63 (EMCS Contractor).

1.05 SUBMITTALS

Submit shop drawings and product data under provisions of Division 01.

Shop drawings shall indicate assembly, unit dimensions, weight loading, required clearances, construction details, and field connection details.

Product data shall indicate dimensions, weights, capacities, ratings, fan performance, motor electrical characteristics, and gauges and finished of materials.

Submit product data or filter media and filter performance data.

Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory installed and field installed wiring.

Submit manufacturer's installation instructions under provisions of Division 01.

Submit operation and maintenance data under provisions of Section 23 02 00.

Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

Terminal units shall include a QR code tag to link directly to the specific IOM for the terminal unit to be accessed by mobile device.

1.06 DELIVERY, STORAGE AND HANDLING

Unit shall be stored and handled in accordance with the unit manufacturer's instructions.

1.07 ENVIRONMENTAL REQUIREMENTS

Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.08 OPERATIONS PERSONNEL TRAINING

Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

Purpose of equipment.

Principle of how the equipment works.

Important parts and assemblies.

How the equipment achieves its purpose and necessary operating conditions.

Most likely failure modes, causes and corrections.

On-site demonstration.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

TITUS

METALAIRE

KRUEGER

NAILOR INDUSTRIES

PRICE

2.02 TERMINAL CASING

The terminal casing shall be minimum 20 gauge galvanized steel, internally lined with 1" natural fiber or fiberglass free insulation which complies with UL 181 with regard to resistance to erosion and mold growth and NFPA 90A. Insulation shall have R-values of 4.0. Exposed fiberglass is not acceptable. The insulation shall be mechanically fastened to the unit casing. The fasteners shall be weld pins. Lining material glued in place without mechanical fasteners are not acceptable. Any exposed insulation edges shall be coated with NFPA 90A approved sealant, or covered with galvanized brackets or foil tape. The terminal shall have round duct collars for the primary air connections and a rectangular discharge suitable for flanged duct connection. The casing shall be provided with mounting brackets for hanging from structure.

The terminal casing shall have a bottom or side access panel, which allows removal of fan and servicing of terminal without disturbing duct connections.

The terminal casing shall have a filter rack/bracket for securing the air filter over the return air inlet. This filter rack shall be sized so that standard sized filters can be installed by the owner as part of ongoing maintenance.

2.03 FAN AND FAN MOTOR

The fan shall be constructed of steel and have a forward curved dynamically balanced wheel with direct drive motor.

The terminal unit shall utilize an ECM variable-speed DC brushless motors specifically designed for use with single phase, 277 volt, 60 hertz electrical input. Motor shall be complete and operated by a single-phase integrated controller/inverter that operates the wound stator and senses rotor position to electronically commutate the stator. All motors shall be designed for synchronous rotation. Rotor shall be permanent magnet type with near zero rotor losses. Motor shall have built-in soft start and soft speed change ramps. Motor shall be able to be mounted with shaft in horizontal or vertical orientation. Motor shall be permanently lubricated with ball bearings. Motor shall be directly coupled to the blower. Motor shall maintain a minimum of 70 percent efficiency over its entire operating range. Provide a motor that is designed to overcome reverse rotation and not affect life expectancy.

The terminal unit manufacturer shall provide a factory-installed controller for manual fan cfm adjustment. The manual PWM controller shall be field adjustable with a standard screwdriver. The factory shall preset the fan cfm as shown on the schedule.

2.04 CONTROL DAMPER

Cooling inlet shall have a damper assembly with factory set and calibrated pressure independent control. The damper shall be heavy gauge steel with shaft rotating in Delrin (Polyoxymethylene) self-lubricating bearings. Nylon bearings are not acceptable. Shaft shall be clearly marked on the end to indicate damper position. Stickers or other removable markings are not acceptable. The damper shall incorporate a mechanical stop to prevent over-stroking and a synthetic seal to limit close-off leakage

Damper and casing leakage shall be tested in accordance with ASHRAE Standard 130 and shall not exceed 2% of rated airflow based on a nominal inlet velocity of 2000 FPM at 2.0 IN WG of static pressure.

Terminals with interior actuator linkage connection must include gasketed access panel, removable without disturbing ductwork

2.05 ELECTRIC HEATING COILS

Modulating electric coils shall be supplied and installed on the terminal unit by the manufacturer. Coils shall be ETL listed. Coils shall be housed in an attenuator section integral with the terminal with element grid recessed from unit discharge a minimum of 5 inches to prevent damage to elements during shipping and installation. Elements shall be 80/20 nickel chrome, supported by ceramic isolators a maximum of 3½ inches apart, staggered for maximum thermal transfer and element life, and balanced to ensure equal output per step. The integral control panel shall be housed in a NEMA 1 enclosure with a hinged access door for access to all controls and safety devices.

Electric coils shall contain a primary automatic reset thermal cutout, a secondary replaceable heat limiter per element, differential pressure airflow switch for proof of flow, and line terminal block. Coil shall include an integral door interlock type disconnect switch, which will not allow the access door to be opened while power is on. Non-interlocking type disconnects are not acceptable. All individual components shall be UL listed or recognized.

Heaters shall be equipped with modulating control (Lynergy Comfort Controller (LCC) or equal) to control heater coil firing. The control panel shall include an interface to control heater coil firing in proportion to the EMCS signal. The EMCS signal shall connect to low voltage universal signal interface circuitry supplied and installed by the terminal manufacturer. The universal interface shall be selected for either 0-10 VDC or 0-20 mA interface options, without additional interface circuitry.

Discharge air temperature limit shall be provided through modulating controller incorporating a downstream air temperature sensor. When invoked, the discharge air from the heater shall not exceed an adjustable maximum temperature setpoint.

2.06 FAN INTAKE FILTER

The filter shall be 1" thick, disposable construction type mounted in a rack on the fan air inlet and designed for ease of service.

Filter size shall be based on standard sizes that are readily available.

2.07 SOUND CRITERIA

Sound ratings for the terminals shall not exceed 40 NC in the occupied space at 1.0 inch w.g. inlet static pressure, and discharge static pressure of 0.25 inch w.g. NC estimations shall be calculated per ARI 885-98, Appendix E. The terminal shall be provided with factory installed internal and external attenuators if sound requirements are not met. The external attenuator shall be shipped internal to the unit to protect it from shipping damage. The external attenuator shall be slid into the operation position and secured without the need for additional screws. Factory provided attenuators that require field installation are not acceptable.

2.08 CONTROLS AND SENSORS

The terminal shall mount the pressure independent electronic controls that are provided by Section 23 09 63.

The terminal unit shall incorporate a multi-point, center-averaging velocity sensor. A minimum of four measuring ports must be parallel to the takeoff point from the sensor. Sensors with measuring ports in series are not acceptable. The sensor must provide a minimum differential pressure signal of 0.03 IN WG at an inlet velocity of 500 FPM. The sensor must provide airflow control signal accuracy of ± 5%, with a hard 45° or 90° elbow attached directly to the inlet.

The terminal unit manufacturer shall provide, mount and wire fan relay, 24-volt transformer, and disconnect switch.

Flow measuring taps and flow curves shall be supplied with each terminal for field balancing airflow. Each terminal shall be equipped with labeling showing unit location, size, minimum and maximum cfm setpoints, damper fail position, QR code label as per submittal section, and thermostat action.

All electronic accessories, including switches for activation of fan shall be supplied and calibrated by the terminal manufacturer.

PART 3 - EXECUTION

3.01 INSTALLATION

Terminal units shall be installed with all required service clearances, according to manufacturer's installation instructions.

Terminal units with electric heat shall be installed with clearance that meets National Electrical Code requirements.

All equipment shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

Space limitation shall be reviewed carefully to ensure that all terminals will fit the available space.

All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturers requirements.

END OF SECTION

SECTION 23 37 13
AIR DISTRIBUTION DEVICES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Ceiling air diffusers.

B. Wall registers and grilles.

C. Louvers.

D. Other air devices indicated on drawings and schedules.

1.02 RELATED SECTIONS

A. Section 23 02 00 – Basic Materials and Methods

B. Section 23 05 93 – Testing, Adjusting and Balancing

C. Section 23 31 13 – Metal Ductwork

D. Section 23 31 19 – Ductwork Accessories

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air distribution devices of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:

1. ARI Compliance: Test and rate air distribution devices in accordance with ARI 650 "Standard for Air Outlets and Inlets".
2. ASHRAE Compliance: Test and rate air distribution devices in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".
3. AMCA Compliance: Test and rate louvers in accordance with AMCA 500 "Test Method for Louvers, Dampers and Shutters".
4. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.
5. NFPA Compliance: Install air distribution devices in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for air distribution devices including the following:

1. Schedule of air distribution devices indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.
2. Data sheet for each type of air distribution devices, and accessory furnished; indicating construction, finish, and mounting details.
3. Performance data for each type of air distribution devices furnished, including aspiration ability, temperature and velocity traverses; throw and drop; and noise criteria ratings. Indicate selections on data.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air distribution devices, indicating materials and methods of assembly of components.

C. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 1.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver air distribution devices wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

B. Store air distribution devices in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

1.06 WARRANTY

A. Warrant the installation of the Work specified herein for two years against becoming unserviceable or causing an objectionable appearance resulting from defective or nonconforming workmanship.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Titus Company

B. Metalaire Industries, Inc.

C. Nailor Industries

D. Krueger

E. Price

F. Substitutions under provisions of Division One.

2.02 GENERAL DESCRIPTION

A. Unless otherwise indicated, provide manufacturer's standard air devices when shown of size, shape, capacity, type and accessories indicated on drawings and schedules, constructed of materials and components as indicated and as required for complete installation and proper air distribution.

B. Provide air devices that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device and listed in manufacturer's current data.

C. Unless noted otherwise on drawings, the finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100 hour ASTM D117 Corrosive Environments Salt Spray Test without creepage, blistering, or deterioration of film. The paint must pass a 250 hour ASTM-870 Water Immersion Test. The paint must also pass the ASTM D-2794 Reverse Impact Cracking Test with a 50 inch pound force applied.

D. Provide air device with border styles that are compatible with adjacent ceiling or wall system, and that are specially manufactured to fit into the wall construction or ceiling module with accurate fit and adequate support. Refer to architectural construction drawings and specifications for types of wall construction and ceiling systems.

E. Provide integral volume damper with roll formed steel blades where indicated on drawings or schedules. Dampers shall be opposed blade design with a screw driver slot or a concealed lever operator for adjustment through the face of the air device.

F. Air devices designated for fire rated systems shall be pre-assembled with UL classified radiation damper and thermal blanket. Fire rated air devices shall be shipped completely assembled; one assembly per carton, Each assembly shall be enclosed in plastic shrink wrap with installation instructions.

2.03 LOUVERS

A. Except as otherwise indicated, provide manufacturer's standard louvers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Provide louvers that have minimum free area, and maximum pressure drop of each type as listed in manufacturer's current data, complying with louver schedule.

C. Provide louvers with frame and sill styles that are compatible with adjacent substrate, and that are specifically manufactured to fit into construction openings with accurate fit and adequate support, for weatherproof installation. Refer to architectural construction drawings and specifications for types of substrate.

D. Louvers shall be constructed of aluminum extrusions, ASTM B 221, Alloy 6063-T5. Weld units or use stainless steel fasteners.

E. Louver Screens: On inside face of exterior louvers, provide 1/2" square mesh anodized aluminum wire bird screens mounted in removable extruded aluminum frames.

F. Acceptable Manufacturers:
1. Ruskin Manufacturing Company
2. Greenheck Company
3. Louvers and Dampers, Inc.
4. Pottorff
5. Arrow
6. Substitutions under provisions of Division One.

PART 3 – EXECUTION

3.01 All interior surfaces of all air devices shall be painted flat black.

3.02 See floor plans for type, neck size and CFM of air for all air distribution devices.

3.03 Install all air distribution devices as detailed on plans and in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 23 41 00
AIR FILTERS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 23 02 00, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

PART 2 - PRODUCTS

2.01 FILTERS

A. The filters shall be MERV 13 2 inch thick or approved equal.

B. APPROVED MANUFACTURERS: The following manufacturers are approved subject to specification compliance.

1. American Air Filter.
2. Airguard Industries, Inc.
3. Cambridge.
4. Filtration Group

2.02 LOW VELOCITY FILTER SECTION

A. Filters shall be of the throwaway cartridge type of the size required to fit within the units filter rack. When installing multiple filters into slide-in frames tape adjacent filters together with duct tape to prevent bypassing of air around the filter. Media shall be rated at 500 feet per minute.

B. Filtering media shall be formed of non-woven reinforced cotton fabric type filtering media bonded to 96% open area media support grid folded into a non-creased radial pleat design. The filter pack shall be bonded to the inclosing frame to prevent air bypass. Average efficiency shall be 25-30% on ASHRAE test standard 52-76. Initial resistance shall not exceed 0.20 inches water gauge at 350 FPM face velocity.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install differential pressure switch to activate "Filter Dirty" light when pressure difference across filters reaches 0.5 inch W.G. (adjustable). Locate "filter dirty" lights in mechanical rooms with identifying label

B. Install and relocate filters in the mechanical or the storage room in accordance with manufacturer's recommendations.

C. Refer to Section 23 02 00 for additional filter information.

END OF SECTION

SECTION 23 55 00
ELECTRIC UNIT HEATERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electric unit heaters.

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 23 09 00 - Building Automation and Controls System: Installation of thermostats and other controls components.

B. Section 26 09 00 - Miscellaneous Electrical Controls and Wiring: Installation and wiring of thermostats and other controls components.

1.03 RELATED SECTIONS

A. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Fan motors.

B. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping.

1.04 REFERENCES

A. ANSI/NEMA MG 1 - Motors and Generators.

B. ANSI/NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.

C. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

1.05 SUBMITTALS

A. Submit under provisions of Division 1.

B. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.

C. Product Data: Provide manufacturer's literature and data indicating rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

D. Manufacturer's Installation Instructions: Indicate rigging, assembly, and installation instructions.

1.06 OPERATION AND MAINTENANCE DATA

A. Submit operation data under provisions of Division 1.

B. Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listing.

1.07 WARRANTY

A. Provide two year warranty under provisions of Division 1.

PART 2 - PRODUCTS

2.01 UNIT HEATERS

A. Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heat exchanger, heater, controls.

B. Assembly: UL listed and labeled assembly with terminal box and cover.

C. Heating Elements: Exposed helical coil of nickel-chrome resistance wire with refractory ceramic support bushings.

D. Performance Ratings: Seasonal efficiency to ANSI/ASHRAE 103.

E. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors, glass fiber insulation and reflective liner.

F. Supply Fan: Propeller type with direct drive.

G. Operating Controls:
1. Room Thermostat: Low voltage, to control two-stage gas valve, to maintain temperature setting. Include fan control switch (auto-on).

M. Accessories:
1. Discharge Louvers: Individually adjustable horizontal louvers to match cabinet finish.
2. Downturn Nozzle: 60 degree nozzle to match outlet and cabinet finish.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that space is ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install to NFPA 90A and NFPA 90B.

C. Install unit heaters with vibration isolation.

END OF SECTION

SECTION 23 62 13
AIR COOLED CONDENSING UNITS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 – Basic Materials and Methods is included as a part of this Section as though written in full in this document.

1.02 SCOPE

Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for Owner's use.

1.03 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

PART 2 - PRODUCTS

2.01 AIR-COOLED CONDENSING UNITS

A. Air-cooled condensing unit shall be designed for use with split system having a remote direct-expansion (DX) cooling coil mounted in evaporator fan unit. Capacity shall be as called for on the Drawings when matched to the appropriate evaporator coil.

B. Condensing unit shall consist of high-efficiency hermetic compressor, air-cooled condenser with quiet fan, factory wired controls, R410A or R407C refrigerant and refrigeration circuit and valves.

C. Cabinet shall be heavy-gauge galvanized steel with bonding primer and baked-enamel finish coat. The entire cabinet shall be protected from rust.

D. Compressor shall be protected from excessive current and temperatures and shall be provided with a thermostatically controlled crankcase heater to operate only when needed for protection of the compressor. Compressor shall be spring-mounted on rubber isolators. Compressor shall be located in compartment isolated from condenser fan and coil. Provide a high-capacity dryer in the system to remove moisture and dirt.

E. Condenser fan shall be directly connected to a weather-protected, quiet, high-efficiency motor. Fan guard shall be provided and shall be protected from rust by PVC finish. Condenser coil shall be aluminum fin with copper tube.

F. Connections for refrigerant suction and liquid lines shall be extended outside the cabinet and provided with service valves with gauge connections.

G. Power connections shall be made to the connectors located inside the electrical connection box.

H. Standard operating and safety controls shall include high-pressure switch, low pressure switch,

compressor overload service, and solid-state timed-off control.

I. All components (parts and labor) of the sealed refrigeration circuit shall be warranted by the manufacturer for five years.

2.02 AUXILIARY EQUIPMENT

A. Auxiliary equipment shall consist of refrigerant lines prepared for the unit involved. These lines shall be cleaned, dried, and pressurized at the factory.

B. Low ambient kit to allow operation at outside temperature below 35 deg. F (2 deg. C) shall be provided.

C. Expansion valve shall be provided with the evaporator coil.

D. Provide thermostat to match the requirements of the job. Thermostat shall provide subbase with Heat-Cool-Off and Fan On-Auto switch. See section on controls for other related requirements.

E. Provide polyethylene structural base designed for that service, and intended to support the unit and eliminate vibration transmission.

F. Provide hard-start kit with unit.

G. Provide guards for condenser coils.

2.03 ACCEPTABLE MANUFACTURERS

A. Condensing unit shall be the make and model number shown on the drawings or acceptable equivalents by Lennox, York, Trane, or Daikin-McQuay.

PART 3 - EXECUTION

3.01 All HVAC equipment shall be installed as per manufacturer's printed installation instructions.

3.02 All items required for a complete and proper installation are not necessarily indicated on the Drawings or in the Specifications. Provide all items required as per manufacturer's requirements.

3.03 INSTALLATION

A. Install the condensing unit on proper foundation as shown on the Drawings, and in location that will not restrict the air entry or discharge from the unit.

B. Install refrigerant lines as recommended by the manufacturer, taking care not to lose the refrigerant charge contained in the lines, or allow air to enter the lines or equipment. Locate the lines in such a way as to not obstruct access to the condensing unit or other equipment. Lines located underground or under concrete shall be installed in a PVC sleeve for protection.

C. Provide electrical connections as required by the applicable codes. Provide control wiring required. All power wiring and control wiring shall be in conduit and located so as not to obstruct access to the unit or other equipment.

3.04 TESTING

A. Operate the condensing unit and the system to assure that unit is operating properly and without excessive noise and vibration.

B. Read and record the power draw and the refrigeration suction and liquid pressures as required by Section 23 05 93 – Testing, Adjusting, and Balancing.

END OF SECTION

SECTION 23 64 23
AIR-COOLED WATER CHILLERS

PART 1 GENERAL

1.01 SCOPE

A. Section includes design, performance criteria, controls and control connections, chilled water connections, electrical power connections and refrigerants of the chiller package.

1.02 REFERENCES

A. Products shall be designed, rated and certified in accordance with applicable sections of the following Standards and Codes:
1. To comply with the most recent versions of applicable Standards and Codes of AHRI 550 / 590.
2. AHRI 370 - Standard for Sound Rating of Large outdoor Refrigerating and Air-conditioning Equipment.
3. To comply with the most recent versions of applicable Standards and Codes of ASHRAE 15.
4. Units shall meet the efficiency standards of the latest ASHRAE 90.1 Standard.
5. To comply with seismic application in accordance with the most recent versions of the International Building Code (IBC).

1.03 QUALITY ASSURANCE

A. UL 1995 -- Standard for Heating and Cooling Equipment.

B. Manufactured facility to be ISO 9001.

C. Factory Functional Test: The chiller shall be pressure tested, evacuated and fully charged with HFC-410A refrigerant and oil. In addition, a factory functional test to verify correct operation by cycling condenser fans, closing compressor contacts and reading data points from temperature and pressure sensors.

D. Warranty: The manufacturer shall warrant all equipment and material of its manufacture against defects in workmanship and material for a period of two years from date of initial start-up.

1.04 SUBMITTALS

A. Submit shop drawings and product data in accordance with the specifications.

B. Submittals shall include the following:
1. Dimensioned plan and elevation view drawings, required clearances, and location of all field connections.
2. Product data indicating rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.

1.05 OPERATION AND MAINTENANCE DATA

A. Include manufacturer's descriptive literature, installation checklist, start-up instructions and maintenance procedure.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Units shall be delivered to job site fully assembled and charged with refrigerant (unless selected with nitrogen charge) and oil by the manufacturer.

B. Unit shall be stored and handled per manufacturer's instructions.

C. During shipment, provide protective covering over vulnerable components. Fit nozzles and open

pipe ends with enclosures.

1.07 WARRANTY

A. Provide a full parts warranty for two years from start-up.

B. A 5-year motor/transmission/compressor warranty shall be provided based upon the RPM of the compressors as follows:

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Trane

B. York

2.02 GENERAL UNIT DESCRIPTION

A. Factory assembled, single-piece chassis, air-cooled liquid chiller. Contained within the package shall be all factory wiring, piping, controls, and refrigerant charge (HFC-410A).

2.03 CABINET

A. Frame shall be heavy-gage, with a powder coated paint finish for both aesthetic appeal and to offer more resistance to corrosion.

B. Units shall be constructed of a galvanized steel frame with galvanized steel panels and access doors. Component surfaces shall be finished with a powder-coated paint. The coating or paint system shall withstand a 1000-consecutive-hour salt spray application in accordance with standard ASTMB117.

2.04 COMPRESSORS

A. Fully hermetic scroll type compressors with R410A optimized and dedicated scroll profile.

B. Direct drive motor cooled by suction gas with only three major moving parts and a completely enclosed compression chamber which leads to increased efficiency.

C. Each compressor will have crankcase heaters installed and properly sized to minimize the amount of liquid refrigerant present in the oil sump during off cycles.

2.05 EVAPORATOR

A. The evaporator shall be a high efficiency, brazed plate-to-plate type heat exchanger consisting of parallel plates. Braze plates shall be stainless steel with copper braze material.

B. The evaporator shall be protected with an etched foil heater and insulated with 3/4 inch insulation. This combination shall provide freeze protection down to -20F ambient temperatures while the heater is powered. Contractor shall provide separate power to energize heater and protect evaporator while chiller is disconnected.

C. The water side working pressure shall be rated at 150 psig and tested at 1.5 times maximum allowable water side working pressure.

D. The refrigerant side working pressure shall be rated at 460 psig and tested at 1.1 maximum allowable refrigerant side working pressure.

2.06 CONDENSER

A. The condenser coils shall consist of copper tubes mechanically bonded into plate-type aluminum fins. A sub-cooling coil shall be an integral part of the main condenser coil.

B. The maximum allowable working pressure of the condenser shall be 650 psig. The condensers shall be factory proof and leak tested at 715 psig.

C. Low Sound Fans shall be dynamically and statically balanced, direct drive, corrosion resistant glass fiber reinforced composite blades molded into a low noise fan blade.

D. Low speed fan motors shall be three-phase with permanently lubricated ball bearings and individually protected by circuit breakers.

E. Unit shall be capable of starting and running at outdoor ambient temperatures from 32F to 125F.

F. Provide full coverage hail guards to include evaporator/compressor enclosure.

2.07 ENCLOSURES

A. Mount starters in a UL1995 rated panel for outdoor use.

B. The starter shall be across-the-line configuration, factory-mounted and fully pre-wired to the compressor motor(s) and control panel.

C. Unit shall have a single point power connection.

D. A control power transformer shall be factory-installed and factory-wired to provide unit control power.

2.08 REFRIGERATION COMPONENTS

A. Each refrigerant circuit shall include a filter drier, electronic expansion valve with site glass, liquid line service valves and a complete operating charge of both refrigerant HFC-410A and compressor oil.

B. Each refrigerant circuit shall include a discharge line service valve to allow the refrigerant to be isolated in the condenser.

2.09 CONTROLS, SAFETIES AND DIAGNOSTICS

A. The microprocessor-based unit controller shall be factory-installed and factory-tested.

B. The unit display shall provide the following data:
1. Water and air temperatures
2. Refrigerant levels and temperatures
3. Flow switch status
4. Compressor starts and run times

C. The unit controller shall provide chilled water reset based on return water as an energy saving option.

D. Chilled water temperature control shall be microprocessor-based, proportional and integral controller to show water and refrigerant temperature, refrigerant pressure, and diagnostics. This microprocessor-based controller is to be supplied with each chiller by the chiller manufacturer. Controls shall include the following readouts and diagnostics:
1. Low evaporator refrigerant temperature and/or pressure
2. High condenser refrigerant pressure
3. Motor current overload
4. High compressor discharge temperature
5. Electronic distribution faults: phase loss, phase imbalance, or phase reversal

E. Unit shall be shipped with factory control and power wiring installed.

F. On chiller, mount weatherproof control panel, containing starters, power and control wiring, factory wired with terminal block power connection. Provide primary and secondary fused control power

transformer and a single 115 volt 60 Hz single phase connection for evaporator freeze protection heaters.

G. The unit controller shall utilize a microprocessor that will automatically take action to prevent unit shutdown due to abnormal operating conditions associated with: evaporator refrigerant temperature, high condensing pressure and motor current overload.

H. Provide the following safety controls with indicating lights or diagnostic readouts.
1. Low chilled water temperature protection.
2. High refrigerant pressure.
3. Low oil flow protection.
4. Loss of chilled water flow.
5. Contact for remote emergency shutdown.
6. Motor current overload.
7. Phase reversal/unbalance/single phasing.
8. Over/under voltage.
9. Failure of water temperature sensor used by controller.
10. Compressor status (on or off).

I. Provide the following operating controls:
1. Chilled water pump output relay that closes when the chiller is given a signal to start.
2. High ambient pressure controller that shuts off a compressor to keep head pressure under control and help prevent high pressure nuisance trip outs on days when outside ambient is above design.
3. Compressor current sensing limit that shuts off a compressor to help prevent current overload nuisance trips.
4. Auto lead-lag functions that constantly even out run hours and compressor starts automatically. If contractor cannot provide this function then cycle counter and hour meter shall be provided for each compressor so owner can be instructed by the contractor on how to manually change lead-lag on compressors and even out compressor starts and running hours.
5. Low ambient lockout control with adjustable setpoint.

J. Provide user interface on the front of the panel. If display is on the inside of the panel, then a control display access door shall be provided to allow access to the display without removal of panels. Provide user interface with a minimum of the following features:
1. Leaving chilled water setpoint adjustment from LCD input
2. Entering and leaving chilled water temperature output
3. Percent RLA output for each compressor
4. Pressure output of condenser for circuits one and two
5. Pressure output of evaporator for circuits one and two
6. Ambient temperature output
7. Voltage output
8. Current limit setpoint adjustment from LCD input.

J. Provide factory installed contact closure input for initiation of ice building. Ice building termination shall be based on an adjustable entering water temperature setpoint. All compressors shall run at full load during ice building. [OPTIONAL]

K. Digital Communications to BAS system shall consist of a BACnet MS/TP interface via a single twisted pair wiring.

L. The chiller control panel shall provide leaving chilled water temperature reset based upon return water temperature.

2.10 Chilled Fluid Circuit

A. Chilled fluid circuit shall be rated for 150 psig working pressure.

B. Proof of flow switch shall be provided by the equipment manufacturer and installed the correct number of pipe diameters from any elbow and in the correct orientation.

C. Flow switch shall be IFM flow monitor type.

D. Units with brazed plate evaporators shall have a water strainer that is factory provided. It shall be installed with a blowdown valve to facilitate periodic cleaning of the strainer to prevent it from becoming clogged.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Align chiller package on steel or concrete foundations.

C. Install units on isolators.

D. Connect to electrical service.

E. Connect to chilled water piping.

3.02 MANUFACTURER'S FIELD SERVICES

A. OEM Startup is performed by factory trained and authorized servicing technicians confirming equipment has been correctly installed and passes specification checklist prior to equipment becoming operational and covered under OEM warranty.
1. Included OEM Factory Startup

B. The manufacturer shall furnish complete submittal wiring diagrams of the package unit as applicable for field maintenance and service.

END OF SECTION

SECTION 23 73 13
MODULAR INDOOR CENTRAL STATION AIR HANDLING UNITS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Central station air handling unit.

1.02 RELATED SECTIONS

A. Section 23 02 00 – Basic Materials and Methods

B. Section 23 05 13 – Common Motor Requirements for HVAC Equipment

C. Section 23 05 26 – Variable Frequency Motor Speed Control for HVAC Equipment

D. Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment

E. Section 23 41 00 – Air Filters

1.03 QUALITY ASSURANCE

A. Unit performance shall be certified in accordance with ARI Standard 430 for central station air handling units.

B. Coil performance shall be certified in accordance with ARI Standard 410.

C. Direct-expansion coils shall be designed and tested in accordance with ASHRAE 15 Safety Code for Mechanical Refrigeration.

D. Insulation and insulation adhesive shall comply with NFPA 90A requirements or flame spread and smoke generation.

1.04 GENERAL DESCRIPTION

A. Indoor mounted, central station air handling unit designed to provide air to a conditioned space as required to meet specified performance requirements for ventilation, heating, cooling, filtration, and distribution. Unit shall be assembled for horizontal/vertical application and arranged to discharge conditioned air as shown on the drawings. Units shall be supplied by the specified manufacturer.

1.05 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Shop drawings shall indicate assembly, unit dimensions, weight loading, required clearances, construction details, and field connection details.

C. Product data shall indicate dimensions, weights, capacities, ratings, fan performance, motor electrical characteristics, and gauges and finishes of materials.

D. Provide fan curves with specified operating point clearly plotted.

E. Submit product data of filter media, filter performance data, filter assembly, and filter frames.

F. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory installed and field installed wiring.

G. Submit manufacturer's installation instructions under provisions of Division One.

H. Submit operation and maintenance data under provisions of Section 23 02 00.

I. Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.06 DELIVERY, STORAGE AND HANDLING

A. Unit shall be stored and handled in accordance with the unit manufacturer's instructions.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.08 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Trane: Performance Climate Changer

B. York: York Solution

C. McQuay: Vision

D. Temtrol: ITF or WF

2.02 GENERAL DESCRIPTION

A. Unit shall be factory supplied, central station air handler suitable for the capacities and configurations as shown on drawings. Unit shall consist of a fan and coil section with a factory installed chilled water coil, filter section, access section, mixing box or combination filter-mixing box.

B. All sections, whether assembled into a unit or supplied as separate components, shall have mating flanges for bolted assembly. The flange shall extend around the complete perimeter of each section. The manufacturer shall supply bolts and sufficient closed cell gasket for full perimeter coverage.

2.03 CASING

A. All unit sections shall be supplied with 12 gauge galvanized steel structural perimeter base rail. Condensate drain connection will not penetrate the base rail. If external isolators are not used, provide 6 inch minimum height housekeeping pads or sufficient overall height to provide p-trap with 1 inch greater that unit total static pressure.

B. Unit panels for all sections shall be double wall construction and shall be constructed of minimum 16 gauge G90 mill galvanized steel. Casing panels shall be fully removable for easy access to the unit, and shall be secured to structural frame with aluminized or cadmium plated screws. Removal of panels must not affect the structural integrity of the unit. All panels shall have a minimum of 1

inch thickness foam insulation or 2 inch thickness, 1-1/2 lb. per cubic feet density fiberglass insulation. All panels shall be completely gasketed prior to shipping.

C. Double wall hinged removable access doors with multiple handles shall be provided in the fan and filter sections on the drive side of the unit. Access doors must also be provided in all sections where the removal of sheet metal screws is required for unit access. Doors shall be of the same thickness and construction as the wall panels. A gasket shall be provided around the entire door perimeter.

2.04 FANS

A. Fan section shall be constructed of insulated galvanized steel and have formed channel base for integral mounting of fan assembly and casing panels. Fan scroll, wheel, shaft, bearings, drives, and motor shall be mounted on a structural steel assembly which shall be isolated from the outer casing with factory installed 2 inch deflection spring isolators and vibration absorbent flexible canvas connection between fan discharge and casing.

B. Fans shall be equipped with double width, double inlet centrifugal type wheels with forward curved blades or airfoil blades as required for stable operation.

C. Fan wheels shall be keyed to the shaft and shall be designed for continuous operation at the maximum rated fan speed and motor horsepower. Fan wheels and shafts shall be selected to operate at least 25% below the first critical speed, and shall be statically and dynamically balanced as an assembly.

D. Fans shafts shall be solid steel coated with rust preventative oil.

E. Fans bearings shall be self-aligning, pillow block, regreasable ball or roller type selected for a minimum average life of 200,000 hours. Extend grease lubrication fittings to drive side of unit with plastic tube and fittings rigidly attached to casing.

F. A motor shall be mounted within the fan section casing on slide rails to permit adjustment of belt tension.

G. Fan drive shall be designed for a minimum 1.3 service factor and shall be adjustable pitch.

2.05 COILS

A. All coils shall be tested at 300 psig air pressure, under water.

B. All coils shall be installed on tracks for easy removal from the air handling unit. Units that require disassembly of the unit for coil removal are not acceptable.

C. Coils shall be aluminum plate fin type with belled collars and shall be bonded to 1/2 inch or 5/8 inch OD copper tubes by mechanical expansion. Coils shall have headers with steel MPT connections. Working pressure shall be 250 psig at 300°F.

D. Coils shall be drainable and have non-trapping circuits. Headers shall have drain and vent connections extended to the outside of the unit casing. Supply and return headers shall be clearly labeled on the outside of the unit. Provide grommets at all pipe penetrations through cabinet.

E. Main drain pan shall be double wall stainless steel with minimum 2 inch insulation, sloped toward drain fitting, with integral elbow for side discharge and FPT connection, and shall comply with ASHRAE Standard 62. A maximum of one drain shall be supplied for each cooling coil section. The unit design shall not require a drain pan in any downstream section to contain the coil condensate. Moisture shall not carry over past the coil. Moisture eliminators are not acceptable for moisture carryover prevention.

F. Direct expansion coils shall be furnished with a brass distributor with solder type connections. Suction and discharge connections shall be on the same end regardless of rows deep. Coils shall have intertwined circuits for equal operation on each circuit.

G. Maximum face velocity across cooling coils shall be 500 FPM, unless noted otherwise on equipment schedule.

H. Coils in series shall have a minimum of 6 inch space between coil casings.

2.06 FILTERS

A. Filter section shall accept 2 inch or 4 inch filters of standard sizes as indicated on drawings and shall be designed and constructed to house the type of filter specified. Section shall include side access slide rails.

B. A magnahelic differential pressure gauge shall be factory installed and flush mounted on drive side to measure the pressure drop across the filter.

2.07 ACCESSORIES

A. Mixing boxes and filter mixing boxes sections shall have opposed blades and interconnecting outside air and return air dampers. All mixing boxes shall have a double wall hinged access door on the drive side of the unit.

B. All damper blades shall be galvanized steel, double skin airfoil type, housed in a galvanized steel frame and mechanically fastened to a hex axle rod rotating in stainless steel bearings. Dampers shall be sectionalized to limit blade length to no more than 48 inches so as to minimize blade warpage. Blade seals are required to assure tight closure. The damper shall be rated for a maximum leakage rate of 1 percent of nominal airflow at 1 inch wg.

C. Access sections shall be installed where indicated on the drawings and shall have a double walled hinged door.

PART 3 - EXECUTION

3.01 If floor mounted air handling units are furnished with internal vibration isolation option, provide 2" thick Amber/Booth type NRC ribbed neoprene pads or approved equal to address high frequency breakout and provide additional unit elevation with overall sufficient height to provide p-trap with one inch greater than the unit total static pressure. Ribbed neoprene pads shall be located in accordance with the air handling unit manufacturer's recommendations. Condensate drain connection shall not penetrate the base air handling unit's rail.

3.02 Install in accordance with manufacturer's instructions.

3.03 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

END OF SECTION

SECTION 23 81 39
WALL MOUNTED AIR CONDITIONING UNIT

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods is included as a part of this Section as though written in full in this document.

1.02 SUBMITTALS

A. Submit drawings indicating components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Indicate accessories where required for complete system.

B. Submit product data indicating rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.

C. Submit manufacturer's installation instructions.

1.03 OPERATION AND MAINTENANCE DATA

A. Submit operation data.

B. Include start-up instructions, controls, and accessories.

C. Submit maintenance data.

1.04 STORAGE AND HANDLING

A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

B. Protect units from physical damage.

1.05 WARRANTY

A. Provide a full parts and labor warranty for two years from start-up.

1.6 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

PART 2 – PRODUCTS

2.01 FURNISH AND INSTALL

A. A one-piece wall-mounted, factory assembled, pre-charged, pre-wired, tested and ready to operate air conditioner unit. The unit shall be approved and listed by Underwriters' Laboratories, Inc. Unit

performance shall be certified in accordance with Air Conditioning and Refrigeration Institute Standard 210/240-89 for Unitary Air-Source Air Conditioners or latest standard.

B. Approved Manufacturers:

1. Mitsubishi
2. Daikin

2.02 COILS

A. Coils shall be of copper tube construction with mechanically bonded aluminum plate fins. The refrigerant control shall be factory installed capillary tube type.

2.03 BLOWERS AND FANS

A. Coil blowers shall have a centrifugal, forward curved, direct driven blower.

2.04 CONTROLS

A. Controls shall be factory wired and located in a readily accessible location. Fan motors shall have both thermal and current sensitive overload devices. Control circuit transformer (24V) shall be factory installed. Line voltage circuit breaker, or pull disconnect with lockable cover, shall be supplied on each unit and shall be easily accessible without removing any unit panels.

2.05 CABINET

A. Cabinet shall be a single, enclosed, casing constructed of 20 gauge galvanized steel. Each exterior casing panel to be bonderized and finished with baked-on exterior polyester paint prior to assembly.

B. Cooling section shall be fully insulated with 1 inch fiberglass to prevent sweating and to muffle sounds.

C. Openings shall be provided for power connections.

2.06 MOUNTING BRACKETS

A. Full length side mounting brackets shall be an integral part of the cabinet.

B. 16 gauge metal bracket shall be provided for bottom.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Connect to electrical service.

3.02 MANUFACTURER'S FIELD SERVICES

A. Supply initial charge of refrigerant and oil.

END OF SECTION

SECTION 23 82 19
FAN COIL UNIT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods is included as a part of this Section as though written in full in this document.

1.02 SCOPE

Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

1.03 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

PART 2 - PRODUCTS

2.01 FAN COIL UNITS

Fan coil units shall be factory built, manufactured as scheduled on Drawings. York, Trane, Lennox or Daikin-McQuay shall be considered as equal, if they comply with the specifications and schedule. Special Note: Contractor shall field verify exact clearances required for fan coil units. Units shall be field located as required and shop drawings shall indicate final location for approval by Architect/Engineer.

A. Furnish and install fan coil units of the type, capacities, ratings and drive motor horsepower shown on the Drawings.

B. Units shall be factory fabricated, draw-thru type, and shall have fan section, cooling coil section, condensate drain pan, adjustable blower drive with motor on resilient mounted base, vee-belts with guard, filter section, and mixing box (if scheduled) assembled as integrated fan coil units.

C. REQUIREMENTS:

1. Mill-galvanized steel, rigidly framed, braced, and reinforced; access panels each side of unit; minimum panel ga. - 18; minimum weight formed framing member 14 ga.
2. Fan section, cooling coil section, and outlet frame throats shall be internally insulated at the factory with 1" thick, 3/4 PCF density, Neoprene coated fiberglass cemented in place with waterproof adhesive, having fire-retardant characteristics in accordance with NFPA 90A.
3. Drain pan shall not be lighter than 14 ga.; extend completely under the coil section and be all-galvanized, foam insulated pan with drain connections.
4. When the fan coil unit is installed above an accessible ceiling, the unit shall incorporate a secondary drain pan. The secondary pan shall be fabricated from galvanized sheet metal, 16 gauge minimum with cross breaking sloped towards a drain. The sides shall be a minimum 2" tall and the corners shall be soldered watertight. The top edge shall have a

1/4" hem to provide additional rigidity and the secondary pan shall be supported at a minimum of six points. The pan shall extend on all sides a minimum of 3" beyond the sides of the unit casing. Route the secondary drain piping to a conspicuous location, or install a float switch at the low point in the secondary pan. The secondary pan should be sloped a minimum of 1/8" per foot and supported so that the unit is not in contact with the bottom of the secondary pan.

5. The fan section, including wheels, shafts, bearings, drive, etc., shall be statically and dynamically balanced as an assembly, and the shaft shall not pass through the first critical speed, while accelerating from rest to operating speed. Submittal data shall state the first critical shaft speed. Shaft bearings shall be of vacuum de-gassed steel, and shall be selected for 200,000 hours average life.
6. Coil shall be as hereinafter specified.

2.02 COILS

A. Cooling coils shall be cartridge type and, when mounted in fan coil units, shall be removable from either end. Coils shall be constructed of copper tubes with aluminum fins and shall be designed for even distribution of air across the face of the coils; air shall not pass around coil frames: Coils shall have same end connection for DX or chilled water piping.

B. DX refrigerant coils shall be counter-flow refrigerant to air; shall have inlet and outlet connections permanently marked; shall have thermostatic expansion valves with adjustable super heat.

C. Maximum face velocity across cooling coils shall be 500 FPM, unless noted otherwise on schedule.

PART 3 - EXECUTION

3.01 All HVAC equipment shall be installed as per manufacturers printed installation instructions.

3.02 All items required for a complete and proper installation are not necessarily indicated on the Drawings or in the Specifications. Provide all items required as per manufacturer's requirements.

END OF SECTION

SECTION 26 02 00
BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all Work herein.

B. The Contract Drawings indicate the extent and general arrangement of the systems. If any departure from the Contract Drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore, shall be submitted to the Architect for approval as soon as practicable. No such departures shall be made without the prior written approval of the Architect.

C. The Building Systems Commissioning for this project shall be by an independent agency employed by the owner. There are requirements of Div 1 that shall apply to work in Division 1 & 26. Division 1 & 26 contractor's shall review Division 1 so that the proper planning can be applied relative to the interactive requirements in completing the Building Systems Commissioning of this project.

1.02 SCOPE OF WORK

A. The Work included under this Contract consists of the furnishing and installation of all equipment and material necessary and required to form the complete and functioning systems in all of its various phases, all as shown on the accompanying Drawings and/or described in these Specifications. The contractor shall review all pertinent drawings, including those of other contracts prior to commencement of Work.

B. This Division requires the furnishing and installing of all items Specified herein, indicated on the Drawings or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, transportation, storage, equipment, utilities, all required permits, licenses and inspections. All work performed under this Section shall be in accordance with the Project Manual, Drawings and Specifications and is subject to the terms and conditions of the Contract.

C. The approximate locations of Electrical items are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of outlets, apparatus, etc. Exact locations are to be determined by actual measurements at the building, and will in all cases be subject to the Review of the Owner or Engineer, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

D. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

E. All discrepancies between the Contract Documents and actual job-site conditions shall be reported to the Owner or Engineer so that they will be resolved prior to the bidding, where this cannot be done at least 7 working days prior to bid; the greater or more costly of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

F. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and fully operating system in cooperation with other trades.

G. It is the intent of the above "Scope" to give the Contractor a general outline of the extent of the Work involved; however, it is not intended to include each and every item required for the Work. Anything omitted from the "Scope" but shown on the Drawings, or specified later, or necessary for a complete and functioning heating, ventilating and air conditioning system shall be considered a part of the overall "Scope".

H. The Contractor shall rough-in fixtures and equipment furnished by others from rough-in and placement drawings furnished by others. The Contractor shall make final connection to fixtures and equipment furnished by others.

I. Contractor shall participate in the commissioning process; including but not limited to meeting attendance, completion of checklists and participation in functional testing.

1.03 RELATED SECTIONS

A. General Conditions

B. Supplementary Conditions

C. Division One

1.04 COOPERATION WITH TRADES:

A. Cooperation with trades of adjacent, related, or affected materials or operations shall be considered a part of this work in order to affect timely and accurate placing of work and bring together in proper and correct sequence, the work of such trades.

1.05 REFERENCES

A. National Electrical Code (NEC)

B. American Society for Testing and Materials (ASTM)

C. Underwriter's Laboratories, Inc. (UL)

D. Insulated Cable Engineer's Association (ICEA).

E. National Electrical Manufacturer's Association (NEMA).

F. Institute of Electrical and Electronic's Engineers (IEEE).

G. American National Standards Institute (ANSI).

H. National Fire Protection Association (NFPA).

I. International Energy Conservation Code (IECC).

1.06 COMPLETE FUNCTIONING OF WORK:

A. All work fairly implied as essential to the complete functioning of the electrical systems shown on the Drawings and Specifications shall be completed as part of the work of this Division unless specifically stated otherwise. It is the intention of the Drawings and Specifications to establish the types of the systems, but not set forth each item essential to the functioning of the system. In case of doubt as to the work intended, or in the event of amplification or clarification thereof, the Contractor shall call upon the Architect for supplementary instructions, Drawings, etc.

B. Contractor shall review all pertinent Drawings and adjust his work to all conditions shown there on. Discrepancies between Plans, Specifications, and actual field conditions shall be brought to the prompt attention of the Architect.

1. Approximate location of transformers, feeders, branch circuits, outlets, lighting and power panels, outlets for special systems, etc., are indicated on the Drawings. However, the Drawings, do not give complete and accurate detailed locations of such outlets, conduit runs, etc., and exact locations must be determined by actual field measurement. Such locations will, at all times, be subject to the approval of the Architect.
2. Communicate with the Architect and secure his approval of any outlet (light fixture, receptacle, switch, etc.) location about which there may be the least question. Outlets obviously placed in a location not suitable to the finished room or without specific

approval, shall be removed and relocated when so directed by the Architect. Location of light fixtures shall be coordinated with reflected ceiling plans.

C. Additional coordination with mechanical contractor may be required to allow adequate clearances of mechanical equipment, fixtures and associated appurtenances. Contractor to notify Architect and Engineer of unresolved clearances, conflicts or equipment locations.

1.07 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

A. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the approved shop drawings.

1.08 CONTRACTOR'S QUALIFICATIONS

A. An approved contractor for the work under this division shall be:

1. A specialist in this field and have the personnel, experience, training, and skill, and the organization to provide a practical working system.
2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.
3. Perform work by persons qualified to produce workmanship of specified quality. Persons performing electrical work shall be required to be licensed. Onsite supervision, journeyman shall have minimum of journeyman license. Helpers, apprentices shall have minimum of apprentice license.

1.09 DATE OF FINAL ACCEPTANCE

A. The date of final acceptance shall be the date of owner occupancy, or the date all punch list items have been completed or final payment has been received. Refer to Division One for additional requirements.

B. The date of final acceptance shall be documented in writing and signed by the architect, owner and contractor.

1.10 DEFINITIONS AND SYMBOLS

A. General Explanation: A substantial amount of construction and Specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic and schematic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article, unless defined otherwise in Division 1.

B. Definitions and explanations of this Section are not necessarily either complete or exclusive, but are general for work to the extent not stated more explicitly in another provision of the Contract Documents.

C. Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications and to similar means of recording requirements in Contract Documents. Where such terms as "Shown", "Noted", "Scheduled", "Specified" and "Detailed" are used in lieu of "Indicated", it is for the purpose of helping the reader locate cross-reference material, and no limitation of location is intended except as specifically shown.

D. Directed: Where not otherwise explained, terms such as "Directed", "Requested", "Accepted", and "Permitted" mean by the Architect or Engineer. However, no such implied meaning will be interpreted to extend the Architect's or Engineer's responsibility into the Contractor's area of construction supervision.

E. Reviewed: Where used in conjunction with the Engineer's response to submittals, requests for information, applications, inquiries, reports and claims by the Contractor the meaning of the term

"Reviewed" will be held to limitations of Architect's and Engineer's responsibilities and duties as specified in the General and Supplemental Conditions. In no case will "Reviewed" by Engineer be interpreted as a release of the Contractor from responsibility to fulfill the terms and requirements of the Contract Documents.

F. Furnish: Except as otherwise defined in greater detail, the term "Furnish" is used to mean supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

G. Install: Except as otherwise defined in greater detail, the term "Install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.

H. Provide: Except as otherwise defined in greater detail, the term "Provide" is used to mean "Furnish and Install", complete and ready for intended use, as applicable in each instance.

I. Installer: Entity (person or firm) engaged by the Contractor or its subcontractor or Sub-contractor for performance of a particular unit of work at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.

J. Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or when so noted by other identified installers or entities.

K. Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended as minimum quality level or quantity of work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable tolerance limits. In complying with requirements, indicated or scheduled numeric values are either minimums or maximums as noted or as appropriate for the context of the requirements. Refer instances of uncertainty to Owner or Engineer via a request for information (RFI) for decision before proceeding.

L. Abbreviations and Symbols: The language of Specifications and other Contract Documents including Drawings is of an abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self explanatory nature have been included in text of Specifications and Drawings. Specific abbreviations and symbols have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of Specification requirements with notations on Drawings and in Schedules. These are frequently defined in Section at first instance of use or on a Legend and Symbol Drawing. Trade and industry association names and titles of generally recognized industry standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicate. Except as otherwise indicated, graphic symbols and abbreviations used on Drawings and in Specifications are those recognized in construction industry for indicated purposes. Where not otherwise noted symbols and abbreviations are defined by 1993 ASHRAE Fundamentals Handbook, chapter 34 "Abbreviations and Symbols", ASME and ASPE published standards.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Deliver products to the project at such time as the project is ready to receive the equipment, pipe or duct properly protected from incidental damage and weather damage.

C. Damaged equipment shall be promptly removed from the site and new, undamaged equipment shall be installed in its place promptly with no additional charge to the Owner.

1.12 SUBMITTALS

A. Coordinate with Division 1 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded the Contractor shall submit a minimum of eight (8) complete bound sets of shop drawings and complete data covering each item of equipment or material. The first submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive shop drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain one (1) copy each of all shop drawings for their files. Where full size drawings are involved, submit one (1) print and one (1) reproducible sepia or vellum in lieu of eight (8) sets. All literature pertaining to an item subject to Shop Drawing submittal shall be submitted at one time. A submittal shall not contain information from more than one Specification section, but may have a section subdivided into items or equipment as listed in each section. The Contractor may elect to submit each item or type of equipment separately. Each submittal shall include the following items enclosed in a suitable binder:

1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.
2. An index page with a listing of all data included in the Submittal.
3. A list of variations page with a listing all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then this page shall state "NO VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.
4. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.
5. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.
6. Identification of each item of material or equipment matching that indicated on the Drawings.
7. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.
8. Additional information as required in other Sections of this Division.
9. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "**REVISE AND RESUBMIT**".

B. Refer to Division 1 for additional information on shop drawings and submittals.

C. Equipment and materials submittals and shop drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of shop drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.

D. Where shop drawings and submittals are marked "**REVIEWED**", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.

E. Shop drawings shall be reviewed and returned to the Contractor with one of the following categories indicated:

1. **REVIEWED:** Contractor need take no further submittal action, shall include this submittal in the O&M manual and may order the equipment submitted on.
2. **REVIEWED AS NOTED:** Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the O&M manual. The contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted.
3. **NOT APPROVED:** Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is not approved, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.
4. **REVISE AND RESUBMIT:** Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous shop drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.
5. **CONTRACTOR'S CERTIFICATION REQUIRED:** Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor's stamp is required stating the submittal meets all conditions of the contract documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all shop drawings.
6. **MANUFACTURER NOT AS SPECIFIED:** Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified, the Contractor will automatically be required to furnish the product, material or method named in the specifications. Contractor shall not order equipment where submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.

F. Materials and equipment which are purchased or installed without shop drawing review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.

G. Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.

H. Furnish detailed shop drawings, descriptive literature, physical data and a specification critique for each section indicating "compliance" and/or "variations" for the following items:

Distribution Panelboards
Lighting and Appliance Panelboards
Wiring Gutters
Heavy Duty Disconnect Switches
Lighting Fixtures
Lighting Contactors
Time Clocks
Lighting Control System
Photocells
Wiring Devices and Plates
Conduit and Fittings
Wire
Harmonic Mitigating Type Transformers
Intercom/PA System
Fire Alarm System
Surge Protection Device (SPD)

I. Refer to each specification section for additional requirements.

1.13 OPERATION AND MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 1 and in addition to the requirements specified in Division 1, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

1.14 COORDINATION DRAWINGS

A. Prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:
   a. Wall and type locations.
   b. Clearances for installing and maintaining insulation.
   c. Locations of light fixtures and sprinkler heads.
   d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
   e. Equipment connections and support details.
   f. Exterior wall and foundation penetrations.
   g. Routing of storm and sanitary sewer piping.
   h. Fire-rated wall and floor penetrations.
   i. Sizes and location of required concrete pads and bases.
   j. Valve stem movement.
   k. Structural floor, wall and roof opening sizes and details.
2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling-mounted items.

B. This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

C. By submitting shop drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

1.15 RECORD DRAWINGS

A. Maintain a continuous record during the course of construction of all changes and deviations in the work from the contract drawings. Upon completion of the work, purchase a set of "Auto Positive

Tracings" on vellum and make corrections as required to reflect the electrical systems as installed. Location and size of all conduit shall be accurately shown to dimension. Submit three prints of the tracings for approval. Make corrections to tracings as directed and deliver "Auto Positive Tracings" to the Architect. Record drawings shall be furnished in addition to shop drawings. Symbols on the Record drawings shall correspond to the identification symbols on the contract drawings and equipment identification plates and tags.

B. The Contractor shall maintain a set of clearly marked black line record "AS-BUILT" prints on the job site on which he shall mark all work details, alterations to meet site conditions and changes made by "Change Order" notices. These shall be kept available for inspection by the Owner, Architect or Engineer at all times.

C. Refer to Division 1 for additional requirements concerning record drawings. If the Contractor does not keep an accurate set of as-built drawings, the pay request may be altered or delayed at the request of the Architect. Mark the drawings with a colored pencil. Delivery of as-built prints and reproducibles is a condition of final acceptance.

D. The record prints shall be updated on a daily basis and shall indicate accurate dimensions for all buried or concealed work, precise locations of all concealed pipe or duct, locations of all concealed valves, controls and devices and any deviations from the work shown on the Construction Documents which are required for coordination. All dimensions shall include at least two dimensions to permanent structure points.

E. Submit three prints of the tracings for approval. Make corrections to tracings as directed and delivered "Auto Positive Tracings" to the architect. "As-Built" drawings shall be furnished in addition to shop drawings.

F. When the option described in paragraph F., above is not exercised then upon completion of the work, the Contractor shall transfer all marks from the submit a set of clear concise set of reproducible record "AS-BUILT" drawings and shall submit the reproducible drawings with corrections made by a competent draftsman and three (3) sets of black line prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The reproducible record "AS-BUILT" drawings shall have the Engineers Name and Seal removed or blanked out and shall be clearly marked and signed on each sheet as follows:

CERTIFIED RECORD DRAWINGS

DATE:

(NAME OF GENERAL CONTRACTOR)

BY:_____
(SIGNATURE)

(NAME OF SUBCONTRACTOR)

BY:_____
(SIGNATURE)

1.16 CERTIFICATIONS AND TEST REPORTS

A. Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and schedule date for each test. This detailed completion and test schedule shall be submittal at least 90 days before the projected Project completion date.

B. Test result reporting forms shall be submitted for review no later than the date of the detailed schedule submitted.

C. Submit 4 copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

D. Certifications and test reports to be submitted shall include, but not be limited to those items outlined in Section of Division 26.

1.17 MAINTENANCE MANUALS

A. Coordinate with Division 1 for maintenance manual requirements, unless noted otherwise bind together in “D ring type” binders by National model no. 79-883 or equal, binders shall be large enough to allow ¼” of spare capacity. Three (3) sets of all approved shop drawing submittals, fabrication drawings, bulletins, maintenance instructions, operating instructions and parts exploded views and lists for each and every piece of equipment furnished under this Specification. All sections shall be typed and indexed into sections and labeled for easy reference and shall utilize the individual specification section numbers shown in the Electrical Specifications as an organization guideline. Bulletins containing information about equipment that is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 26 shall be clearly and legibly set forth in memoranda that shall, likewise, be bound with bulletins.

B. Prepare maintenance manuals in accordance with Special Project Conditions, in addition to the requirements specified in Division 26, include the following information for equipment items:

1. Identifying names, name tags designations and locations for all equipment.
2. Fault Current calculations and Coordination Study.
3. Reviewed shop drawing submittals with exceptions noted compliance letter.
4. Fabrication drawings.
5. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable, i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts.
6. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
7. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions, servicing instructions and lubrication charts and schedules.
8. Equipment name plate data.
9. Wiring diagrams.
10. Exploded parts views and parts lists for all equipment and devices.
11. Color coding charts for all painted equipment and conduit.
12. Location and listing of all spare parts and special keys and tools furnished to the Owner.
13. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.

C. Refer to Division 1 for additional information on Operating and Maintenance Manuals.

D. Operating and Maintenance Manuals shall be turned over to the Owner or Engineer a minimum of 14 working days prior to the beginning of the operator training period.

1.18 OPERATOR TRAINING

A. The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include 12 hours of onsite training in three 4 hour shifts.

B. Before proceeding with the instruction of Owner Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

C. Refer to other Division 26 Sections for additional Operator Training requirements.

1.19 SITE VISITATION

A. Visit the site of the proposed construction in order to fully understand the facilities, difficulties and restriction attending the execution of the work.

B. Before submitting a bid, it will be necessary for each Contractor whose work is involved to visit the site and ascertain for himself the conditions to be met therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.

C. Understand the existing utilities from which services will be supplied; verify locations of utility services, and determine requirements for connections.

D. Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.20 WARRANTY

A. The undertaking of the work described in this Division shall be considered equivalent to the issuance, as part of this work, of a specific guarantee extending two years beyond the date of completion of work and acceptance by Owner, against defects in materials and workmanship. Materials, appliances and labor necessary to effect repairs and replacement so as to maintain said work in good functioning order shall be provided as required. Replacements necessitated by normal wear in use or by Owner's abuse are not included under this guarantee.

B. All normal and extended warranties shall include parts, labor, miscellaneous materials, travel time, incidental expenses, freight/shipping, refrigerant, oils, lubricants, belts, filters and any expenses related to service call required to diagnose warranty problems.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. The names and manufacturers and model numbers have been used in the Contract documents to establish types of equipment and standards of quality. Where more than one manufacturer is named for a specific item of equipment, only one of the specified manufacturers will be considered for approval. Where only one manufacturer is mentioned with the phrase "or approved equal", Contractor may submit an alternate manufacturer for consideration, provided the following conditions are met:

1. Submit alternate equipment with complete descriptive data in shop drawing form. Provide sample of equipment upon request for review by Architect. Samples will be returned if requested in writing.
2. Alternate equipment must be equal from the standpoint of materials, construction and performance.
3. Alternate submittal must be presented to the Engineer/Architect ten (10) days prior to bid date for approval.

B. The Architect and Engineer shall be the sole judge of quality and equivalence of equipment, materials and methods.

2.2 All materials and products used on this project shall be listed by Underwriters' Laboratories.

2.3 ACCESS DOORS

A. Wherever access is required in walls or ceilings to concealed junction boxes, pull boxes, equipment, etc., installed under this Division, furnish a hinged access door and frame with flush latch handle to another Division for installation. Doors shall be as follows:

1. Plaster Surfaces: Milcor Style K.
2. Ceramic Tile Surfaces: Milcor Style M.
3. Drywall Surfaces: Milcor Style DW.
4. Install panels only in locations approved by the Architect.

2.4 EQUIPMENT PADS

A. Unless noted otherwise 4" high concrete pads for indoor floor mounted equipment shall be installed under Division 3. Pads shall conform to the shape of the equipment with a minimum of 3" margin at equipment supports. Top and sides of pads shall be troweled to a smooth finish, equal to floor. External corners shall be bullnosed to a 3/4" radius, unless shown otherwise.

2.5 ESCUTCHEONS

A. Provide heavy chrome or nickel plated plates, of approved pattern, on conduit passing through walls, floors and ceilings in finished areas. Where conduit passes through a sleeve, no point of the conduit shall touch the building construction. Caulk around such conduit with sufficient layers of two hour rated firesafing by Thermafiber 4.0 P.C.F. density, U.S.G. fire test 4/11/78 and seal off openings between conduit and sleeves with non-hardening mastic prior to application of escutcheon plate. Escutcheons shall be Gravler Sure-Lock, or approved equal.

2.6 SPACE LIMITATIONS

A. Equipment shall be chosen which shall properly fit into the physical space provided and shown on the drawings, allowing ample room for access, servicing, removal and replacement of parts, etc. Adequate space shall be allowed for clearances in accordance with Code requirements. Physical dimensions and arrangement of equipment shall be subject to the approval of the Architect.

2.7 PAINTING

A. All factory assembled equipment for electrical work, except light fixtures, that normally is delivered with a factory applied finish shall be delivered with a hard surface factory applied finish such as baked-on machinery enamel which will not require additional field painting. The finish shall consist of not less than 2 coats of medium gray color paint USA No. 61 Munsell Notation 8-3G, 6. 10/0.54 enamel. This Contractor shall protect this finish from damage due to construction operations until acceptance of the building. He shall be responsible for satisfactorily restoring any such finishes or replacing equipment that becomes stained or damaged.

2.8 ELECTRICAL SYSTEM IDENTIFICATION

A. Conduit Systems: Provide adequate marking of major conduit which is exposed or concealed in accessible spaces to distinguish each run as either a power or signal/communication conduit. Except as otherwise indicated, use orange banding with black lettering. Provide self-adhesive or snap-on type plastic markers. Indicate voltage for that raceway. Locate markers at ends of conduit runs, on pull boxes, on junction boxes, near switches and other control devices, near items of equipment served by the conductors, at points where conduit passes through walls or floors, or enters non-accessible construction and at spacings of not more than 50 feet along each run of conduit. Switch-leg conduit and short branches for power connections do not have to be marked, except where conduit is larger than ¾ inch. Branch circuit conduits, junction boxes and pull boxes shall be marked with a permanent marker indicating panel name and branch circuit numbers.

B. Underground Cable Identification: Bury a continuous, preprinted, bright colored plastic ribbon cable marker with each underground cable (or group of cables), regardless of whether conductors are in conduit, duct bank, or direct buried. Locate each directly over cables, 6 to 8 inches below finished grade.

C. Identification of Equipment:

1. All major equipment shall have a manufacturer’s label identifying the manufacturer’s address, equipment model and serial numbers, equipment size, and other pertinent data. Care shall be taken not to obliterate this nameplate in any way.

2. A black-white-black laminated plastic engraved identifying nameplate shall be secured by stainless steel screws to each automatic transfer switch, switchboard, distribution panel, motor control center, motor starter panels and panelboards.
   a. Identifying nameplates shall have ¼ inch high engraved letters and shall contain the following information:
      1) Name
      2) Voltage
      3) Phase
      4) "3" or "4" wire, and
      5) Where it is fed from.
   b. An example of a panelboard nameplate is:
      Center **Panel – 1HB**
      480/277 volt, 3 phase, 4 wire
      Center **Fed from DP2**
3. Each feeder device in a switchboard, distribution panel, and motor control center device shall have a nameplate showing the load served in ½ inch high engraved letters.
4. A black-white-black laminated plastic engraved identifying nameplate shall be secured by screws to each safety switch, disconnect switch, individual motor starter, enclosed circuit breaker, wireway, and terminal cabinet.
   a. Identifying nameplates shall have ¼ inch high engraved letters and shall indicate the equipment served.
   b. An example if a disconnect switch is: AHU-1.
5. Each wiring device shall be identified with the branch circuit (LA-15) using black on clear tape on the front of the coverplate.
6. Cardholders and directory cards shall be furnished for circuit identification in panelboards. Cardholder shall be located on inside of panel door and shall be in a metal frame with clear plastic front. Circuit lists shall be typewritten. Circuit descriptions shall include location and name of each item of equipment served. Spares and spaces shall be written in erasable pencil for future use. Circuit directory shall show the room served by each circuit. The final graphs/signage room numbers shall be used. Do not use Architectural numbering on plans.
7. Prohibited Markings: Markings which are intended to identify the manufacturer, vendor, or other source from which the material has been obtained are prohibited for installation within public, tenant, or common areas within the project. Also, prohibited are materials or devices which bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters' Laboratories, Inc.), and approval labels are exceptions to this requirement.
8. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of electrical facilities. Provide text of sufficient clarity and lettering of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with recognized industry standards for color and design.
9. Operational Tags: Where needed for proper and adequate information on operation and maintenance of electrical system, provide tags of plasticized card stock, either preprinted or hand printed. Tags shall convey the message, example: "DO NOT OPEN THIS SWITCH WHEN BURNER IS OPERATING."

PART 3 - EXECUTION

3.1 EXCAVATING AND BACKFILLING

A. Trenching and backfilling and other earthwork operations required to install the facilities specified herein shall conform to the applicable requirements of Division 2 (95% of maximum standard density). Where trenching or excavation is required in improved areas, the backfill shall be compacted to a condition equal to that of adjacent undisturbed earth and the surface of the area restored to the condition existing prior to trenching or excavating operations. Provide a minimum of 3" of sand underneath all conduits. The plans indicate information pertaining to surface and sub-surface obstructions; however, this information is not guaranteed. Should obstructions be encountered whether or not shown, the Contractor shall alter routing of new work, reroute existing lines, remove obstructions where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of new work and leave existing surfaces and structures in a satisfactory and serviceable condition. **All work shall comply with OSHA Standards.**

3.2 WORKMANSHIP AND CONCEALMENT

A. The work of this Section shall be performed by workman skilled in their trade. Installation shall be consistent in completeness whether concealed or exposed. Each item of electrical work shall be concealed in walls, chases, under floors and above ceilings except:

1. Where shown to be exposed.
2. Where exposure is necessary to the proper function.

3.3 SLEEVES, CUTTING AND PATCHING

A. This section shall be responsible for placing sleeves for all conduit passing through walls, partitions, sound walls, beams, floors, roof, etc. Sleeves through below-grade walls shall use water-tight fitting manufactured by O-Z/Gedney.

B. All cutting and patching will be done under another Division, but this Section will be responsible for timely performance of this work and layout of holes and setting sleeves.

C. All un-used sleeves shall be sealed with 2 hour UL approved fire sealant manufactured by “3M” or approved equal.

D. Refer to 26 05 33 for additional requirements.

3.4 ELECTRICAL GEAR

A. Install all electrical equipment in accordance with the National Electrical Code and as shown on the drawings.

B. Lighting contactors, time clocks, disconnect switches, etc. mounted in mechanical/electrical rooms shall be mounted at a working height not requiring a ladder, when wall space is available. Installation of these devices at greater elevations shall be approved by the Engineer. Contractor shall provide a coordination sketch of each mechanical/electrical room noting locations and mounting heights of all electrical devices(note bottom and top elevations) shown to be installed. Sketches shall be provided to the Engineer for review and the general contractor for coordination with other trades working in these rooms.

3.5 CLEANING

A. Clean lighting fixtures and equipment.

B. Touch-up and refinish scratches and marred surfaces on panels, switches, starters, and transformers.

3.6 CORROSIVE AREAS

A. In areas of a corrosive nature, which include but are not limited to the following: pool equipment rooms, cooling towers and areas subject to salt air, etc., provide NEMA 4 X stainless steel or fiberglass reinforced enclosures for contactors, panel boards, controllers, starters, disconnects and materials used as supporting means (i.e. plastibond unistrut, pipe, fittings). The use of spray on coating may be acceptable in some applications.

3.7 TESTS AND INSPECTIONS

A. Tests and inspection requirements shall be coordinated with Division I.

B. Date for final acceptance test shall be sufficiently in advance of completion date of contract to permit alterations or adjustments necessary to achieve proper functioning of equipment prior to contract completion date.

C. Conduct re-tests as directed by Architect on portions of work or equipment altered or adjusted as determined to be necessary by final acceptance test. No resultant delay or consumption of time as

a result of such necessary re-test beyond contract completion date shall relieve Contractor of his responsibility under contract.

D. Put circuits and equipment into service under normal conditions, collectively and separately, as may be required to determine satisfactory operation. Demonstrate equipment to operate in accordance with requirements of these specifications. Perform tests in the presence of Architect. Furnish instruments and personnel required for tests.

E. Final Inspection:

1. At the time designated by the Architect, the entire system shall be inspected by the Architect and Engineer. The contractor or his representative shall be present at this inspection.
2. Panelboards, switches, fixtures, etc., shall be cleaned and in operating condition.
3. Certificates and documents required hereinbefore shall be in order and presented to the Architect prior to inspection.
4. Panel covers, junction box covers, etc., shall be removed for visual inspection of the wire, bus bars, etc.
5. After the inspection, any items which are noted as needing to be changed or corrected in order to comply with these specifications and the drawings shall be accomplished without delay.

F. The contractor shall provide a thermographic test using an independent testing laboratory using an infrared scanning device. This test shall include but not limited to all switchboards, distribution panelboards, panelboards, automatic transfer switches and other electrical distribution devices. This test shall be conducted to locate high temperature levels. This test shall be conducted between 3 to 8 months after occupancy, but not beyond the two year warranty period. Submit test to the architect and engineer using test reporting forms. All unacceptable conditions shall be corrected prior to the end of the warranty period.

END OF SECTION

SECTION 26 05 19
WIRE, CABLE AND RELATED MATERIALS

PART 1 - GENERAL

1.1 SCOPE

A. Provide 600 volt building wire, cable and connectors and 300 volt wire, cable and connectors.

B. WORK INCLUDED: Include the following Work in addition to items normally part of this Section.

1. Wiring for lighting and power.
2. Automatic Control Wiring.
3. Connection of equipment shown.
4. Intercom System. Division 27
5. Fire Alarm System. Division 28

C. WORK SPECIFIED ELSEWHERE:

1. Heating, ventilating, and air conditioning equipment.
2. Structured cabling system.
3. Coaxial cables
4. Voice Data Systems

1.2 STANDARDS

A. UL83

B. ASTM B-3

C. All wire cable and connectors shall be UL approved.

1.3 ACCEPTABLE MANUFACTURERS

A. 600 VOLT WIRE AND CABLE

1. Southwire
2. Encore
3. Cerro
4. Tyco Thermal Controls
5. AIW

B. 300 VOLT WIRE AND CABLE

1. Westpenn
2. Beldon
3. Alpha
4. Tappan - Southwire

C. FLEXIBLE CABLE SYSTEMS

1. AFC Modular Cable Systems

D. CONNECTORS

1. Ilsco
2. Cooper
3. AMP - TYCO
4. Burndy
5. Ideal
6. 3M

7. O.Z. Gedney
8. Thomas & Betts
9. Buchanan

1.4 SUBMITTALS

A. Shop drawings shall include, but not limited to:

1. Cutsheets of wire, cable and connectors to indicate the performance, fabrication procedures, product variations, and accessories.

1.5 REQUIREMENTS OF REGULATORY AGENCIES WORK IN ACCORDANCE WITH:

A. National Electrical Code.

B. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.1 WIRING

A. All wire shall be new and continuous without weld, splice, or joints throughout its length. It must be uniform in cross-section, free from flaws, scales and other imperfections.

B. WIRE MATERIAL: Conductors shall be soft drawn, annealed copper. Aluminum wiring is not acceptable unless otherwise noted on drawings.

C. TYPES:

1. Provide type “THHN/THWN-2” or XHHW” insulation for all buried feeders and service entrance conductors.
2. Provide type “THHN/THWN-2” insulation for all branch circuits and above grade feeders.
3. All wire No. 8 and larger shall be stranded. All wire No. 10 and smaller shall be stranded or solid.
4. Provide type "XHHW" or other 90 degrees insulation wiring for branch circuit wiring installed through continuous rows of fluorescent fixture bodies.
5. All 300-volt cable including but not limited to telephone, fire alarm, data, CATV and security shall be UL listed for use in return air plenums.

D. CONDUCTOR SIZES

1. Feeder conductors shall be sized for a maximum of 2% drop in rated voltage at scheduled load.
2. Branch circuit conductors shall be sized for a maximum 3% drop in the rated voltage to the longest outlet on the circuit.
3. Minimum wire shall be No. 12, unless otherwise shown on Drawings or required by Code.

E. COLOR CODING: No. 6 or larger (No. 4 or larger grounding conductors) shall use tape for color coding. No. 8 and smaller (No. 6 and smaller grounding conductors) shall be color coded in accordance with the governing authority requirements or as follows:

120/208 VOLT	277/480 VOLT
NEUTRAL: White	Neutral: Gray
PHASE A: Black	Phase A: Purple
PHASE B: Red	Phase B: Brown
PHASE C: Blue	Phase C: Yellow
GROUND: Green	Ground: Green

2.2 GROUNDING

Permanently connect all conduit work, motors, starters, and other electrical equipment to grounding system in accordance with the National Electrical Code.

2.3 METAL CLAD CABLE - TYPE MC

At the contractor's option, metal clad cable (MC) may be used if approved by the authority having jurisdiction. The cable shall contain an insulated green grounding conductor (3 wire) and shall be the same size as the phase conductor. Conductors shall be solid copper and the armor shall be flexible galvanized steel.

PART 3 - EXECUTION

3.1 WIRE

A. Do not pull wire into conduit until Work of an injurious nature is completed. Where two or more circuits run to a single outlet box, each circuit shall be properly tagged. Wyreze or approved equal may be used as a lubricant where necessary.

B. Splices shall be fully made up in outlet boxes with compression crimp-on type splice connectors.

C. Joints and splices will not be permitted in service entrance or in feeders. Joints in branch circuits will be permitted where branch circuits divide, and then shall consist of one through-circuit to which the branch shall be spliced. Joints shall not be left for the fixture hanger to make. Connect joints and splices with Buchanan Series "2000" solderless connectors complete with insulating caps or properly sized twist on wire nuts. "Wago" push-in connectors are not acceptable.

D. All stranded conductors shall be furnished with lugs or connectors.

E. Connectors furnished with circuit breakers or switches shall be suitable for copper wire termination.

F. "Sta-Cons" shall be used to terminate stranded conductors on all switches and receptacles.

G. Metal Clad Cable - Type MC

1. Metal clad cable shall not be used for homeruns. Metal clad cable shall only be used for branch circuit drops from ceiling mounted junction boxes to outlets and for horizontal runs in a common wall from outlet to outlet. Do not route to outlets to adjacent walls. Metal clad cable may be looped from outlet to outlet in areas where non-accessible ceilings are used. Metal clad cable shall only be used in air-conditioned areas and shall not be run exposed.
2. Metal clad cable shall be UL approved connectors and shall be used and installed per Article 334 of the National Electrical Code. The cable shall be supported at intervals not exceeding 6 feet and within 12 inches of every box.
3. Provide anti-short bushing at cable ends.
4. Refer to electrical details for additional information and restrictions.
5. Metal clad cable shall not be installed in concrete.

H. All stranded #10 and small conductors shall be terminated with an approved solderless terminal if the device or light fixture does not have provisions for clamp type securing of the conductor.

I. The jacket for all travelers used on 3-way and 4-way switches shall be pink.

3.2 BALANCING SYSTEM

The load on each distribution and lighting panel shall be balanced to within 10% by proper arrangement of branch circuits on the different phase legs. Provide written documentation showing results. Submit with O & M manuals.

3.3 LOW VOLTAGE WIRING

A. Low voltage wiring shall be plenum rated. All wiring in mechanical rooms, electrical rooms, drywall ceiling, inaccessible areas, underground, plaster ceiling, inside concealed walls areas exposed to occupant view, and other areas subject to physical damage shall be run in conduit.

B. Low voltage wiring shall be routed in separate raceways from power wiring systems.

C. Sleeves shall be placed in the forms of concrete, masonry and fire rated walls, floor slabs and beams, for the passage of wiring. Sleeves should be set in place a sufficient time ahead of the concrete work so as not to delay the work. Sleeves shall be rigid galvanized steel.

3.4 CABLE SUPPORTS

A. Provide cable supports in all vertical raceways in accordance with Article 300.19 of the NEC.

3.5 DEFECTS

A. Defects shall include, but are not to limited to, the following:

1. Tripping circuit breakers under normal operation.
2. Improperly connected equipment.
3. Damaged, torn, or skinned insulation.

END OF SECTION

SECTION 26 05 26
GROUNDING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

1.2 SCOPE

A. WORK COMBINED WITH OTHER SECTIONS: Combine the work specified herein with the following Sections to form a single responsibility for the Work:

1. Electrical.
2. Basic materials and methods.

B. Provide electrical service, equipment and wiring device grounding as shown, scheduled and as specified.

C. The types of grounding include, but not limited to, the grounding bonding of all equipment devices, building steel piping, and as required by the National Electrical Code, Local Inspection Department and Power Company.

1.3 STANDARDS

A. NATIONAL ELECTRICAL CODE (NFPA-70)

B. Local municipal and State codes that have jurisdiction.

C. NECA

1.4 ACCEPTABLE MANUFACTURES

A. Provide grounding products manufactured by Copperweld and Cadweld.

1.5 SUBMITTALS

A. Shop drawings shall include, but not limited to the following:

1. Cut sheets of ground rods, clamps and connectors.
2. Grounding system diagram.

PART 2 - PRODUCTS

A. GENERAL: Provide all materials required to construct a complete grounded electrical system.

B. GROUND RODS: Ground rods shall be 3/4" inch diameter by 10 feet long construction with copper jacket and a steel core.

C. CLAMPS: Ground clamps shall be copper except for steel or iron pipes in which the clamps shall be galvanized iron.

D. CONDUCTORS: Conductors shall be connected by means of an approved pressure connector or clamp.

PART 3 - EXECUTION

3.1 INSTALLATION

A. GENERAL: Install grounding system as shown and specified to ensure a properly grounded

system.

B. SERVICE ENTRANCE GROUNDING SYSTEM: Provide a main bonding jumper between the neutral and ground bus of each switchboard. Route a separate grounding electrode conductor in conduit from each main distribution panel to the ground rod grid, incoming cold water piping system, and to the "lightning protection system" (250 - 106 of NEC) underground bonding loop. Provide a bonding jumper around water meter. The grounding electrode conductor shall be stranded copper, 98% conductivity and shall be run continuous without splices or joints and installed at least 12" below grade.

C. BUILDING STEEL AND PIPING SYSTEM: Install a bonding jumper between building steel and metallic piping systems to bond them to the electrical grounding system.

D. NEUTRAL: The neutral shall be grounded only at the service entrance and other separately derived systems. The neutral shall be kept separate from the grounding system and shall not be used as a ground.

E. GROUNDING SEPARATELY DERIVED ALTERNATING CURRENT SYSTEM

1. TRANSFORMERS: The center point (neutral) of each wye connected transformer shall be bonded to the case and a grounding electrode conductor shall be connected to a ground rod or building steel.

F. GROUNDING CONDUCTOR: A grounding conductor and metallic conduit system shall bond all equipment served by the electrical system. Provide a flexible bonding jumper for isolated metallic piping and ductwork and around expansion fittings and joints.

G. CONDUIT GROUNDING BUSHING:

Conduit terminating in equipment that has a ground bus such as switchboards, panelboards, etc., shall have grounding bushings installed. Ground each conduit by means of a grounding bushing and to the ground bus in the equipment.

H. MOTORS: The frame of all motors shall be grounded.

I. SPECIAL GROUNDING: Provide a #6 AWG copper grounding conductor for each telephone board, television system, etc. Terminate the grounding conductor on ground bus and to the building electrical grounding system. Refer to 800.100(D) and 820.100(D) of the NEC.

J. REMOTE PANELBOARDS: Provide a grounding electrode conductor in all remote panels as required by the NEC and shown on drawings.

K. LIGHTING FIXTURES: Flexible lighting fixture whips containing a green grounding conductor shall be used to connect lighting fixtures. Flexible lighting fixture whips shall not exceed ten feet.

L. RECEPTACLES: All receptacles shall be grounded using the branch circuit grounding conductor. Receptacles shall use an approved grounding yoke.

3.2 TESTING: Perform a ground resistance test using a biddle analog or digital portable earth/ground resistance tester. The system resistance shall not exceed 5 OHMS. Provide additional electrodes as required (refer to 250.53(A) of the NEC. Test shall not be conducted following wet weather. Provide personal instruments to conduct these tests and submit certified test for review. Test shall be verified by Engineer.

END OF SECTION

SECTION 26 05 33
RACEWAYS

PART 1 - GENERAL

1.01 SCOPE

A. Provide electrical raceways and fittings as shown, scheduled and specified.

B. The types of raceways and fittings required are as follows:

1. Rigid hot-dipped galvanized steel conduit (RGS)
2. Intermediate hot-dipped galvanized steel conduit (IMC)
3. Electrical metallic tubing (EMT)
4. PVC
5. Flexible metal conduit
6. Liquid-tight flexible metal conduit (non-metallic is not acceptable)

1.02 STANDARDS

A. ANSI, C80.1 & C80.3

B. NEMA FB-1

C. NEMA TC3

D. UL, 6, 797 & 1242

1.03 ACCEPTABLE MANUFACTURERS

A. Raceways

1. Allied
2. Triangle
3. Republic
3. Carlon
4. Wheatland Tube
5. Cantex
6. Western Tube
7. Robroy Industries

B. Fittings

1. Appleton
2. Crouse Hinds
3. Steel City
4. O.Z. Gedney
5. Carlon
6. Raco, Inc.

1.04 SUBMITTALS

A. Shop drawing shall include but not be limited to:

1. Cutsheets for raceways and fitting.

1.05 REQUIREMENTS OF REGULATORY AGENCIES WORK IN ACCORDANCE WITH:

A. National Electrical Code.

B. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.1 PROVIDE CONDUIT AS FOLLOWS:

A. Except as noted or otherwise specified, all wiring shall be installed in galvanized rigid steel, rigid aluminum conduit or electrical steel tube (EMT) of the proper size to contain the number of conductors required in accordance with the latest edition of the N.E.C. Where conduit sizes are shown on the drawings, these shall take precedence. Contractor shall epoxy coat galvanized rigid steel conduit for use in natatoriums.

B. EMT in sizes up to 4 inches when concealed or not exposed to damage and located indoors only.

C. Rigid galvanized steel where embedded in concrete or masonry construction, mechanical yard or in exterior/interior applications where subject to damage.

D. Carlon Schedule 40 PVC may be utilized underground, in or below slab where shown on the construction documents.

E. MINIMUM SIZE: 1/2 inch. All homeruns shall be 3/4" minimum. ½" conduit may be used for drops down walls to a single receptacle or switch**.**

F. Lighting Fixture whips: Refer to 26 51 00 for additional information.

G. Flexible metal conduit shall be used for connecting rotating or vibrating equipment installed in conditioned spaces.

H. Sealtite shall be used for connecting rotating equipment installed in non-conditioned spaces, damp or wet locations, and outside.

I. Bear the stamped approval of the UL and be approved by the Architect and Engineer.

2.2 Branch circuits run underground shall be run in Carlon Schedule 40 PVC conduit. Install ground wire in accordance with NEC table 250.122.

2.3 FITTINGS

A. Couplings for rigid steel or intermediate conduit shall be hot dipped galvanized steel. Set screw type is not acceptable.

B. Steel or malleable iron fittings shall be used on all other raceway types except for PVC.

C. EMT systems shall utilize steel insulated throat, set screw connectors and steel set screw couplings in all indoor conditioned spaces. EMT system shall utilize steel insulated throat, threadless, watertight compression type connectors and steel threadless watertight compression type coupling in all non-conditioned spaces**.** EMT shall not be installed on the exterior of the building, exposed to the elements, Die-cast fittings are not allowed..

D. Metal sealtite fittings shall be steel. Plastic is not acceptable.

E. Provide nylon bushing on end of all low voltage cabling system conduits (sleeves, rough-ins, etc.).

PART 3 - EXECUTION

3.1 CONDUIT

A. GENERAL

The Drawings are diagrammatic, and are intended to show the general location of outlets, devices, fixtures, and arrangement and control of circuits. The Contractor shall determine exact locations by actual measurement of the building or by reference to the Architectural Drawings.

B. Of such size, and so installed that conductors may be drawn in without injury or excessive strain.

C. Where entering panels, pull boxes, junction boxes, or outlet boxes, shall be secured in place with lock nuts inside and outside, and insulated bushings inside.

D. Have Red seal type VCC or approved equal cable supports in risers, as required by N.E.C.

E. Have ends reamed after cutting and application of die.

F. Keep conduit corked and dry during construction, and swab out before conductors are pulled.

G. Have bends and offsets made with approved tools. Bends or offsets in which the pipe is crushed or deformed shall not be installed.

H. Where not embedded in concrete or masonry, be firmly secured by approved clamps, half-straps or hangers.

I. Have O.Z. Gedney or approved equal expansion fittings where crossing building expansion joints.

J. EXPANSION JOINTS: Make provision for expansion and shifting of metal or PVC conduits where risers occur from underground.

K. Except in the mechanical equipment rooms, run conduit concealed, and by the shortest practicable route between outlets. Install risers, drops, and offsets necessary to avoid conflict with ductwork, piping, structural members, and similar items.

L. Install exposed conduit in mechanical rooms, and elsewhere as indicated, parallel to horizontal and vertical lines of walls, ceilings, and floors.

M. In general, fluorescent fixtures in finished areas having suspended acoustical ceilings shall be connected to outlet boxes of lighting grid by flexible metal conduit; length not to exceed ten feet.

N. Outlet boxes in partitions shall never be set back to back. They shall be offset to prevent undue noise transmission from room to room.

O. Concealed conduit shall run in as direct manner as possible using long bends. Exposed conduit shall be run parallel with or at right angles to the lines of the building; and all bends shall be made with standard conduit elbows or conduit benders. Not more than equivalent of four quarter bends shall be used in any run between terminals and cabinet, of between outlet or junction boxes. Approved condulets shall be used in lieu of conduit elbows where ease of installation and appearance warrants their use and approved by the engineer. Conduit joints shall be made with approved couplings and unions.

P. Conduits shall be continuous from outlet to outlet and from outlets to cabinets, junction or pull boxes and shall be electrically continuous throughout. Terminals of all conduits shall be provided with double lock nuts and bushing or terminated on conduit hubs. Use of running threads is prohibited.

Q. Each entire conduit system shall be installed complete before any conductors are drawn in. Every run of conduit shall be finished before covering up to guard against obstructions and omissions.

R. Sleeves shall be placed in the forms of concrete, masonry and fire rated walls, floor slabs and beams, for the passage of conduits. Sleeves should be set in place a sufficient time ahead of the concrete work so as not to delay the work. Sleeves shall be rigid galvanized steel and set to extend 4” above slab.

S. All pipe penetrations through walls and concrete floors shall be fire rated by applying USG Thermafiber in the space between the concrete and the pipe. The fire rating shall be additionally sealed by using 3M brand model CP 25 or 303 fire barrier caulk and putty. All fire rating material shall be installed in accordance with manufacturer's printed instructions.

T. All conduit shall be cleaned and swabbed to remove all foreign matter and moisture prior to pulling wire and cable. All boxes in which conduits terminate shall be cleaned of all concrete mortar and other foreign matter.

U. Provide #30 nylon pulling line in all conduits in which permanent wiring is not installed.

V. All conduit shall be securely fastened and supported using hot galvanized malleable iron one-hole pipe straps, clamps, hanger or other means approved by the engineer. Supports shall be as required by NEC Table 344.30(B)(2). Tie wire shall not be used as support or securing means. Support conduit independently of ceiling hanger wire. Use all thread rods to support outlet boxes, junction boxes and conduit.

W. When PVC conduit is routed underground, all stub-up's and 90° elbows shall be rigid galvanized steel. Use rigid galvanized steel when penetrating concrete on grade.

X. Route all conduit above grade, concealed unless otherwise noted on the construction documents.

Y. Contact the Architect and Engineer for an installation review before covering any below grade or above grade conduit.

Z. All new outlets shall be flush mounted, unless indicated otherwise.

AA. Contractor shall not penetrate water proof barriers without using proper fitting to maintain barriers. This shall include exterior walls and slabs. Coordinate with Architect for proper methods.

3.2 FITTINGS

A. Install approved expansion fitting in all conduit runs in excess of 150 feet or when crossing building expansion joints.

3.3 CONDUIT CORROSION PROTECTION

A. Branch circuit conduits installed in concrete slabs on fill or grade shall be positioned in a manner to ensure complete concrete cover. In no case shall such conduits be exposed below or above the slab surfaces, or penetrate the waterproof membrane.

B. At locations where metallic conduits pass through slabs on grade or transitions below grade, rigid galvanized conduit shall be used.

3.4 OUTLET AND JUNCTION BOXES

A. Provide an approved galvanized outlet box with adequate volume for number of conductors installed.

B. Provide standard galvanized switch boxes of the required number of gangs. Switch boxes where conduit is exposed shall be handy boxes or approved equal.

C. Outlet boxes for receptacles shall be similar to Universal 52151 with suitable raised cover. Receptacle boxes where conduit is exposed shall be handy boxes or approved equal.

D. Weatherproof boxes shall be FS or FD. Provide these boxes in all non-conditioned areas, exterior areas and natatoriums.

E. Outdoor boxes shall be NEMA 3R, with conduit connections made by Myers Hubs.

F. See notes and details on Drawings for special box requirements.

G. Provide junction boxes required to facilitate installation of the various conduit systems. Provide support boxes required for risers, each complete with approved cable supports as described elsewhere in this Division.

H. Outlet boxes for drywall shall be standard galvanized 4" square boxes with the appropriate device

cover.

I. Provide floor outlet fittings for telephone to match fittings for duplex floor receptacles.

J. Provide 3-1/2" deep gangable masonry boxes in all masonry wall (CMU). Steel City GW-135-G or approved equal.

K. Provide shallow 4"x4" boxes in all demountable partitions.

L. Metallic boxes located in fire rated walls or partitions shall be separated by a minimum horizontal distance of 24 in. This minimum separation distance between metallic boxes may be reduced when " Wall Opening Protective Materials" (CLIV) are installed according to the requirements of their Classification. Metallic boxes shall not be installed on opposite side of walls or partitions of staggered stud construction unless "Wall Opening Protective Materials" are installed with the metallic boxes in accordance with Classification requirements for the protective materials.

M. Junction, pull boxes, condulets, gutters, disconnects, contactors, etc., above 2-foot x 2-foot grid ceilings shall be mounted within 18-inches of ceiling grid. Above 2-foot x 4 – foot grid ceiling they shall be mounted within 30-inches of ceiling grid. All junction box, pull box, gutter openings shall be side or bottom accessible.

3.5 THRU-WALL SEALS

A. Provide O.Z. Gedney "Thru-wall" seals for all conduits passing through concrete structure below grade, above grade, and floor penetrations below grade. These prevent moisture from entering the building.

B. Straight sleeves are not acceptable.

3.6 PULL BOXES

A. Pull boxes shall be provided for conduit systems as required and shall be constructed of galvanized steel of not less than gauge and size specified by National Electrical Code.

B. Where two or more feeders pass through a common pull box, they shall be tagged to indicate clearly their electrical characteristics, circuit number, and panel designation.

3.7 WIREWAYS

A. Wireways shall be installed as indicated or required and locations shall be coordinated with architect.

B. Wireways shall be made of not less than 16-gauge sheet steel for 4 inch and 6 inch square sizes and 14 gauge steel for 8 inch and 12 inch square sizes. Couplings end plates, and knockouts shall be furnished as required. Each section of wireways shall be rigidly supported.

C. Wiring in wireways shall be neatly bundled, tied and suitably tagged.

D. The finish shall be ANSI-49 gray epoxy paint applied by a cathodic electrode position paint process over a corrosion resistant phosphate preparation for NEMA 1 wireways. Provide galvanized steel for NEMA 3R wireways. NEMA 3R wireways and auxiliary gutters are for horizontal mounting only.

3.8 UNDERGROUND DUCTBANK SYSTEM

A. DUCT SYSTEM

1. The duct system shall consist of Schedule 40 PVC or type 1-EB PVC conduits encased in concrete as detailed on the drawings. Use rigid conduit for stub-ups and the last ten feet at the end of each ductbank. Duct lines shall be laid to a minimum grade of 4 inches per 100 feet and shall be free from either horizontal or vertical waves. Duct lines shall be straight unless otherwise noted on the drawings. Duct lines shall be installed so that the top of concrete in encased duct lines is not less than 24 inches below finished grade or

finished paving at any point. Changes in direction or runs exceeding a total of 10 degrees, either vertical or horizontal, shall be accomplished by long sweep bends having a minimum radius of curvature of 5 feet. The long sweep bends may be made up of one or more curved or straight sections and/or combinations thereof using five degree angle couplings. Conduit shall be thoroughly cleaned before using or laying. During construction and after the duct line is completed, the ends of the conduit shall be plugged to prevent water washing mud into the conduits. Particular care shall be taken to keep the conduits clean of concrete, dirt, and any other substance during the course of construction.

2. Each single conduit of the duct bank shall be completely encased in steel reinforced concrete as indicated. The thickness of concrete encasement indicated is the minimum thickness, and may be increased to fit the actual shape of trench.
3. Concrete for duct bank envelopes shall be standard 2000 psi concrete mix as described in Division 03.
    a. Envelopes may be poured directly against sides of trenches if the "cut" is clean, even and free of loose material. All loose dirt and extraneous material shall be removed from the trenches before and during the pouring of concrete to ensure sound envelopes. Concrete shall be carefully spaded during pouring to eliminate all voids under and between the conduit and honeycombing of the exterior surfaces. Power driven tampers of agitators shall not be used, unless specifically designed for the application, in order to ensure that the water-tightness of the conduits is not destroyed.
    b. Generally, each run of envelopes shall be poured in one continuous operation. Where more than one pour is necessary, each pour shall terminate in a vertical plane. Partial pours shall not terminate in horizontal or angular planes.

B. For normal underground installation see Section 26 02 00 -3.01 for Excavating and Backfilling.

END OF SECTION

SECTION 26 08 00
COMMISSIONING OF ELECTRICAL

PART 1 - GENERAL

1.1. SUMMARY

A. The purpose of this guideline is to describe the technical requirements for the application of the Commissioning Process as described in Section 01 91 13 that will verify the Electrical System achieves the Owner's Project Requirements and are compliant with the Basis of Design.

B. Section Includes:
1. Electrical commissioning description.
2. Electrical commissioning responsibilities.

C. Related Sections:
1. List related sections.
2. Section 01 91 13: general commissioning requirements.
3. Section 23 08 00: HVAC systems commissioning requirements.
4. Section 22 08 00: Plumbing systems commissioning requirements.

1.2. REFERENCES

A. Institute of Electrical and Electronic Engineers (IEEE).

B. National Electric Code (NEC).

C. Others as specified.

1.3. COMMISSIONING DESCRIPTION

A. Electrical commissioning process includes the following tasks:
1. Testing and startup of Electrical equipment and systems.
2. Equipment and system readiness checklists.
3. Provide qualified personnel to assist in commissioning tests, including seasonal testing.
4. Complete and endorse functional performance test checklists provided by Commissioning Authority to assure equipment and systems are fully operational and ready for functional performance testing.
5. Provide equipment, materials, and labor necessary to correct deficiencies found during commissioning process to fulfill contract and warranty requirements.
6. Provide operation and maintenance information and record drawings to Commissioning Authority for review verification and organization, prior to distribution.
7. Provide assistance to Commissioning Authority to develop, edit, and document system operation descriptions.
8. Provide training for systems specified in this Section with coordination by Commissioning Authority.

B. Equipment and Systems to Be Commissioned:

1. Lighting Control Systems

1.4. COMMISSIONING SUBMITTALS

A. Section 01 91 13 - Commissioning: Requirements for commissioning submittals.

B. Test Reports: Indicate data on system verification form for each piece of equipment and system as specified.

C. Field Reports: Indicate deficiencies preventing completion of equipment or system verification checks equipment or system to achieve specified performance.

1.5. CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record revisions to equipment and system documentation necessitated by commissioning.

C. Operation and Maintenance Data: Submit revisions to operation and maintenance manuals when necessary revisions are discovered during commissioning.

1.6. QUALITY ASSURANCE

A. Perform Work in accordance with specified codes, the OPR and BOD.

B. Perform Work in accordance with all governing building codes as specified in the contract documents.

1.7. COMMISSIONING RESPONSIBILITIES

A. Equipment or System Installer Commissioning Responsibilities:
1. Attend commissioning meetings.
2. Provide instructions and demonstrations for Owner's personnel.
3. Ensure subcontractors perform assigned commissioning responsibilities.
4. Ensure participation of equipment manufacturers in appropriate startup, testing, and training activities when required by individual equipment specifications.
5. Develop startup and initial checkout plan using manufacturer’s startup procedures and functional performance checklists for equipment and systems to be commissioned.
6. Installation Contractor, under the direction of the Construction Manager (CM), with the Commissioning Authority (CxA) observing and documenting the results, will execute the Functional Performance Testing procedures for the various systems and pieces of equipment associated with the requirements for the electrical system.
7. During verification check and startup process, execute electrical related portions of checklists for equipment and systems to be commissioned.
8. Perform and document completed startup and system operational checkout procedures, providing copy to Commissioning Authority.
9. Provide manufacturer’s representatives to execute starting of equipment. Ensure representatives are available and present during agreed upon schedules and are in attendance for duration to complete tests, adjustments and problem-solving.
10. Coordinate with equipment manufacturers to determine specific requirements to maintain validity of warranties.
11. Provide personnel to assist Commissioning Authority during equipment or System Readiness Checks (SRC’s) and Functional Performance Tests (FPT’s).
12. Prior to FPT’s, review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during tests.
13. Prior to startup, inspect, check, and verify correct and complete installation of equipment and system components for verification checks included in commissioning plan. When deficient or incomplete work is discovered, ensure corrective action is taken and re-check until equipment or system is ready for startup.
14. Provide factory supervised startup services for equipment and systems. Coordinate work with manufacturer and Commissioning Authority.
15. Perform verification checks and startup on equipment and systems as specified.
16. Assist Commissioning Authority in performing FPT’s on equipment and systems as specified.
17. Perform operation and maintenance training sessions scheduled by Commissioning Authority.
18. Conduct electrical system orientation and inspection.

19. Perform training sessions to instruct Owner's personnel in hardware operation, software operation, programming, and application in accordance with commissioning plan and specifications.
20. Demonstrate system performance and operation to Commissioning Authority during functional performance tests including each mode of operation.
21. Assist in performing operation and maintenance training sessions scheduled by Commissioning Authority.

1.8. COMMISSIONING MEETINGS

A. Section 01 91 13 - Commissioning: Requirements for commissioning meetings.

B. Attend initial commissioning meeting and progress commissioning meetings as required by Commissioning Authority.

1.9. SCHEDULING

A. Prepare schedule indicating anticipated start dates for the following:
1. Normal electric power.
2. Emergency electric power (if applicable).
3. Lighting control system.
4. Electrical system orientation and inspections.
5. Operation and maintenance manual submittals.
6. Training sessions.

B. Schedule seasonal tests of equipment and systems during peak weather conditions to observe full-load performance.

C. Schedule occupancy sensitive tests of equipment and systems during conditions of both minimum and maximum occupancy or use.

1.10. COORDINATION

A. Notify Commissioning Authority minimum of 5 days in advance of the following:
1. Scheduled equipment and system startups.

B. Coordinate programming of automatic temperature control system with construction and commissioning schedules.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

1.1. INSTALLATION

A. Place electrical systems and equipment into full operation and continue operation during each working day of commissioning.

1.2. COMMISSIONING

A. Be responsible to participate in initial and alternate peak season test of systems required to demonstrate performance.

B. Occupancy Sensitive Functional Performance Tests:

1. Test equipment and systems affected by occupancy variations at minimum and peak loads to observe system performance.
2. Participate in testing delayed beyond final completion to test performance with actual occupancy conditions.

END OF SECTION

SECTION 26 21 13
LOW VOLTAGE UNDERGROUND ELECTRICAL POWER SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Power company fees shall be paid by the Contractor.

1.02 SCOPE

A. INCLUDED: Power Supply through main disconnect or service Panel. This project requires three separate services from the utility.

B. RELATED WORK:

1. Basic Electrical Materials and Methods.
2. Earthwork Section.

C. PRIMARY: All services shall be from overhead transformer banks delivering underground secondary to the buildings.

D. SECONDARY: Provide conduit and wire to meet capacity requirements noted on drawings or per CPS Energy requirements.

1.03 PERMITS, CODES, LAWS AND ORDINANCES

A. NFPA-70, NESC, State and local.

1.04 MINIMUM COMPLIANCE STANDARDS

PART 2 – PRODUCTS

2.01 ELECTRICAL SERVICE

A. POWER SOURCE: CPS Energy, from overhead aerial primary with pole mounted transformers. Route onto site with underground secondary ductbanks, per CPS Energy requirements.

B. SOURCE VOLTAGE: 480Y/277 volt, three phase, four wire system.

2.02 CABLE TERMINAL BOX

A. Provide size as required.

2.03 METER PROVISIONS

A. As required.

PART 3 - EXECUTION

3.01 SYSTEM ARRANGEMENT

A. Underground service to main switchgear.

3.02 COORDINATION

A. Confirm with power company exact locations of service entry and other requirements.

3.03 INSTALLATION

A. Provide concrete, as required and conduit and wire.

END OF SECTION

SECTION 26 22 22
LOW VOLTAGE HARMONIC DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.01 SCOPE

A. Provide 480 – 208Y/120 volt 3 phase, 4 wire transformers as shown, scheduled and as specified.

B. The type of transformers required are dry-type harmonic mitigating transformers.

1.02 STANDARDS

A. Products shall be designed, manufactured, tested and installed in compliance with applicable IEEE, NEMA ST1 and ST20, CSA, EPA, NFPA, ANSI C33.4 and C89.2 standards.

B. All transformers shall be UL-labeled.

C. Manufacturer shall be ISO 9001 certified.

D. Transformers shall be CSA certified and UL listed.

E. Transformers shall be factory tested to CSA C9.

1.03 ACCEPTABLE MANUFACTURERS

A. Provide the following manufacturer:

1. Power Quality International, Inc.
2. Powersmith’s

1.04 SUBMITTALS

A. Shop drawings shall include, but not be limited to:

1. Cutsheets of transformers with sound and load ratings, dimensions, weights, impedance rating, insulation type, temperature rise, phase displacement and tap configurations.

1.05 REQUIREMENTS OF REGULATORY AGENCIES

A. National Electrical Code.

B. Local, municipal, and/or state codes that have jurisdiction.

1.06 DESIGN OBJECTIVES

A. The design of the electrical distribution system, as described by this specification and detailed in the accompanying electrical drawings, provides for control of the harmonic currents that are generated by non-linear electronic loads. These design objectives, and the various standards that apply, are detailed herein as follows:

1. To reduce the ‘penalty losses’ that are produced by harmonic currents, which would otherwise result in an increase in the cost-of-power, apparatus heating and the cost of air-conditioning, within economic limits.
2. To limit harmonic current injection into the Point of Common Coupling (PCC), as required in (ANSI) IEEE Std. 519-1992, Section 10.4, Table 10.3.
3. To limit positive, negative and zero sequence harmonic currents in the distribution system so that the Individual Harmonic Distortion of Voltage (IHDv) levels do not exceed 3% at the loads and the Total Harmonic Distortion of Voltage (THDv) levels do not exceed 5% at the loads, as recommended in (ANSI) IEEE Std. 519-1992.
4. To limit zero sequence harmonic currents in the neutral conductors so that their ratings are not exceeded and Common Mode Noise (CMN) neutral-ground voltage levels do not

exceed 5 volts at the loads, as recommended by CBEMA. Where computers and/or audio/visual devices are interconnected into a communications 'network', to limit the difference in CMN to < 2 volts at all loads, as recommended by EPRI.

1.07 FACTORY TESTING

A. The manufacturer shall provide linear and non-linear efficiency test on each transformer. Transformers not meeting the following criteria will not be used on this job. The data shall be included in the Operations and Maintenance Manuals. The tests shall be conducted between 0% and 100% full load and shall be plotted for each transformer.

1. Linear Load Efficiency: This requirement is defined as meeting the efficiency requirements of NEMA TP1-2002 and CSA C802.2-00, which are linear load efficiency requirements. Proof of compliance Type Tests, for each transformer type and rating, must be based on NEMA TP2-1998 – 'Standard Test Method for Measuring the Energy Consumption of Distribution Transformers'. Type Test are required with each submission.
2. Non-Linear Load Efficiency: This requirement is defined as meeting the efficiency requirements of NEMA TP1-2002 under non-linear loading, which has 100% THD_I and a harmonic profile that is based on IEEE Std. 519-1992, Table 4.3 – 'Spectrum of Typical Switch Mode Power Supplies'. Proof of compliance Type Tests, for each transformer type and rating, must be based on the Voltage and Current Difference Loss Measurement Method using laboratory grade CTs and 0.1% accuracy Wattmeters or shall be calculated in accordance with IEEE Std. C57.110.. Type Tests are required with each submission. The Power In – Power Out Measurements Method is not an acceptable test method since it exceeds the minimum required accuracy.

1.08 FACTORY NAME PLATES

A. Provide two (2) – name plates per transformer indicating all code required items (i.e. kVA voltage, phase etc.). Name plates shall also include, phase shift and a name as indicated on transformer schedule or one-line diagram. The name plates shall be located on a non removable section of the outer shell.

1.09 ALTERNATES

A. In the event the contractor wishes to propose an alternative to the specified Harmonic Mitigating Transformers and/or Zero Sequence Harmonic Filters, the contractor shall provide the engineer with a detailed alternate Harmonic Mitigation Plan, which includes a schedule of proposed replacement devices that will meet all of the requirements elaborated in this specification. The equipment proposal from the non-specified vendor(s) shall include the following information:

1. Evidence of significant relevant application experience.
2. Quantitative performance data including before/after effect on voltage distortion at the loads that demonstrates the vendor's capability to achieve the harmonic treatment called for in this specification.
3. Product technical specification and installation wiring diagram.
4. Pertinent product application information.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Type 'DY', Single Output, Harmonic Mitigating Distribution Transformers (Dry Type) shall be provided for all transformers indicated with a zero (0) degree primary to secondary phase shift.

B. Type 'DV', Single Output, Harmonic Filtering Distribution Transformers (Dry Type) shall be provided for all transformers indicated with a thirty (30), fifteen (15), forty-five (45), twenty (20) and forty (40) degree primary to secondary phase shifts.

C. Harmonic mitigating transformers with Wye configured primary windings are not acceptable.

D. Harmonic mitigating transformers without zig-zag configured secondary windings that completely cancel zero-sequence flux under balanced load conditions are not acceptable.

2.02 PRODUCT DESCRIPTION

A. The design of the harmonic filtering transformers, described in this Specification, shall be optimized for harmonic rich environments that are characterized by high neutral currents. These transformers shall:

1. Provide an ultra-low zero sequence impedance path for all load-generated zero sequence harmonic currents, including I_3, I_9, I_{15}, I_{21}, etc.
2. Provide for the cancellation of the 5^{th}, 7^{th}, etc. positive and negative sequence harmonic currents, at the units' primary bus, when 0° and 30° (15° and 45°) phase-shifting units are used in combination.
3. Provide for the cancellation of the 5^{th}, 7^{th}, 11^{th}, 13^{th}, etc. positive and negative sequence harmonic currents, at the units' primary bus, when 0°, 20° and 40° phase-shifting units are used in combination.
4. Provide for the cancellation of 5^{th}, 7^{th}, 11^{th}, 13^{th}, 17^{th}, 19^{th}, etc. positive and negative sequence harmonic currents, at the units' primary bus, when 0°, 15°, 30° and 45° phase-shifting units are used in combination.
5. Harmonic cancellation shall be by electromagnetic means only. No capacitors or electronics shall be used.
6. Reduce voltage and current distortion and imbalance at the primary terminals of the unit.
7. Reduce current crest factor at the primary terminals of the unit.
8. Reduce average and peak phase current on the primary terminals of the unit.
9. Reduce system losses.
10. Improve system power factor.
11. Reduce voltage distortion in the secondary sub-system.

2.03 DEVICE CONFIGURATION

A. Type: ANN

B. Insulation Class: 220°C

C. Temperature Rise: 150°C

D. System Frequency: 60 Hertz

E. Primary Voltage: 480 Volts Delta (Wye configured primary is not acceptable)

F. Secondary Voltage: 208/120 Volts Zig-Zag with two (2) windings per core leg for 0 degree phase shift and 208/120 Volt modified zig-zag with three (3) windings per core leg for 30, 15, 45, 20 and 40 degree phase shifts.

G. Phase: Three Phase

H. Rating: as scheduled on drawings

I. Rating: as scheduled on drawings

J. Primary-Secondary Phase-Shift: as scheduled on drawings

2.04 TRANSFORMER CHARACTERISTICS

A. Key Requirements

1. Positive & negative sequence impedance: standard %
2. Zero sequence reactance at 60Hz: < 0.3 %
3. Zero sequence impedance at 60Hz: < 0.9 %
4. Crest Factor suitability: 5
5. BIL: 10,000 Volts (windings 1000V
6. Capability to deliver full nameplate kVA to loads of K-factor up to: 30
7. Neutral connection shall be rated at two times the ampacity of the secondary phase current.

B. Basic Requirements:

1. Built to the following Standards: CSA C9-M1981, CSA22.2 No.47-1977, UL-506, ANSI C75.110, and NEMA ST-20
2. Three-phase, common core construction
3. Convection air-cooled
4. Copper or Aluminum Windings
5. Insulation Class: R(200 degree C)
6. Magnetic field at 1.5 feet: max. 0.1 Gauss
7. Full load Efficiency at 170°C
8. Magnetizing Inrush Current: max. 10 times full load rating
9. Taps: 2 x ± 2.5%
10. Sound level: per C57.12.91
11. Enclosure: ventilated, drip-proof NEMA-1
12. Finish: PQI white power coat
13. Anti-vibration pads shall be used between the core and the enclosure

2.05 VENDOR INFORMATION

A. Evidence of significant relevant application experience.

B. Quantitative performance data including before/after effect on voltage distortion at load panels that demonstrates the capability to achieve the harmonic mitigation called for in this specification.

C. Product technical specification.

D. Pertinent product application information.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install transformer in accordance with manufacturer's written instructions, and recognized industry practices.

B. Housekeeping Pad: Provide a nominal 3-½" high, 2500 PSI (28 Day) concrete reinforced pad with number 6 welded wire mesh. The pad shall conform to the shape of the transformer and extend at least 3 inches beyond the length and width of the transformer. All corners of the pad shall be rounded.

C. Mounting: Install floor mounted transformers on properly sized rubber-in-shear vibration isolators. Trapeze mounted transformers shall use rubber-in-shear hangers. Wall mounted transformers shall not be mounted directly to the wall without vibration isolation.

D. Connection: Route conductors in a minimum of 2 feet of flexible steel conduit to transformer enclosure. Provide grounding conductor sized per NEC, connected to the building grounding electrode system.

3.02 FIELD TESTING

A. Insulation, Tests: Prior to energization, check transformers windings for continuity and test the insulation resistance. Tests shall be made using a Biddle Megger or equivalent test instrument, per manufacturers' recommendations.

B. Tap Setting: Measure current and voltage under load conditions to provide correct tap settings.

C. Receptacle Tests: At the furthest receptacle from each panel serving a computer or copier, a harmonic analyzer shall be used to determine the following:

1. Voltage
2. Current
3. Current Distortion
4. Common Mode Noise (Neutral to ground voltage)
5. Voltage Distortion

Conduct all tests 3 to 6 months after building occupation. Submit all tests for Engineer's review.

END OF SECTION

SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.01 SCOPE

A. Provide panelboards as shown, scheduled and as specified herein.

B. The types of panelboards include:

1. Lighting and appliance panelboards.
2. Power distribution panelboards.

1.02 STANDARDS

A. Products shall be designed, manufactured, tested and installed in compliance with applicable standards.

B. Products shall conform to all applicable UL standards and shall be UL-labeled.

1.03 ACCEPTABLE MANUFACTURERS

A. Provide one of the following manufacturers:

1. General Electric Company
2. Square D Company
3. Siemens
4. Eaton

1.04 SUBMITTALS

A. Shop drawings shall include, but not be limited to:

1. Cutsheets of all enclosures, circuit breakers, fusible switches, bussing, rating, schedules and all accessories clearly labeled.

1.05 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:

1. National Electrical Code.
2. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.01 MATERIALS AND COMPONENTS

A. General

Furnish and install power distribution, lighting and appliance panelboards as indicated in the panelboard schedule and as shown on the plans. Power distribution panelboards shall be equipped with fusible switches or circuit breakers as shown on the schedule. Panelboards shall be equipped with thermal-magnetic, molded case circuit breakers of frame and trip ratings as shown on the schedule.

B. Busing Assembly and Temperature Rise

Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on the panelboard schedule. Such ratings shall be established by heat rise tests with maximum hot spot temperature on any connector or bus bar not to exceed 50ºC. rise above 40ºC ambient. Heat rise test shall be conducted in accordance with Underwriters Laboratories Standard UL 67. The use of

conductor dimensions will not be accepted in lieu of actual heat tests. All current carrying parts of the bus shall be tin or silver plated copper.

1. Bus structure shall be insulated. Bus bar connections to the branch circuit breakers shall be distributed phase or phase sequence type and shall accept bolt-on circuit breakers for lighting and appliance panelboards.

Provide a bare uninsulated and/or insulated ground bus and full size neutral bus as required and indicated in each panelboard enclosure.

C. Distribution Panelboards

1. Circuit breakers shall be equipped with individually insulated, braced and protected connectors. The front faces of all circuit breakers shall be flush with each other. Large, permanent, individual circuit numbers shall be affixed to each breaker in a uniform position. Tripped indication shall be clearly shown by the breaker handle taking a position between "ON" and "OFF". Provisions for additional breakers shall be such that no additional connectors will be required to add breakers. Circuit breakers shall be of the frame size, trip setting and interrupting capacity as indicated on the drawings.

   Current limiting circuit breakers shall be equal to Square D Company "I-Limiter" Series.

   Circuit breakers shall be conventional interrupting capacity but in no case be less than the following symmetrical amperes RMS.

FRAME SIZE/ VOLTAGE	CONVENTIONAL INTERRUPTING CAPACITY	HIGH INTERRUPTING CAPACITY	CURRENT LIMITING
100AF/240V	10,000 AIC	65,000 AIC	200,000 AIC
225AF/240V	10,000 AIC	65,000 AIC	200,000 AIC
400AF/240V	42,000 AIC	65,000 AIC	200,000 AIC
100AF/480V	14,000 AIC	25,000 AIC	200,000 AIC
225AF/480V	22,000 AIC	65,000 AIC	200,000 AIC
400AF/480V	30,000 AIC	35,000 AIC	200,000 AIC
600AF/480V	30,000 AIC	65,000 AIC	200,000 AIC

D. 480/277 Volt Lighting Panelboards

Main breakers shall be vertically mounted. Horizontally mounted main breakers are not acceptable.

Circuit breakers shall be bolt-on thermal-magnetic, molded case circuit breakers. Breakers shall be 1, 2 or 3 pole with an integral crossbar to assure simultaneous opening of all poles in multiple circuit breakers. Breaker shall have an over-center, trip-free, toggle-type operating mechanism with quick-make, quick-break action and positive handle indication. Handles shall have "ON", "OFF" and "TRIPPED" positions. Circuit breakers shall be UL listed in accordance with UL Standard 489 and shall be rated 277 volt ac (single pole, 15-30 amperes) or 480Y/277 volts ac (2 and 3 pole) with continuous current ratings as noted on the plan. Interrupting ratings shall be a minimum of 18,000 rms symmetrical amperes at 277 volts ac (single pole) or 480Y/277 volts ac (2 and 3 pole). Single pole, 15 and 20 ampere circuit breakers intended to switch fluorescent lighting loads on a regular basis shall carry the SWD marking.

1. The lugs for terminating conductors shall be rated at 75° C on all panel boards and circuit breakers.

E. 240 Volt Lighting and Appliance Panelboard

Main breakers shall be vertically mounted. Horizontally mounted main breakers are not acceptable.

Circuit breakers shall be bolt-on thermal-magnetic, molded case circuit breakers. Breakers shall be

1, 2, or 3 pole with an integral crossbar to assure simultaneous opening of all poles in multiple circuit breakers. Breakers shall have an overcenter, trip-free, toggle-type operating mechanism with quick-make, quick-break action and positive handle indication. Handles shall have "ON", "OFF" and "TRIPPED" positions.

Circuit breakers shall be UL listed in accordance with UL standard 489 and shall be rated 240 volts ac maximum with continuous current rating as noted on the plans.

Branch circuit breakers feeding convenience outlets shall have sensitive instantaneous trip settings of not more than 10 times the trip settings of the breaker to prevent repeated arcing short resulting from frayed appliance cords. Single pole 15 and 20 ampere circuit breakers shall be UL listed as "Switching Breakers" at 120V ac and carry the SWD marking.

UL Class A ground fault circuit protection shall be provided on all receptacle circuits serving wet areas and on all 120V ac branch circuits as specified on the plans or panelboard schedule. This protection shall be an integral part of the branch circuit breaker which also provides overload and short circuit protection for branch circuit wiring. Tripping of a branch circuit breaker containing ground fault circuit interruption shall not disturb the feeder circuit to the panelboard. A single pole circuit breaker with integral ground fault circuit interruption shall require no more panelboard branch circuit space than a conventional circuit breaker. Circuit breakers shall be rated 10,000 AIC at 240V unless otherwise noted on plans.

Provide double sized neutral bus with panels served from a non-linear transformer or when indicated on drawings. This shall be a UL approved assembly.

F. Cabinets and Fronts

The panelboard bus assembly shall be enclosed in a steel cabinet with multiple knockouts. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. Wiring gutter space shall be in accordance with UL Standard 67 for panelboards. The box shall be fabricated from galvanized steel or equivalent rust resistant steel. All NEMA-1 lighting and receptacle panels shall have hinged front covers. The front cover shall have a door with hinges, latch and a lock. The hinged front covers shall allow full access to the circuit breaker gutter area without having to remove the entire front cover**.** All panelboard lock shall be keyed alike. Circuit breaker and fusible distribution panels shall have four-piece trims. A circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door. Provide NEMA 1 enclosure where installed indoors unless otherwise noted. Provide NEMA 3R enclosure where installed outside or in a sprinkled area.

G. Safety Barrier

The distribution panelboard interior assembly shall be dead front with panelboard front removed. Main lugs or main breakers shall have barriers on five sides. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the bus structure opposite the mains shall have barriers.

H. Integrated Equipment Short Circuit Rating

Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the plans. This rating shall be established by testing with the over-current devices mounted in the panelboard. The short circuit tests on the over-current devices and on the panelboard structure shall be made simultaneously by connecting the fault to each over-current device with the panelboard connected to its rated voltage source. Method of testing shall be per Underwriters Laboratories Standard UL 67. The source shall be capable of supplying the specified panelboard short circuit current or greater. Testing of panelboard over-current devices for short circuit rating only while individually mounted is not acceptable. Also, testing of the bus structure alone is not acceptable. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install panelboards, including electrical connections, in accordance with manufacturers written instructions, NEC and recognized industry practices.

B. Housekeeping Pads: Mount floor mounted panelboards on 4 inch high concrete housekeeping pads.

C. Fuses: Install fuses of the rating and class as shown in each fusible distribution panel scheduled on drawings.

D. Conduits: Stub up three one inch conduits to an accessible location above the ceiling for each recessed panelboard.

3.02 IDENTIFICATION

A. Nameplate: Each panelboard shall have an engraved bakelite nameplate. Nameplates shall be white with black letters and show panel designation. Nameplates shall be attached with stainless steel screws.

B. Directory Card: Place a neat, carefully typewritten directory card identifying the load served by each branch circuit in the frame on the panel door, under a clear plastic cover. Spares and spaces shall be written with erasable pencil for future use.

C. Replacement Components: Nameplate shall identify replacement components.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.01 SCOPE

A. Provide wiring devices as shown; scheduled, required and as specified.

B. The types of wiring devices required include:

1. Receptacles
2. Switches
3. Coverplates

1.02 STANDARDS

A. NEMA WD-1

B. NEMA WD-5

C. UL

D. Federal Spec WC-596-F and WS-896

1.03 ACCEPTABLE MANUFACTURERS

A. Leviton Manufacturing

B. Hubbell

C. Pass & Seymour

1.04 SUBMITTALS

A. Shop drawings shall include but not limited to:

1. Cut sheets of all devices indicating NEMA configuration, rating, materials, color, and all accessories.
2. Cut sheets of all coverplates indicating materials, color and any engraving specified on drawing or in the specifications.

1.05 REQUIREMENTS OF REGULATORY AGENCIES WORK IN ACCORDANCE WITH:

A. National Electrical Code.

B. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.01 MATERIALS AND COMPONENTS

A. GENERAL

1. Provide factory assemble wiring devices with the rating type and color as required and specified for the service indicated.
2. Provide matching one-piece multiple gang plates where switches are ganged. Provide wall plates for each receptacle furnished.
3. Architect reserves the right to select wiring device styles and colors to match wall finish.
4. Wall plates shall be of same manufacturer as devices.

2.02 SWITCHES

A. Provide specification grade White toggle switches, as selected by the Architect where indicated on the Drawings. Coordinate exact locations with architect.

B. Wall switches shall be 20 amp, 120-277 volt and shall be Leviton, Hubbell or P&S as follows:

1. SINGLE POLE SWITCHES:
   Leviton 1221-2, Hubbell HBL 1221, P&S PS20AC1
2. DOUBLE POLE SWITCHES:
   Leviton 1222-2, Hubbell HBL 1222, P&S PS20AC2
3. THREE WAY SWITCHES:
   Leviton 1223-2, Hubbell HBL 1223, P&S PS20AC3
4. FOUR WAY SWITCHES:
   Leviton 1224-2, Hubbell HBL 1224, P&S PS20AC4
5. MOMENTARY CONTACT SWITCHES:
   Leviton 1257, Hubbell HBL 1557, P&S 1251
6. THREE POSITION, TWO CIRCUIT MAINTAINED CONTACT SWITCHES:
   Leviton 1285, Hubbell HBL 1385, P&S 1225
7. KEY TYPE LOCKABLE CORBIN STYLE:
   Leviton 1221-2KL with 2KL key or P&S PS20AC1-KL with 4609 key for each switch, Hubbel #HBL 1221-RKL.

C. Dimmers: Provide Lutron Nova "T" series or Leviton or as shown on drawings. Wall box dimmers shall be sized to handle the load. Where fluorescent dimming ballasts are to be used, coordinate wall box dimmer with ballast manufacturer.

D. Light Handle Switches: Provide Leviton 1221-7L-LHC, Hubbell HBL1221-IL, P&S PS20AC1-ISL lighted handles to switch emergency lights were noted on the drawings.

2.03 RECEPTACLES

A. Provide specification grade White receptacles, as selected by the Architect where indicated on the Drawings. Provide "Red" receptacles for receptacles on emergency power. Coordinate exact location with architect.

B. Receptacles shall be Leviton, Hubbell or Pass & Seymour as follows:

1. Duplex 20A-125V-self grounding: (Nema configuration 5-20R):
   Leviton 5362, Hubbell HBL5362, P&S 5362A
2. Simplex 20A-125V-Self Grounding: (Nema configuration 5-20R):
   Leviton 5361, Hubbell HBL5361, P&S 5361
3. Isolated ground duplex, 20A-125V: (Orange, Nema configuration 5-20R)
   Leviton 5362IG, Hubbell IG5362, P&S IG6300.
4. Clock hanger receptacle 15A-125V: (Brown with stainless steel plate with hanger, Nema configuration 5-15R).
   Leviton 5361-CH, Hubbell 5235, P&S S3733-SS
5. Ground fault circuit interrupter (GFCI) receptacle 20A-125V; (Nema Configuration 5-20R, shall incorporate features which will lock-out or render the device incapable of being reset if ground fault protection is compromised, with "Feed through" connectors capable of protecting connected downstream receptacles on a single circuit, and of being installed in a 2-3/4" deep outlet box without adapter, Leviton 8899, P & S 2094.
6. Tamper resistant receptacles 20A-125V (Nema configuration 5-20R):
   Leviton 8300-SG, Hubbell HBL8300SG, P&S TR63-H.
7. Surge Protection Duplex Receptacles 20A-125V, (Nema 5-20R) Hospital grade to include LED light and audible alarm:
   Leviton 8380, Hubbell HBL 8362SA, P&S 8300SP
8. Equipment receptacles shall be coordinated with owner/manufacturer requirements and the correct and appropriate receptacle and coverplate shall be installed.

2.04 PLATES

A. Furnish and install plates on all outlet boxes. Oversize (Jumbo) plates are not acceptable.

B. Plates shall be 302/304 smooth stainless steel in Mechanical Rooms, Electrical Rooms and throughout Fleet and Supply**.** The Administration Building shall utilize nylon plates, to match the device color.

C. Provide Taymac Bell, Carlon or Leviton NEMA 3R weatherproof coverplates on all exterior wiring devices. Enclosure shall be suitable for wet locations when in use.

D. Plates shall be Leviton, Pass & Seymour or Hubbell 302/304 smooth stainless steel on all receptacles 30 amps and larger.

E. Stainless steel device plates shall be provided at locations with tile or stone walls.

2.05 Floor boxes shall be cast iron or stamped steel, concrete type as manufactured by Hubbell or equal by Wiremold and as indicated on the drawings. Refer to the Electrical Symbol Legend.

PART 3 - EXECUTION

3.01 WIRING DEVICE MOUNTING HEIGHTS

A. Unless noted to the contrary on plans, or directed otherwise during the progress of the Work, wiring devices shall be set as follows:

1. Switches 42" above finished floor.
2. Wall mounted receptacles shall be installed vertically at 15 inches to the bottom outlet above finished floor unless otherwise noted or as required by local codes.
3. Wall telephone outlets shall be mounted 15 inches to the bottom above finished floor unless otherwise noted. Mount even with wall mounted receptacles.
4. At locations above counters, set devices at 6 inches above to the centerline counter tops, verify exact mounting height with the architect.

3.02 INSTALLATION (Refer to 26 05 33 for outlet box specifications.)

A. Wall switches shall be set in a suitable steel box and shall be installed on the strike side of the door as finally hung, whether so indicated on the Drawings or not.

B. Receptacles shall be installed in a suitable steel box.

C. The Architect reserves the right to relocate wiring device up to a distance of 5 feet from the location shown, before rough-in, without additional cost.

D. Provide multi-gang device covers at locations where devices gang together.

E. Device locations are indicated schematically on the drawings along with the type and mounting height. Final locations and mounting heights shall be coordinated with the Architect on the jobsite, and with shop drawings of equipment; including equipment to be furnished and installed by the Owner. Devices installed in walls covered with vinyl, fabric wallpaper or other special finishes shall be coordinated and verified with the Architect on the job-site.

F. Stranded wire termination to switches, receptacles, devices and miscellaneous control devices shall be with an approved solderless terminal if clamp type securing is not possible (i.e. Sta-Con crimp on fork tongue connectors; Burndy Type TP-F).

G. Provide keyed switches in all common areas not monitored by the faculty (i.e. gym, corridors, cafeteria, commons natatoriums).

END OF SECTION

SECTION 26 28 13
FUSES

PART 1 - GENERAL

1.01 SCOPE

A. Provide fuses as shown and scheduled and indicate by this specification section and other specifications sections.

B. The type of fuses include:

1. 600 volt current limiting.
2. 250 volt current limiting.

1.02 STANDARDS

A. ANSI

B. UL

1.03 ACCEPTABLE MANUFACTURERS

Provide fuses manufactured by Bussmann manufacturing.

1.04 SUBMITTALS

A. Shop drawings shall include, but not be limited to:

1. Cutsheets of all fuses showing ratings and fuse curves.

1.05 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:

1. National Electrical Code.
2. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.01 CURRENT - LIMITING FUSES

A. General: Provide 200,000 amp interrupting capacity current limiting fuses of the ampacity and voltage indicated and scheduled.

B. Mains, Feeders and Branch Circuits

1. Circuits 0 to 600 ampere shall be protected by current limiting BUSSMANN LOW-PEAK Dual Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts). All dual-element fuses shall have separate overload and short-circuit elements. Fuse shall incorporate a spring activated thermal overload element having a 284 degree Fahrenheit melting point alloy and shall be independent of the short-circuited clearing chamber. The fuse must hold 500% of rated current for a minimum of 10 seconds and listed by Underwriters' Laboratories Inc., with an interrupting rating of 200,000 amperes r.m.s. symmetrical. The fuses shall be UL Class RK1.
2. Motor Circuits - All individual motor circuits rated 600 amperes or less shall be protected by BUSSMANN LOW-PEAK Dual Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts). The fuses for 1.15 service factor motors shall be installed in ratings approximately 125% of motor full current except where high ambient temperatures prevail, or where the motor drives a heavy revolving part which cannot be brought up to full speed quickly, such as large fans. Under such conditions the fuse should be 150% to 200% of the motor full

load current. The fuses shall be UL Class RK5.

2.02 SPARES

Upon completion of the building the contractor shall provide the owner with spare fuses as shown below.

A. 10% (minimum of 3) of each type and rating of installed fuses shall be supplied as spares.

B. BUSSMANN spare fuse cabinets - Catalog No. SFC - shall be provided to store the above spares.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Fuses: Fuses shall not be installed until equipment is ready to be energized. This measure prevents fuse damage during shipment of the equipment from the manufacturer to the job-site or from installation. All fuses shall be furnished and installed by the electrical contractor. All fuses shall be of the same manufacturer.

B. All fuses shall be installed in fuse holders.

END OF SECTION

SECTION 26 28 16
SAFETY AND DISCONNECT SWITCHES

PART 1 - GENERAL

1.01 SCOPE

A. Provide safety and disconnect switches as shown, scheduled and as specified herein.

1.02 STANDARDS

A. Products shall be designed, manufactured, tested and installed in compliance with applicable standards.

1. NEMA KS1 - Enclosed switches
2. Federal specification W-S-865C-Heavy duty switches

B. Products shall conform all applicable UL standards, including UL98 (standard for safety, enclosed and dead front switches) and shall be UL-labeled.

1.03 ACCEPTABLE MANUFACTURERS

A. Provide one of the following manufacturers:

1. General Electric Company
2. Square D Company
3. Siemens
4. Eaton

1.04 SUBMITTALS

A. Shop drawings shall include, but not be limited to:

1. Cutsheets of switches with ratings, physical dimensions and all accessories clearly labeled.

1.05 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:

1. National Electrical Code.
2. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.01 GENERAL

A. Furnish and install heavy duty type safety switches with the number of switched poles as indicated on the plans and specifications. All safety switches shall be NEMA Heavy Duty Type HD, and Underwriters Laboratories listed.

2.02 MATERIALS AND COMPONENTS

A. Switch Interior

All switches shall have switch blades that are fully visible in the "OFF" position when the door is open. Switches shall have removable arc suppressor where necessary, to permit easy access to line side lugs. Lugs shall be front removable and UL listed for 60ºC and 75ºC copper or aluminum cables. All switches blades and contacts shall be plated copper. Adjust fuse block to accept Class J fuses.

B. Switch Mechanism

Switches shall have a quick-make and quick-break operating handle and mechanism, which shall be an integral part of the box, not the cover. Padlocking provisions shall be provided for locking in the "OFF" position with at least three padlocks. Switches shall have a dual cover interlock to prevent unauthorized opening of the switch door when the handle is in the "ON" position, and to prevent closing of the switch mechanism with the door open. A means shall be provided to permit authorized personnel to release the interlock for inspection purposes. Handle position shall indicate if switch is "ON" or "OFF".

C. Neutral and Ground

Provide a solid neutral with the safety switch where a neutral is present in the circuit. Provide and install grounding lug or bar for terminating grounding conductor(s).

D. Ratings

Switches shall be horsepower rated for ac and/or dc as indicated by the plans. The fused switches shall have Class R rejection fuse clips or adjusted for Class J fuses. UL listed short circuit ratings of the switches, when equipped with Class R fuses, shall be 200,000 symmetrical amperes.

E. Enclosures

1. Indoor switches shall be furnished in NEMA 1 enclosures.
2. Outdoor switches, switches located in wet areas or sprinkled areas shall be furnished in NEMA 3R enclosures.
3. Switches installed in wet areas such as cooling tower areas shall be NEMA 4X stainless steel or fiberglass reinforced polyester.
4. Switches installed in kitchens shall be stainless steel.
5. Switches installed in areas of a corrosive nature and subjected to salt air shall be NEMA 4X stainless steel or fiberglass reinforced polyester.

F. Electrical Interlock Contacts

Provide electrical interlock contacts on all disconnect switches serving motors in which remote VFDs are serving the motor. Provide conductors from contacts to the safe circuit inside the VFD. De-energizing the disconnect switch shall signal VFD to stop.

G. Service Entrance

Switch shall be suitable for use as service entrance equipment as specified, and installed in accordance with the National Electrical Code.

PART 3 - EXECUTION

3.01 GENERAL

A. Install safety and disconnect switches, including electrical connections, and fuses in accordance with manufacturer’s written instructions, NEC and recognized industry practices.

B. Location: Install switches within sight of controllers.

C. Hubs: Provide bolt-on hubs for rainproof or wet area applications.

3.02 IDENTIFICATION

A. Nameplate: Each disconnect switch shall have an engraved bakelite nameplate. Nameplates shall be white with black letters and show equipment served. Nameplates shall be attached with stainless steel screws.

END OF SECTION

SECTION 26 29 26
MISCELLANEOUS ELECTRICAL CONTROLS AND WIRING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

1.02 SCOPE

A. Provide the various miscellaneous control devices, wiring and additional branch circuits as required, shown and specified.

B. The types of miscellaneous control devices and wiring include but not limited to the following.

1. Contactors
2. Relays
3. Photocells
4. Time switches
5. Additional control wiring and safety devices as shown and specified.
6. Connect power from fire alarm relays to starters to shut down air handling units.

C. WORK SPECIFIED ELSEWHERE:

1. Various control devices, of an electrical nature, for the safe operation and temperature control of the heating, ventilating, air conditioning and plumbing systems provided under Division 21, 22, or 23.
2. All control wiring and conduit shall be furnished under Division 23. All power wiring 120 volt or larger shall be provided by Division 26.
3. Refer to building controls specification, Division 23 for scope of work required to be performed by Division 26 (electrical contractor).

1.03 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:

1. National Electrical Code.
2. Local municipal or state codes that have jurisdiction.

1.04 ACCEPTABLE MANUFACTURERS

A. Provide one of the following manufacturers:

1. LIGHTING CONTACTORS AND RELAYS
   a. General Electric
   b. Square D Company
   c. Automatic Switch Company
2. PHOTOCELLS AND TIME SWITCHES
   a. Tork, Inc.
   b. Intermatic time controls
   c. AMF paragon

PART 2 - PRODUCTS

2.01 MATERIAL

A. GENERAL: This Section shall outline the basic installation of electric devices, conduit, boxes, fittings, and wiring required for complete interconnection of several systems, this may not reflect every required appurtenance. It does not cover integral parts of mechanical equipment.

B. CONTACTORS AND RELAYS: Provide control wiring, contactors, and relays with the ampere-rating and number of poles as shown, specified, and required for a complete and functioning system:

1. Rated at 600 volts, 60 hertz.
2. Continuously rated contacts for all types of ballast and tungsten lighting, resistance and motor loads. Contacts shall be sized as scheduled or noted.
3. Shall have totally enclosed, double-break silver-cadmium-oxide power contacts. Auxiliary arcing contacts are not acceptable. Contact inspection and replacement shall be possible without disturbing line or load wiring.
4. The contactor shall have straight-through wiring with all terminals clearly marked.
5. The contactor shall be approved per UL508 and/or CSA, and be designed in accordance with NEMA ICS2-21 1B.
6. They shall be industrial-duty rated for applications to 600 volts maximum.
7. The contactor shall have provisions for factory or field addition of:
   a. Four (4) N.O. or N.C. auxiliary contacts rated 6 amperes continuous at 600 volts.
   b. Single or double circuit, N.O. or N.C., 30 or 60 ampere 600 volt power-pole adder.
8. The contactor shall have a NEMA type 1 enclosure unless otherwise noted.
9. Control power to the contactor 120V control circuit shall be provided from the nearest panelboard 120V circuit. If the 120V control power circuit is not shown, provide a control power transformer for 120 volt control power and a 120 volt coil when required for control. Provide primary and secondary fuses on the control power transformer..
10. Mechanically Held Lighting Contactors - Coil-clearing contacts shall be supplied so that the contactor coils shall be energized only during the instance of operation. Both latch and unlatch coils shall be encapsulated. All contactors shall be mechanically held unless noted otherwise on the plans.
11. Provide 2-wire or 3-wire control modules as required to operate lighting contactors.
12. Provide hand-off-automatic controls (H-O-A) for each lighting contactor.
13. Provide relays and contactors to shut down air handling units.

C. Photocells: Provide a specification grade self contained, weatherproof, photoelectric control that shall be mounted on an FS type weatherproof junction box. The photocell shall:

1. Switch "ON" at dusk and "OFF" at dawn.
2. Adjustable from 2 to 50 foot candles.
3. Rated at 2000 watts.
4. Use 1" diameter cadmium sulphide cell.
5. Have a 2 minute delay to prevent false switching.

D. TIME SWITCHES: Provide a 7-day digital time clock with battery back-up feature installed in a NEMA 3R enclosure.

E. Control wiring shall be not less than #14 AWG type TW, and shall be color coded and labeled with Brady markers throughout. Bundle multiple conductors with Ty-Raps.

PART 3 - EXECUTION

3.01 Install miscellaneous electrical controls and wiring to provide a functioning system.

3.02 H.V.A.C. AND PLUMBING CONTROL

A. Install electrical devices not an integral part of mechanical equipment providing conduit, boxes, fittings, wiring, and other devices.

B. Electrical contractor is responsible for providing all line voltage power to devices indicated by controls contractor that require electrical power to operate. Electrical contractor shall terminate line voltage power to termination points indicated by control contractor. Electrical contractor shall coordinate with controls contractor to determine sizing and quantities of line voltage circuits to adequately power control devices. Electrician is to obtain circuits from nearest low voltage panel using spare circuits provided, if device requires power not already available.

3.03 Install contactor and relays in electrical/mechanical rooms unless otherwise noted.

3.04 Install photocells on the roof unless otherwise directed by the architect. Coordinate any roof penetrations with all other trades and shield from other light sources.

3.05 Provide miscellaneous connections for signs and other furnished equipment as shown on the Drawings.

END OF SECTION

Section 26 3219 POWER GENERATORS

AS-BUILT DATA FROM PHASE I

DATE: **8/16/2015**

PROJECT: **SAWS WSOC**

CUSTOMER: **BIG STATE ELECTRIC**

TABLE OF CONTENTS

Southern Plains

Materials List

Cummins Southern Plains, LLC
600 N. Watson Road
Arlington, TX 76011
Phone 817 640 6801
cummins-sp.com

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Power Generation

Material List

CUMMINS SOUTHERN PLAINS, LLC
Cummins Southern Plains, LLC
6226 N Interstate 35
San Antonio TX 78218 United States
Direct: 210-655-5420

June 25, 2015
Project Name: SAWS WSOC

Item	Description	Qty
	Diesel Genset: 60Hz-450/410kW	
US-Stat	U.S. EPA, Stationary Emergency Application	1
450DFEJ	Genset-Diesel,60Hz,450kW-Standby Rating	1
A331-2	Duty Rating-Standby Power	1
L090-2	Listing-UL 2200	1
L170-2	EmissionCert,EPA,Tier 2,NSPS CI Stationary Emergency	1
F202-2	Enclosure-Steel,SndAtt,Level 2,Base Mtd,w/ExhSys **(74dB(A) @ 23ft)**	1
C201-2	Fuel Tank-Subbase,**300 Gallon**,UL142 Compliant	1
R002-2	Voltage-277/480,3 Phase,Wye,4 Wire	1
B259-2	Alternator-60 Hz, 12 Lead, Extended Range, 105/80C	1
H703-2	GenSet Control-PowerCommand 2.3	1
H536-2	Display Language-English	1
K631-2	Relays-Genset Status, User Configured	1
KA08-2	Alarm-Audible, Engine Shutdown	1
H678-2	Display-Control, LCD	1
KU32-2	Relay - Alarm Shutdown	1
H609-2	Control Mounting-Left Facing	1
A292-2	Heater-Alternator, 120 Volt AC	1
KU94-2	CB or EB or TB-Right Only	1
KC62-2	Circuit Breaker-800A,Right CB on Right side,3-Pole,UL 600,IEC 690 100%	1
KB72-2	CB or EB or TB-Bottom Entry, Right	1
P177-2	Enclosure Color-Sandstone,Steel Enclosure	1
L120-2	Compliance-Fuel Tank, Michigan	1
L163-2	Listing, ULC-S601-07	1
C232-2	Alarm-High Fuel Level, External	1
C127-2	Separator-Fuel/Water	1
C234-2	Spill/Fill Box-Fuel, 5 Gallon	1
C235-2	Vent Extensions-Fuel Tank, 4 Inch Diameter	1

E074-2	Engine Cooling-Radiator, 50C Ambient	1
H389-2	Shutdown-Low Coolant Level	1
H557-2	Coolant Heater-208/240/480V, Below 40F Ambient Temp	1
D041-2	Engine Air Cleaner-Normal Duty	1
L010-2	Test Record-Strip Chart	1
L026-2	Test Record-Certified	1
L189-2	ST 5YR 1500HR P + L + T	1
L050-2	Literature-English	1
A412-2	Packing-Base Mtd Housing	1
CP01-2	Common Parts Listing	1
SPEC-N	Product Revision - N	1
A048G602	Battery Charger. 10amp-120/208/240Vac (60/50Hz)	1
Submittals	Installation Documents	3 sets
0300-5929-02	Digital Remote Annunciator w/enclosure - PCCnet/Universal	1
Battery - SAE 8D	12 Volt, Lead Acid	2
Load Bank-Site Testing Resistive	4 Hour Resistive Load Bank, with written record	1
Manual	Maintenance, Operations, Installation & Parts	3 sets
GS120	Red Mushroom Head Remote Emergency Stop Station w/Clear Cover	1
Initial Fill	Coolant & Lubricant	1
Level I Walk Through Training	System Instruction for Site Personnel by Field Technician	1
Genset Freight	Generator Freight FOB Jobsite	1
Load Bank Charge	Resistive, Transportation, Set-Up & Operation	450kW
Start-Up	System Check & Inspection	1
Parts Freight	Freight of Parts (Billed to WO)	1
Load-Site Testing Building	2 Hour Building Load, with written record	1

Southern Plains

Engine Generator Section

Cummins Southern Plains, LLC
600 N. Watson Road
Arlington, TX 76011
Phone 817 640 6801
cummins-sp.com

PROTOTYPE TEST SUPPORT (PTS)
60 HZ TEST SUMMARY

GENERATOR SET MODELS	REPRESENTATIVE PROTOTYPE	
450DFEJ	Model:	500DFEK
500DFEK	Engine:	QSX15-G9
	Alternator:	HC5F

The following summarizes prototype testing conducted on the designated representative prototype of the specified models. This testing is conducted to verify the complete generator set electrical and mechanical design integrity. Prototype testing is conducted only on generator sets not sold as new equipment.

Maximum Surge Power: 516 KW

The generator set was evaluated to determine the stated maximum surge power.

Maximum Motor Starting: 2429 KVA

The generator set was tested to simulate motor starting by applying the specified kVA load at low lagging power factor (0.4 or lower). With this load applied, the generator set recovered to a minimum of 90% rated voltage

Torsional Analysis and Testing:

The generator set was tested to verify that the design is not subjected to harmful torsional stresses in excess of 5000psi. A spectrum analysis of the transducer output was conducted over the
speed range of 1200 to 2000 RPM.

Cooling System: 50 °C Ambient
0.50 in. H2O restriction

The cooling system was tested to determine ambient temperature and static restriction capabilities. The test was performed at full rated load in elevated ambient temperature under stated static restriction conditions.

Durability:

The generator set was subjected to a minimum 500 hour endurance test operating at variable load up to the standby rating based upon MIL-STD-705 to verify structural soundness and durability of the design.

Electrical and Mechanical Strength:

The generator set was tested to several single phase and three phase faults to verify that the generator can safely withstand the forces associated with short circuit conditions. The generator set was capable of producing full rated output at the conclusion of the testing.

Steady State Performance:

The generator set was tested to verify steady state operating performance was within the specified maximum limits.

Voltage Regulation:	±0.5%
Random Voltage Variation:	±0.3%
Frequency Regulation:	Isochronous
Random Frequency Variation:	±0.25%

Transient Performance:

The generator set was tested with the standard alternator to verify single step loading capability as required by NFPA 110. Verify acceptable Voltage and frequency response on load addition or rejection were evaluated. The following results were recorded:

Full Load Acceptance:		
Voltage Dip:	30.1	%
Recovery Time:	3.6	Second
Frequency Dip:	9.9	%
Recovery Time:	3.8	Second
Full Load Rejection:		
Voltage Rise:	12.8	%
Recovery Time:	3.8	Second
Frequency Rise:	3.2	%
Recovery Time:	1.5	Second

Harmonic Analysis:
(per MIL-STD-705B, Method 601.4)

	Line to Line		Line to Neutral	
Harmonic	No Load	Full Load	No Load	Full Load
3	0.1	0.1	0.1	0.1
5	0.3	1.2	0.3	1.1
7	0.4	1.1	0.4	1.0
9	0.0	0.0	0.0	0.0
11	0.7	0.9	0.6	0.8
13	0.2	0.3	0.1	0.2
15	0.0	0.0	0.0	0.0

Specification sheet

Diesel generator set QSX15 series engine

450 kW - 500 kW standby

Description

Cummins Power Generation commercial generator sets are fully integrated power generation systems providing optimum performance, reliability and versatility for stationary standby and prime power applications.

Features

Cummins® heavy-duty engine - Rugged 4-cycle, industrial diesel delivers reliable power, low emissions and fast response to load changes.

Alternator - Several alternator sizes offer selectable motor starting capability with low reactance 2/3 pitch windings, low waveform distortion with non-linear loads and fault clearing short-circuit capability.

Permanent magnet generator (PMG) - Offers enhanced motor starting and fault clearing short-circuit capability.

Control system - The PowerCommand® electronic control is standard equipment and provides total genset system integration including automatic remote starting/stopping, precise frequency and voltage regulation, alarm and status message display, AmpSentry™ protection, output metering, auto-shutdown at fault detection and NFPA 110 Level 1 compliance.

Cooling system - Standard integral set-mounted radiator system, designed and tested for rated ambient temperatures, simplifies facility design requirements for rejected heat.

Enclosures - Optional weather protective and sound attenuated enclosures are available.

Fuel tanks - Dual wall sub-base fuel tanks are also available.

NFPA - The genset accepts full rated load in a single step in accordance with NFPA 110 for Level 1 systems.

Warranty and service - Backed by a comprehensive warranty and worldwide distributor network.

	Standby rating	Prime rating	Continuous rating	Data sheets
Model	60 Hz kW (kVA)	60 Hz kW (kVA)	60 Hz kW (kVA)	60 Hz
DFEJ	450 (563)	410 (513)		D-3400
DFEK	500 (625)	455 (569)		D-3401

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Generator set specifications

Governor regulation class	ISO 8528 Part 1 Class G3
Voltage regulation, no load to full load	± 0.5%
Random voltage variation	± 0.5%
Frequency regulation	Isochronous
Random frequency variation	± 0.25%
Radio frequency emissions compliance	IEC 61000-4-2: Level 4 Electrostatic discharge IEC 61000-4-3: Level 3 Radiated susceptibility

Engine specifications

Design	Turbocharged with air-to-air charge air cooling
Bore	136.9 mm (5.39 in)
Stroke	168.9 mm (6.65 in)
Displacement	14.9 L (912.0 in^3)
Configuration	Cast iron with replaceable wet liners, in-line 6 cylinder
Battery capacity	900 amps minimum at ambient temperature of 0 °C (32 °F)
Battery charging alternator	35 amps
Starting voltage	24 volt, negative ground
Fuel system	Full authority electronic (FAE) Cummins HPI-TP
Fuel filter	
Air cleaner type	
Lube oil filter type(s)	Single spin-on combination full flow and bypass filters
Standard cooling system	40 °C (104 °F) ambient radiator

Alternator specifications

Design	Brushless, 4 pole, drip proof revolving field
Stator	2/3 pitch
Rotor	Single bearing, flexible discs
Insulation system	Class H
Standard temperature rise	125 ºC standby at 40 °C ambient
Exciter type	PMG (Permanent magnet generator)
Phase rotation	A (U), B (V), C (W)
Alternator cooling	Direct drive centrifugal blower
AC waveform total harmonic distortion	< 5% no load to full linear load, < 3% for any single harmonic
Telephone influence factor (TIF)	< 50 per NEMA MG1-22.43
Telephone harmonic factor (THF)	< 3

Available voltages

60 Hz line–neutral/line-line

- 110/190
- 110/220
- 115/200
- 115/230
- 120/208
- 127/220
- 139/240
- 220/380
- 230/400
- 240/416
- 255/440
- 277/480
- 347/600

Note: Consult factory for other voltages.

Generator set options and accessories

Engine
- ☐ 208/240/480 V thermostatically controlled coolant heater for ambient above 4.5 °C (40 °F)
- ☐ 208/240/480 V thermostatically controlled coolant heater for ambient below 4.5 °C (40 °F)
- ☐ 120 V 300 W lube oil heater
- ☐ Heavy duty air cleaner with safety element

Alternator
- ☐ 80 °C rise
- ☐ 105 °C rise
- ☐ 150 °C rise
- ☐ 120/240 V 300 W anti-condensation heater

Exhaust System
- ☐ Critical grade exhaust silencer
- ☐ Exhaust packages
- ☐ Industrial grade exhaust silencer
- ☐ Residential grade exhaust silencer

Fuel system
- ☐ 1022 L (270 gal) sub-base tank
- ☐ 1136 L (300 gal) sub-base tank
- ☐ 1514 L (400 gal) sub-base tank
- ☐ 1893 L (500 gal) sub-base tank
- ☐ 2271 L (600 gal) sub-base tank
- ☐ 2498 L (660 gal) sub-base tank
- ☐ 3218 L (850 gal) sub-base tank
- ☐ 6435 L (1700 gal) sub-base tank
- ☐ 9558 L (2525 gal) sub-base tank

Cooling system
- ☐ High ambient 50 °C radiator

Control panel
- ☐ PC3.3
- ☐ PC3.3 with MLD
- ☐ 120/240 V 100 W control anti-condensation heater
- ☐ Ground fault indication
- ☐ Remote fault signal package
- ☐ Run relay package

Generator set
- ☐ AC entrance box
- ☐ Battery
- ☐ Battery charger
- ☐ Export box packaging
- ☐ UL 2200 Listed
- ☐ Main line circuit breaker
- ☐ Paralleling accessories
- ☐ Remote annunciator panel
- ☐ Spring isolators
- ☐ Enclosure: aluminum, steel, weather protective or sound attenuated
- ☐ 2 year standby power warranty
- ☐ 2 year prime power warranty
- ☐ 5 year basic power warranty
- ☐ 10 year major components warranty

Note: Some options may not be available on all models - consult factory for availability.

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Control system 2.3

PowerCommand 2.3 control - An integrated generator set control system providing voltage regulation, engine protection, generator protection, operator interface and isochronous governing (optional).
Control - Provides battery monitoring and testing features and smart-starting control system.
InPower™ - PC-based service tool available for detailed diagnostics.
PCCNet RS485 - Network interface (standard) to devices such as remote annunciator for NFPA 110 applications.
Control boards - Potted for environmental protection.
Ambient operation - Suitable for operation in ambient temperatures from -40 °C to +70 °C and altitudes to 13,000 feet (5000 meters).
Prototype tested - UL, CSA and CE compliant.

AC protection

- AmpSentry protective relay
- Over current warning and shutdown
- Over and under voltage shutdown
- Over and under frequency shutdown
- Over excitation (loss of sensing) fault
- Field overload
- Overload warning
- Reverse kW shutdown
- Reverse Var shutdown
- Short circuit protection

Engine protection

- Overspeed shutdown
- Low oil pressure warning and shutdown
- High coolant temperature warning and shutdown
- Low coolant level warning or shutdown
- Low coolant temperature warning
- High, low and weak battery voltage warning
- Fail to start (overcrank) shutdown
- Fail to crank shutdown
- Redundant start disconnect
- Cranking lockout
- Sensor failure indication
- Low fuel level warning or shutdown
- Fuel-in-rupture-basin warning or shutdown

Operator/display panel

- Manual off switch
- 128 x 128 Alpha-numeric display with push button access for viewing engine and alternator data and providing setup, controls and adjustments (English or international symbols)
- LED lamps indicating genset running, not in auto, common warning, common shutdown, manual run mode and remote start
- Suitable for operation in ambient temperatures from -20 °C to +70 °C

Alternator data

- Line-to-neutral AC volts
- Line-to-line AC volts
- 3-phase AC current
- Frequency
- kVA, kW, power factor

Engine data

- DC voltage
- Lube oil pressure
- Coolant temperature

Other data

- Genset model data
- Start attempts, starts, running hours
- Fault history
- RS485 Modbus® interface
- Data logging and fault simulation (requires InPower service tool)
- Total kilowatt hours
- Load profile

Digital governing (optional)

- Integrated digital electronic isochronous governor
- Temperature dynamic governing

Digital voltage regulation

- Integrated digital electronic voltage regulator
- 3-phase line-to-line sensing
- Configurable torque matching
- Fault current regulation under single or three phase fault conditions

Control functions

- Time delay start and cool down
- Glow plug control (some models)
- Cycle cranking
- PCCNet interface
- (4) Configurable inputs
- (4) Configurable outputs
- Remote emergency stop
- Battle short mode
- Load shed
- Real time clock with exerciser
- Derate

Options

- ⊟ ~~Auxiliary output relays (2)~~
- ⊟ ~~120/240 V, 100 W anti-condensation heater~~
- ☐ Remote annunciator with (3) configurable inputs and (4) configurable outputs
- ☐ PMG alternator excitation
- ⊟ ~~PowerCommand for Windows® remote monitoring software (direct connect)~~
- ⊟ ~~AC output analogue meters~~
- ☐ PowerCommand 2.3 ~~and 3.3 control with AmpSentry protection~~

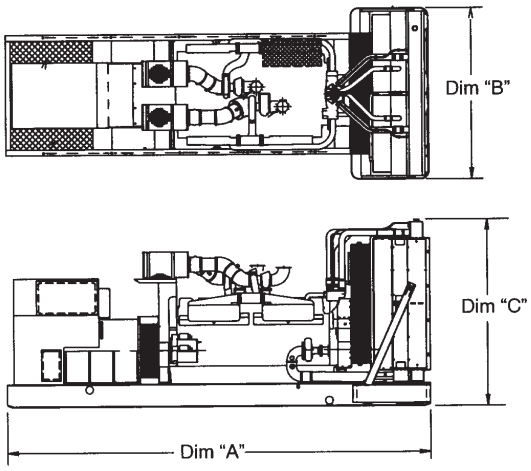
For further detail on PC 2.3 see document S-1569.
For further detail on PC 3.3 see document S-1570.

Emergency standby power (ESP):
Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

Limited-time running power (LTP):
Applicable for supplying power to a constant electrical load for limited hours. Limited Time Running Power (LTP) is in accordance with ISO 8528

Prime power (PRP):
Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

Base load (continuous) power (COP):
Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.



This outline drawing is for reference only. See respective model data sheet for specific model outline drawing number.

Do not use for installation design

Model	Dim "A" mm (in.)	Dim "B" mm (in.)	Dim "C" mm (in.)	Set Weight* dry kg (lbs)	Set Weight* wet kg (lbs)
DFEJ	3864 (152.1)	1524 (60.0)	1812 (71.3)	4098 (9035)	4234 (9335)
DFEK	3864 (152.1)	1524 (60.0)	1812 (71.3)	4325 (9535)	4461 (9835)

* Weights represent a set with standard features. See outline drawings for weights of other configurations.

Codes and standards

Codes or standards compliance may not be available with all model configurations – consult factory for availability.

ISO 9001	This generator set is designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002.	UL	The generator set is available listed to UL 2200, Stationary Engine Generator Assemblies for all 60 Hz low voltage models. The PowerCommand control is Listed to UL 508 - Category NITW7 for U.S. and Canadian usage. Circuit breaker assemblies are UL 489 Listed for 100% continuous operation and also UL 869A Listed Service Equipment.
PTS	The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design. Cummins Power Generation products bearing the PTS symbol meet the prototype test requirements of NFPA 110 for Level 1 systems.	**U.S. EPA**	Engine certified to Stationary Emergency U.S. EPA New Source Performance Standards, 40 CFR 60 subpart IIII Tier 2 exhaust emission levels. U.S. applications must be applied per this EPA regulation.
CSA	All low voltage models are CSA certified to product class 4215-01.	**International Building Code**	The generator set package is available certified for seismic application in accordance with the following International Building Code: IBC2000, IBC2003, IBC2006, IBC2009 and IBC2012.

Warning: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

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Minneapolis, MN 55432
USA
Phone 763 574 5000
Fax 763 574 5298

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S-1582i (6/15)

Cummins Power Generation

power.cummins.com

Generator set data sheet

Model: DFEJ
Frequency: 60
Fuel type: Diesel
KW rating: 450 standby
~~410 prime~~
Emissions level: EPA NSPS Stationary Emergency Tier 2

Exhaust emission data sheet:	**EDS- 184**
Exhaust emission compliance sheet:	**EPA-1025**
Sound performance data sheet:	**MSP-183**
Cooling performance data sheet:	**MCP-106**
Prototype test summary data sheet:	**PTS-145**
Standard set-mounted radiator cooling outline:	**0500-3326**
Optional set-mounted radiator cooling outline:	
Optional heat exchanger cooling outline:	
Optional remote radiator cooling outline:	

Fuel consumption

	Standby				**~~Prime~~**				**~~Continuous~~**
	kW (kVA)				**kW (kVA)**				**kW (kVA)**
Ratings	450 (563)				410 (513)				
Load	**1/4**	**1/2**	**3/4**	**Full**	**1/4**	**1/2**	**3/4**	**Full**	**Full**
US gph	10.8	17.4	23.4	30.1	10.2	16.2	21.9	27.7	
L/hr	41	66	89	114	39	61	83	105	

Engine

	Standby rating	**~~Prime rating~~**	**~~Continuous rating~~**
Engine manufacturer	Cummins Inc.		
Engine model	QSX15-G9		
Configuration	Cast iron with replaceable wet cylinder liners, in-line 6 cylinder		
Aspiration	Turbocharged with air-to-air charge air cooling		
Gross engine power output, kWm (bhp)	563.0 (755.0)	507.3 (680.0)	
BMEP at set rated load, kPa (psi)	2192.5 (318.0)	2006.4 (291.0)	
Bore, mm (in)	136.9 (5.39)		
Stroke, mm (in)	168.9 (6.65)		
Rated speed, rpm	1800		
Piston speed, m/s (ft/min)	10.1 (1995.0)		
Compression ratio	17.0:1		
Lube oil capacity, L (qt)	83.3 (88.0)		
Overspeed limit, rpm	2150 ± 50		
Regenerative power, kW	52.00		

Fuel flow

Fuel flow at rated load, L/hr (US gph)	423.9 (112.0)
Maximum inlet restriction, mm Hg (in Hg)	127.0 (5.0)
Maximum return restriction, mm Hg (in Hg)	165.1 (6.5)

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Air

	Standby rating	Prime rating	Continuous rating
Combustion air, m3/min (scfm)	38.3 (1355.0)	36.8 (1300.0)	
Maximum air cleaner restriction, kPa (in H2O)	6.2 (25.0)		
Alternator cooling air, m3/min (scfm)	62.0 (2190.0)		

Exhaust

Exhaust flow at set rated load, m^3/min (cfm)	87.9 (3105.0)	82.4 (2910.0)	
Exhaust temperature, ° C (° F)	462.8 (865.0)	440.6 (825.0)	
Maximum back pressure, kPa (in H_2O)	10.2 (41.0)		

Standard set-mounted radiator cooling

Ambient design, ° C (° F)	40 (104)		
Fan load, kW_m (HP)	19 (25.5)		
Coolant capacity (with radiator), L (US Gal)	57.9 (15.3)		
Cooling system air flow, m^3/min (scfm)	707.5 (25000.0)		
Total heat rejection, MJ/min (Btu/min)	19.6 (18485.0)	17.7 (16680.0)	
Maximum cooling air flow static restriction, kPa (in H_2O)	0.12 (0.5)		

Optional set-mounted radiator cooling

Ambient design, °C (°F)	50 (122)		
Fan load, kW_m (HP)	19 (25.5)		
Coolant capacity (with radiator), L (US gal)	57.9 (15.3)		
Cooling system air flow, m^3/min (scfm)	707.5 (25000.0)		
Total heat rejection, MJ/min (Btu/min)	19.6 (18485.0)	17.7 (16680.0)	
Maximum cooling air flow static restriction, kPa (in H_2O)	0.12 (0.5)		

Optional heat exchanger cooling

Set coolant capacity, L (US Gal.)			
Heat rejected, jacket water circuit, MJ/min (Btu/min)			
Heat rejected, aftercooler circuit, MJ/min (Btu/min)			
Heat rejected, fuel circuit, MJ/min (Btu/min)			
Total heat radiated to room, MJ/min (Btu/min)			
Maximum raw water pressure, jacket water circuit, kPa (psi)			
Maximum raw water pressure, aftercooler circuit, kPa (psi)			
Maximum raw water pressure, fuel circuit, kPa (psi)			
Maximum raw water flow, jacket water circuit, L/min (US Gal/min)			
Maximum raw water flow, aftercooler circuit, L/min (US Gal/min)			
Maximum raw water flow, fuel circuit, L/min (US Gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, jacket water circuit, L/min (US Gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, aftercooler circuit, L/min (US Gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, fuel circuit, L/min (US Gal/min)			
Raw water delta P at min flow, jacket water circuit, kPa (psi)			
Raw water delta P at min flow, aftercooler circuit, kPa (psi)			
Raw water delta P at min flow, fuel circuit, kPa (psi)			
Maximum jacket water outlet temp, °C (°F)			
Maximum aftercooler inlet temp, °C (°F)			
Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F)			

Optional remote radiator cooling[1]	Standby rating	Prime rating	Continuous rating
Set coolant capacity, L (US gal)			
Max flow rate at max friction head, jacket water circuit, L/min (US gal/min)			
Max flow rate at max friction head, aftercooler circuit, L/min (US gal/min)			
Heat rejected, jacket water circuit, MJ/min (Btu/min)			
Heat rejected, aftercooler circuit, MJ/min (Btu/min)			
Heat rejected, fuel circuit, MJ/min (Btu/min)			
Total heat radiated to room, MJ/min (Btu/min)			
Maximum friction head, jacket water circuit, kPa (psi)			
Maximum friction head, aftercooler circuit, kPa (psi)			
Maximum static head, jacket water circuit, m (ft)			
Maximum static head, aftercooler circuit, m (ft)			
Maximum jacket water outlet temp, °C (°F)			
Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F)			
Maximum aftercooler inlet temp, °C (°F)			
Maximum fuel flow, L/hr (US gph)			
Maximum fuel return line restriction, kPa (in Hg)			

Weights[2]

Unit dry weight kgs (lbs)	4082 (9000)
Unit wet weight kgs (lbs)	4218 (9300)

Notes:
[1] For non-standard remote installations contact your local Cummins Power Generation representative.
[2] Weights represent a set with standard features. See outline drawing for weights of other configurations.

Derating factors

Standby	Genset may be operated up to 1740 m (5700 ft) and 40 °C (104 °F) without power deration. For sustained operation above these conditions up to 2220 m (7280 ft), derate by 2.8% per 305 m (1000 ft), and 5.7% per 10 °C (3.2% per 10 °F). Above 2220 m (7280 ft) up to 3000 m (9840 ft), derate 3.9% total for 2200 m (7280 ft) plus 4.3% per 305 m (1000 ft), and 5.7% per 10 °C (3.2% per 10 °F). Above 3000 m (9840 ft), derate 14.9% total for 3000 m (9840 ft) plus 1.8% per 305 m (1000 ft) and 10% per 10 °C (5.6% per 10 °F).
Prime	Genset may be operated up to 1740 m (5700 ft) and 40 °C (104 °F) without power deration. For sustained operation above these conditions up to 2220 m (7280 ft), derate by 2.8% per 305 m (1000 ft), and 5.7% per 10 °C (3.2% per 10 °F). Above 2220 m (7280 ft) up to 3000 m (9840 ft), derate 3.9% total for 2200 m (7280 ft) plus 4.3% per 305 m (1000 ft), and 5.7% per 10 °C (3.2% per 10 °F). Above 3000 m (9840 ft), derate 14.9% total for 3000 m (9840 ft) plus 1.8% per 305 m (1000 ft) and 10% per 10 °C (5.6% per 10 °F).
Continuous	

Ratings definitions

Emergency standby power (ESP):	Limited-time running power (LTP):	Prime power (PRP):	Base load (continuous) power (COP):
Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.	Applicable for supplying power to a constant electrical load for limited hours. Limited Time Running Power (LTP) is in accordance with ISO 8528.	Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.	Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) is in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.

Alternator data

Three Phase Table[1]		105 °C	105 °C	125 °C	125 °C	125 °C	125 °C	125 °C	150 °C	150 °C	150 °C	150 °C
Feature Code		B259	B301	B258	B252	B414	B246	B300	B426	B413	B424	B419
Alternator Data Sheet Number		308	306	307	306	307	305	305	307	306	305	305
Voltage Ranges		110/190 thru 139/240 220/380 thru 277/480	347/600	110/190 thru 139/240 220/380 thru 277/480	120/208 thru 139/240 240/416 thru 277/480	120/208 thru 139/240 240/416 thru 277/480	277/480	347/600	110/190 thru 139/240 220/380 thru 277/480	120/208 thru 139/240 240/416 thru 277/480	277/480	347/600
Surge kW		515	516	513	512	515	513	511	513	512	513	511
Motor Starting kVA (at 90% sustained voltage)	~~Shunt~~											
	PMG	2429	1896	2208	1896	2208	1749	1749	2208	1896	1749	1749

Full Load Current Amps at Standby Rating	110/190	120/208	110/220	115/230	139/240	220/380	230/400	240/416	255/440	277/480	347/600
	1711	1563	1478	1414	1355	856	813	782	739	677	542

Note:
[1] Single phase power can be taken from a three phase generator set at up to 40% of the generator set nameplate kW rating at unity power factor.

Formulas for calculating full load currents:

Three phase output

$$\frac{\text{kW} \times 1000}{\text{Voltage} \times 1.73 \times 0.8}$$

Single phase output

$$\frac{\text{kW} \times \text{SinglePhaseFactor} \times 1000}{\text{Voltage}}$$

Warning: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

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D-3400c (11/12)

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PowerCommand® 2.3 control system

> Specification sheet

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Control system description

The PowerCommand® control system is a microprocessor-based generator set monitoring, metering and control system designed to meet the demands of today's engine driven generator sets. The integration of all control functions into a single control system provides enhanced reliability and performance, compared to conventional generator set control systems. These control systems have been designed and tested to meet the harsh environment in which gensets are typically applied.

Features

- 320 x 240 pixels graphic LED backlight LCD.
- Multiple language support.
- AmpSentry™ Protective Relay - UL Listed true alternator overcurrent protection.
- Real time clock for fault and event time stamping.
- Exerciser clock and time of day start/stop.
- Digital voltage regulation. Three phase full wave FET type regulator compatible with either shunt or PMG systems.
- Generator set monitoring and protection.
- 12 and 24 VDC battery operation.
- Modbus® interface for interconnecting to customer equipment.
- Warranty and service. Backed by a comprehensive warranty and worldwide distributor service network.
- Certifications - Suitable for use on generator sets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std., CE and CSA standards.

PowerCommand digital generator set control PCC 2300

Description

The PowerCommand generator set control is suitable for use on a wide range of generator sets in non-paralleling applications. The PowerCommand control is compatible with shunt or PMG excitation style. It is suitable for use with reconnectable or non-reconnectable generators, and it can be configured for any frequency, voltage and power connection from 120-600 VAC line-to-line.

Power for this control system is derived from the generator set starting batteries. The control functions over a voltage range from 8 VDC to 30 VDC.

Features

- 12 and 24 VDC battery operation.
- Digital voltage regulation - Three phase full wave FET type regulator compatible with either shunt or PMG systems. Sensing is three phase.
- Full authority engine communications (where applicable) - Provides communication and control with the Engine Control Module (ECM).
- AmpSentry protection - for true alternator overcurrent protection.
- Common harnessing - with higher feature Cummins Power Generation controls. Allows for easy field upgrades.
- Generator set monitoring - Monitors status of all critical engine and alternator functions.
- Digital genset metering (AC and DC).
- Genset battery monitoring system to sense and warn against a weak battery condition.
- Configurable for single or three phase AC metering.
- Engine starting - Includes relay drivers for starter, fuel shut off (FSO), glow plug/spark ignition power and switch B+ applications.
- Generator set protection – Protects engine and alternator.
- Real time clock for fault and event time stamping.
- Exerciser clock and time of day start/stop.
- Advanced serviceability - using InPower™, a PC-based software service tool.
- Environmental protection - The control system is designed for reliable operation in harsh environments. The main control board is a fully encapsulated module that is protected from the elements.
- Modbus interface for interconnecting to customer equipment.
- Configurable inputs and outputs - Four discrete inputs and four dry contact relay outputs.
- Warranty and service - Backed by a comprehensive warranty and worldwide distributor service network.
- Certifications - Suitable for use on generator sets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std., CE and CSA standards.

Base control functions

HMI capability

Operator adjustments - The HMI includes provisions for many set up and adjustment functions.

Generator set hardware data - Access to the control and software part number, generator set rating in KVA and generator set model number is provided from the HMI or InPower.

Data logs - Includes engine run time, controller on time, number of start attempts, total kilowatt hours, and load profile. (Control logs data indicating the operating hours at percent of rated kW load, in 5% increments. The data is presented on the operation panel based on total operating hours on the generator.)

Fault history - Provides a record of the most recent fault conditions with control date and time stamp. Up to 32 events are stored in the control non-volatile memory.

Alternator data

- Voltage (single or three phase line-to-line and line-to-neutral)
- Current (single or three phase)
- kW, KVAR, power factor, KVA (three phase and total)
- Frequency

Engine data

- Starting battery voltage
- Engine speed
- Engine temperature
- Engine oil pressure
- Engine oil temperature
- Intake manifold temperature
- Comprehensive Full Authority Engine (FAE) data (where applicable)

Service adjustments - The HMI includes provisions for adjustment and calibration of generator set control functions. Adjustments are protected by a password. Functions include:

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Service adjustments (continued)
- Engine speed governor adjustments
- Voltage regulation adjustments
- Cycle cranking
- Configurable fault set up
- Configurable output set up
- Meter calibration
- Display language and units of measurement

Engine control

SAE-J1939 CAN interface to full authority ECMs (where applicable). Provides data swapping between genset and engine controller for control, metering and diagnostics.

12 VDC/24 VDC battery operations - PowerCommand will operate either on 12 VDC or 24 VDC batteries.

Temperature dependent governing dynamics (with electronic governing) - modifies the engine governing control parameters as a function of engine temperature. This allows the engine to be more responsive when warm and more stable when operating at lower temperature levels.

Isochronous governing - (where applicable) Capable of controlling engine speed within +/-0.25% for any steady state load from no load to full load. Frequency drift will not exceed +/-0.5% for a 33 °C (60 °F) change in ambient temperature over an 8 hour period.

Droop electronic speed governing - Control can be adjusted to droop from 0 to 10% from no load to full load.

Remote start mode - It accepts a ground signal from remote devices to automatically start the generator set and immediately accelerate to rated speed and voltage. The remote start signal will also wake up the control from sleep mode. The control can incorporate a time delay start and stop.

Remote and local emergency stop - The control accepts a ground signal from a local (genset mounted) or remote (facility mounted) emergency stop switch to cause the generator set to immediately shut down. The generator set is prevented from running or cranking with the switch engaged. If in sleep mode, activation of either emergency stop switch will wakeup the control.

Sleep mode - The control includes a configurable low current draw state to minimize starting battery current draw when the genset is not operating. The control can also be configured to go into a low current state while in auto for prime applications or applications without a battery charger.

Engine starting - The control system supports automatic engine starting. Primary and backup start disconnects are achieved by one of two methods: magnetic pickup or main alternator output frequency. The control also supports configurable glow plug control when applicable.

Cycle cranking - Is configurable for the number of starting cycles (1 to 7) and duration of crank and rest periods. Control includes starter protection algorithms to prevent the operator from specifying a starting sequence that might be damaging.

Time delay start and stop (cooldown) - Configurable for time delay of 0-300 seconds prior to starting after receiving a remote start signal and for time delay of 0-600 seconds prior to shut down after signal to stop in normal operation modes. Default for both time delay periods is 0 seconds.

Alternator control

The control includes an integrated three phase line-to-line sensing voltage regulation system that is compatible with shunt or PMG excitation systems. The voltage regulation system is a three phase full wave rectified and has an FET output for good motor starting capability. Major system features include:

Digital output voltage regulation - Capable of regulating output voltage to within +/-1.0% for any loads between no load and full load. Voltage drift will not exceed +/-1.5% for a 40 °C (104 °F) change in temperature in an eight hour period. On engine starting or sudden load acceptance, voltage is controlled to a maximum of 5% overshoot over nominal level. The automatic voltage regulator feature can be disabled to allow the use of an external voltage regulator.

Droop voltage regulation - Control can be adjusted to droop from 0-10% from no load to full load.

Torque-matched V/Hz overload control - The voltage roll-off set point and rate of decay (i.e. the slope of the V/Hz curve) is adjustable in the control.

Fault current regulation - PowerCommand will regulate the output current on any phase to a maximum of three times rated current under fault conditions for both single phase and three phase faults. In conjunction with a permanent magnet generator, it will provide three times rated current on all phases for motor starting and short circuit coordination purpose.

Protective functions

On operation of a protective function the control will indicate a fault by illuminating the appropriate status LED on the HMI, as well as display the fault code and fault description on the LCD. The nature of the fault and time of occurrence are logged in the control. The service manual and InPower service tool provide service keys and procedures based on the service codes provided. Protective functions include:

Battle short mode

When enabled and the *battle short* switch is active, the control will allow some shutdown faults to be bypassed. If a bypassed shutdown fault occurs, the fault code and description will still be annunciated, but the genset will

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not shutdown. This will be followed by a *fail to shutdown* fault. Emergency stop shutdowns and others that are critical for proper operation are not bypassed. Please refer to the Control Application Guide or Manual for list of these faults.

Derate

The Derate function reduces output power of the genset in response to a fault condition. If a Derate command occurs while operating on an isolated bus, the control will issue commands to reduce the load on the genset via contact closures or Modbus.

Configurable alarm and status inputs

The control accepts up to four alarm or status inputs (configurable contact closed to ground or open) to indicate a configurable (customer-specified) condition.

The control is programmable for warning, shutdown or status indication and for labeling the input.

Emergency stop

Annunciated whenever either emergency stop signal is received from external switch.

Full authority electronic engine protection

Engine fault detection is handled inside the engine ECM. Fault information is communicated via the SAE-J1939 data link for annunciation in the HMI.

General engine protection

Low and high battery voltage warning - Indicates status of battery charging system (failure) by continuously monitoring battery voltage.

Weak battery warning - The control system will test the battery each time the generator set is signaled to start and indicate a warning if the battery indicates impending failure.

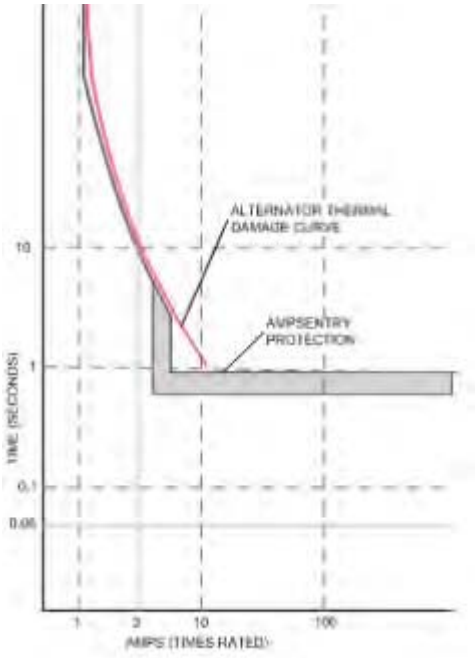
Fail to start (overcrank) shutdown - The control system will indicate a fault if the generator set fails to start by the completion of the engine crack sequence.

Fail to crank shutdown - Control has signaled starter to crank engine but engine does not rotate.

Cranking lockout - The control will not allow the starter to attempt to engage or to crank the engine when the engine is rotating.

Alternator protection

AmpSentry Protective relay - A UL Listed comprehensive monitoring and control system integral to the PowerCommand Control System that guards the electrical integrity of the alternator and power system by providing protection against a wide array of fault conditions in the generator set or in the load. It also provides single and three phase fault current regulation so that downstream protective devices have the maximum current available to quickly clear fault conditions without subjecting the alternator to potentially catastrophic failure conditions. See document R1053 for a full size time over current curve.



High AC voltage shutdown (59) - Output voltage on any phase exceeds preset values. Time to trip is inversely proportional to amount above threshold. Values adjustable from 105-125% of nominal voltage, with time delay adjustable from 0.1-10 seconds. Default value is 110% for 10 seconds.

Low AC voltage shutdown (27) - Voltage on any phase has dropped below a preset value. Adjustable over a range of 50-95% of reference voltage, time delay 2-20 seconds. Default value is 85% for 10 seconds. Function tracks reference voltage. Control does not nuisance trip when voltage varies due to the control directing voltage to drop, such as during a V/Hz roll-off during synchronizing.

Under frequency shutdown (81 u) - Generator set output frequency cannot be maintained. Settings are adjustable from 2-10 Hz below reference governor set point, for a 5-20 second time delay. Default: 6 Hz, 10 seconds. Under frequency protection is disabled when excitation is switched off, such as when engine is operating in idle speed mode.

Over frequency shutdown/warning (81o) - Generator set is operating at a potentially damaging frequency level. Settings are adjustable from 2-10 Hz above nominal governor set point for a 1-20 second time delay. Default: 6 Hz, 20 seconds, disabled.

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Overcurrent warning/shutdown - Thresholds and time delays are configurable. Implementation of the thermal damage curve with instantaneous trip level calculated based on current transformer ratio and application power rating.

Loss of sensing voltage shutdown - Shutdown of generator set will occur on loss of voltage sensing inputs to the control.

Field overload shutdown - Monitors field voltage to shutdown generator set when a field overload condition occurs.

Over load (kW) warning - Provides a warning indication when engine is operating at a load level over a set point. Adjustment range: 80-140% of application rated kW, 0-120 second delay. Defaults: 105%, 60 seconds.

Reverse power shutdown (32) - Adjustment range: 5-20% of standby kW rating, delay 1-15 seconds. Default: 10%, 3 seconds.

Reverse Var shutdown - Shutdown level is adjustable: 15-50% of rated Var output, delay 10-60 seconds. Default: 20%, 10 seconds.

Short circuit protection - Output current on any phase is more than 175% of rating and approaching the thermal damage point of the alternator. Control includes algorithms to protect alternator from repeated over current conditions over a short period of time.

Field control interface

Input signals to the PowerCommand control include:

- Coolant level (where applicable)
- Fuel level (where applicable)
- Remote emergency stop
- Remote fault reset
- Remote start
- Battleshort
- Rupture basin
- Start type signal
- Configurable inputs - Control includes (4) input signals from customer discrete devices that are configurable for warning, shutdown or status indication, as well as message displayed

Output signals from the PowerCommand control include:

- Load dump signal: Operates when the generator set is in an overload condition.
- Delayed off signal: Time delay based output which will continue to remain active after the control has removed the run command. Adjustment range: 0 - 120 seconds. Default: 0 seconds.
- Configurable relay outputs: Control includes (4) relay output contacts (3 A, 30VDC). These outputs can be configured to activate on any control warning or shutdown fault as well as ready to load, not in auto, common alarm, common warning and common shutdown.
- Ready to load (generator set running) signal: Operates when the generator set has reached 90% of rated speed and voltage and latches until generator set is switched to off or idle mode.

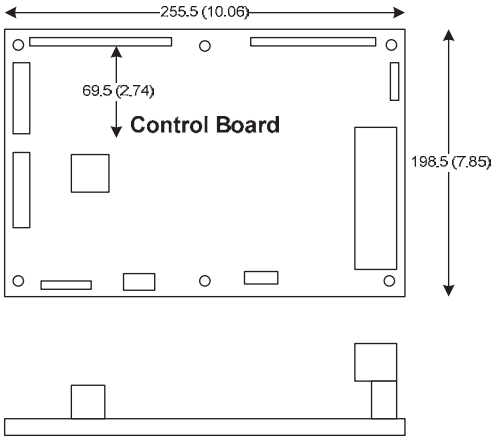
Communications connections include:

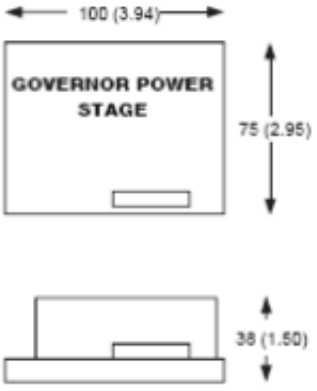
- PC tool interface: This RS-485 communication port allows the control to communicate with a personal computer running InPower software.
- Modbus RS-485 port: Allows the control to communicate with external devices such as PLCs using Modbus protocol.

  Note - An RS-232 or USB to RS-485 converter is required for communication between PC and control.

- Networking: This RS-485 communication port allows connection from the control to the other Cummins Power Generation products.

Mechanical drawings





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PowerCommand human machine interface HMI320

Description

This control system includes an intuitive operator interface panel that allows for complete genset control as well as system metering, fault annunciation, configuration and diagnostics. The interface includes five generator set status LED lamps with both internationally accepted symbols and English text to comply with customers needs. The interface also includes an LED backlit LCD display with tactile feel soft-switches for easy operation and screen navigation. It is configurable for units of measurement and has adjustable screen contrast and brightness.

The *run/off/auto* switch function is integrated into the interface panel.

All data on the control can be viewed by scrolling through screens with the navigation keys. The control displays the current active fault and a time-ordered history of the five previous faults.

Features:

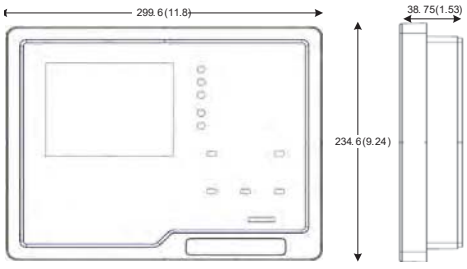
- LED indicating lamps
  - genset running
  - remote start
  - not in auto
  - shutdown
  - warning
  - auto
  - manual and stop
- 320 x 240 pixels graphic LED backlight LCD.
- Four tactile feel membrane switches for LCD defined operation. The functions of these switches are defined dynamically on the LCD.
- Seven tactile feel membrane switches dedicated screen navigation buttons for up, down, left, right, ok, home and cancel.
- Six tactile feel membrane switches dedicated to control for auto, stop, manual, manual start, fault reset and lamp test/panel lamps.
- Two tactile feel membrane switches dedicated to control of circuit breaker (where applicable).
- Allows for complete genset control setup.
- Certifications: Suitable for use on generator sets that are designed, manufactured, tested and certified to relevant UL, NFPA, ISO, IEC, Mil Std., CE and CSA standards.

LCD languages supported: English, Spanish, French, German, Italian, Greek, Dutch, Portuguese, Finnish, Norwegian, Danish, Russian, Czech and Chinese Characters.

Communications connections include:

- PC tool interface - This RS-485 communication port allows the HMI to communicate with a personal computer running InPower.
- This RS-485 communication port allows the HMI to communicate with the main control board.

Mechanical drawing



HMI

Dimensions mm(inches)

Software

InPower (beyond 6.5 version) is a PC-based software service tool that is designed to directly communicate to PowerCommand generator sets and transfer switches, to facilitate service and monitoring of these products.

Environment

The control is designed for proper operation without recalibration in ambient temperatures from -40 ºC to +70º C (104 ºF to 158 ºF) and for storage from -55 ºC to +80 ºC (131 ºF to 176 ºF). Control will operate with humidity up to 95%, non-condensing.

The HMI is designed for proper operation in ambient temperatures from -20 ºC to +70 ºC (-4 ºF to 158 ºF) and for storage from -30 ºC to +80 ºC (-22 ºF to 176 ºF).

The control board is fully encapsulated to provide superior resistance to dust and moisture. Display panel has a single membrane surface, which is impervious to effects of dust, moisture, oil and exhaust fumes. This panel uses a sealed membrane to provide long reliable service life in harsh environments.

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The control system is specifically designed and tested for resistance to RFI/EMI and to resist effects of vibration to provide a long reliable life when mounted on a generator set. The control includes transient voltage surge suppression to provide compliance to referenced standards.

Certifications

PowerCommand meets or exceeds the requirements of the following codes and standards:

- NFPA 110 for level 1 and 2 systems.
- ISO 8528-4: 1993 compliance, controls and switchgear.
- CE marking: The control system is suitable for use on generator sets to be CE-marked.
- EN 50081-1,2 residential/light industrial emissions or industrial emissions.
- EN 50082-1,2 residential/light industrial or industrial susceptibility.
- ISO 7637-2, level 2; DC supply surge voltage test.
- Mil Std 202C, Method 101 and ASTM B117: Salt fog test.
- UL 508 recognized or Listed and suitable for use on UL 2200 Listed generator sets.
- CSA C282-M1999 compliance
- CSA 22.2 No. 14 M91 industrial controls.
- PowerCommand control systems and generator sets are designed and manufactured in ISO 9001 certified facilities.

Warranty

All components and subsystems are covered by an express limited one year warranty. Other optional and extended factory warranties and local distributor maintenance agreements are available.

PCCNet COMPATIBLE

See your distributor for more information

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Kent CT 12 5BF United Kingdom
Phone 44 1843 255000
Fax 44 1843 255902

Asia Pacific
10 Toh Guan Road #07-01
TT International Tradepark
Singapore 608838
Phone 65 6417 2388
Fax 65 6417 2399

Warning: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

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Cummins Power Generation

ALTERNATOR DATA SHEET

Frame Size HC5F

CHARACTERISTICS

WEIGHTS:	Wound Stator Assembly:	1776 lb	800 kg
	Rotor Assembly:	1512 lb	681 kg
	Complete Assembly:	3738 lb	1684 kg
MAXIMUM SPEED:		2250	rpm
EXCITATION CURRENT:	Full Load	1.72	Amps
	No Load	0.40	Amps

INSULATION SYSTEM: Class H Throughout

3 ∅ RATINGS (0.8 power factor) (Based on specific temperature rise at 40°C ambient temperature)		**60 Hz** (winding no)				**50 Hz** (winding no)		
		110/190 220/380 (311/312)	120/208 240/416 (311/312)	139/240 277/480 (311/312)	347/600 (07/17)	110/190 220/380 (311/312)	120/208 240/415 (311/312)	127/220 254/440 (311/312)
150°C Rise Ratings	kW	570	625	700	700	568	568	552
	kVA	713	781	875	875	710	710	690
125°C Rise Ratings	kW	538	590	660	660	536	536	520
	kVA	673	738	825	825	670	670	650
105°C Rise Ratings	kW	500	550	600	600	496	496	480
	kVA	625	688	750	750	620	620	600
80°C Rise Ratings	kW	440	484	528	528	432	432	416
	kVA	550	605	660	660	540	540	520

REACTANCES (per unit ± 10%) (Based on full load at 125C Rise Rating)	110/190 220/380	120/208 240/416	139/240 277/480	347/600	110/190 220/380	120/208 240/415	127/220 254/440
Synchronous	3.64	3.33	2.80	2.80	2.90	2.43	2.10
Transient	0.17	0.15	0.13	0.13	0.17	0.14	0.12
Subtransient	0.12	0.11	0.09	0.09	0.11	0.09	0.08
Negative Sequence	0.23	0.21	0.18	0.18	0.18	0.15	0.13
Zero Sequence	0.10	0.09	0.08	0.08	0.08	0.07	0.06

MOTOR STARTING	Broad Range	600	Broad Range
Maximum kVA (90% Sustained Voltage)	2429	2429	1769

TIME CONSTANTS (Sec)	Broad Range	600	Broad Range
Transient	0.080	0.080	0.080
Subtransient	0.012	0.012	0.012
Open Circuit	2.500	2.500	2.500
DC	0.019	0.019	0.019

WINDINGS (@20°C)	Broad Range	600	Broad Range
Stator Resistance (Ohms per phase)	0.0062	0.0098	0.0062
Rotor Resistance (Ohms)	2.1600	2.1600	2.1600
Number of Leads	12	6	12

Single phase power can be taken up to 40% of 3 phase- ratings

Exhaust Emission Data Sheet

450DFEJ

60 Hz Diesel Generator Set
EPA NSPS Stationary Emergency

Engine Information:

Model: Cummins Inc. QSX15-G9 NR 2
Nameplate BHP @ 1800 RPM: 755
Type: 4 Cycle, In-Line, 6 Cylinder Diesel
Aspiration: Turbo-charged with air-to-air charge air cooling
Compression Ratio: 17:1
Emission Control Device: Turbocharged with Charge Air Cooled

Bore: 5.39 in. (137 mm)
Stroke: 6.65 in. (169 mm)
Displacement: 912 cu. in. (14.9 liters)

	1/4	1/2	3/4	Full	~~Full~~
PERFORMANCE DATA	Standby	Standby	Standby	Standby	~~Prime~~
Engine HP @ Stated Load (1800 RPM)	185	344	502	661	605
Fuel Consumption (gal/hr)	10.6	17.4	23.6	30.3	~~28.0~~
Exhaust Gas Flow (CFM)	1360	2000	2605	3110	2920
Exhaust Temperature (°F)	735	820	810	865	825
EXHAUST EMISSION DATA					
HC (Total Unburned Hydrocarbons)	0.20	0.08	0.06	0.08	0.07
NOx (Oxides of Nitrogen as NO2)	2.75	2.95	4.25	5.15	4.95
CO (Carbon Monoxide)	0.50	0.36	0.31	0.42	0.45
PM (particular Matter)	0.08	0.05	0.05	0.03	0.05
Smoke (Pierburg)	0.52	0.56	0.52	0.40	0.45

All values are Grams per HP-Hour

TEST METHODS AND CONDITIONS

Test Methods:
Steady-State emissions recorded per ISO8178-1 during operation at rated engine speed (+/-2%) and stated constant load (+/-2%) with engine temperatures, pressures and emission rated stabilized.

Fuel Specification: 40-48 Cetane Number, 0.05 Wt.% max. Sulfur; Reference ISO8178-5, 40CFR86.1313-98 Type 2-D and ASTM D975 No. 2-D.

Reference Conditions:
25 °C (77 °F) Air Inlet Temperature, 40 °C (104 °F) Fuel Inlet Temperature, 100 kPa (29.53 in Hg) Barometric Pressure; 10.7 g/kg (75 grains H_2O/lb) of dry air Humidity (required for NOx correction); Intake Restriction set to maximum allowable limit for clean filter; Exhaust Back pressure set to maximum allowable limit.

Data was taken from a single engine test according to the test methods, fuel specification and reference conditions stated above and is subjected to instrumentation and engine-to-engine variability. Tests conducted with alternate test methods, instrumentation, fuel or reference conditions can yield different results.

Data Subject to Change Without Notice.

2015 EPA Tier 2 Exhaust Emission Compliance Statement

450DFEJ

Stationary Emergency

60 Hz Diesel Generator Set

Compliance Information:

The engine used in this generator set complies with Tier 2 emissions limit of U.S. EPA New Source Performance Standards for stationary emergency engines under the provisions of 40 CFR 60 Subpart IIII when tested per ISO8178 D2.

Engine Manufacturer:	Cummins Inc
EPA Certificate Number:	FCEXL015.AAJ-011
Effective Date:	08/11/2014
Date Issued:	08/11/2014
EPA Engine Family (Cummins Emissions Family):	FCEXL015.AAJ (J103)

Engine Information:

Model:	QSX / QSX15 / QSX15-G / QSX15-G9	Bore:	5.39 in. (137 mm)
Engine Nameplate HP:	755	Stroke:	6.65 in. (169 mm)
Type:	4 Cycle, In-line, 6 Cylinder Diesel	Displacement:	912 cu. in. (15 liters)
Aspiration:	Turbocharged and CAC	Compression Ratio:	17.0:1
Emission Control Device:	Electronic Control	Exhaust Stack Diameter:	8 in.

Diesel Fuel Emission Limits

D2 Cycle Exhaust Emissions

	Grams per BHP-hr			Grams per kWm-hr		
	NOx + NMHC	CO	PM	NOx + NMHC	CO	PM
Test Results - Diesel Fuel (300-4000 ppm Sulfur)	4.3	0.4	0.10	5.7	0.6	0.13
EPA Emissions Limit	4.8	2.6	0.15	6.4	3.5	0.20
Test Results - CARB Diesel Fuel (<15 ppm Sulfur)	3.9	0.4	0.08	5.2	0.6	0.11
CARB Emissions Limit	4.8	2.6	0.15	6.4	3.5	0.20

The CARB emission values are based on CARB approved calculations for converting EPA (500 ppm) fuel to CARB (15 ppm) fuel.
Test Methods: EPA/CARB Nonroad emissions recorded per 40CFR89 (ref. ISO8178-1) and weighted at load points prescribed in Subpart E, Appendix A for Constant Speed Engines (ref. ISO8178-4, D2)
Diesel Fuel Specifications: Cetane Number: 40-48. Reference: ASTM D975 No. 2-D.
Reference Conditions: Air Inlet Temperature: 25°C (77°F), Fuel Inlet Temperature: 40°C (104°F). Barometric Pressure: 100 kPa (29.53 in Hg), Humidity: 10.7 g/kg (75 grains H2O/lb) of dry air; required for NOx correction, Restrictions: Intake Restriction set to a maximum allowable limit for clean filter; Exhaust Back Pressure set to a maximum allowable limit.

Tests conducted using alternate test methods, instrumentation, fuel or reference conditions can yield different results.
Engine operation with excessive air intake or exhaust restriction beyond published maximum limits, or with improper maintenance, may result in elevated emission levels.

Power Generation

Sound Data

450DFEJ **60Hz**

Sound Pressure Level @ 7 meters, dB(A)

See Notes 1-8 listed below

Configuration		Measurement Location Number								Average
		1	2	3	4	5	6	7	8	
Standard - Unhoused	Infinite Exhaust	89	92	92	91	88	91	91	93	91
F183 -Residential Muffler	Mounted Muffler	87	90	90	88	87	88	87	90	89
F200–Weather	Mounted Muffler	88	89	84	87	89	87	84	90	88
F201 - Quiet Site II First Stage	Mounted Muffler	87	88	83	82	78	80	82	89	85
F202 - Quiet Site II Second Stage	Mounted Muffler	73	73	72	74	75	75	75	74	74

Sound Power Level, dB(A)

See Notes 2-6, 9, 10 listed below

Configuration		Octave Band Center Frequency (Hz)								Overall Sound Power Level
		63	125	250	500	1000	2000	4000	8000	
Standard - Unhoused	Infinite Exhaust	85	100	103	110	112	113	108	105	118
F183 –Residential Muffler	Mounted Muffler	104	114	113	110	108	107	101	103	119
F200–Weather	Mounted Muffler	102	108	104	108	110	109	106	101	116
F201 - Quiet Site II First Stage	Mounted Muffler	102	108	104	107	109	107	105	98	115
F202 - Quiet Site II Second Stage	Mounted Muffler	83	92	95	95	97	99	96	90	104

Exhaust Sound Pressure Level @ 1 meter, dB(A)

Open Exhaust (No Muffler Rated Load)	Octave Band Center Frequency (Hz)								Sound Pressure Level
	63	125	250	500	1000	2000	4000	8000	
	103	119	125	123	125	126	127	121	133

Note:

1. Position 1 faces the engine front. The positions proceed around the generator set in a counter-clockwise direction in 45° increments. All positions are at 7m (23 ft) from the surface of the generator set and 1.2m (48”) from floor level.
2. Sound levels are subject to instrumentation, measurement, installation and manufacturing variability.
3. Sound data with remote-cooled generator sets are based on rated loads without cooling fan noise.
4. Sound levels for aluminum enclosures are approximately 2 dB(A)s higher than listed sound levels for steel enclosures.
5. Sound data for generator set with infinite exhaust do not include exhaust noise.
6. Data is based on full rated load with standard radiator-cooling fan package
7. Sound Pressure Levels are measured per ANSI S1.13 and ANSI S12.18, as applicable.
8. Reference sound pressure is 20 µPa.
9. Sound Power Levels per ISO 3744 and ISO 8528-10, as applicable.
10. Reference power = 1 pw (10^{-12} W)
11. Exhaust Sound Pressure Levels are per ISO 6798, as applicable.

40 Degree C Ambient Radiator Cooling System

Duty		Rating (kW)	Max Cooling @ Air Flow Static Restriction, Unhoused (inches water/mm water)					Housed in Free Air, No Air Discharge Restriction			
			0.0/0.0	0.25/6.4	0.5/12.7	0.75/19.1	1.0/25.4	F183	F200	F201	F202
			Maximum Allowable Ambient Temperature, Degree C								
60 Hz	Standby	450	43	43	43	43	43	43	43	43	43
	Prime	410	43	43	43	43	43	N/A	N/A	N/A	N/A
50 Hz	Standby	400	43	43	43	43	43	N/A	N/A	N/A	N/A
	Prime	364	43	43	43	43	43	N/A	N/A	N/A	N/A

50 Degree C Ambient Radiator Cooling System

Duty		Rating (kW)	Max Cooling @ Air Flow Static Restriction, Unhoused (inches water/mm water)					Housed in Free Air, No Air Discharge Restriction			
			0.0/0.0	0.25/6.4	0.5/12.7	0.75/19.1	1.0/25.4	F183	F200	F201	F202
			Maximum Allowable Ambient Temperature, Degree C								
60 Hz	Standby	450	55	55	55	49	45	55	55	55	55
	Prime	410	55	54	53	48	44	N/A	N/A	N/A	N/A
50 Hz	Standby	400	55	55	55	55	54	N/A	N/A	N/A	N/A
	Prime	364	55	55	55	55	53	N/A	N/A	N/A	N/A

Note:

1. Data shown are anticipated cooling performance for typical generator set.
2. Cooling data is based on 1000ft (305 m) site test location.
3. Generator set power output may need to be reduced at high ambient conditions. Consult generator set data sheet for derate schedules.
4. Cooling performance may be reduced due to several factors including but not limited to: Incorrect installation, improper operation, fouling of the cooling system, and other site installation variables.

PTC® Creo® Parametric

REL NO	LTR	NO	REVISION	DRN	CKD	APVD	DATE
ECO-152559	A	1	PRODUCTION_RELEASE	MLL	JCB	J_BRODY	21MAY15

TABULATION

WEIGHT, BASE AND GENSET

FEATURE CODES	MODEL	ALT DATA SHEET	WEIGHT KG [LBS]	CG_DIM "A" MM [IN]	CG_DIM "B" MM [IN]	CG_DIM "C" MM [IN]
F214 W/F215	DFEJ, DFEK	305	4625 [10196]	2088 [82.2]	1041 [41]	617 [24.3]
	DFEJ, DFEK	306	4755 [10482]	2116 [83.3]		620 [24.4]
	DFEJ, DFEK	307	4905 [10813]	2141 [84.3]		622 [24.5]
	DFEJ, DFEK	308	5045 [11122]	2174 [85.6]		625 [24.6]

WEIGHT, DRY TANK AND WET GENSET

FEATURE CODES	MODEL	ALT DATA SHEET	WEIGHT KG [LBS]	CG_DIM "A" MM [IN]	CG_DIM "B" MM [IN]	CG_DIM "C" MM [IN]
C201 W/F215	DFEJ, DFEK	305	5153 [11360]	2091 [82.3]	1041 [41]	538 [21.2]
	DFEJ, DFEK	306	5283 [11646]	2114 [83.2]		543 [21.4]
	DFEJ, DFEK	307	5433 [11977]	2136 [84.1]		547 [21.5]
	DFEJ, DFEK	308	5573 [12286]	2166 [85.3]		552 [21.7]
C202 W/F215	DFEJ, DFEK	305	5217 [11501]	2094 [82.4]	1041 [41]	532 [20.9]
	DFEJ, DFEK	306	5347 [11787]	2117 [83.3]		537 [21.1]
	DFEJ, DFEK	307	5497 [12118]	2139 [84.2]		540 [21.3]
	DFEJ, DFEK	308	5637 [12427]	2169 [85.4]		546 [21.5]
C203 W/F215	DFEJ, DFEK	305	5292 [11666]	2085 [82.1]	1041 [41]	515 [20.3]
	DFEJ, DFEK	306	5421 [11952]	2108 [83.0]		521 [20.5]
	DFEJ, DFEK	307	5571 [12283]	2130 [83.9]		525 [20.7]
	DFEJ, DFEK	308	5712 [12592]	2160 [85.0]		530 [20.9]
C204 W/F215	DFEJ, DFEK	305	5356 [11809]	2081 [81.9]	1041 [41]	498 [19.6]
	DFEJ, DFEK	306	5486 [12095]	2103 [82.8]		504 [19.8]
	DFEJ, DFEK	307	5636 [12426]	2126 [83.7]		508 [20.0]
	DFEJ, DFEK	308	5777 [12735]	2155 [84.8]		514 [20.2]
C205 W/F215	DFEJ, DFEK	305	5403 [11912]	2079 [81.9]	1041 [41]	489 [19.3]
	DFEJ, DFEK	306	5533 [12198]	2101 [82.7]		495 [19.5]
	DFEJ, DFEK	307	5683 [12529]	2123 [83.6]		499 [19.6]
	DFEJ, DFEK	308	5823 [12838]	2152 [84.7]		505 [19.9]
C207 W/F215	DFEJ, DFEK	305	5531 [12193]	2072 [81.6]	1041 [41]	454 [17.9]
	DFEJ, DFEK	306	5660 [12479]	2093 [82.4]		461 [18.1]
	DFEJ, DFEK	307	5811 [12810]	2115 [83.3]		466 [18.3]
	DFEJ, DFEK	308	5951 [13119]	2144 [84.4]		472 [18.6]
C209 W/F215	DFEJ, DFEK	305	6221 [13715]	2574 [101.3]	1041 [41]	360 [14.2]
	DFEJ, DFEK	306	6351 [14001]	2598 [102.3]		369 [14.5]
	DFEJ, DFEK	307	6501 [14332]	2624 [103.3]		376 [14.8]
	DFEJ, DFEK	308	6641 [14641]	2654 [104.5]		384 [15.1]
C211 W/F215	DFEJ, DFEK	305	7134 [15728]	5653 [222.6]	1041 [41]	274 [10.8]
	DFEJ, DFEK	306	7264 [16014]	5687 [223.9]		283 [11.1]
	DFEJ, DFEK	307	7414 [16345]	5722 [225.3]		291 [11.5]
	DFEJ, DFEK	308	7554 [16654]	5761 [226.8]		300 [11.8]
C242 W/F215	DFEJ, DFEK	305	5138 [11328]	2091 [82.3]	1041 [41]	538 [21.2]
	DFEJ, DFEK	306	5268 [11614]	2114 [83.2]		543 [21.4]
	DFEJ, DFEK	307	5418 [11945]	2136 [84.1]		547 [21.5]
	DFEJ, DFEK	308	5558 [12254]	2166 [85.3]		552 [21.7]

***WEIGHT & CG'S ARE SHOWN WITH FUEL TANK AND STANDARD WET GENSET. ADDITION OF OTHER FEATURES MAY CHANGE THE WEIGHT.

NOTES:

1. DIMENSIONS SHOWN IN [ ] ARE INCHES.
2. FOUNDATION REFERENCE POINT (⌀). SEE FOUNDATION DRAWING FOR DETAILS.
3. FOR FEATURE CODE LI16 (FLORIDA TANKS) AND LI20 (MICHIGAN TANKS) ADD 162 [6.4] TO DIMS D-J.
4. SEE SHEET 2 FOR TANK VENT LOCATIONS.
5. SUBBASE FUEL TANK MOUNTING.
   EXCESSIVE TWISTING OF THE FUEL TANK, WHEN FASTENING IT TO A FOUNDATION, MAY RESULT IN STRUCTURAL FAILURE OF THE TANK. TO ENSURE THE INSTALLATION DOES NOT EXCESSIVELY TWIST THE FUEL TANK, THE FOLLOWING PROCEDURE MUST BE OBSERVED:
   5.1 REFER TO CUMMINS APPLICATION MANUAL T030 FOR GENERAL GENSET/TANK MOUNTING GUIDELINES.
   5.2 TIGHTEN TANK HOLD DOWN MOUNTING FASTENERS.
6. GENSET SUPPLIED WITH FLEXIBLE FUEL LINES THAT CAN BE CONNECTED TO GENERATOR SET INTERFACE POINTS.
   6.1 FUEL SUPPLY LINE: 1600 [63] LONG WITH 1/2-14NPT (MALE) TERMINATION.
   FUEL RETURN LINE: 2166 [85] LONG WITH 1/2-14NPT (MALE) TERMINATION.
7. TABULATED WEIGHT AND CG IS FOR GENERATOR SET WITH NO OPTIONS.
8. REFER TO CIRCUIT BREAKER OUTLINE DRAWING FOR ELECTRICAL STUB-UP AREA FOR SPECIFIC BREAKERS.
9. REFER TO SUBBASE FUEL TANK OUTLINE DRAWING FOR ELECTRICAL STUB-UP AREA AVAILABLE WITH FUEL TANKS.
10. FUEL STUB-UP AREA: REFER TO SUBBASE FUEL TANK OUTLINE OR GENSET FOUNDATION OUTLINE FOR AVAILABLE STUB-UP AREAS.
11. DIMENSION IS △2 AS INDICATED ON CIRCUIT BREAKER OUTLINE DRAWING (0500_4233).
12. CONTROL INTERFACE CONNECTIONS SHOULD BE MADE WITH FLEXIBLE CONNECTIONS. NOT RIGID CONDUIT.
13. ENTRANCE BOX (SHOWN) OR OPTIONAL BREAKER BOX (NOT SHOWN) WILL BE MOUNTED ON THE RIGHT SIDE AS VIEWED FROM THE CONTROL.

TABULATION

FEATURE CODE		TANK CAPACITY	WEIGHTS KG [LBS] LIFT BASE	WEIGHTS KG [LBS] FUEL TANK DRY	DIM_D MM [IN]	DIM_E MM [IN]	DIM_F MM [IN]	DIM_H MM [IN]
LIFT BASE	F214	---	576 [1270]	---	2146 [84.5]	87 [3.4]	203 [8]	351 [13.8]
FUEL TANK	C201	300	---	954 [2103]	2248 [88.5]	187 [7.4]	305 [12]	452 [17.8]
	C202	400	---	1018 [2244]	2298 [90.5]	238 [9.4]	356 [14]	502 [19.8]
	C203	500	---	1093 [2409]	2357 [92.8]	295 [11.6]	413 [16.3]	561 [22.1]
	C204	600	---	1158 [2552]	2426 [95.5]	364 [14.4]	483 [19]	630 [24.8]
	C205	660	---	1204 [2655]	2470 [97.2]	409 [16.1]	527 [20.7]	674 [26.5]
	C207	850	---	1332 [2936]	2604 [102.5]	542 [21.4]	660 [26]	808 [31.8]
	C209	1700	---	2022 [4458]	2856 [112.4]	796 [31.3]	914 [36]	1060 [41.7]
	C211	2525	---	2935 [6471]	2856 [112.4]	796 [31.3]	914 [36]	1060 [41.7]
	C242	270	---	939 [2071]	2248 [88.5]	187 [7.4]	305 [12]	452 [17.8]

TABULATION

TANK/LIFT BASE FEATURE CODE	TANK CAPACITY	DIM_G QSX15 L-FRAME	DIM_G QSX15 P-FRAME
F214	N/A	1606.3 [63.24]	1458.5 [57.42]
C201	300	~~1707.9 [67.24]~~	1560 [61.42]
C202	400	1758.7 [69.24]	1610.9 [63.42]
C203	500	1817.1 [71.54]	1669.3 [65.72]
C204	600	1885.7 [74.24]	1737.9 [68.42]
C205	660	1928.9 [75.94]	1781 [70.12]
C207	850	2063.5 [81.24]	1915.7 [75.42]
C209	1700	2317.5 [91.24]	2169.7 [85.42]
C211	2525	2317.5 [91.24]	2169.7 [85.42]
C242	270	1707.9 [67.24]	1560 [61.42]

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS

DIM		HOLE
X	± 3	0.00- 4.99 +0.15/-0.08
.X	± 0.8	5.00- 9.99 +0.20/-0.10
.XX	± 0.38	10.00-17.49 +0.25/-0.13
		17.50-24.99 +0.30/-0.13

ANG TOL: ± 1.0° SCALE: 1/16

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DRN M_LEHR | CKD J_BRODY | APVD J_BRODY | DATE 21MAY15

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, REF ASME Y14.5M-1994 | FIRST USED ON DFEJ,DFEK

SITE CODE PGF

CUMMINS POWER GENERATION

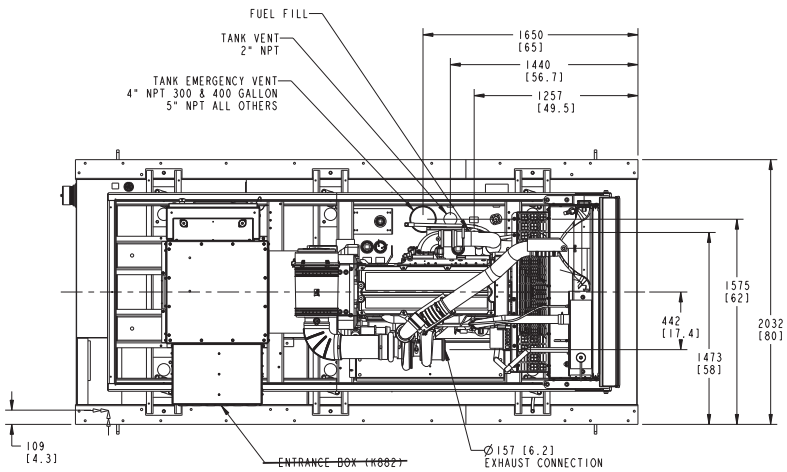
OUTLINE,GENSET

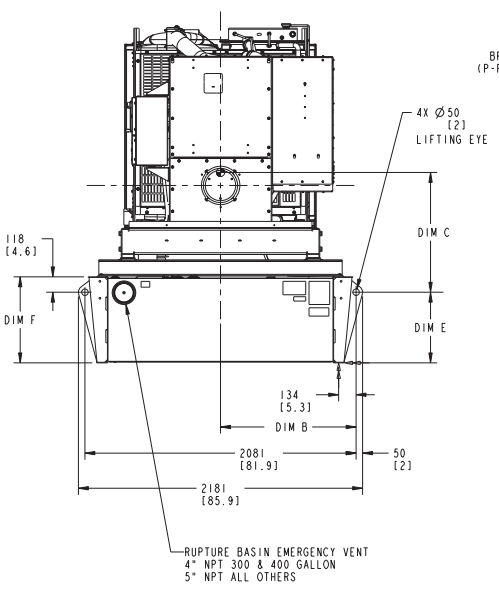
SIZE D | A052W384 | SHEET 1 of 6 | REV A

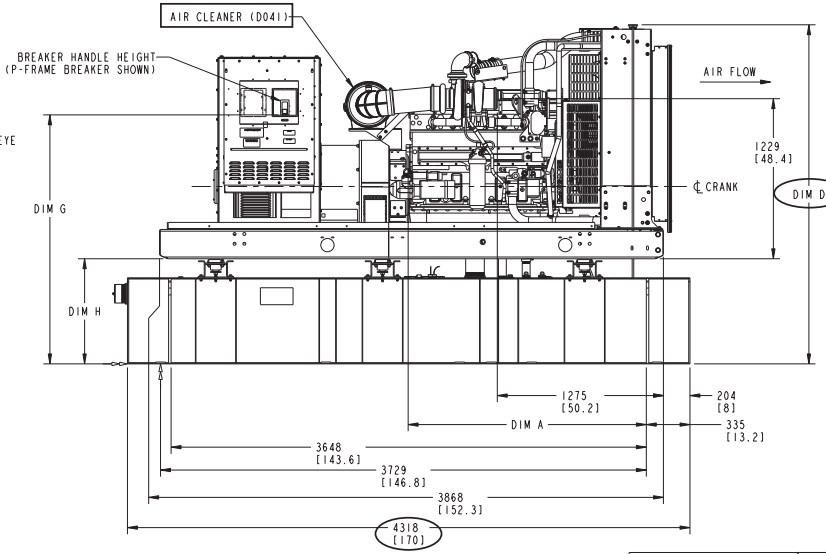
Drawing Name: A052W385 Revision: A
Part Name: A052W384 Revision: A
Sheet 1 of 7

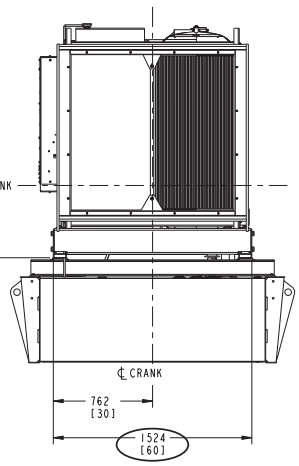
PTC® Creo® Parametric

REL NO	LTR	NO	REVISION	DRN	CKD	APVD	DATE
ECO-152559	A	1	PRODUCTION_RELEASE	MLL	JCB	J_BRODY	21MAY15









HOUSING READY SUBBASE F215 WITH FUEL TANK C200, C201, C202, C203, C204, C205, C207, OR C242

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		DIM ID A050L798	DRN M_LEHR		CUMMINS POWER GENERATION
DIM: X ±3, .X ±0.8, .XX±0.30	HOLE: 0.00- 4.99 +0.15/-0.08; 5.00- 9.99 +0.20/-0.10; 10.00-17.49 +0.25/-0.13; 17.50-24.99 +0.30/-0.13	DO NOT SCALE PRINT	CKD J_BRODY APVD J_BRODY DATE 21MAY15		OUTLINE,GENSET
ANG TOL: ± 1.0°	SCALE: 1/16	- CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP	FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994	FIRST USED ON DFEJ,DFEK	SITE CODE PGF SIZE D A052W384 SHEET 2 of 6 REV A

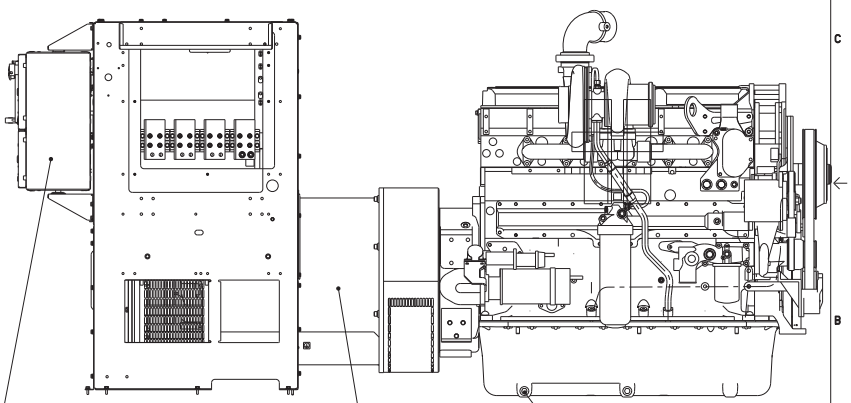
Drawing Name: A052W385 Revision: A
Part Name: A052W384 Revision: A
Sheet 2 of 7

PTC® Creo® Parametric

HE

REL NO	LTR	NO	REVISION	DRN	CKD	APVD	DATE
ECO-152559	A	1	PRODUCTION_RELEASE	MLL	JCB	J_BRODY	19MAY15

HEATERS



CONTROL CABINET HEATER

(A362):
120-240VAC, 400 WATTS
TINNED LEADS

ALTERNATOR HEATER

(A292):
110-125V, 300 WATTS
CONNECTION: COMPRESSION TERMINAL BLOCK, #18 TO #12 AWG WIRE

(A293):
220-260V, 300 WATTS
CONNECTION: COMPRESSION TERMINAL BLOCK, #18 TO #12 AWG WIRE

ENGINE OIL HEATER

(H487):
120V, 450 WATTS
CONNECTION: 1830 [72 IN] CORD WITH NEMA 5-15P [1 IN] CORD END

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS

DIM	TOL	HOLE
X ± 1		0.00- 4.99 +0.15/-0.08
.X ± 0.8		5.00- 9.99 +0.20/-0.10
.XX± 0.38		10.00-17.49 +0.25/-0.13
		17.50-24.99 +0.30/-0.13

ANG TOL: ± 1.0° | SCALE: 3/32

DO NOT SCALE PRINT

- CONFIDENTIAL -
PROPERTY OF CUMMINS POWER GENERATION GROUP

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, REF ASME Y14.5M-1994

FIRST USED ON: DFEJ,DFEK

DWN M_LEHR
CKD J_BRODY
APVD J_BRODY
DATE 19MAY15

SITE CODE: PGF

CUMMINS POWER GENERATION

OUTLINE,GENSET

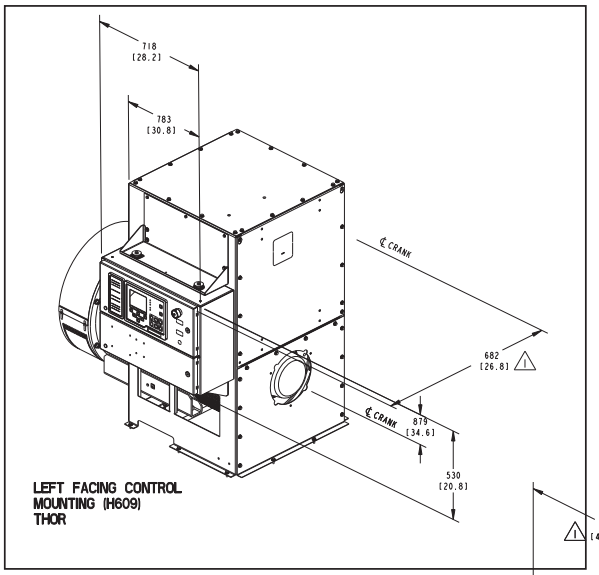
SIZE D | A052W391 | SHEET 1 of 2 | REV A

Drawing Name: A052W392 Revision: A
Part Name: A052W391 Revision: A
Sheet 1 of 3

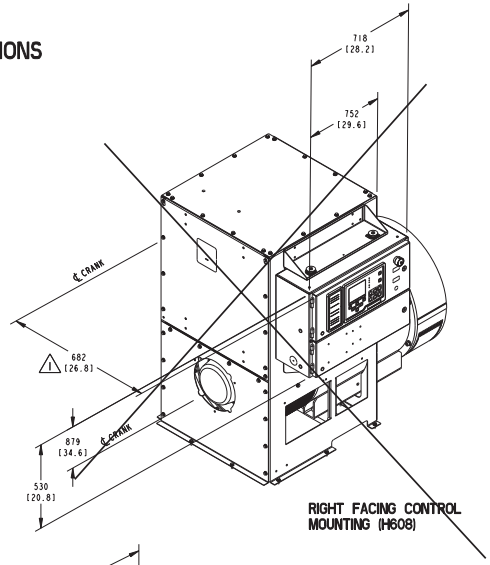
PTC® Creo® Parametric

REL NO	LTR	NO	REVISION	DRN	CKD	APVD	DATE
ECO-152559	A	1	PRODUCTION_RELEASE	MLL	JCB	J_BRODY	19MAY15

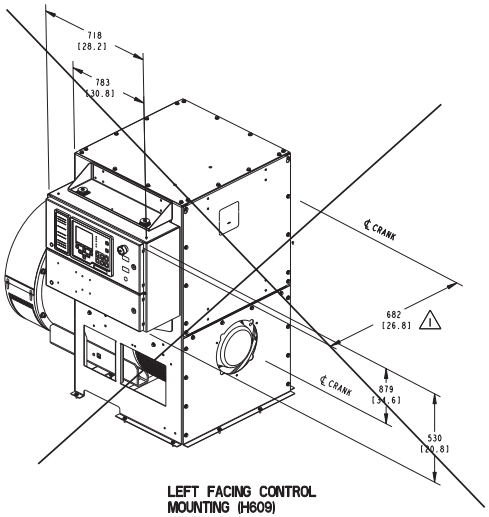
CONTROL BOX LOCATIONS



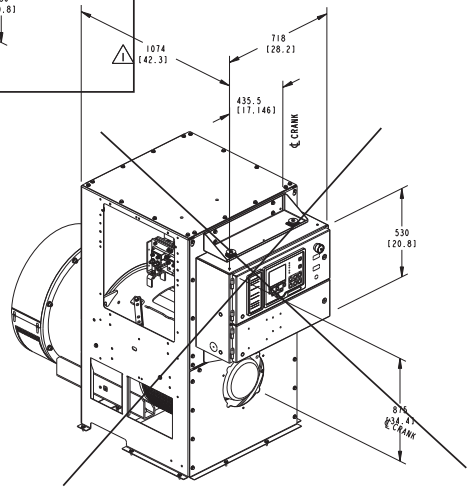
LEFT FACING CONTROL
MOUNTING (H609)
THOR



RIGHT FACING CONTROL
MOUNTING (H608)



LEFT FACING CONTROL
MOUNTING (H609)
NONTHOR



FRONT FACING CONTROL
MOUNTING (H679)

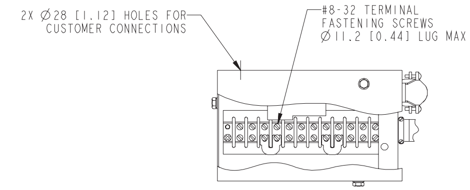
NOTE:
⚠1 DIMENSION TO FACE OF CONTROL BOX. COMPONENTS ON FACE EXTEND 34.3 [1.35] BEYOND FACE.

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS						
DIM	X ± 1	HOLE	0.00- 4.99 +0.15/-0.08	DWG NO A041F617	DRN M_LEHR	CUMMINS POWER GENERATION
	.X ± 0.8		5.00- 9.99 +0.20/-0.10	DO NOT SCALE PRINT	CKD J_BRODY	
	.XX± 0.38		10.00-17.49 +0.25/-0.13		APVD J_BRODY	OUTLINE,GENSET
ANG TOL: ± 1.0°		SCALE: 3/32	17.50-24.99 +0.30/-0.13	- CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP	DATE 19MAY15	SITE CODE PGF
				FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994	FIRST USED ON DFEJ,DFEK	SIZE D — A052W391 — SHEET 2 of 2 — REV A

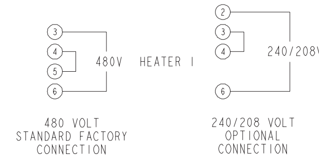
Drawing Name: A052W392 Revision: A
Part Name: A052W391 Revision: A
Sheet 2 of 3

0500_3820 | D | Pro/ENGINEER | METRIC DWG

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD16606	A	1	PRODUCTION_RELEASE	-	WP	WP	EK	05-06-03



DETAIL OF HETER TERMINAL BOX

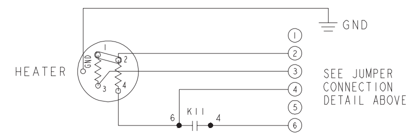


JUMPER CONNECTION DETAIL

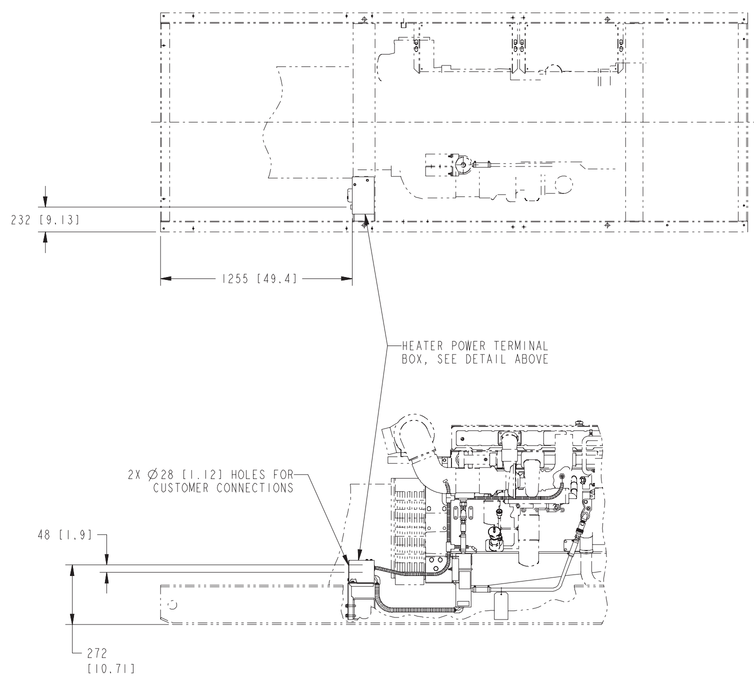
NOTES:

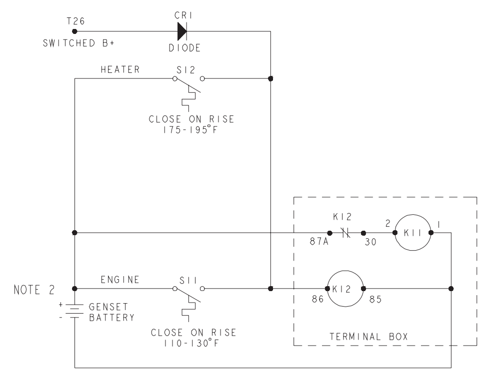
1. DIMENSIONS IN [ ] ARE INCHES.
2. THE HEATER CONTROL RELAY DRAWS 83mA OF CURRENT WHEN THE HEATERS ARE UNPOWERED. HEATERS ARE NOT POWERED WHEN:
   1) THE ENGINE HAS REACHED DESIGN TEMPERATURE OR
   2) THE ENGINE IS RUNNING.

⚠ A BATTERY CHARGER IS REQUIRED TO PREVENT BATTERY DISCHARGE.



AC POWER SCHEMATIC





DC CONTROL SCHEMATIC

HEATER AMPERAGE TABLE

SINGLE PHASE HEATER VOLTAGE	FEATURE CODE H556 ONE HEATER: HEATER AMPS	FEATURE CODE H556 ONE HEATER: TOTAL WATTS	FEATURE CODE H557 ONE HEATER: HEATER AMPS	FEATURE CODE H557 ONE HEATER: TOTAL WATTS
208	18.0	3744	23.2	4825
240	20.8	4990	26.75	6420
480	10.4	4990	13.375	6420

DO NOT SCALE PRINT

DR	W_PELTIER 05-06-03
CHKR / MFG	W PELTIER 05-06-03
APPROVED	E KROHNFELDT 05-06-03
MODEL FIRST USED ON	DFEH,EJ,EK
SIM TO	0500-3312
SITE CODE	PGA
TITLE	INTERFACE_OUTLINE (HEATER)
DWG NO	0500_3820
SHEET	1 of 1
DWG SIZE	D

CUMMINS POWER GENERATION
1400 73RD AVE NE
MINNEAPOLIS, MINNESOTA 55432

PTC® Creo® Parametric

REL NO	LTR	NO	REVISION	DRN	CKD	APVD	DATE
ECO-152559	A	1	PRODUCTION_RELEASE	MLL	JCB	J_BRODY	15MAY15

NOTES:

1 ALL DIMENSIONS ARE FOR REFERENCE ONLY

2 DIMENSIONS SHOWN IN [ ] ARE IN INCHES

3 BOTTOM COVER IS ADJUSTABLE VERTICALLY PLUS OR MINUS 6 [0.25] TO EASE CONDUIT ATTACHMENT

4 THESE WIRE-CONDUIT COMBINATIONS MEET NEC AND CEC. TO USE OTHER COMBINATIONS, REFER TO APPLICABLE CODES TO ENSURE THAT WIRE AMPACITY, BEND SPACE AND GUTTER SPACE MEET THE REQUIREMENTS

5 "NS" SHUNT TRIP HAS NO INTERNAL CONTACTS, IT MUST BE USED IN CONJUNCTION WITH AUXILIARY CONTACTS TO ACCEPT CONTINUOUS APPLIED VOLTAGE. IT CAN OPERATE AT 75% OF NOMINAL VOLTAGE

6 CONDUITS AND WIRING SHOULD BE DESIGNED AND INSTALLED TO ALLOW FOR NORMAL GENERATOR SET MOVEMENT DURING CRANKING SHUT DOWN OR EXPECTED SEISMIC DISTURBANCES

7 SEE FOUNDATION LAYOUT DRAWING (GENSET OUTLINE (FOUNDATION)) FOR THE LOCATION OF THE ELECTRICAL STUB UP AREAS AND FOUNDATION REFERENCE POINT (⟶▷)

8 ON FLORIDA UNITS WITH TANKS (FEATURE CODE L116) ADD 106 [4.2] FOR RISER BEAMS THAT ARE REQUIRED ON THE UNDERSIDE OF THE TANK

9 BOX DIMENSIONS AND CONDUIT LOCATIONS ARE THE SAME FOR ENTRANCE BOX WITHOUT CONDUITS

10 EQUIPMENT GROUND AND GROUNDING ELECTRODE LUG IS MECHANICAL TYPE,
COPPER 400 MCM-6 AWG
SCREW 11/16"-16 UN-2B
5/16" HEX WRENCH
RECOMMENDED TORQUES:
250 MCM-1 AWG - 375 IN-LBS
2-6 AWG - 275 IN-LBS

11 NEUTRAL LUG IS MECHANICAL TYPE,
COPPER #2-600 MCM
SCREW 15/16"-16 UN-2B
3/8" HEX WRENCH
RECOMMENDED TORQUES:
600 MCM-4 AWG - 500 IN-LBS

12 TORQUE TO 9.8-11.9 Nm [7.2-8.8 FT-LBS]
HARDWARE IS PROVIDED WITH BONDING JUMPER.

13 250 MCM SYSTEM BONDING JUMPER SIZED PER NEC TABLE 250.122 USING COPPER CABLE FOR A MAXIMUM AMPACITY RATING OF 2000 AMPS.

14 CIRCUIT BREAKER LUGS - REFER TO RECOMMENDED TORQUE ON LABEL.

15 MINIMUM WIRE BENDING SPACE AT BREAKER TERMINALS CALCULATED PER NEC TABLE 312.6(B) USING 500 MCM CABLES (2 WIRES PER TERMINAL), MECHANICAL LUGS USED AS TERMINALS.

NUMBER OF CONDUCTORS PER PHASE CALCULATED PER TABLE 310.16 USING COPPER CABLES RATED AT 75° C ON A MAXIMUM AMBIENT TEMP OF 40° C.

16 MINIMUM WIRE BENDING SPACE AT GROUND TERMINALS CALCULATED PER NEC TABLE 312.6(A) USING [3/0-14] CABLES (1 WIRE PER TERMINAL), MECHANICAL LUGS USED AS TERMINALS.

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS

DIM	±	RND
X	± 1	0.00- 4.99 +0.15/-0.08
.X	± 0.8	5.00- 9.99 +0.20/-0.10
.XX	± 0.38	10.00-17.49 +0.25/-0.13
		17.50-24.99 +0.30/-0.13

ANG TOL: ± 1.0° SCALE: 3/32

DWG TO A040J749 DRN M_LEHR
DO NOT SCALE PRINT CKD J_BRODY
APVD J_BRODY
DATE 25MAY11
- CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP
FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, REF ASME Y14.5M-1994 FIRST USED ON DFEJ,DFEK
SITE CODE PGF

CUMMINS POWER GENERATION

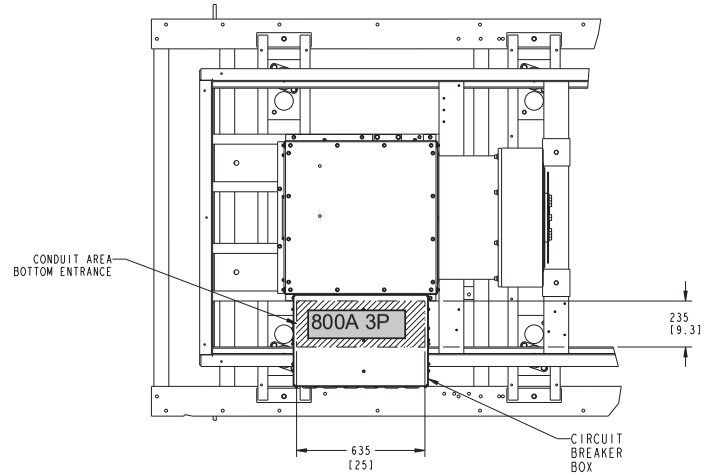
OUTLINE,CIRCUIT BREAKER

SIZE D A052W389 SHEET 1 OF 3 REV A

Drawing Name: A052W390 Revision: A
Part Name: A052W389 Revision: A
Sheet 1 of 4

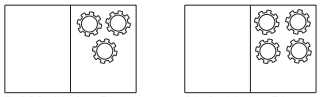
PTC® Creo® Parametric

REL NO	LTR	NO	REVISION	DRN	CKD	APVD	DATE
ECO-152559	A	1	PRODUCTION_RELEASE	MLL	JCB	J_BRODY	15MAY15

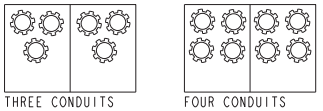


P-FRAME 800-1200A BREAKER
RECOMMENDED CONDUIT LOCATIONS

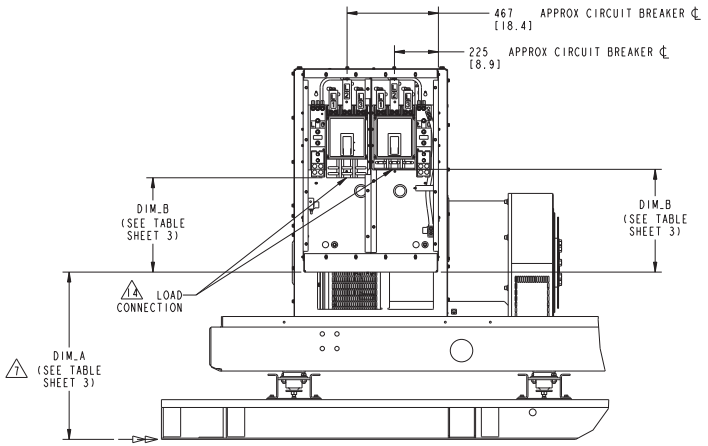
SINGLE BREAKER

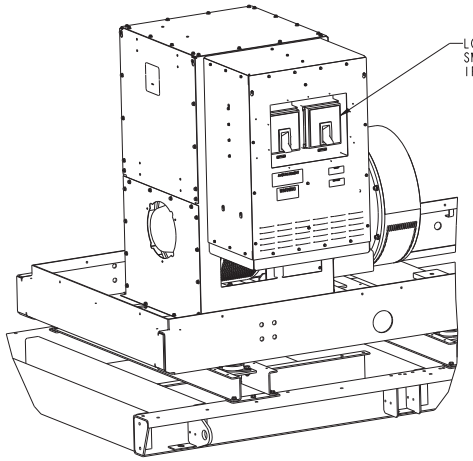


DUAL BREAKER



BOTTOM COVER
(LOOKING DOWN AT BOTTOM
OF BREAKER BOX)





DFEJ/DFEK
CIRCUIT BREAKER BOX
(RIGHT HAND BOTTOM ENTRY CONFIGURATION
P-FRAME BREAKERS SHOWN)

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS	DWG NO A040J749	DRN M_LEHR		CUMMINS POWER GENERATION	
DIM: X ± 1 / .X ± 0.8 / .XX± 0.38 — HOLE: 0.00- 4.99 +0.15/-0.08; 5.00- 9.99 +0.20/-0.10; 10.00-17.49 +0.25/-0.13; 17.50-24.99 +0.30/-0.13	DO NOT SCALE PRINT	CKD J_BRODY		OUTLINE,CIRCUIT BREAKER	
ANG TOL: ± 1.0°	SCALE: 3/32	APVD J_BRODY	SITE CODE		
- CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP	FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994	DATE 25MAY11	PGF	SIZE D — A052W389	SHEET 2 of 3 — REV A
		FIRST USED ON DFEJ,DFEK			

Drawing Name: A052W390 Revision: A
Part Name: A052W389 Revision: A
Sheet 2 of 4

PTC® Creo® Parametric

REL NO	LTR	NO	REVISION	DRN	CKD	APVD	DATE
ECO-152559	A	1	PRODUCTION_RELEASE	MLL	JCB	J_BRODY	15MAY15

800A 3P

UL/IEC LUGS					ACCESSORY SPECIFICATIONS			
LUG	FRAME	MAX AMPS	WIRE RANGE COPPER	DIM_B	ACCESSORY DESCRIPTION	CONTACT RATING	INRUSH CURRENT	CONNECTION TYPE
	NSJ/NLG	400A 3 POLE	#2-600 KCMIL	565 [22.2]	24 VDC SHUNT TRIP	-	10A 5	COMPRESSION TERMINALS #20-16 AWG OR SMALLER TORQUE: 1.13 Nm [10 LB-IN]
		600A 3-POLE	2/0-350 KCMIL		1 EA. FORM C 1 AUX CONTACT + 1 TRIP ALARM	6A AT 690 VAC 2.5A AT 48 VDC, 0.3A AT 250 VDC	-	
	P	800A 3-POLE	3/0-500 KCMIL	18.9 [480]	24 VDC SHUNT TRIP	-	200VA	COMPRESSION TERMINALS FOR 1 OR 2 #18-16 AWG. TORQUE: 1.13 Nm [10 LB-IN]
					1 EA. FORM C 4 AUX CONTACTS + 1 TRIP ALARM	6A AT 240 VAC, 6A AT 480 VAC, 3A AT 600 VAC, 2.5A AT 48 VDC, 0.8A AT 125 VDC, 0.3A AT 250 VDC	-	
	P	1200A 3-POLE	3/0-500 KCMIL	17.2 [437]	24 VDC SHUNT TRIP	-	200VA	COMPRESSION TERMINALS FOR 1 OR 2 #18-16 AWG. TORQUE: 1.13 Nm [10 LB-IN]
					1 EA. FORM C 4 AUX CONTACTS + 1 TRIP ALARM	6A AT 240 VAC, 6A AT 480 VAC, 3A AT 600 VAC, 2.5A AT 48 VDC, 0.8A AT 125 VDC, 0.3A AT 250 VAC	-	

TYPICAL CONDUIT AND WIRE SIZE BASED ON NEC 2008, ARTICLE 310.15 AT 75C TEMPURATURE RATED CONDUCTOR AT 40C AMBIENT AND ANNEX C 4
(LIQUID TIGHT FLEXIBLE METAL CONDUIT - LFCM)

MAX BRKR AMPS	WIRE (COPPER)		CONDUIT	
	QTY	SIZE	QTY	SIZE
1200	4	500 KCMIL	4	4"
800	3	350 KCMIL	3	3 1/2"
600	2	350 KCMIL	2	3 1/2"
500	2	300 KCMIL	2	3 1/2"
450	2	300 KCMIL	2	3 1/2"
400	1	600 KCMIL	1	4"
350	1	600 KCMIL	1	4"
300	1	500 KCMIL	1	4"

DFEJ,DFEK

DIM_A TABULATION			
MODEL NAME	TANK/LIFT BASE FEATURE CODE	TANK CAPACITY (GAL)	HEIGHT DIM_A
DFEJ,DFEK	C201	300	958[37.7]
	C202	400	1009[39.7]
	C203	500	1060[41.7]
	C204	600	1136[44.7]
	C205	660	1174[46.2]
	C207	850	1314[51.7]
	C209	1700	1568[61.7]
	C211	2525	1568[61.7]
	C242	270	1009[39.7]
	F214	NA	856[33.7]

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS

DIM	HOLE
X ± 1	0.00- 4.99 +0.15/-0.08
.X ± 0.8	5.00- 9.99 +0.20/-0.10
.XX± 0.38	10.00-17.49 +0.25/-0.13
	17.50-24.99 +0.30/-0.13

ANG TOL: ± 1.0° SCALE: 3/32

DO NOT SCALE PRINT

- CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, REF ASME Y14.5M-1994

FIRST USED ON DFEJ,DFEK

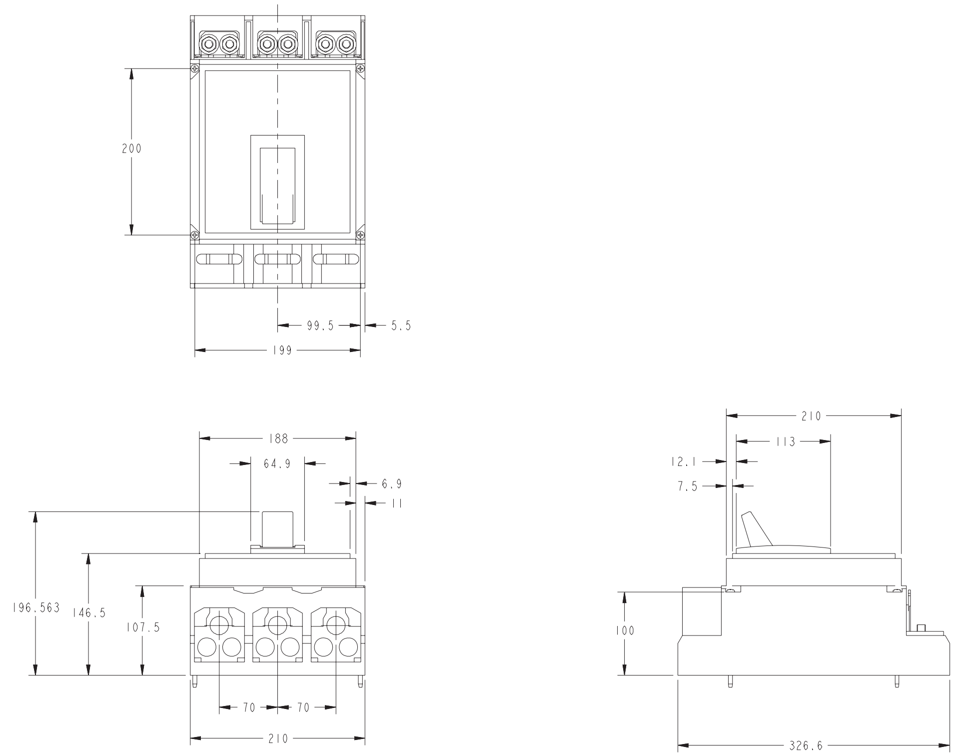
DWG NO	A040J749
DRN	M_LEHR
CKD	J_BRODY
APVD	J_BRODY
DATE	25MAY11
SITE CODE	PGF
SIZE	D
DWG NO	A052W389
SHEET	3 of 3
REV	A

CUMMINS POWER GENERATION

OUTLINE,CIRCUIT BREAKER

0320_2182 | D | Pro/ENGINEER | METRIC DWG

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD16140	A	1	PRODUCTION_RELEASE	-	DC	EC	EC	03-21-03
FRD16280	B	1	3.0 TRIP WAS 5.0 TRIP. ADD (LI).	2D	DC	EC	EC	04-08-03
		2	CHANGE TABLE	2C	DC	EC	EC	04-08-03
		3	PJ WAS PG	2B	DC	EC	EC	04-08-03
FRD19293	C	1	ADD & RELEASE DASH NO -01	-	BMM	PL	LARSON	04-06-04
		2	ADD CURRENT ER TABULATION	2B	BMM	PL	LARSON	04-06-04
		3	ADD NOTE 7	2B	BMM	PL	LARSON	04-06-04
FRD20430	D	1	NOTE 3, RMV -01 AMPERAGE SETTINGS	2-C	SJG	PPL	LARSON	05-28-04
		2	ADD MATERIAL TO -01 CURRENT ER TAB	1-B	SJG	PPL	LARSON	05-28-04
		3	REVISE INTERRUPT RATING TABLE	2-C	SJG	PPL	LARSON	05-28-04
FRD26895	E	1	NOTE 4, STUDS FOR BUSS BAR WAS STABS	-	WP	PPL	LARSON	03-22-06
FRD29478	F	1	ADD NOTE 8	2B	GWH	BG	LARSON	10-10-06



NOTES:

1. THIS PART IS VENDOR SOURCE CONTROLLED.

(B1) 2. ELECTRONIC TRIP CIRCUIT BREAKER. STANDARD MICROLOGIC 3.0 TRIP UNIT. (LI).

(D1) 3. BREAKERS TO BE SUPPLIED WITH TYPE F PLUG.

TYPE F PLUG AMPERAGE SETTINGS									
TYPE F	84%	86%	88%	90%	92%	94%	96%	98%	100%
0320_2182	672	688	704	720	736	752	768	784	800

4. BREAKERS TO BE SUPPLIED WITH STUDS FOR BUSS BAR ON LINE/TOP SIDE AND WITH LUGS ON LOAD/BOTTOM SIDE.

5. AGENCIES: 3 POLE UL LISTED
IEC

6. INTERRUPTING RATING

(D3)

CIRCUIT BREAKER	UL/CSA RATING (60 Hz)			IEC 60947-2 RATING (50/60 Hz)			
				240 Vac		380/415 Vac	
	240 Vac	480 Vac	600 Vac	Icu	Ics	Icu	Ics
PJ	100 kA	65 kA	25 kA	65 kA	35 kA	50 kA	25 kA

(C3) 7. LEVEL OF OPERATION ABOVE 80% CONTINUOUS LOAD REQUIRES SPECIAL TESTING, INSTALLATION AND APPLICATION REQUIREMENTS PER VENDOR LITERATURE.

(F1) 8. 3 LUGS ACCEPTING (2) 3/0 - 600 kcmil CONDUCTORS IS AVAILABLE THRU ACCESSORIES: PGA PART NUMBER 0332-4278.

(B3)

CURRENT_ER	PRODUCTION P/N	BREAKER	POLES	VOLTS UL/(IEC)	PLUG TYPE
FRD29478	0320_2182	PJ800	3	600 (690)	F

(C2)

CURRENT_ER	ACCESSORIES P/N	MATERIAL
FRD29478	0320_2182_01	0320_2182

(D2)

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED
mm: .X ± 1 / .X ± 0.8 / .XX ± 0.38
ANG TOL ± 1.0°
DRAWN TO SCALE OF 3/8

THIRD ANGLE PROJECTION

DR	D CRANE	03-21-03
CHKR MFG	E_CZECHOWSKI	03-21-03
APPROVED	E_CZECHOWSKI	03-21-03

MODEL FIRST USED ON: HC6/HC7

SITE CODE: PGA

CUMMINS POWER GENERATION
1400 73RD AVE NE
MINNEAPOLIS, MINNESOTA 55432

TITLE: CIRCUIT_BREAKER (800A)

DWG NO: 0320_2182 SHEET 1 OF 1 DWG SIZE D

Table 37: UL/IEC Rated, Unit-Mount[1], Manually-Operated, 100%-Rated Electronic Trip Circuit Breakers with Micrologic® Electronic Trip Units

Trip Unit, Interchangeable 3P, 4P		Circuit Breaker Catalog Number (Prefix Required)						
		Prefix	Current Rating (Sensor Rating)					
	Type		250 A	400 A	600 A	800 A	1000 A	1200 A
Micrologic Standard Trip Unit	3.0 (LI) 3P 4P[2] (G & K only)	PGL	36025CU31A	36040CU31A	36060CU31A	36080CU31A	36100CU31A	36120CU31A
		PJL	36025CU31A	36040CU31A	36060CU31A	36080CU31A	36100CU31A	36120CU31A
		PKL	36025CU31A	36040CU31A	36060CU31A	36080CU31A	36100CU31A	36120CU31A
		PLL[3]	34025CU31A	34040CU31A	34060CU31A	34080CU31A	34100CU31A	34120CU31A
	5.0 (LSI) 3P 4P[2] (G & K only)	PGL	36025CU33A	36040CU33A	36060CU33A	36080CU33A	36100CU33A	36120CU33A
		PJL	36025CU33A	36040CU33A	36060CU33A	36080CU33A	36100CU33A	36120CU33A
		PKL	36025CU33A	36040CU33A	36060CU33A	36080CU33A	36100CU33A	36120CU33A
		PLL[3]	34025CU33A	34040CU33A	34060CU33A	34080CU33A	34100CU33A	34120CU33A
Micrologic Ammeter Trip Unit[4]	3.0A (LI) 3P 4P[2] (G & K only)	PGL	36025CU41A	36040CU41A	36060CU41A	36080CU41A	36100CU41A	36120CU41A
		PJL	36025CU41A	36040CU41A	36060CU41A	36080CU41A	36100CU41A	36120CU41A
		PKL	36025CU41A	36040CU41A	36060CU41A	36080CU41A	36100CU41A	36120CU41A
		PLL[3]	34025CU41A	34040CU41A	34060CU41A	34080CU41A	34100CU41A	34120CU41A
	5.0A (LSI) 3P 4P[2] (G & K only)	PGL	36025CU43A	36040CU43A	36060CU43A	36080CU43A	36100CU43A	36120CU43A
		PJL	36025CU43A	36040CU43A	36060CU43A	36080CU43A	36100CU43A	36120CU43A
		PKL	36025CU43A	36040CU43A	36060CU43A	36080CU43A	36100CU43A	36120CU43A
		PLL[3]	34025CU43A	34040CU43A	34060CU43A	34080CU43A	34100CU43A	34120CU43A
	6.0A (LSIG) 3P 4P[2] (G & K only)	PGL	36025CU44A	36040CU44A	36060CU44A	36080CU44A	36100CU44A	36120CU44A
		PJL	36025CU44A	36040CU44A	36060CU44A	36080CU44A	36100CU44A	36120CU44A
		PKL	36025CU44A	36040CU44A	36060CU44A	36080CU44A	36100CU44A	36120CU44A
		PLL[3]	34025CU44A	34040CU44A	34060CU44A	34080CU44A	34100CU44A	34120CU44A
Micrologic Power Trip Unit with Modbus® Communications	5.0P (LSI) 3P 4P[2] (G & K only)	PGL	36025CU63AE1	36040CU63AE1	36060CU63AE1	36080CU63AE1	36100CU63AE1	36120CU63AE1
		PJL	36025CU63AE1	36040CU63AE1	36060CU63AE1	36080CU63AE1	36100CU63AE1	36120CU63AE1
		PKL	36025CU63AE1	36040CU63AE1	36060CU63AE1	36080CU63AE1	36100CU63AE1	36120CU63AE1
		PLL[3]	34025CU63AE1	34040CU63AE1	34060CU63AE1	34080CU63AE1	34100CU63AE1	34120CU63AE1
	6.0P (LSIG) 3P 4P[2] (G & K only)	PGL	36025CU64AE1	36040CU64AE1	36060CU64AE1	36080CU64AE1	36100CU64AE1	36120CU64AE1
		PJL	36025CU64AE1	36040CU64AE1	36060CU64AE1	36080CU64AE1	36100CU64AE1	36120CU64AE1
		PKL	36025CU64AE1	36040CU64AE1	36060CU64AE1	36080CU64AE1	36100CU64AE1	36120CU64AE1
		PLL[3]	34025CU64AE1	34040CU64AE1	34060CU64AE1	34080CU64AE1	34100CU64AE1	34120CU64AE1
Micrologic Harmonic Trip Unit with Modbus Communications	5.0H (LSI) 3P 4P[2] (G & K only)	PGL	36025CU73AE1	36040CU73AE1	36060CU73AE1	36080CU73AE1	36100CU73AE1	36120CU73AE1
		PJL	36025CU73AE1	36040CU73AE1	36060CU73AE1	36080CU73AE1	36100CU73AE1	36120CU73AE1
		PKL	36025CU73AE1	36040CU73AE1	36060CU73AE1	36080CU73AE1	36100CU73AE1	36120CU73AE1
		PLL[3]	34025CU73AE1	34040CU73AE1	34060CU73AE1	34080CU73AE1	34100CU73AE1	34120CU73AE1
	6.0H (LSIG) 3P 4P[2] (G & K only)	PGL	36025CU74AE1	36040CU74AE1	36060CU74AE1	36080CU74AE1	36100CU74AE1	36120CU74AE1
		PJL	36025CU74AE1	36040CU74AE1	36060CU74AE1	36080CU74AE1	36100CU74AE1	36120CU74AE1
		PKL	36025CU74AE1	36040CU74AE1	36060CU74AE1	36080CU74AE1	36100CU74AE1	36120CU74AE1
		PLL[3]	34025CU74AE1	34040CU74AE1	34060CU74AE1	34080CU74AE1	34100CU74AE1	34120CU74AE1

1 Catalog numbers are for circuit breakers with lugs on line and load ends. Consult the product selector for catalog numbers for circuit breakers with alternate terminations.

2 For 4P, replace the leading 3 in the catalog number following the prefix with a 4 (PGL36024CU31A becomes PGL46024CU31A).

3 The L interrupting rating at 600 Vac is 25 kA.

4 Add E1 suffix for Modbus communications.

Specifications

Electronic trip molded case circuit breakers have a molded case made of a glass-reinforced insulating material (thermal set composite resin) that provides high dielectric strength. These circuit breakers:

- Are available in either dual-rated UL/IEC or IEC-only constructions
- Are also CSA and ANCE certified (dual-rated UL/IEC circuit breakers only)
- Are manufactured in unit-mount, I-Line® and drawout (P-frame and NS630b–NS1600) constructions
- Are available with either ET type or Micrologic electronic tripping systems
- Provide optional power monitoring, communications, protective relaying, integral ground-fault protection for equipment and zone-selective interlocking functions
- Share common tripping of all poles
- Can be mounted and operated in any position
- Are equipped with an externally-accessible test port for use with hand-held and full-function test sets
- Are available in motor circuit protector and automatic molded case switch constructions
- Can be reverse connected, without restrictive LINE and LOAD markings
- Meet the requirements of National Electrical Code® (NEC®) Sections 240.6 by providing a means to seal the rating plug and trip unit adjustments

Codes and Standards

M-, P- and R-frame, and NS630b–NS3200 electronic trip circuit breakers and switches are manufactured and tested in accordance with the following standards:

Table 1: Standards

M-Frame, P-Frame and R-Frame Circuit Breakers	P- and R-Frame Switches	NS630b–NS3200 Circuit Breakers	NS630b–NS3200 Switches
UL 489[1] IEC Standard 60947-2 CSA 22.2 No 5-02 Federal Specification W-C-375B/GEN NEMA AB1 NMX J-266 UTE, VDE, BS, CEI, UNE	UL 489[2] IEC Standard 60947-3 CSA 22.2 No 5-02 Federal Specification W-C-375B/GEN NEMA AB1 NMX J-266 UTE, VDE, BS, CEI, UNE	IEC Standard 60947-2 Federal Specification W-C-375B/GEN NEMA AB1 UTE, VDE, BS, CEI, UNE	IEC Standard 60947-3 Federal Specification W-C-375B/GEN NEMA AB1 UTE, VDE, BS, CEI, UNE

1 PowerPact® M-frame circuit breaker is in UL File E10027.
PowerPact P-frame circuit breaker is in UL File E63335.
PowerPact R-frame circuit breaker is in UL FIle E10027.

2 PowerPact P-frame switch is in UL File E103740.
PowerPact R-frame switch is in UL FIle E33117.

Circuit breakers should be applied according to guidelines detailed in the NEC® and other local wiring codes.

Circuit Breaker Ratings

Interrupting Rating

The interrupting rating is the highest current at rated voltage the circuit breaker is designed to safely interrupt under standard test conditions. Circuit breakers must be selected with interrupting ratings equal to or greater than the available short-circuit current at the point where the circuit breaker is applied to the system (unless it is a branch device in a series rated combination). Interrupting ratings are shown on the front of the circuit breaker. For grounded B phase interrupting ratings, see Data Bulletin 2700DB0202.

Table 2: UL/IEC Circuit Breaker Interrupting Ratings

Circuit Breaker[1]	UL/CSA Rating (60 Hz)						IEC 60947-2 Rating (50/60 Hz)			
	3 Phase			Grounded B Phase (1Ø-3Ø)			240 Vac		380/415 Vac	
	240 Vac	480 Vac	600 Vac	240 Vac 2P	240 Vac 3P	480 Vac 3P	Icu	Ics	Icu	Ics
MG	65 kA	35 kA	18 kA	65 kA	—	—	50 kA	25 kA	35 kA	20 kA
MJ	100 kA	65 kA	25 kA	65 kA	—	—	65 kA	35 kA	50 kA	25 kA
PG	65 kA	35 kA	18 kA	65 kA	65 kA	35 kA	50 kA	25 kA	35 kA	20 kA
PJ	100 kA	65 kA	25 kA	65 kA	100 kA	14 kA	65 kA	35 kA	50 kA	25 kA
PK	65 kA	50 kA	50 kA	65 kA	65 kA	35 kA	50 kA	25 kA	50 kA	25 kA
PL	125 kA	100 kA	25 kA	65 kA	100 kA	14 kA	125 kA	65 kA	85 kA	45 kA
RG	65 kA	35 kA	18 kA	—	65 kA	35 kA	50 kA	25 kA	35 kA	20 kA
RJ	100 kA	65 kA	25 kA	100 kA	100 kA	35 kA	65 kA	35 kA	50 kA	25 kA
RK	65 kA	65 kA	65 kA	—	65 kA	35 kA	85 kA	65 kA	70 kA	55 kA
RL	125 kA	100 kA	50 kA	125 kA	125 kA	35 kA	125 kA	65 kA	85 kA	45 kA

[1] The K interrupting rating is recommended for applications having high inrush and/or non-linear loads such as large motors, transformers, motors with soft starts, etc.

Table 3: IEC Only Circuit Breaker Interrupting Ratings (50/60 Hz)

Circuit Breaker	220/240 Vac		380/415 Vac		440 Vac		500/525 Vac		660/690 Vac	
	Icu	Ics	Icu	Ics	Icu	Ics	Icu	Ics	Icu	Ics
NS630b–NS1600 N Interrupting Rating	50 kA	75% Icu	50 kA	75% Icu	50 kA	75% Icu	40 kA	75% Icu	30 kA	75% Icu
NS630b–NS1600 H Interrupting Rating	70 kA	50% Icu	70 kA	50% Icu	65 kA	50% Icu	50 kA	50% Icu	42 kA	50% Icu
NS630b–NS1000 L Interrupting Rating	150 kA	100% Icu	150 kA	100% Icu	130 kA	100% Icu	100 kA	100% Icu	25 kA	100% Icu
NS1600b–NS3200 N Interrupting Rating	85 kA	75% Icu	70 kA	75% Icu	65 kA	100% Icu	65 kA	100% Icu	65 kA	100% Icu
NS1600b–NS3200 H Interrupting Rating	125 kA	75% Icu	85 kA	75% Icu	85 kA	75% Icu	—	—	—	—

exceeded, will trip the circuit breaker with no intentional delay. Instantaneous trip dial settings are 2–16 x I_n for 600 A circuit breakers and 1.5–12 x I_n for 800–1200 A circuit breakers.

Micrologic® Electronic Trip Systems

The P-frame, R-frame and NS630b–NS3200 electronic trip circuit breakers can be equipped with the optional Micrologic trip systems listed below:

Table 15: Micrologic Trip Systems

Model	(LS0) Long-time + Short-time + Zero delay (IEC Rated Only)	(LI) Long-time + Instantaneous Protection (UL Listed, IEC Rated)	(LSI) Long-time + Short-time + Instantaneous Protection (UL LIsted, IEC Rated)	(LSIG) Long-time + Short-time + Instantaneous Protection + Equipment Ground-fault Protection (UL LIsted, IEC Rated)
Micrologic Basic Trip Unit	2.0	3.0	5.0	—
Micrologic A Trip Unit	2.0A	3.0A	5.0A	6.0A
Micrologic P Trip Unit	—	—	5.0P	6.0P
Micrologic H Trip Unit	—	—	5.0H	6.0H

Trip units are designed to protect power circuits and loads. Micrologic trip systems use a set of current transformers (called CTs or sensors) to sense current, a trip unit to evaluate the current, and a tripping solenoid to trip the circuit breaker. Adjustable rotary switches on the trip unit allow the user to set the proper overcurrent or equipment ground-fault current protection required in the electrical system. If current exceeds a set value for longer than its set time delay, the trip system opens the circuit breaker. Alarms may be programmed for remote indications. Measurements of current, voltage, frequency, power, and power quality optimize continuity of service and energy management.

Integration of protection functions in the Application Specific Integrated Circuit (ASIC) electronic component used in all Micrologic trip units guarantees a high degree of reliability and immunity to conducted or radiated disturbances. On Micrologic P and H trip units, advanced functions are managed by an independent microprocessor.

Circuit breakers are shipped with the trip unit long-time pickup switch set at 1.0 and all other trip unit adjustments set at their lowest settings. Actual settings required for a specific application must be determined by a qualified consultant or plant engineer. A coordination study is recommended to provide coordination between all circuit breakers in the distribution system.

Table 16: Micrologic® Trip Unit Features

Feature	Micrologic Trip Unit (X = Standard Feature O = Available Option)										
	Standard			Ammeter				Power		Harmonics	
	2.0	3.0	5.0	2.0A	3.0A	5.0A	6.0A	5.0P	6.0P	5.0H	6.0H
Field-Installable	X	X	X	X	X	X	X	X	X	X	X
LI		X			X						
LS0	X			X							
LSI			X			X		X		X	
LSIG/Ground-Fault Trip[1]							X		X		X
Ground-Fault Alarm/No Trip[1, 2]								X		X	
Ground-Fault Alarm and Trip[1, 2]									X		X
Adjustable Rating Plugs	X	X	X	X	X	X	X	X	X	X	X
True RMS Sensing	X	X	X	X	X	X	X	X	X	X	X
UL Listed		X	X		X	X	X	X	X	X	X
Thermal Imaging	X	X	X	X	X	X	X	X	X	X	X
Phase-Loading Bar Graph				X	X	X	X	X	X	X	X
LED for Long-Time Pick-Up	X	X	X	X	X	X	X	X	X	X	X
LED for Trip Indication				X	X	X	X	X	X	X	X
Digital Ammeter				X	X	X	X	X	X	X	X

Table 16: Micrologic® Trip Unit Features *(continued)*

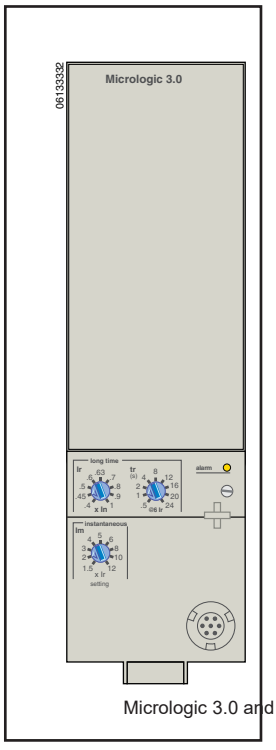
Feature	Micrologic Trip Unit (X = Standard Feature O = Available Option)										
	Standard			Ammeter				Power		Harmonics	
	2.0	3.0	5.0	2.0A	3.0A	5.0A	6.0A	5.0P	6.0P	5.0H	6.0H
Zone-Selective Interlocking[3]				X		X	X	X	X	X	X
Communications				O	O	O	O	X	X	X	X
LCD Dot Matrix Display								X	X	X	X
Advanced User Interface								X	X	X	X
Protective Relay Functions								X	X	X	X
Neutral Protection[1]								X	X	X	X
Contact Wear Indication								X	X	X	X
Incremental Fine Tuning of Settings								X	X	X	X
Selectable Long-Time Delay Bands								X	X	X	X
Power Measurement								X	X	X	X
Power Quality Measurements										X	X
Waveform Capture										X	X

1 3Ø, 4W circuits require either a neutral current transformer or a 4-pole breaker..

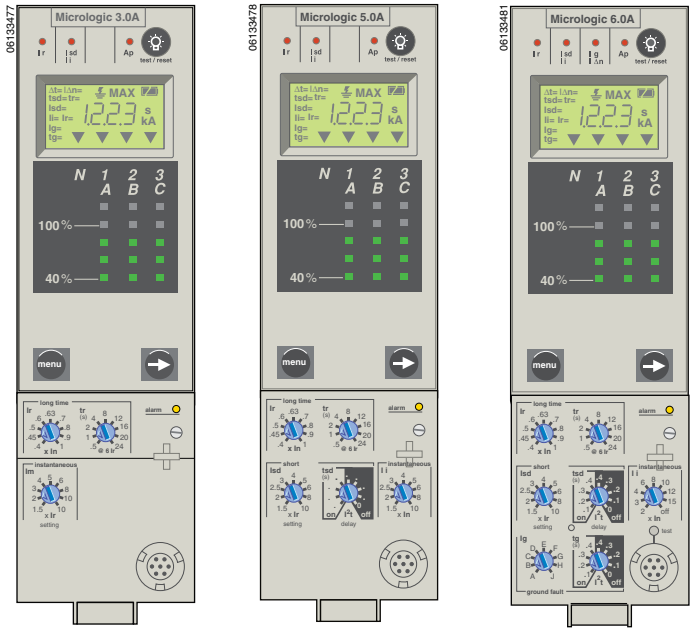
2 Requires M6C Programmable Contact Module.

3 Not available for 2.0A trip unit as upstream devices.

Micrologic® 2.0, 3.0 and 5.0 Basic Trip Units

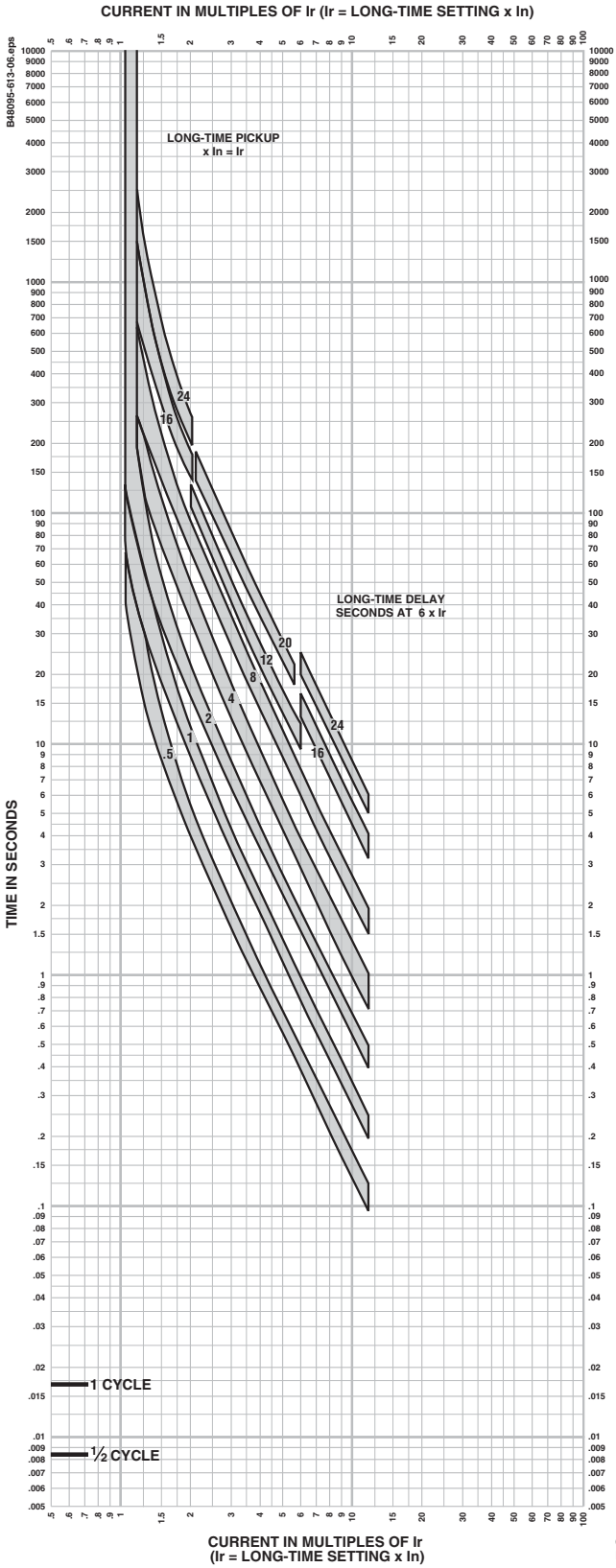


Micrologic 3.0 and 5.0 Basic Trip Units



Micrologic 3.0A, 5.0A and 6.0A Trip Units

Micrologic 3.0A P-Frame and R-Frame Trip Unit Characteristic Trip Curve



Micrologic 3.0A Trip Unit

Long-Time Pickup and Delay

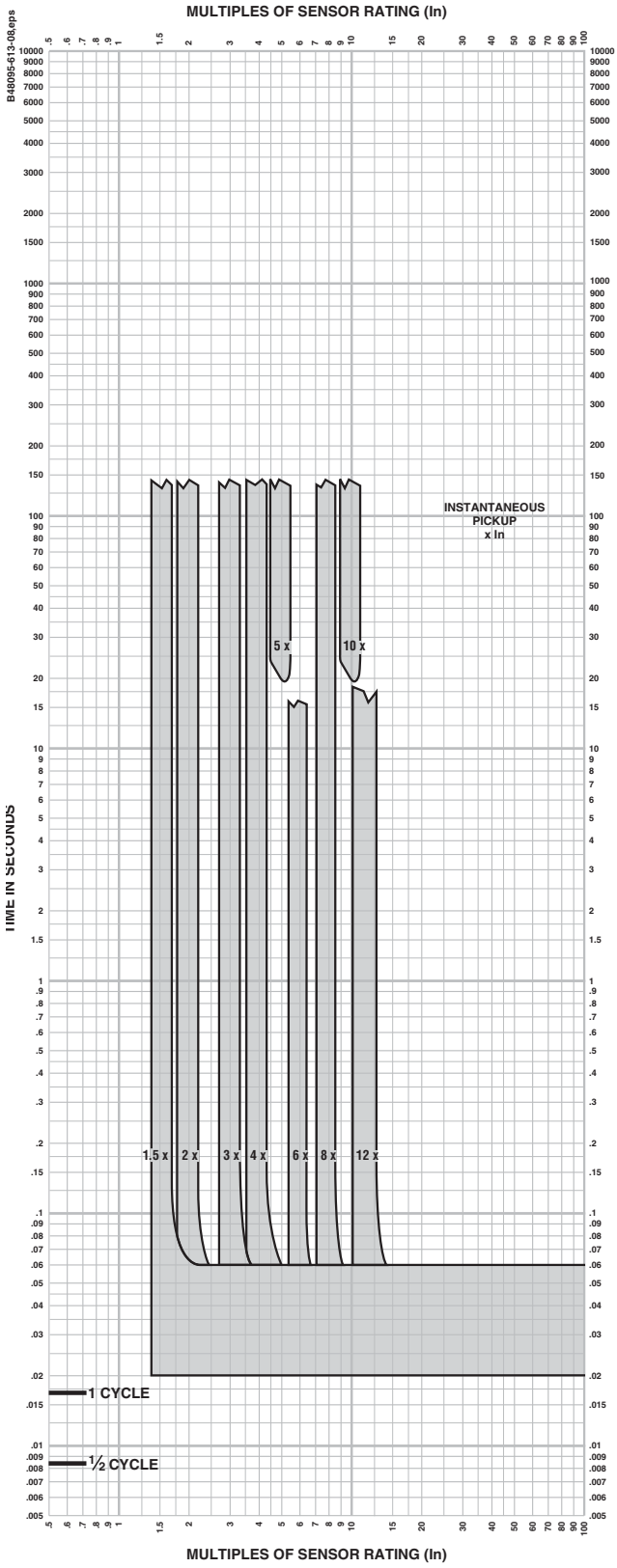
The time-current curve information is to be used for application and coordination purposes only.

Notes:

1. There is a thermal-imaging effect that can act to shorten the long-time delay. The thermal-imaging effect comes into play if a current above the long-time delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in a shorter time than normal. The amount of time delay reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately twenty minutes is required between overloads to completely reset thermal-imaging.
2. The end of the curve is determined by the instantaneous setting of the circuit breaker.
3. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of current.
4. See trip curve 613-8 on page 131 for instantaneous pickup trip curve.

Curve No. 0613TC0006
Drawing No. B48095-613-06

Micrologic 3.0A P-Frame and R-Frame Trip Unit Characteristic Trip Curve



Curve No. 0613TC0008
Drawing No. B48095-613-08

Micrologic 3.0A Trip Unit

Instantaneous Pickup, 1.5X to 12X

Characteristic Trip Curve No. 613-8

The time-current curve information is to be used for application and coordination purposes only.

Notes:

1. The end of the curve is determined by the interrupting rating of the circuit breaker.
2. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of current.
3. The instantaneous region of the trip curve shows maximum total clearing times. Actual clearing times in this region can vary depending on the circuit breaker mechanism design and other factors. The actual clearing time can be considerably faster than indicated. Contact your local sales office for additional information.
4. See trip curve 613-6 on page 130 for long-time pickup and delay trip curves.

Enclosures and tanks 250-1000 kW gensets

> Specification sheet

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Power Generation

Enclosure standard features

- 14-gauge steel construction (panels)
- Stainless steel hardware
- Zinc phosphate pretreatment, e-coat primer and super durable powder topcoat paint minimize corrosion and color fade
- Package listed to UL 2200
- Designed to satisfy National Electrical Code installation requirements
- Fuel and electrical stub-up area within enclosure perimeter
- Fixed louvers
- Cambered roof prevents water accumulation
- Recessed, lockable doors in two sides
- Retainers hold doors open for easy access
- Enclosed exhaust silencer ensures safety and protects against rust
- Rain cap
- Exterior oil and coolant drains with interior valves for ease of service
- Rodent barriers on inlet
- Non-hydroscopic sound attenuating material
- Side mounted controls and circuit breakers
- Easy access lifting points for spreader bars
- Dual vibration isolation system (250-500 kW)
- Spring vibration isolation system (600-1000 kW)
- Enclosure mounts to lifting base or fuel tank (250-500 kW)
- Enclosure mounts to lifting base (600-1000 kW)
- Factory pre-assembled package
- Designed for outdoor use only
- Externally mounted emergency stop button for operator safety (optional on 250-500 kW)
- Horizontal air discharge to prevent leaf and snow accumulation (600-1000 kW)

Options

- Three levels of sound attenuation
- ~~Motorized louvers to protect from ice and snow accumulation (available on air inlet for all models and on air outlet on level II, 250-500 kW enclosures only)~~
- ~~Horizontal air discharge, sound level 2 only (250-500 kW)~~
- ~~Aluminum construction with roll-coated polymer paint~~
- ~~Wind rated to 150 mph~~
- Neutral sandstone paint color
- ~~Factory mounted battery charger~~
- ~~External 120 VAC service outlet~~
- ~~Rain hoods for air inlet (250-500 kW)~~
- ~~Lifting base in lieu of a sub-base tank (250-500 kW)~~
  - ~~Pre-wired AC distribution package~~
  - ~~100 amp (250-500 kW) or 150 amp (600-1000 kW) main circuit breaker; connected to 120 VAC line-neutral and 208 or 240 VAC line-line, spare breaker positions and capacity for future upgrades (600-1000 kW)~~
  - ~~GFCI protected internal 120 VAC service receptacle~~
  - ~~GFCI protected weather proof external 120 volt service receptacle~~
  - ~~All factory installed AC powered features pre-wired into load center~~
- ~~Interior lights – 120 volt (600-1000 kW)~~
- ~~Rain hoods for air inlet (250-500 kW)~~
- ~~Seismic isolators available (600-1000 kW)~~

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S-1443z (9/14)

Power Generation

Fuel tanks

Standard sub-base tank features

- UL 142 Listed
- ULC-S601-07 Listed
- NFPA37 compliant
- Dual walled, steel construction
- Emergency tank and rupture basin vents
- Tank mounted mechanical fuel gauge
- Fuel supply and return tubes
- Top mounted leak detection float switch
- Low and high level fuel switches
- Mounting brackets for optional pump and control (250-500 kW)
- Integral lifting points

Sub-base tank options

- Pre-wired fuel pump and control
- Fuel overfill alarm – internal or external
- Overflow and tank fill plugs
- Five gallon spill fill box – internal or external
- Fill pipe extender
- Local code approvals available

200-500 kW dual wall sub-base fuel tanks – usable operating hours

Genset model (60 Hz)	Gallons/ hour at full load	270 gallon tank	300 gallon tank	400 gallon tank	500 gallon tank	600 gallon tank	660 gallon tank	720 gallon tank	850 gallon tank	1420 gallon tank	1470 gallon tank	1700 gallon tank	2050 gallon tank	2525 gallon tank
250 DQDAA	20	14	15	20	25	30	33	36		72	74		104	
275 DQDAB	21	13	14	19	24	29	31	34		66	70		96	
300 DQDAC	23	12	13	17	22	26	29	31		61	64		88	
300 DQHAB	23	12	13	17	22	26	29		37			74		
450 DFEJ	30	9	10	13	17	20	22		28			57		84
500 DFEK	34	8	9	11	15	18	19		25			50		74

Operating hours are measured at 60 Hz, standby rating.

~~600-1000 kW dual wall sub-base fuel tanks – usable operating hours~~

~~Genset model~~	~~Gallons/ hour at full load~~	~~200 gallon tank~~	~~660 gallon tank~~	~~1000 gallon tank~~	~~1500 gallon tank~~	~~2000 gallon tank~~	~~2400 gallon tank~~
~~**600 DQCA**~~	~~42~~	~~5~~	~~16~~	~~24~~	~~36~~	~~48~~	~~57~~
~~**600 DQPAA**~~	~~45~~	~~4~~	~~15~~	~~22~~	~~33~~	~~44~~	~~53~~
~~**650 DQPAB**~~	~~50~~	~~4~~	~~13~~	~~20~~	~~30~~	~~40~~	~~48~~
~~**750 DQCB**~~	~~51~~	~~4~~	~~13~~	~~20~~	~~29~~	~~39~~	~~47~~
~~**750 DQFAA**~~	~~53~~	~~4~~	~~12~~	~~19~~	~~28~~	~~38~~	~~45~~
~~**800 DQCG**~~	~~53~~	~~4~~	~~12~~	~~19~~	~~28~~	~~38~~	~~45~~
~~**800 DQFAB**~~	~~56~~	~~4~~	~~12~~	~~18~~	~~27~~	~~36~~	~~43~~
~~**900 DQFAC**~~	~~64~~	~~3~~	~~10~~	~~16~~	~~23~~	~~31~~	~~38~~
~~**1000 DQFAD**~~	~~72~~	~~3~~	~~9~~	~~14~~	~~21~~	~~28~~	~~33~~

*3000 gallon tank offered as an accessory kit – refer to NAAC-5853 spec sheet

- Operating hours are measured at 60Hz, standby rating.
- Up to 90% fill alarm to comply with NFPA30, operating capacity is reduced by 10%.

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S-1443z (9/14)

Cummins Power Generation

Enclosure package sound pressure levels @ 7 meters dB(A)

Genset model	~~Weather protective enclosure (F200, F203)~~	~~QuietSite Level 1 sound attenuated enclosure (F201, F204)~~	QuietSite Level 2 sound attenuated enclosure (F202, ~~F205~~)
250 DQDAA	90	88	72
275 DQDAB	90	88	73
300 DQDAC	90	88	73
300 DQHAB	89	88	76
450 DFEJ	88	85	74
500 DFEK	89	87	73
600 DQCA	86/86*	82/78*	74/73*
600 DQPAA	89	81	77
650 DQPAB	90	81	80
750 DQCB	88/87*	83/79*	75/74*
750 DQFAA	89	79	75
800 DQCC	88/87*	83/79*	75/74*
800 DQFAB	89	79	75
900 DQFAC	89	80	76
1000 DQFAD	90	80	76

72dB per Spec

- All data is 60Hz, full load standby rating, steel enclosures only.
- Data is a measured average of 8 positions.
- Sound levels for aluminum enclosures are approximately 2 dB(A) higher than listed sound levels for steel enclosures.

* Sound data with seismic feature codes L228-2 (IBC) and/or L225-2 (OSHPD)

Package dimensions of enclosure, exhaust system, and UL tank

250-500 kW

Tank size (gal)	Weather protective package length (in)	QuietSite level I package length (in)	QuietSite level 2 package length (in)	Width (in)	Height (in)	Weather protective package weight (lbs)	QuietSite level 1 package weight (lbs)	QuietSite level 2 package weight (lbs)
270	188	188	222	82	106	4991	5471	6711
300	188	188	222	82	104	5648	6073	6991
400	188	188	222	82	106	5833	6258	7176
500	188	188	222	82	108	5956	6381	7299
600	188	188	222	82	111	6116	6541	7459
660	188	188	222	82	113	6235	6660	7578
720	188	188	222	82	114	6174	6599	7517
850	188	188	222	82	118	6529	6954	7872
1420	200	200	222	82	128	6863	7343	8583
1470	192	192	222	82	128	7253	7733	8973
1700	234	234	234	82	128	7982	8407	9325
2050	284	284	284	82	128	8383	8863	10103
2525	346	346	346	82	128	9391	9871	11111
Lifting base	188	188	222	82	100	4335	4760	5678

~~600-1000 kW~~

~~Tank size (gal)~~	~~Weather Protective package length (in)~~	~~QuietSite level I package length (in)~~	~~QuietSite level 2 package length (in)~~	~~Width (in)~~	~~Height (in)~~	~~Weather protective package weight (lbs)~~	~~QuietSite level 1 package weight (lbs)~~	~~QuietSite level 2 package weight (lbs)~~
~~200~~	~~260~~	~~303~~	~~315~~	~~98~~	~~137~~	~~10194~~	~~13074~~	~~14954~~
~~660~~	~~260~~	~~303~~	~~315~~	~~98~~	~~137~~	~~9586~~	~~12466~~	~~14346~~
~~1000~~	~~260~~	~~303~~	~~315~~	~~98~~	~~141~~	~~10117~~	~~12997~~	~~14877~~
~~1500~~	~~260~~	~~303~~	~~315~~	~~98~~	~~146~~	~~10677~~	~~13557~~	~~15437~~
~~2000~~	~~292~~	~~327~~	~~327~~	~~98~~	~~143~~	~~11959~~	~~14839~~	~~16719~~
~~2400~~	~~338~~	~~338~~	~~338~~	~~98~~	~~143~~	~~12961~~	~~15841~~	~~17721~~

- This weight does not include the generator set. Consult your local Cummins Power Generation distributor or the appropriate generator specification sheet.
- Width is 86” lifting eye to lifting eye (250-500 kW), 102” lifting eye to lifting eye (600-1000 kW).
- Height - Florida, Michigan, and Suffolk add 4” (250-500 kW) or 2” (600-1000 kW) for bottom space.
- Maximum length emergency vent removed.

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S-1443z (9/14)

Cummins Power Generation

CSA - The generator set is CSA certified to product class 4215-01.

UL - The generator set is available Listed to UL 2200, Stationary Engine Generator Assemblies. The PowerCommand control is Listed to UL 508 - Category NITW7 for U.S. and Canadian usage.

See your distributor for more information

Americas
1400 73rd Avenue N.E.
Minneapolis, MN 55432 USA
Phone: 763 574-5000
Fax: 763 574-5298

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www.cumminspower.com

S-1443z (9/14)

Power Generation

PTC® Creo® Parametric

REL NO	LTR	NO	REVISION	DRN	CKD	APVD	DATE
ECO-145369	A	1	PRODUCTION_RELEASE	AM	KK	K_KISHORE	05AUG14

TABULATION

TANK/LIFT BASE FEATURE CODE	TANK CAPACITY	TANK WEIGHT DRY KG (LBS)	DIM_D	DIM_E	DIM_F	DIM_G DFEJ, DFEK	DIM_G DOHAB	DIM_G DODAA, DODAB, DODAC	DIM_H	DIM_J	DIM_K	DIM_L
C242	270	939 (2071)	2643 (104)	183 (7.2)	305 (12)	1625.6 (64.0)	1447.6 (57.0)	1371.8 (54.0)	526 (20.7)	1126 (44.3)	1122 (44.2)	614.7 (24.2)
C201	300	954 (2103)	2643 (104)	183 (7.2)	305 (12)	1625.6 (64.0)	1447.6 (57.0)	1371.8 (54.0)	526 (20.7)	1126 (44.3)	1122 (44.2)	614.7 (24.2)
C202	400	1019 (2246)	2694 (106)	234 (9.2)	356 (14)	1676.6 (66.0)	1498.6 (59.0)	1422.8 (56.0)	577 (22.7)	1177 (46.3)	1173 (46.2)	665 (26.2)
C203	500	1097 (2419)	2749.6 (108.2)	291 (11.5)	413 (16.2)	1733.2 (68.2)	1555.2 (61.2)	1479.4 (58.2)	633.6 (24.9)	1234.6 (48.5)	1230.6 (48.4)	722.9 (28.4)
C204	600	1161 (2559)	2819 (111)	361 (14.2)	483 (19)	1803.6 (71.0)	1625.6 (64.0)	1549.8 (61.0)	704 (27.7)	1304 (51.3)	1300 (51.2)	792.5 (31.2)
C205	660	1198 (2641)	2864.3 (112.7)	405 (15.9)	527 (20.7)	1847.9 (72.7)	1669.9 (65.7)	1594.1 (62.7)	748.3 (29.4)	1349.3 (53.0)	1345.3 (52.9)	836.9 (32.9)
C206	720	1243 (2741)	2908.2 (114.5)	450 (17.7)	572 (22.5)	NA	NA	1639 (64.2)	793.2 (31.2)	1394.2 (54.8)	1390.2 (54.7)	881.9 (34.7)
C207	850	1332 (2936)	2997 (118)	538 (21.2)	660 (26)	1980.6 (78.0)	1802.6 (71.0)	NA	881 (34.7)	1481 (58.3)	1478 (58.2)	970.3 (38.2)
F214	NA	NA	2540 (100)	81 (3.2)	203 (8)	1523.6 (60.0)	1345.6 (53.0)	1371.8 (50.0)	424 (16.7)	1024 (40.3)	1021 (40.2)	513.1 (20.2)

TABULATION

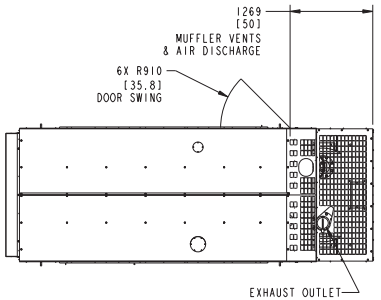
MODEL	KW	CG_DIM "A"	CG_DIM "B"	CG_DIM "C"	STEEL ENCLOSURE WEIGHT KG (LBS)	ALUMINUM ENCLOSURE WEIGHT KG (LBS)
DFEJ	450	1956 [77.0]	1041 [41]	737 [29.0]	8026 (17696)	7536 (16606)
DFEK	500	1933 [76.1]			8162 (17996)	7672 (16906)
DODAA	250	1927 [75.9]		723 [28.5]	5957 (13088)	5467 (11998)
DODAB	275					
DODAC	300	1945 [76.6]		724 [28.5]	6057 (13388)	5567 (12298)
DOHAB	300	2085 [82.1]		871 [34.3]	6384 (14076)	5894 (12986)

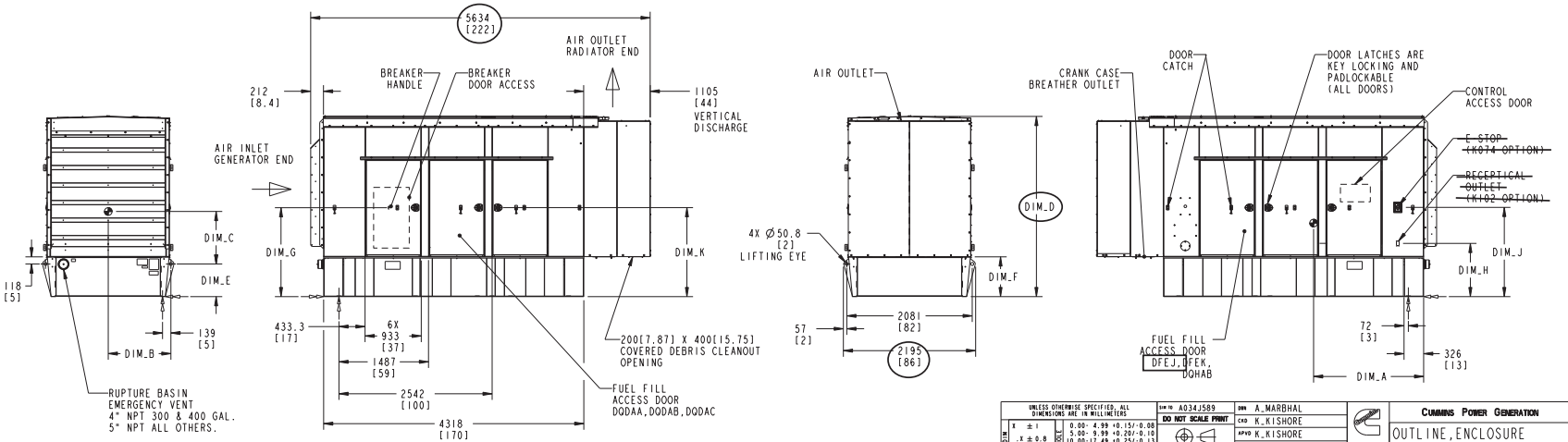
***WEIGHT & CG'S ARE SHOWN WITH HIGHEST GALLON FUEL TANK, ENCLOSURE, AND STANDARD WET GENSET. ADDITION OF OTHER FEATURES MAY CHANGE THE WEIGHT.

NOTES:

1. DIMENSIONS SHOWN IN [ ] ARE INCHES.
2. FOUNDATION REFERENCE POINT (⊂⊃). SEE FOUNDATION DRAWING FOR DETAILS.
3. FOR FEATURE CODE LI16 (FLORIDA TANKS) AND LI20 (MICHIGAN TANKS) ADD 162MM [6.4"] TO DIMS D-L
4. SEE SHEET 2 FOR TANK VENT LOCATIONS.
5. EXCESSIVE TWISTING OF THE FUEL TANK, WHEN FASTENING IT TO A FOUNDATION, MAY RESULT IN STRUCTURAL FAILURE OF THE TANK. TO INSURE THE INSTALLATION DOES NOT EXCESSIVELY TWIST THE FUEL TANK, THE FOLLOWING PROCEDURE MUST BE OBSERVED:
   - 5.1 REFER TO CUMMINS APPLICATION MANUAL TO30 FOR GENERAL GENSET/TANK MOUNTING GUIDELINES.
   - 5.2 TIGHTEN TANK HOLD DOWN MOUNTING FASTENERS.
6. ALL DIMENSIONS NOT SHOWN ARE IDENTICAL TO THOSE SHOWN ON SHEET 1.
7. THE ENCLOSURE IS ENGINEERED TO MAINTAIN IT'S INTEGRITY WITH A 150 MPH WIND LOAD CONDITION.

OPTIONAL FEATURE
F202,F205

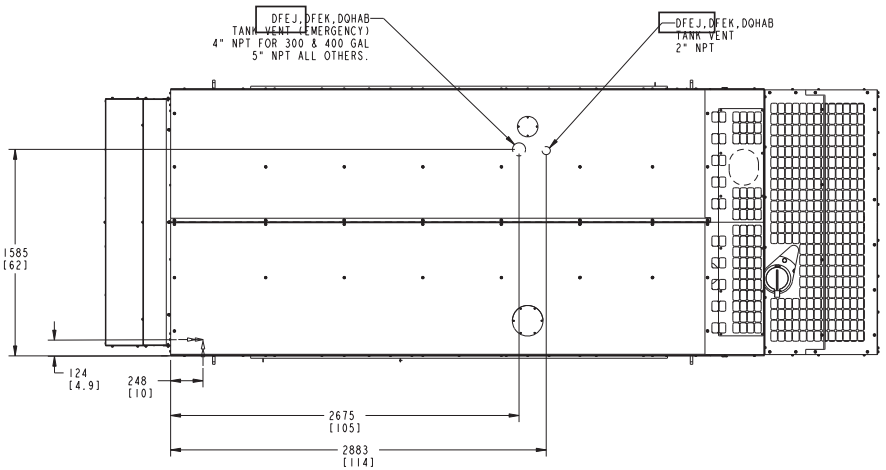




UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS	DWG NO A034J589	DRN A_MARBHAL	CUMMINS POWER GENERATION
DIM: X ±1, .X ±0.8, .XX± 0.38 / HOLE: 0.00- 4.99 +0.15/-0.08, 5.00- 9.99 +0.20/-0.10, 10.00-17.49 +0.25/-0.13, 17.50-24.99 +0.30/-0.13	DO NOT SCALE PRINT	CKD K_KISHORE	
		APVD K_KISHORE	
		DATE 05AUG14	
ANG TOL: ± 1.0°	SCALE: 1/32	- CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP	FIRST USED ON DFEJ,K
			SITE CODE PGF
			OUTLINE,ENCLOSURE (LEVEL 2)
			SIZE D — A050L370 — SHEET 1 of 4 — REV A

PTC® Creo® Parametric

REL NO	LTR	NO	REVISION	DRN	CKD	APVD	DATE
ECO-145369	A	1	PRODUCTION_RELEASE	AM	KK	K_KISHORE	05AUG14



UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS

DIM	TOLERANCE
X	± 1
.X	± 0.8
.XX	± 0.38
HOLE	0.00- 4.99 +0.15/-0.08 5.00- 9.99 +0.20/-0.10 10.00-17.49 +0.25/-0.13 17.50-24.99 +0.30/-0.13

ANG TOL: ± 1.0° SCALE: 1/16

DWG TO A034J589
DO NOT SCALE PRINT

- CONFIDENTIAL -
PROPERTY OF CUMMINS POWER GENERATION GROUP

FOR INTERPRETATION OF DIMENSIONS AND TOLERANCING, SEE ASME Y14.5M-1994

DRN	A_MARBHAL
CKD	K_KISHORE
APVD	K_KISHORE
DATE	05AUG14
FIRST USED ON	DFEJ,K

SITE CODE PGF

CUMMINS POWER GENERATION

OUTLINE,ENCLOSURE
(LEVEL 2)

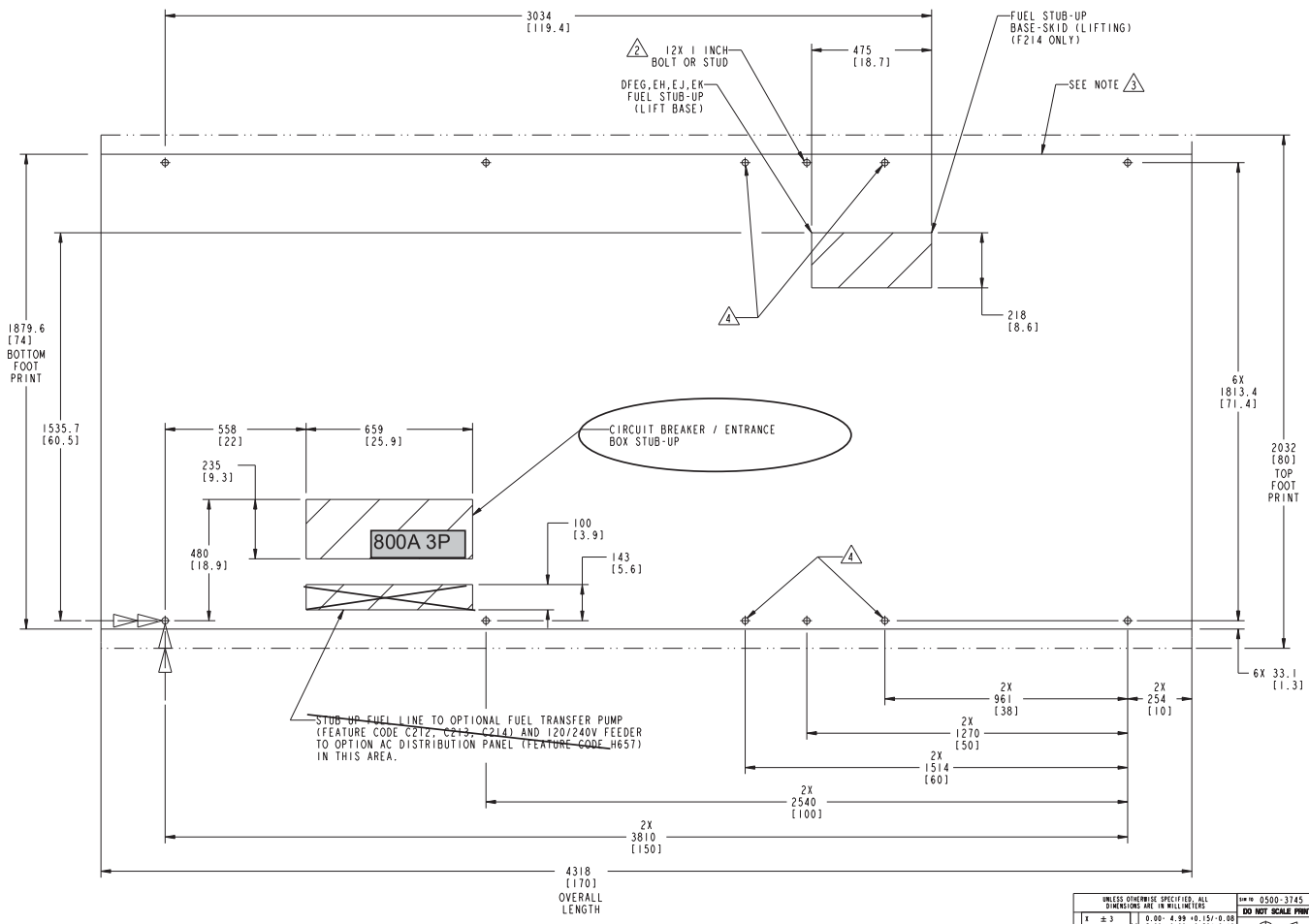
SIZE D | DWG NO A050L370 | SHEET 2 of 5 | REV A

Drawing Name: A050L371 Revision: A
Part Name: A050L370 Revision: A
Sheet 2 of 5

Pro/ENGINEER

DFEG, DFEH, DFEJ, DFEK
(C201-C207,C242,F214)

REL NO	LTR	NO	REVISION	DRN	CKD	APVD	DATE
ECO-118385	C	1	6X 1813.4 WAS 1803.4, ZONE C2	WGM	BJD	K.KISHORE	27JUL11
		2	6X 33.1 WAS 38.1, ZONE B2	WGM	BJD	K.KISHORE	27JUL11
		6	143 WAS 138, ZONE B4	WGM	BJD	K.KISHORE	27JUL11
		7	480 WAS 475, ZONE B6	WGM	BJD	K.KISHORE	27JUL11
		8	1535.7 WAS 1530.7, ZONE C6	WGM	BJD	K.KISHORE	27JUL11



NOTE:

1. DIMENSIONS IN [ ] ARE IN INCHES.
2. SKID-BASE (LIFTING) AND FUEL TANK HAVE A FLANGE THICKNESS OF 4.76mm [.19 INCHES], (FLORIDA UNITS WITH FEATURE CODE LI16) 8.76mm [.35 INCHES]. ALLOW EXTRA LENGTH ON HARDWARE FOR UNEVENESS OF MOUNTING SURFACE.
3. LIFTING BASE OR FUEL TANK PERIMETER IS SHOWN. FOUNDATION SHOULD BE EXTENDED BEYOND THIS PERIMETER. SEE (T030) APPLICATION MANUAL.
4. FEATURE OPTION F214-2 DOES NOT USE THIS BOLT.

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS
DIM: X ±3, .X ±0.8, .XX±0.38
HOLE: 0.00- 4.99 +0.15/-0.08; 5.00- 9.99 +0.20/-0.10; 10.00-17.49 +0.25/-0.13; 17.50-24.99 +0.30/-0.13
ANG TOL: ± 1.0° SCALE: ~1/8

SIM ID: 0500-3745
DO NOT SCALE PRINT
CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP
FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, REF ASME Y14.5M-1994
FIRST USED ON: DFEK

DRN M. JOHNSON
CKD Z. MOGES
APVD Z. MOGES
DATE 10JAN11

SITE CODE: PGA

CUMMINS POWER GENERATION
OUTLINE, GENSET (FOUNDATION)
SIZE D | A035F947 | SHEET 2 of 3 | REV C

Drawing Name: A035F948 Revision: C
Part Name: A035F947 Revision: C
Sheet 2 of 4

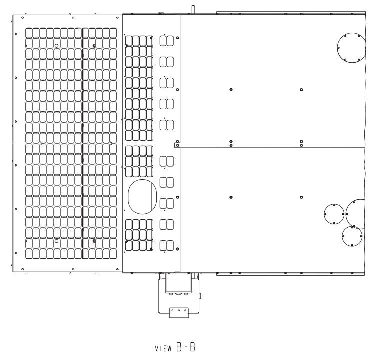
NOTES:

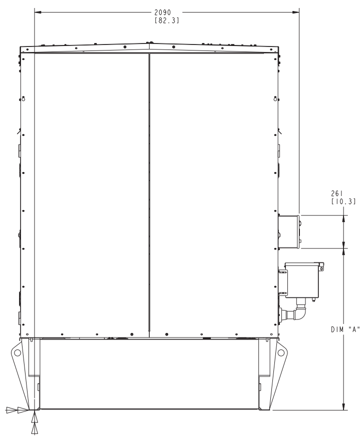
1. DIMENSIONS SHOWN IN [ ] ARE IN INCHES.
2. SEE FOUNDATION DRAWING FOR REFERENCE POINT LOCATION.
3. THIS FUEL SYSTEM OUTLINE APPLIES TO GENSET MODELS DFEJ, DFEK, DQDAA, DQDAB, DQDAC AND DQHAB, FEATURE CODES C231 AND C232, KITS A049R696, A049R697, AND A049R698

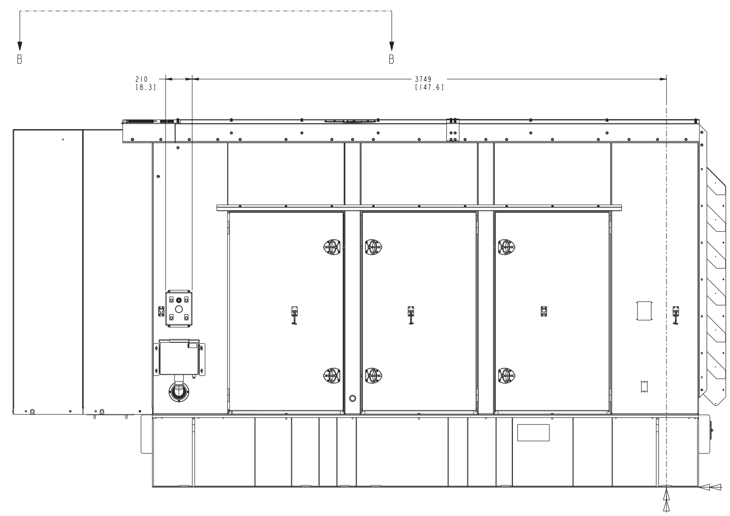
Alarm- High Fuel Level

TABULATION

TANK FEATURE CODE	TANK CAPACITY (GALLONS)	HEIGHT DIM "A"
C201	300	1013 [39.9]
C202	400	1064 [41.9]
C203	500	1121 [44.1]
C204	600	1191 [46.9]
C205	660	1235 [48.6]
C206	720	1280 [50.4]
C207	850	1368 [53.8]



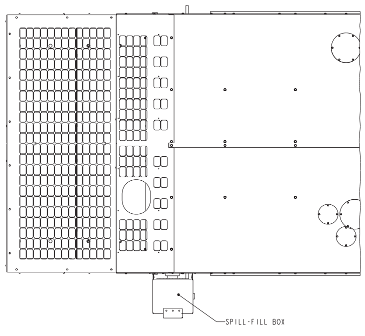




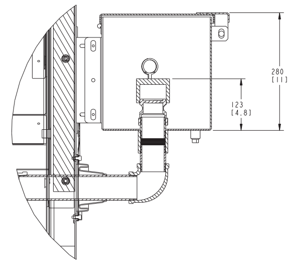
CUMMINS POWER GENERATION
OUTLINE, FUEL SYSTEM
A050L197
DFEJ,K
SCALE: 3/32
A.MARBHAL
K.KISHORE
05AUG14
CONFIDENTIAL
DO NOT SCALE PRINT

Drawing Name: A050L198 Revision: A
Part Name: A050L197 Revision: A
Sheet 1 of 2

REL NO	LTR	NO	REVISION	DWN	CKD	APVD	DATE
ECO-145369	A	1	PRODUCTION_RELEASE	AM	KK	K_KISHORE	05AUG14



VIEW B-B



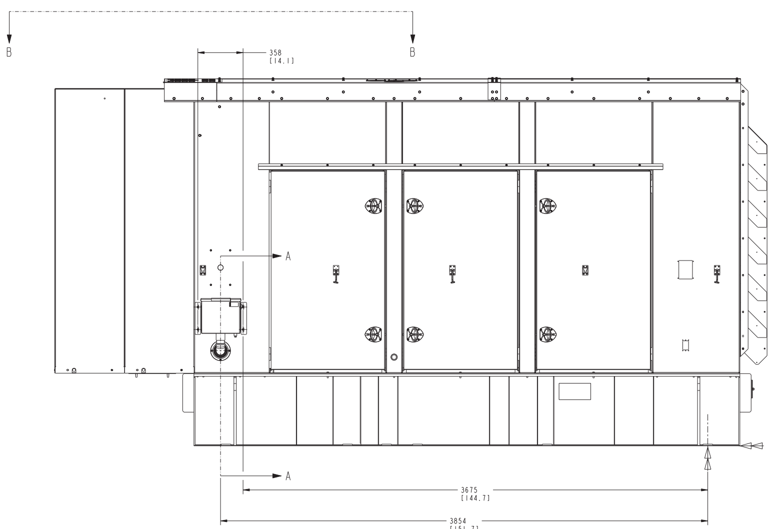
SECTION A-A
SCALE 5/16

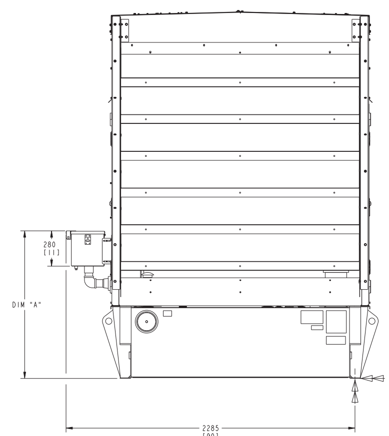
NOTES:

1. DIMENSIONS SHOWN IN [ ] ARE IN INCHES.
2. SEE FOUNDATION DRAWING FOR REFERENCE POINT LOCATION ( ).
3. THIS FUEL SYSTEM OUTLINE APPLIES TO GENSET MODELS DFEJ, DFEK, DQDAA, DQDAB, DQDAC AND DQHAB, FEATURE CODES C233 AND C234, KITS A049R699, A049R700, A049R701 AND A049R702

Fuel Fill/Spill Box

TABULATION		
TANK FEATURE CODE	TANK CAPACITY (GALLONS)	HEIGHT DIM "A"
C201	300	902.1 [35.5]
C202	400	953.1 [37.5]
C203	500	1010.1 [39.7]
C204	600	1080.1 [42.5]
C205	660	1124.1 [44.2]
C206	720	1169.1 [46]
C207	850	1257.1 [49.5]





UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS	SIM TO 0500-3916	DWN A_MARBHAL	CUMMINS POWER GENERATION
DIM: X ±1; .X ± 0.8; .XX± 0.38 / HOLE: 0.00- 4.99 +0.15/-0.08; 5.00- 9.99 +0.20/-0.10; 10.00-17.49 +0.25/-0.13; 17.50-24.99 +0.30/-0.13	DO NOT SCALE PRINT	CKD K_KISHORE	OUTLINE,FUEL SYSTEM
		APVD K_KISHORE	
		DATE 05AUG14	SITE CODE
ANG TOL: ± 1.0° SCALE: 3/32	- CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP	FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ASME Y14.5M-1994; FIRST USED ON DFEJ,K	PGF; DWG SIZE E; A050L145; SHEET 1 OF 1; DWG REV A

PTC® Creo® Parametric

Drawing Name: A050L146 Revision: A
Part Name: A050L145 Revision: A
Sheet 1 of 2

PTC® Creo® Parametric

REV NO	LTR	NO	REVISION	BY	CHK	APVD	DATE
ECO-145348	A	1	PRODUCTION RELEASE	CJF	KK	K KISHORE	24JUL14

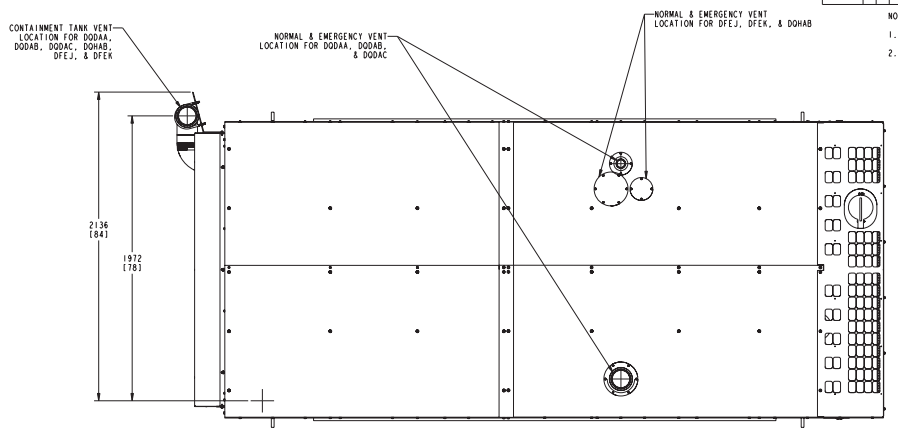
TABULATION (ALL DIMS ±25.4 [1])				
TANK FEATURE CODE	TANK CAPACITY (GALLONS)	HEIGHT DIM A	HEIGHT DIM B	HEIGHT DIM C
C201	300	3621.5 [142.6]	3523.9 [138.7]	3795.3 [149.4]
C202	400	3672.5 [144.6]	3574.9 [140.7]	3846.3 [151.4]
C203	500	3729.5 [146.8]	3631.9 [143]	3903.3 [153.7]
C204	600	3799.5 [149.6]	3701.9 [145.7]	3973.3 [156.4]
C205	660	3843.5 [151.3]	3745.9 [147.5]	4017.3 [158.2]
C206	720	3888.5 [153.1]	3790.9 [149.2]	4062.3 [159.9
C207	850	3976.5 [156.6]	3879.9 [152.8]	4150.3 [163.4]

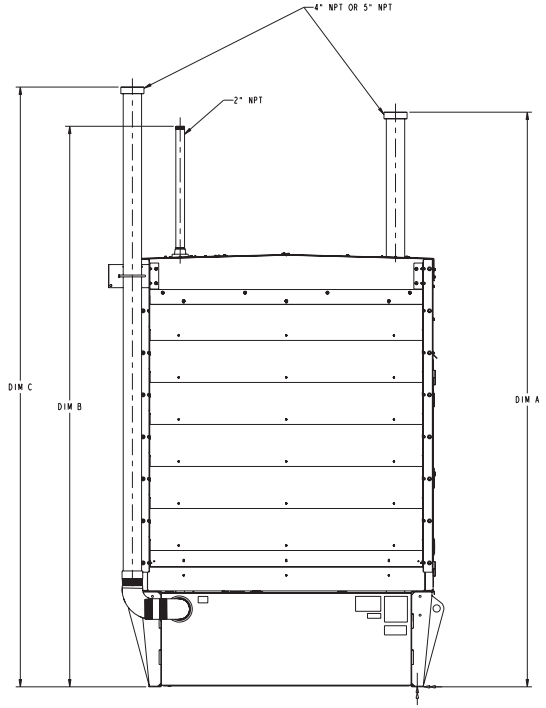
DFEJ, DFEK, DQDAA, DQDAB, DQDAC, DQHAB

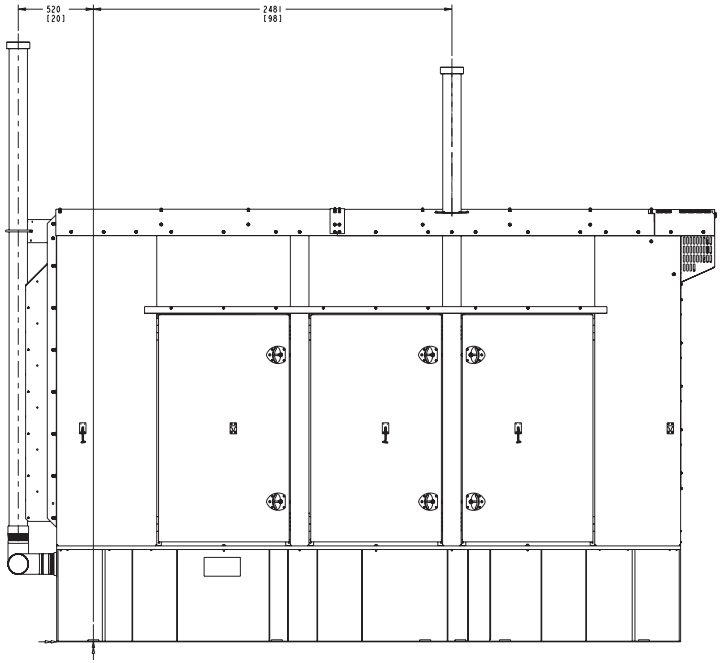
(C235 4") & (C243 5")

KITS: A049R703, A049R704

4" Fuel Vent Extention







NOTES:

1. DIMENSIONS IN [ ] ARE IN INCHES.
2. SEE FOUNDATION DRAWING FOR REFERENCE POINT LOCATION (⟷).

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS

X ±0.1	0.00 - 4.99 ±0.15/-0.08
.X ±0.8	5.00 - 9.99 ±0.20/-0.10
.XXX ±0.38	10.00-17.49 ±0.25/-0.13
	17.50-24.99 +0.30/-0.13

ANG TOL: ± 1.0° | SCALE: 3:32

DRW 0500-3917 | DO NOT SCALE PRINT

CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP

DRN	C FORNELL
CHK	K KISHORE
APVD	K KISHORE
DATE	24JUL14
TOP ASSEMBLY NO.	DFA-DFE

CUMMINS POWER GENERATION

OUTLINE, TANK

SITE CODE: PGF | SIZE: D | DWG NO: A050L754 | SHEET 1 of 1 | REV: A

Installation Accessory Section

Cummins Southern Plains, LLC
600 N. Watson Road
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PowerCommand® Annunciator Discrete Input or PCCNet

> Specification sheet

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Power Generation

Description

The Universal Annunciator Module provides visual and audible indication of up to 20 separate alarm or status conditions, based on discrete (relay) inputs or network inputs. Each LED can be controlled by either a discrete wire input or by a signal on the PCCNet network sent from an external device, such as a PCC1301 or PCC2100 (version 2.4 or later) control.

In addition to the LEDs, the annunciator can control four custom relays based on signals received over the PCCNet. When one of the annunciator's discrete inputs is activated, the annunciator will broadcast that information over the network. By taking advantage of the network, discrete inputs and custom relays, the annunciator can be used as expanded I/O for a genset controller.

Easily installed in a location to give immediate notification of an alarm or warning status. Designed to give operating/monitoring personnel quick-glance status information. The module directly senses battery voltage to provide green/yellow/red alarm and status information for that parameter.

Genset controller complies with NFPA level two requirements when used with the display but without the annunciator panel. When used with the annunciator it meets NFPA level one requirements (emergency and standby power systems). The annunciator module can also be used for monitoring of transfer switch or other equipment status.

Features

- Visual and audible warnings of up to 20 separate alarm or status conditions.
- LEDs can be controlled either via PCCNet or discrete input.
- Status of discrete inputs is broadcast on network.
- Four custom relays can be controlled over the PCCNet network.
- Configurable LED color (red, yellow or green) and selectable horn operation allows maximum flexibility.
- Standard NFPA 110 label, field configurable for other alarm status and conditions.
- Each audible alarm is annunciated, regardless of the number of existing alarm conditions displayed.
- Sealed membrane panel design provides environmental protection for internal components and is easy to clean.
- Configurable for negative (ground) input or positive input.
- Integral DC voltage sensing.
- Flush or surface mount provisions.
- UL Listed and labeled; CSA certified; CE marked.

S-1472e (8/09)

Specifications

Signal requirements

Positive - Input impedance is 1.82 kOhms to ground; maximum input voltage = 31 VDC.

Negative - Input impedance is 1.82 kOhms to Bat+: inputs are at Bat+ level when open.

Sink/source current threshold for detection - 150 uA minimum, 3 mA maximum.

Typical conductor size: 16 ga for 304.8 m (1000 ft)

Max conductor size for terminal: 12 ga

Relay outputs

0.2 A at 125 VAC and 1 A at 30 VDC

Network connections

Use Belden 9729 two pair, stranded, shielded 24 AWG twisted pair cable for all PCCNet connections. Total network length can not exceed 1219 m (4000 ft). Up to 20 nodes can be connected to the network.

Note: Any communications wire connected to the generator set should be stranded cable.

Power

Maximum consumption: 15 watts

Battery voltage

Functional range - Audible and visual conditions operational from 6.5 to 31 VDC.

Low voltage setting - 12.0 VDC for 12 Volt nominal systems; 24.0 for 24 Volt nominal systems.

High voltage setting - 16.0 Volt for 12 Volt nominal systems; 32.0 Volt for 24 Volt nominal systems.

Alarm horn

Sound level: 90 dB at 30 cm

Physical

Weight (with enclosure): 1.4 kg (3.0 lbs)

Temperature

-20 °C to +70 °C (-4 °F to +158 °F)

Humidity

10% to 95% RH (non-condensing)

Default lamp configurations

Can be configured for current NFPA 110 standard or as a replacement for Legacy (pre-2001) NFPA 110 annunciator (300-4510 or 300 4511)

		NFPA 110		
Lamp	Description	Color	Horn	Flash
DS1	Customer fault 1	Green	No	No
DS2	Customer fault 2	Amber	No	No
DS3	Customer fault 3	Red	No	No
DS4	Genset supplying load	Amber	No	No
DS5	Charger AC failure	Amber	Yes	No
DS6	Low coolant level	Amber	Yes	No
DS7	Low fuel level	Red	Yes	No
DS8	Check generator set	Amber	No	No
DS9	Not in auto	Red	Yes	Yes
DS10	Generator set running	Amber	No	No
DS11	High battery voltage	Amber	Yes	No
DS12	Low battery voltage	Red	Yes	No
DS13	Weak battery	Red	Yes	No
DS14	Fail to start	Red	Yes	No
DS15	Low coolant temp	Red	Yes	No
DS16	Pre-high engine temp	Amber	Yes	No
DS17	High engine temp	Red	Yes	No
DS18	Pre-low oil pressure	Red	Yes	No
DS19	Low oil pressure	Red	Yes	No
DS20	Overspeed	Red	Yes	No

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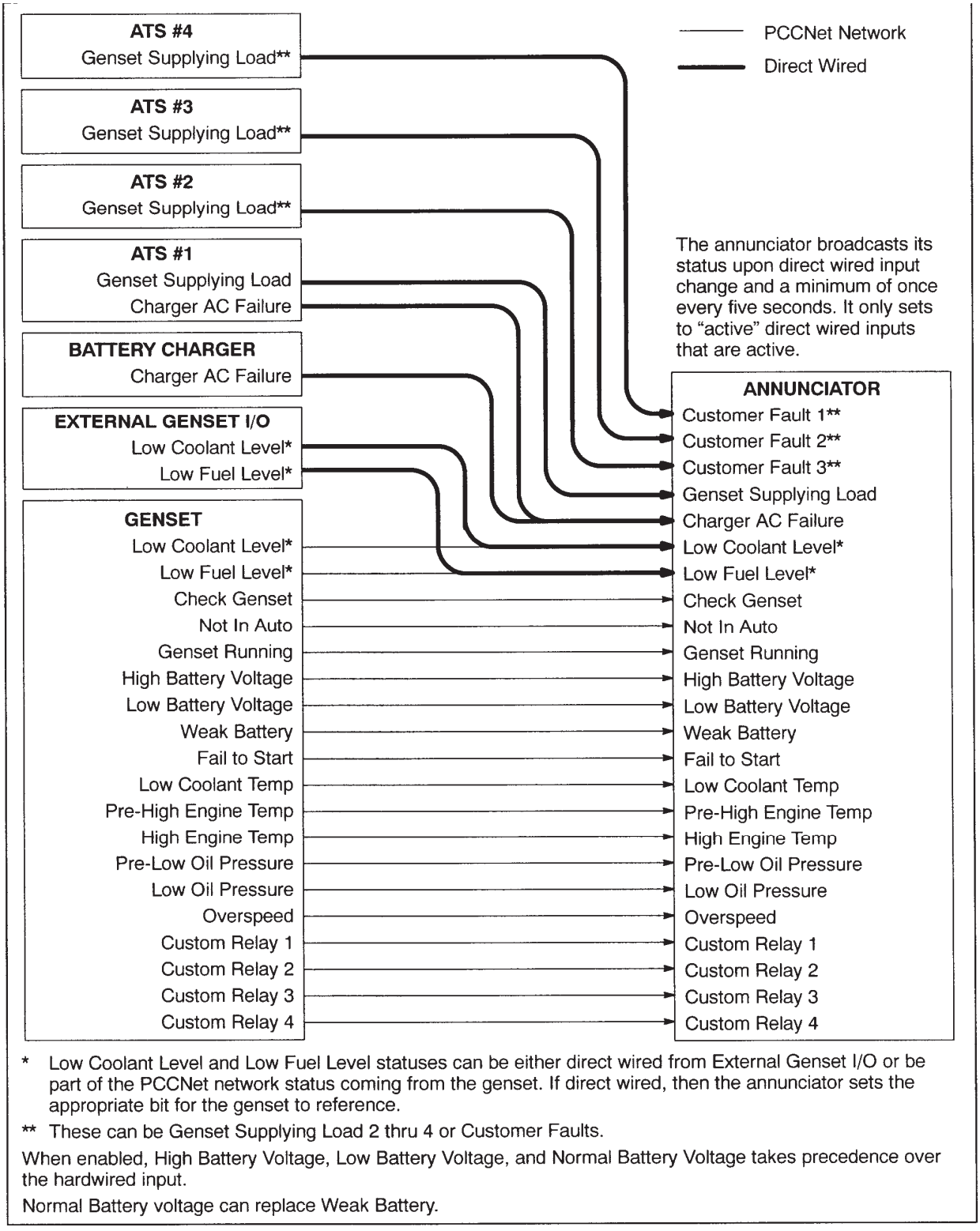
Typical installation



* Low Coolant Level and Low Fuel Level statuses can be either direct wired from External Genset I/O or be part of the PCCNet network status coming from the genset. If direct wired, then the annunciator sets the appropriate bit for the genset to reference.

** These can be Genset Supplying Load 2 thru 4 or Customer Faults.

When enabled, High Battery Voltage, Low Battery Voltage, and Normal Battery Voltage takes precedence over the hardwired input.

Normal Battery voltage can replace Weak Battery.

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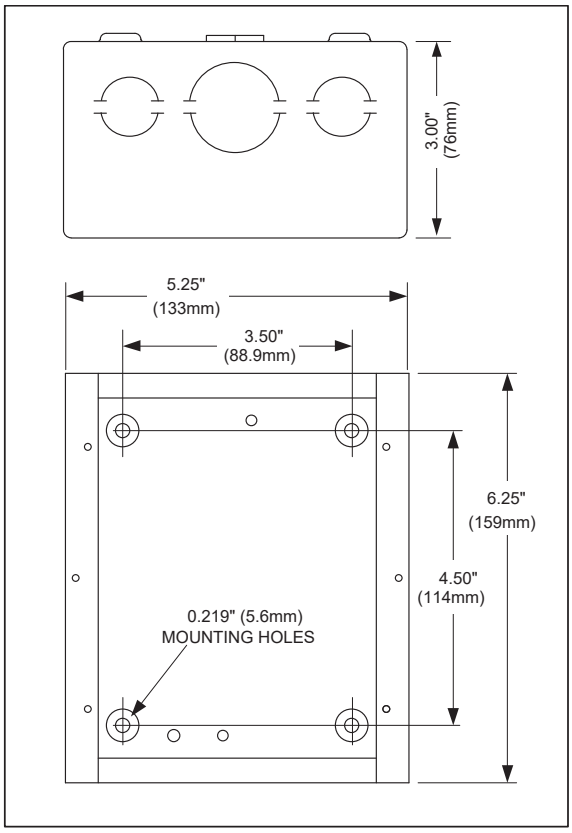
Dimensions



Dimensions: in (mm)

Ordering information

Part number	Description
0300-5929-01	Panel mount
0300-5929-02	Panel with enclosure

PCCNet COMPATIBLE

See your distributor for more information.

Cummins Power Generation

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Revision:	Drawn By:	Checked By:	Date:	Revision Description:
00	CRD	TJT	5-16-08	RELEASE PER ECO # 8072
01	CRD	TJT	6-20-08	RELEASE PER ECO # 8084
02	CRD	TJT	1-9-09	RELEASE PER ECO # 9003
03	CRD	TJT	9-30-09	RELEASE PER ECO # 9122
04	JAA	CRD	2-29-14	RELEASE PER ECO # 14019

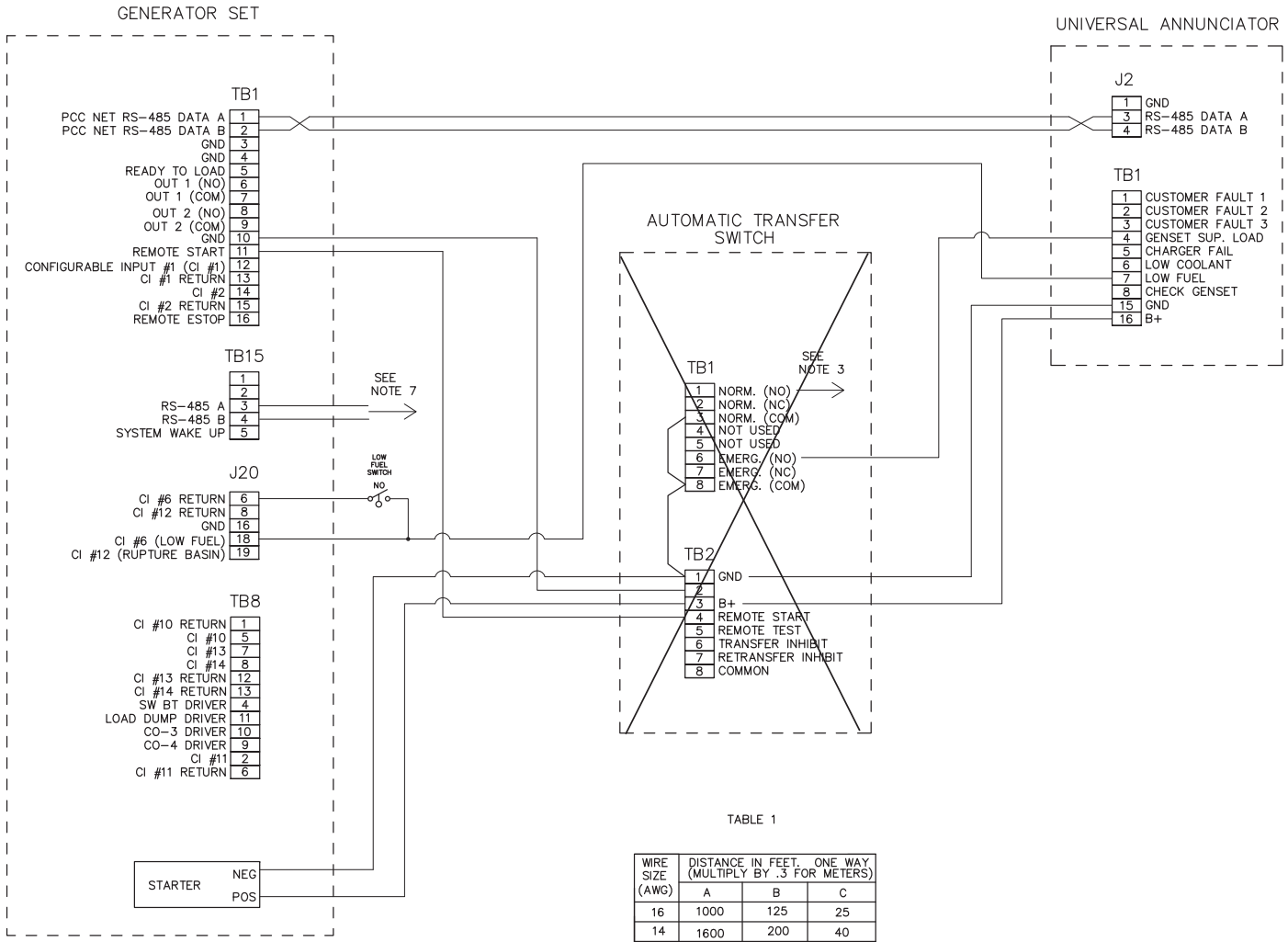

TABLE 1

WIRE SIZE (AWG)	DISTANCE IN FEET. ONE WAY (MULTIPLY BY .3 FOR METERS)		
	A	B	C
16	1000	125	25
14	1600	200	40
12	2400	300	60
10	4800	500	100

NOTES:

GENSET:
1. NETWORK DATA CONNECTIONS TO BE WIRED IN DAISY CHAIN FOR MULTIPLE ATS AND ALARM PANEL APPLICATIONS. USE BELDEN 9729 TWISTED PAIR. ANY COMMUNICATION WIRE CONNECTED TO GENSET MUST BE STRANDED CABLE.

2. BATTERY POSITIVE FROM CHARGER TO TERMINATE AT THE STARTER SOLENOID ON THE ENGINE, BATTERY NEGATIVE FROM CHARGER TO BE TERMINATED TO THE ENGINER BLOCK.

3. NORMAL UTILITY NOT REQUIRED BY NFPA 110. IF NORMAL POSITION REQUIRED, RUN A WIRE FROM TB1-1 ON THE ATS TO ANY OF THE CUSTOMER FAULT INPUTS ON THE ANNUNCIATOR, TB1-1,2,3.

4. REFER TO COLUMN "A" IN TABLE 1 FOR GENSET WIRING.

5. IF INSTALLING MULTPLE ATS'S AND ANNUNCIATORS, DAISY CHAIN GROUND AND B+ POWER CONNECTIONS.

6. REFER TO CPG DRAWING #620-0304 FOR MORE DETAIL.

7. MODBUS RS-485 CONNECTION FOR CUSTOMER DATA.

ATS:
1. TB1 PROVIDES DRY FORM C CONTACTS FOR TRANSFER SWITCH POSITION.

REFER TO CPG DRAWING #630-3440, PAGES 6 THROUGH 9 OF 18 FOR MORE DETAIL.

AUTOCAD

TOLERANCES
.X ±.1
.XX ±.06
.XXX ±.031
ANGULAR ±2°
WEIGHT ±5%
DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED

Cummins Southern Plains, LLC.
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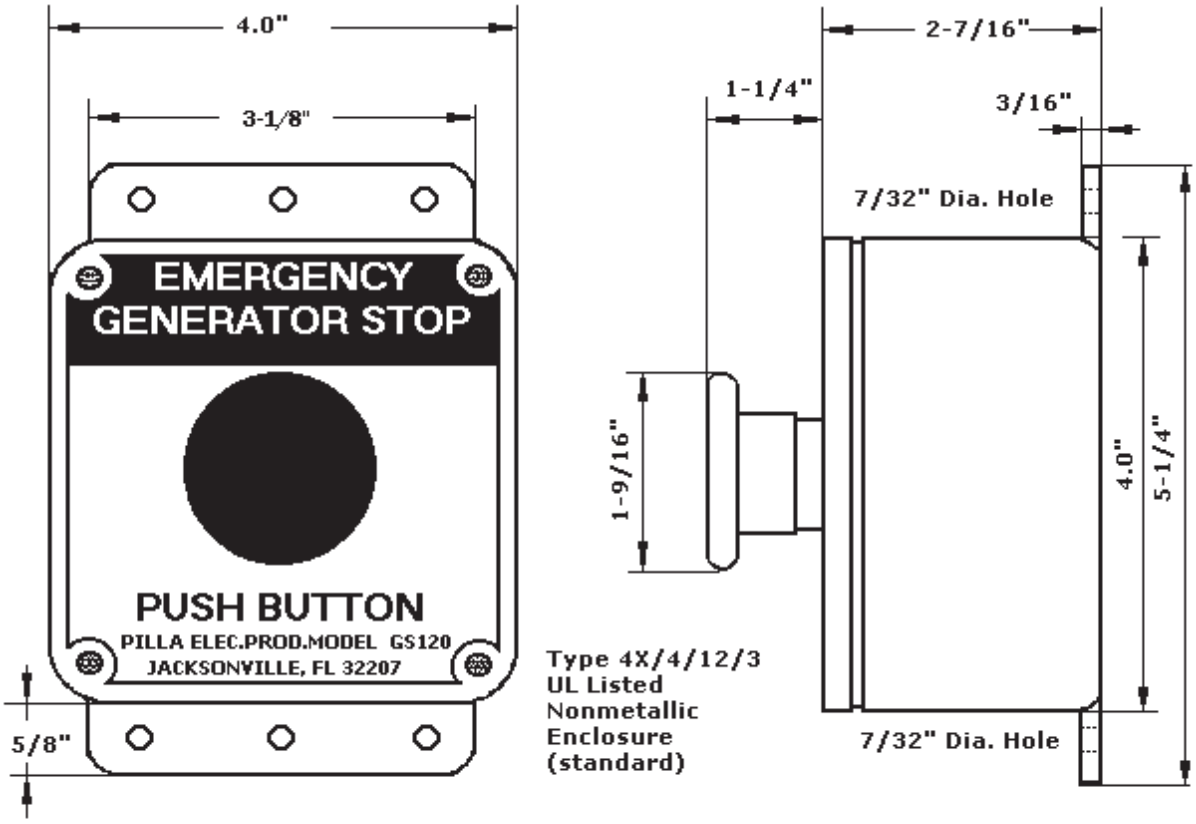
Arlington, TX 76011

Engine Model: XXXX
Weight (lbs):
Drawing Title: INTERCONNECT, PCC2300, PCC 2.2, PCCNET
Format: D
Scale: X/X
Drawing Number: E0159
Sheet: 1 OF 1



PILLA MODEL GS120 (Generator Stop) PUSH BUTTON STATION

Specification sheet

Battery charger-10 amp

~~A026H213 60Hz~~

A048G602 60Hz/50Hz

Description

Cummins Power Generation fully automatic battery chargers are constant voltage/constant current chargers incorporating a 4-stage charging algorithm. Designed for use in applications where battery life and reliability are important; these chargers, complete with built-in equalize charge capability, are ideal for stationary or portable starting battery charging service.

To achieve optimum battery life, a 4-stage charging cycle is implemented. The four charging stages are constant current, high-rate taper charge, finishing charge, and maintaining charge. During the constant current cycle the charger operates at maximum possible output in the fast charge mode. During the high-rate taper charge cycle the charger stays at fast charge voltage level until battery current acceptance falls to a portion of the chargers rated output. During the finishing charge cycle the charger operates at the float voltage and completes the battery charge. During the maintaining charge cycle the charger supplies only a few milliamps required by the battery to stay at peak capability.

An optional temperature sensor (A048N240) may be used to adjust charging voltage based on temperature of the battery. Use of a battery temperature sensor helps to increase battery life by preventing over or under charging. The battery temperature sensor also protects the battery from overheating. Temperature compensation is recommended in all applications, but is particularly valuable for generator sets in outdoor applications.

Battery chargers are field-configurable for charging either 12 or 24 VDC battery systems at 60 Hz operation. Simple jumper selectors enable selection of output voltage and battery type.

Features

Protection – Surge protected to IEEE and EN standards. All models include single pole cartridge type fuses mounted on the printed circuit board to protect against input or output overcurrent.

Easy installation – Clearly marked terminal blocks and panel knockouts provide convenient connections of input and output leads.

User display – Output voltage and current, fault information and status are indicated on the front panel. Includes precision ammeter and voltmeter.

Monitoring – Status LED indicators are provided to show the condition of the charger. LED's on the right side of the monitor indicate operational functions for Temperature Compensation active (Green), AC on (Green), Float (Green) or Boost (Amber) mode, as well as Battery Fault (Red). LED's on the left side of the monitor illuminate (in Red) when Charger fail, High or Low VDC or AC fail occur.

Adjustable float voltage – Float voltage can be set, using easy to understand jumpers, for optimum battery performance and life.

Construction – NEMA-1 (IP20) corrosion resistant aluminum enclosure designed for wall mounting.

Faults – The charger senses and annunciates the following fault conditions: AC power loss, battery overvoltage, battery undervoltage, battery fault conditions and charger failure. Includes an individual 30 volt/2 amp isolated contact for each alarm.

Vibration resistant design – complies with UL991 class B vibration resistance requirements.

Listed – C-UL listed to UL 1236 CSA standard 22.2 no 107.2-M89. Suited for flooded and AGM lead acid and NiCd batteries in generator set installations.

Warranty – 5 year CPG warranty.

Specifications

Performance and physical characteristics

Output:	Nominal voltage	12 or 24 VDC
	Float voltage – 12 V batteries	12.87, 13.08, 13.31, 13.50, 13.62, 14.30
	Float voltage – 24 V batteries	25.74, 26.16, 26.62, 27.00, 27.24, 28.60
	Equalize-voltage	6.5% above float voltage sensing
	Output voltage regulation	±0.5% (1/2%) line and load regulation
	Maximum output current	10 A @ 12 VDC nom or 10 A @ 24 VDC
	Equalize charging	Battery interactive autoboost
Input:	Voltage AC	120, 208, 240 ±10%
	Frequency	60 Hz ±5% Part Number A026H213 60/50 Hz ±5% Part Number A048G602
Approximate net weight:		25 lbs (11.36 Kg)
Approximate dimensions: height x width x depth-in(mm)		12.5 x 7.7 x 6.5 (318 x 195 x 165)
Ambient temperature operation: At full rated output		- 4 ˚F to 104 ˚F (-20 ˚C to 45 ˚C)

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10 Toh Guan Road #07-01
TT International Tradepark
Singapore 608838
Phone 65 6417 2388
Fax 65 6417 2399

Warning: Back feed to a utility system can cause electrocution and/or property damage. Do not connect generator sets to any building electrical system except through an approved device or after building main switch is open.

Warning: For professional use only. Must be installed by a qualified service technician. Improper installation presents hazards of electrical shock and improper operation, resulting in severe personal injury and/or property damage.

Cummins Power Generation

SECTION 26 41 13.13
LIGHTNING PROTECTION SYSTEM FOR LOW RISE BUILDING

PART 1 – GENERAL

1.01 GENERAL

A. The General Conditions, Supplementary General Conditions, Division 1 and the Section entitled "Electrical Work - General Requirements" apply to all work herein.

B. Objective: To provide safety for the building and occupants by preventing damage to building structure caused by lightning.

1.02 STANDARDS

A. The following specifications and standards of the latest issue form a part of this specification:

1. Lightning Protection Institute
   Installation Standard, LPI 175
2. Underwriters Laboratories, Inc.
   Installation Requirements, UL96A
3. National Electrical Code (NEC)
4. National Fire Protection Association
   Lightning Protection Code, NFPA 780
5. U.S. Bureau of Standards

1.03 SCOPE

A. The work covered in this section of the specifications consists of furnishing all labor, materials, and items of service required for the completion of a functional and unobtrusive lightning protection system as approved by the engineer, and in strict accordance with this section of the specifications and the applicable Contract Drawings. Provide Class I materials.

B. If any departure from the Contract Drawings or submittal drawings covered below are deemed necessary by the Contractor, details of such departures and reasons therefore shall be submitted as soon as practical to the engineer for approval.

1.04 QUALITY ASSURANCE

A. The lightning protection system shall conform to the requirements and standards for lightning protection systems of the LPI, UL, NFPA and NEC. Upon completion, application shall be made to the Underwriters Laboratories, Inc. for inspection and certification. In addition, the Lightning Protection Institute certified system certificate shall be issued and delivered to the owner ensuring that the concealed components have also been monitored during job progress.

B. The system to be furnished under this specification shall be the standard product of manufacturers regularly engaged in the production of lightning protection equipment and shall be the manufacturer's latest approved design. The equipment shall be UL listed and properly UL labeled.

1.05 QUALIFIED MANUFACTURERS:

A. Bonded Lightning Protection Systems, Inc. – Dallas

B. Advanced Lightning Technology - Dallas

C. Thompson Lightning Protection - Minnesota

D. Harger Lightning Protection - Illinois

E. East Coast Lightning Equipment – Connecticut

1.06 SUBMITTALS

A. Complete shop drawings showing the type, size and locations of all grounding, down conductors, through-wall assemblies, roof conductors and air terminals shall be submitted to the engineer for approval.

PART 2 - PRODUCTS

2.01 LIGHTNING PROTECTION EQUIPMENT: All materials shall be copper and bronze and of the size, weight and construction to suit the application and used in accordance with LPI, UL, NEC and NFPA. Class I sized components are required for roof levels not exceeding 75 feet in height. Bolt-type connectors and splicers shall be utilized on Class I structures. Pressure squeeze clamps are not acceptable. All mounting hardware on the roof shall be stainless steel and on the facade shall be brass and/or copper.

2.02 MATERIALS:

A. All materials on the roof shall be copper as manufactured by Thompson Lightning Protection, Inc., Minneapolis, Minn., or approved equal, and shall be approved by the Underwriters' Laboratories, Inc. All down conductors shall be copper. All anchors on down conductors shall be Thompson #169 Loop Masonry Anchors which includes 1/4"-20 Pak-tite masonry anchors and 1/4" x 3/4" brass machine screws (no exceptions).

B. STANDARD: All equipment used in this installation shall be UL listed and properly UL labeled. All equipment shall be new, and of a design and construction to suit the application where it is used in accordance with accepted industry standards and LPI, UL, NFPA and NEC code requirements.

C. All roof-mounted and downlead conductors shall be Thompson No. 29X "Century rope lay copper with a minimum of 29 strand, 17 gauge heavy duty copper (99.97% pure), and shall be stranded cable weighing not less than 190 lbs. per 1000 feet, with 3/8” diameter.

D. Air terminals shall be nickel-tipped copper, having a copper base. Air terminals shall be spaced not more than twenty feet apart. Provide flathead air terminals on the roof in areas where accidental implement may occur.

PART 3 – INSTALLATION

3.01 INSTALLATION

A. The installation shall be accomplished by an experienced installation company that is UL listed, a member of the Lightning Protection Institute, United Lightning Protection Association qualified, and an employer of Certified Master Installers of lightning protection systems. A Certified Master Installer shall directly supervise the work.

B. All equipment shall be installed in a neat, workmanlike manner. The system shall consist of a complete conductor network at the roof and include air terminals, connectors, splicers, bonds, copper down leads and proper ground terminals.

C. Copper downlead cables shall be utilized. No penetration shall be made in the roof membrane.

D. Provide 20% spare air terminals to owner for replacement stock.

E. Where conductors are run in conduit for protection, the conductor shall be bonded to the entrance and exit point of the conduit by bonding wedges or approved methods to maintain electrical continuity.

F. Down conductors shall be attached to ground devices in accordance with the specific provisions of the Underwriters' Laboratories, Inc., Code. All-down conductors shall be concealed. Any exposed conductors shall be approved by Architect.

G. All metals of conductance within six feet of the lightning protection system shall be securely bonded and made a part thereof. Where stack or chimney is present, lead covered non-corrosive air

terminals and conductors shall be used. Metal water pipes extending into the ground may be rated as best in ground virtue and should be made an integral part of the grounding system.

3.02 COORDINATION

A. The lightning protection installer will work with any other trades present to insure a correct, neat and unobtrusive installation.

B. It shall be the responsibility of the lightning protection installer to assure a solid bond to the main water service and to assure interconnection with other ground systems.

3.03 COMPLETION

A. Upon completion of the installation, the lightning protection installer shall secure and deliver to the owner the Underwriters Laboratories, Inc. Master Label certification and the Lightning Protection Institute Certified System certification. The system will not be accepted without the UL Master Label plate and the LPI certification certificate.

END OF SECTION

SECTION 26 43 13
SURGE PROTECTIVE DEVICE – SERVICE ENTRANCE

PART 1 - GENERAL

1.1 SCOPE

A. Provide electrical and mechanical requirements for a modular high-energy surge protective device system (SPD). The system shall provide effective high energy surge current diversion and be suitable for application in ANSI/IEEE C62.41 Category A, B and C3 environments, as tested by ANSI/IEEE C62.11, C62.45.

B. The system shall be constructed using multiple surge current diversion modules utilizing metal oxide varistors (MOV) computer matched to +/- 1 volt variance and tested for manufacturer's defects. The modules shall be designed and constructed in a manner that ensures surge current sharing. Use of gas tubes or silicon avalanche diodes are unacceptable.

1.2 STANDARDS

A. The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards:

Canadian Standards Association (CSA)
American National Standards Institute and
Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.11, C62.41, C62.45)
Institute of Electrical and Electronic Engineers 1100 Emerald Book
Federal Information Processing Standards Publication 94 (FIBS PUB 94)
National Electrical Manufacturer Association (NEMA LS-1 1992)
National Fire Protection Association (NFPA 20, 75 and 780)
National Electric Code NFPA 70
Underwriters Laboratories (UL 1449 and UL 1283) (Third Edition 2006)
Revisions (June 1, 2009)
International Electrotechnical Commission (IEC 801)
International Standards Organization(ISO) Company certified ISO 9001 for manufacturing, design and service
EMC Directive 89/336/EEC - CE compliant

B. The systems individual units shall be UL Listed and labeled under UL 1449 (Third Edition) Standard for Surge Protection Device type 1 nominal discharge current of 20kA and the surge ratings shall be permanently affixed to the SPD. The units shall also be listed and labeled to UL1283 for type 2 locations Standard for Electromagnetic Interference Filters, and CSA Listed.

1.3 ACCEPTABLE MANUFACTURERS

A. Emerson - Liebert Corporation

B. Thomas & Betts – Current Technology

1.4 SUBMITTALS

A. Shop drawings shall include, but not be limited to:

1. Cutsheets of surge protection devices with ratings, physical dimensions and all accessories clearly labeled.
2. Device labels shall be clearly indicated in cutsheets.
3. All standards and listings, as specified in section 1.2A-B, shall be clearly labeled in cutsheets provided.
4. Cutsheets shall clearly outline that design requirements of this specification have been met.

1.5 QUALITY ASSURANCE

A. The manufacturer shall be ISO 9001 certified. The specified system shall be tested at the component and fully assembled level, under surge conditions with AC power applied for a minimum of 1 hour. Testing shall include but not be limited to quality control checks, dielectric voltage withstand test per UL and CSA requirements, UL ground continuity tests and operational and calibration tests.

B. The unit shall be designed and manufactured in the USA by a qualified manufacturer of line conditioning equipment and Active Tracking Filters. The manufacturer shall have been engaged in the design and manufacture of such products for a minimum of 10 years.

PART 2 - PRODUCTS

2.1 ENCLOSURE

A. The specified system shall be provided in a heavy duty NEMA 4 dust-tight, drip-tight enclosure with no ventilation openings. The cover of the enclosure shall be hinged on the left side and require a tool for access to internal components. A drawing pocket shall be provided inside the door for storage of unit drawings and installation/operation manual. All monitoring indication must be visible without opening the door. The enclosure maximum dimensions shall be (20) inches/(508) millimeters high, (16) inches/(406) millimeters wide and (8) inches/(203) millimeters deep.

2.2 OVERCURRENT PROTECTION (FUSING)

A. All suppression components shall be individually fused and rated to allow maximum specified surge current capacity. For every 100 k Amps of Surge Current Capacity, 120 amps RMS of internal, integral fusing shall be required. Devices that utilize a single fuse to protect two or more suppression paths are not accepted.

Individual surge components shall be sand packed and fused at a maximum of 17.2 amps to prevent violent failure. The fusing shall be UL listed to be capable of interrupting up to 200kA symmetrical fault current with 480VAC applied. Replaceable fusing is unacceptable. Overcurrent protection that limits specified surge currents is not acceptable.

2.3 DESIGN REQUIREMENTS

A. Protection Modes

The SPD shall provide protection as follows: All modes, L-N or L-L, L-G and N-G (where applicable) Note: L = Line, G = Ground, N = Neutral

B. UL 1449 Ratings

The maximum UL 1449 listed surge ratings for each and/or all of the specified protection modes shall not exceed the following:

System voltage	Voltage Protection Rating			
	L-N	L-G	N-G	L-L
120/240	700 volts	700 volts	700 volts	1000 volts
120/208	700 volts	700 volts	700 volts	1000 volts
240		1200 volts		1000 volts
277/480	1000 volts	1000 volts	1200 volts	1800 volts
480		1800 volts		1800 volts

C. Noise Attenuation

The unit shall be UL 1283 Listed as an electromagnetic interference filter for type 2 locations. The filter shall provide 41dB at 100kHz, 31dB at 1MHz, 35dB at 10MHz, 53dB at 100MHz, per 50 Ohm Insertion Loss Methodology from MIL 220A. The system shall provide up to 120-dB insertion loss from 100 kHz to 100 MHz when used in a coordinated facility system.

D. Life Cycle Testing

The SPD system shall be duty life cycle tested to survive, 10kA (8x20μs), 20kV (1.2x50μs), IEEE C62.41 Category C surge current with less than 5% degradation of clamping voltage. The minimum numbers of surges the unit shall be able to protect against are:

Model Surge Rating	Number of Life Cycle Surges			
	Per Mode			*Per Phase*
	L-N	L-G	N-G	(L-N + L-G)
125kA per phase	15000	15000	15000	30000
160kA per phase	30000	30000	30000	60000

2.4 CONNECTIONS

A. The terminals shall be provided to accommodate wire sizes up to #2 AWG.

2.5 INTERNAL CONNECTIONS AND SERVICEABILITY

A. All surge current diversion module intra-unit connections shall be by way of low impedance copper plates. Surge current diversion modules shall use bolted connections to the plates for reliable, low impedance connections. The system shall be designed for simple change out of any or all SPD component modules by a qualified electrician. Designs that require factory service are not acceptable. All connections, conductors and terminals must be appropriately sized for specified surge current capacity.

2.6 STANDARD FEATURES

A. Component Testing and Monitoring
The monitoring circuitry must continually verify the protection status during operation, and display this information on the front cover status panel. The SPD must also contain a built-in-test circuit that will verify the integrity of all fuse links and each associated MOV. The built-in-test circuit must cycle through all phase banks and the neutral-ground bank sending test signals to all modules. The integrity of all fuses in test must be indicted on the status panel. All testing must be able to be performed without disconnecting power to the SPD. Units that require external test sets or equipment are unacceptable.

B. Unit Status Indicators:
Red and green solid state indicators with printed labels shall be provided on the hinged front cover to redundantly indicate on-line unit status. The absence of the green light and the presence of the red light shall reliably indicate that surge protection is reduced and service is needed to restore full operation.

C. Surge Counter:
Provide 7 digit surge counter to total transient voltage surges.

D. Dry Contacts for remote monitoring:

Electrically isolated Form C dry contacts, one normally open and one normally closed set standard on all units for remote monitoring.

E. Undervoltage detection:

Unit shall be equipped with 70% undervoltage detection capability.

F. Phase Loss Monitoring:

Unit shall be equipped with phase loss monitoring.

G. Power Loss Monitoring:

H. Unit shall be equipped with power loss monitoring.

2.7 ENVIRONMENTAL REQUIREMENTS

A.	Storage Temperature:	-55 to +85 C (-67 to +187 F)
B.	Operating Temperature:	-40 to +60 C (-40 to 140 F)
C.	Relative Humidity:	0% to 95%
D.	Audible Noise:	less than 45 dBa at 5 feet (1.5 m).
E.	Operating Altitude:	0 to 18,000 feet above sea level.

2.8 WARRANTY

A. The manufacturer shall provide a full 10 year parts and 5 year on site labor warranty from date of shipment against any part failure when installed in compliance with manufacturer's written instructions, UL Listing requirements and any applicable national, state or local electrical codes. Direct, factory trained, ISO 9001 certified employees must be available for 48 hour assessment. A 24 hour 800 number must be available to support warranty.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The contractor shall install the parallel SPD with short and straight conductors as practically possible. Locate adjacent to the switchboard or panel it is serving. The contractor shall twist the SPD input conductors together to reduce input conductor inductance. The contractor shall follow the SPD manufacturer's recommended installation practices as found in the installation, operation and maintenance manual and comply with all applicable codes. Note, when TVSS location is more than 5 feet from switchboard/panel it is protecting connection shall be made using Liebert Accuguide cables.

END OF SECTION

SECTION 26 51 00
LIGHTING FIXTURES

PART 1 - GENERAL

1.1 SCOPE

A. Furnish and install general and emergency lighting fixtures as noted on the drawings. Fixtures shall be completely wired with lamps installed and shall be in perfect operating condition at the time of substantial completion.

B. The types of lighting fixtures required for this project include:

1. Fluorescent
2. Incandescent and
3. High-Intensity-Discharge (HID)
4. LED

1.2 STANDARDS

A. All fixtures shall conform to all applicable UL standards and shall be UL label including damp and wet location ratings.

B. All fluorescent ballast shall comply with certified ballast manufacture (CBM) standard and CBM labeled.

C. NFPA 101

D. ANSI C82.1

E. NEMA-LE

F. IEEE Publication 587 Category "A" (Electronic Ballast)

G. All LED drivers shall be UL recognized Class 2 per UL1310 or non-Class 2 per UL 1012 as applicable.

H. All LED drivers shall comply with applicable requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 15, for Non-Consumer Equipment.

I. All LED drivers shall be RoHS compliant.

J. TM-21

K. LM-80

L. LM-79

M. L70

N. DLC

1.3 ACCEPTABLE MANUFACTURERS

A. Provide lighting fixtures produced by manufacturers as shown and scheduled.

B. BALLAST:

1. Provide one of the following manufacturers
   a. Advance Transformer Company
   b. Universal Lighting Technologies
   c. Osram Sylvania

C. LAMPS:

1. Provide one of the following manufacturers
   a. General Electric Company
   b. Osram Sylvania
   c. North American Philips

1.4 SUBMITTALS

A. Shop drawings shall include a brochure with a separate cut sheet for each fixture type arranged in alphabetical order with fixture and all accessories/options clearly labeled. Provide performance data for each fixture. Provide an independent test lab report for each fixture if requested by the Architect/Engineer.

B. Provide ballast and lamp data brochures indicating which lamp and ballast (if required) will be used in each fixture type.

C. Furnish air handling and heat removal data for light fixtures specified with these requirements.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:

1. National Electrical Code.
2. Local, municipal, or state codes that have jurisdiction.
3. UL fire resistance directory.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. General:

Provide the size, type and rating of each light fixture shown and scheduled. All light fixtures shall complete with reflectors, lens, trim rings, flanges, lamps, lamp holders, ballast, starters, fuses, wiring, earthquake clips, etc. to provide a complete functioning light fixture.

B. Lighting Fixture Types:

1. Fluorescent Fixtures
   a. Fixture ballast and lamp holders shall be pre-wired and installed. Fixture shall be equipped with a top access plate with knockouts for conduit entry. Fixture shall also include knockouts at each end plate for conduit entry.
   b. Provide disconnect switch as required by the 2008 National Electrical Code.
   c. Fixtures shall be cold roll steel finished using a multistage iron phosphate pretreatment to ensure maximum bonding and rust inhibitor. Finish shall be a lighting grade, baked white enamel finish with a minimum reflectance of 85%.
   d. Door frame shall be heavy gauge flush white steel or aluminum and hinged from one side and use a positive spring action latch on the other side for latching.
   e. Any lamp shall be easily replaced without removing another lamp.
   f. Fixtures installed in continuous rows shall utilize nipples or other accessories such as snap together plug in connectors supplied by the fixture manufacturer.
   g. Provide battery ballast for emergency light fixtures.
2. Incandescent Fixtures
   a. Fixtures shall be pre-wired equipped with frame in kit and an integral thermal protection required by UL for recessed fixtures.
   b. Provide appropriate trim rings for recessed mounted fixtures compatible with the ceiling in which the fixture is installed.
   c. All lamps shall be inside frosted unless otherwise noted or scheduled.
3. High Intensity Discharge Fixtures (HID)
   a. Fixtures shall be pre-wired with frame-in kit and integral thermal protection

required by UL for recessed fixtures. Ballast shall be encased and potted and mounted on the frame-in kit.

b. Provide remote ballast mounted on a separate mounting plate where indicated or scheduled. Ballast shall include a splice box.

c. Provide a heat resistant glass shield below the lamp to contain lamp glass envelope and ARC tube to prevent them from falling to the floor and causing damage to life and property. Lamp rated for open fixtures may be used in lieu of glass shield if approved by the engineer.

d. Provide a fuse and fuse holder installed on the line side of each ballast to prevent branch circuit from tripping due to faulty ballast. The fuse and fuse holder shall be mounted in a junction box for recessed fixtures and in the base of all poles. The fuse holder shall be waterproof when installed in damp or wet locations. Fuse size and type shall be as recommended by ballast manufacturer.

4. LED Fixtures

a. Fixtures shall be pre-wired with frame-in kit and integral thermal protection required by UL for recessed fixtures. Driver shall be encased in metal-can construction for optimal thermal performance.

b. Total fixture lumen output is dependent on the chip, thermal management, driver current and optical system. LED fixtures shall be tested as a complete unit or system. Only DOE recognized CALiPER testing laboratory results shall be utilized.

c. LED fixtures shall have integral common mode and differential mode surge protection of 3kV(1.2/50μs, 2 ohm combination wave).

5. Exit signs

a. Exit signs shall meet all federal, state and local codes.

b. Provide fire alarm interface relay when required to flash exit signs.

c. Provide battery packs for emergency operation when not connected to emergency generator power.

2.2 BALLASTS AND DRIVERS - COORDINATE WITH LIGHT FIXTURE SCHEDULE

A. Fluorescent

1. Program start electronic ballast shall be high power factor 98% minimum), operate lamp at 40 KHz, less than 10% total harmonic content, normal ballast factor 50,000 switching cycles, universal voltage, crest factor less than 1.7, multi-lamp, class “P” thermally protected, sound “A” rating, encased and potted and 0°F minimum starting temperature. Provide 5 year warranty parts and labor. Ballast shall be Osram Sylvania PSN Series or approved equal by Universal Lighting Technologies or Advance Transformer Company.

2. All outdoor ballast unless otherwise noted shall be high power factor, rapid start, class P thermally protected, encased and potted, sound rating B and a 0ºF temperature rating. Ballast shall be CBM certified by an ETL and UL approved.

3. Provide suitable dimming ballast where indicated.

4. Compact fluorescent ballast shall be electronic, shall have circuitry designed to shut down the system reliably and safely when lamps have reached their end of life, high power factor, sound rating “A” and UL approved. Provide 5-year warranty, parts and labor.

B. HID

1. Provide high power factor, constant wattage auto-transformer with a -20 degree F temperature rating. Ballast shall have a sound rating of “B” for lamps less than 400 watts. Ballast for recessed downlights or located remotely shall be encased and potted and shall be provided with a splice box. Provide 120 volt tap for auxiliary lamp when specified.

C. LED

1. Driver manufacturer shall have a 10-year history producing electronic drivers for the North American market.

2. Driver shall carry a five year limited warranty from date of manufacture against defects in material or workmanship (including replacement) for operation at a maximum case temperature of 80 degrees Celsius.

3. Drivers shall not contain any Polychlorinated Biphenyl (PCB).

4. Provide driver with integral color-coded leads.
5. Driver shall operate from 50/60 Hz input source of 120 Volt through 277 Volt or 347 Volt through 480 Volt with sustained variations of +/- 10% (voltage) with no damage to the driver.
6. Driver output shall be regulated to +/- 5% across published load range. And shall have a power factor greater than .90 for primary application to 50% of full load rating with an input current Total Harmonic Distortion (THD) of less than 20% to 50% of full load rating.
7. Provide drivers with a Class A sound rating.
8. Provide LED drivers for outdoor fixtures with a minimum operating temperature of -40 degrees Celsius (-40 F). Provide LED drivers for indoor fixtures with a minimum operating temperature of -20 degrees Celsius (-2F).
9. Drivers shall tolerate sustained open circuit and short circuit output conditions without fail and auto-resetting without need for external fuses or trip devices.
10. Driver output ripple current shall be less than 15% measured peak-to-average, with ripple frequency being greater than 100Hz.
11. Driver performance requirements shall be met when operated to 50% of full load rating.
12. Driver shall have integral thermal foldback to reduce driver power above rated case temperature to protect the driver if temperatures reach unacceptable levels.
13. Drivers shall comply with NEMA 410 for in-rush current limits.
14. Dimmable drivers shall be controlled by a Class 2 low voltage 0-10VDC controller with dimming range controlled between 1 and 8VDC with source current 150µA.

2.3 LAMPS – COORDINATE WITH LIGHT FIXTURE SCHEDULE

A. Extended life F032 T8 Fluorescent lamps shall be 40,000 hours 3,500°K, 32 watt and low mercury. Life rating is based on 3 hours/start using programmed start ballast.

B. All incandescent lamps shall be inside frosted, extended life rated for 2500 hours unless otherwise noted. 130 volt lamps may be used to provide extended life.

C. All HID lamps shall be base up, base down, horizontal, or universal burn as indicated or specified.

D. All compact fluorescent (T5 and smaller diameter) lamps shall be 3500ºK and 4-pin

2.4 EMERGENCY FLUORESCENT BATTERY BALLAST

A. Provide Bodine #B50ST Emergency Battery with self-test for emergency light fixtures using T8 or T12 lamps in 9 or 10 foot ceiling.

B. Provide Bodine #B30ST Emergency Battery with self-test for emergency light fixtures using T8 lamps in ceiling heights greater than 12 feet.

C. Provide Bodine #B84CST Emergency Battery with self-test for emergency light fixtures using compact fluorescent lamps.

D. Provide unswitched hot leg. Hot leg shall originate from the same branch circuit as required in NEC article 700.12 (F).

2.5 SPARE LAMPS

A. Provide 5% spare lamps, minimum of 3 of each type.

B. Ship lamps to the Owner in original cartons (loose lamps are not acceptable).

PART 3 - EXECUTION

3.1 INSTALLATIONS

A. General

1. Install the type of light fixture where shown and indicated in accordance with manufacturer's written instructions.
2. Provide earthquake clips on all recessed lay-in light fixtures as required by building code.
3. Adjust all adjustable light fixtures, as directed by the Architect.
4. Provide safety chains and wire guards for light fixtures located in gymnasium, multi-purpose rooms, play areas, etc.

B. Coordination

1. The contractor shall verify the type of fixtures with the ceiling types as indicated on the drawings. Any discrepancies shall immediately be brought to the architect's attention before the contractor places his order and accepts delivery. Fixtures shall fit exact in the type of ceiling scheduled. Provide plaster frames, trim rings and other accessories required for a correct fit.
2. Provide supports attached to structural member to support fixtures when the ceiling system cannot maintain support. Provide separate supports for all recessed ceiling mounted HID fixtures.
3. Refer to architectural reflected ceiling plan for the exact location of all light fixtures. Notify the architect for any discrepancies or conflicts with structural, architectural, mechanical piping or ductwork before installation.

C. Mounting

1. Provide support channels to support outlet boxes used support surface mounted light fixtures such as exit signs or downlights.
2. Pendant or surface mounted fixture shall be provided with required mounting devices and accessories, including hickeys and stud-extensions, ball-aligners, canopies and stems. Locations of fixtures in mechanical areas shall be coordinated with mechanical contractor. Mounting stems of pendant fixtures shall be of the correct length to uniformly maintain the fixture heights shown on the drawings or established in the field. The allowable variation tolerance in mounting individual fixtures shall not exceed 1/4 inch and shall not vary more than 1/2 inch from the floor mounting height shown on the Drawings. Fixtures hung in continuous runs shall be installed absolutely level and in line with each other. Hanging devices shall comply with Code requirements. Fixtures shall employ single - not twin - stem hangers unless otherwise noted.
3. All structure mounted fixtures (i.e. bracket mounted, pipe mounted and surface mounted) shall be provided with cables of suitable size and weight to support the weight of the fixture. Cables shall be fastened around or fastened to the housing of the fixture. On pendant fixtures, one safety cable of suitable size and weight to support the weight of the fixture assembly shall connect the top of the pendant to the supporting structure by means of welding or bolting, and one safety cable shall connect the housing of the fixture to the bottom of the pendant. Where more than one pendant per fixture occurs, only one pendant must be cabled. Track fixtures for pendant mounted track shall also be supplied with clip-on safety cables of suitable size and weight to support the weight of the fixture.

D. Electrical Connection

1. All lighting fixtures installed in an accessible suspended ceiling shall be connected from a branch circuit junction box using 1/2" flexible metal conduit or MC cable fixture pigtails not exceeding 8'- 0". All fixtures must be grounded by using a grounding conductor. Fixture to fixture wiring of fixtures installed in an accessible ceiling is not permitted. Fixture whips shall not lay-on ceiling tile or grid. Provide caddy clips to provide additional support.

E. Fire Rated Ceiling

1. Provide fire rated canopy or enclosure for all fixtures recessed in a fire rated ceiling. The fire rated canopy or enclosure shall be as required by the UL design number listed in the UL fire resistance directory. Refer to architectural drawing for the UL design number. Coordinate with ceiling installer and manufacturer.

F. Air Handling Fixtures

1. Install all air handling light fixtures with return air slot in the open position, if it is to be as an air handling fixture. Coordinate with mechanical contractor.

3.2 FINAL INSPECTION

A. Remove all plastic and protective coating from all fixtures. Fixtures shall be thoroughly cleaned. Replace any damaged fixture or fixture parts including reflectors, louvers, lens and metal parts that show signs of corrosion.

B. All final incandescent lamps used during construction shall be replaced with new lamps. Replace all other defective ballast, lamps or discolored lamps, showing signs of excessive usage.

C. Demonstrate proper operation of all fixtures and controls.

END OF SECTION

SECTION 27 10 00 STRUCTURED CABLING SYSTEM

PART 1 - GENERAL

1.01 This section identifies the requirements, technical design, and specifications for the structured cabling system at the San Antonio Water Systems East Side and Northwest Operations Center, located in San Antonio, Texas (“Owner”). The structured cabling system as specified is an Industry-Standard Category 6A structured cabling system and includes backbone cabling, horizontal cabling and equipment room hardware as specified.

1.02 The Contractor shall provide a Manufacturer’s 20-Year Performance Certification for the installed structured cabling system.

1.03 Contractor shall include materials, equipment, and labor necessary to provide a complete and functional structured cabling system regardless of any items not listed or described in this specification or associated drawings.

1.04 Requirements

A. Contractor Experience Requirements

B. Submittal Requirements

C. Acceptable Manufacturers

D. Codes, Standards and Regulations

E. General Requirements

F. System Requirements

G. Testing Requirements

H. Project Closeout Documentation

I. Attachments

1.05 Related Requirements

A. The Drawings, Specifications, General Conditions, Supplementary General Conditions, and other requirements of Division 1 apply to the work specified in Division 27, and shall be complied with in every respect. The Contractor shall examine all of the items which make up the Contract Documents, and shall coordinate them with the work on the project.

B. Contractor Experience Requirements

1. The Contractor shall be a Commscope, Uniprise certified installer prior to submitting a bid for the work.

2. The Contractor shall possess all relevant Manufacturer Certifications (i.e. structured cable systems, testing equipment, etc,) for both the company and individual technicians prior to submitting a bid for the work.

3. The Contractor's Project Manager shall be a Registered Communications Distribution Designer (RCDD) and available for all onsite coordination meetings.

4. The Contractor shall have been in business for a minimum of five (5) years.

5. The Contractor shall have a local office with local technicians and an adequate workforce to complete this project within a 75-mile radius of the project site.

6. The Contractor shall have completed a minimum of five (5) projects similar in size and scope to the Owner's installation, where the systems have been in continuous satisfactory operation for at least one (1) year.

C. Subcontractors shall be identified at the time of bid and comply with the requirements and intentions of these specifications, associated drawings, and related contract documents.

1.06 Submittal Requirements

A. Pre-Installation Submittal

1. Contractor shall not order, purchase, or install any equipment until pre-installation submittals have been accepted in writing by the Architect/Engineer.

2. All submittals shall be submitted in the same sequence as they are listed in the specifications (i.e. product data in the sequence items are listed in the product data section, manufacturer product certifications for company, manufacturer product certifications for installers, etc.). Submittals not in the proper sequence will not be approved.

3. Manufacturer product data sheets for each proposed system component.

   a. For product data sheets containing more than one (1) part number or product, the Contractor shall clearly identify the specific part number or product being submitted. Product data sheets without the part number clearly identified will not be approved.

4. Manufacturer Product Certifications for Company.

5. Manufacturer Product Certifications for Installers.

6. Manufacturer Certifications for testing equipment technicians.

7. Manufacturer Certifications for testing equipment calibration.

8. RCDD Certificate for Contractor's Project Manager.

9. Manufacturer Warranty letter.

10. Documentation indicating that Contractor has been in business for (5) years.

11. Address of Contractor's local office within a 75-mile radius of the project site.

12. Quantity of full time local technicians within a 75-mile radius of the project site.

13. List of five (5) contractor-installed projects of a similar size and scope that have been in operation for at least (1) year. The Contractor shall provide the following

information for each project: Project Name, Project Location, Project Start Date, Project Completion Date, Project Start Cost, Project Completion Cost, Brief Description of Project, Client Point of Contact Name and Phone Number.

14. List of completed and ongoing projects with the Owner. The Contractor shall provide the following information for each project: Project Name, Project Location, Project Start Date, Project Completion Date, Project Start Cost, Project Completion Cost, and Brief Description of Project.

15. List of subcontractors performing any work on the project. List shall clearly identify the subcontractor's legal name and address, the scope of work to be performed by the subcontractors and the overall percentage of the project being provided by the subcontractor. If there are no subcontractors performing any work on the project, submit a statement on company letterhead clearly indicating no subcontractors will be performing any work on this project.

PART 2 - PRODUCTS

2.01 General Requirements

A. The following sections specifically list the acceptable equipment types and items for this project.

B. Architect/Engineer will have final determination of acceptability of all proposed equipment and must approve submitted equipment prior to purchase or installation.

C. Proposed equivalent items must be approved in writing by the Architect/Engineer prior to purchase or installation. Proposed equivalent items must meet or exceed these specifications and the specifications of the specified item.

D. In the event a manufacturer's specified product or part number has changed or is no longer available, Contractor shall substitute the appropriate equivalent manufacturer's part number.

E. In the event of a discrepancy between the specifications and the drawings, the greater quantity and/or better quality will be furnished.

F. For listed products with no part number specified, Contractor shall provide a product that meets the performance requirements of these specifications, industry standard practices, and intended application.

G. All wiring, equipment, and installation materials shall be new and of the highest quality.

H. Labels on all cabling, materials, and equipment must indicate a nationally recognized testing laboratory.

I. Original Equipment Manufacturer (OEM) documentation must be provided to the Architect/Engineer which certifies performance characteristics and compliance with ANSI/TIA/EIA 568-C standards.

2.02 Acceptable Manufacturers

A. Fiber Optic Backbone Cable

1. Outdoor Underground

a. 9/125µm Outside Plant Rated Single-Mode 24 Strand

1) Corning Part Number – 024EU4-T4101D20

2. Fiber Optic Innerduct

a. Indoor Plenum Rated

1) MaxCell 2" 3-Cell

b. Outdoor (White)

1) MaxCell 2" 3-Cell, Detectable

B. Horizontal Cable

1. Category 6A UTP Plenum
    a. Network Access (Blue Sheath)
        1) CommScope Ultra 10 Part Number – 8441604/10
2. Category 5e OSP
    a. OSP (Blue Sheath)
        1) Superior Essex Part Number - BBDGe
3. OSP Category 5e6A surge protection
    a. Ditek POE surge protection Part Number – DTK-MRJPOE

C. Fiber Optic Cable Termination

1. 2RU Fiber Enclosure
    a. Corning Rack Mounted Fiber Optic Enclosure – Part Number CCH-02U
2. 9µm Single-Mode Fiber Adapter Plate
    a. Corning OS1/2, LC, 24 fibers,– Part Number – CCH-CP24-A9
3. Fiber Blank Plate
    a. Corning Blank Metal Adapter Plate – Part Number – CCH-BLNK
4. 9µm Single-Mode LC Connectors
    a. Corning LC Single-mode Connector, – Part Number – ADP-DLC0-CCNRC-NLS
5. Loose Tube Fiber Fan-Out Kit
    a. Corning 24" Fiber Optic Fan-Out Kit, 24fiber – Part Number – FAN-OD25-12
6. Category 6A Horizontal Rack Mounted Patch Panels
    a. CommScope 2RU 48-Port Systimax 360 X10D – Part Number - 760152595
7. Category 6a Modular Jacks
    a. Network Access
        1) Equipment Room/Telecommunications Room End (Blue)
            a) GigaSPEED X10D MGS600 Information Outlet CAT 6a Connector – Part Number 760092452 MGS600-318
        2) Field End (Blue)
            a) GigaSPEED X10D MGS600 Information Outlet CAT 6a Connector – Part Number 760092452 MGS600-318

8. Telecommunications Faceplates with Designation Window

    a. 2-Port Single Gang Flush (White)

        1) CommScope L-type Flush Mount Faceplate, Two Port White – Part number – 108168469 M12L-262

    b. 4-Port Single Gang Flush (White)

        1) CommScope L-type Flush Mount Faceplate, Four Port White – Part number – 108168543 M14L-262

    c. Wall Phone Faceplate (Stainless Steel)

        1) CommScope Phone Wallplate - Part Number -760117572 - M10LWSP

9. 2-Port Surface Mount Box (White)

    a. CommScope M102 Type Surface Mount Box – Part Number – 107984056 M102SMB-B-262

10. 4-Port Surface Mount Box (White)

    a. CommScope M104 Type Surface Mount Box – Part Number – 107952459 M104SMB-A-262

D. Equipment Racks, Cabinets, Cable Management, and Accessories

1. Two-Post Rack - 19” x 84” Open Frame (Black)

    a. Chatsworth – Part Number 55053-703

2. Four-Post Open Frame Rack – 20.3” x 84” x 29” (Black)

    a. Chatsworth – Part Number 50120-703

3. Wall Mount Cabinet (Grey)

    a. Pentair Air Conditioned – Part Number PTHS242428G4A

        1) Steel Panel – CP2020

        2) Rack Angles – PTRA24T

    b. Chatsworth CUBE-iT Wall Mounted Cabinet

        1) Chatsworth – Part # 13496-760

    c. Power Strip for Wall Mount Cabinet

        1) Chatsworth – Part # 12820-705

    d. Fan Kit For Wall Mount Cabinet

        1) Chatsworth – 12804-701

    e. Filter Kit for Wall Mount Cabinet

1) Chatsworth – Part # 12805-701

f. Light for Wall Mount Cabinet

1) Chatsworth – Part # 12803-701

g. Vertical Cable Manager for Wall Mount Cabinet

1) Chatsworth – Part # 13485-760

4. Vertical Cable Managers (Black)

a. Chatsworth Double Sided Vertical cabling Section - Part Number 11729-703

5. Horizontal Cable Managers (Black)

a. Chatsworth Rack Cabling Manager - Part Number 11753-719

6. Vertical Power Strip for 7’ Equipment Rack

a. Chatsworth 20 Outlet (5-20R) Power Strip with Meter and NEMA 5-20P – Part Number 12851-755

E. Cable Runway (Ladder Type)

1. Universal Cable Runway

a. 12-inch Chatsworth - Part Number 10250-712

2. Cable Runway Radius Drop, Cross Member

a. 12-inch Chatsworth - Part Number 12100-712

3. Cable Runway Radius Drop, Stringer

a. Chatsworth - Part Number 12101-701

4. Cable Runway Butt-Splice Kit

a. Chatsworth - Part Number 11301-701

5. Cable Runway Junction-Splice Kit

a. Chatsworth - Part Number 11302-701

6. Cable Runway Butt-Swivel Splice Kit

a. Chatsworth - Part Number 10487-701

7. Rack-to-Runway Mounting Kit

a. 9 to 12-inch runway Chatsworth - Part Number 10595-712

8. Cable Runway Elevation Kit for Racks

a. Chatsworth - Part Number 10506-706

9. Cable Runway Elevation Kit for Cabinets
    a. Chatsworth - Part Number 10506-716
10. Triangular Support Bracket, Aluminum
    a. 6 to 12-inch runway Chatsworth - Part Number 11312-712
    b. 12 to 18-inch runway Chatsworth - Part Number 11421-718
11. Triangular Support Bracket, Steel
    a. 24-inch runway Chatsworth - Part Number 11746-724
12. Wall Angle Support Kit, Cable Runway
    a. 12-inch runway Chatsworth - Part Number 11421-712
13. 90 Degree Runway-Splice Kit
    a. Chatsworth - Part Number 11314-701
14. 45 Degree Runway-Splice Kit
    a. Chatsworth - Part Number 11313-701
15. Foot Kit, Cable Runway
    a. Chatsworth - Part Number 11309-001
16. Vertical Wall Brackets (pair)
    a. Chatsworth - Part Number 10608-701
17. Threaded Ceiling Kit, Cable Runway
    a. Chatsworth - Part Number 11310-001
18. Threaded Rod Cover
    a. Chatsworth - Part Number 11085-001
19. Protective End Caps for Cable Runway
    a. Chatsworth - Part Number 10642-001
20. End Closing Kit, Cable Runway
    a. Chatsworth - Part Number 11700-712

F. Pathway Cable Support
    1. Panduit J-Mod Cable Support System
    2. Erico – CADDY CAT LINKS J-Hook Series
    3. Erico – Caddy Adjustable Cable Support Series

4. Panduit Plenum Rated Hook & Loop (Black)
5. Erico – Caddy Grid Support – Part Number – ATA41 or ATS41

G. Grounding and Bonding

1. Grounding Bus Bar, 20”
   a. Chatsworth - Part Number 40153-020
2. Grounding Bus Bar, 12”
   a. Chatsworth - Part Number 13622-012
3. Cable Runway Ground Strap Kit
   a. Chatsworth - Part Number 40164-001
4. One Mounting Hole Ground Terminal Block
   a. Chatsworth - Part Number 08009-001
5. Horizontal Rack Ground Bar for Wall Mount Cabinet
   a. Chatsworth - Part Number 10610-019
6. #6 AWG Solid Green Insulation Ground Wire
   a. Superior Essex - Part Number 12-018-04
7. #3/0 Stranded Green Insulation Ground Wire
8. Cable Sheath Bonding Clamp

H. Labeling

1. Permanent Labels for Fiber Optic Cables
   a. Brady
   b. Panduit Self Laminating Labels
2. Permanent Labels for Inner-duct
   a. Panduit Dome-Top Ty Marker
3. Permanent Labels for Copper Cables
   a. Panduit Self-Laminating Labels
4. Permanent Labels for Backbone Fiber Optic Cables
   a. Panduit Dome-Top Ty Marker
5. Permanent Labels for Patch Panels
   a. Panduit Component Label

6. Permanent Labels for Faceplates

a. Panduit Component Label

I. Fire Stop

1. STI Spec Seal Part Number

2. 3M Products Part Number

J. Plywood

1. 8’ H x 4’ W x ¾” Sheets of BC grade fire-rated plywood

K. Fire Retardant Paint (White)

L. Fiber Patch Cables

1. Corning Fiber Optic patch Cords

M. Copper Patch Cables

1. CommScope Category 6a Patch Cord – Part Number CPCSSX2-0ZF00X – X denotes length.

PART 3 - EXECUTION

3.01 Codes, Standards, Regulations

A. American National Standards Institute (ANSI)

B. American Society for Testing and Materials (ASTM)

1. ASTM B 1 (2001; R 2007) Standard Specification for Hard-Drawn Copper Wire
2. ASTM B 8 (2004) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
3. ASTM D 1557 (2007) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
4. ASTM D 709 (2001; R 2007) Laminated Thermosetting Materials

C. Alliance for Telecommunications Industry Solutions (ATIS)

D. Building Industry Consulting Service International (BICSI)

1. Telecommunications Distribution Methods Manual 13th Edition
2. Outside Plant Design Reference Manual 5th Edition
3. ANSI/BICSI 002-2011, Data Center Design and Implementation Best Practices
4. NECA/BICSI 568-2006 – Standard for Installing Commercial Building Telecommunications Cabling
5. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings

E. Electronics Industry Alliance (EIA)

F. Federal Communications Commission (FCC)

1. FCC Part 15, Radiated Emissions Limits, revised 1998
2. FCC Part 68, Connection of Terminal Equipment to the Telephone Network, revised 1998
3. FCC Part 76, Cable Television Service, revised 1998

G. Insulated Cable Engineers Association (ICEA)

1. ICEA S-87-640 (2006) Fiber Optic Outside Plant Communications Cable
2. ICEA S-98-688 (2006) Broadband Twisted Pair, Telecommunications Cable Aircore, Polyolefin Insulated Copper Conductors
3. ICEA S-99-689 (2006) Broadband Twisted Pair Telecommunications Cable Filled, Polyolefin Insulated Copper Conductors

H. International Electrotechnical Commission (IEC)

I. Institute of Electrical and Electronics Engineers, Inc. (IEEE)

1. IEEE Standard 81-1983, IEEE Guide for Measuring Earth Resistance, Ground Impedance, and Earth Surface Potential of a Ground System

2. IEEE Standard 1100-1999, Recommended for practice for Powering and Grounding Sensitive

3. Electronic Equipment in Industrial and Commercial Power Systems (IEEE Emerald Book)

4. IEEE C2 (2007; Errata 2007; INT 2008) National Electrical Safety Code

5. IEEE Std 100 (2000) The Authoritative Dictionary of IEEE Standards Terms

J. International Organization for Standardization (ISO)

1. International Organization of Standardization/International Electrotechnical Commission (ISO/IEC)

2. ISO/IEC 11801, Information Technology-Generic Cabling for Customer Premises, 1995

3. ISO/IEC 14763-1, Information Technology-Implementation and Operation of Customer Premises Cabling-Administration, 1999

4. ISO/IEC 11801, Information Technology-Generic Cabling for Customer Premises, 1995

5. ISO/IEC 14763-1, Information Technology-Implementation and Operation of Customer Premises Cabling-Administration, 1999

K. National Cable Television Association (NCTA)

L. National Electrical Manufacturers Association (NEMA)

1. NEMA C62.61 (1993) Gas Tube Surge Arresters on Wire Line Telephone Circuits

M. National Fire Protection Association (NFPA)

1. NFPA-70, National Electrical Code

2. NFPA-75, Protection of Electronic Computer Data Processing Equipment.

3. NFPA-101, Life Safety Code

4. NFPA-297, Guide on Principles and Practices for Telecommunications Systems

5. NFPA-780, Standard for the Installation of Lightning Protection Systems.

N. National Institute Standards and Technology (NIST)

O. Occupational Safety and Health Administration (OSHA)

P. Telecommunications Industry Association (TIA)

1. ANSI/TIA-568-C.0, Generic Telecommunications Cabling for Customer Premises, 2009
2. ANSI/TIA-568-C.1, Commercial Building Telecommunications Cabling Standard, 2009
3. ANSI/TIA -568-C.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standard, 2009
4. ANSI/TIA-568-C.3, Optical Fiber Cabling Components Standard, 2008
5. ANSI/TIA/EIA–569-B, Commercial Building Standard for Telecommunications Pathways and Spaces, 2005
6. ANSI/TIA–569-B Amendment 1, Commercial Building Standard for Telecommunications Pathways and Spaces, 2009
7. ANSI/TIA/EIA-606-B, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 2012
8. ANSI/TIA/EIA-607-B, Commercial Building Grounding and Bonding Requirements for Telecommunications, 2011
9. ANSI/TIA-758, Customer-Owned Outside Plant Telecommunications Infrastructure Standard, 2004

Q. U.S. Department of Agriculture (USDA)

1. RUS 1755 Telecommunications Standards and Specifications for Materials, Equipment and Construction
2. RUS Bull 1751F-643 (2002) Underground Plant Design
3. RUS Bull 1751F-815 (1979) Electrical Protection of Outside Plant
4. RUS Bull 1753F-201 (1997) Acceptance Tests of Telecommunications Plant (PC-4)
5. RUS Bull 1753F-401 (1995) Splicing Copper and Fiber Optic Cables (PC-2)
6. RUS Bull 345-65 (1985) Shield Bonding Connectors (PE-65)
7. RUS Bull 345-72 (1985) Filled Splice Closures (PE-74)
8. RUS Bull 345-83 (1979; Rev Oct 1982) Gas Tube Surge Arrestors (PE-80)

R. Underwriters Laboratories, Inc. (UL)

1. UL 510 (2005; Rev thru Aug 2005) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
2. UL 910 (NFPA 262 1990) Applicable Flame Test

3.02 In the event of any conflicts between documents referenced herein and the contents of this specification, the Contractor shall notify the Architect/Engineer in writing of any such occurrences before purchasing or installing any equipment or materials. The

Architect/Engineer will notify the Contractor of any actions required to resolve these conflicts. Such actions may include but are not limited to: design changes, equipment, materials and/or installation changes. In any event Contractor shall not supersede specifications and standards from the latest NFPA and NEC publications. In the event of any conflicts between Standards and Codes the more stringent shall take precedence.

3.03 General Requirements

A. Contractor shall comply with the requirements of local Authority Having Jurisdiction (AHJ), State of Texas, the National Fire Protection Association (NFPA), and the National Electrical Code (NEC). If the Contractor identifies any item in the plans or specifications that will not strictly comply with the aforementioned laws, ordinances, and rules, the matter shall be referred to the Architect/Engineer for direction before proceeding with that part of the work.

B. The Contractor shall be responsible for coordination with other trades to ensure any conflicts or potential conflicts are resolved prior to any work beginning on the project.

C. The Contractor shall install the materials in accordance with these specifications and the manufacturer's installation guidelines.

D. No deviations from the plans or specifications shall be made without full consent in writing of the Architect/Engineer. The Contractor shall have written approval from the Architect/Engineer for any additional work beyond the Contract Documents prior to beginning such work. If the Contractor does not obtain written approval from the Architect/Engineer prior to proceeding with the work, the contractor shall not be reimbursed for the work.

E. The Contractor shall obtain written permission from the Architect/Engineer before proceeding with any work that would necessitate cutting into or through any part of the building structure such as, but not limited to girders, beams, floors, walls, roofs, or ceilings.

F. Contractor shall notify the Architect/Engineer a minimum of (2) weeks prior to beginning work and will participate in a pre-construction meeting with the Architect/Engineer to perform a walkthrough, review the scope of work, schedule, and escalation procedures.

G. The Contractor shall maintain a work area free of debris, trash, empty cable reels, scrap cable, etc., and dispose of such items on a daily basis and return the site to the original state of cleanliness. The Contractor shall not use Owner's facilities for the disposal of excess or scrap materials.

H. Equipment and materials installed by the Contractor shall be free of defects and damage.

I. Contractor shall be responsible for the repair of any damage caused by the contractor during the installation.

J. Contractor shall test all cables prior to installation. By failing to perform this testing operation, the Contractor shall accept the cable as compliant and assume all liability for the replacement of the cable at no cost to the Owner should it be found defective at a later date.

K. Contractor shall maintain a set of working specifications, design drawings, and record drawings to be kept on site at all times and shall update the record drawings with any

changes on a weekly basis. Record drawings shall be made available for inspection at the request of the Architect/Engineer.

L. Equipment and materials shall be consistent throughout the installation. Where multiple units of the same type of equipment and materials are required, these units shall be a standard product with the same manufacturer and model number.

M. Equipment and materials shall be delivered and stored in accordance with the manufacturer's guidelines at the Contractor's expense.

N. Contractor shall make all stored equipment and materials available for inspection at the request of the Architect/Engineer.

O. All equipment and material used in the installation shall be approved by the manufacturer for the environment in which it is being installed.

P. Cables shall be properly supported in accordance with industry standards at all times. Improperly supported cables shall be corrected by the Contractor at no cost to the Owner.

Q. Contractor shall be responsible to properly protect information outlets from damage by other trades during construction.

R. Cables shall be routed at 90-degree angles to the building structure. At no time shall a diagonal pull be installed.

S. The Contractor shall not install cables in conduits or sleeves without nylon bushings. Cables installed through conduits or sleeves without nylon bushings shall be removed and replaced at no cost to the Owner.

3.04 System Requirements

A. Quantities listed are for reference only, contractor is responsible for furnishing materials as required to provide a complete and functioning system. Where quantities are not noted, they may be obtained from the drawings. In the event of a discrepancy between the specifications and the drawings, the greater quantity shall be furnished.

B. Inter-Building Cable Plant

1. Fiber Optic Cable

a. 9 µm Single Mode

1) Contractor shall furnish and install outdoor underground fiber optic cables in contractor-furnished and installed inner-duct/MAXCELL.

a) Each fiber optic cable shall be provided with a dedicated inner-duct/MAXCELL.

2) The Contractor shall install a 10-foot service loop at the ends of each cable to be coiled, mounted, and stored on the wall above the ladder rack.

3) Cables shall be routed utilizing the pathways as indicated in the technology drawings.

4) The contractor shall furnish and install:

a) 24 strand outdoor fiber optic cable from Eastside Admin MDF Room 1428 to Admin IDF 1463 as indicated on the technology drawings.

b) 24 strand outdoor fiber optic cable from Eastside Admin MDF Room 1428 to Admin IDF A232 as indicated on the technology drawings.

c) 24 strand outdoor fiber optic cable from Eastside Admin MDF Room 1428 to Supply IDF S105 as indicated on the technology drawings.

d) 24 strand outdoor fiber optic cable from Eastside Admin MDF Room 1428 to Training IDF room as indicated on the technology drawings.

2. Fiber Optic Termination

a. Contractor shall terminate fiber optic strands with fan-out kits when required and connectors and place into fiber optic enclosures as indicated in the technology drawings.

b. Contractor shall furnish fiber optic enclosures and coupler panels for all fiber optic strands and blank panels for all unused slots.

c. The Contractor shall furnish and install:

1) 2U fiber enclosure(s) inside North West Production Building MDF Room M114 as indicated on the technology drawings.

2) 2U fiber enclosure(s) inside Eastside Administration MDF Room 1428 as indicated on the technology drawings.

3) 2U fiber enclosure(s) inside Eastside Administration IDF Room 1463 as indicated on the technology drawings.

4) 2U fiber enclosure(s) inside Eastside Administration IDF Room A232 as indicated on the technology drawings.

5) 2U fiber enclosure(s) inside Eastside Supply IDF Room S105 as indicated on the technology drawings.

6) 2U fiber enclosure(s) inside Eastside Training IT Room as indicated on the technology drawings.

C. Copper Cable

1. Horizontal Cable

2. No horizontal cable shall be longer than two hundred ninety-five (295) feet. If any station cable will be longer than two hundred ninety-five (295) feet, Contractor shall stop installation of the cable and immediately notify

Architect/Engineer in writing. If Contractor fails to notify the Architect/Engineer in writing, Contractor shall replace cable at no cost to the Owner.

3. The Contractor shall furnish and install horizontal cables within each Technology Region from the respective ER or TR to each outlet location as indicated in the technology drawings.

4. The Contractor shall install a 10-foot service loop to be coiled, mounted, and stored above the ladder rack in each respective Equipment Room or Telecommunications Room.

5. The Contractor shall provide a 2-foot service loop coiled and supported directly above the workstation outlet.

D. Horizontal Cable Termination

1. Contractor shall terminate cables as defined by the ANSI/TIA/EIA 568-A Commercial Building Wiring Standard with the EIA-568B sequence.

2. Workstations

a. Contractor shall furnish and install modular jacks to terminate UTP horizontal cables.

b. Contractor shall furnish and install faceplates, systems furniture faceplates, or surface-mount boxes to house modular jacks as indicated in the technology drawings.

1) Any unused faceplate positions shall have the appropriate number and color of blanks installed.

3. Equipment Rooms / Telecommunications Rooms

a. Horizontal Cable for Data

1) Contractor shall furnish and install patch panels and horizontal cable managers to terminate horizontal data cables as indicated in the technology drawings.

4. The Contractor shall provide and install: Patch Panels

1) The Contractor shall furnish and install rack mounted panels.

2) The Contractor shall extend all copper cable pairs from the building entrance terminals to the rack mounted panels utilizing plenum rated high pair count cable.

3) The Contractor shall furnish and install:

a) 2U 48-port patch panel(s) inside Northwest Production MDF M114 as required to terminate 100% of all data cables and to provide for 10% growth as indicated on technology drawings.

b) 2U 48-port patch panel(s) inside Eastside Admin IDF 1463 as required to terminate 100% of all data cables and to provide for 10% growth as indicated on technology drawings.

c) 2U 48-port patch panel(s) inside Eastside Admin IDF A232 as required to terminate 100% of all data cables and to provide for 10% growth as indicated on technology drawings.

d) 2U 48-port patch panel(s) inside Eastside Supply IDF S105 as required to terminate 100% of all data cables and to provide for 10% growth as indicated on technology drawings.

e) 2U 48-port patch panel(s) inside Eastside Training IDF as required to terminate 100% of all data cables and to provide for 10% growth as indicated on technology drawings.

E. Patch Cables

1. Fiber

a. Equipment Rooms / Telecommunications Room

1) The Contractor shall furnish and store (1) patch cable in original manufacturer packaging for each strand terminated per Equipment Room / Telecommunications Room:

a) 100% of the patch cables shall be (3) meters in length and stored in the applicable Equipment Room / Telecommunications Room

2. Copper

a. Workstations

1) The Contractor shall furnish and install (1) patch cable in original manufacturer packaging for each cable terminated.

a) 100% of the patch cables shall be (10) feet in length and stored in the applicable Equipment Room / Telecommunications Room.

b. Equipment Rooms / Telecommunications Rooms

1) The Contractor shall furnish and install (1) patch cable in original manufacturer packaging for each cable terminated per Equipment Room / Telecommunications Room:

a) 50% of the patch cables shall be (5) foot in length and stored in the applicable Equipment Room / Telecommunications Room

b) 25% of the patch cables shall be (7) foot in length and stored in the applicable Equipment Room / Telecommunications Room

c) 25% of the patch cables shall be (10) foot in length and stored in the applicable Equipment Room / Telecommunications Room

F. Cable Support

1. All cables shall be installed and supported in conduit systems, cable trays, cores, sleeves, etc. as indicated in the technology drawings.

2. When cables leave the main pathway systems as indicated on the technology drawings, they shall be installed and supported in Contractor furnished and installed j-hooks or adjustable cable supports.

3. No cable pathway shall exceed 40% fill ratio.

4. The contractor shall furnish a separate j-hook or adjustable cable support pathway for each cable type (data, voice, video, and security).

5. J-hooks and adjustable cable supports shall be installed no more than five-feet (5') apart on center, using only manufacturer-approved installation methods and hardware.

6. J-hooks and adjustable cable supports shall be installed no higher than 3-feet above the accessible ceiling to allow for ease of access for future moves, adds and changes

7. If utilizing ceiling grid wire, that is contractor installed, both ends shall be supported and independent from the grid wire to provide support for the actual grid and ceiling tile. Grid wire shall be painted blue and attached to ceiling grid with a Caddy Component Support.

8. J-hooks shall be furnished with closure clips.

9. Maximum sag between supports shall not exceed twelve-inches (12").

10. Contractor shall establish j-hook and adjustable cable supports pathways and shall coordinate pathways with all other disciplines. Under no-circumstances shall these pathways be used to support other low-voltage applications not included in this specification.

11. Cable Dressing

    a. No nylon cable ties shall be used at any time during the installation of the cable.

    b. Above Ceiling

        1) Contractor shall furnish and install plenum-rated hook & loop straps in plenum-rated airspaces.

            a) The Contractor shall install no more than (1) hook & loop strap between each j-hook or saddle strap or at service loop locations.

    c. Equipment Rooms / Telecommunications Rooms

        1) The Contractor shall bundle all visible cables with Contractor furnished and installed hook & loop straps.

            a) Hook & loop straps shall be installed twenty-four (24) inches apart on center.

G. Equipment Rooms / Telecommunications Room Build-Out

1. Plywood

a. The Contractor shall furnish and install 8’ H x 4’ W x ¾” D sheets of BC grade fire-rated plywood as indicated in the technology drawings.

b. The Contractor shall mount all plywood vertically starting at 24” AFF.

c. The Contractor shall cover the plywood with two (2) coats of Contractor furnished white fire retardant paint leaving exposed (1) fire rating stamp per sheet.

2. Cable Runway (Ladder Type)

a. Contractor shall furnish and install cable runway using manufacturer-approved hardware and installation methods as indicated in the technology drawings.

b. Contractor shall furnish and install vertical sections of cable runway using manufacturer-approved hardware and installation methods to provide transition and support where cables enter or exit the room using a vertical pathway.

c. Contractor shall furnish and install radius drops cross member and stringers above each rack using manufacturer-approved hardware and installation methods where cables exit the horizontal section of the ladder rack.

d. Contractor shall ground and bond each cable runway section to the next utilizing ground straps and ensure metal-to-metal contact.

3. Equipment Racks and Cabinets

a. Contractor shall furnish and install equipment racks with vertical management using manufacturer approved hardware and installation methods as indicated in the technology drawings.

b. Contractor shall secure relay racks to the concrete floor utilizing expandable concrete anchors.

c. Contractor shall secure the equipment racks to the cable runway using cable runway elevation kits and manufacturer approved hardware and installation methods.

d. Contractor shall bolt all equipment racks and vertical cable managers together.

e. Contractor shall individually ground and bond each equipment rack and ensure metal-to-metal contact.

f. Contractor shall furnish and install:

1) 19” x 84" equipment rack(s) in Northwest Production MDF Room M114 as indicated on the technology drawings.

2) 19” x 84" equipment rack(s) in Eastside Admin MDF Room 1428 as indicated on the technology drawings.

3) 19” x 84" equipment rack(s) in Eastside Admin IDF Room 1463 as indicated on the technology drawings.

4) 19” x 84" equipment rack(s) in Eastside Admin IDF Room A232 as indicated on the technology drawings.

5) 19” x 84" equipment rack(s) in Eastside Supply IDF Room S105 as indicated on the technology drawings.

6) 19” x 84" equipment rack(s) in Eastside Training IDF Room as indicated on the technology drawings.

H. Grounding and Bonding

1. General

a. The Contractor shall ensure metal-to-metal contact for all terminations.

b. All materials shall be UL Listed.

c. All connections shall be made with UL Listed compression 2-hole lugs.

d. Contractor shall use an anti-oxidation compound on all connections.

e. In a metal frame (structural steel) building, where the steel framework is readily accessible within or external to the room; each TMGB and TGB shall be bonded to the vertical steel metal frame using a minimum # 6 AWG plenum rated green insulated conductor.

f. A Grounding Equalizer conductor shall be installed when required by ANSI/TIA/EIA-607-B (Interconnects multiple TBBs on the top floor and every 3rd floor in between).

g. The connection to building steel does not eliminate the requirement for the TBB or EBC to the service ground.

2. Telecommunications Main Grounding Busbar (TMGB)

a. Contractor shall furnish and install a TMGB in the Equipment Room/Main Telecommunication Room as indicated in the technology drawings.

b. TMGB shall be insulated from its support using an insulator that is listed for the purpose by a nationally recognized testing laboratory (NRTL).

c. Only one lug shall occupy a hole. No stacking lugs or “Double Lugging” shall be accepted.

3. Telecommunications Grounding Busbar (TGB)

a. Contractor shall furnish and install a TGB in each Telecommunications Room as indicated in the technology drawings.

b. TGB shall be insulated from its support using an insulator that is listed for the purpose by a nationally recognized testing laboratory (NRTL).

c. Only one lug shall occupy a hole. No stacking lugs or “Double Lugging” shall be accepted.

4. Telecommunications Bonding Backbone (TBB)

a. The Contractor shall furnish and install a TBB consisting of a minimum #6 AWG plenum rated green insulated copper conductor in a star topology between the TMGB and each TGB as indicated in the Technology drawings.

b. When exceeding (13), feet the TBB shall be sized at (2) kcmil per linear foot of conductor length up to a maximum of 750 kcmil.

c. Where the TRs are stacked the TBB shall be continuous to the uppermost TR. “T” taps shall be used to tie TGBs on floors between the TMGB and the uppermost TGB.

d. Conductor shall be sized from the TMGB to the uppermost TGB and each conductor between a “T” tap and the TGB shall be the same size as the TBB it is fed from.

5. Equipment Bonding Conductor (EBC)

a. Contractor shall furnish and install a minimum #6 AWG plenum rated green insulated conductor from the TMGB or TGB as applicable to each ladder rack system, equipment rack, cabinet, metallic raceway, lightning protector, or multi-pair cable with a metallic element. Contractor shall use an anti-oxidation compound on all connections.

b. When exceeding (13) feet the EBC shall be sized at (2) kcmil per linear foot of conductor length up to a maximum of 750 kcmil.

6. Bonding Conductor for Telecommunications (BCT)

a. Contractor shall furnish and install a minimum #6 AWG plenum rated green insulated copper conductor from the TMGB to the main building electrical service ground as indicated in the Technology drawings.

b. The installation of the BCT to the main building electrical ground shall be performed by a licensed Electrical Contractor.

c. When exceeding (13) feet the BCT shall be sized at (2) kcmil per linear foot of conductor length up to a maximum of 750 kcmil

I. System Labeling

1. Contractor shall verify room numbers and confirm the final room numbering scheme prior to generating any labels.

2. Horizontal Cables shall be labeled within (12) inches from the termination point inside the Equipment Room/Telecommunications Rooms.

3. Horizontal Cables shall be labeled within (6) inches from the termination point at the workstation end.

4. Backbone Fiber and Copper Cables shall be labeled within (12) inches of the visible end of the jacket.

5. Fiber Innerduct shall be labeled within (12) inches of the point of entry of the fiber optic enclosure.

6. Bonding conductors shall be labeled within (12) inches from their termination point.

7. Cables shall be labeled identically at both ends.

8. Equipment Racks

   a. Equipment racks in each Equipment/Telecommunication Room shall be labeled in sequential numeric order.

      1) Labels shall be centered on the top front of the equipment rack.

9. Cabinets

   a. Cabinets in each Equipment/Telecommunication Room shall be labeled in sequential numeric order.

      1) Labels shall be centered on the top front of the Cabinet.

10. Fiber Optic Enclosures

    a. Fiber optic enclosures shall be labeled alpha-numeric starting with the 1st fiber optic enclosure in the top of the 1st equipment rack.

    b. A label for each terminated strand shall be securely placed inside each fiber optic enclosure.

11. Backbone Cable

    a. Fiber Optic Cable

       1) Fiber optic backbone cable labels shall contain the cable origin room number, the cable destination room number, fiber strand numbers, and type (i.e. M114-A118/001-012MM).

       2) Fiber optic couplers panels in fiber enclosures shall be labeled at each end by strand denoting building code, Equipment Room and/or Telecommunications Room, enclosure number, and strand number to and from respectively (i.e. M114/01/01-12 – A118/01/01-12).

12. Horizontal Cable

    a. Inside Equipment Rooms

       1) Horizontal cables shall be labeled at each end with the destination end and origin room number, patch panel number, and port number. (i.e. A109-127-A01).

       2) Patch panels in each closet shall be labeled sequentially starting with the first Patch Panel in the top of the first relay rack (A, B, C, D, E, etc.).

       3) 110-type blocks shall contain the destination room number, pair numbers, and binder pair number under each pair termination. (example)

a) 110-type block labels shall be printed on product-specific label strips and placed into label holders.

13. Workstation Faceplates

a. Cables and wall plates shall be labeled denoting origin, Equipment Room/Telecommunications Room Number, Patch Panel, 110-type termination block, and Port Number. (i.e. M114-A01).

14. TMGB and TGB

a. TMGB and TGB shall be labeled with a unique identifier (i.e. TMGB-M114, TGB-M114).

15. Bonding Conductors

a. The following conductors shall be labeled at each end with the destination end and origin room number (i.e. M114 – MDFM114).

1) Bonding Conductor for Telecommunications

2) Telecommunications Bonding Backbone

3) Grounding Equalizer

3.05 Testing Requirements

A. Fiber Optic Cable

1. Installed strands shall be tested and certified in accordance with industry standards.

2. Only Manufacturer Certified Technicians shall perform testing.

3. The Contractor shall test and certify all fiber optic cable strands with approved field tester(s) that are within their calibration period. The Contractor shall be liable for all re-testing required in the event tests are performed with non-approved test equipment or tester(s) that are not within their calibration period.

4. The Contractor shall provide calibration results from the manufacturer showing the current calibration of the testers.

5. The Contractor shall notify the Architect/Engineer a minimum of five (5) days in advance to observe cable testing.

6. The Architect/Engineer may randomly select 5% of the installed strands for test verification purposes. The Contractor shall re-test these strands in the presence of the Architect/Engineer and the results shall be compared to the previously Contractor submitted test results. In the event that any of the verification tests differ in results from the previously submitted test results, all testing shall be declared a failure and the Contractor shall re-test 100% of the installed strands at no cost to the Owner.

B. Copper Backbone Cable

1. Installed pairs shall be tested and certified in accordance with industry standards.

2. Only Manufacturer Certified Technicians shall perform testing.

3. The Contractor shall test and certify all copper pairs with approved field tester(s) that are within their calibration period. The Contractor shall be liable for all re-testing required in the event tests are performed with non-approved test equipment or tester(s) that are not within their calibration period.

4. The Contractor shall provide calibration results from the manufacturer showing the current calibration of the testers.

5. The Contractor shall notify the Architect/Engineer a minimum of five (5) days in advance to observe cable testing.

6. The Architect/Engineer may randomly select 5% of the installed pairs for test verification purposes. The Contractor shall re-test these pairs in the presence of the Architect/Engineer and the results shall be compared to the previously Contractor submitted test results. In the event that any of the verification tests differ in results from the previously submitted test results, all testing shall be declared a failure and the Contractor shall re-test 100% of the installed pairs at no cost to the Owner.

C. Category 6a UTP Cable

1. Cable links shall be tested in accordance with industry standards.

2. Only Manufacturer Certified Technicians shall perform testing.

3. The Contractor shall test and certify the structured cable system with approved field tester(s) that are within their calibration period. The Contractor shall be liable for all re-testing required in the event tests are performed with non-approved test equipment or tester(s) that are not within their calibration period.

4. No Fail or *Pass results will be accepted.

5. The Contractor shall notify the Architect/Engineer a minimum of five (5) days in advance to observe field testing.

6. The Architect/Engineer may randomly select 5% of the installed links for test verification purposes. The Contractor shall re-test these links in the presence of the Architect/Engineer and the results shall be compared to the previously Contractor submitted test results. In the event that any of the verification tests differ in results from the previously-submitted test results, all testing shall be declared a failure and the Contractor shall re-test 100% of the installed links at no cost to the Owner.

D. Grounding and Bonding

1. Main Building Ground

a. Coordinate with electrical contractor and provide a copy of their test results for the main building ground. The results shall be below 25 Ohms.

2. Two-Point Ground/Continuity Testing

a. Prior to the two-point ground testing, a visual inspection shall be performed to verify that the bonding and grounding system is installed according to the drawings and specifications and in compliance with the TIA-607-B Standard.

b. All testing shall be conducted prior to any active equipment is installed.

c. The Contractor shall use an earth ground resistance tester that is configured for a continuity test. This is also known as a two-point tester or a “dead earth” test.

d. Prior to the two-point continuity test conduct a voltage test to ensure there is no stray voltage in the system.

e. The testing shall include but is not limited to the following points.

1) Building electrical grounding electrode and the TMGB.

2) TMGB/TGB to electrical ground in ER/TR.

3) TMGB/TGB to the building steel (if present).

4) TMGB to each TGB.

5) Building steel (if present) to the electrical ground.

f. Per the TIA-607-B, the maximum value for resistance between any point in the telecommunications bonding and grounding system and the building’s electrical grounding electrode system is 100 milliohms. In the case of long TBB and Grounding Equalizer conductor runs, the resistance of the conductor must be factored into the total resistance. For example 1 km of a No. 3/0 conductor has a resistance of 0.2028 ohms. (0.06180 ohms per 1000 ft.)

g. The Contractor shall notify the Architect/Engineer a minimum of five (5) days in advance to observe field testing.

3.06 Project Closeout Documentation

A. As-Built Drawings

1. Drawings shall be provided to the Architect/Engineer at the time of substantial completion. Final payment will not be recommended until drawings are received and approved by the Architect/Engineer.

2. Three (3) sets of drawings depicting the condition of the structured cabling system as installed.

3. As-Built drawings shall be produced in AutoCAD 2017 or higher and provided in hardcopy and electronically in .dwg and PDF format.

4. Hardcopy drawings shall be provided in the original size as issued by the Architect/Engineer.

5. Drawings shall retain the formatting and title block of the original drawings as issued by the Architect/Engineer.

6. Drawings shall be provided utilizing the original scale and shall include the exact dimensions and locations of all equipment room/telecommunication room layouts, wall elevations, equipment rack elevations, ladder racks, cable tray, sleeves, backbone and horizontal cable pathways, workstation locations, and labeling scheme.

B. Test Documentation

1. Test documentation shall be provided to the Architect/Engineer at the time of substantial completion. Final payment will not be recommended until these test results are received and approved by the Architect/Engineer.

2. Three (3) sets of test documentation for the structured cabling system as installed.

3. Test results shall be provided in hard copy and electronic format (i.e., manufacturer's proprietary testing software along with applicable reader software) and PDF electronic format.

4. Test documentation shall be bound, sectioned, and tabbed in the following sequence as applicable:

a. Tester(s) Calibration Certificate(s)

b. Inter-Building Backbone Fiber Optic Cable

c. Inter-Building Backbone Copper Cable

d. Intra-Building Backbone Fiber Optic Cable

e. Intra-Building Backbone Count Copper

f. Horizontal Category 3 Cable

g. Horizontal Category 5e Cable

h. Horizontal Category 6 Cable

i. Horizontal Category 6A Cable

j. Main Building Ground

k. Two-Point Ground/Continuity Test

C. Manufacturer's Performance Certification

1. Certificate shall be provided to the Architect/Engineer at the time of final system acceptance. Final payment will not be recommended until the certificate of certification is received and approved by the Architect/Engineer.

a. The manufacturer of the solution shall furnish a performance certification for a period of no less than twenty (20) years starting at final system acceptance.

b. One original and two copies of the Manufacturer's Certificate shall be provided.

D. Manufacturer's Product Warranty

1. Certificate of product warranty shall be provided to the Architect/Engineer at the time of final system acceptance. Final payment will not be recommended until this certificate of product warranty is received and approved by the Architect/Engineer.

   a. The manufacturer of the solution shall furnish an extended warranty for a period of no less than twenty (20) years starting at final system acceptance.

   b. One original and two copies of the Manufacturer's product warranty shall be provided.

E. Contactor's Statement of Warranty

1. Statement of warranty shall be provided to the Architect/Engineer at the time of substantial completion. Final payment will not be recommended until statement of warranty is received and approved by the Architect/Engineer.

   a. Contractor shall furnish a minimum of a one (1) year warranty on all materials, labor and workmanship starting at final system acceptance.

   b. One original and two copies of Contractor's warranty terms and conditions to include contact information (i.e. Contractor name, Point of Contact, address, phone number and email address) and start and end date for warranty call outs.

END OF SECTION 27 10 00

SECTION 27 21 00 – DATA NETWORK

PART 1 GENERAL

1. This section identifies the technical design and specification requirements for a Data Networking System for renovations at the San Antonio Water Systems – Phase II in San Antonio, Texas (“Owner”).
2. Contractor shall provide all materials, equipment, and labor necessary to provide a complete and functional Data Network regardless of any materials and/or equipment not listed or described in this specification and/or supplementary drawings.
3. The Contractor is responsible for obtaining complete construction documents for bidding purposes, including but not limited to; T-Series construction documents, Equipment Schedules, specifications and any supplementary addenda. Contractors that bid off of incomplete documents shall be liable for any materials and/or services required as indicated or specified in the complete construction document set. In the event of any discrepancies between the documents the greater quantities or scope shown on drawings or indicated in the specification shall be provided by the contractor.
4. The Contractor shall provide a complete 1-year warranty for all hardware systems and applicable software components installed as part of this specification inclusive of total price. Warranty shall include Cisco SmartNet Support and on-site services.

1.1 REQUIREMENTS INCLUDED

A. Contractor Requirements

B. Acceptable Manufacturers

C. Codes, Standards and Regulations

D. General Requirements

E. System Requirements

F. Testing Requirements

G. Project Closeout Documentation

1.2 RELATED REQUIREMENTS

A. The Drawings, Specifications, General Conditions, Supplementary General Conditions and other requirements of Division 1, apply to the work specified in Division 27, and shall be complied with every respect. The Contractor shall examine all of the documents, which make up the Contract Documents, and shall coordinate them with the work on the Telecommunications Drawings and Division 27 of these Specifications.

1.3 CONTRACTOR EXPERIENCE REQUIREMENTS

A. The Contractor shall be a Cisco Certified Partner prior to submitting a proposal for the work.

B. The Contractor shall possess any and all relevant Manufacturer Certifications for the company and all installers prior to submitting a proposal for the work. Contractor shall provide a list of their installers with their work experience, training history and manufacturer’s certifications for the Company and installers.

C. Installers must be certified, trained and experienced on the specific installation, configuration and testing of the systems as specified.

D. Contractor's onsite Project Manager/Superintendent shall be an Cisco Certified installer with all applicable and associated certifications.

E. The Contractor shall certify and the Manufacturer of the solution shall warrant the solution for a period of no less than one (1) year.

F. The Contractor shall be an established business with local support and shall have been in business for a minimum of five (5) years.

G. The Contractor shall have prior experience with projects of a similar size and scope. The Contractor shall provide references for a minimum of five (5) installed systems comparable to the Owner's installation, where the systems have been in continuous satisfactory operation for at least one (1) year. The Contractor shall provide the following information for each reference: Project Name, Project Location, Project Start Date, Project Completion Date, Project Start Cost, Project Completion Cost, Brief Description of Project, Client Point of Contact Name and Phone Number.

H. Past performance with the Owner is a selection criterion. Experience related to any past or present project with the Owner should be disclosed with bid response.

I. Qualified Contractors shall submit proof of all certifications and experience detail with bid response and product submittals.

1.4 SUBMITTALS

A. Pre-Installation

1. Original Equipment Manufacturer (OEM) documentation for each component proposed must be provided to Owner, which certifies performance characteristics. Contractor shall not purchase or install any equipment until OEM documentation has been received and approved by the Architect/Engineer.

2. Product data sheets for all proposed system components. Product data sheets shall include: an equipment schedule listing of all system components to be installed in the project and the manufacturer's product reference and specification literature for all products to the utilized and/or installed in the project. Contractor shall not purchase or install any equipment until product data sheets have been received and approved by the Architect/Engineer.

3. Contractor shall provide to owner's representative shop drawings of the proposed layouts of equipment. Shop drawings shall include equipment rack layouts and system schematics

4. These include detailed shop drawings submitted on 30" X 42" bond paper. Contractor shall not install any equipment until shop drawings have been received and approved by the Architect/Engineer. Manufacturer Certifications for Company as identified in Contractor Experience Requirements.

5. Manufacturer Training Certifications for Installers as identified in Contractor Experience Requirements.

6. Project Manager/Superintendent Cisco Certifications as identified in Contractor Experience Requirements.

7. Manufacturer Certification/Warranty offering as identified in Contractor Experience Requirements.

B. Post Installation

1. Contractor shall prepare, update and make available to the Architect/Engineer a comprehensive three (3) copy set of drawings accurately depicting the “as-built” condition of the Data Network as it was installed. As-Built drawings must be provided in original hardcopy format and in AutoCAD 2017 or higher as well as in PDF format. The Contractor shall prepare, update, and make available to the Consultant a comprehensive set of "as built" drawings using the original scale, indicating exact dimensions and locations of all Wireless Access Points, switches, racks, and labeling scheme. These drawings shall be turned over to the Consultant at the time of final systems acceptance of the data network installation. Final payment will not be made until these drawings are received and approved by the Architect/Engineer.

2. The Contractor shall provide three (3) sets of documentation for the data network to the Architect/Engineer at the time of final systems acceptance. Test results shall be provided in original hardcopy format and on a CD-ROM. Final payment will not be made until these test results are received and approved by the Architect/Engineer.

3. The Contractor shall furnish the original Certificate of Certification/Warranty to the Architect/Engineer at the time of final systems acceptance. Final payment will not be made until this Certificate of Warranty is received and approved by the Architect/Engineer.

4. Contractor shall provide warranty information to include the name, address and phone number contacts for warranty call outs. Final payment will not be made until this warranty information is received and approved by the Architect/Engineer.

PART 2 PRODUCTS

1. The following sections specifically list the acceptable equipment types and items for this project. Proposed equivalent items must meet or exceed these specifications and the specifications of the listed item. In the event a specified manufacturer’s part number has changed or is no longer valid, Contractor shall substitute the appropriate equivalent manufacturer’s part number. Owner or Owner’s designate will have final determination of acceptability of all proposed equipment and must approve submitted equipment prior to installation. Where quantities are not noted, they may be obtained from the drawings. In the event of a discrepancy between the specifications and the drawings, the greater quantity and/or better quality will be furnished.

2. Any materials or equipment not installed in the project shall be returned to the Owner. Contractor shall store all materials and equipment in accordance with manufacturers' instructions in a weather-tight, secure enclosure. Contractor shall be responsible for safety and security of all materials until project is complete and accepted by Owner.

2.1 ACCEPTABLE MANUFACTURERS

A. Quantities listed below are based on per site. Refer to technology drawings for locations of equipment.

B. Aggregate Switches - Refer to Technology Drawings for Locations

1. Cisco WS-C4507R+E Chassis (2) WS-X4648-RJ45V+E Sup7L-E, LAN Base – Part Number WS-C4507RE+96V+ to include:
   a. (1) 12 Months of SmartNet 8X5XNBD Part Number WS-C4507R+E Chassis, (2) WS-X4648-RJ45V+E Sup7L-E, LAN Base – Part Number CON-SNT-C4507REV
   b. (1) Sup8-E and WS-X4748-RJ45V+E Upgrade for Bundle – Part Number C4500E-S7L-S8
   c. (1) Catalyst 4500 E-Series Supervisor 8-E – Part Number WS-X45-SUP8-E
   d. (1) Catalyst 4500 E-Series Redundant Supervisor 8-E – Part Number WS-X45-SUP8-E/2
   e. (1) CAT4500e SUP8e Universal Crypto Image – Part Number S8EUK9-33-1511XO
   f. (1) Catalyst 4500 4200W AC dual input Power Supply (Data + PoE) – Part Number PWR-C45-4200ACV
   g. (4)NEMA 5-15 to IEC-C19 13ft US Power Cord – Part Number CAB-US515P-C19-US
   h. (1) Catalyst 4500 4200W AC dual input Power Supply (Data + PoE) – Part Number PWR-C45-4200ACV/2
   i. (1) Paper IP Base License – Part Number C4500E-IPB
   j. (2) Catalyst 4500E 48-Port PoE 802.3at 10/100/1000(RJ45) – Part Number WS-X4748-RJ45V+E
   k. (1) Catalyst 4500 E-Series 48-Port PoE+ Ready 10/100/1000(RJ45) – Part Number WS-X4648-RJ45V+E
   l. (10) 1000BASE-LX/LH SFP transceiver module, MMF/SMF, 1310nm, DOM – Part Number GLC-LH-SMD=

C. Access Switches
1. Cisco Catalyst 3560X 24 Port PoE IP Base – Part Number WS-C3560X-24P-S to include
   a. (2) 12 Months of SMARTNET 8X5XNBD Catalyst 3560X 24 Port PoE IP Base – Part Number CON-SNT-3560X2PS
   b. (4) AC Power Cord for Catalyst 3K-X (North America) – Part Number CAB-3KX-AC
   c. (2) Catalyst 3K-X 715W AC Secondary Power Supply – Part Number C3KX-PWR-715WAC/2
   d. (2) Catalyst 3K-X 1G Network Module option PID – Part Number C3KX-NM-1G
   e. (2) CAT 3560X IOS Universal with Web Based Device Manager – Part Number S356XVK9T-15002SE
   f. (2) Catalyst 3K-X 715W AC Power Supply – Part Number C3KX-PWR-715WAC
   g. (2) Insert, Packout - PI-MSE – Part Number PI-MSE-PRMO-INSRT

2. Cisco Catalyst 3560X 48 Port Full PoE IP Base – Part Number WS-C3560X-48PF-S to include
   a. (2) 12 Months of SMARTNET 8X5XNBD Catalyst 3560X 48 Port Full PoE IP Base – Part Number CON-SNT-3560X4FS
   b. (4) AC Power Cord for Catalyst 3K-X (North America) – Part Number CAB-3KX-AC
   c. (2) Catalyst 3K-X 1100W AC Secondary Power Supply – Part Number C3KX-PWR-1100WAC/2
   d. (2) Catalyst 3K-X 1G Network Module option PID – Part Number C3KX-NM-1G
   e. (2) CAT 3560X IOS Universal with Web Based Device Manager – Part Number S356XVK9T-15002SE
   f. (2) Catalyst 3K-X 1100W AC Power Supply – Part Number C3KX-PWR-1100WAC
   g. (2) Insert, Packout - PI-MSE – Part Number PI-MSE-PRMO-INSRT

D. Exterior Enclosures Quantities listed below are based on per enclosure. Refer to technology drawings for quantity of enclosures.
   1. Uninterruptible Power Supply
      a. (1) 1500 VA Smart-UPS by APC/Schneider Electric with management card – Part Number SMT1500RM1U
      b. (1) UPS Network Management Card – Part Number AP9630

   2. (1) Cisco Catalyst 3560X 24 Port PoE IP Base – Part Number WS-C3560X-24P-S to include
      a. (1) 12 Months of SMARTNET 8X5XNBD Catalyst 3560X 24 Port PoE IP Base – Part Number CON-SNT-3560X2PS
      b. (2) AC Power Cord for Catalyst 3K-X (North America) – Part Number CAB-3KX-AC
      c. (1) Catalyst 3K-X 715W AC Secondary Power Supply – Part Number C3KX-PWR-715WAC/2
      d. (1) Catalyst 3K-X 1G Network Module option PID – Part Number C3KX-NM-1G
      e. (1) CAT 3560X IOS Universal with Web Based Device Manager – Part Number S356XVK9T-15002SE
      f. (1) Catalyst 3K-X 715W AC Power Supply – Part Number C3KX-PWR-715WAC
      g. (1) Insert, Packout - PI-MSE – Part Number PI-MSE-PRMO-INSRT
      h. (4) 1000BASE-LX/LH SFP transceiver module, MMF/SMF, 1310nm, DOM – Part Number GLC-LH-SMD=

PART 3 EXECUTION

3.1 CODES, STANDARDS AND REGULATIONS

NOTE: Use the most current versions of all referenced Code, Standard or Regulation

A. American National Standards Institute (ANSI)
B. American Society for Testing and Materials (ASTM)
C. Alliance for Telecommunications Industry Solutions (ATIS)
D. Electronics Industry Alliance (EIA)
E. Building Industry Consulting Service International, Inc. (BICSI)
   1. BICSI -- Telecommunications Distribution Methods Manual
   2. BICSI -- Cabling Installation Manual
   3. BICSI -- LAN Design Manual
   4. BICSI -- Customer-Owned Outside Plant Design Manual
F. Federal Communications Commission (FCC)
   1. FCC Part 15, Radiated Emissions Limits, revised
   2. FCC Part 68, Connection of Terminal Equipment to the Telephone Network
   3. FCC Part 76, Cable Television Service
G. International Electrotechnical Commission (IEC)
H. Institute of Electrical and Electronics Engineers, Inc. (IEEE)
   1. IEEE Standard 81-1983, IEEE Guide for Measuring Earth Resistance, Ground Impedance, and Earth Surface Potential of a Ground System
   2. IEEE Standard 1100-1999, Recommended for practice for Powering and Grounding Sensitive Electronic Equipment in Industrial and Commercial Power Systems (IEEE Emerald Book)
   3. IEEE-802.3af – Power Over Ethernet (PoE) Standard
   4. IEEE-802.3ac – Power Over Ethernet + (PoE+) Standard

5. IEEE-802.3an – Physical Layer & Management for 10Gbps – 10BASE-T
6. IEEE-802.11 – Wireless Standard

I. International Organization for Standardization (ISO)

J. International Organization of Standardization/International Electrotechnical Commission (ISO/IEC)
1. ISO/IEC 11801, Information Technology-Generic Cabling for Customer Premises
2. ISO/IEC 14763-1, Information Technology-Implementation and Operation of Customer Premises Cabling-Administration

K. National Cable Television Association (NCTA)

L. National Electrical Code (NEC)

M. National Electrical Manufacturers Association (NEMA)

N. National Fire Protection Association (NFPA)
1. NFPA-70, National Electrical Code
2. NFPA-75, Protection of Electronic Computer Data Processing Equipment.
3. NFPA-101, Life Safety Code
4. NFPA 262 – Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces
5. NFPA-297, Guide on Principles and Practices for Telecommunications Systems
6. NFPA-780, Standard for the Installation of Lightning Protection Systems.

O. National Institute Standards and Technology (NIST)

P. Occupational Safety and Health Administration (OSHA)

Q. Rural Utility Services (RUS)

R. Telecommunications Industry Association (TIA)
1. ANSI/TIA-568-C.0, Generic Telecommunications Cabling for Customer Premises
2. ANSI/TIA-568-C.1, Commercial Building Telecommunications Cabling Standard, Latest Version
3. ANSI/TIA-568-C-2, Corrections Balanced Twisted-Pair Telecommunications Cabling and Components Standard
4. ANSI/TIA-568-C-3, Optical Fiber Cabling Components Standard
5. ANSI/TIA-568-C-4, Broadband Coaxial Cabling and Components
6. ANSI/TIA–569-C, Commercial Building Telecommunications Pathways and Spaces
7. ANSI/TIA-569-C.1, Revised Temperature and Humidity Requirements for Telecommunications Spaces
8. ANSI/TIA-606-B, Administration Standard for Telecommunications Infrastructure of Commercial Buildings
9. ANSI/TIA-607-B, Commercial Building Grounding and Bonding Requirements for Telecommunications
10. ANSI/TIA-758-B, Customer-Owned Outside Plant Telecommunications Cabling Standard
11. ANSI/TIA-862-A Building Automation Systems Cabling Standard
12. ANSI/TIA-526-14-B, OFSTP-14 - Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant

S. Underwriters Laboratories, Inc. (UL)

T. Any and all requirements of the Local Authority Having Jurisdiction (LAHJ of AHJ)

NOTE: In the event of any conflicts between documents referenced herein and the contents of this specification, the Contractor shall notify in writing to the Architect/Engineer of any such occurrences

before the purchasing of any equipment, materials and/or installation by the Contractor. The Architect/Engineer will notify the Contractor of any actions required to resolve these conflicts. Such actions may include but are not limited to: design changes, equipment, materials and/or installation changes. In any event Contractor shall not supersede specifications and standards from the latest NFPA and NEC publications.

3.2 GENERAL REQUIREMENTS

A. In the installation of this work, the Contractor shall comply in every way with the requirements of local and laws of the State of Texas, the National Board of Fire Underwriters, and the National Electrical Code. If, in the opinion of the Contractor, there is anything in the plans or specifications that will not strictly comply with the above laws, ordinances, and rules, the matter shall be referred to the attention of the Architect/Engineer for a decision before proceeding with that part of the work.

B. No change in the plans or in the specifications shall be made without full consent in writing of the Architect/Engineer.

C. The Contractor shall obtain written permission from the Architect/Engineer before proceeding with any work that would necessitate cutting into or through any part of the building structure such as, but not limited to girders, beams, floors, or partition ceilings.

D. The Contractor shall install the materials in accordance with the manufacturers' guidelines and specifications.

E. The Contractor shall promptly correct all system discrepancies or defects for which the Contractor is responsible.

F. The Contractor shall coordinate all work with the Architect/Engineer prior to purchase of products or installation of cable plant.

G. The Contractor shall submit product data sheets for all materials to the Architect/Engineer prior to the purchase or installation of data network.

H. The Contractor shall maintain a work area free of debris, trash, etc., and dispose of such items on a daily basis and return the site to the original state of cleanliness. The Contractor shall not use Owner's facilities for the disposal of excess or scrap materials.

I. The Contractor shall be certain that all work areas are in compliance with the Occupational Safety and Health Administration (OSHA) regulations.

J. The Contractor shall have written approval from the Architect/Engineer for any additional work outside the Contract Document Scope prior to beginning such work.

K. The Contractor shall install all equipment as close to the wiring fields as possible, taking into consideration, testing, administration, maintenance, and future growth.

L. The Contractor shall be responsible for testing all cable prior to the installation of the cable. If the Contractor fails to perform this testing operation, the Contractor shall accept the cable as being good and assume all liability for the replacement of the cable should it be found defective at a later date.

M. The Contractor shall maintain a set of working specifications and drawings on site at all times and shall be responsible for keeping the drawings updated on a minimum of a weekly basis. These working drawings shall be made available for inspection at the request of the Architect/Engineer or the Owner.

N. Materials shall be consistent throughout the building. Where two or more units of the same class of equipment or wiring are required, these units shall be the standard product of a single manufacturer and shall be the same product with the same material, model, and manufacturer number.

O. All wiring, equipment and installation materials shall be new and of the highest quality. Cable, equipment and installation materials shall be delivered and stored in a clean, dry space at the Contractors expense. Materials and equipment will be properly packaged in factory-fabricated type containers and protected from the environment, damaging fumes, construction debris, and traffic, etc. until the job is installed or completion of the project.

P. Labels on all wiring, materials, and equipment must show that a nationally recognized testing laboratory lists them. Original Equipment Manufacturer (OEM) documentation must be provided to the Architect/Engineer and Owner, which certifies performance characteristics and which meet ANSI/TIA 568-C standard.

Q. All external screws, nuts, and locking washers shall be stainless steel. No self-tapping screws shall be allowed unless specifically approved or specified by the Architect/Engineer.

R. All material used in the installation shall be made of corrosion-resistant material, such as plastic, anodized aluminum, or brass and be resistant to fungus growth and moisture deterioration. An inert dielectric material shall separate dissimilar metals apt to corrode through electrolysis under the environmental operating conditions specified.

S. All cable installed in a plenum rated environment shall meet or exceed the Underwriters Laboratories (UL) fire rated cable insulation requirements.

3.3 SYSTEM REQUIREMENTS

A. Metropolitan Area Network (MAN)

1. Currently the Owner has a functional MAN utilizing Gigaman connectivity. Contractor shall provide SFP+ interconnection of new switches in TR1.0 for interconnection of MAN Fiber service.

B. Local Area Network (LAN)

1. Contractor shall furnish, install and configure all systems hardware and software required for the Local Area Network (LAN) as specified or required to provide a complete turn-key installation for the designated campuses. All Local Area Network (LAN) equipment shall be rack mounted unless specified otherwise. Contractor shall furnish, configure and install an APC UPS System with a Network Management Card and vertically mounted 0U PDU's for each exterior enclosure as indicated and specified on the Technology Drawings to maintain power to the equipment in the event of a complete power failure.

   Contractor shall provide CAT 6A patch cables at each telecommunications room that for each switch port installed as CAT 6A. Color of Patch Cord shall match the color of the cable drop sheath.

   Contractor shall provide CAT 6A patch cables at each workstation location that are 10 foot long for each switch port installed as CAT 6. Color of Patch Cord shall match the color of the cable drop sheath.

   Contractor shall provide CAT 6 patch cables at each telecommunications room that for each switch port installed as CAT 6. Color of Patch Cord shall match the color of the cable drop sheath.

   Contractor shall provide CAT 6 patch cables at each workstation location that are 10 foot long for each switch port installed as CAT 6. Color of Patch Cord shall match the color of the cable drop sheath.

   Contractor shall provide OS2 8.3µm (Yellow) patch cords for each uplink installed.

2. Contractor shall furnish, configure and install the Data Network in the quantities described in the T-series drawings. These switches shall be interconnected to the existing network via Gigabit Ethernet interfaces for interconnection to the Core MAN switch and LAN network. Contractor shall provide all services for discovery of existing MAN/LAN network prior to

beginning installation of the new equipment. All work shall be coordinated with the Owner or designated representative prior to starting the work.

Contractor shall configure VLANs for Switch Management, Servers, Printers, Data (DHCP to be supplied by the existing network service), Voice, Electronic Security, and 802.11a/b/g and N Wireless across the network. Contractor shall provide proper rack mounting hardware and all fiber-optic and copper patch cords of the appropriate/specified type, length and color for the complete interconnection of LAN components as specified. Contractor shall be responsible for coordination with the Owner for discovery of all pertinent LAN parameters for configuration of new switching equipment.

3.4 TESTING REQUIREMENTS

A. Metropolitan Area Network (MAN)

1. Contractor shall test for full functionality of the MAN to ensure connectivity from the new LAN to the NOC.

B. Local Area Network (LAN)

1. Contractor shall unpack and bench test each piece of equipment. All electronic components shall be operational for a minimum of 24 hours prior to be putting into service.
2. Each piece of equipment shall be verified for configuration and functionality.

3.5 PROJECT CLOSEOUT DOCUMENTATION

A. The contractor shall provide a designated representative as Project Manager to be available for all project meetings and all inspection activities.

B. All project correspondence shall be sent in hardcopy to all relevant parties via letter, facsimile or email. Verbal agreements, arrangements or other communications shall not be binding on either party or have precedent for the duration of Contract.

C. The contractor shall present an installation schedule prior to beginning the installation. All project activities shall be coordinated in advance of such stated activities.

D. Upon successful operation and cutover of the system, the contractor shall notify the Architect/Engineer and Owner that the installation is substantially complete at which time the designated representative shall perform a formal Substantial Completion inspection to verify the work. Any and all discrepancies will be documented. The Contractor shall have ten (10) working days to resolve any and all system discrepancies noted on the Certificate of Substantial Completion.

E. Title for all equipment (Hardware and Software) shall not pass to the Owner from the contractor until the system is accepted and both the Owner and contractor execute the Certificate of Systems Acceptance.

F. Contractor shall provide the Owner one (1) original and two (2) identical copy sets of the system installation and O&M documentation at the time of Substantial Completion. This documentation at a minimum shall contain the following:

1. Contractor shall provide product cut-sheets and manuals for every hardware and software product installed as part of this project.
2. Contractor shall provide the Owner a complete listing of all equipment and software installed as part of this project. This data shall be shown on a spreadsheet format, indicating, Manufacturer, Description, Model #, Serial # and all applicable revision or release information.
3. Contractor shall provide the Owner logical network diagrams indicating both Physical and Logical network topology, including Physical Arrangement, IP addressing, Sub-net information, VLAN and security policy.

4. Contractor shall provide the Owner with as-built installation drawings indicating the physical installation of the system in both plan and rack elevation format. Softcopy of the drawings are to be in Visio or AutoCAD 2014 format. PDF drawings derived from either applications shall also be included.
5. Contractor shall provide the Owner all original and archival copies of the operational and application software with applicable software licenses and code keys. All software must be submitted in the original packaging and contain original documentation.
6. Contractor shall provide all applicable systems documentation in Hard and Softcopy as applicable.
7. Contractor shall submit close-out documentation in bound and tabbed binders to Owner. Soft documentation, where applicable are to be included in the binder using CD sleeves.

END OF SECTION 27 21 00

SECTION 27 40 00 – Audio/Video

Communications PART 1 GENERAL

1.1 This section identifies the requirements, technical design, and specifications for the Integrated Security and Communication System at the San Antonio Water Systems – East Side and Northwest Operations Centers in San Antonio, Texas (“Owner”). The Integrated security and communication system as specified is an industry-standard and includes card readers, cameras, and cabling as specified.

1.2 The Contractor shall provide a Manufacturer’s Performance Certification for the installed access control system.

1.3 Contractor shall include materials, equipment, and labor necessary to provide a complete and functional access control system regardless of any items not listed or described in this specification or associated drawings.

1.4 Requirements

A. Contractor Experience Requirements

B. Submittal Requirements

C. Acceptable Manufacturers

D. Codes, Standards and Regulations

E. General Requirements

F. System Requirements

G. Testing Requirements

H. Training Requirements

I. Project Closeout Documentation

J. Attachments

1.5 Related Requirements

A. The Drawings, Specifications, General Conditions, Supplementary General Conditions, and other requirements of Division 1 apply to the work specified in Division 27 and Division 28, and shall be complied with in every respect. The Contractor shall examine all of the items which make up the Contract Documents, and shall coordinate them with the work on the project.

B. Contractor Experience Requirements

1. The Contractor shall possess all relevant Manufacturer Certifications (i.e. hardware installation, software installation and programming, etc.) for both the company and individual technicians prior to submitting a bid for the work.

2. The Contractor shall have been in business for a minimum of five (5) years.

3. The Contractor shall have a local office with local technicians and an adequate workforce to complete this project within a 75-mile radius of the project site.

4. The Contractor shall have completed a minimum of five (5) projects similar in size and scope to the Owner's installation, where the systems have been in continuous satisfactory operation for at least one (1) year.

C. Subcontractors shall be identified at the time of bid and comply with the requirements and intentions of these specifications, associated drawings, and related contract documents.

1.6 Submittal Requirements

A. Pre-Installation Submittal

1. Contractor shall not order, purchase, or install any equipment until pre-installation submittals have been accepted in writing by the Architect/Engineer.

2. Manufacturer product data sheets for each proposed system component.

a. For product data sheets containing more than one (1) part number or product, the Contractor shall clearly identify the specific part number or product being submitted Equipment schedules listing all system components, the manufacturer, model number and quantity of each.

3. Shop drawings of the proposed system installation.

a. Shop drawings shall include card reader locations, door position sensor locations, access control panel elevations to include layout and power supply locations, installation typical details, preliminary cable numbers, proposed cable pathways, system schematics, and riser diagrams. Shop drawings shall be submitted on 30" X 42" bond paper.

b. Contractor shall maintain a set of shop drawings on site at all times and shall update the shop drawings on a weekly basis. Shop drawings shall be made available for inspection at the request of the Architect/Engineer.

4. Manufacturer Product Certifications for Company.

5. Manufacturer Product Certifications for Installers.

6. Manufacturer Warranty letter.

7. Documentation indicating that Contractor has been in business for (5) years.

8. Address of Contractor's local office within a 75-mile radius of the project site.

9. Quantity of full time local technicians within a 75-mile radius of the project site.

10. List of five (5) contractor-installed projects of a similar size and scope in operation for at least (1) year. The Contractor shall provide the following information for each project: Project Name, Project Location, Project Start Date, Project Completion Date, Project Start Cost, Project Completion Cost, Brief Description of Project, Client Point of Contact Name and Phone Number.

11. List of completed and ongoing projects with the Owner. The Contractor shall provide the following information for each project: Project Name, Project Location, Project Start Date, Project Completion Date, Project Start Cost, Project Completion Cost, GENERAL

PART 2 PRODUCTS

2.1 General Requirements

A. The following sections specifically list the acceptable equipment types and items for this project.

B. Architect/Engineer will have final determination of acceptability of all proposed equipment and must approve submitted equipment prior to purchase or installation.

C. Proposed equivalent items must be approved in writing by the Architect/Engineer prior to submitting a bid. Proposed equivalent items must meet or exceed these specifications and the specifications of the specified item.

D. In the event a manufacturer's specified product or part number has changed or is no longer available, Contractor shall substitute the appropriate equivalent manufacturer's part number.

E. In the event of a discrepancy between the specifications and the drawings, the greater quantity and/or better quality will be furnished.

F. For listed products with no part number specified, Contractor shall provide a product that meets the performance requirements of these specifications, industry standard practices, and intended application.

G. All wiring, equipment, and installation materials shall be new and of the highest quality.

H. Labels on all wiring, materials, and equipment must indicate a nationally recognized testing laboratory.

I. Original Equipment Manufacturer (OEM) documentation must be provided to the Architect/Engineer which certifies performance characteristics and compliance with industry standards.

2.2 Acceptable Manufacturers

A. Acceptable Manufacturer: 2N Helios IP Force Intercom

a. 91151104C – 4 Buttons and Camera

B. Or approved equal.

2.3 System Description

A. Integrated security and communication system.

1. General

a. Intercom shall be compact unit, anti-vandal design with protecting frame and black surface.

2. Mechanical requirements

a. Robust construction and easy to install.

b. Two separate microphones for back up and noise cancellation.

c. Backlit, easy to exchange nametags which are push buttons at the same time.

d. Camera shall be hidden and protected by the chassis of the intercom.

e. Intercom shall be equipped with tamper switch which enables connection of a separate wiring to alarm system. Opening, removing or disconnecting of the intercom shall be recognizable even if the intercom is out of operation. Intercom shall be able to react on tamper switch activation with sound alarm, call triggering, sending of an email and sending of HTTP message.

3. Configuration

a. Intercom shall support auto provisioning / triggered or automatic prescheduled updates and upgrades.

b. Intercom shall support DHCP option 66 function to obtain auto provisioning server address.

c. Automatic upgrade of firmware or update of configuration shall support TFTP or HTTP protocol.

d. Specific configuration file for particular unit, model, or general shall be supported.

4. Communication

a. Audio and video communication.

b. Audio communication using G.711 or G.729 codecs.

c. Following Ethernet protocols have to be supported DHCP, HTTP, HTTPS, TFTP, SMTP, 802.1x, NTP, RTP, RTSP, ONVIF, Syslog

d. Intercom shall be able to send pictures separately from audio to 2N® Helios IP Eye application.

e. Audible and visible information for user about current status of the intercom using pictograms and human voice instructions.

f. Separate visible indicator of armed or alarm status.

g. Intercom shall be interoperable with public announcement systems as both destination of announcement as well as source of announcement.

h. Intercom shall support multicast audio dissemination, both as source and destination.

i. Group of intercoms shall be able to perform basic public announcement tasks.

j. On predefined situations, intercom shall be able to send an email with pictures from camera and predefined message text. Intercom shall be able to address every user in phonebook, or use a default general email address.

k. Intercom shall be able to address 1999 separate users, three numbers for each user.

5. Access control

a. Intercom shall be able to communicate with external access control system using Wiegand interface or HTTP messages.

b. Electrical outputs shall be remotely operable by external access control system.

c. Intercom shall support connection of “Push to exit” button.

d. Electrical outputs shall be either opened for predefined time, or closed manually.

e. Ten anonymous visitor cards shall be supported.

f. Each user of intercom included in phonebook shall have at least one access RFID card.

6. Network security

a. Intercom shall be able to use user certificates to encrypt communication.

b. Intercom shall support 802.1x for network authentication.

7. Physical security

a. Particular intercoms in the network shall be able to intercommunicate and perform group actions such as emergency lockdown, door release, disabling of access cards.

b. Intercom shall be ONVIF profile S certified to provide proper interoperability with video monitoring and recording systems. Streaming of the video from the intercom shall not interfere with other operation of the unit. Up to four independent clients shall be able to be accommodated.

c. Intercom shall be able to test proper operation of its speaker and microphone and inform about result of such test. Test shall be manually triggered, or prescheduled.

d. Intercom shall be able to block predefined actions, such as user accessibility, RFID card or access code functionality to specific time on a weekly basis.

8. Additional Requirements

a. Power Supply

1) 802.3af (PoE) 48 V / 380 mA DC/Adaptor 230 V10%,

2) 50/60 Hz / 12V DC

3) DC power supply 12 V / 2A DC

b. VoIP

1) Signalization SIP

c. Number of voice channels

1) 2

d. Audio Codecs

1) G.711, G.729

e. Video Codecs

1) H.264, 64 – 2048 kbit/s
2) H.263
3) H.263+

f. Interfaces
   1) Ethernet
      a) Connector RJ-45
      b) Ethernet speed 10/100 BASE-T

g. Relay outputs
   1) Maximal voltage 30 V DC
   2) Maximal current 1 A DC

h. Active output 9V – 13V DC/700m

i. Audio & Video
   1) Audio
   2) 2 integrated microphones
   3) 10W D-Class amplifier
   4) Full duplex (AEC)

j. Video
   1) Camera 640 (H) x 480 (V)
   2) View angle 135° (H), 109° (V)
   3) IR Night Vision

k. Dimensions
   1) 217x109x83 mm (H x W x D)
   2) 242x136x83 mm (H x W x D) with a frame

l. Weight max. 2000 g

m. Operating temperatures from –40 to +55 ºC

n. Cover level IP65, selected models IP69k

o. Mounting Boxes
   1) Flush Mount Box
   2) Plaster Mount

p. RFID card reader
   1) Card Reader Compatible with HID iClass

2.4 Quality Assurance

A. Manufacturer Qualifications: ISO 9001:2000 certified company.

B. Installer Qualifications:

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Finish areas designated by Architect.

2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.

3. Refinish mock-up area as required to produce acceptable work.

2.5 Delivery, Storage, and Handling

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.

C. Handling: Protect materials during handling and installation to prevent damage.

2.6 Product Conditions

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 3 EXECUTION

3.1 Codes, Standards, Regulations

A. TIA/EIA-568-B.1 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements – (May 2001)

B. TIA-569-B Commercial Building Standard for Telecommunications Pathways and Spaces - (October 2004)

C. TIA/EIA-606-A Administration Standard for Commercial Telecommunications Infrastructure - (May 2002)

D. SIA

E. Local

F. NEC

G. ISO

H. FCC

I. UL

J. OSHA

K. NFPA

L. NEMA

M. Plenum Applications

N. Applicable Flame Test: UL 910 (NFPA 262 1990).

3.2 In the event of any conflicts between documents referenced herein and the contents of this specification, the Contractor shall notify the Architect/Engineer in writing of any such occurrences before purchasing or installing any equipment or materials. The Architect/Engineer will notify the Contractor of any actions required to resolve these conflicts. Such actions may include but are not limited to: design changes, equipment, materials and/or installation changes. In any event Contractor shall not supersede specifications and standards from the latest NFPA and NEC publications.

3.3 General Requirements

A. Contractor shall comply with the requirements of local Authority Having Jurisdiction (AHJ), State of Texas, the National Fire Protection Association (NFPA), and the National Electrical Code (NEC). If the Contractor identifies any item in the plans or specifications that will not strictly comply with the aforementioned laws, ordinances, and rules, the matter shall be referred to the Architect/Engineer for direction before proceeding with that part of the work.

B. The Contractor shall install the materials in accordance with these specifications and the manufacturer's installation guidelines.

C. No deviations from the plans or specifications shall be made without full consent in writing of the Architect/Engineer. The Contractor shall have written approval from the Architect/Engineer for any additional work beyond the Contract Documents prior to beginning such work. If the Contractor does not obtain written approval from the Architect/Engineer prior to proceeding with the work, the contractor shall not be reimbursed for the work.

D. The Contractor shall obtain written permission from the Architect/Engineer before proceeding with any work that would necessitate cutting into or through any part of the building structure such as, but not limited to girders, beams, floors, walls, roofs, or ceilings.

E. Contractor shall notify the Architect/Engineer a minimum of (2) weeks prior to beginning work and will participate in a pre-construction meeting with the Architect/Engineer to perform a walkthrough, review the scope of work, schedule, and escalation procedures.

F. The Contractor shall maintain a work area free of debris, trash, empty wire reels, scrap wire, etc., and dispose of such items on a daily basis and return the site to the original state of cleanliness. The Contractor shall not use Owner's facilities for the disposal of excess or scrap materials.

G. Equipment and materials installed by the Contractor shall be free of defects and damage.

H. Contractor shall be responsible for the repair of any damage caused by the contractor during the installation.

I. Contractor shall test all wires prior to installation. By failing to perform this testing operation, the Contractor shall accept the wire as compliant and assume all liability for the replacement of the wire at no cost to the Owner should it be found defective at a later date.

J. Contractor shall maintain a set of working specifications, design drawings, and shop drawings to be kept on site at all times and shall update the shop drawings on a weekly basis. Shop drawings shall be made available for inspection at the request of the Architect/Engineer.

K. Equipment and materials shall be consistent throughout the installation. Where multiple units of the same type of equipment and materials are required, these units shall be a standard product with the same manufacturer and model number.

L. Equipment and materials shall be delivered and stored in accordance with the manufacturer's guidelines at the Contractor's expense.

M. Contractor shall make all stored equipment and materials available for inspection at the request of the Architect/Engineer.

N. All equipment and material used in the installation shall be approved by the manufacturer for the environment in which it is being installed.

O. Wires shall be properly supported in accordance with industry standards at all times. Improperly supported wires shall be corrected by the Contractor at no cost to the Owner.

P. Contractor shall be responsible to properly protect wiring from damage by other trades during construction.

Q. Cables shall be routed at 90-degree angles to the building structure. At no time shall a diagonal pull be installed.

R. The Contractor shall not install wires in conduits or sleeves without nylon bushings. Wires installed through conduits or sleeves without nylon bushings shall be removed and replaced at no cost to the Owner.

3.4 Installation

A. Coordination

1. Coordinate with the Architect to ensure that adequate conduit is provided and that equipment backboxes are adequate for system installation.

2. Coordinate with the Architect to ensure that adequate power has been provided and properly located for the integrated security and communication system equipment.

3. Coordinate with the Architect to ensure that doors and door frames are properly prepared for electric locking hardware and door position switches.

4. Coordinate locations of all devices with the Architect prior to installation.

5. Coordinate and verify the location of each piece of rack mounted equipment with the Owner.

6. Install integrated security and communication system in accordance with manufacturer's instructions at locations indicated on the Drawings.

7. Mount equipment plumb, level, square, and secure.

3.5 Examination

C. Examine areas to receive integrated security and communication system.

D. Notify Architect of conditions that would adversely affect installation or subsequent use.

E. Do not begin installation until unacceptable conditions are corrected.

3.6 Adjusting

F. Adjust integrated security and communication system for proper operation in accordance with manufacturer's instructions.

3.7 Demonstration and Training

A. Demonstration:

1. Demonstrate that integrated security and communication system functions properly.

2. Perform demonstration at final system inspection by qualified representative of manufacturer.

B. Instruction and Training:

1. Provide instruction and training of Owner's personnel as required for operation of integrated security and communication system.

2. Provide hands-on demonstration of operation of system components and complete system, including user-level program changes and functions.

3. Provide instruction and training by qualified representative of manufacturer.

3.8 Project Closeout Documentation

A. As-Built Drawings

1. Drawings shall be provided to the Architect/Engineer at the time of substantial completion. Final payment will not be recommended until drawings are received and approved by the Architect/Engineer.

2. Three (3) sets of drawings depicting the condition of the access control system as installed.

3. As-Built drawings shall be produced in AutoCAD 2010 or higher and provided in hardcopy and electronically in .dwg and PDF format.

4. Hardcopy drawings shall be provided in the original size as issued by the Architect/Engineer.

5. Drawings shall retain the formatting and title block of the original drawings as issued by the Architect/Engineer.

6. Drawings shall be provided utilizing the original scale and shall include the exact dimensions and locations of all equipment room/telecommunication room layouts, wall elevations, equipment rack elevations, ladder racks, cable tray, sleeves, pathways, integrated security and communication locations and labeling scheme.

B. Contactor’s Statement of Warranty

1. Statement of warranty shall be provided to the Architect/Engineer at the time of substantial completion. Final payment will not be recommended until statement of warranty is received and approved by the Architect/Engineer.

2. Contractor shall furnish a minimum of a one (1) year warranty on all materials, labor and workmanship starting at final system acceptance.

3. One original and two copies of Contractor's warranty terms and conditions to include contact information (i.e. Contractor name, Point of Contact, address, phone number and email address) and start and end date for warranty call outs.

END OF SECTION

SECTION 27 41 00 – Audio Visual Systems

PART 1 GENERAL

1.01 This section identifies the requirements, technical design, and specifications for the audio-visual systems at San Antonio Water Systems – East Side and Northwest Operations Centers located in San Antonio, TX (“Owner”). The audio-visual systems as specified are industry standard and may include (but not be limited to) the following: flat panel display(s), flat panel display mounting hardware, audio visual switching and distribution equipment, projector(s), projection screen(s), audio systems, microphone systems, speaker systems, assistive listening systems, and audio visual hardware as specified.

1.02 Contractor shall include materials, equipment, and labor necessary to provide a complete and functional audio visual system regardless of any items not listed or described in this specification or the associated drawings.

1.03 Contractor shall verify presence and proper operation of all OFE prior to beginning work. Contractor shall inventory all existing equipment and turn over all unused equipment to Owner.

1.04 WARRANTY:

A. The Contractor shall include a one (1) year labor, materials and workmanship warranty on the work performed in the execution of this project to include any alterations or changes to the scope of this project through system completion and system acceptance. The warranty period shall not start until the final project completion is in writing.

1.05 GENERAL REQUIREMENTS

A. The Drawings, Specifications, General Conditions, Supplementary General Conditions, and other requirements of Division 1 apply to the work specified in Division 27, and shall be complied with in every respect. The Contractor shall examine all of the items which make up the Contract Documents, and shall coordinate them with the work on the project.

B. Contractor Experience Requirements

1. The Contractor shall possess all relevant manufacturer certifications (i.e. AV equipment, AV equipment mounting hardware, control system programming, AV transport, switching installation and commissioning, etc.) for both the company and individual technicians when submitting a proposal for work.

2. The Contractor shall have been in business for a minimum of five (5) years.

3. The Contractor shall have a local office with local technicians and an adequate workforce to complete this project within a 75-mile radius of the project site.

4. The Contractor shall have completed a minimum of three (3) projects similar in size and scope to the Owner’s installation, where the systems have been in continuous satisfactory operation for at least one (1) year.

C. Subcontractors shall be identified at the time of bid and comply with the requirements and intentions of these specifications, associated drawings and related contract documents.

1.06 SUBMITTAL REQUIREMENTS

A. Proposal Submittal

1. Submit the Contractors standard proposal format with the following included in the proposal or as an attachment:

   a. Itemized list of all equipment and materials. This list shall contain: quantity, manufacturer, part number and description to provide a complete and functional audio visual system. Acceptance of the proposal does not accept the equipment list “as-is” and any Contractor oversights during the proposal process are to be included at no additional cost.

   b. Manufacturer Product Certifications (Project Specific) for Company, Installers and Programmers including Subcontractors. (Crestron, Extron, Biamp, etc.)

   c. Key staff profiles with documentation of industry certifications. Preference is given for personnel with Infocomm CTS, CTS-I and CTS-D certifications.

   d. List of three (3) contractor-installed projects of a similar size and scope in operation for at least one (1) year. The Contractor shall provide the following information for each project: project name, project location, project completion date (Month/Year), brief description of project, and client point of contact name/information.

   e. Provide a Warranty Statement that contains specific details on the Contractors’ Warranty being proposed for this scope of work.

   f. The proposal shall include an itemized breakdown of the cost of equipment, materials, labor, the standard workmanship warranty, and any shipping and taxes (if applicable). Line item pricing of equipment is not required. Do not include optional warranties or alternates in the total where applicable. Any optional warranties or alternates should be itemized separately and proposed as “in-addition-to.”

2. Manufacturer product specification sheets for pre-submittal substitution requests.

   a. Manufacturer product data sheets are only required when submitting a substitution request. All substitutions or alterations to the project scope must be approved in writing prior to proposal submittal.

   b. For product data sheets containing more than one (1) part number or product, the Contractor shall clearly identify the specific part number or product being submitted.

   c. Submit specification sheets only. Do not submit a user or operator’s manual in lieu of a specification sheet. If a specification sheet is not available from the manufacturer, submit a catalog page or the specification appendix (only) from the operation manual. The last resort acceptable submittal is a pdf of the specification section of the product from the manufacturer’s website.

B. Pre-Installation Submittal

1. Contractor shall not order, purchase or install any equipment until pre-installation submittals have been accepted in writing by the Owner/Consultant.

2. Include the Proposal Submittal from the previous section in the event the Proposal Submittal was not previously provided.

3. Manufacturer product specification sheets for post award substitution requests. The requirements are the same as described in proposal substitution requests above.

4. Product Configuration Sheets.

a. Contractor shall provide a product configuration report in PDF format completed by a certified designer/engineer for the configurable device when a manufacturer provides a tool for the applicable product. For example, but not all inclusive, a Crestron DM Switcher Configuration Report.

b. Provide projector lens calculations to include projection installation distance from screen.

5. Shop drawings of the proposed system installation.

a. Shop drawings shall be provided clearly depicting any proposed modification to the project drawings. Any modifications shall be highlighted on the shop drawings.

b. Shop drawings shall include system line diagrams, floor plans (include projector installed distance from screen with dimensioned distance), rack elevations, and/or detail drawings as required. Shop drawings shall be submitted electronically in pdf format for a 30”x42” paper size. Shop drawings shall not contain copies of, snippets of or depictions of Combs Consulting Group’s drawings.

c. Contractor shall maintain a set of shop drawings on site at all times and shall update the shop drawings on a weekly basis. Consultant drawings and specifications shall be made available during the installation of the project for reference only. Both sets of drawings are the responsibility of the Contractor to provide and maintain. Drawings shall be made available for inspection at the request of the Owner/Consultant.

6. Itemized list of all equipment and materials including any substitutions that were approved and any proposal discrepancies. This list shall contain: quantity, manufacturer, part number and description to provide a complete and functional audio visual system.

C. Custom Programmed Control System Submittal

1. Provide the control system submittal prior to initiating any substantial programming work and/or production of custom produced keys/labeling. Do not proceed with custom work until the proposed work product is approved in writing.

2. Proposed touch panel/keypad control layouts for each room/panel.

a. Initial touch panel/keypad control layouts will be required for each room/panel as part of the product submissions.

b. Contractor will design and modify control interface(s) based on Owner feedback. Contractor shall participate in an initial control system kick-off meeting along with progress meetings to review control system layout and design with the owner to ensure the control system fully meets the Owner’s needs and expectations.

c. Contractor shall fully brief Owner on available programming options. Record Owner's decisions and set up initial system program. Prepare a written record of decisions, implementation methodology and results.

d. Contractor will also be expected to make reasonable adjustments to completed control systems based on Owner feedback once system is in use.

e. Once initial system programming is implemented; allow owner a two-month period to utilize the system and make comments.

f. After initial evaluation period coordinate with Owner. Record Owner's feedback and provide adjustments as requested.

D. Project Closeout Submittal

1. The Contractor shall provide three (3) sets of comprehensive drawings accurately depicting the "as-built" condition of the audio-visual systems as it was installed to the Owner/Consultant at the time of substantial completion. Final payment will not be made until these as-built documents are received and approved by the Owner/Consultant.

a. As-built drawings must be provided in original hardcopy format and on a CD-ROM and/or delivered electronically in AutoCAD rel. 2010 or higher.

2. Documentation shall include but not be limited to:

a. Equipment O & M manuals

b. Installed equipment list (manufacturer model numbers, serial numbers, installed locations, etc.)

c. Configuration information in Microsoft Excel format (IP addresses, Passwords and Usernames etc.)

d. Warranty support information

e. Documentation shall be bound, sectioned and tabbed in the following order (when applicable):

1. Equipment O&M Manuals (Bound Separately)

2. Installed Equipment List

3. Configuration Information

4. Warranty Support Information

3. All control system programming shall be delivered to the Owner. The Programmer shall transfer all source code/files related to the system. All programming shall be delivered in both compiled and un-compiled form. Upon system acceptance, ownership of the control programming shall be transferred to the Owner for their future use or modification. No claim shall be made by the programmer for continued licensing or other ongoing fees for continued usage of the control system program.

1.07 SYSTEM DESCRIPTIONS

A. TRAINING ROOMS T104 AND T105:

1. VIDEO SYSTEMS:

a. Projectors Systems:

1. Each Training Room will consist of a ceiling mounted projector (OFCI) and projection screen (CFCI). The display system was sized for the viewable area of each Training Room individually. The flush mount motorized projection screens shall be 87"x139". The projection screen will have a screen gain of 1.1. The projector will be a WXGA DLP video projector with a 6500 lumen rating. The projection system will have a brightness distribution of 85 lumens

per square foot after screen gain. A plenum rated storage box with power conditioning will be installed near the projector location in the ceiling. The storage box will provide built in ventilation, power conditioning and a mounting location for terminal equipment.

b. Video Distribution and Processing Systems:

1. The core of the distribution and processing system will be an 8x8 video matrix switcher. The matrix switcher will provide routing/switcher functionality for the spaces. The matrix switcher will pass HDCP protected content from the HDBASET transmitters to the scaling receivers located at the projector locations. The matrix switcher will also de-embed the audio from the digital transport and provide analog audio to the audio DSP. Each outside Training Room will have two HDBASET transmitter input locations and the middle bay will have four transmitters. The HDBASET transmitters will be able to accept HDMI, VGA and 3.5mm Audio inputs. The scaling receivers will scale any inputs provided to the native resolution of the video projectors.

2. AUDIO SYSTEMS:

a. Each Training Room speaker system will each have 6.5” in-ceiling speakers spread throughout each room. The flush mount in-ceiling speakers will be tapped at 30W. All ceiling speakers will be powered by an audio amplifier located in the AV Rack on the second floor. The audio amplifier will receive digital audio from the audio DSP located in the AV Rack. The wireless microphone system will also be connected to the audio system through the DANTE transport. The wireless microphones will consist of four handheld microphones and four bodypack transmitters. The wireless microphones will be assignable to each Training Room based on a combination of the “Linking” function of the base station and a routing matrix in the audio DSP controllable from the touch panel control system. An assistive listening system will be present for each room and sized per the expected seating capacity of the rooms.

3. CONTROL SYSTEMS:

a. A touch panel control system will be programmed and installed. Touch panels will be installed in each Training Room. The touch panel control system will allow functions to be controlled such as video source selection, system power on/off. System power will consist of power sequencing of non-essential rack equipment in both system equipment racks and video equipment. Other functions that will be covered by the touch panel control system are items such as volume up/down, auto-mixing, items such as mic muting, projector screen control and level control feeding the assistive listening. A partition sensor will be installed allowing the automatic configuration of the divide/combine spaces. A fire relay signal provided by others will be accepted by the control system allowing the speaker systems to be disabled when an event is being signaled.

B. “TYPE 1” ROOM:

1. Video:

a. The Type 1 Room will utilize a 123” diagonal projection screen (CFCI). The projector screens are ceiling recessed motorized high definition screens with a wide viewing angle and a screen gain of 1.1. The projector light distribution will be around 82 lumens per square foot after screen gain. The ceiling mounted projectors (OFCI) are 3500 lumen laser projectors. The projectors will each have equipment installed in a recessed 2’x2’ plenum rated storage box. The ceiling enclosure will provide power

conditioning and space for terminal equipment. Electrical power will be required for the projection screens and the ceiling enclosure.

b. An extension system that provides auto-switching, scaling and digital signal distribution over twisted pair will be installed. The wall mounted input plate will be installed and will provide HDMI, VGA and audio connectivity. Control processing and the operator interface will be provided by a wall mounted touch panel with integrated control processor. The control system will provide basic on/off, source selection and audio controls to include volume up, volume down and volume mute. In-ceiling flush mount ceiling speakers will be installed.

C. “TYPE 2” ROOM:

1. Video:

a. Each Type 2 room will have a wall mounted display (OFCI) and wallbox. Each display will have a data drop and power outlet behind the display. The displays will be mounted not to exceed 4” of protrusion from the wall to comply with ADA requirements.

b. An extension system that provides auto-switching, scaling and digital signal distribution over twisted pair will be installed. At the table a cable caddy system will be installed that will provide HDMI, VGA and audio connectivity. The cable caddy will have two buttons that will override the automatic source selection as needed. Control processing and the operator interface will be provided by a wall mounted touch panel with integrated control processor. The control system will provide basic on/off, source selection and audio controls to include volume up, volume down and volume mute.

2. Audio:

a. Audio will be connected from the twisted pair extender to the audio amplifier. The audio amplifier will drive flush mounted in-ceiling speakers. The audio amplifier will be installed in the flat panel display wallbox. The intended use of the audio system is to provide full range audio reinforcement of the displayed video source.

1. Conference Room A222 Only. All other Type 2 Rooms utilize the internal speakers of the flat panel display.

3. Floor Box and Table:

a. The owner furnished table will mount the equipment as described above. The audio video contractor will be responsible to coordinate with Owner/General Contractor, mounting locations, cable routing, conduit requirements and connectorization/interfacing. All cabling shall be neatly dressed and routed appropriately. Where cabling bundles are exposed they shall be covered with flexible sheathing.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. The following sections specifically list the acceptable equipment types and items for this project.

B. Owner/Consultant will have final determination of acceptability of all proposed equipment and must approve submitted equipment prior to purchase or installation.

C. Proposed equivalent items must be approved in writing by the Owner/Consultant prior to submitting a bid. Proposed equivalent items must meet or exceed these specifications and the specifications of the specified item.

D. In the event a manufacturer’s specified product or part number has changed or is no longer available, Contractor shall substitute the appropriate equivalent manufacturer’s part number.

E. In the event of a discrepancy between the specifications and the drawings, the greater quantity and/or better quality will be furnished.

F. For listed products with no part number specified, Contractor shall provide a product that meets the performance requirements of these specifications, industry standard practices and intended application.

G. All wiring, equipment and installation materials shall be new and of the highest quality.

H. Labels on all wiring, materials and equipment must indicate a nationally recognized testing laboratory.

I. All new equipment shall be received, stored, and staged at the Contractor’s facility until delivered and installed. Contractor shall store all materials and equipment in accordance with manufacturers' instructions in a weather-tight, secure enclosure. All equipment shall be protected from dust, debris and environmental contamination. Contractor shall be responsible for safety and security of all Contractor furnished equipment and OFE until project close-out.

2.02 EQUIPMENT

A. TRAINING ROOMS T104 and T105:

1. VIDEO PROJECTION

a. Provide and install ceiling mounted projection system in each room. Test, adjust and calibrate the projection system to meet industry standards. Provide and install ceiling enclosure system. Utilize structural ceiling plate, vibration isolating couple and trim NPT pipe with decorative ring. Provide and install motorized projection screen. Coordinate power requirements and installation with other trades.

1. Video Projector Panasonic Model# PT-RW630BU. (QTY3)

a) TYPE P1.

b) **Owner Furnished Contractor Installed (OFCI).**

2. Video Projector Mounting System.

a) Heavy Duty Universal Projector Mount Chief Model #VCMU. (QTY3)

b) Structural Ceiling Plate Chief Model #CMA345. (QTY3)

c) Decorative Ring Chief Model #CMA640W. (QTY3)

d) Custom white powder coated extension pipe. Cut to length. (QTY3)

3. Plenum rated storage box with power conditioning Chief Model #CMS491P2. (QTY3)

a) Enclosure Fan Chief Model# CMSFAN. (QTY3)

4. Projection Screen, 87”x139” HD Progressive 1.1 Dalite Model# 21816FL. (QTY3)

a) Projection Screen Enclosure Dalite Model# 21816BL. (QTY3)

b) Install enclosure first for rough-in construction and install the screen assembly when the work site is dust free and environmentally controlled.

2. VIDEO DISTRIBUTION AND SOURCES

a. Provide and install all equipment and hardware required to support the Video Distribution System. Test, configure and calibrate all systems.

b. Digitalmedia system to be initialized, configured and tested by DMC-E technician. Provide commissioning report. Label Digitalmedia Switcher inputs and outputs, coordinate labeling nomenclature with Consultant. Provide DM Planning Worksheet prior to ordering.

c. Provide the following equipment to support the installation of the Video Distribution System:

a) Digitalmedia Switcher Crestron Model DM-MD8x8. (QTY1)

(1) Crestron Model DMC-4K-C-HDCP2. (QTY6)

(2) Crestron Model DMC-4K-CO-HD-HDCP2. (QTY2)

(3) Crestron Model DMC-HDO. (QTY2)

b) Video Scaler Crestron Model #DM-RMC-SCALER-C. (QTY3)

c) Wallplate transmitter Crestron Model #DM-TX-200-C-2G-W-T. (QTY6)

3. MICROPHONE SYSTEMS

a. Provide and install all equipment and hardware required to support the Wireless Microphone Systems. Test, configure and calibrate all systems. Configure DANTE controller software and coordinate channel routing with the Audio DSP and associated equipment. Assemble, configure and test all wireless transmitters.

1. Wireless four channel microphone transceiver Shure Model #MXWAPT4. (QTY2)

2. Network charging station Shure Model #MXWNCS8. (QTY1)

a) Sliding Rack Shelf Middle Atlantic Model# SSL. (QTY1)

3. Handheld wireless microphone transmitter Shure Model #MXW2/BETA58. (QTY4)

4. Wireless bodypack transmitter Shure Model #MXW10. (QTY4)

a) Cardioid lavaliere microphone Shure Model #WL185. (QTY4)

4. SPEAKER/AMPLIFIER SYSTEMS

a. Provide and install all equipment and hardware required to support the speaker and amplifier systems. Test, configure and calibrate all systems. Coordinate mounting locations with the Owner/Consultant and coordinate all mounting locations with the as-built ceiling hardware to include lighting fixtures.

b. Program the Audio DSP to provide proper protection of speaker systems. Properly initialize and setup amplified speaker systems. Provide room equalization as required and provide equalization recommended by the loudspeaker manufacturer.

1. In-ceiling 6.5” loudspeaker JBL Model #CONTROL47C/T. (QTY37)

a) TYPE S1

2. Four channel network 70V power amplifier Ashley Model #NXE8004. (QTY1)

a) DAC option card Ashley Model #OPDAC4. (QTY1)

b) DANTE input card Ashley Model #OPDANTE. (QTY1)

5. AUDIO DSP AND DISTRIBUTION

a. Provide and install all equipment and hardware required to support the Audio DSP. Test, configure and calibrate all systems.

b. Program the Audio DSP to provide proper protection of speaker systems. Properly initialize and setup amplified speaker systems. Provide room equalization as required and provide equalization recommended by the loudspeaker manufacturer.

c. Provide system programming to Owner/Consultant for approval prior to programming deployment. All programming to be completed by a Symetrix Certified Programmer.

1. Audio DSP Symetrix Model# Prism8x8. (QTY1)

2. 24 port gigabit PoE Ethernet smart switch Netgear Model #GS728TPP. (QTY1)

6. ASSISTIVE LISTENING SYSTEM

a. Provide and install assistive listening system and components. Consult manufacturer instruction for proper antenna distribution and mounting locations. Use only 50 OHM cabling and terminations for antenna equipment. Size cabling for antenna system based on cable distance runs and signal attenuation performance requirements. Coordinate location and installation of required signage with the OWNER/Architect.

1. Assistive listening system Listen Technologies Model #LS-55-72. (QTY1)

a) RF Receiver Listen Technologies Model# LR-4200-072. (QTY5)

(1) Universal Ear Speaker Listen Technologies Model# LA-401. (QTY5)

b) Neck Loop Listen Technologies Model# LA-430. (QTY1)

7. CONTROL AND NETWORK

a. Provide and install all equipment and hardware to support the control and network systems. Test, configure and calibrate as required. Coordinate all IP addresses as required. Document and provide all configuration information to include IP addresses, usernames and passwords.

b. Provide the following equipment to support the control and network systems:

1. Control Processor.

a) Crestron Model #CP3. (QTY1)

b) Coordinate and obtain approval for programming from the Owner/Consultant prior to program deployment. Comply with all other sections of this specification in regards to system programming.

2. 7” BLACK Touch Screen Crestron Model #TSW-750-B-S. (QTY1)

a) Custom Rack Mount Plate for #TSW-750-B-S. (QTY1)

(1) Custom rack mount plate is a 3RU plate with a standard two or three gang cut-out in the center of the plate. Liberty Panelcrafters or equal.

b) Coordinate and obtain approval for programming from the Owner/Consultant prior to program deployment. Comply with all other sections of this specification in regards to system programming.

3. 7” WHITE Touch Screen Crestron Model #TSW-750-W-S. (QTY3)

a) Custom Rack Mount Plate for #TSW-750-W-S. (QTY3)

(1) Custom rack mount plate is a 3RU plate with a standard two or three gang cut-out in the center of the plate. Liberty Panelcrafters or equal.

b) Coordinate and obtain approval for programming from the Owner/Consultant prior to program deployment. Comply with all other sections of this specification in regards to system programming.

4. Partition Sensor Crestron Model# GLS-PART-CN. (QTY1)

8. LECTERNS

a. Provide, configure and install for each training room a lectern. Coordinate finishes with OWNER/Architect. Coordinate any millwork with the OWNER/Architect. Dress all cabling neatly and wrap with flexible nylon wrap where applicable. Provide and install a microphone stand to support mounting of a wireless handheld microphone. Manage power distribution as necessary.

1. Lexington 32” floor standing, laminate, lectern Dalite Model# 98101. (QTY2)

a) Microphone stand K&M Model #234. (QTY2)

b) Power strip Middle Atlantic Model #PD-815SC. (QTY2)

c) HDMI Cable, 25’ Middle Atlantic Model #50633. (QTY3)

9. EQUIPMENT RACKS

a. Provide and install all equipment and hardware to support the rack mounting system. Provide all parts and pieces required for a clean rack installation. Protect equipment racks and equipment rack hardware from damage and scratches. All damage is the responsibility of the Contractor until final system turnover regardless of the party responsible for said damage. Equipment racks should be turned over to the Owner clean, dust free and with any applicable keys.

b. Provide all cable management hardware necessary to complete a neat cabling installation. Provide all lacing strips, ‘hook and loop’ and mounting hardware required. Restrict cable tie use to minimal use and when ‘hook and loop’ installation is not practical.

c. Install wall mounted equipment racks as instructed by the manufacturer. Wall mounted equipment racks shall be installed with either toggle bolt through steel stud, lag screw into wood stud or bolted to strut spanning multiple studs as required.

d. Provide the following equipment and hardware for the equipment racks installation:

1. Swinging Wall Mounted Rack.

a) Middle Atlantic Model SR-40-32. (QTY1)

b) Middle Atlantic Model DWR-RR40. (QTY2)

c) One rear rail kit is to be installed in the audio equipment rack (EQ1) to support a front rail recess of the Network Switch and Brush Panels.

d) Middle Atlantic Model LACE-40-OP. (QTY1)

(1) Package of six.

2. Thermal Management

a) Middle Atlantic Model VBK-S32. (QTY1)

(1) Vent blocker kit is to be installed blocking the upper vent intakes per manufacturer instructions.

b) Middle Atlantic Model QFAN. (QTY2)

(1) Installed in upper rack openings for equipment rack fans. Connect to Thermostatic Fan Controllers as required.

c) Middle Atlantic Model FC-4-1CA. (QTY1)

(1) Install one Thermostatic Fan Controller in the 40RU equipment rack. The sensor shall be placed in the upper portion of the rack per manufacturer instructions.

3. Rack Blank and Brush Panels

a) All empty rack spaces shall be blanked and all manufacturer provided hardware installed per manufacturer instructions. Contractor shall provide all additional blank panels as required for As-Built conditions at no additional cost.

b) Middle Atlantic Model FEB1. (QTY5)

c) Middle Atlantic Model FEB2. (QTY1)

d) Middle Atlantic Model FEB3. (QTY1)

e) Middle Atlantic Model FEB4. (QTY2)

f) Middle Atlantic Model BR2. (QTY1)

10. EQUIPMENT RACK POWER DISTRIBUTION

a. Provide and install all equipment and hardware required for the power distribution system. Follow all codes when addressing high voltage circuitry and coordinate with other divisions as required. Ensure all circuits are clearly labeled with circuit number and/or breaker identification. Do not alter power cords and maintain UL listings when present. Provide longer premade IEC UL listed power cords as required.

b. Provide the following equipment to support the equipment rack electrical distribution system:

1. Three Module Raceway.

a) Middle Atlantic Model MPR-3A. (QTY1)

b) Middle Atlantic Model RLM-20A-SP. (QTY2)

c) Middle Atlantic Model M-20A-SP. (QTY1)

d) Middle Atlantic Model MPR-BL4A. (QTY1)

2. Jumpers and Tails

a) Middle Atlantic Model T-80X6. (QTY1)

(1) Package of six.

b) Middle Atlantic Model J-12X6. (QTY1)

(1) Package of six.

3. Vertical Power Strips

a) Middle Atlantic Model PDT-1415C-NS. (QTY2)

B. “TYPE 1” Rooms

a. Install owner furnished projector. Ceiling mount projection screens and install all terminal equipment. Provide and install ceiling enclosure near the projector to house terminal equipment. Install extender kit and all connections from source to

destination. Provide and install wall input plate, coordinate location with client/architect. Provide, install and program the touch panel. Provide custom button labels as required. Provide and install audio amplifier in the ceiling enclosure. Provide and install the flush mount in-ceiling speakers. Provide the following per room:

1. Video Projector Panasonic Model# PT-RW330U. (QTY4)
    a) TYPE P2.
    b) **Owner Furnished Contractor Installed. (OFCI)**
2. 2'x2' Plenum Rated Storage Box and Column Drop Chief Model# CMS492CP2. (QTY4)
    (1) Enclosure Fan Chief Model# CMSFAN. (QTY4)
    (2) AV Component Shelf Chief Model# CMSUNV2. (QTY4)
    (3) Projector Mount Chief Model# RSMAUW. (QTY4)
    (4) Fixed Extension Column Drop Chief Model# CMS003W. (QTY4)
3. Projection Screen, 65"x104" HD Progressive 1.1 Dalite Model# 21810FL. (QTY4)
    a) Projection Screen Enclosure Dalite Model# 21810BL. (QTY4)
    b) Install enclosure first for rough-in construction and install the screen assembly when the work site is dust free and environmentally controlled.
4. Wall Input Plate and Digitalmedia Transmitter Crestron Model# DM-TX-200-C-2G-W-T. (QTY4)
5. Digitalmedia Receiver and Scaler Crestron Model# DM-RMC-200-C. (QTY4)
6. Touch Screen Control System Crestron Model# TPCS-4SMD-W-S. (QTY4)
    a) Engravable Button Covers Crestron Model# 4SM-BTNO-W-S_ENGRAVED. (QTY2)
7. 5-Port PoE Switch Crestron Model# CEN-SW-POE-5. (QTY4)
8. Audio Amplifier Stewart Audio Model# DSP100-1-CV. (QTY4)
9. In-Ceiling Speaker JBL Model# Control 16C/T. (QTY28)
    a) Provide and Install per floor plans per room.

C. "TYPE 2" ROOMS:

1. Install owner furnished flat panel display, size as noted in the floor plans per room. Wall mount flat panel displays and install all terminal equipment. Install extender kit and all connections from source to destination. Dress in cabling neatly at table, cover in flexible nylon wrap as required. Provide and install cable caddy, coordinate location with client/architect. Provide, install and program the button panel. Provide custom button labels as required. Provide the following per room:

a. Flat Panel Displays:

1. 82” Flat Panel Display Samsung Model# DM82D. (QTY1)

a) **Owner Furnished Contractor Installed. (OFCI)**

2. 75” Flat Panel Display Samsung Model# DM75E. (QTY1)

a) **Owner Furnished Contractor Installed. (OFCI)**

3. 65” Flat Panel Display Samsung Model# DM65E. (QTY2)

a) **Owner Furnished Contractor Installed. (OFCI)**

4. Flat Panel Display Wall Mount Chief Model #RLF2. (QTY4)

b. In-wall storage box Chief Model #PAC526FWP4. (QTY4)

1. AV component bracket Chief Model#PACUNV1. (QTY4)

c. HD auto-scaling and extender kit Crestron Model#HD-MD-400-C-E. (QTY4)

d. Cable caddy with HDMI, VGA, audio and Ethernet cables Crestron Model #TT-101-B-T. (QTY4)

e. Touch Screen Control System Crestron Model# TPCS-4SMD-W-S. (QTY4)

1. Engravable Button Covers Crestron Model# 4SM-BTNO-W-S_ENGRAVED. (QTY2)

f. 5-Port PoE Switch Crestron Model# CEN-SW-POE-5. (QTY4)

g. Audio Amplifier Stewart Audio Model# DSP100-1-CV. (QTY1)

h. In-Ceiling Speaker JBL Model# Control 16C/T. (QTY3)

1. Provide and Install per floor plans per room.

2. Floor Boxes:

a. Provide and install floor box and grade mounting kit as required. Coordinate trim work with other trades, follow manufacturer’s instructions in regards to installation heights for cover type “FL-500P-BLK-C”. Provide all hardware for installation and shims as required. Clean and install temporary cover. Protect floor box from damage during construction. Provide isolation brackets to Owner for installation. Power is required. Field coordinate mounting locations with Owner/Consultant.

b. 4” Deep Floor Box FSR Model #FL-500P-4-B. (QTY4)

(1) Floor Box Cover Black FSR Model# FL-500P-BLK-C. (QTY4)

(2) Floor Box Grade Mounting Kit Model# FL-GRD4. (QTY4)

(3) Floor Box Custom I/O Plate. (QTY4)

2.03 CABLE/CONNECTOR REQUIREMENTS

All indoor cabling shall be plenum rated. All outdoor cabling shall be outdoor rated and direct-burial rated when in contact with grade or within conduit in contact with grade. Coordinate all cable colors with Owner/Consultant prior to ordering or installation. Provide connectors and termination as specified by manufacturer for each application.

1. Provide all cabling with Black jacketing unless otherwise noted.

2. Acceptable manufacturers include Extron, Crestron, Belden, West Penn Wire, Gepco and Liberty. Liberty is specified to establish a cabling baseline. Cross reference equal or greater cabling and connectors when making substitutions with the acceptable manufacturers. Submit substitution requests as described in the submittal requirements section when using a manufacturer not identified as acceptable.

A. Pathway Wire Support

1. Panduit J-Mod Cable Support System

2. Erico Caddy Cat Links J-Hook Series

3. Panduit Plenum Rated Hook & Loop (Black)

B. Fire Stop

1. STI Spec Seal Part Number

2. 3M Products Part Number

C. HD-SDI | Analog Video | Genlock Cabling:

1. <50’:

a. Liberty Cable Part# 20-CMP-VID-COAX-BLK.

b. Terminate with Liberty Part# CM-RG59M-BNC or Liberty Part# 112975.

2. 50’-200’:

a. Liberty Cable Part# 18-CMP-VID-COAX-BLK.

b. Terminate with Liberty Part# CM-RG6M-BNC

D. HDBASET Cabling:

1. Liberty Cable Part# 24-4P-P-L5SH-BLK

a. Foil Shielded CAT5e Cable, Black.

b. Terminate with Liberty Part# 111S08080016C34, use copper foil conductive tape and adhesive lined heat shrink for termination.

E. Digital Audio Network Cabling:

1. Liberty Cable Part# 24-4P-P-L6SH-BLK

a. Foil Shielded CAT6 Cable, Black.

b. Terminate with Liberty Part# 111S08080091C34, use copper foil conductive tape and adhesive lined heat shrink for termination.

F. Network | USB/KVM Extension Cabling

1. Liberty Cable Part# 24-4P-P-L6-EN-BLK.

a. Unshielded CAT6 cable, Black.

b. Terminate with Liberty Part# 11108080034 RJ45 Connector.

G. HDMI | Displayport | DVI | USB Passive Cabling

1. Provide cable/signal transport of sufficient length to reach from source device to destination device. No digital cable shall exceed a length of 15 feet unless otherwise specified. Provide a high retention cable when available.

a. HDMI - Liberty Cable Part# HD-600 Series.

H. Serial Control Cabling

1. Single data pair only.

a. Liberty Part# 22-1P-CMP-EZ-BLK.

2. Two data pair RS232(RTS/CTS or RS485).

a. Liberty Part# 24-2P-P485.

3. Terminate all data cabling with a reliable termination system, include hoods and retention mechanisms when available.

I. Relay | Control Cabling:

1. Liberty 18 Gauge, 2-Conductor Plenum-Rated Cabling – Part Number 18-2C-P-BLK.

J. Cresnet Cabling:

1. <500’:

a. Liberty Part# LLINX-U-P.

2. > 500’

a. Consult with Manufacturer/Consultant prior to ordering / installation.

K. Analog Audio | Microphone | Intercom | IFB Cabling

a. Liberty Part# 22-1P-CMP-EZ-BLK.

b. Terminate cabling with Neutrik XX series for XLR connectors. For ¼” TRS/TS, 1/8” and RCA connectors use Rean manufactured connectors.

L. High Impedance Speaker Level Cabling (25v/70v):

1. < 300’:

a. Liberty 16 Gauge, 2-Conductor Plenum-Rated Cabling – Part Number 16-2C-P-BLK.

2. 300’ to 500’

a. Liberty 14 Gauge, 2-Conductor Plenum-Rated Cabling – Part Number 14-2C-P

1. Provide Cable with Black Jacket – Coordinate Cable Color with Architect.

3. > 500’

a. Consult with Manufacturer/Consultant prior to ordering / installation.

4. Terminate when available with Neutrik “Speakon” type connectors.

M. Low Impedance Speaker Level Cabling:

1. < 50’:

a. Liberty 14 Gauge, 2-Conductor Plenum-Rated Cabling – Part Number 14-2C-P-BLK.

2. 50’ to 100’

a. Liberty 12 Gauge, 2-Conductor Plenum-Rated Cabling – Part Number 12-2C-P-BLK.

3. > 100’

a. Consult with Manufacturer/Consultant prior to ordering / installation.

4. Terminate when available with Neutrik ‘Speakon’ type connectors.

N. Low Voltage Power Supply Cabling:

1. Provide cabling of sufficient gauge and conductor count as required for power supply in use. Size cabling per manufacturer’s device specific minimum required voltage drop.

PART 3 EXECUTION

3.01 CODES, STANDARDS AND REGULATIONS

A. American National Standards Institute (ANSI)

B. American Society for Testing and Materials (ASTM)

1. ASTM B 1 (2001; R 2007) Standard Specification for Hard-Drawn Copper Wire

2. ASTM B 8 (2004) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

3. ASTM D 1557 (2007) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)

4. ASTM D 709 (2001; R 2007) Laminated Thermosetting Materials

C. Alliance for Telecommunications Industry Solutions (ATIS)

D. Building Industry Consulting Service International (BICSI)

1. Telecommunications Distribution Methods Manual 13th Edition

2. NECA/BICSI 568-2006 – Standard for Installing Commercial Building Telecommunications Cabling

3. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings

E. Electronics Industry Alliance (EIA)

F. Federal Communications Commission (FCC)

1. FCC Part 15, Radiated Emissions Limits, revised 1998

2. FCC Part 68, Connection of Terminal Equipment to the Telephone Network, revised 1998

3. FCC Part 76, Cable Television Service, revised 1998

G. Insulated Cable Engineers Association (ICEA)

1. ICEA S-87-640 (2006) Fiber Optic Outside Plant Communications Cable

2. ICEA S-98-688 (2006) Broadband Twisted Pair, Telecommunications Cable Aircore, Polyolefin Insulated Copper Conductors

3. ICEA S-99-689 (2006) Broadband Twisted Pair Telecommunications Cable Filled, Polyolefin Insulated Copper Conductors

H. International Electrotechnical Commission (IEC)

I. Institute of Electrical and Electronics Engineers, Inc. (IEEE)

1. IEEE Standard 81-1983, IEEE Guide for Measuring Earth Resistance, Ground Impedance, and Earth Surface Potential of a Ground System

2. IEEE Standard 1100-1999, Recommended for practice for Powering and Grounding Sensitive

3. Electronic Equipment in Industrial and Commercial Power Systems (IEEE Emerald Book)

4. IEEE C2 (2007; Errata 2007; INT 2008) National Electrical Safety Code

5. IEEE Std 100 (2000) The Authoritative Dictionary of IEEE Standards Terms

J. International Organization for Standardization (ISO)

1. International Organization of Standardization/International Electrotechnical Commission (ISO/IEC)

2. ISO/IEC 11801, Information Technology-Generic Cabling for Customer Premises, 1995

3. ISO/IEC 14763-1, Information Technology-Implementation and Operation of Customer Premises Cabling-Administration, 1999

4. ISO/IEC 11801, Information Technology-Generic Cabling for Customer Premises, 1995

5. ISO/IEC 14763-1, Information Technology-Implementation and Operation of Customer Premises Cabling-Administration, 1999

K. National Cable Television Association (NCTA)

L. National Electrical Manufacturers Association (NEMA)

1. NEMA C62.61 (1993) Gas Tube Surge Arresters on Wire Line Telephone Circuits

M. National Fire Protection Association (NFPA)

1. NFPA-70, National Electrical Code

2. NFPA-101, Life Safety Code

3. NFPA-297, Guide on Principles and Practices for Telecommunications Systems

4. NFPA-780, Standard for the Installation of Lightning Protection Systems.

N. National Institute Standards and Technology (NIST)

O. Occupational Safety and Health Administration (OSHA)

P. Telecommunications Industry Association (TIA)

1. ANSI/TIA-568-C.0, Generic Telecommunications Cabling for Customer Premises, 2009

2. ANSI/TIA-568-C.1, Commercial Building Telecommunications Cabling Standard, 2009

3. ANSI/TIA -568-C.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standard, 2009

4. ANSI/TIA-568-C.3, Optical Fiber Cabling Components Standard, 2008

5. ANSI/TIA/EIA–569-B, Commercial Building Standard for Telecommunications Pathways and Spaces, 2005

6. ANSI/TIA–569-B Amendment 1, Commercial Building Standard for Telecommunications Pathways and Spaces, 2009

7. ANSI/TIA/EIA-606-B, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 2012

8. ANSI/TIA/EIA-607-B, Commercial Building Grounding and Bonding Requirements for Telecommunications, 2011

9. ANSI/TIA-758, Customer-Owned Outside Plant Telecommunications Infrastructure Standard, 2004

Q. Underwriters Laboratories, Inc. (UL)

1. UL 510 (2005; Rev thru Aug 2005) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape

2. UL 910 (NFPA 262 1990) Applicable Flame Test

R. In the event of any conflicts between documents referenced herein and the contents of this specification, the Contractor shall notify the Architect/Engineer in writing of any such occurrences before purchasing or installing any equipment or materials. The Architect/Engineer will notify the Contractor of any actions required to resolve these conflicts. Such actions may include but are not limited to: design changes, equipment, materials and/or installation changes. In any event Contractor shall not supersede specifications and standards from the latest NFPA and NEC publications. In the event of any conflicts between Standards and Codes the more stringent shall take precedence.

3.02 GENERAL REQUIREMENTS

A. Contractor shall comply with the requirements of local Authority Having Jurisdiction (AHJ), Project State, the National Fire Protection Association (NFPA), and the National Electrical Code (NEC). If the Contractor identifies any item in the plans or specifications that will not strictly comply with the aforementioned laws, ordinances, and rules, the matter shall be referred to the Architect/Engineer for direction before proceeding with that part of the work.

B. The Contractor shall be responsible for coordination with other trades to ensure any conflicts or potential conflicts are resolved prior to any work beginning on the project.

C. The Contractor shall install the materials in accordance with these specifications and the manufacturer’s installation guidelines.

D. No deviations from the plans or specifications shall be made without full consent in writing of the Architect/Engineer. The Contractor shall have written approval from the Architect/Engineer for any additional work beyond the Contract Documents prior to beginning such work. If the Contractor does not obtain written approval from the Architect/Engineer prior to proceeding with the work, the contractor shall not be reimbursed for the work.

E. The Contractor shall obtain written permission from the Architect/Engineer before proceeding with any work that would necessitate cutting into or through any part of the building structure such as, but not limited to girders, beams, floors, walls, roofs, or ceilings.

F. Contractor shall notify the Architect/Engineer a minimum of (2) weeks prior to beginning work and will participate in a pre-construction meeting with the Architect/Engineer to perform a walkthrough, review the scope of work, schedule, and escalation procedures.

G. The Contractor shall maintain a work area free of debris, trash, empty cable reels, scrap cable, etc., and dispose of such items on a daily basis and return the site to the original state of cleanliness. The Contractor shall not use Owner's facilities for the disposal of excess or scrap materials.

H. Equipment and materials installed by the Contractor shall be free of defects and damage.

I. Contractor shall be responsible for the repair of any damage caused by the contractor during the installation.

J. Contractor shall test all cables prior to installation. By failing to perform this testing operation, the Contractor shall accept the cable as compliant and assume all liability for the replacement of the cable at no cost to the Owner should it be found defective at a later date.

K. Contractor shall maintain a set of working specifications, design drawings, and record drawings to be kept on site at all times and shall update the record drawings with any changes on a weekly basis. Record drawings shall be made available for inspection at the request of the Architect/Engineer.

L. Equipment and materials shall be consistent throughout the installation. Where multiple units of the same type of equipment and materials are required, these units shall be a standard product with the same manufacturer and model number.

M. Equipment and materials shall be delivered and stored in accordance with the manufacturer's guidelines at the Contractor's expense.

N. Contractor shall make all stored equipment and materials available for inspection at the request of the Architect/Engineer.

O. All equipment and material used in the installation shall be approved by the manufacturer for the environment in which it is being installed.

P. Cables shall be properly supported in accordance with industry standards at all times. Improperly supported cables shall be corrected by the Contractor at no cost to the Owner.

Q. Contractor shall be responsible to properly protect information outlets from damage by other trades during construction.

R. Cables shall be routed at 90-degree angles to the building structure. At no time shall a diagonal pull be installed.

S. The Contractor shall not install cables in conduits or sleeves without nylon bushings. Cables installed through conduits or sleeves without nylon bushings shall be removed and replaced at no cost to the Owner.

T. Contractor shall immediately report to the Engineer any design or installation irregularities, particularly architectural elements that interfere with the intended coverage angles of loudspeakers and projector, so that appropriate action may be taken.

U. Contractor shall observe all HDBaseT Alliance cable types, lengths, bundling, termination, and patching requirements and limitations when installing audio/video over twisted-pair cabling.

V. Contractor shall observe signal separation and signal separation best practices at all times.

W. Any cabling found to be damaged shall be replaced at no cost.

X. Signals shall be separated and grouped according to type and voltage level.

Y. Contractor shall provide all required conduit and sleeves unless otherwise specified. Contractor shall provide conduit bushings even when it is the responsibility of other trades prior to cable installation.

Z. Contractor shall provide and utilize rear rack rails, lacing bars, and any other required cable dressing equipment/supplies to ensure proper industry-standard signal separation is achieved.

3.03 AUDIO VISUAL CONTROL SYSTEM(S)

A. Contractor shall furnish, install and configure a complete audio/video switching, transport and control system as specified and indicated on the technology drawings.

B. Contractor is responsible for all ancillary AV switching or active components necessary to provide a complete and functional AV system.

C. Contractor is responsible for all AV specific cabling, interconnects, patch cords and other ancillary devices required to provide a complete system.

D. Contractor shall coordinate the programming of the touch panels with the Owner/Design Team. Touch panels shall be branded to reflect the colors and logos of the Owner. This coordination may consist of multiple in-person meetings to ensure that the finished product fully meets the Owner's needs and expectations.

a. Contractor shall fully brief Owner on available configuration settings / options of the program(s).

b. Contractor shall record the Owner's preferences / decisions and build the initial system program(s).

c. Contractor shall deliver a written record including (at minimum):

1. The Owner's preferences / decisions

2. Contractor's plan for implementation and its methodology.

3. The final programming / implementation results.

d. Once the system programming has been completed and implemented, the Contractor shall allow a minimum 2-month evaluation period for the Owner to use the system and provide feedback.

e. After the evaluation period, the Contractor shall coordinate with the Owner to gain feedback on the system operation. The Contractor shall record the Owner's feedback and provide programming adjustments to resolve any items as directed by the Owner.

E. Contractor shall install the entire control system as specified in accordance with manufactures guidelines and industry best practices.

F. Control processor(s) shall be connected to an un-switched power outlet. Control processor(s) shall be connected to UPS outlet(s) if available.

G. Control system shall be programmed in a manner consistent with current industry best practices.

1. Control functions include (but are not limited to) the following:

a. System/Device Power On/Off.

b. Display Source and Sink Switching.

c. Program Volume Adjustment.

d. Audio DSP Control.

H. All network-enabled control systems shall be provided with virtual ‘soft’ control panel client(s)

I. All control system programming shall be delivered to the Owner. The Programmer shall transfer all source code/files related to the system. All programming shall be delivered in both compiled and non-compiled form. Upon system acceptance, ownership of the control programming shall be transferred to the Owner for their future use or modification. No claim shall be made by the programmer for continued licensing or other ongoing fees for continued usage of the control system program.

3.04 CABLE INSTALLATION

A. Cable Support

1. All cables shall be installed and supported in conduit systems, cable trays, cores, sleeves, etc.

2. When cables leave the main pathway systems, they shall be installed and supported in Contractor furnished and installed j-hooks or saddle straps.

3. No cable pathway shall exceed NEC limited low voltage fill ratios.

4. The contractor shall furnish a separate j-hook or saddle strap pathway for each cable type (data, voice, video and security).

5. J-hooks and saddle straps shall be installed no more than five-feet (5’) apart on center, using only manufacturer-approved installation methods and hardware.

6. J-hooks shall be furnished with closure clips.

7. Maximum sag between supports shall not exceed twelve-inches (12”).

8. Contractor shall establish j-hook and saddle strap pathways and shall coordinate pathways with all other disciplines. Under no-circumstances shall these pathways be used to support other low-voltage applications not included in this specification.

9. Cable Dressing

a. No nylon cable ties shall be used at any time during the installation of the cable.

b. Signal separation guidelines and best practices shall be observed for the complete length of all cable runs.

10. Above Ceiling

a. Contractor shall furnish and install plenum-rated hook & loop straps in plenum-rated airspaces.

1. The Contractor shall install no more than (1) hook & loop strap between each j-hook or saddle strap or at service loop locations.

11. Equipment Rooms / Telecommunications Rooms

a. The Contractor shall bundle all visible cables with Contractor furnished and installed hook & loop straps.

1. Hook & loop straps shall be installed twenty-four (24) inches apart on center.

b. Plywood

1. The Contractor shall furnish and install 8’ H x 4’ W x ¾” D sheets of BC grade fire-rated plywood as when in the technology drawings.

2. The Contractor shall mount all plywood vertically starting at 24” AFF.

3. The Contractor shall cover the plywood with two (2) coats of Contractor furnished white fire retardant paint leaving exposed (1) fire rating stamp per sheet

3.05 IDENTIFICATION

A. Contractor will permanently affix labels to each cable. Labels will be affixed at a distance of 3” from the end of each cable end. If label cannot be easily viewed from this placement, cable may be placed 1” from the cable end. Cable label shall include unique cable number, source system name, source termination point, and destination system name and destination termination point. Cable labels will be identical on each cable end. Contractor to contact Consultant for additional information, if necessary.

B. Contractor will provide equipment labeling for each device front and back according to the system name used in the shop drawings. Contractor may use laminated labels (white print on black labels in front, black print on yellow in back) or equivalent.

C. Contractor will provide engraved plastic laminate labels for all racks. Rack labels to be 1” x 2” with white lettering (Arial font) on black matte finish, plastic.

1. Contractor will provide all Input/Output (I/O) panels. I/O panels will be produced from black anodized aluminum and engraved with white lettering.

3.06 TESTING REQUIREMENTS

A. Audio Visual System Testing and Configuration

1. Contractor shall un-pack and pre-test equipment prior to installation into the production environment. All configurations shall be re-verified prior to the units being placed into service.

2. Contractor shall test and commission each component per the specifications and manufacture’s installation instructions.

3. Contractor shall test and verify for full operational and network support control functionalities and connections per the specifications and manufacturer’s installation instructions.

4. All network devices shall be verified for link and auto negotiation to the highest connection rate.

5. Audio conferencing systems shall be configured to provide excellent audio performance. Verify POTS or VoIP phone system with Owner/Owner/Consultant prior to ordering and installation. Contractor shall place test calls utilizing the audio conferencing system to the system manufacturer for system calibration and testing.

6. Video conferencing systems shall be configured to provide excellent audio performance. Contractor shall place test calls utilizing the video conferencing system to the system manufacturer for system calibration and testing.

7. Contractor shall test and verify all functionalities as installed per the specifications and manufacturer's installation instructions.

8. All Crestron Digitalmedia demonstration and acceptance tests shall be performed by a Crestron Digitalmedia Certified Engineer (DMC-E).

9. Projector(s) shall be installed square in relation to the screen, and shall be adjusted to fit and fill the screen fully. Projector(s) shall be overscanned slightly into the screen border (if applicable). Projected image shall be square and level. Projector(s) shall be installed so that digital keystone correction is not utilized.

    a. In situations where keystone correction may be required, notify Owner/Consultant and coordinate solution prior to installation.

    b. Projector(s) shall be installed in such a way that the axis of the lens is perpendicular to the plane of the projection surface.

    c. In case of mismatch between projector aspect ratio and screen aspect ratio, projector shall be configured to output at screen aspect ratio.

    d. In case of mismatch between display device and signal aspect ratio, system shall be configured such that the source image best fits and fills the display device.

10. Unless noted otherwise, all projection screens shall be mounted with the lower edge of the viewable image area at 48" A.F.F.

    a. Provide additional black drop as required.

11. Video display system(s) minimum test protocols:

    a. Test each video display system with test signal generating equipment capable of outputting the following resolutions. (Ultra HD and 4K resolutions required only when testing 4K systems)

        1. 4:3 - 640x480, 800x600, 1024x768

        2. 16:9 - 1280x720 (720p), 1366x768, 1600x900, 1920x1080 (1080p), 3840x2160 (Ultra HD), 4096x2160 (DCI 4K).

        3. 16:10 - 1280x800, 1440x900, 1680x1050, 1920x1200

    b. Test signal generator must be capable of outputting the correct signal protocol using the applicable connectivity (RCA/BNC, S-Video, VGA, DVI, HDMI, Displayport, Etc.).

c. The test signal generator must can output a standard set of color bars, grid pattern, grayscale, checkerboard and multi-burst.

3.07 AUDIO VISUAL SYSTEMS TRAINING

A. Contractor shall provide a proposed training schedule to the Owner/Consultant prior to substantial completion.

B. Contractor shall provide a proposed training syllabus for both administrative users and end-users prior to substantial completion.

C. Training shall include all aspects of the Audio/Visual System as specified and installed.

D. Contractor shall include provisions within the total cost proposal for a minimum of two (2) System Administrator training sessions. It is anticipated these trainings will cover advanced functions of the system, trouble-shooting techniques and other subject matter pertinent to the on-going support of the video conference system at the installed facility. System administration training sessions should be planned for approximately 5 persons. Each training session shall be planned for at least 2 hours per session.

E. Contractor shall include provisions within the total cost proposal for a minimum of three (3) End-User training sessions. It is anticipated this training will cover basic function and operation of the system by faculty. This would include event display management, source control and general systems operation for all installed system. User training sessions should be planned for approximately 10 persons each session. Each training session shall be planned for at least 2 hours per session.

END OF SECTION

SECTION 28 05 13 – SECURITY SYSTEM WIRING

PART 1 GENERAL

1.1 This section identifies the requirements, technical design, and specifications for the access control system and IP Intercom wiring at the San Antonio Water Systems – East Side and Northwest Operations Centers in San Antonio, Texas (“Owner”).The security system wiring as specified is an Industry-Standard security system wiring and includes access control and IP Intercom wiring as specified.

1.2 The Contractor shall provide a Manufacturer’s Performance Certification for the installed access control system wiring.

1.3 Contractor shall include materials, equipment, and labor necessary to provide a complete and functional access control wiring system regardless of any items not listed or described in this specification or associated drawings.

A. Requirements

B. Contractor Experience Requirements

C. Submittal Requirements

D. Acceptable Manufacturers

E. Codes, Standards and Regulations

F. General Requirements

G. System Requirements

H. Testing Requirements

I. Project Closeout Documentation

J. Attachments

1.4 Related Requirements

A. The Drawings, Specifications, General Conditions, Supplementary General Conditions, and other requirements of Division 1 apply to the work specified in Division 27 and Division 28, and shall be complied with in every respect. The Contractor shall examine all of the items which make up the Contract Documents, and shall coordinate them with the work on the project.

B. Contractor Experience Requirements

1. The Contractor shall have been in business for a minimum of five (5) years.

2. The Contractor shall have a local office with local technicians and an adequate workforce to complete this project within a 75-mile radius of the project site.

3. The Contractor shall have completed a minimum of five (5) projects similar in size and scope to the Owner’s installation, where the systems have been in continuous satisfactory operation for at least one (1) year.

1.5 Subcontractors shall be identified at the time of bid and comply with the requirements and intentions of these specifications, associated drawings, and related contract documents.

1.6 Submittal Requirements.

A. Pre-Installation Submittal

1. Contractor shall not order, purchase, or install any equipment until pre-installation submittals have been accepted in writing by the Architect/Engineer.

a. Manufacturer product data sheets for each proposed system component.

2. For product data sheets containing more than one (1) part number or product, the Contractor shall clearly identify the specific part number or product being submitted.

a. Shop drawings of the proposed system installation.

1) Shop drawings shall include Equipment Room/Telecommunications Room layouts, equipment rack elevations, wall elevations, outlet locations, preliminary wire numbers, proposed wire pathways, system schematics, and riser diagrams. Shop drawings shall be submitted on 30” X 42” bond paper.

2) Contractor shall maintain a set of shop drawings on site at all times and shall update the shop drawings on a weekly basis. Shop drawings shall be made available for inspection at the request of the Architect/Engineer.

b. Itemized list of all equipment, materials and labor required for the installation of the access control system wiring as specified herein.

1) This list shall be provided in printed and electronic format (Microsoft Excel) and shall contain: Part Number, Description, Unit of Measure, Unit Cost, Quantity, Labor Cost and Extended Cost to provide a complete and functional access control wiring system. Attachment “A” attached to these specifications shall be used for this purpose.

c. Estimated wiring count for each Equipment Room and/or Telecommunications Room indicating the quantity of drops served from each applicable ER/TR.

1) This listing shall be provided in printed form and electronic format (Microsoft Excel). Attachment “B” attached to these specifications shall be used for this purpose.

B. Manufacturer Warranty offering.

1. Documentation indicating that Contractor has been in business for (5) years.

2. Address of Contractor’s local office within a 75-mile radius of the project site.

3. Quantity of full time local technicians within a 75-mile radius of the project site.

4. List of five (5) contractor-installed projects of a similar size and scope in operation for at least (1) year. The Contractor shall provide the following information for each project: Project Name, Project Location, Project Start Date, Project Completion Date, Project Start Cost, Project Completion Cost, Brief Description of Project, Client Point of Contact Name and Phone Number.

5. List of completed and ongoing projects with the Owner. The Contractor shall provide the following information for each project: Project Name, Project Location, Project Start Date, Project Completion Date, Project Start Cost, Project Completion Cost, and Brief Description of Project.

PART 2 **PRODUCTS**

2.1 General Requirements

A. The following sections specifically list the acceptable equipment types and items for this project.

B. Architect/Engineer will have final determination of acceptability of all proposed equipment and must approve submitted equipment prior to purchase or installation.

C. Proposed equivalent items must be approved in writing by the Architect/Engineer prior to submitting a bid. Proposed equivalent items must meet or exceed these specifications and the specifications of the specified item.

D. In the event a manufacturer's specified product or part number has changed or is no longer available, Contractor shall substitute the appropriate equivalent manufacturer's part number.

E. In the event of a discrepancy between the specifications and the drawings, the greater quantity and/or better quality will be furnished.

F. For listed products with no part number specified, Contractor shall provide a product that meets the performance requirements of these specifications, industry standard practices, and intended application.

G. All wiring, equipment, and installation materials shall be new and of the highest quality.

H. Labels on all wiring, materials, and equipment must indicate a nationally recognized testing laboratory.

I. Original Equipment Manufacturer (OEM) documentation must be provided to the Architect/Engineer which certifies performance characteristics and compliance with industry standards.

2.2 Acceptable Manufacturers

A. Category 6a

1. Commscope – 7504

B. Access Control Wiring for Card Reader Doors

1. Card Reader

a. Superior Essex 2F-C4x-44 18AWG, 6 Conductor, Shielded

2. Lockset

a. Superior Essex 2F-F1x-44 12AWG, 2 Conductor, Stranded

3. Request to Exit Device

a. Superior Essex 2F-C3x-44 18AWG, 4 Conductor, Stranded

4. Door Position Sensor
    a. Superior Essex 2F-C3x-44 18AWG, 4 Conductor, Stranded

C. IP Intercom Wiring
1. Superior Essex 2F-B1x-44 20AWG, 4 Conductor, Stranded
    a. Or approved equal
2. Category 6a
    a. Commscope – 7504

D. Wiring for Door Position Switches
1. Superior Essex 2F-C3x-44 18AWG, 4 Conductor, Stranded
2. Or approved equal

E. Pathway Wire Support
1. Reference Division 27

F. Labeling
1. Permanent Labels for Copper Wires
    a. Panduit Self-Laminating Labels

G. Fire Stop
1. STI Spec Seal Part No.
2. 3M Products Part No.

PART 3 **EXECUTION**

3.1 Codes, Standards, Regulations

A. TIA/EIA-568-B.1 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements – (May 2001)

B. TIA-569-B Commercial Building Standard for Telecommunications Pathways and Spaces - (October 2004)

C. TIA/EIA-606-A Administration Standard for Commercial Telecommunications Infrastructure - (May 2002)

D. ANSI J-STD-607-B Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications - (October 2011)

E. TIA-758-A Customer-owned Outside Plant Telecommunications Infrastructure Standard - (August 2004)

F. AIA

G. Local

H. NEC

I. ISO

J. FCC

K. UL

L. OSHA

M. NFPA

N. NEMA

O. Plenum Applications

P. Applicable Flame Test: UL 910 (NFPA 262 1990).

3.2 In the event of any conflicts between documents referenced herein and the contents of this specification, the Contractor shall notify the Architect/Engineer in writing of any such occurrences before purchasing or installing any equipment or materials. The Architect/Engineer will notify the Contractor of any actions required to resolve these conflicts. Such actions may include but are not limited to: design changes, equipment, materials and/or installation changes. In any event Contractor shall not supersede specifications and standards from the latest NFPA and NEC publications.

3.3 General Requirements

A. Contractor shall comply with the requirements of local Authority Having Jurisdiction (AHJ), State of Texas, the National Fire Protection Association (NFPA), and the National Electrical Code (NEC). If the Contractor identifies any item in the plans or specifications that will not strictly comply with the aforementioned laws, ordinances, and rules, the matter shall be referred to the Architect/Engineer for direction before proceeding with that part of the work.

B. The Contractor shall install the materials in accordance with these specifications and the manufacturer’s installation guidelines.

C. No deviations from the plans or specifications shall be made without full consent in writing of the Architect/Engineer. The Contractor shall have written approval from the Architect/Engineer for any additional work beyond the Contract Documents prior to beginning such work. If the Contractor does not obtain written approval from the Architect/Engineer prior to proceeding with the work, the contractor shall not be reimbursed for the work.

D. The Contractor shall obtain written permission from the Architect/Engineer before proceeding with any work that would necessitate cutting into or through any part of the building structure such as, but not limited to girders, beams, floors, walls, roofs, or ceilings.

E. Contractor shall notify the Architect/Engineer a minimum of (2) weeks prior to beginning work and will participate in a pre-construction meeting with the Architect/Engineer to perform a walkthrough, review the scope of work, schedule, and escalation procedures.

F. The Contractor shall maintain a work area free of debris, trash, empty wire reels, scrap wire, etc., and dispose of such items on a daily basis and return the site to the original state of cleanliness. The Contractor shall not use Owner's facilities for the disposal of excess or scrap materials.

G. Equipment and materials installed by the Contractor shall be free of defects and damage.

H. Contractor shall be responsible for the repair of any damage caused by the contractor during the installation.

I. Contractor shall test all wires prior to installation. By failing to perform this testing operation, the Contractor shall accept the wire as compliant and assume all liability for the replacement of the wire at no cost to the Owner should it be found defective at a later date.

J. Contractor shall maintain a set of working specifications, design drawings, and shop drawings to be kept on site at all times and shall update the shop drawings on a weekly basis. Shop drawings shall be made available for inspection at the request of the Architect/Engineer.

K. Equipment and materials shall be consistent throughout the installation. Where multiple units of the same type of equipment and materials are required, these units shall be a standard product with the same manufacturer and model number.

L. Equipment and materials shall be delivered and stored in accordance with the manufacturer's guidelines at the Contractor's expense.

M. Contractor shall make all stored equipment and materials available for inspection at the request of the Architect/Engineer.

N. All equipment and material used in the installation shall be approved by the manufacturer for the environment in which it is being installed.

O. Wires shall be properly supported in accordance with industry standards at all times. Improperly supported wires shall be corrected by the Contractor at no cost to the Owner.

P. Contractor shall be responsible to properly protect wiring from damage by other trades during construction.

Q. Wires shall be routed at 90-degree angles to the building structure. At no time shall a diagonal pull be installed.

R. The Contractor shall not install wires in conduits or sleeves without nylon bushings. Wires installed through conduits or sleeves without nylon bushings shall be removed and replaced at no cost to the Owner.

3.4 System Requirements

A. Quantities listed are for reference only, contractor is responsible for furnishing materials as required to provide a complete and functioning system. Where quantities are not noted, they may be obtained from the drawings. In the event of a discrepancy between the specifications and the drawings, the greater quantity shall be furnished.

1. Access Control System Wiring for Card Reader Door

a. Card Reader

1) Superior Essex 2F-C4x-44 18AWG, 6 Conductor, Shielded

b. Lockset

1) Superior Essex 2F-D1x-44 16AWG, 2 Conductor, Stranded

c. Request to Exit Device

1) Superior Essex 2F-C3x-44 18AWG, 4 Conductor, Stranded

d. Door Position Sensor

1) Superior Essex 2F-C3x-44 18AWG, 4 Conductor, Stranded

e. Remote Release Button

1) Superior Essex 2F-C3x-44 18AWG, 4 Conductor

f. Or approved equal

2. Contractor shall furnish and install indoor plenum rated access control wiring.

3. The Contractor shall install a 20-foot service loop at the ends of each wire to be coiled, mounted, and stored on the wall above the ladder rack in the ER/TR.

4. The Contractor shall install a 20-foot service loop at the ends of each wire to be coiled, mounted, and stored on the wall above the card reader.

5. Wires shall be routed utilizing the pathways as indicated in the technology drawings.

6. The contractor shall furnish and install:

7. Shielded plenum rated wire from MDF/IDF Room as indicated in the security schedules and technology drawings to each card reader location as indicated in the technology and security drawings.

B. Integrated Security and Communication Intercom

1. Superior Essex 2F-B1x-44 20AWG, 2 Conductor, Stranded

a. Or approved equal

2. Category 6a

a. Commscope – 7504

3. Contractor shall furnish and install indoor plenum wiring.

4. The Contractor shall install a 20-foot service loop at the ends of each wire to be coiled, mounted, and stored on the wall above the ladder rack in the ER/TR.

5. The Contractor shall install a 20-foot service loop at the ends of each wire to be coiled, mounted, and stored above the key pad.

6. Wires shall be routed utilizing the pathways as indicated in the technology drawings.

7. The contractor shall furnish and install:

    a. Plenum rated wire from MDF/IDF Room as indicated in the security schedules and technology drawings to each Intercom station location as indicated in the technology and security drawings.

C. Wire Support

1. All wires shall be installed and supported in conduit systems, cable trays, cores, sleeves, etc. as indicated in the technology drawings.

2. When wires leave the main pathway systems as indicated on the technology drawings, they shall be installed and supported in Contractor furnished and installed j-hooks or saddle straps.

3. No wire pathway shall exceed 40% fill ratio.

4. The contractor shall furnish a separate j-hook or saddle strap pathway for each wire type.

5. J-hooks and saddle straps shall be installed no more than five-feet (5’) apart on center, using only manufacturer-approved installation methods and hardware.

6. J-hooks shall be furnished with closure clips.

7. Maximum sag between supports shall not exceed twelve-inches (12”).

8. Contractor shall establish j-hook and saddle strap pathways and shall coordinate pathways with all other disciplines. Under no-circumstances shall these pathways be used to support other low-voltage applications not included in this specification.

9. Wire Dressing

    a. No nylon cable ties shall be used at any time during the installation of the wire.

    b. Above Ceiling

        1) Contractor shall furnish and install plenum-rated hook & loop straps in plenum-rated airspaces.

    c. The Contractor shall install no more than (1) hook & loop strap between each j-hook or saddle strap or at service loop locations.

    d. Equipment Rooms / Telecommunications Rooms

        1) The Contractor shall bundle all visible wires with Contractor furnished and installed hook & loop straps.

2) Hook & loop straps shall be installed twenty-four (24) inches apart on center.

D. Grounding and Bonding

1. General

a. The Contractor shall ensure metal-to-metal contact for all terminations.

b. All materials shall be UL Listed.

c. All connections shall be made with UL Listed compression 2-hole lugs.

d. Contractor shall use an anti-oxidation compound on all connections.

e. In a metal frame (structural steel) building, where the steel framework is readily accessible within or external to the room; each TMGB and TGB shall be bonded to the vertical steel metal frame using a minimum # 6 AWG plenum rated green insulated conductor.

f. A Grounding Equalizer conductor shall be installed when required by ANSI/TIA/EIA-607-B (Interconnects multiple TBBs on the top floor and every 3rd floor in between).

g. The connection to building steel does not eliminate the requirement for the TBB or EBC to the service ground.

E. System Labeling

1. Contractor shall not permanently label any wires until the Architect / Engineer has provided a spreadsheet detailing the labeling scheme.

2. Contractor shall verify room numbers and confirm the final room numbering scheme prior to generating any labels.

3. Wires shall be labeled within (12) inches from the termination point inside the Equipment Room/Telecommunications Rooms.

4. Wires shall be labeled within (6) inches from the termination point at the workstation end.

5. Wires shall be labeled identically at both ends.

6. Equipment Room/Telecommunications Rooms

a. Contractor shall use the following room designations for wire labeling:

1) IDF #

2) MDF #

7. Wire

a. Access Control Wire

1) Access control system wiring labels shall contain the wire origin room number, wire destination door number, and wire type (i.e. 138-Door 1/18AWG-4CONDUCTOR).

3.5 Testing Requirements

A. Security System Wiring

1. Wires shall be tested in accordance with industry standards.

2. Wires shall be tested for continuity on all wires to ensure there are no broken conductors, damaged components or excessive resistance.

3. Only Manufacturer Certified Technicians shall perform testing.

4. The Contractor shall test and certify all wires with approved field tester(s) that are within their calibration period. The Contractor shall be liable for all re-testing required in the event tests are performed with non-approved test equipment or tester(s) that are not within their calibration period.

5. The Contractor shall notify the Architect/Engineer a minimum of five (5) days in advance to observe wire testing.

6. The Architect/Engineer may randomly select 5% of the installed wires for test verification purposes. The Contractor shall re-test these wires in the presence of the Architect/Engineer and the results shall be compared to the previously Contractor submitted test results. In the event that any of the verification tests differ in results from the previously submitted test results, all testing shall be declared a failure and the Contractor shall re-test 100% of the installed strands at no cost to the Owner.

7. Failing wires shall be diagnosed and corrected by the Contractor. Corrective actions shall be followed by a new test of the previously failing wires. The Contractor shall promptly submit all re-test data.

3.6 Project Closeout Documentation

A. As-Built Drawings

1. Drawings shall be provided to the Architect/Engineer at the time of substantial completion. Final payment will not be recommended until drawings are received and approved by the Architect/Engineer.

2. Three (3) sets of drawings depicting the condition of the access control wiring system as installed.

3. As-Built drawings shall be produced in AutoCAD 2010 or higher and provided in hardcopy and electronically in .dwg and PDF format.

4. Hardcopy drawings shall be provided in the original size as issued by the Architect/Engineer.

5. Drawings shall retain the formatting and title block of the original drawings as issued by the Architect/Engineer.

6. Drawings shall be provided utilizing the original scale and shall include the exact dimensions and locations of all equipment room/telecommunication room layouts, wall elevations, equipment rack elevations, ladder racks, cable tray, sleeves, pathways, card reader locations and labeling scheme.

B. Test Documentation

1. Test documentation shall be provided to the Architect/Engineer at the time of substantial completion. Final payment will not be recommended until these test results are received and approved by the Architect/Engineer and Owner.

2. Three (3) sets of test documentation for the access control wiring system as installed.

3. Test results shall be provided in hard copy and electronic format (i.e., manufacturer's proprietary testing software along with applicable reader software).

4. Test documentation shall be bound, sectioned, and tabbed in sequence as applicable:

C. Wiring Records

1. Wire records shall be provided to the Architect/Engineer at the time of substantial completion. Final payment will not be recommended until these wire records are received and approved by the Architect/Engineer and Owner.

2. Three (3) sets of wire records for the access control wiring system as installed.

3. List of all wires installed produced in an Excel format and provided in hardcopy and electronic format.

4. Wire records shall include wire number, unique wire label (owner's label), wire type, origin and destination, length, and termination method.

D. Contactor's Statement of Warranty

1. Statement of warranty shall be provided to the Architect/Engineer at the time of substantial completion. Final payment will not be recommended until statement of warranty is received and approved by the Architect/Engineer.

2. Contractor shall furnish a minimum of a one (1) year warranty on all materials, labor and workmanship starting at final system acceptance.

3. One original and two copies of Contractor's warranty terms and conditions to include contact information (i.e. Contractor name, Point of Contact, address, phone number and email address) and start and end date for warranty call outs.

PART 4 **Attachment "A"**

Provide an itemized listing of all equipment and material required to meet the specifications for the Access Control System Wiring. This listing shall include Part Number, Description, Unit of Measure, Unit Cost, Quantity, Labor Cost, and Extended Cost.

Part Number	Description	Unit of Measure	Unit Cost	Quantity	Labor Cost	Extended Cost
Total Equipment and Materials					**$ -**	
Total Labor and Installation					**$ -**	
Grand Total					**$ -**	

PART 5 **Attachment "B"**

Provide an estimated drop count for each Equipment Room/Telecommunications Room indicating the quantity of wires served from each applicable Equipment Room/Telecommunications Room.

Equipment Room/Telecommunications Room	Card Readers	Motion Detectors	Key Pads
Total			

END OF SECTION 28 05 13

SECTION 28 13 00 - ACCESS CONTROL SYSTEM

PART 1 GENERAL

1.1 This section identifies the requirements, technical design, and specifications for the access control system at the San Antonio Water Systems – North East Operations Center in San Antonio, Texas (“Owner”). The access control system as specified is an industry-standard and includes card readers, door position sensors, control panels, and access control server, as specified.

1.2 The Contractor shall provide a Manufacturer’s Performance Certification for the installed access control system.

1.3 Contractor shall include materials, equipment, and labor necessary to provide a complete and functional access control system regardless of any items not listed or described in this specification or associated drawings.

1.4 Requirements

A. Contractor Experience Requirements

B. Submittal Requirements

C. Acceptable Manufacturers

D. Codes, Standards and Regulations

E. General Requirements

F. System Requirements

G. Testing Requirements

H. Training Requirements

I. Project Closeout Documentation

J. Attachments

1.5 Related Requirements

A. The Drawings, Specifications, General Conditions, Supplementary General Conditions, and other requirements of Division 1 apply to the work specified in Division 28, and shall be complied with in every respect. The Contractor shall examine all of the items which make up the Contract Documents, and shall coordinate them with the work on the project.

B. Qualified Contractor

1. The entire system shall be designed, coordinated, supplied, and integrated by single approved licensed security Contractor. The contractor shall be certified by Open Options Access Technology as an Open Options installer. All system integration and testing shall be performed by SAWS agent of record with Alterman, Inc. There are to be no substitutions.

1.6 Submittal Requirements

A. Pre-Installation Submittal

1. Contractor shall not order, purchase, or install any equipment until pre-installation submittals have been accepted in writing by the Architect/Engineer.

2. Manufacturer product data sheets for each proposed system component.

a. For product data sheets containing more than one (1) part number or product, the Contractor shall clearly identify the specific part number or product being submitted Equipment schedules listing all system components, the manufacturer, model number and quantity of each.

3. Shop drawings of the proposed system installation.

a. Shop drawings shall include card reader locations, door position sensor locations, access control panel elevations to include layout and power supply locations, installation typical details, preliminary cable numbers, proposed cable pathways, system schematics, and riser diagrams. Shop drawings shall be submitted on 30” X 42” bond paper.

b. Contractor shall maintain a set of shop drawings on site at all times and shall update the shop drawings on a weekly basis. Shop drawings shall be made available for inspection at the request of the Architect/Engineer.

4. Manufacturer Product Certifications for Company.

5. Manufacturer Product Certifications for Installers.

6. Manufacturer Warranty letter.

PART 2 PRODUCTS

2.1 General Requirements

A. The following sections specifically list the acceptable equipment types and items for this project.

B. Architect/Engineer will have final determination of acceptability of all proposed equipment and must approve submitted equipment prior to purchase or installation.

C. Proposed equivalent items must be approved in writing by the Architect/Engineer prior to submitting a bid. Proposed equivalent items must meet or exceed these specifications and the specifications of the specified item.

D. In the event a manufacturer’s specified product or part number has changed or is no longer available, Contractor shall substitute the appropriate equivalent manufacturer’s part number.

E. In the event of a discrepancy between the specifications and the drawings, the greater quantity and/or better quality will be furnished.

F. For listed products with no part number specified, Contractor shall provide a product that meets the performance requirements of these specifications, industry standard practices, and intended application.

G. All wiring, equipment, and installation materials shall be new and of the highest quality.

H. Labels on all wiring, materials, and equipment must indicate a nationally recognized testing laboratory.

I. Original Equipment Manufacturer (OEM) documentation must be provided to the Architect/Engineer which certifies performance characteristics and compliance with industry standards.

2.2 Acceptable Manufacturers

A. Access Control System Software/Hardware by Open Options Tecnology

PART 3 EXECUTION

DController

Intelligent Door Controller

Intelligence at the edge

Smart. Easy. Convenient.

Overview

The **DController** is a compact, IP-based, Intelligent Door Controller designed to quickly and easily add doors to your system using standard 10/100 network infrastruture. The DController supports class 3 Power over Ethernet (PoE) to power the device as well as peripheral devices at the door and communicates with DNA Fusion™ access control software over a standard network connection thus eliminating traditional "home run" wiring to every door. The DController is an intelligent device, meaning all cardholder and access control decisions are made locally at the device.

The **DController** is also an extended door controller that can support up to 16 network door modules (NSC-100) and up to 8 traditional RS-485 I/O panels up to 1000 feet. The DController will support a total of 17 readers.

The **DController** connects directly to the network with a standard RJ45 connection and supports two readers (paired as single door), two supervised inputs, and two output relays. The DController comes complete with pre-wired connection leads (primary and auxiliary) for quick and easy termination of peripheral devices such as card readers, motion detectors, etc.

DController Features

Utilizes a standard 10/100 Ethernet connection to communicate with DNA Fusion access control software.

6MB memory and storage for up to 240,000 cardholders and 50,000 transactions.

Powered by PoE (IEEE Compliant 802.af) or optional external power supply.

PoE power output for supplying power to peripheral devices such as readers and locks.

Support for iClass, proximity, magnetic stripe, Wiegand, RS-485 and keypad readers.

Two reader ports available for in/out doors.

2 programmable inputs and 2 relay outputs.

Additional support for (16) NSC-100 network sub-controllers as well as RS-485 connected sub-controllers.

MET Certified for UL-294 and ULC S319-05 Compliance

Plenum-rated enclosure meets UL94-5VA flammability standard.

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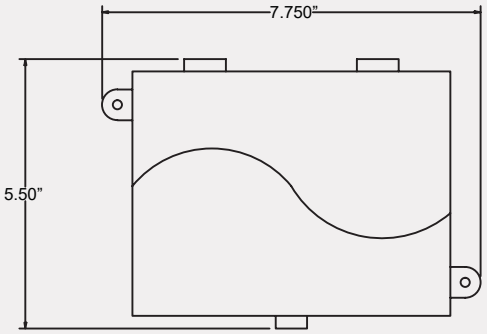
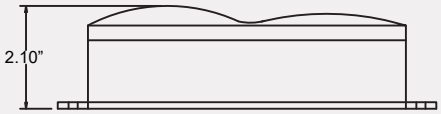
DController - Intelligent Door Controller

DController Specification





DController Dimensions

MET Certified for UL-294 & ULC S319-05 compliance and plenum-rated enclosure meets UL94-5VA flammability standard.

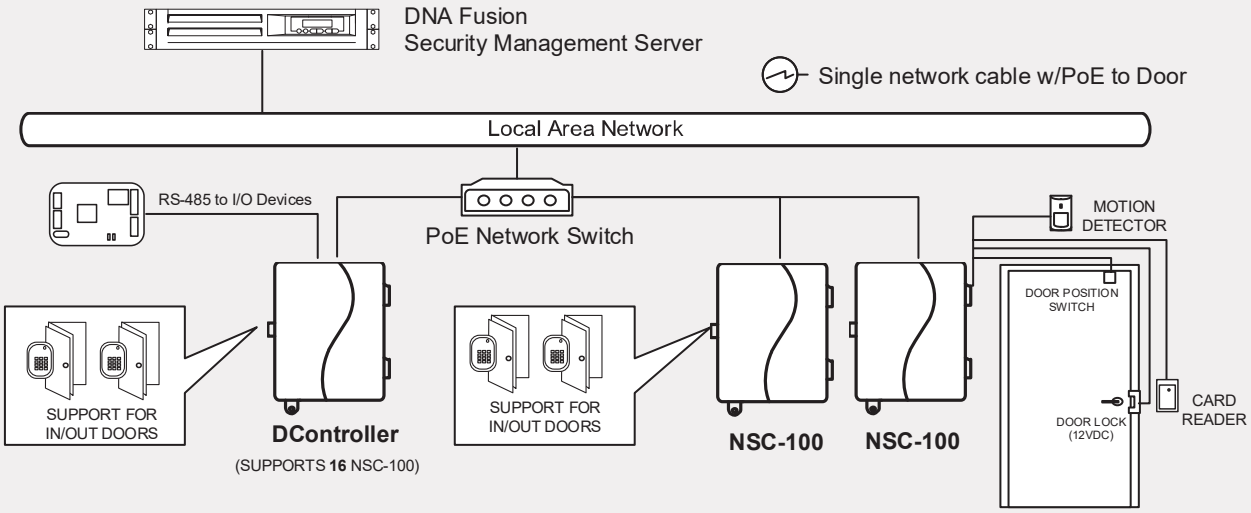
Power Input: PoE, 12.95W, Class 3, compliant to IEEE 802.3af -OR- 12 VDC ±10% 900mA max Power Supply.
Power Output: 12VDC @ 650mA including reader and Aux. output.
Outputs: 2 Form C contacts 2A @ 30VDC.
Inputs: 2 programmable inputs, EOL 1k/1k ohm.
Reader Power: 12VDC ±10%, 150mA Max.
Reader Data: Two TTL compatible inputs or one 2-wire RS-485*
Communication: 10Base-T/100Base-TX

Dimension: 7.75"L (197mm) x 5.50"W (140mm) x 2.1"H (53mm)
Weight: 12.8 oz. (360g) (without cables)
Environment:
Temperature: -10˚C to +55˚C, storage; 0˚C to +40˚C, operating;
Humidity: 10% to 95% RHNC

Cable Requirements:
Power: (External, Non-PoE)18AWG, 1 twisted pair
Alarm Inputs: 1 twisted pair per input, 30-ohm max.
Reader data (TTL): 22AWG, 6 conductors, 500-foot (150 m) max.
Reader data (RS-485): 24AWG, 120-ohm impedance, twisted pair with shield, 4000ft (1,219m) max.

* 485 Available on primary reader port only

Application



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fax: 972.818.7003
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PHYSICAL ACCESS SOLUTIONS

iCLASS® Readers

13.56 MHZ CONTACTLESS SMART CARD READERS. PLUG-N-PLAY WITH NEW AND EXISTING ACCESS CONTROL SYSTEMS

- **Simple Upgrades** – iCLASS® readers have the same wiring connections, same low-current consumption and same 5 to 12 volt operation as our Prox readers
- **Multiple Applications** – HID Connect offers over 70 technology partners which have embedded iCLASS technology into their products providing a single card solution for all your application requirements
- **GSA approved** – Included in the U.S. General Services Administration (GSA) FIPS 201 Approved Products List
- **Field Upgradeable** – Utilize firmware upgrade cards to modify reader firmware while installed on site

iCLASS® 13.56 MHz contactless smart cards and readers make access control more powerful, more versatile and offer enhanced security through data encryption and mutual authentication between the card and reader.

iCLASS readers are user-friendly, delivering the same convenience and reliability of HID's world-renowned Prox technology, with state-of-the-art features, driven by evolving industry requirements.

Upgrading from Prox to iCLASS technology has never been so simple. All iCLASS readers provide the same wiring connections, low-current consumption and 5 to 16 volt operation as our Prox readers. Additionally, you can transfer your Prox format and user identification numbers to iCLASS credentials, making the change completely transparent to your access control system.

Key Features

- **Format Portability -** Upgrading is completely transparent since the same Prox format and user identification numbers are brought across to your iCLASS credentials, including HID Corporate 1000 formats. Also, Elite custom key program is available for a higher level of security.
- **Secure -** All RF data transmission between the card and reader is encrypted using a secure algorithm. By using industry-standard encryption techniques and advanced key management systems, iCLASS reduces the risk of compromised data or duplicated cards.
- **Interoperability -** iCLASS is based on ISO interoperability standards providing compatibility with many popular card technologies (ISO 15693, ISO 14443A and ISO 14443B).
- **Optimal Read Range Performance -** An auto-tuning feature automatically adjusts the reader for optimal read range performance on any mounting surface.

FEATURES:

- **Security -** 64-bit authentication keys are extremely secure. Readers and cards require matching keys to function. All RF data transmission between the card and reader is encrypted using a secure algorithm. The key management system reduces the risk of compromised data or duplicated cards.
- **Elite Custom Keys -** Custom keys provide the highest level of security, where cards and readers are uniquely matched to individual sites or customers, and are non-interchangeable. Combining Elite custom keys with our Corporate 1000 can offer companies a scalable solution that can be implemented in facilities worldwide.
- **Audiovisual Indication -** Audio sounder provides various tone sequences to signify access granted, access denied, power up and diagnostics. Visually impaired cardholders can easily distinguish between access granted and access denied. A high-intensity light bar provides a clear visual status indication in red, green or amber, even in bright sunlight. **Note:** Light bar will illuminate amber when a FIPS 201/PIV card is read.
- **Indoor/Outdoor Design -** Rugged, weatherized polycarbonate enclosure, designed to withstand harsh environments, provides reliable performance and resistance to vandalism.
- **Easily Interfaced -** The reader's Wiegand output easily interfaces with most existing Wiegand and Clock-and-Data protocol access control panels. The reader reads standard proximity format data from HID iCLASS® cards and will output data as encoded. When reading ISO 14443A cards (MIFARE®/ DESFire®), the reader can be configured to output 26-bit, 32-bit (MSB), 32-bit (LSB), 34-bit, 40-bit or 56-bit Wiegand formats based on the CSN (card serial number).
- **Options -**
  Colors - Black or Gray
  Key Management - Standard or Elite
  Selectable Output Type (for MIFARE cards)
  Termination Options - 18" Pigtail or Terminal Strip
  Programmable LED/Beeper operation
  Accessory - Security Tool; 04-0001-03
  Transit – Enable FeliCa IDm and/or CEPAS CAN/CSN

SPECIFICATIONS

*Model Name	R10	R15	R30	R40
Model Number	6100C (Wiegand) 6108C (Clock-and-Data) 6109C (Transit)	6140C (Wiegand) 6148C (Clock-and-Data) 6149C (Transit)	6110C (Wiegand) 6118C (Clock-and-Data) 6119C (Transit)	6120C (Wiegand) 6128C (Clock-and-Data) 6129C (Transit)
**Read Range	iCLASS Card : Up to 3.25" (8.9 cm) iCLASS Key/Tag : Up to 1.5" (3.8 cm) Mifare / DESFire Card (CSN) : Up to 2.0" (5.1 cm)	iCLASS Card: Up to 3.5" (8.9 cm) iCLASS Key/Tag : Up to 1.5" (3.8 cm) Mifare / DESFire Card (CSN) : Up to 2.0" (5.1 cm)	iCLASS Card : Up to 4.0" (10.2 cm) iCLASS Key/Tag : Up to 2.0" (5.1 cm) Mifare / DESFire Card (CSN) : Up to 2.75" (7.0 cm)	iCLASS Card : Up to 4.75" (12.1 cm) iCLASS Key/Tag : Up to 2.0" (5.1 cm) Mifare / DESFire Card (CSN) : Up to 2.5" (6.4 cm)
Mounting	The R10 and R15 are physically our smallest readers and are ideally suited for mullion-mounted door installations, U.S. single-gang J-box or any flat surface (Reader will not cover junction box).		The R30 is 83.8 mm (3.3") square reader is designed to mount to and coverstandard European and Asian back boxes.	The R40 is designed to mount and cover single gang switch boxes primarily used in the United States and includes a slotted mounting plate for European and Asian back box spacing.
Color	Black or Gray			
Keypad	No	No	No	No
Dimensions	1.9" x 4.0" x 0.9" 4.8 cm x 10.3 cm x 2.3 cm	1.9" x 6.0" x 0.9" 4.8 cm x 15.3 cm x 2.3 cm	3.3" x 3.3" x 0.9" 8.4 cm x 8.4 cm x 2.3 cm	3.3" x 4.8" x 1.0" **8.4 cm x 12.2 cm x 2.4 cm**
Power Supply	5-16 VDC, Linear supply recommended			
Power Requirements (Standard Power)	55 mA AVG, 116 mA PEAK	55 mA AVG, 112 mA PEAK	55 mA AVG, 121 mA PEAK	55 mA AVG, 121 mA PEAK
Operating Temperature	-31° to 150° F (-35° to 65° C)			
Operating Humidity	5% to 95% relative humidity non-condensing			
Transmit Frequency	13.56 MHz	13.56 MHz	13.56 MHz	13.56 MHz
13.56 MHz Card Compatibility	15693 - read only; 2k bit (256 Byte), 16k bit (2k Byte), 32k bit (4k Byte) iCLASS credentials, serial number / 14443B - read only; 2k bit (256 Byte), 16k bit (2k Byte), 32k bit (4k Byte) iCLASS credentials serial number / 14443A - read only; MIFARE® and DESFire (serial number) / US Government PIV / FeliCa IDm (Transit Readers Only) / CEPAS CAN/CSN (Transit Readers Only)			
Environmental	IP55			
Cable Distance	Wiegand/Clock-and-Data Interface 500ft (150m) 22 AWG			
Termination	Pigtail or Terminal Strip			
Certifications	UL294/cUL (US), FCC Certification (US), IC (Canada), CE (EU), C-tick (Australia, New Zealand), SRRC (China), MIC (Korea), NCC (Taiwan), iDA (Singapore), RoHS			
Housing Material	UL94 Polycarbonate			
Family Model	R-640X-300			
Warranty	Lifetime			

**Consult How to Order Guide for specific ordering instructions.*
***Dependent upon installation conditions*

North America: +1 949 732 2000
Toll Free: 1 800 237 7769
Europe, Middle East, Africa: +44 (0) 1440 714 850
Asia Pacific: +852 3160 9800
Latin America: +52 (55) 5081 1650

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20110319-hid-iclass-readers-ds-en

NSC-100

IP-Based Door Module

IP Door Module

Compact. Simple. Convenient.

NSC-100 Product Features

Utilizes a standard 10/100 Ethernet connection to communicate with SSP™ IP Series Controllers.

Powered by PoE (IEEE Compliant 802.af) or optional external power supply.

PoE power output for supplying power to peripheral devices such as readers and locks.

Support for iClass, proximity, magnetic stripe, Wiegand, RS-485 and keypad readers.

Two reader ports available for in/out doors.

4 programmable inputs support normally open, normally closed, supervised and non-supervised circuits.

2 relay outputs can be set for fail safe or fail secure operation.

Uses strong encryption between NSC-100 and SSP™ Controller.

MET Certified for UL-294 and ULC S319-05 Compliance

Plenum-rated enclosure meets UL94-5VA flammability standard.

Overview

The **NSC-100**, network sub-controller, provides the interface between local devices at the door and the SSP™ IP Series Controllers on the local area network. Communication is accomplished via TCP/IP in the standard network environment.

The **NSC-100** connects directly to the network with a standard RJ45 connection and supports two readers (paired as single door), four supervised inputs, and two output relays. The **NSC-100** comes complete with pre-wired connection leads (primary and auxiliary) for quick and easy termination of peripheral devices such as card readers, motion detectors, etc. The **NSC-100** also supports full Power over Ethernet (PoE) to supply power to electric locks, motion detectors, and other peripheral door devices.

The **NSC-100** has built in support for most available reader technologies including but not limited to iClass, Mifare, Proximity, Wiegand, and magnetic stripe. In addition, the primary reader port supports RS-485 communication protocol for bi-directional and read/write capability.

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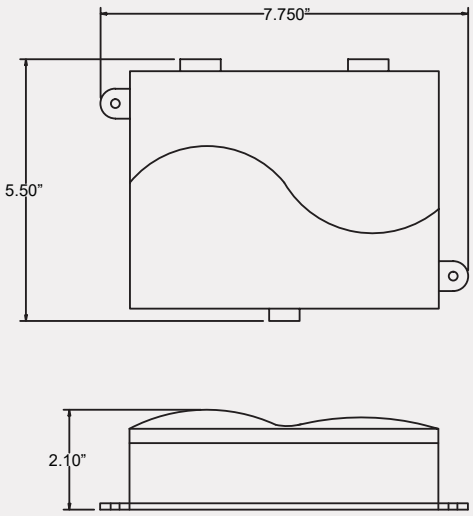
NSC-100 - IP Door Module

NSC-100 Specification



NSC-100 Dimensions

MET Certified for UL-294 & ULC S319-05 compliance and plenum-rated enclosure meets UL94-5VA flammability standard.

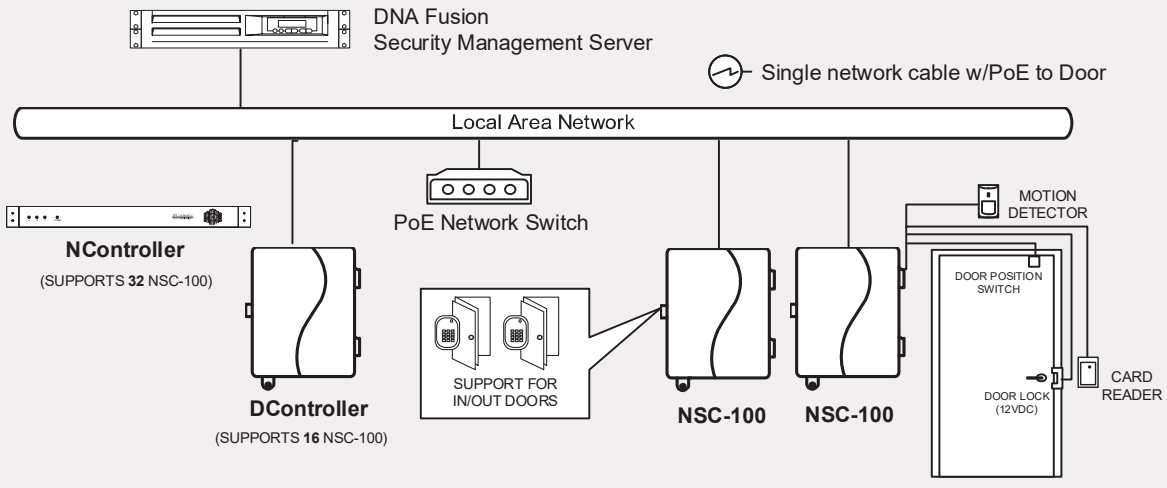
Power Input: PoE, 12.95W, Class 3, compliant to IEEE 802.3af -OR- 12 VDC ±10%, 900mA max Power Supply.
Power Output: 12VDC @ 700mA including reader and Aux. output.
Outputs: 2 Form C contacts 5A @ 28VDC.
Inputs: 4 programmable inputs, EOL 1k/1k ohm.
Reader Power: 12VDC ±10%, 150mA Max.
Reader Data: TTL compatible inputs or 2-wire RS-485*
Communication: 10Base-T/100Base-TX

Dimension: 7.75"L (197mm) x 5.50"W (140mm) x 2.1"H (53mm)
Weight: 12.8 oz. (360g) (without cables)
Environment:
Temperature: -10˚C to +55˚C, storage; 0˚C to +40˚C, operating;
Humidity: 10% to 95% RHNC

Cable Requirements:
Power: (External, Non-PoE)18AWG, 1 twisted pair
Alarm Inputs: 1 twisted pair per input, 30-ohm max.
Reader data (TTL): 22AWG, 6 conductors, 500-foot (150 m) max.
Reader data (RS-485): 24AWG, 120-ohm impedance, twisted pair with shield, 4000ft (1,219m) max.

* 485 Available on primary reader port only

Application



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Enclosed Products

Open Options Pre-wired Assemblies

Ready to Install

Quick. Simple. Convenient.

Overview

Open Options Enclosed Products deliver a complete solution for security integrators wanting to provide quality, flexible, ready-to-install panel enclosures on all their projects. Both the E2 Series enclosure and the Sub-controller enclosures offer a wide variety of configuration options to meet the needs of the open architecture system and provide a professionally consistent image on every project.

The **E2 Series Enclosure** comes complete with a power supply, power distribution board, and tamper switch. The E2 Enclosure is extremely flexible and can be ordered with any combination of boards with enough power to handle additional downstream devices.

Sub-controller Enclosures come in two basic forms. The standard "C" enclosure is a 12" x 14" assembly that consists of any single sub-controller panel that is pre-wired to a terminal strip and a tamper switch.

The **E3 Series Enclosure** is available with any combination of two sub-controller boards pre-wired to a terminal strip in a 16" x 20" metal enclosure with a tamper switch.

Enclosed Product Features

Single-source solution eliminates cost of multiple part vendors, orders and payments.

Dramatically reduces time associated with field construction of panel enclosures.

Provides standard and consistent field wiring of controllers and sub-controllers across all projects for easy service.

Overall enhanced profitability through simplified sales, order entry, and installation.

Pre-wired for quick and simple installation.

Automatic switch over to backup battery in applicable units.

Cabinet tamper switch comes standard on all enclosure assemblies.

Sub-controller enclosures are compact and convenient for above-door installation.

All enclosures are certified with MET Labs and comply with UL 294 and ULC S319-05 standard.

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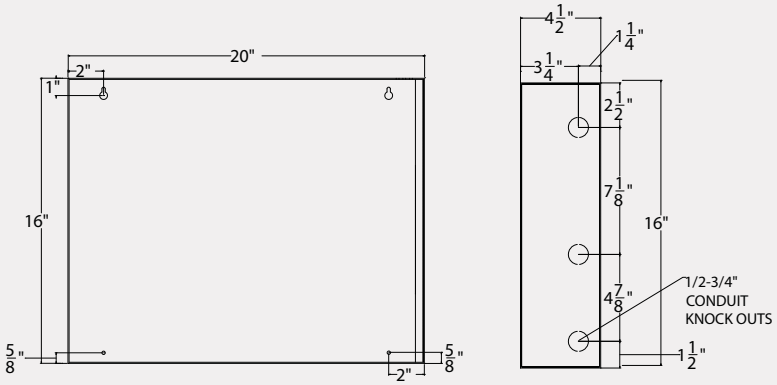
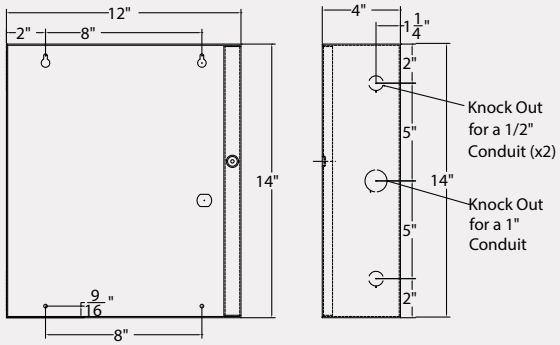
Enclosed Products

E2 Series Enclosure



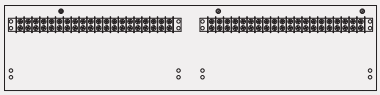
- 16" x 20" metal enclosure with removable cover and key slot mounting holes.
- SPS-10 Power Supply with Universal AC input (85-264VAC) and 12VDC output (8 continuous amps).
- Self contained transformer.
- Built in charger for battery backup.
- Power distribution board provides 8 class II power limited outputs.
- Micro tamper switch and key lock.
- MET Labs certified - UL 294 & ULC S319-05 compliant
- Available with any combination of Open Options intelligent controllers or sub-controllers.

"C" Enclosure



- 12" x 14" metal enclosure with removable cover and key slot mounting holes.
- Knock outs for 1/2" and 1" conduit.
- Most configurations come pre-wired to a 24 position terminal strip for added convenience and easy installation.
- MET Labs certified - UL 294 & ULC S319-05 compliant.
- Micro tamper switch and key lock.
- Available with any combination of Open Options sub-controllers.

E3 Series Enclosure



The E3 Series is the same basic enclosure as the E2 without power supply and distribution.

- Most configurations come pre-wired to (2) 24 position terminal strips for added convenience and easy installation.
- MET Labs certified - UL 294 & ULC S319-05 compliant.
- Micro tamper switch and key lock.
- Available with any combination of Open Options sub-controllers.

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RSC-1 & RSC-2

Reader Sub-controllers

Door Modules

Reliable. Versatile. Secure.

RSC-2- Dual Reader

- Support for proximity, magnetic stripe, Wiegand,RS-485 and keypad readers
- 8 programmable inputs support normally open, normally closed, supervised and non-supervised circuits
- 6 relay outputs can be set for fail safe or fail secure operation
- Stores up to 8 facility codes for basis of access decisions in offline mode
- Speeds up to 38,400 bits per second

RSC-1- Single Reader

- Support for proximity, magnetic stripe, Wiegand, RS-485 and keypad readers
- 2 programmable inputs support normally open, normally closed, supervised and non-supervised circuits
- 2 relay outputs can be set for fail safe or fail secure operation
- Stores up to 8 facility codes for basis of access decisions in offline mode
- Speeds up to 38,400 bits per second

Overview

Reader Sub-controllers provide the interface between door devices and the SSP™ Series Controllers.

Both RSC devices support a multitude of magnetic stripe, Wiegand, RS-485 and proximity readers, as well as providing I/O support for door devices such as request to exits and door contacts.

The **RSC-2** supports two readers for two completely separate doors or an in/out configuration. The RSC-2 also includes inputs and outputs beyond the requirements for a typical door configuration allowing for system expansion without the added cost.

The **RSC-1** is the perfect solution for almost any single door configuration and has an extra relay output for auxiliary device control.

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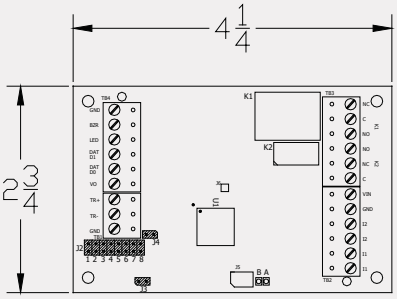
Reader Modules

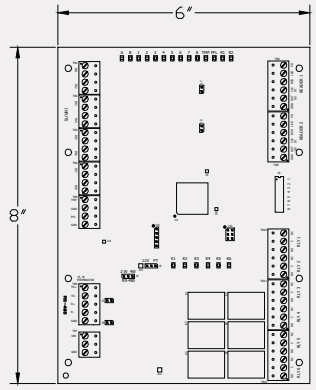
RSC-1



RSC-1

Primary Power	12 to 24VDC ± 10%, 12VDC @ 110mA (plus reader current) nominal, 24VDC @ 60mA (plus reader current) nominal
Wiring Specifications	
Power:	1 twisted pair, 18 AWG min.
RS-485:	22 AWG, 4,000ft (1,200m) max., twisted pair with shield
Reader Ports	
Power:	12 to 24VDC +/- 10% (input voltage passed through)
LED:	TTL compatible, high >3V, low <0.5V, 5mA sink max.
Buzzer:	Open collector, 5VDC open circuit max, 10mA sink max.
Reader:	TTL compatible inputs or 2-wire 485
Inputs/Outputs	
2 General purpose:	Programmable circuit type
1 dedicated:	Tamper
Relay 1:	Form-C, 5A 28 VDC
Relay 2:	Form-C, 1A 28 VDC
Environmental	
Temperature:	-40 to 70C operational, -55to 85C storage
Humidity:	10% to 95% RHNC
Mechanical	
Dimensions:	4.25 in. W x 2.75 in. L x 1.0 in. H (108mm W x 70mm L x 25.4mm H)
Weight:	4 oz. (120gm) nominal
Listing	UL Listed ALVY2, CE

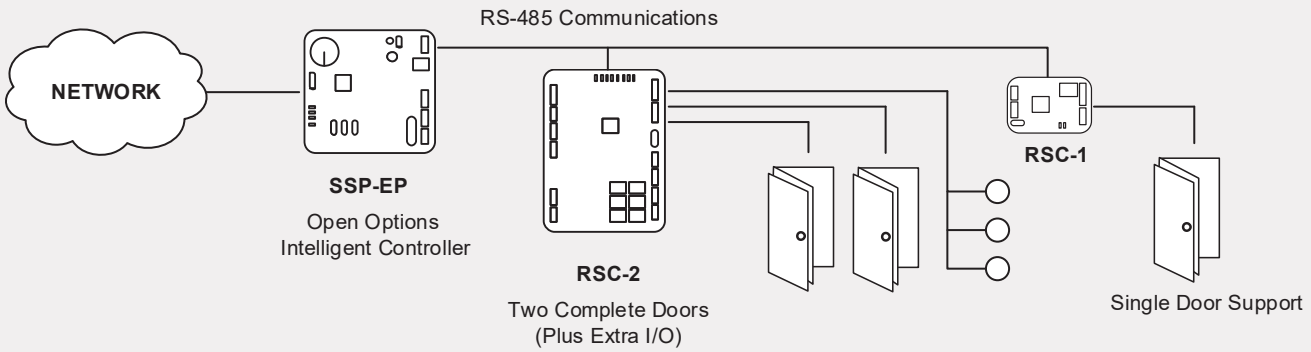
RSC-2



RSC-2

Primary Power	12 to 24VDC ± 10%, 12VDC @ 450mA (plus reader current) nominal, 24VDC @ 270mA (plus reader current) nominal
Wiring Specifications	
Power:	1 twisted pair, 18 AWG min.
RS-485:	22 AWG, 4,000ft (1,200m) max., twisted pair with shield
Reader Ports	
Power:	12 VDC ± 10% regulated, 125mA max each reader OR 12 VDC ± 10% (voltage passed through), 125mA max each reader All other reader port specifications are same as RSC-1 (see above).
Inputs/Outputs	
8 General purpose:	Programmable circuit type
2 dedicated:	1tamper and 1 power monitor each
6 Relays:	Form-C, 5A @ 28VDC, resistive
Environmental	
Temperature:	0 to 70C operational, -55to 85C storage
Humidity:	0 to 95% RHNC
Mechanical	
Dimensions:	6 in. W x 8 in. L x 1.0 in. H (152mm W x 203mm L x 25mm H)
Weight:	11 oz. (312gm) nominal
Listing	UL Listed ALVY2, CE

Application



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SSP-D2

Open Options
Intelligent Two Door Controller

Power for the Enterprise

SSP-D2 Features

- Native on-board 10/100 Ethernet for up to 10x faster throughput than traditional serial connections
- DHCP and static IP addressing support
- Built-in control for 2 access control doors (2 reader ports, 4 Form-C relay outputs, 8 supervised inputs)
- Standard 6 MB available non-volatile flash memory stores up to 250,000 cardholders*
- Background firmware downloads with system configuration restored from flash memory for seamless updates.
- Storage and backup for 50,000 events
- 12 or 24 VDC input voltage
- Biometric template management
- AES 128-bit encryption option for host communications
- On-board readers support mag, Wiegand, and OSDP 485 readers and keypads
- Support for multiple card formats
- Diagnostic LEDs
- Dedicated inputs for tamper and power failure alarms
- Improved Area management and Anti-passback support
- Precision Access
- Elevator Control up to 128 floors
- If/Then Macro functionality

* Based on estimated values and memory allocation options.

Overview

The Open Options **SSP-D2** is a native IP-ready intelligent controller with a built-in reader interface module allowing control of two doors right off the board and a total of 64 using additional reader and/or IO modules.

The **SSP-D2** connects directly to the LAN and supports the new Open Supervised Device Protocol (OSDP) for bidirectional communication to RS-485 and biometric devices.

The integrated 10/100 Ethernet port not only means faster more efficient connections to the host, but also less equipment and connections to manage compared to earlier generation panels. Connecting over IP is simplified using DHCP for auto-assigning IP addresses and device name recognition for easy management with a DNS server.

When used in conjunction with DNA Fusion™, the Open Options **SSP-D2** is the perfect solution that is scalable for any access control application.

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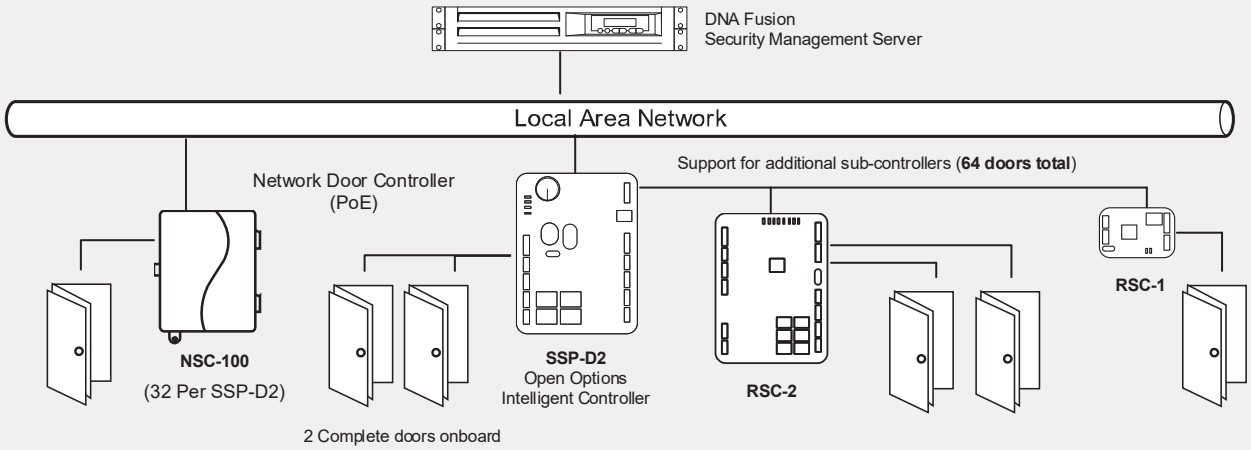
ACCESS TECHNOLOGY

SSP-D2 Controller

Specification

Primary Power	The SSP-D2 is for use in low voltage, power-limited, class 2 circuits only.
DC input:	12 or 24 VDC ± 10%. 500 mA maximum (reader current not included) 12Vdc @ 250mA (plus reader current) nominal 24Vdc @ 150mA (plus reader current) nominal
Memory and Clock Backup	3 V Lithium, type BR2325, BR2330, CR2330
Communication	
Primary (Ethernet) Port:	10/100Base-T Ethernet high-speed port
Alternate Upstream Port 1:	RS-232 9600 to 115.2 Kbps async
Downstream Port 2:	RS-485 (2-wire) 9600 to 38.4 Kbps async
Inputs	
Tamper and Power Monitors:	Unsupervised, dedicated
Door status, REX, and AUX:	8 programmable inputs (normally open/closed/supervised/non-supervised)
Outputs	
Relay outputs:	4 Form-C 5 A at 30 VDC relay outputs (user-defined as strike or AUX)
Reader Ports	
DC output:	12VDC±10% regulated, current limited to 150mA for each reader OR 12 to 24VDC±10% (pass through) current limited to 150mA per reader
Reader Compatibility	Wiegand Data1/Data0, Magnetic Clock/Data, OSDP Compatible Devices (Open Supervised Device Protocol RS-485)
Environmental	
Temperature:	Operating: 0° to 70° C (32° to 158° F) Storage: -55° to 85° C (-67° to 185° F)
Humidity:	0 to 95% RHNC
Mechanical	
Dimensions:	6 x 8 x 1 in. (152 x 203 x 25 mm)
Weight:	9 oz. (255 g) nominal
Listings/Approvals	UL Recognized Component ROHS-compliant Advanced Encryption Standard (AES) 128-bit communication algorithm

Application



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3.1 Codes, Standards, Regulations

A. TIA/EIA-568-B.1 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements – (May 2001)

B. TIA-569-B Commercial Building Standard for Telecommunications Pathways and Spaces - (October 2004)

C. TIA/EIA-606-A Administration Standard for Commercial Telecommunications Infrastructure - (May 2002)

D. SIA

E. Local

F. NEC

G. ISO

H. FCC

I. UL

J. OSHA

K. NFPA

L. NEMA

M. Plenum Applications

N. Applicable Flame Test: UL 910 (NFPA 262 1990).

3.2 In the event of any conflicts between documents referenced herein and the contents of this specification, the Contractor shall notify the Architect/Engineer in writing of any such occurrences before purchasing or installing any equipment or materials. The Architect/Engineer will notify the Contractor of any actions required to resolve these conflicts. Such actions may include but are not limited to: design changes, equipment, materials and/or installation changes. In any event Contractor shall not supersede specifications and standards from the latest NFPA and NEC publications.

3.3 General Requirements

A. Contractor shall comply with the requirements of local Authority Having Jurisdiction (AHJ), State of Texas, the National Fire Protection Association (NFPA), and the National Electrical Code (NEC). If the Contractor identifies any item in the plans or specifications that will not strictly comply with the aforementioned laws, ordinances, and rules, the matter shall be referred to the Architect/Engineer for direction before proceeding with that part of the work.

B. The Contractor shall install the materials in accordance with these specifications and the manufacturer's installation guidelines.

C. No deviations from the plans or specifications shall be made without full consent in writing of the Architect/Engineer. The Contractor shall have written approval from the Architect/Engineer for any additional work beyond the Contract Documents prior to beginning such work. If the Contractor does not obtain written approval from the Architect/Engineer prior to proceeding with the work, the contractor shall not be reimbursed for the work.

D. The Contractor shall obtain written permission from the Architect/Engineer before proceeding with any work that would necessitate cutting into or through any part of the building structure such as, but not limited to girders, beams, floors, walls, roofs, or ceilings.

E. Contractor shall notify the Architect/Engineer a minimum of (2) weeks prior to beginning work and will participate in a pre-construction meeting with the Architect/Engineer to perform a walkthrough, review the scope of work, schedule, and escalation procedures.

F. The Contractor shall maintain a work area free of debris, trash, empty wire reels, scrap wire, etc., and dispose of such items on a daily basis and return the site to the original state of cleanliness. The Contractor shall not use Owner's facilities for the disposal of excess or scrap materials.

G. Equipment and materials installed by the Contractor shall be free of defects and damage.

H. Contractor shall be responsible for the repair of any damage caused by the contractor during the installation.

I. Contractor shall test all wires prior to installation. By failing to perform this testing operation, the Contractor shall accept the wire as compliant and assume all liability for the replacement of the wire at no cost to the Owner should it be found defective at a later date.

J. Contractor shall maintain a set of working specifications, design drawings, and shop drawings to be kept on site at all times and shall update the shop drawings on a weekly basis. Shop drawings shall be made available for inspection at the request of the Architect/Engineer.

K. Equipment and materials shall be consistent throughout the installation. Where multiple units of the same type of equipment and materials are required, these units shall be a standard product with the same manufacturer and model number.

L. Equipment and materials shall be delivered and stored in accordance with the manufacturer's guidelines at the Contractor's expense.

M. Contractor shall make all stored equipment and materials available for inspection at the request of the Architect/Engineer.

N. All equipment and material used in the installation shall be approved by the manufacturer for the environment in which it is being installed.

O. Wires shall be properly supported in accordance with industry standards at all times. Improperly supported wires shall be corrected by the Contractor at no cost to the Owner.

P. Contractor shall be responsible to properly protect wiring from damage by other trades during construction.

Q. Cables shall be routed at 90-degree angles to the building structure. At no time shall a diagonal pull be installed.

R. The Contractor shall not install wires in conduits or sleeves without nylon bushings. Wires installed through conduits or sleeves without nylon bushings shall be removed and replaced at no cost to the Owner.

3.4 Installation

A. Coordination

1. Coordinate with the Architect to ensure that adequate conduit is provided and that equipment backboxes are adequate for system installation.

2. Coordinate with the Architect to ensure that adequate power has been provided and properly located for the security system equipment.

3. Coordinate with the Architect to ensure that doors and door frames are properly prepared for electric locking hardware and door position switches.

4. Coordinate the provision key cylinders and cores for LAs, DMUs and bypass key switches with the Architect. Coordinate cylinder and master key requirements with the Architect and related trades.

5. Coordinate locations of all devices with the Architect prior to installation.

6. Coordinate and verify the location of each piece of rack mounted equipment with the Owner.

7. Coordinate the incorporation of the ACS into the existing with Owner.

8. Coordinate all initial database partitioning and setup with the Owner prior to initial programming and card holder data entry.

9. Coordinate final camera locations, desired views, and camera housing and mount requirements with the Architect prior to installation.

10. Coordinate camera housing and mount finishes with the Architect prior to installation.

11. Coordinate finishes and colors of all equipment with the Architect. Submit all finish and graphics for all equipment in public areas to the Architect for approval prior to installation.

B. General

1. Verify acceptance of each type of specified request-to-exit hardware for each application with local life safety code officials.

2. Verify fail-safe and fail-secure lock requirements with the Architect.

3. Contractor or equipment manufacturer logos or names shall not be visible on equipment in public areas.

4. Provide tamper proof fasteners for all equipment in public areas. Fastener finish shall match equipment finish.

C. ACS Software

1. Contractor will program alarms from controllers into existing Open Options system:

a. Alarm Input Points: Icon identifying open, closed, alarm, secure, and trouble status.

b. Card Readers and Card Reader / Intercom units.

c. Icon identifying open, closed, secure, propped open, intrusion, and trouble status of door.

d. Icons identifying secure, bypass, and trouble status of card reader.

e. Icon identifying locked and unlocked status of electric locking mechanism.

f. Controls for lock, momentary unlock (preprogrammed for five second unlock time), timed unlock with selectable unlock time, and maintained unlock.

D. Door Controls

1. Electric Locks: Controls for lock, momentary unlock (preprogrammed for five second unlock time), timed unlock with selectable unlock time, and maintained unlock.

2. Parking Gates: Controls for open, close, and maintained open functions.

3. Overhead Doors: Controls for open, close, and stop functions.

E. Access Control

1. Card reader and remote control of doors as indicated in the Security Drawings.

2. Control point outputs for lock power control activated by card reader, File Server / system workstation keyboard or time schedule.

3. Contractor will program according to Owner requirements. All programming must be coordinated with Owner (Security)

3.5 Equipment

A. Provide equipment as indicated on the drawings and specified herein. Additional specific installation requirements are as follows:

1. Transaction time for authorized cards shall be less than 0.5 second from the time of card read until the door is unlocked.

2. Provide one spare card reader input point and 20 percent spare alarm input points and output point's after all specified points are initially connected. Sufficient modules shall be provided to accommodate only the number of card readers initially installed, as well as one spare input per control panel at each communications closet or consolidation point.

3. Configure the system such that devices can be connected to spare input points, output points and card reader inputs on the control panel without requiring reconfiguration of the ACS.

4. Configure the control panel communication chains such that no more than 48 card readers (including all possible spare card readers) shall be connected to each control panel chain.

5. Communications

a. Communications between servers, workstations, and control panel will be based on utilizing the Owner's LAN.

b. The ACS shall support 10 Base T Ethernet communications between the ACS File Server and the System Workstations, and between the ACS File Server and the control panel's.

c. Communications shall be encapsulated in a TCP/IP network transport layer in a client / server type Architecture.

B. Card Readers

1. Provide card reader as indicated on the drawings.

2. The card reader shall be HID iClass combatable technology and shall read encoded data from access cards and transmit the data to the DGP.

3. A two-color LED on the face of the Card Reader and an audible tone shall indicate authorized and unauthorized reader uses.

4. Provide manufacturer recommended power to each reader directly from the DGP or a secondary supply. The power supply shall be UL Class 2, power limited and shall provide necessary output voltage to allow the card reader to operate at its maximum specified read range.

5. Wire card reader LEDs to indicate valid and invalid card reads, and door locked and unlocked conditions. All card reader LED indicators shall operate identically.

C. Card Reader Wiegand Signal Extender

1. Provide card reader Wiegand signal extension devices as necessary for card readers with cable distances to the DGP greater than 500 feet as required.

2. Card reader signal extenders shall amplify / extend the Wiegand signal for distances of up to 10,000 feet without signal degradation.

3. Monitor normally closed contacts from card reader, Wiegand, signal extenders for power and communication loss between the remote units and the centralized receiving units.

D. Electric Locking mechanical

1. Interface with electric locking mechanical provided by the door hardware supplier.

2. Wire electric locking mechanism as indicated on the drawings.

3. Wire fail-safe electric locking mechanical in accordance with local codes.

4. Wire fail-secure electric locking mechanical and power supplies such that a fire alarm condition or building power failure shall not affect operation of the lock.

E. Delayed Egress Locking Devices

1. Interface with delayed egress locking devices provided by the door hardware supplier.

2. Wire delayed egress locking devices as indicated on the Drawings.

3. Wire delayed egress locking devices for fail-safe operation in accordance with local codes.

4. Interface with a normally closed alarm contacts that shall open upon activation of the unlock timer.

5. Interface with sounder bypass control contacts. Wire ACS control output contacts to bypass sounder by system workstation.

6. Interface with lock control contacts activated by system workstation and / or time schedule. Wire ACS control output contacts to lock / unlock devices by time schedule and / or system workstation.

F. Electrified Locking Mechanism Power Supply

1. Provide power supplies for all ACS electric locking mechanisms as specified with the exception of those noted as having Time-Delay functions as defined by NFPA 101.

2. Power supplies for time-delay function locks shall be provided by others. The security Contractor shall coordinate with others as necessary to ensure proper ACS operation of all Time-Delay electric locking mechanisms to include the provision of, and final termination of, ACS control and monitoring wire and cable as necessary to facilitate desired operation and integration with the ACS.

3. Provide power supplies for all electric locking mechanisms (with the exception of fire stair doors). Fail-safe locking devices shall unlock automatically under the following conditions:

a. Any building fire alarm

b. Loss of building power

c. Failure of the power supply

4. Provide battery chargers and batteries for all power supplies except those for fail-safe locks.

5. Monitor low battery and power fail alarms for each power supply.

6. Fire Alarm Interface

    a. Connect (hard wire) fail-safe electric and time delay locking mechanical to the building fire alarm system for fail-safe release upon any fire alarm.

    b. Interface with a single low voltage/low current normally closed dry contact from the fire alarm system provided by the fire alarm contractor in the Fire Command Center (FCC). The contact shall open on any fire alarm condition.

    c. Provide all additional UL listed fail-safe relays and power supplies necessary to interface to this contact and unlock all fail-safe doors.

    d. Connect fail-safe relays and power supplies to standard building power. Connection of fail-safe devices to emergency or UPS power shall not be acceptable.

    e. Reference the drawings for fire alarm interface requirements.

G. Device Power Supply

1. Provide U.L. Listed power supplies for all ACS equipment as specified.

2. Provide battery chargers and batteries for all power supplies except those for fail-safe locks.

3. Monitor low battery and power fail alarms for each power supply.

H. Door Position Switches

1. Provide normally closed magnetic concealed door position switches, surface mount door position switches and overhead door position switches to monitor the open/closed status of doors as specified herein and as indicated on the drawings.

2. Provide double-pole / double-throw (DPDT) contacts if contact is monitored by ACS and Intrusion Detection system.

3. Provide armored cable (as required) from the switch location to the associated junction box in order to conceal the wire.

I. Door Management and Local Alarm Units

    a. Provide unit for local and remote monitoring of the secure status of doors as indicated on the Security Drawings.

    b. The units shall provide for supervised monitoring of the door position switch(es) for the associated door(s).

    c. A horn within the unit shall sound and a normally closed alarm output contact from the unit shall be activated whenever a protected door is held open beyond a user adjustable time (0 to 60 seconds). Adjust the timer to zero so that the unit activates immediately when a door is opened. At the option of the Owner, certain unit's may be configured to allow the door(s) to be opened for a selectable period of time (0 to 60 seconds) without generating an alarm.