



SAN ANTONIO WATER SYSTEM
University Pump Station Improvements Project
SAWS Job No. 12-6002
Solicitation No. B-14-002-DD

ADDENDUM NO. 3
March 13, 2014

TO BIDDER OF RECORD:

The following changes, additions, and/or deletions are hereby made a part of the Contract Documents for the University Pump Station Improvements Project, for the San Antonio Water System, San Antonio, Texas, dated January 2014, as fully and completely as if the same were set forth therein.

Mandatory Pre-Proposal and Site Visit – Firms in Attendance

Invitation for Competitive Sealed Proposals – Proposals will not be accepted from any company not represented at the mandatory pre-proposal meeting and site visit held on February 28, 2014 at 10:00 a.m. The following list is a record of represented firms:

Webber · Archer Western · Pepper Lawson Waterworks · MGC Contractors
Shannon Monk, Inc. · Cunningham Constructors & Associates · Lambda Construction I, Ltd.

PART 1 – BIDDING AND CONTRACT DOCUMENTS

1. PROPOSAL CHECKLIST: REMOVE AND REPLACE in its entirety with the attached and utilize this version when submitting a proposal.
2. PRICE PROPOSAL: REMOVE AND REPLACE in its entirety with the attached and utilize this version when submitting a proposal.
3. SPECIAL CONDITIONS: Add the following to the end of the section:

“SC-13: Contractor to complete all Equipment List and Equipment Templates as found in Appendix C by the end of construction.

SC-14: None of the funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j-12) shall be used for a project for the construction, alteration, maintenance, or repair of a public water system or treatment works unless all of the iron and steel products used in the project are produced in the United States.

In this section, the term "iron and steel products" means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.”

PART 2 – TECHNICAL SPECIFICATIONS

1. SECTION 01130, PAYMENT PROCEDURES: REVISE paragraph 1.04.C.1 as follows:

“C. Item No. 3: City of San Antonio Building, Tree, and ROW Permit Allowance

1. Description – This item shall be an allowance for fees associated with acquiring building, tree, and ROW permits from the City of San Antonio. This allowance shall reimburse Contractor for the direct cost for all fees incurred in obtaining the permits from the City of San Antonio. Any unused portion of the allowance will be credited to the Owner by a deductible change order. Fees associated with additional inspections due to Contractor error shall not be paid under this allowance and are the responsibility of the Contractor.”

2. SECTION 01380, PHOTOGRAPHIC DOCUMENTATION: DELETE Section 2.01.F.

3. SECTION 01570, TEMPORARY CONTROLS: REPLACE this section in its entirety with the attached section.

4. SECTION 11210, HORIZONTAL SPLIT-CASE CENTRIFUGAL PUMPS:

- A. REVISE paragraph 1.03.B.2.a as follows:

“At the expense of the Contractor, the Owner’s employees will visit the pump manufacturer facilities for witness testing of the pump. The Contractor shall notify the Owner in writing not less than 21 days prior to the start of any phase of the testing. The total number of days required for each site visit shall be determined by the Contractor. The Contractor shall include in the total cost of their bid the cost for transportation, lodging, and per diem rates for meals for four people designated by the Owner. The Owner will deduct the total amount of each site visit from the total compensation due the Contractor through a Change Order.”

- B. REVISE paragraph 2.01.F.2 as follows:

“The stuffing box shall be fitted with a mechanical seal. The hardware shall be 316 stainless steel, rotary face shall be silicon carbide, stationary face shall be carbon, and elastomers shall be EPDM or Buna-N. Stainless steel piping for recirculation shall be provided from the discharge side of pump to the seal. The seal installation shall be inspected by the seal manufacturer prior to testing the pump. Mechanical seals shall be manufactured by the following manufacturers:

- a. Chesterton, Type 442
- b. John Crane, Type 1
- c. No other manufacturers will be accepted.”

5. SECTION 13300, INSTRUMENTATION AND CONTROLS GENERAL PROVISIONS

- A. Page 13300-8, Article 1.05.D, replace “The PCSI shall be one of the following:” with “The following PCSIs have been pre-qualified by the Owner for this project.”

B. Page 13300-8, Article 1.05.D, add the following:

3. “Richardson Logic Controls, LLC
2596 CR 168
McKinney, TX 75071
Attn: Michael Cunningham
Phone: 972.542.7375
Fax: 214.733.8254
4. Wunderlich-Malec Engineering
5501 Feltl Road
Minnetonka, MN 55343
Attn: Erick Carlson
Phone: 952.843.5840
Fax: 952.933.0608”

C. Page 13300-10, replace Article 1.06.C.3 in its entirety with the following:

“The following ASPs have been pre-qualified by the Owner for this project:”

- a. Signature Automation, LLC
14679 Midway Road, Suite 205
Addison, Texas 75001
Attn: Brett Whitaker
Phone: 469.619.1241 x102
Fax: 469.619.1242
- b. Transdyn
4256 Hacienda Dr, Suite 100
Pleasanton, CA 94588
Attn: David C. Gumpel
Phone: 925.460.5533
Fax: 832.816.0028
- c. Prime Controls
1725 Lakepointe Dr.
Lewisville, TX 75057
Attn: Gary McNeil
Phone: 972.221.4849
Fax: 972.420.4842
- d. Control Panels USA
2530 Shell Road
Georgetown, TX 78628
Attn: Martin Salyer
Phone: 512.863.3224
Fax: 832.816.0028
- e. Schneider Electric
Business Development, Water Wastewater Competency Center
12121 Wickchester Lane, Suite 400

Houston, Texas 77079
Attn: Mike Ford
Phone: 832.816.0028

f. Hierholzer Engineering, Inc.
P.O. Box 300
Seguin, Texas 78156-0300
Attn: Jeremy Davenport
Phone: 830.372.4808”

6. SECTION 13310, FIELD INSTRUMENTS

- A. Page 13310-4; replace “Siemens” in Article 2.01.A.1 with “Endress + Hauser”.
- B. Page 13310-4, delete Article 2.01.A.2.
- C. Page 13310-4, re-number Article 2.01.A.3 as Article 2.01.A.2
- D. Page 13310-7, delete Article 2.01.H.3. in its entirety and re-number subsequent paragraph.

7. SECTION 16110 RACEWAYS, BOXES AND FITTINGS

- A. Article 3.02.B.2; revise to read “all embedded conduit bends, underground duct bank bends of more than 32 degrees, and all conduit stub-ups to minimum of 6’ above finished floor or grade and in chlorine and caustic room.”
- B. Article 3.14.C; revise to read “All raceways, installed underground shall be installed in accordance with section 16600 Underground System, and be minimum of 2”C unless noted on drawings.”

8. SECTION 16196 LOW VOLTAGE AC SURGE PROTECTIVE DEVICES (SPDs)

Article 2.01.A; Add “Siemens” as acceptable Manufacturer

9. SECTION 16345 MEDIUM VOLTAGE METAL-CLAD SWITCHGEAR

Article 2.01.A; Add “Siemens” as acceptable Manufacturer

10. SECTION 16430 PAD-MOUNTED TRANSFORMERS

Article 2.01.A; Add “Siemens” as acceptable Manufacturer

11. SECTION 16461 DISTRIBUTION DRY-TYPE TRANSFORMERS

Article 2.01.A; Add “Siemens” as acceptable Manufacturer

12. SECTION 16470 PANELBOARDS

Article 2.01.A; Add “Siemens” as acceptable Manufacturer

13. SECTION 16475 LOW VOLTAGE ENCLOSED CIRCUIT BREAKERS AND DISCOUNTED SWITCHES

Article 2.01.A; Add “Siemens” as acceptable Manufacturer

14. SECTION 16480 LOW VOLTAGE MOTOR CONTROL CENTERS

Article 2.01.A; Add “Siemens” as acceptable Manufacturer

15. SECTION 16481 LOW VOLTAGE MOTOR CONTROLLERS

Article 2.01.A; Add “Siemens” as acceptable Manufacturer

16. SECTION 16481 MEDIUM VOLTAGE MOTOR CONTROL CENTERS

Article 2.01.A; Add “Siemens” as acceptable Manufacturer

17. SECTION 16487 ELECTRICAL CONTROL PANELS (OEMs)

Article 2.01.A; Add “Siemens” as acceptable Manufacturer

18. APPENDIX C – EQUIPMENT LIST: REPLACE this entire section with the attached Equipment List and Equipment Templates.

19. APPENDIX E – VERTICAL TURBINE O&M INFORMATION: ADD the attached additional Vertical Turbine O&M Information to the end of this section.

PART 3 – DRAWINGS

1. SHEET G-1: ADD the following sheet to the Table of Contents:
“EZ-05 Electrical Standard Details – V”

2. SHEET P-1:

A. REPLACE Note #7 with the following note:

“PAINT ALL PIPING AND EQUIPMENT FOR HSP #1 PER SPECIFICATION SECTION 09905. PUMP AND MOTOR SHALL BE PAINTED IN THE FIELD TO MATCH PIPING. PAINT ALL PROPOSED MOTORS, APPURTENANCES & PIPING, AS WELL AS EXISTING PUMPS, PIPING, AND APPURTENANCES, FOR HSP #3, 4, AND 5 TO MATCH HSP #1.

B. REVISE Note by Symbol #8, by replacing 3” combination air valve with 4” combination air valve.

3. SHEET P-4: REPLACE this sheet in its entirety.

4. SHEET S-2: DELETE Notes #1 and #2 for the “IBC Chapter 17 Special Inspection Requirements”.

5. Sheet E-09, MODIFY Note #8 as follows:

“Provide two cable trays, one cable tray for 5kv feeders and the other for 600 volts and below. See sheet E-12 for plans and sections.”

6. Sheet E-10, MODIFY as follows:

The feeder size from SWGR-1 to transformer: 3#6 (5KV shielded)+ #6 ground- 3”c

7. Sheet E-11, MODIFY as follows:

- A. The transformer designation shown”TX-4” to read “TX-LB
- B. The transformer designation shown”TX-3” to read “TX-LA”

8. Sheet E-18, MODIFY as follows:

Remove Reference #6 from exhaust fan EF-1

9. Sheet E-22, MODIFY as follows:

Modify the CCTV camera pole cap to 3 inch, threaded galvanized cap

10. Sheet ED-01, MODIFY Note #6 as follows:

“Contractor shall field verify all utilities to include electrical duct bank prior to construction; Contractor shall coordinate with Inspector to determine if duct bank shall be removed or remain. Contractor shall remove all existing conductors (wiring) and remove all duct bank that is three (3) feet below existing ground; all duct bank greater than three (3) feet depth shall remain in place.”

11. SHEET EZ-05: ADD this sheet in its entirety.

PROPOSAL CHECKLIST

Addendum 3

Project Name: University Pump Station Improvements Project

Solicitation Number: B-14-002-DD

ENVELOPE 1 (sealed envelope or box)

- Signed revised Price Proposal issued with Addendum 3 (Do not include this Price Proposal within the 7 required copies)
- Signed Proposal Certification Page (PC-1)

ENVELOPE (OR BOX) 2

ORIGINAL PROPOSAL

- Proposal Checklist
- Good Faith Effort Plan
- Financial Statement (do **not** include this item within the copies)
- Conflict of Interest Questionnaire
- Bid Bond/Cashier's Check
- W-9
- Proof of Insurability (Letter from Insurer or Sample Certificate of Insurance)
- Respondent Questionnaire
- Background, Experience, and Qualifications narrative (*including, but not limited to*):
 - Organizational Chart
 - Three (3) projects of similar size and scope within the last five (5) years as outlined on page SIR-2, C.1. f.)
- Project Plan, Safety and Quality Program narrative (*including, but not limited to*):
 - OSHA 300
 - OSHA Form 300A
 - TRIR
 - Any OSHA Citations
- Acknowledgement of Pollution Abatement Compliance
- Acknowledgement of Addendum(s)
- TWDB -0216 (*Reference DB-0210 and FAQ*)
- TWDB -0217 (*Reference DB-0210 and FAQ*)
- TWDB -0373 (*Reference DB-0210 and FAQ*)
- TWDB-0255
- TWDB Form 0459
- TWDB Form SRF-404
- 6100-3 DBE Subcontractor Performance Form
- 6100-4 DBE Subcontractor Utilization Form
- One (1) CD of Original Proposal Packet (*excluding the Price Proposal and Financial Statement*)

Project Name: University Pump Station Improvements Project

Solicitation Number: B-14-002-DD

PROPOSAL PACKET COPIES -7 (sealed box or large envelope containing all 7 copies)

The copies should include **only** the following items:

- Proposal Checklist**
- Respondent Questionnaire**
- Background, Experience, and Qualifications narrative**
 - Organizational Chart
 - Three (3) projects of similar size and scope within the last five (5) years as outlined on page SIR-2, C.1. f.)
- Project Plan, Safety and Quality Program narrative** (*including, but not limited to*):
 - OSHA 300
 - OSHA Form 300A
 - TRIR
 - Any OSHA Citations

I certify that the proposal packet submitted includes the items as indicated above.

Signature

Date

Printed Name/Title

Company Name

PRICE PROPOSAL

PROPOSAL OF _____,
 a corporation _____
 a partnership consisting of _____
 an individual doing business as _____

THE SAN ANTONIO WATER SYSTEM:

Pursuant to Instructions and Invitations for Competitive Sealed Proposals, the undersigned proposes to furnish all labor and materials as specified and perform the work required for the construction of the **UNIVERSITY PUMP STATION IMPROVEMENTS PROJECT**, San Antonio Water System Job Number 12-6002 in accordance with the Plans and Specifications for the following prices, to wit:

BID ITEMS

ITEM NO.	ITEM DESCRIPTION Price to be written in words)	(Unit UNIT	ESTIMATED QUANTITY	UNIT PRICES (FIGURES)	TOTAL PRICE (FIGURES)
A BASE BID					
1	Total amount for furnishing all labor materials, services, equipment, and appurtenances in conjunction with and incidental to all work (site work, general construction) for execution of the University Pump Station Improvements Project in conformance with the Project Documents, with the exception of those items specifically listed in other bid items. _____ Dollars and _____ Cents	LS	1	\$ _____	\$ _____
2	On-site security guard during performance of the work _____ Dollars and _____ Cents	LS	1	\$ _____	\$ _____
3	Allowance for City of San Antonio (COSA) building, tree, and ROW permits. Thirty-Five Thousand _____ Dollars and <u>no</u> _____ Cents	LS	1	<u>\$35,000.00</u>	<u>\$35,000.00</u>
4	Allowance for City Public Service (CPS Energy). Eighty-Five Thousand _____ Dollars and <u>no</u> _____ Cents	LS	1	<u>\$85,000.00</u>	<u>\$85,000.00</u>
5	Allowance for Traffic Control. Twenty-Five Thousand _____ Dollars and <u>no</u> _____ Cents	LS	1	<u>\$25,000.00</u>	<u>\$25,000.00</u>
LINE ITEM "A" SUBTOTAL BASE BID (Items 1-5)					
100	Mobilization and Demobilization: This item includes project move-in and move-out of personnel and equipment, for work shall include furnishing all labor, materials, tools, equipment and incidentals required to mobilize, demobilize, bond and insure the Work for the <i>UNIVERSITY PUMP STATION IMPROVEMENTS PROJECT</i> , in accordance with the contract documents, complete in place. Percent of the <u>Line Item "A"</u> , Subtotal Base Bid written in words _____ Percent (Maximum of 10% of <u>Line Item "A"</u> Subtotal Base Bid amount)	LS	1	\$ _____	\$ _____
MOBILIZATION SUBTOTAL (Item 100)					

Mobilization and Demobilization lump sum bid shall be limited to a maximum 10% of the Line Item "A" Subtotal Base Bid Amount. The Line Item "A" Subtotal Base Bid Amount is defined as all bid items EXCLUDING Item 100, Mobilization and Demobilization. **In the event of a discrepancy between the written percentage and dollar amount shown for Mobilization and Demobilization bid item, the bid item's written percentage will govern. If the percentage written exceeds the allowable maximum stated for Mobilization and Demobilization, SAWS reserves the right to cap the amount at the percentage shown and adjust the extensions of the bid item accordingly.**

TOTAL BID AMOUNT (LINE ITEM "A", MOBILIZATION)

DOLLARS

\$

AND

CENTS

RESPONDENT'S SIGNATURE & TITLE

FIRM'S NAME (TYPE OR PRINT)

FIRM'S ADDRESS

FIRM'S PHONE NO./FAX NO.

FIRM'S PHONE EMAIL ADDRESS

The Contractor herein acknowledges receipt of the following:
Addendum Nos. _____

The Respondent offers to construct the Project in accordance with the Contract Documents for the contract price, and to final completion, as defined in the General Conditions, within **600 calendar days** after the start date, as set forth in the Authorization to Proceed. **The Respondent understands and accepts the provisions of the contract Documents relating to liquidated damages of the project if not completed on time.**

Complete the additional requirements of the Proposal which are included on the following pages.

SECTION 01570

TEMPORARY CONTROLS

1.00 GENERAL

1.01 WORK INCLUDED

- A. Provide labor, materials, equipment and incidentals necessary to construct temporary facilities to provide and maintain control over environmental conditions at the Site. Remove temporary facilities when no longer needed.
- B. Construct temporary impounding works, channels, diversions, furnishing and operation of pumps, installing piping and fittings, and other construction for control of conditions at the Site. Remove temporary controls at the end of the Project.
- C. Provide a Storm Water Pollution Prevention Plan in accordance with TCEQ General Permit TXR150000, file required legal notices and obtain required permits prior to beginning any construction activity.
- D. Provide labor, materials, equipment, and incidentals necessary to prevent storm water pollution for the duration of the Project. Provide and maintain erosion and sediment control structures as required to preventive sediment and other pollutants from the Site from entering any storm water system, including open channels. Remove pollution control structures when no longer required to prevent storm water pollution.
- E. Cost for Temporary Controls as described in this Section and provided by Suppliers and Subcontractors as described in this Section are to be included in the Cost of Work.

1.02 QUALITY ASSURANCE

- A. Construct and maintain temporary controls with adequate workmanship using durable materials to provide effective environmental management systems meeting the requirements of the Contract Documents and requiring minimal maintenance that will disrupt construction activities while providing adequate protection of the environment.
- B. Periodically inspect systems to determine that they are meeting the requirements of the Contract Documents.

1.03 SUBMITTALS

- A. Provide copies of notices, records and reports required by the Contract Documents or regulations as Record Data in accordance with Section 01300 "Submittal Procedures."
- B. Provide documents requiring approval by the Owner or Engineer as Shop Drawings in accordance with Section 01300 "Submittal Procedures."

1.04 STANDARDS

- A. Provide a storm water pollution prevention plan that complies with Local, State, and Federal requirements. Comply with all requirements of the Texas Commission on Environmental Quality General Permit (TXR150000) for storm water discharges from construction activities under the Texas Pollutant Discharge Elimination System (TPDES) program.

- B. Perform Work to comply with “Best Practice” as established by the North Central Texas Council Of Governments (NCTCOG) integrated Storm Water Management (iSWM) Design Manual for Construction or the local agency of jurisdiction.

1.05 PERMITS

- A. Submit the following to the TCEQ and the Operator of any Municipal Separate Storm Sewer System (MS4) receiving storm water discharges from the Site:
 - 1. Notice of Intent (NOI) at least 48 hours prior to beginning construction activity. Construction activity may commence 24 hours after the submittal of an electronic NOI.
 - 2. Notice of Change (NOC) letter when relevant facts or incorrect information was submitted in the NOI, or if relevant information in the NOI changes during the course of construction activity.
 - 3. Notice of Termination (NOT) when the construction project has been completed and stabilized.
- B. Post a copy of the NOI at the Site in a location where it is readily available for viewing by the general public and Local, State, and Federal authorities prior to starting construction activities and maintain the posting until completion of the construction activities.
- C. Maintain copies of a schedule of major construction activities, inspection reports, and revision documentation with the storm water pollution prevention plan (SWPPP) required under the TPDES General Permit (TXR150000) for Storm Water Discharges from Construction Activities for all projects.

1.06 STORM WATER POLLUTION CONTROL

- A. Comply with the current requirements of TPDES General Permit No. TXR15000 (General Storm Water Permit) set forth by the Texas Commission on Environmental Quality for the duration of the Project:
 - 1. Develop a Storm Water Pollution Prevention Plan meeting all requirements of the General Storm Water Permit.
 - 2. Submit of a Notice of Intent to the Texas Commission on Environmental Quality.
 - 3. Develop and implement appropriate Best Management Practices as established by local agencies of jurisdiction.
 - 4. Provide all monitoring and/or sampling required for reporting to the Texas Commission on Environmental Quality.
 - 5. Submit reports to the Texas Commission on Environmental Quality as required as a condition of the permit.
 - 6. Submit copies of the reports to the Engineer as Record Data in accordance with Section 01300 “Submittal Procedures.”
 - 7. Retain copies of these documents at the Site at all times for review and inspection by the Owner or regulatory agencies. Post a copy of the permit as required by regulations.
 - 8. Pay all costs associated with complying with the provisions of the General Storm Water Permit. Assume solely responsible for implementing, updating, and modifying the General Storm Water Permit per regulatory requirements the Storm Water Pollution Prevention Plan and Best Management Practices.

- B. Use forms required by the Texas Commission on Environmental Quality to file the Notice of Intent. Submit the Notice of Intent at least 2 days prior to the start of construction. Develop the Storm Water Pollution Prevention Plan prior to submitting the Notice of Intent. Provide draft copies of the Notice of Intent, Storm Water Pollution Prevention Plan, and any other pertinent Texas Commission on Environmental Quality submittal documents to Owner for review prior to submittal to the Texas Commission on Environmental Quality.
- C. Return any property disturbed by construction activities to either specified conditions or pre-construction conditions as set forth in the Contract Documents. Provide an overall erosion and sedimentation control system that will protect all undisturbed areas and soil stockpiles/spoil areas. Implement appropriate Best Management Practices and techniques to control erosion and sedimentation and maintain these practices and techniques in effective operating condition during construction. Permanently stabilize exposed soil and fill as soon as practical during the Work.
- D. Assume sole responsibility for the means, methods, techniques, sequences, and procedures for furnishing, installing, and maintaining erosion and sedimentation control structures and procedures and overall compliance with the General Storm Water Permit. Modify the system as required to effectively control erosion and sediment.
- E. Retain copies of reports required by the General Storm Water Permit for 3 years from date of final completion.

1.07 POLLUTION CONTROL

- A. Prevent the contamination of soil, water or atmosphere by the discharge of noxious substances from construction operations. Provide adequate measures to prevent the creation of noxious air-borne pollutants. Prevent dispersal of pollutants into the atmosphere. Do not dump or otherwise discharge noxious or harmful fluids into drains or sewers, nor allow noxious liquids to contaminate public waterways in any manner.
- B. Provide equipment and personnel and perform emergency measures necessary to contain any spillage.
 - 1. Contain chemicals in protective areas and do not dump on soil. Dispose of such materials at off-site locations in an acceptable manner.
 - 2. Excavate contaminated soil and dispose at an off-site location if contamination of the soil does occur. Fill resulting excavations with suitable backfill and compact to the density of the surrounding undisturbed soil.
 - 3. Provide documentation to the Owner which states the nature and strength of the contaminant, method of disposal, and the location of the disposal site.
 - 4. Comply with local, State and Federal regulations regarding the disposal of pollutants.
- C. Groundwater or run-off water which has come into contact with noxious chemicals, sludge, or sludge-contaminated soil is considered contaminated. Contaminated water must not be allowed to enter streams or water courses, leave the Site in a non-contained form or enter non-contaminated areas of the Site.
 - 1. Pump contaminated water to holding ponds constructed by the Contractor for this purpose, or discharge to areas on the interior of the Site, as designated by the Engineer.
 - 2. Construct temporary earthen dikes or take other precautions and measures as required to contain the contaminated water and pump to a designated storage area.

3. Wash any equipment used for handling contaminated water or soil within contaminated areas three times with uncontaminated water prior to using such equipment in an uncontaminated area. Dispose of wash water used to wash such equipment as contaminated water.

1.08 EARTH CONTROL

- A. Remove excess soil, spoil materials and other earth not required for backfill at the time of generation. Control stockpiled materials to eliminate interference with Contractor and Owner's operations.
- B. Dispose of excess earth off the Site. Pay cost for disposal unless otherwise noted. Provide written approval by the property owner for all disposal on private property, and approval by the Owner if such disposal affects the use of Site or other easements.

1.09 MANAGEMENT OF WATER

- A. Manage water resulting from rains or ground water at the Site. Maintain trenches and excavations free of water at all times.
- B. Lower the water table in the construction area by acceptable means if necessary to maintain a dry and workable condition at all times. Provide drains, sumps, casings, well points, and other water control devices as necessary to remove excess water.
- C. Provide continuous operation of water management actions. Maintain standby equipment to provide proper and continuous operation for water management.
- D. Ensure that water drainage does not damage adjacent property. Divert water into the same natural watercourse in which its headwaters are located, or other natural stream or waterway as approved by the Owner. Assume responsibility for the discharge of water from the Site.
- E. Remove the temporary construction and restore the Site in a manner acceptable to the Engineer and to match surrounding material at the conclusion of the Work.

2.00 PRODUCTS

2.01 MATERIALS

- A. Provide materials meeting regulatory requirements.

3.00 EXECUTION

3.01 CONSTRUCTING, MAINTAINING AND REMOVING TEMPORARY CONTROLS

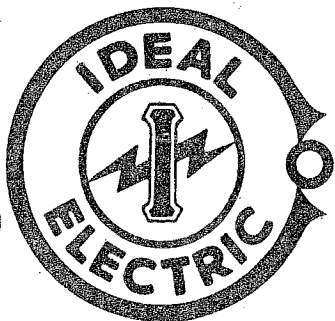
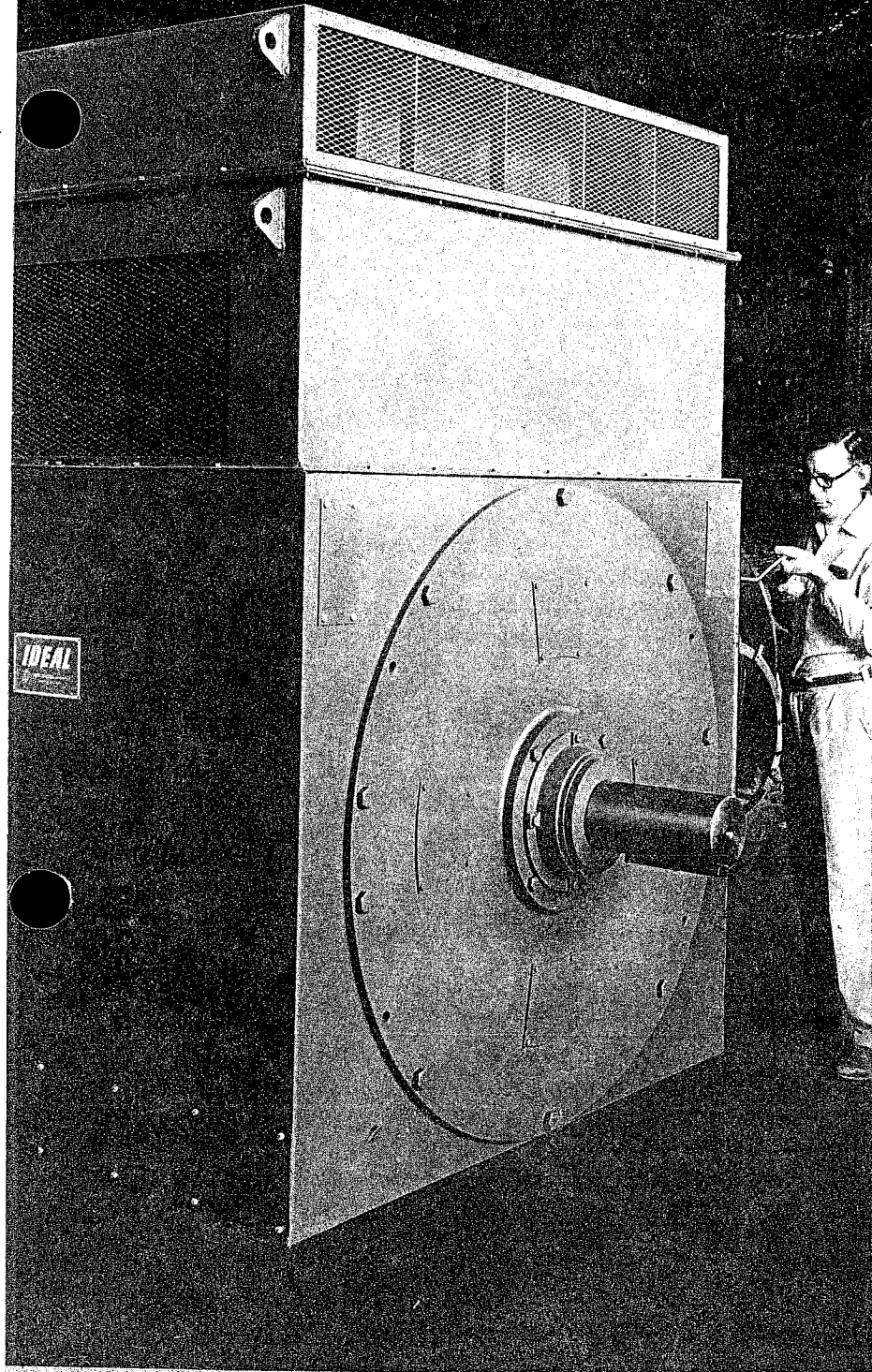
- A. Construct temporary controls in accordance with regulatory requirements.
- B. Maintain controls in accordance with regulatory requirements where applicable, or in accordance with the requirements of the Contract Documents.
- C. Remove temporary control when no longer required, but before the Project is complete. Correct any damage or pollution that occurs as the result of removing controls before the point where they are no longer required.

ADDITIONAL VERTICAL TURBINE
O&M INFORMATION

MANUAL IM-500

INSTRUCTION MANUAL

Squirrel Cage & Wound Rotor Induction Motors



IDEAL ELECTRIC

*Where Service Makes
An Excellent Product
Even Better!*

THE IDEAL ELECTRIC & MANUFACTURING COMPANY • MANSFIELD, OHIO, U.S.A.

THE IDEAL ELECTRIC WARRANTY

The Ideal Electric & Manufacturing Company, in connection with apparatus sold hereunder, agrees to correct any defect or defects in workmanship or material which may develop under proper or normal use during the period of one year from the date of shipment, by repair or by replacement, f.o.b. factory, Mansfield, Ohio, of the defective part or parts where our inspection proves the claim. Ideal's liability arising out of the supplying of the said apparatus, or its use whether on warranty, contract or otherwise, shall not in any case exceed the cost of correcting defects in the apparatus, as herein provided, and upon the expiration of said one year all such liability shall terminate. The foregoing shall constitute the sole remedy of the Purchaser.

THE IDEAL ELECTRIC & MANUFACTURING COMPANY

330 East First Street Mansfield, Ohio 44903

TELEPHONE (AREA CODE 419) 522-3611

TWX 810-448-2808

TELEX 98-7410



INSTRUCTION MANUAL IM-500

IDEAL ELECTRIC

SQUIRREL CAGE & WOUND ROTOR INDUCTION MOTORS

CONTENTS

INTRODUCTION	4
SECTION I — RECEIVING, HANDLING AND STORAGE	5
1.1 Receiving	
1.2 Handling	
1.3 Storage	
SECTION II — INSTALLATION	5
2.1 Location	
2.2 Mounting	
2.3 Start-Up Precautions	
SECTION III — LUBRICATION	6
3.1 Lubrication of Sleeve Bearing Machines	
3.2 Oil Levels	
3.3 Changing Oil	
3.4 Replacement of Sleeve Bearings	
3.5 Grease Lubricated Bearings	
3.6 Choice of Lubricants	
3.7 Lubricating Procedures	
SECTION IV — INSPECTION	12
4.1 Routine	
4.2 Weekly	
4.3 Every Six Months	
4.4 Once a Year	
4.5 Records	
SECTION V — CARE OF INSULATION	13
5.1 General	
5.2 Insulation Resistance	
5.3 Factors Affecting Insulation Resistance	
5.4 Minimum Values of Insulation Resistance	
5.5 Effect of Duration of Test Voltage	
5.6 Polarization Index	
5.7 Drying Out Windings	
5.8 Methods of Applying Heat	
5.9 Observing the Progress of Dryout	
5.10 Taking Insulation Resistance Measurements	
5.11 Safe Values of Insulation Resistance	
SECTION VI — MAINTENANCE	17
6.1 Routine Maintenance	
6.2 Cleaning	
6.3 Removing Grease	
6.4 Brushes and Brush Holders — Non-Adjustable (Wound Rotor)	
6.5 Collector Rings — Wound Rotor	
SECTION VII — TYPICAL DRAWINGS & CONNECTION DIAGRAMS	19
SECTION VIII — LUBRICANT RECOMMENDATIONS	30

INTRODUCTION

This manual covers installation, operation and maintenance of Polyphase Induction Motors. They are of two general types, Squirrel Cage and Wound Rotor. Wound Rotor motors are sometimes referred to as Slip Ring motors.

Squirrel Cage motors are inherently less complicated than Wound Rotor motors. For this reason alone, they are normally selected for applications requiring automatic or remote control. They are available with various starting torque and current inrush values to fit various types of drives and available power conditions.

We must assume for the purpose of this manual, that the proper motor characteristics have been selected for the location and type of equipment the motor is to power. If there is any doubt, please consult with your nearest Ideal Electric and Manufacturing Company sales office or direct with the factory in Mansfield, Ohio. The telephone number is (419) 522-3611.

Ideal Electric Squirrel Cage motors are carefully designed and truly balanced electrically and mechanically to insure high efficiency at high full load speeds while making use of the lowest possible inrush current during starting.

A Wound Rotor motor should be used when your power source is not adequate to start a Squirrel Cage motor without producing excessive line voltage drop. The starting current inrush for a Wound Rotor motor can be limited to 150% of full load current. The output speed of a Wound Rotor motor can be controlled. Their use should be considered where capacity reduction is required through a change in speed, or where speed control is necessary or desirable.

Both types of motors are made with various types of enclosures, such as dripproof, weather protected (NEMA I), weather protected (NEMA II), totally enclosed fan cooled, totally enclosed pipe ventilated, and totally enclosed water cooled. The motor you are installing should have the proper type of enclosure to provide adequate protection for the location where it will be required to operate.

We urge you to read carefully this Instruction Manual before attempting to install or operate your motor. If there is any doubt about the motor's characteristics, or the type of enclosure, or anything else concerning installation, operation or maintenance, we invite you to contact your nearest Ideal Sales and Engineering Office or the factory.

SECTION I - RECEIVING, HANDLING AND STORAGE

1.1 RECEIVING

This machine has been carefully tested, inspected and crated before leaving the factory. When unpacking and removing crate, thoroughly inspect unit to see if any damage has occurred during transit, and to make sure that all accessories are there and in proper condition. If damage has occurred or parts are missing, file a claim with the transportation company immediately and contact your nearest Ideal Electric representative or call the factory directly.

1.2 HANDLING

When lifting the unit use the eyebolts or lifting lugs provided and protect the windings from damage. When handling the rotor alone, support

the rotor by slings or blocks under the shaft or a cradle under the rotor laminations. Protect bearing journals to prevent marring of polished surfaces.

1.3 STORAGE

If the machine is not to be placed into service immediately it should be kept in a clean, dry place which is not subjected to large variations in temperature. If the air temperature suddenly changes, moisture will condense on the exposed metal and windings. **This should be avoided.** Some machines are equipped with space heaters. If any storage is contemplated, these heaters should be connected. Supplemental heaters can be used during storage to maintain a steady temperature.

SECTION II - INSTALLATION

2.1 LOCATION

The ambient conditions at the installation should be considered to insure that they will be satisfactory for the type of protection to which the machine was constructed. Maintenance will cost less and service life will be increased if unnecessary dirt, dust, moisture, splashing liquids or similar hazards are excluded from the area especially when open protected and drip-proof machines are installed. Care should be taken during installation to allow for adequate space around the machine, to permit the free flow of cooling air.

2.2 MOUNTING

For direct coupled units, alignment is of the utmost importance. Experience has shown that many vibration and bearing problems can be traced directly to poor alignment. Normally, for higher speed equipment, the better the alignment, the better the equipment will operate.

During alignment the run-out of the couplings should be checked with a dial indicator from the shaft of the driven equipment to the shaft of the drive unit by turning the coupling half.

Make sure that the misalignment of the coupling is well within the limits set up by the coupling manufacture for the HP rating and

speed. After final alignment and run in period of at least four hours, the machine alignment should again be checked. If alignment is suitable and well within limits, the machine should be doweled. The coupling should operate at the mid-point of the total end-float of the machine (sleeve bearing) to avoid imposing end thrust on the bearings. Sleeve bearing machines have a line scribed around the shaft on the shaft extension end. When this scribed line on the shaft is in line with the outer face of the bearing housing, the rotor is at its magnetic center.

For belted installations, good alignment and proper belt tension are important considerations. The slide base or rails should be securely tightened on the foundation and carefully aligned so that the faces of the driver and driven sheaves are parallel and in line. Normally, on motors of 100 HP and above, the belt speed should be between 4500 and 5000 feet per minute. The sheave should be mounted on the shaft as close to the bearing as possible with inside edge of the sheave in line with the shaft shoulder. The precautions relating to operation at midpoint of the total rotor end-float as noted for coupled machines should apply.

2.3 START-UP PRECAUTIONS

1. Check the nameplate for voltage and frequency and make sure these correspond with the drawings so as to insure proper wire size and protection.

2. Measure insulation resistance of the windings with an insulation megohm instrument, or other suitable instrument.

Insulation resistance is a variable factor depending upon the moisture content and cleanliness of the winding at the time of the test. If available, it is preferable to make some comparison with the original factory test data. Lacking this data, some average typical rule of thumb values are indicated below.

Voltage	Insulation Resistance
600 Volts & below	5 Megohms
2300 to 5000 Volts	20 Megohms

These values are more conservative than the IEEE Code values given in Section 5.11. If insulation resistance is lower than what is felt to be an acceptable value, refer to the section dealing with dry out procedure. It is good practice to dry out all units 2300 volts and above.

3. If it is proposed to apply an A.C. high potential ground test to this new machine at the job site, make certain that machine is dry then, according to IEEE and ASA Standards, apply a test voltage equal to 85 percent of the original standard factory test for machines 5000 volts and 6250 KVA and larger. For all other ratings apply a test voltage equal to 75 percent of the factory test voltage. Factory test voltages are usually twice rated voltage plus 1000 volts.

4. Check all connections with wiring diagrams.
5. Check the bearings for proper grease and oil instructions from nameplate or information plate affixed close to the bearings. Refer to lubrication data sheet for proper oil and grease.
6. Check for mechanical looseness anywhere on the machine.
7. Some machines are designed to operate in only one direction due to the type of fan and positioning of exhaust ducts. For such machines an arrow showing proper rotation is affixed to the machine.
8. When brushes are used on a machine, make sure that the brushes are free in the holders and that the pigtailed are bent away from each other.
9. Turn the rotor by hand to insure free rotation. On single bearing machines, rotate by barring over and check air gap with light and gauge to insure uniformity.
10. When connecting main leads to the machine leads make sure that these leads are correctly identified as to the phases from the starter.

Bump motor to check proper rotation. To reverse the direction of rotation, interchange any two of the three line leads for 3-phase motors.

SECTION III - LUBRICATION

3.1 LUBRICATION OF SLEEVE BEARING MACHINES

The bearings and bearing housings of machines using oil lubrication normally do not need to be treated to prevent rust and corrosion, due to condensation of moisture, if the storage period is less than 30 days. When the period of storage or standing idle exceeds 30 days, the bearing housings should be filled to the proper level with "engine-type" preservative oil that

meets military specifications MIL-L-21260; or consult your oil supplier's industrial applications engineer for his recommendation of the proper type preservative oil to use.

When the bearing housings are filled with preservative oil the machine should be run a few minutes to make sure the preservative oil coats all of the bearings. If it is not possible to use power to turn the rotor, turn it over a few turns by hand.

MODERN BEARING DESIGN

The patented oil lubricated sleeve bearings supplied on Ideal equipment represent the latest and most modern concepts of bearing design. A one-to-one ratio of journal length to diameter together with optimum values of surface velocity and unit pressure assures minimum operating temperatures and long bearing life. Precision craftsmen further contribute to the excellence of these bearings.

The husky bearing body is of cast bronze, with a thin wall lining of highest grade babbitt. A center point support in the bracket housing provides self aligning characteristics and assures full utilization of the bearing surface. Two oil rings, each fitted with a wiper, carry an adequate supply of oil to the top of the bearing. Circumferential grooves at each end of the bearing carry oil completely around the shaft journal and assure adequate distribution of oil to the bearing surfaces regardless of the direction of the radial load on the bearing.

The entire sleeve bearing is split to allow convenient bearing replacement without disturbing the alignment of the generator on its base or without removing the coupling. Oil reservoirs of liberal capacity are arranged to be effectively cooled by the inlet air streams to the motor.

HEAVY DUTY BEARING BRACKETS

The bearing brackets of Ideal equipment incorporate all the latest design techniques to insure the longest possible life with a minimum of costly repairs. The rugged three arm bracket is made of cast iron. The elimination of the fourth, or top arm, allows complete inspection and preventative maintenance of the equipment as well as to allow changing of the split bearing in a matter of minutes as compared to hours on other types of brackets.

Plate brackets are utilized on many machines. Incorporated is a machine plate bracket with separable bearing housings. These bearing housings are bolted in place and insure proper alignment as well as ease of maintenance.

The bracket is precision machined to fit the frame to insure the proper alignment of the rotor. The bearing is supported by a machined circumferential surface to produce a self aligning condition.

Ideal ball bearing brackets utilize the same rugged three arm construction that has made the Ideal sleeve bearing bracket motor a leader in the industry.

VACUUM BREAK OIL SEAL

A vacuum break oil seal is cast into all sleeve bearing brackets to prevent oil leaks. A spinning rotor, which is drawing air into a motor, creates a partial vacuum which, in turn, attempts to suck air and oil through the bearing along the shaft. By providing an opening in the front of the bearing housing, which extends through the bracket to the rear of the bearing, Ideal has eliminated or equalized this suction. Machined oil seals, which return the oil to the reservoir, act as a double safeguard against oil leaks.

The oil filler caps on Ideal sleeve bearings extend almost up to the inspection cover to enable the operator to more easily fill the bearing and inspect the operation of the oil rings. The oil level gauge is clearly marked with permanent wire indicators to show the correct oil level.

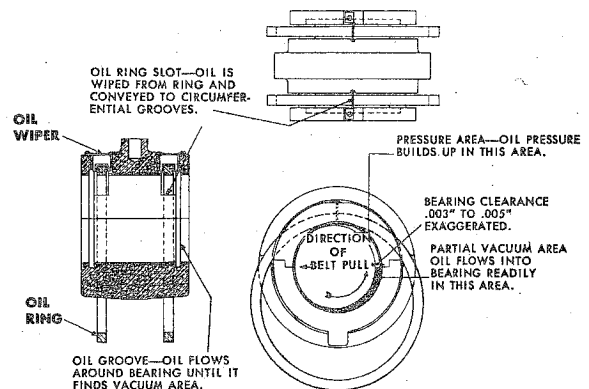
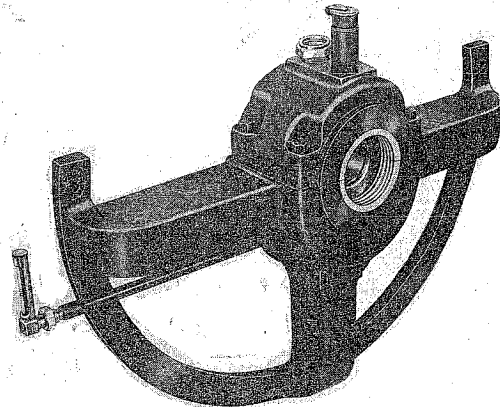
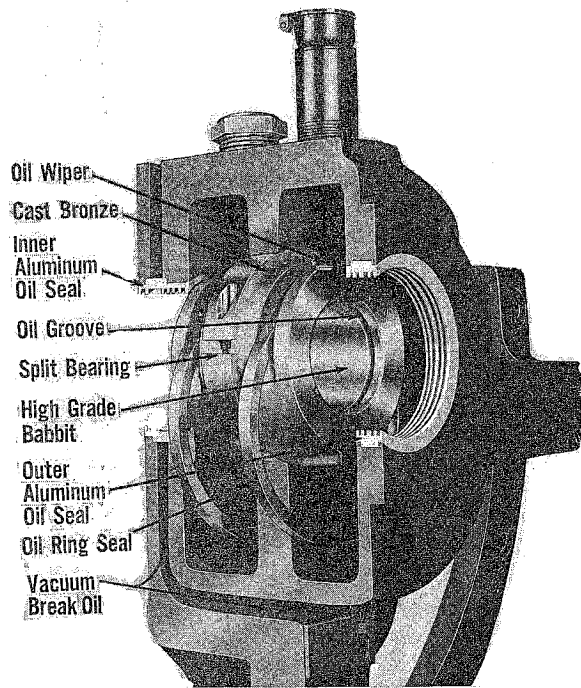


Figure 1 — Description of the Ideal Electric patented oil lubricated sleeve bearing and housing.

Bearing housings that have been filled with preservative oil, should be drained and refilled with the proper grade of bearing oil before putting the machine into service.

Cleanliness is the most important consideration in the care of bearings. Use extreme caution to prevent foreign matter from entering the bearings by way of the lubricant, or when servicing the bearings.

Consult lubrication chart (Fig. 10 on page 30) for specific recommendations as to type and viscosity of oil for various manufacturers. The recommended oil viscosity for each bearing oil sump of a machine is usually stamped on a nameplate mounted on the bearing housing. Machines are shipped from the factory dry to avoid spillage during shipment. Upon arriving at its destination the machine bearings should be immediately filled with oil to their proper level and turned a few times by hand to avoid damage to the bearings due to rust or corrosion. (For storage or extended idle periods see section pertaining to care of bearings during storage.)

Horizontal Sleeve Bearings

Sleeve bearings furnished in Ideal equipment, frame sizes 580 and over, are of the split babbit type (see figure 1.) These bearings represent the latest and most modern concepts of bearing design. A one-to-one ratio of journal length to diameter assures minimum operating temperature and long bearing life. The center point support in the housing provides self-aligning characteristics and helps to assure full utilization of the bearing surface. Two oil rings, each fitted with a wiper, carry an adequate supply of oil to the top of the bearing. Circumferential grooves at each end of the bearing carry oil completely around the shaft journal and assure adequate distribution of oil to the bearing surfaces regardless of the direction of the radial load on the bearing. The entire sleeve bearing is split to allow convenient bearing replacement without disturbing the alignment of the motor on its base or without removing the coupling.

For special duty applications, and on larger size motors, this basic bearing can be supplied for use with pressure lubrication. To assure adequate lubrication under the most adverse conditions, oil under pressure is fed into the bearing from an oil groove. The oil rings are retained as an emergency lubrication system in the event the pressure lubrication system fails.

3.2 OIL LEVELS

For all horizontal machines equipped with oil sight gages, the gages have two marks. Fill to high mark **with machine idle**. When oil level drops to low mark **with machine idle**, oil should be added.

Air Pressure Adjustment for Sleeve Bearing Machines

On high-speed sleeve bearing machines, the bearing housings are located in the air intake path. This means that a vacuum exists around the bearing housings. This vacuum will possibly draw the oil out of the bearings and into the machine. To prevent this, an air seal on the in-board end of the bearing housing is supplied with air from the pressure side of the fan to maintain atmospheric pressure, or slightly above, in the air seal and bearing housing. This prevents leakage.

The proper pressure adjustment has been made before machine was shipped from the factory. This adjustment will result in the running oil level being one eighth inch ($\frac{1}{8}$ ") above the stationary level. **The stationary level should be between the high and low marks on the oil sight gage.**

Should it become necessary to adjust the pressure balance, proceed as follows:

1. The bearings should be filled to the upper line on the oil sight gage while the machine is stopped.
2. Start the machine, and allow it to reach full speed.
3. Loosen the screws holding the air adjusting plate - located on the bearing bracket below the bearing housing - and move the plate up or down as needed, so that the oil is one eighth inch ($\frac{1}{8}$ ") above the oil level before the machine was started.
4. Tighten the screws holding the air adjusting plate securely. This will give a pressure in the bearing housing slightly greater than atmospheric pressure.

3.3 CHANGING OIL

When the oil becomes dirty or contaminated, drain it off by removing the drain plug, which is usually located at the bottom or side of the bearing housing. Flush bearing with warm, light grade, clean oil until the outcoming oil shows clean. Refill to the proper level with oil of the recommended type and viscosity. **CAUTION:** Make sure that dirt or foreign particles are not permitted to enter the oil sump chamber.

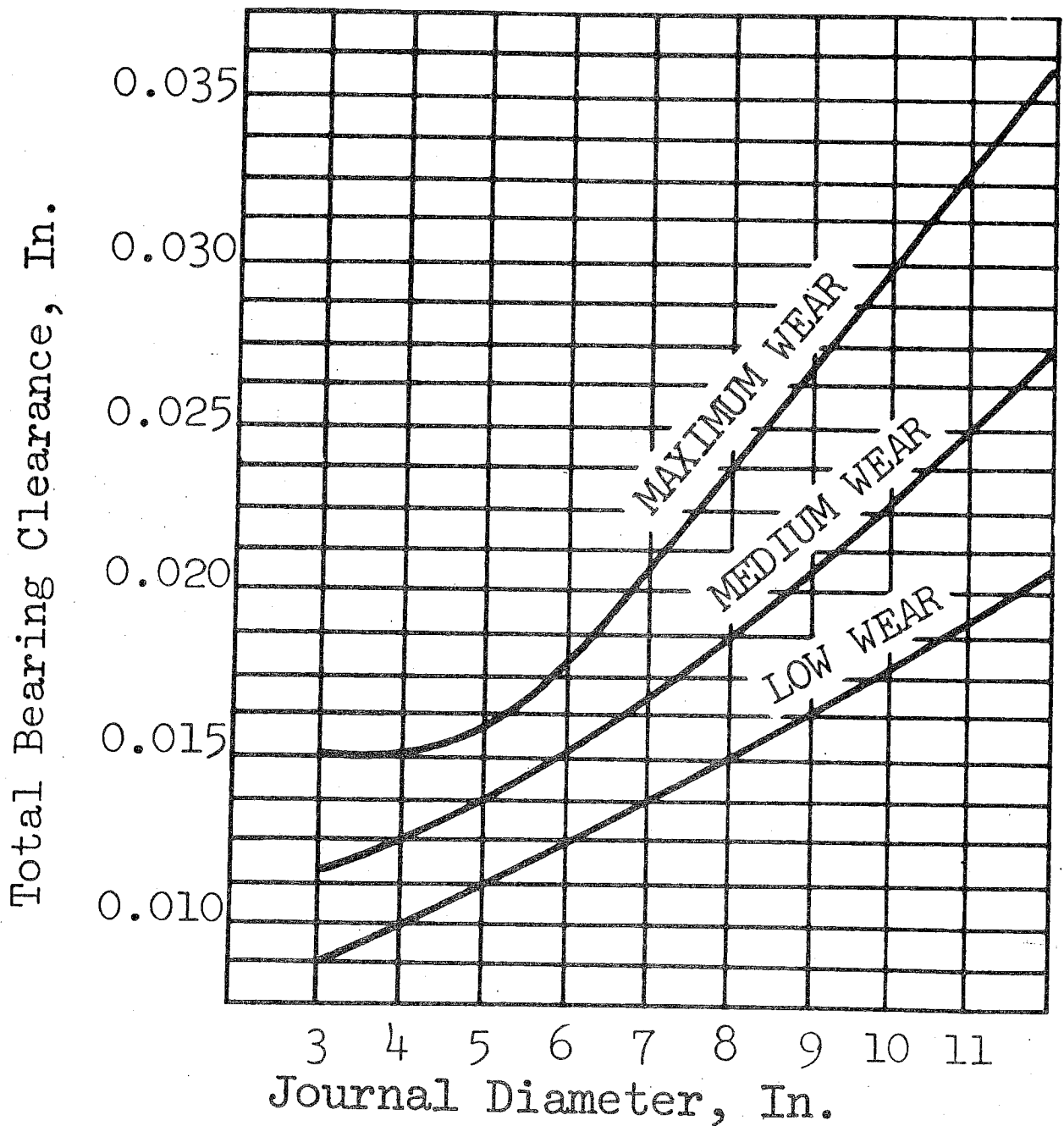


Figure 2 — Bearing replacement chart.

A lubrication nameplate is attached near each bearing specifying the proper viscosity oil (S.S.U. @ 100° F.) for operation in a 77° F. or 25° C. ambient. See Figure 10 (Chart of Oil Supplier), page 30-31.

Also recommended is the use of turbine type oil with a minimum viscosity index of 90. The oil should contain rust and oxidation inhibitors. This is generally recommended when the machine is used in conjunction with a compressor, gear box or engine. Where conditions are unusually severe or abnormal, consult lubricant manufacturer for proper oil.

NOTE: Be sure that the oil rings are in place and rotating while the unit is in operation. Bearings using pressure lubrication require the same grade and viscosity of oil. Recommended oil pressure 15 to 25 psi. When starting and, or at regular intervals observe the oil flow from each bearing.

3.4 REPLACEMENT OF SLEEVE BEARINGS

When replacing sleeve bearings remove the cap and take the bearing apart. Jack up, or otherwise lift, the shaft a few thousandths of an inch to take the weight off from the lower half of the bearing. The lower half of bearing can then be rolled out. **NOTE:** Before jacking up the shaft loosen the bearing housing cap bolts on the opposite bearing. This is to prevent this bearing from being wedged in its housing, and resulting in damage when the unit is started again. When the new bearing is installed, before installing the cap, be sure to check to see that there is clearance on each side of the bearing between the bearing shell and the bearing housing seat. The bearing should never be so tight in its seat that it cannot be easily rotated slightly when the weight of the shaft or journal is removed.

Under normal conditions bearings should be replaced when they have become worn until their clearance is in excess of the values shown on the graph. (See Figure 2.)

The nominal clearance between the shaft and the bearing housing is .015" with new bearings. As the bearings become worn it is a good idea to check, using feeler gages, the clearance between the shaft and the bearing housing.

Always make sure bearings are adjusted so that they are in the center of the journal while operating.

When replacing a bearing that has failed, and the shaft shows signs of rubbing the brackets, use special care in fitting the bearing in its housing; and check the shaft for runout to make sure that the shaft hasn't been distorted due to concentrated local heating. After replacing bearings and the machine is run for a short period of time it is recommended that the bearing or bearings be disassembled and inspected for wear pattern. The wear pattern should be distributed quite evenly over at least 60% of the projected area of the bearing. If necessary the bearing should be fitted by scraping to obtain a good wear pattern.

The shaft should be scribed at the outer end of the bearing housing as shown at "A" in Figure 3 to indicate the running endwise position of the rotor. If it has not been marked and is a two bearing machine, then with the machine running, mark the shaft in line with the outer end of the bearing housing.

With the bearing cap or top half of the bearing housing removed and the rotor located endwise so that the mark on shaft is in line with the bearing housing, position the bearing in center between the shaft thrust shoulders "B". Measure the distance from the center of hole in top of bearing to the finished outer end of housing as at "C".

Place the Bearing Locating Yoke in the slot provided on inside of the bearing cap and position it so that the distance from the center of pin to the finished out end agrees with the dimension "C" measured above. Lock the Yoke securely in this position with set screws provided.

Clean the mating surfaces of the bearing housing thoroughly and coat with Permatex or similar sealer. The top half of bearing housing should then be replaced. The pin of the Locating Yoke should fit into the hole in the top of bearing, positioning and locking the bearing against rotation and endwise movement.

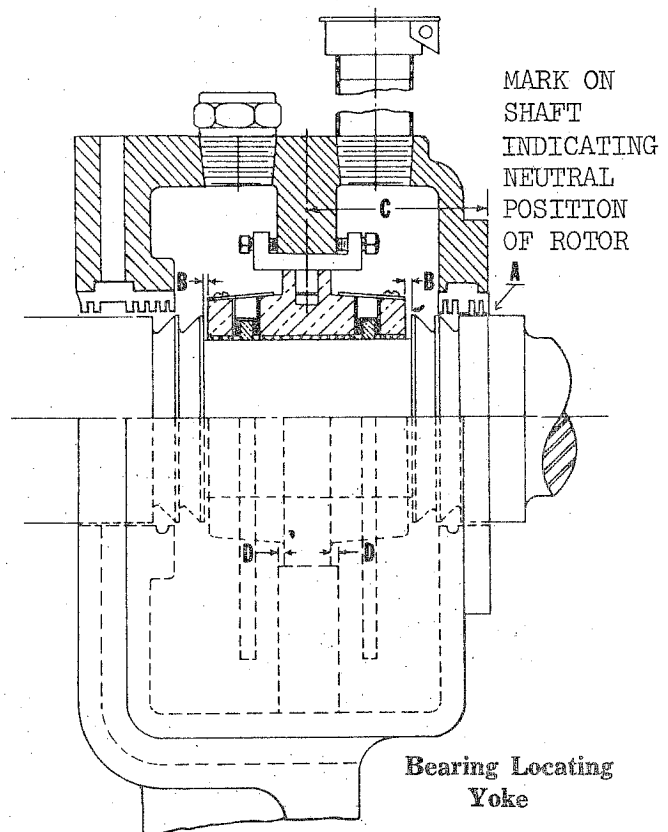


Figure 3 — Bearing detail showing bearing locating yoke.

3.5 GREASE LUBRICATED BEARINGS (Ball or Roller Type)

Grease lubricated bearings are subject to damage due to corrosion and rust as easily as oil lubricated bearings, and need protection during storage or extended idle periods. Due to the labor involved in greasing and regreasing, the more practical method of protecting the bearings and bearing housings is proper storage. If proper storage is not available, satisfactory storage can be obtained by enclosing the machine with a canvas cover. A vent should be provided at top to permit moisture to escape.

Heaters should be installed inside the cover, for small machines light bulbs may suffice. As this method will also protect the windings from moisture it is essential that the warm, dry air be circulated. Fans set to blow over the heaters will give good results. **NOTE:** The temperature of the windings should not exceed 85° C. for class "A" insulated machines. The life of grease in bearings that are in storage is definitely limited and must be considered in the periods between regreasing. Machines, having grease lubricated anti-friction bearings that have been in storage or standing idle for more than 90 days where there are appreciable temperature variations, or one year in dry storage, should have the bearings and grease inspected. If the grease shows signs of moisture or deterioration the bearings should be regreased.

The primary purpose of a lubricant is to prevent metallic contact between the individual component parts of the anti-friction bearing, thus keeping friction and wear down to a minimum. Another purpose of the lubricant is to protect the bearing against corrosion. It can also be used for sealing and for dissipating and reducing heat.

3.5.1 ANTI-FRICTION BEARING GREASES

Only high quality, acid-free greases - generally of a calcium or sodium base are used. Synthetic greases for example, silicone greases, are recommended in extreme temperature areas, where the manufacturer's recommendations should be followed very carefully. Anti-friction bearing grease must be resistant to aging and oxidation, and should not bleed off any oil i.e. it must retain its structure under continuous service conditions. Greases containing animal or vegetable fats are unsuitable.

3.5.2 OILS

Turbine type mineral oils are mainly used for lubricating anti-friction bearings. Any lubricating oil for anti-friction bearings must meet the following requirements:

- It should be of extreme purity
- Be free from acids
- Be proof against aging
- It must not have any resinous tendencies

3.6 CHOICE OF LUBRICANTS

Generally speaking grease lubrication is preferred because of its sealing properties and ease of maintenance. Oil lubrication, on the other hand, has the advantage that it can be easily introduced into the bearings. The choice of a lubricant (grease or oil) is determined by a combination of speed and/or load requirements. This has been determined by the machine manufacturer in conjunction with the recommendations of the bearing manufacturer. The result of this joint effort gives better operational results and longer life.

3.6.1 BEARING SIZE

In the case of small bearings - particularly high speed bearings - a lesser viscous oil or soft pliable grease is used in order to keep the overall friction in the bearings as low as possible. With large bearings, on the other hand, the proportion of lubricant friction is of minor importance and one is, generally speaking, not so restricted by the choice of lubricants as with small bearings.

3.6.2 SPEED

The friction, and consequently the temperature within the bearing, rises with increasing speed. The lubricant should be of the minimum viscosity to maintain a good oil film at operating speeds. The latter, however, drops and with it its lubricating properties, as the temperature rises. The lubricant must therefore preferably be of low viscosity at a certain speed. On the other hand it must be viscous enough to satisfactorily lubricate the bearing at the working temperatures which are met in service.

3.6.3 LOAD

The lubricant must form a film of sufficient carrying capacity for the load incurred, and the prevailing speeds and temperature. As the carrying capacity of the film of lubricant rises with the viscosity of the lubricant, it follows that more viscous lubricants will be used for higher loads. Sufficient adhesive qualities are also important. Lubricants with high pressure additives must be used for extreme loads.

3.6.4 WORKING TEMPERATURE

The temperature at the bearing location is the result of the frictional heat of the bearing, the heat emission at that point, or external heating. The working temperature is important and influences the choice of lubricant to a very considerable degree, because the viscosity of the

lubricant falls with the rise of temperature. The lubricating properties can therefore only be maintained within a certain temperature range.

3.7 LUBRICATING PROCEDURES

Only well known and branded grease should be used for lubricating anti-friction bearings. Greases with different soap bases **must not be mixed**, as this would reduce the permissible working temperatures of both greases and also affect their sealing characteristics. Further, different base greases may also set up an undesirable chemical reaction. With grease lubrication the hollow spaces in the housings and in the bearing itself should only be half filled. The bearing should be re-packed with grease at certain intervals. Over-lubrication with grease is detrimental to the running of the bearing since the churning action causes heating and the grease to lose its lubricating properties and results in the bearing running hot.

A greasing tag is affixed to the machine next to the bearing and in plain sight. This plate gives the greasing interval and the amount of grease to be used.

The greasing interval and the amount of grease to be added are based on average conditions.

Where severe operating conditions are encountered grease may need to be added more often than stated on lubrication nameplate.

When adding grease to the bearings remove drain plug to prevent pressure build-up in bearing housing. If the bearing heats above the normal bearing temperature, run machine with drain plug removed until excess grease is expelled. Where a special instruction plate is not included, regreasing usually is not necessary before one year of moderate operation. Observation and inspection during the first few months of service will best determine the frequency of regreasing. Add a small quantity after each three to twelve months of service depending on the type of operation. After each one to two years of service, remove all old grease, clean bearing thoroughly and repack housing one-third to one-half full of new grease. Consult a reputable lubricant manufacturer for proper grease for abnormal service conditions such as high or low temperatures, excess moisture, etc.

SECTION IV - INSPECTION

4.1 ROUTINE

Inspection and service should be systematic. Frequency of inspection and degree of thoroughness may vary and will have to be determined by the maintenance engineer. They will be governed by (1) the importance of the machines in the production scheme (if the machine fails, will production be slowed seriously?) (2) percentage of day the machine operates, (3) nature of service, (4) environment.

An inspection schedule must therefore, be elastic and adapted to the needs of each plant.

4.2 WEEKLY

1. Check oil level in bearings
2. See that the shaft is free of oil or grease from bearings.
3. Examine starter, switch, fuses, and other controls.
4. Start machine and see that it accelerates up to speed in normal time.

4.3 EVERY SIX MONTHS

1. Clean machine thoroughly, blowing out dirt from windings, and wipe slip rings on wound rotor machines. If windings are lashed (tied) to a ring, or have blocks (wedges) between the windings on the end turns, these points should be checked to make sure all tie down points are secure.
2. Check brushes and renew any that are more than half worn.
3. Examine brush holders and clean them if dirty. Make sure that the brushes ride free in the holders.
4. Check brush pressure.
5. Drain, wash out, and renew oil in bearings if oil shows evidence of contamination.
6. Check grease in ball or roller bearings. (Where grease lubricated)
7. Check operating speed or speeds.
8. Inspect and tighten connections on machine and control.

9. Check current input and compare with normal.

10. Run machine and examine drive critically for noise, vibration, or any other abnormal conditions.

4.4 ONCE A YEAR

1. Examine grease in ball or roller bearings bearing housings and renew if necessary.

2. Test insulation by megger.

3. Check air gap.

4. Clean out any dirt accumulation that may be in air gap.

4.5 RECORDS

The maintenance man should have a record card for every machine in the plant. All repair work with its cost, and every inspection can be entered on the record. In this way, excessive amounts of attention or expense will show up and the causes can be determined and corrected. Each time the machine is meggered the results should be placed on the machine record.

SECTION V - CARE OF INSULATION

5.1 GENERAL

Care of insulation goes hand in hand with lubrication as one of the major features of a sound motor or generator maintenance program. These features concern two of the most vital and probably the two most vulnerable parts of a machine.

Machines should always be stored in a dry, clean place until ready for installation. Heat should be supplied to protect the machine against alternate thawing and freezing or other temperature changes that cause moisture condensation on the machine parts or insulation.

Machines that have been long in transit, in a moist atmosphere, or idle for an extended period of time, should be thoroughly dried out before being placed in service. Since machines sometimes sweat as a result of a difference in their temperature and that of the surrounding air, they should be kept warm at all times to prevent this condition.

Current at a low voltage can be passed through the windings or electric heaters can be utilized for protective purposes. In the case of extended idle periods, tarpaulins with a vent at top to permit moisture to escape, may be stretched over the machine and small heaters put inside to maintain the proper temperatures. It is essential that there be a circulation of warm, dry air over any windings that may have absorbed moisture. Fans, set to blow over the heaters, will give good results.

INSULATION RESISTANCE

Insulation resistance of a winding is defined as the resistance (in megohms) offered by the winding insulation to an impressed direct voltage. The insulation resistance of a rotating machine winding, as commonly measured

with present day commercial instruments, is as much a function of winding temperature, moisture and dirt present, as it is of the type and assembly of insulating material.

The insulation resistance of a winding, while not a definite measure of the insulation dielectric strength, when properly interpreted may afford a useful indication as to the suitability of the winding for operation or for the application of an appropriate over-potential (high potential) test. Consideration should be given as to whether a low insulation resistance results from foreign matter distributed throughout the winding or from a concentrated weak spot in the insulation.

A high value of insulation resistance is usually indicative of clean, dry insulation, but it is not, by itself, proof that the insulation is free from mechanical or physical weakness. Such weakness may be of a type which does not affect insulation resistance at low voltage, but may be the cause of breakdown upon the application of normal working voltage. Periodic cleaning and visual inspection are necessary regardless of the insulation resistance value. Relatively low insulation resistance or sudden changes in insulation resistance should be considered as cause for careful investigation. Under normal conditions the measurement of insulation resistance may be considered a non-destructive test. It must be remembered, however, that the applied voltage used constitutes a voltage test; and that the voltage value employed and the voltage characteristic of the testing apparatus should be selected accordingly, particularly for low voltage or wet machines.

5.3 FACTORS AFFECTING INSULATION RESISTANCE

Insulation resistance may vary with changes in operating conditions such as temperature, moisture, or the cleanliness and age of the winding. It will also vary with the length of time of application of the test voltage and somewhat with the magnitude of this voltage. Many of the apparent inconsistencies in the measured value of insulation resistance can be explained if consideration is given to these factors. Where successive or periodic readings are to be correlated it is necessary to obtain test data taken at a definite temperature, voltage and duration of the applied voltage.

5.4 MINIMUM VALUES OF INSULATION RESISTANCE

It is impossible to set a rigidly fixed value for the minimum permissible insulation resistance on a machine and state positively that, if it has an insulation resistance above the minimum value, it will operate satisfactorily. Machines can and have operated satisfactorily over extended periods of time with low insulation resistance. Conversely, a high value of insulation resistance is alone not sufficient to insure satisfactory operation. Therefore, it is necessary to know as much about the history of the insulation, its condition, and resistance as possible to determine if it is in a condition to operate satisfactorily. Therefore, it is essential to keep complete records of insulation resistance values to assist in determining the condition of the insulation.

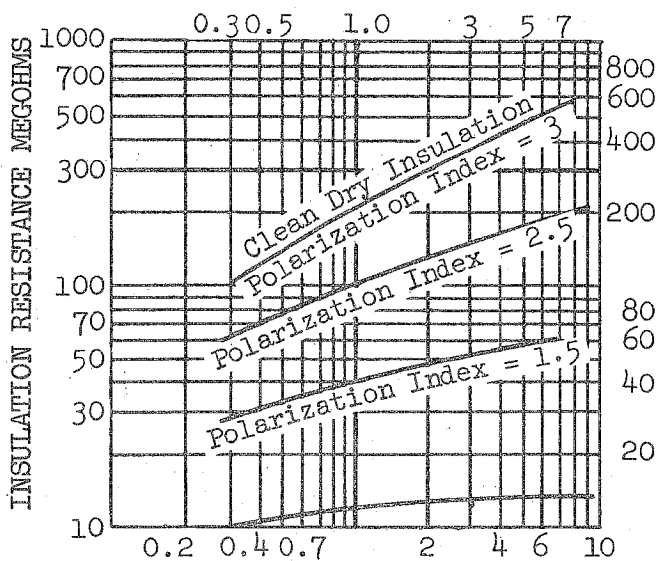


Figure 4 — Typical curves showing variation of insulation resistance with time for Class B insulation A.C. armature windings.

5.5 EFFECT OF DURATION OF TEST VOLTAGE

The magnitude of the insulation resistance of a winding will increase with the duration of application of the direct current test potential. The rise in readings will be quite rapid when the voltage is first applied and decrease as time elapses. The rate and magnitude of this rise is usually a fair indication of the condition of the insulation. When the insulation is dry and in good condition the increase in resistance will be quite large and will continue for several hours. If the insulation is wet or dirty the rise will be smaller and become steady in usually one or two minutes after the voltage is applied.

5.6 POLARIZATION INDEX

The amount of insulation resistance increase during application of a test voltage is a useful method of appraising the cleanliness and dryness of a winding or when drying can be terminated. This is known as the Polarization Index. Resistance readings should be taken after one minute and ten minutes of applying 500 volts test voltage continuously. The ratio obtained by dividing the ten minute reading by the one minute reading is known as the Polarization Index and should be 2.5 or higher for Class "B" insulation. For Class "A" insulation the Polarization Index should be 1.5 or higher. This Polarization Index is particularly useful in determining the condition of winding insulation on which no previous insulation resistance data is available.

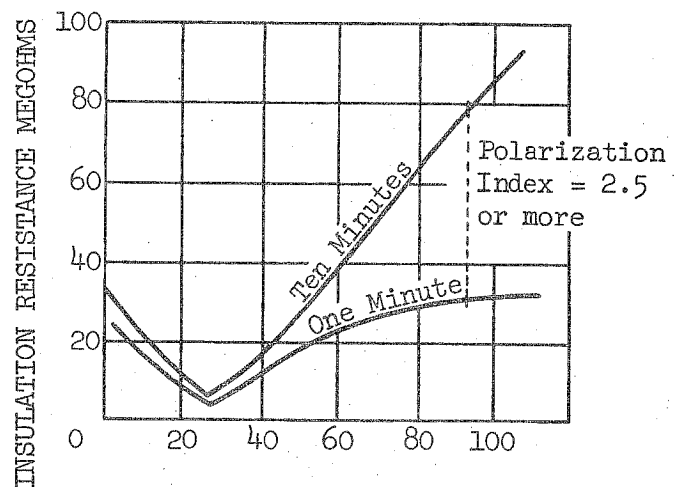


Figure 5 — Change in one-minute and ten-minute insulation resistance during the drying process of a Class B insulation A.C. armature winding.

5.7 DRYING OUT WINDINGS

In general, heat and circulation of dry air are necessary to remove moisture from insulation. Various methods for applying such heat are discussed in the following paragraphs, but regardless of the drying method employed, a number of precautions must be observed:

(1) A close check must be kept on the temperature of the insulation. If the machine has permanently installed temperature detectors they may be used as an indication of temperature, or thermometers may be placed on some of the hottest parts of the equipment where they may be readily observed. It is particularly important never to allow the internal temperature of the coils to exceed the boiling point of water, since temperatures above this point may convert the moisture to steam, creating internal pressures which may injure the insulation. It is necessary, therefore, to raise the temperature slowly and control it continuously.

(2) The drying operation cannot be hurried. It may take many hours or even days to secure satisfactory results. In all cases, positive air circulation must be provided with ample ventilation for the escape of moisture.

5.8 METHODS OF APPLYING HEAT

5.8.1 OVEN DRYING

Small equipment which can readily be moved may be dried in baking ovens. When no oven is available, a temporary oven may be constructed around the equipment using sheet iron, insulating board or a tarpaulin cover, making sure that provisions have been made for the escape of moisture. Heat may be introduced by means of electric heaters, infrared rays, hot-air furnaces, steam coils, radiators, and stoves. Use of an open flame is not recommended.

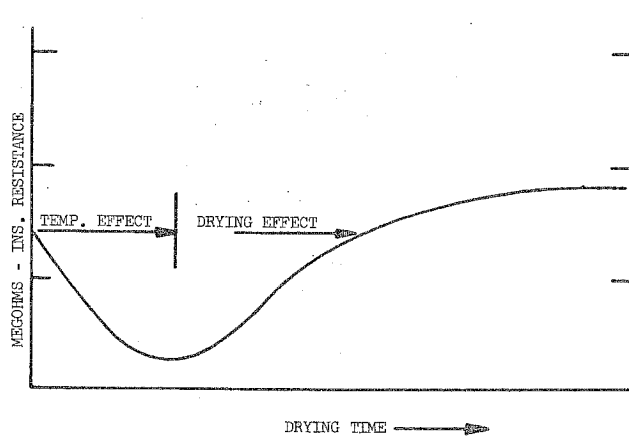


Figure 6 — Effect of drying on insulation resistance of a winding.

The temperature of air in the oven must not reach temperatures which will damage the insulation. It is recommended that the air temperature not exceed 185° F (85°C) when drying Class "A" insulation, and 220° F (105°C) when drying Class "B" insulation. These precautions must be observed if permanent damage to the insulation is to be avoided.

5.8.2 DRYING WITH CIRCULATING CURRENTS

One of the most effective means of drying out a piece of electrical equipment is by passing current through the windings. Suitable sources of low voltage power are exciter sets or arc welding sets. Voltage must be adjusted to limit the current in the windings to a safe value, usually something less than rated amperes. Either A.C. or D.C. current may be used in the stator windings of A.C. generators or motors, except that A.C. should be used only when the rotor is removed to prevent excessive heating of the rotor. D.C. current should be used for field windings of both A.C. and D.C. machines, and for D.C. armatures. Limit the observable temperature on the surface of the coils to 185° F (85°C).

Care must be taken in introducing current to a winding through slip rings, not to burn the rings through localized heating. In cases where current is being passed through an armature by means of brushes resting on the commutator, the armature should be rotated continuously to prevent localized heating.

5.9 OBSERVING THE PROGRESS OF DRYOUT

Careful observation of the properties of the insulation during drying is the only means of determining when safe operating conditions have been reached. The instrument generally used for this test is an insulation resistance meter or "Megger." A record should be kept of insulation resistance readings taken at regular intervals during dryout. It must be remembered that two effects are present — drying, which increases insulation resistance, and increased temperature, which lowers insulation resistance. In general an effect such as is shown on the accompanying graph will be observed. Drying should continue until insulation resistance values show no abrupt changes, and do not increase more than 5% over an 8-10 hour period. Erratic readings or failure of the insulation resistance to increase normally may indicate an insulation fault or damage requiring repair before energizing the machine.

5.10 TAKING INSULATION RESISTANCE MEASUREMENTS

AIEE No. 43, 4.42 states, "Insulation resistance readings taken for purposes of correlation should be made at the end of a definite in-

terval following the application of a definite test voltage. For purposes of Standardization, 60 seconds application of 500 volts Direct Current is recommended where short time single readings are to be made on windings and where

ASSUMED MEASURED INSULATION RESISTANCE = 1.0 MEGOHMS

ASSUMED MEASURED TEMPERATURE OF WINDINGS = 70°C

Set Straight Edge to 1.0 Megohm on Scale A and to 70°C. on Scale C. Read the Insulation Resistance corrected to 25°C. (nominal room temperature) directly from Scale B. In this example: 7.0 Megohms

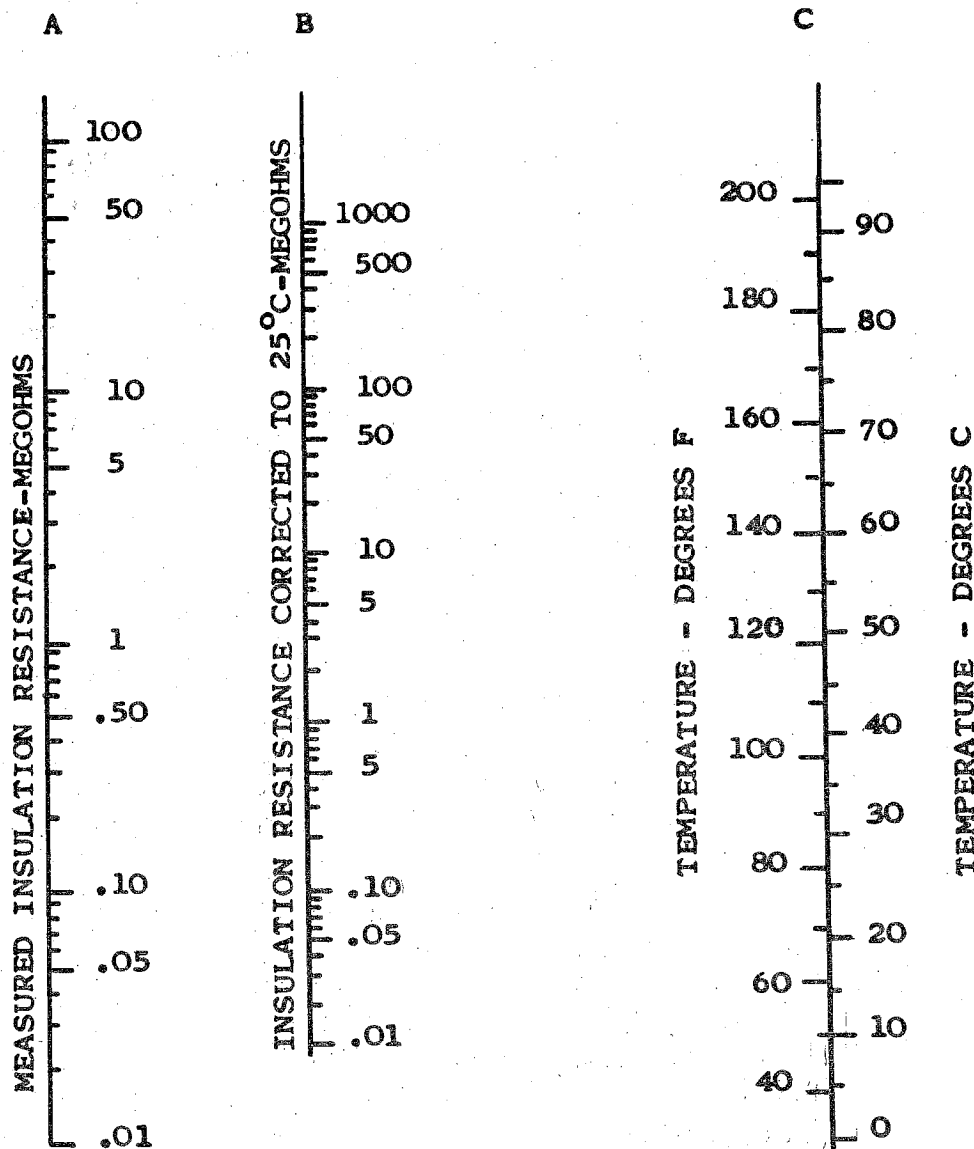


Figure 7 — Example showing use of nomograph.

comparisons with earlier and later data are to be made."

The magnitude of the insulation resistance of a winding will increase with the duration of the application of the test potential. Insulation of a dry winding in good condition may continue to increase for hours with test voltage continuously applied; however, fairly steady value is usually reached in 10 to 15 minutes. If the winding is wet or dirty the steady value will be reached in a much shorter time.

5.11 SAFE VALUES OF INSULATION RESISTANCE

After the insulation resistance has reached a consistent level, it is necessary to determine if this is a safe operating value. While the IEEE Test Code gives a formula, safe value in Megohms = $\frac{\text{Rated Voltage}}{\frac{\text{KVA Rating} + 1000}{100}}$ the values

seem rather low. It is our belief that the Rule of thumb values given on Page 5 are a better guide for stator windings.

The insulation resistance of 125 or 250 volt field windings of synchronous machines should

normally be one megohm or higher, although it is known that machines have operated without damage with a resistance value as low as one half megohm.

Since insulation resistance varies so widely with temperature and humidity from day to day, and even from machine to machine, a considerable amount of experience and judgment is required to know when a machine is safe to energize. The accompanying nomograph for correcting resistance readings to 25°C is useful for comparison purposes and may be an aid in checking progress of drying procedure.

Once a safe value of insulation resistance is reached and the machine placed in service, the insulation resistance should continue to increase as it is further dried by the heat developed in normal operation. It is possible for the insulation resistance of a machine which has been in service for some time to exceed the value it had as a new machine, since the heat of operation may evaporate certain solvents used in the bonding varnish and thus raise the dielectric quality as the varnish dries.

SECTION VI - MAINTENANCE

6.1 ROUTINE MAINTENANCE

Periodic inspection should be made giving special attention to cleanliness, bolts, brushes, collector rings, bearings and abnormal heating. Keep the machine free of metal dust, dirt, oil and water. Inspect and tighten bolts and nuts. The collector rings should be kept cleaned and polished by wiping with a piece of canvas or non-linting cloth.

6.2 CLEANING

A systematic and periodic cleaning of machines is desirable. While some machines are installed where dust, dirt and moisture are not present, most are located where some sort of dirt accumulates in the windings. Steel mill dusts are usually highly conductive, if not abrasive, and lessen creepage distances. Other dusts are sometimes highly abrasive and actually cut insulation during their first passage through the ventilating ducts. Fine cast iron dust quickly penetrates most insulating materials. Hence, the desirability of cleaning the machines periodically. If conditions are severe, open machines might require a certain amount of cleaning each day. For less severe conditions, weekly inspection and partial cleaning are desirable.

For weekly cleaning, the machine should be blown out with dry compressed air (about 25 to 30 lbs. per sq. in. pressure). Where conducting and abrasive ducts are present, even lower pressure may be necessary, and **suction is to be preferred**, as damage can easily be caused by blowing the dust and metal chips into the insulation. In cleaning a machine, the heavy dirt and grease should first be removed with a heavy stiff brush, wooden or fiber scrapers, and cloths. Rifle cleaning brushes can be used in the air ducts. Dry dust and dirt may be blown off, using dry compressed air at moderate pressure. Care must be taken to direct the air so that dust will not be pocketed in the various corners.

6.3 REMOVING GREASE

Grease, oil, and sticky dirt are easily removed by applying liquids like Penetone 602 used in accordance with manufacturer's recommendation. Inflammable fluids are not recommended. There are several good methods of applying the cleaning medium. Probably the best method is to spray it on. Care must be taken not to soak the insulation by dipping coils or small machines into the liquid.

While insulation will dry quickly at ordinary room temperature after cleaning, it is highly desirable to heat it to drive off all moisture before applying varnish. If the machine can be spared from service long enough, the insulation should be dried out by heating from 80 to 90 degrees C. While machine is warm, a high grade insulating varnish should be applied. For severe acid, alkali, or moisture conditions where oil or dusts are present, special varnishes can be applied. The varnish may be sprayed or brushed on. After applying the varnish, the best results, are obtained by baking for a length of time recommended by the varnish manufacturer, which often is 3 to 7 hours at about 150 degrees C. If the machine must be put back into service quickly, or if facilities are not available for baking, fairly good results will be obtained by applying one of the quick drying black or clear varnishes which dry in a few hours at ordinary room temperature.

6.4 BRUSHES AND BRUSH HOLDERS — NON-ADJUSTABLE (WOUND ROTOR)

Collector ring brush holders of the radial type are suitable for either direction of rotation. Use Penetrox "A" between terminal and holders. Negator type, non-adjustable, constant ten-

sion springs, are used with these brush holders to provide correct tension to the brushes. This type brush holder is mounted on insulated support studs. Brushes should have full contact with the rings and be free from sticking in the holders. Brush pig tail connections must always be securely tightened where fastened to brush holder or terminals. A spare set of the proper grade brushes should be on hand at all times.

6.5 COLLECTOR RINGS — WOUND ROTOR

The collector ring assembly for wound rotor machines consists of 3 or 6 rings, spider sleeve, insulating sleeve, and insulating tubes. The spider sleeve is mounted on the shaft, and anchored with 3 set screws.

Normally the rings require very little attention. Look for ring pitting, which may be caused by excessive overloads or badly worn brushes, and correct at once. A small amount of pitting may be corrected by using a coarse grade of sandpaper to eliminate the roughness, after which the rings should be finished with a fine grade of sandpaper. If the rings are badly pitted or scored, it may be necessary to true up the rings in a lathe and then finish with fine grade sandpaper.

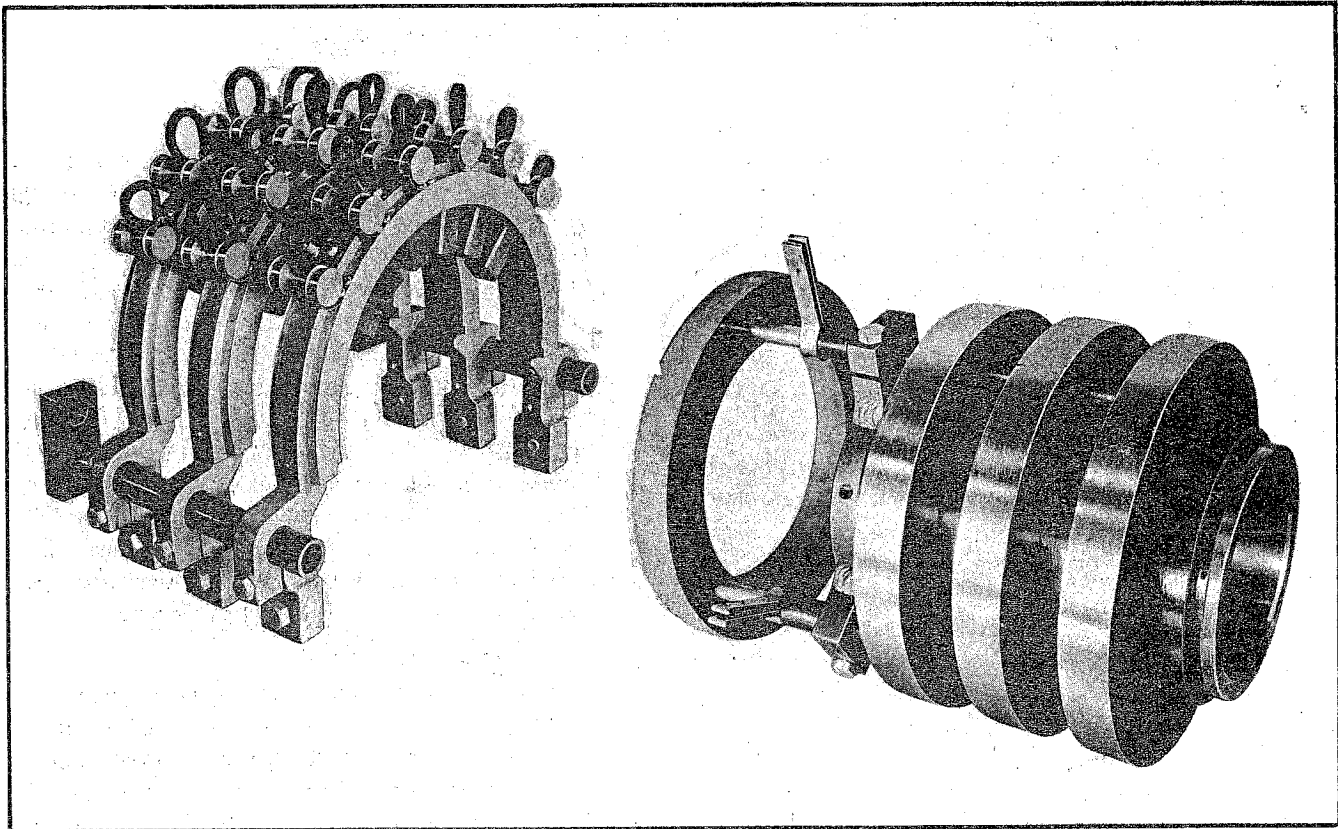
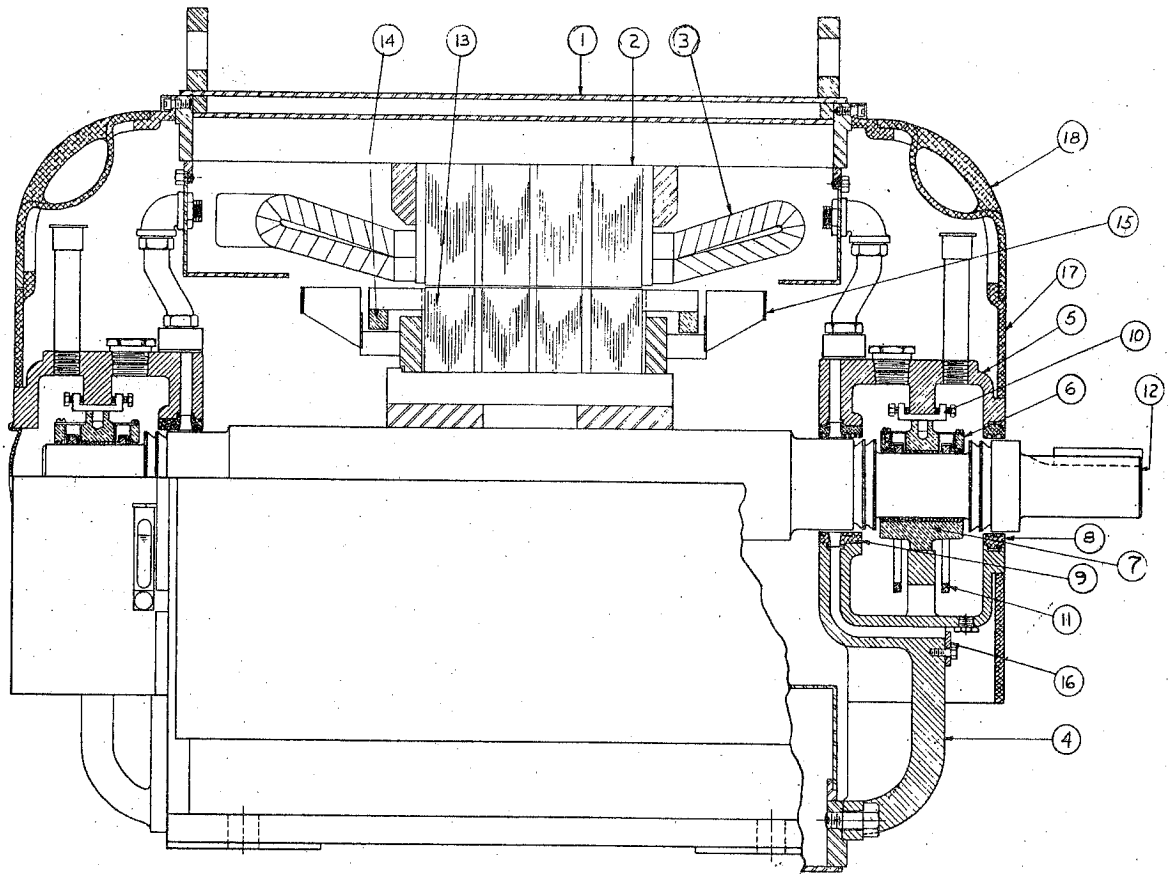


Figure 8 — Constant tension brush rigging and slip ring assembly.

SECTION VII - TYPICAL DRAWINGS AND CONNECTION DIAGRAMS

ASSEMBLY DRAWING OF SLEEVE BEARING

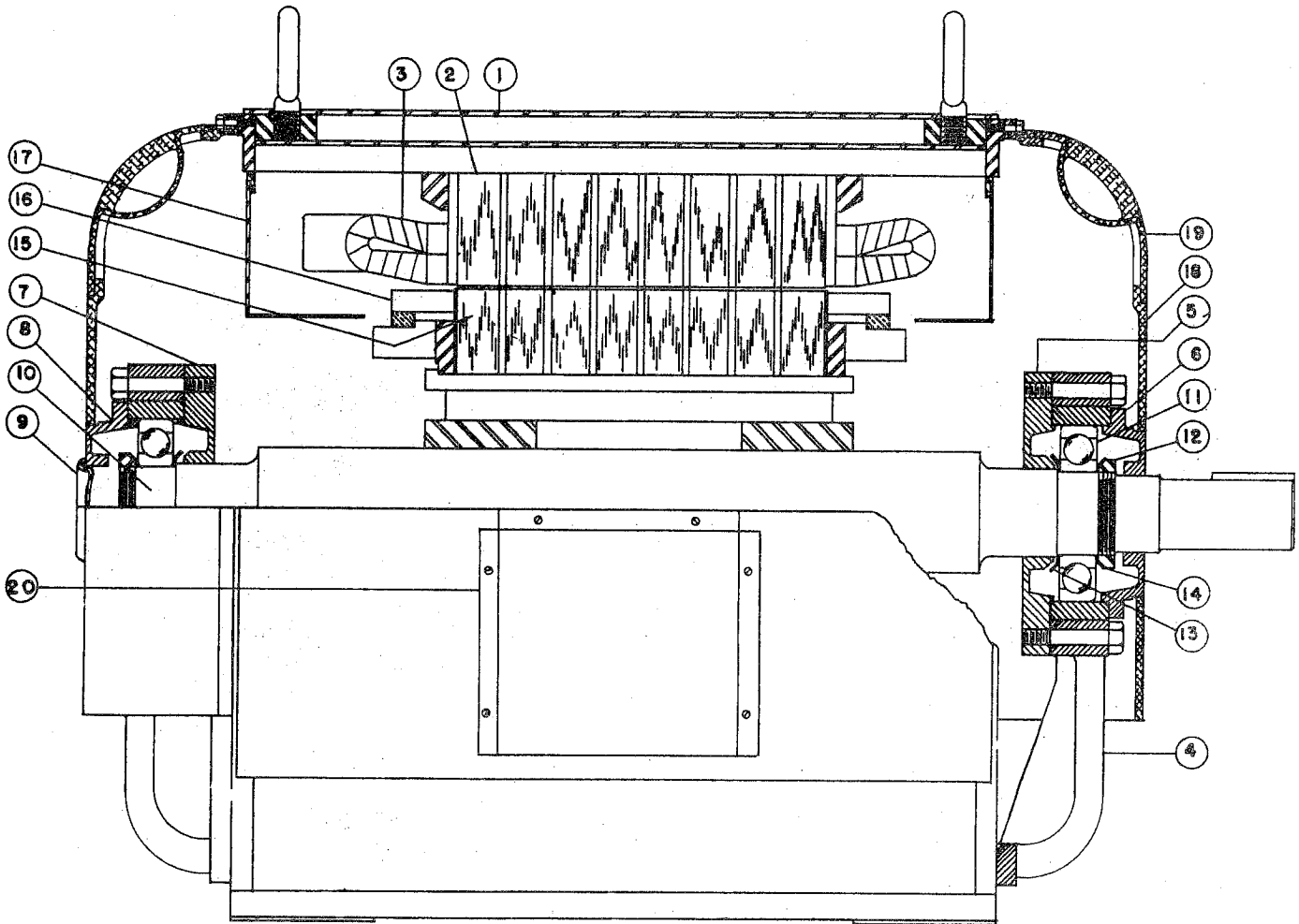
SQUIRREL CAGE INDUCTION MOTORS



- | | | | |
|---|---------------------------|----|------------------------|
| 1 | Frame | 10 | Bearing Adjusting Yoke |
| 2 | Stator Core | 11 | Oil Ring |
| 3 | Stator Coils | 12 | Shaft |
| 4 | Bearing Bracket | 13 | Rotor Core |
| 5 | Bearing Cap | 14 | Rotor Winding |
| 6 | Bearing Sleeve Upper Half | 15 | Rotor Fan |
| 7 | Bearing Sleeve Lower Half | 16 | Housing Air Vent Plate |
| 8 | Labyrinth Oil Seal Outer | 17 | Shroud |
| 9 | Labyrinth Oil Seal Inner | 18 | Shroud Oil Hole Cover |

ASSEMBLY DRAWING OF BALL BEARING

SQUIRREL CAGE INDUCTION MOTORS

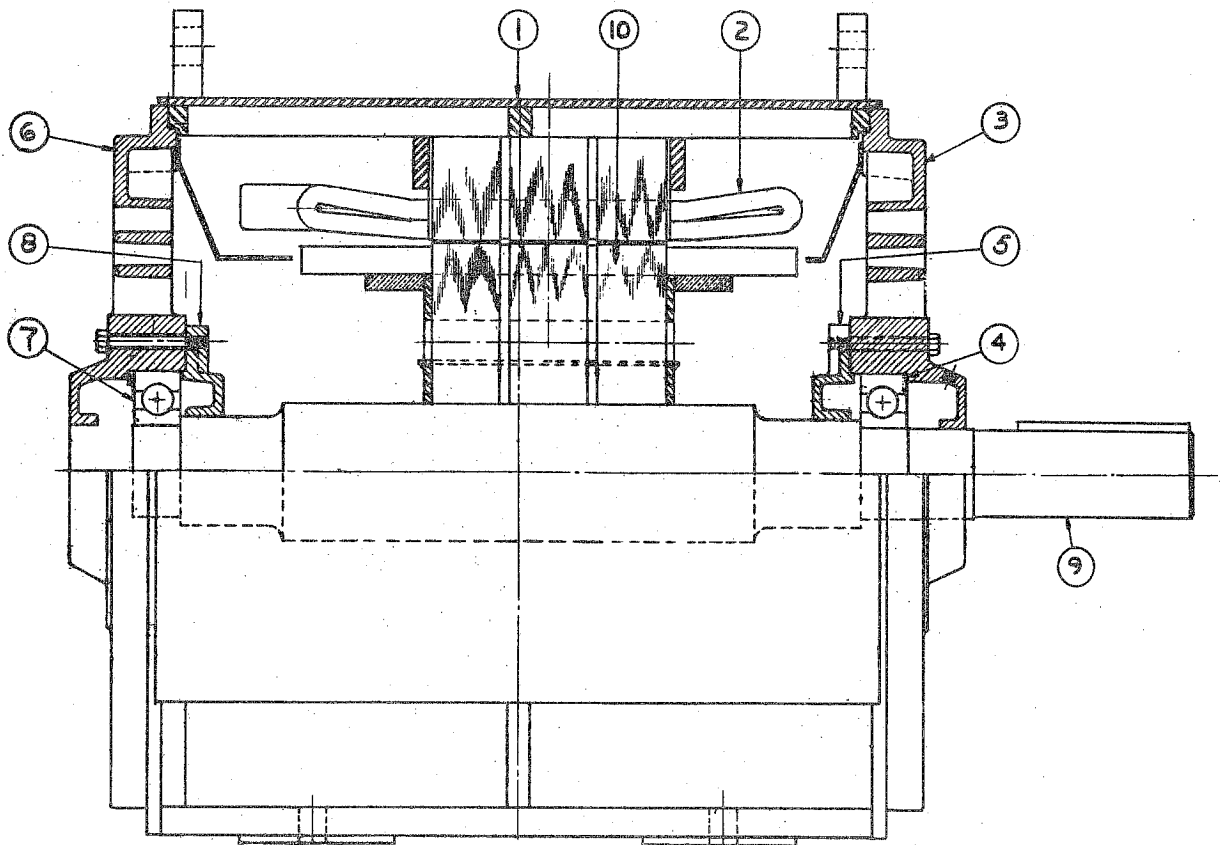


- | | | | |
|----|-------------------------------|----|-----------------------|
| 1 | Frame | 11 | Ball Bearing |
| 2 | Stator Core | 12 | Bearing Locknut |
| 3 | Stator Coil | 13 | Bearing Lockwasher |
| 4 | Bearing Bracket | 14 | Grease Slinger |
| 5 | Inner Bearing Cap (Drive End) | 15 | Rotor Core |
| 6 | Outer Bearing Cap (Drive End) | 16 | Rotor Winding |
| 7 | Inner Bearing Cap (Front End) | 17 | Rotor Baffle |
| 8 | Outer Bearing Cap (Front End) | 18 | Shroud |
| 9 | Housing End Plate | 19 | Shroud Oil Hole Cover |
| 10 | Shaft | 20 | Conduit Box |

ASSEMBLY DRAWING OF BALL BEARING

SQUIRREL CAGE INDUCTION MOTORS

(SQUARE FRAME)

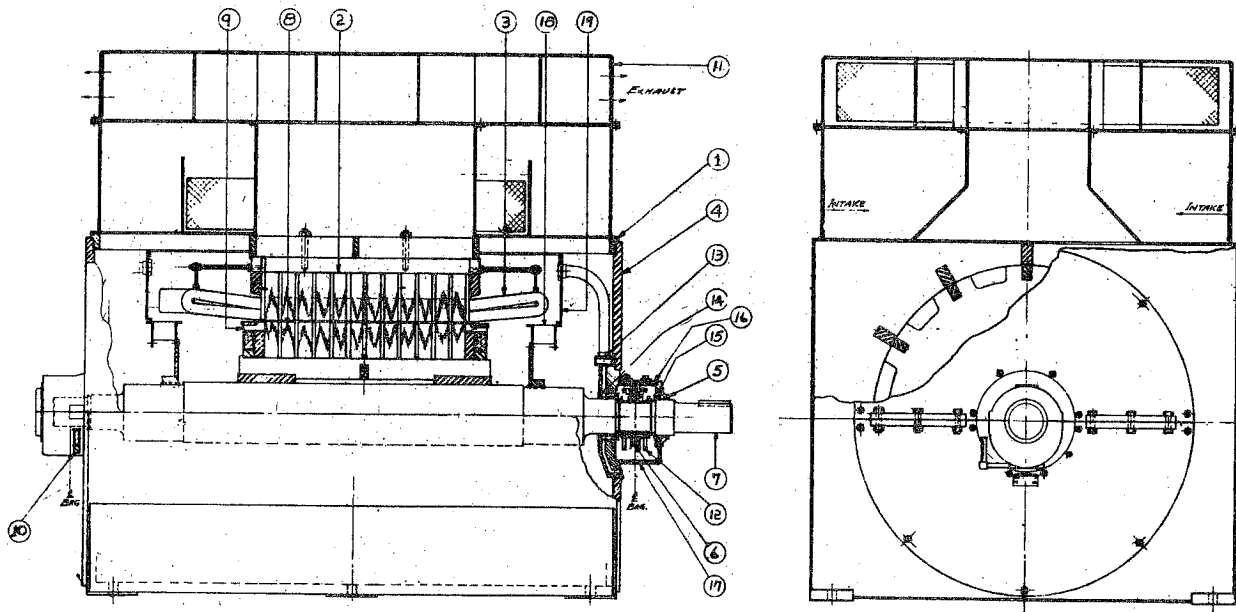


- | | |
|---------------------------------|------------------------------------|
| 1 Stator Frame | 6 Bearing Bracket (Opposite End) |
| 2 Stator Coils | 7 Bearing (Opposite End) |
| 3 Bearing Bracket (Drive End) | 8 Inner Bearing Cap (Opposite End) |
| 4 Bearing (Drive End) | 9 Shaft |
| 5 Inner Bearing Cap (Drive End) | 10 Rotor Core & Winding |

ASSEMBLY DRAWING OF SLEEVE BEARING

SQUIRREL CAGE INDUCTION MOTORS - PROTECTED TYPE

MAX. 1800 RPM

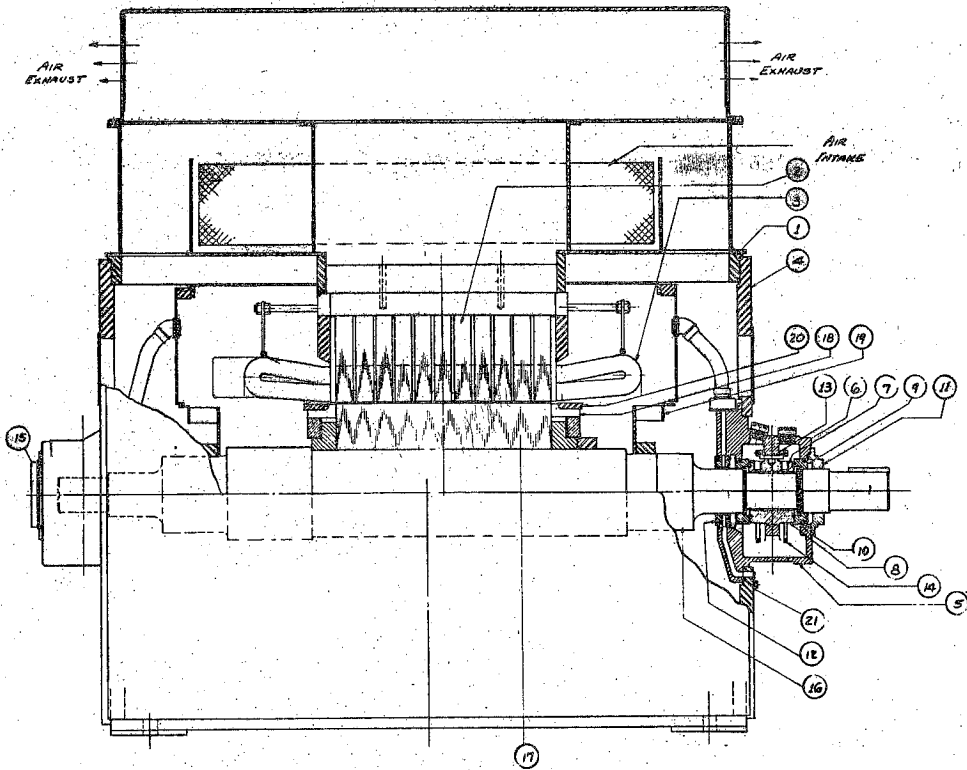


- | | |
|-------------------------------|--|
| 1 Stator Frame | 11 Bearing Adjusting Yoke |
| 2 Stator Core | 12 Oil Ring |
| 3 Stator Coils | 13 Bearing Housing Air pressure Reg. Plate |
| 4 Bearing Bracket | 14 Bearing Oil Seal Collar (Inner) |
| 5 Outer Bearing Cap | 15 Bearing Oil Seal Collar (Outer) |
| 6 Bearing Sleeve (Upper Half) | 16 Bearing Housing (Upper Half) |
| 6 Bearing Sleeve (Lower Half) | 17 Bearing Housing (Lower Half) |
| 7 Shaft | 18 Fan |
| 8 Rotor Core | 19 Baffle |
| 9 Rotor Winding | |
| 10 Oil Sight Gauge | |

ASSEMBLY DRAWING OF SLEEVE BEARING

SQUIRREL CAGE INDUCTION MOTORS - PROTECTED TYPE

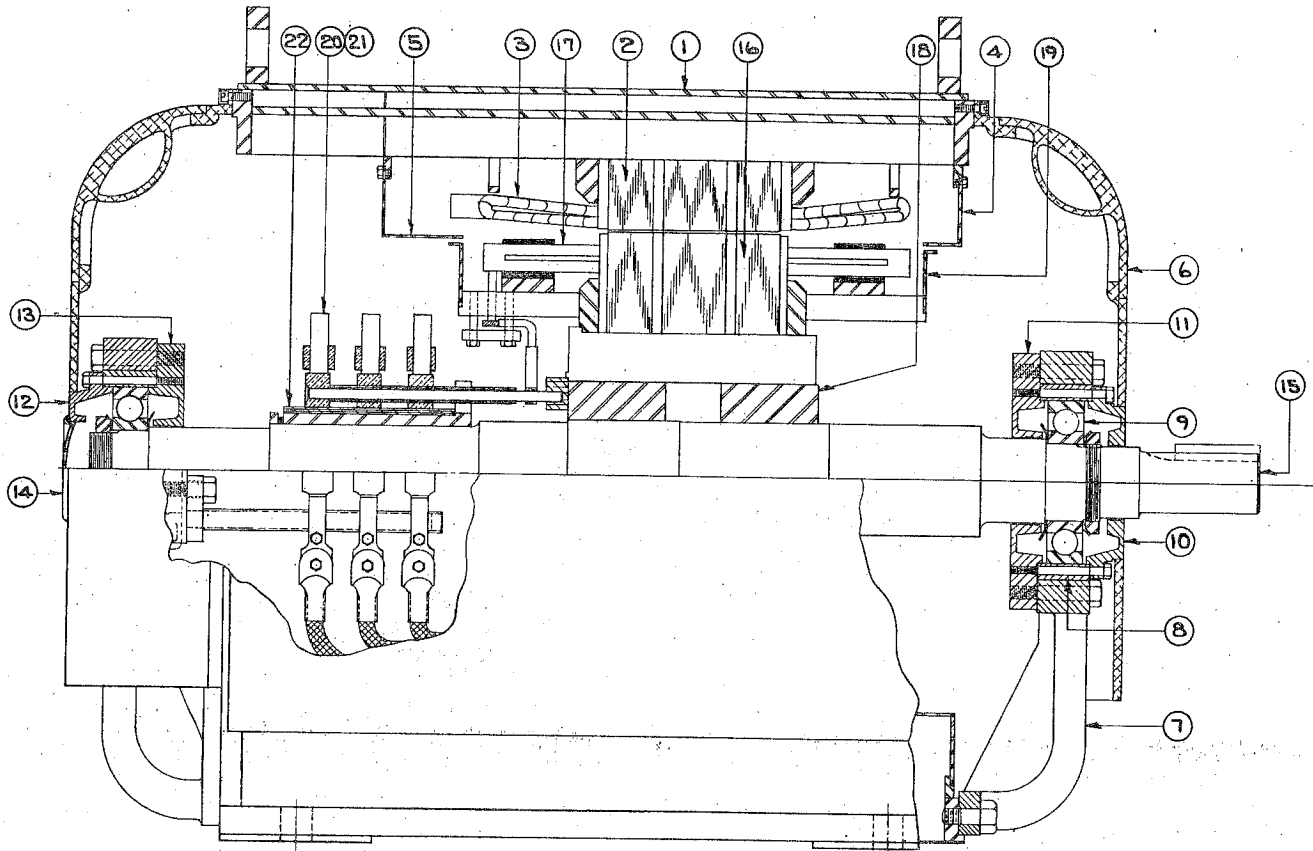
3600 RPM



- | | |
|----------------------------------|--|
| 1 Stator Frame | 13 Bearing Adjusting Yoke |
| 2 Stator Core | 14 Oil Ring |
| 3 Stator Coils | 15 Outer Bearing Cap (Opposite Drive End) |
| 4 Bearing Bracket | 16 Shaft |
| 5 Bearing Housing | 17 Rotor Core |
| 6 Bearing Cap | 18 Rotor Winding |
| 7 Bearing Sleeve (Upper Half) | 19 Fan |
| 8 Bearing Sleeve (Lower Half) | 20 Rotor Bar Retaining Ring |
| 9 Bearing Oil Seal Collar | 21 Bearing Housing Air Pressure Reg. Plate |
| 10 Bearing Oil Seal "O" Ring | |
| 11 Outer Bearing Cap (Drive End) | |
| 12 Bearing Oil Seal Collar | |

ASSEMBLY DRAWING OF BALL BEARING

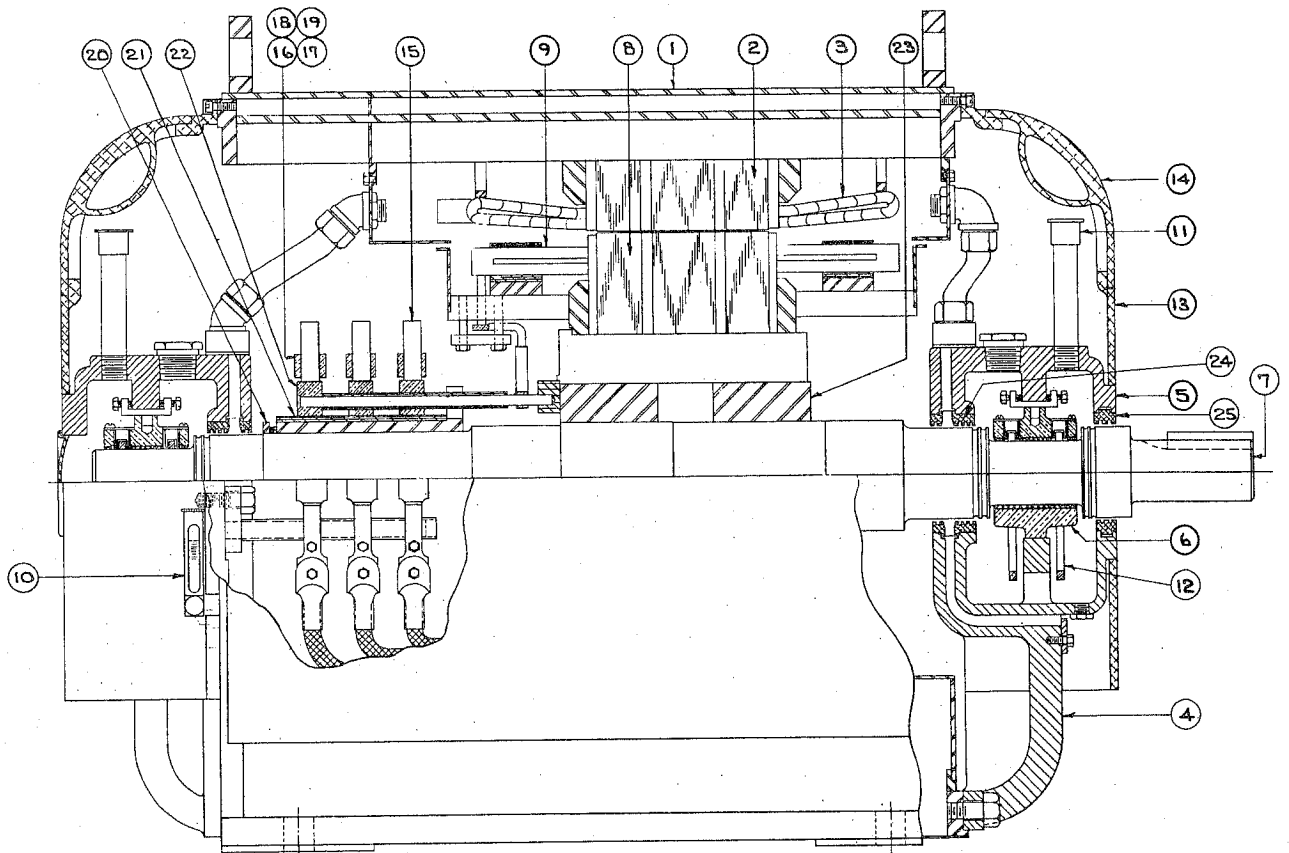
WOUND ROTOR INDUCTION MOTORS



- | | | | |
|----|-------------------------------|----|-------------------------------|
| 1 | Frame | 12 | Outer Bearing Cap (Front End) |
| 2 | Stator Core | 13 | Inner Bearing Cap (Front End) |
| 3 | Stator Coil | 14 | Housing End Plate |
| 4 | Baffle (Drive End) | 15 | Shaft |
| 5 | Baffle (Front End) | 16 | Rotor Core |
| 6 | Shroud | 17 | Rotor Coil |
| 7 | Bearing Bracket | 18 | Rotor Spider |
| 8 | Bearing Shell | 19 | Rotor Baffle |
| 9 | Ball Bearing | 20 | Brush |
| 10 | Outer Bearing Cap (Drive End) | 21 | Brush Holder |
| 11 | Inner Bearing Cap (Drive End) | 22 | Collector Assembly |

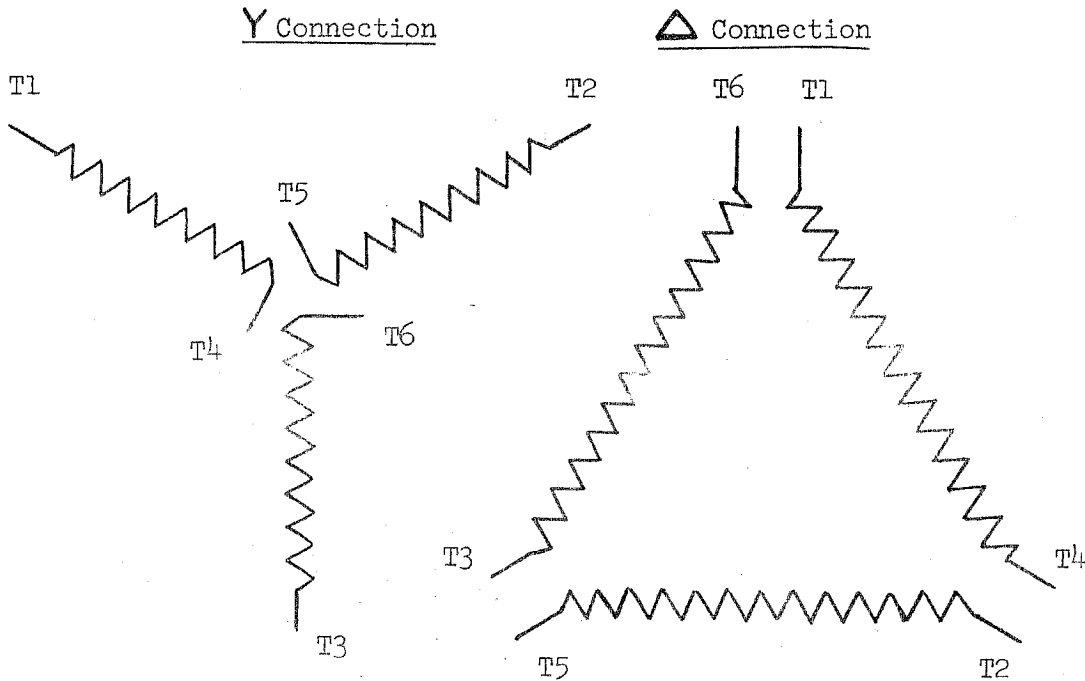
ASSEMBLY DRAWING OF SLEEVE BEARING

WOUND ROTOR INDUCTION MOTORS



- | | | | |
|----|-----------------|----|-----------------------------|
| 1 | Frame | 14 | Shroud Oil Hole Cover |
| 2 | Stator Core | 15 | Brush |
| 3 | Stator Coil | 16 | Brush Holder |
| 4 | Bearing Bracket | 17 | Brush Holder Spring |
| 5 | Bearing Cap | 18 | Brush Stem |
| 6 | Sleeve Bearing | 19 | Brush Stem Insulation Tube |
| 7 | Shaft | 20 | Collector Sleeve |
| 8 | Rotor Core | 21 | Collector Sleeve Insulation |
| 9 | Rotor Winding | 22 | Collector Ring |
| 10 | Oil Level Gauge | 23 | Spider |
| 11 | Oil Filler Cup | 24 | Labyrinth Oil Seal - Inner |
| 12 | Oil Ring | 25 | Labyrinth Oil Seal - Outer |
| 13 | Shroud | | |

STAR DELTA TERMINAL CONNECTION DIAGRAM FOR INDUCTION MOTORS

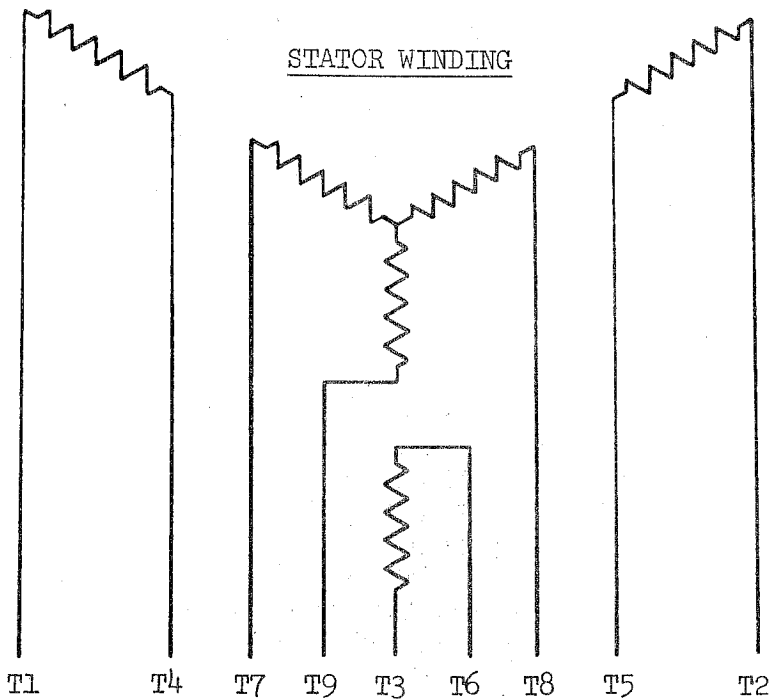


FOR CONNECTION - HIGHER VOLTAGE
 Line Leads T1, T2, T3.
 Connect T4, T5, T6 together.

FOR CONNECTION - LOWER VOLTAGE
 Connect Line Leads to
 T1, T6, T2 T4, T3 T5

1159

CONNECTION DIAGRAM - 9 LEAD - DUAL VOLTAGE - STAR CONNECTION



STATOR WINDING

FOR HIGHER VOLTAGE
 Line Terminals - T1, T2, T3.
 Connect - T4 & T7, T5 & T8, T6 & T9.

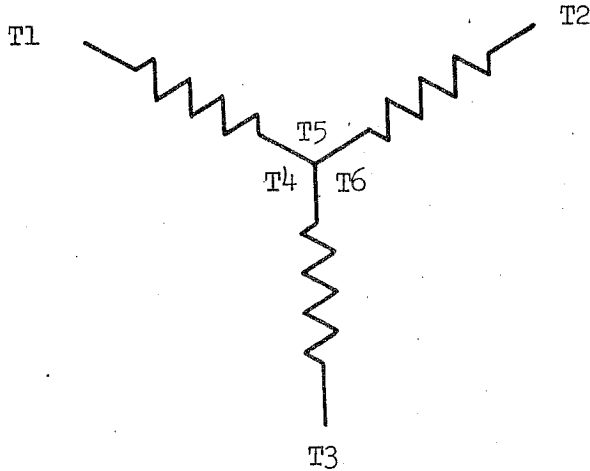
FOR LOWER VOLTAGE
 Line Terminals Formed by - T1 & T7,
 T2 & T8, T3 & T9.
 Connect - T4, T5, T6 Together.

FOR PART WINDING STARTING -
LOWER VOLTAGE ONLY
 Connect - T1, T2 & T3 to First
 Contactor.
 Connect - T7, T8 & T9 to Second
 Contactor.
 Connect - T4, T5, & T6 Together

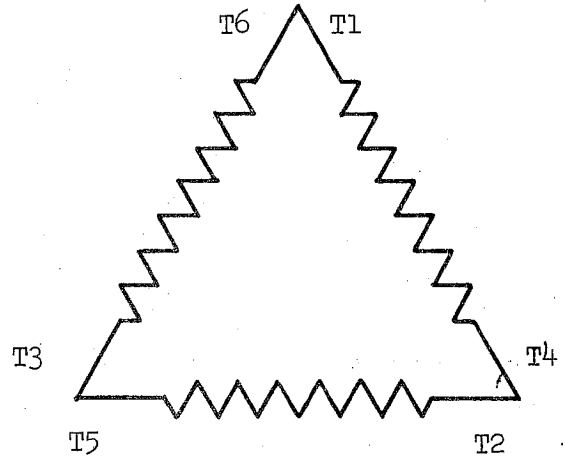
1184

CONNECTION DIAGRAM FOR Y-DELTA STARTING

Starting Connection



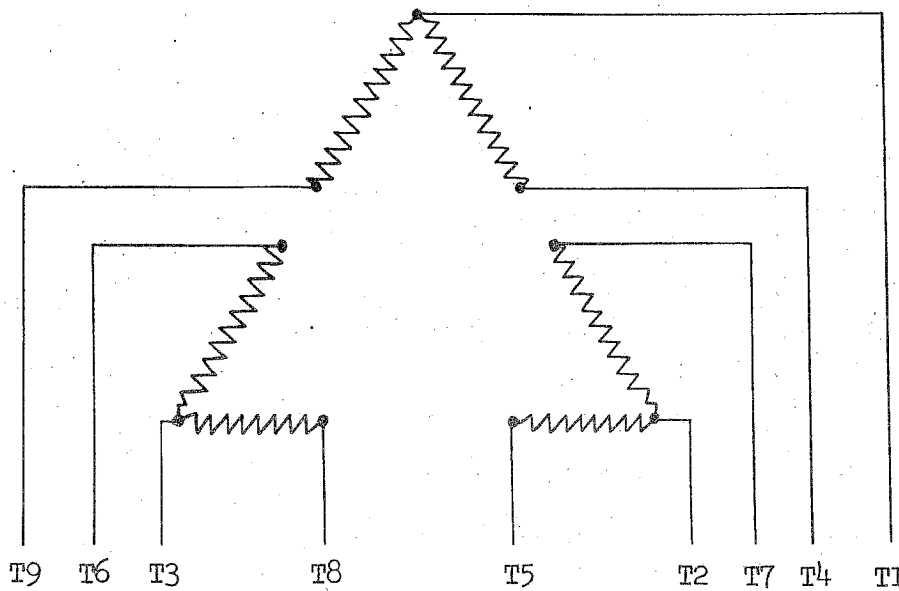
Running Connection



Line Leads T1, T2, T3 Connect Line Leads To T1 T6, T2 T4, T3 T5.
 Connect T4, T5, T6 Together

1195

CONNECTION DIAGRAM - 9 LEAD - DUAL VOLTAGE - DELTA CONNECTION



HIGH VOLTAGE

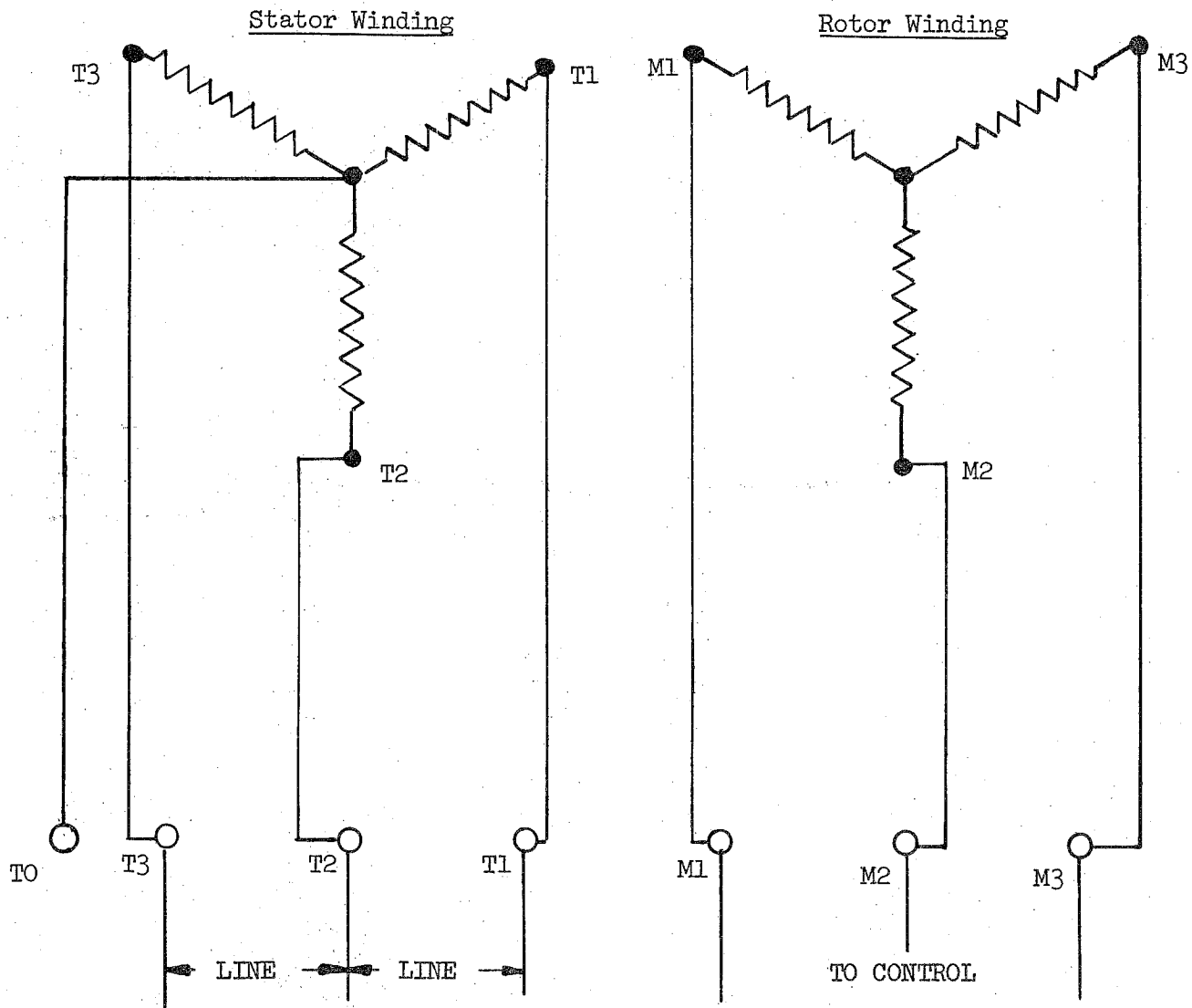
Line Terminals - T1, T2, T3
 Connect T4 & T7, T5 & T8,
 T6 & T9

LOW VOLTAGE

Line Terminals - T1, T2, T3
 Connect T1, T6 & T7; T2, T4
 & T8; T3, T5 & T9

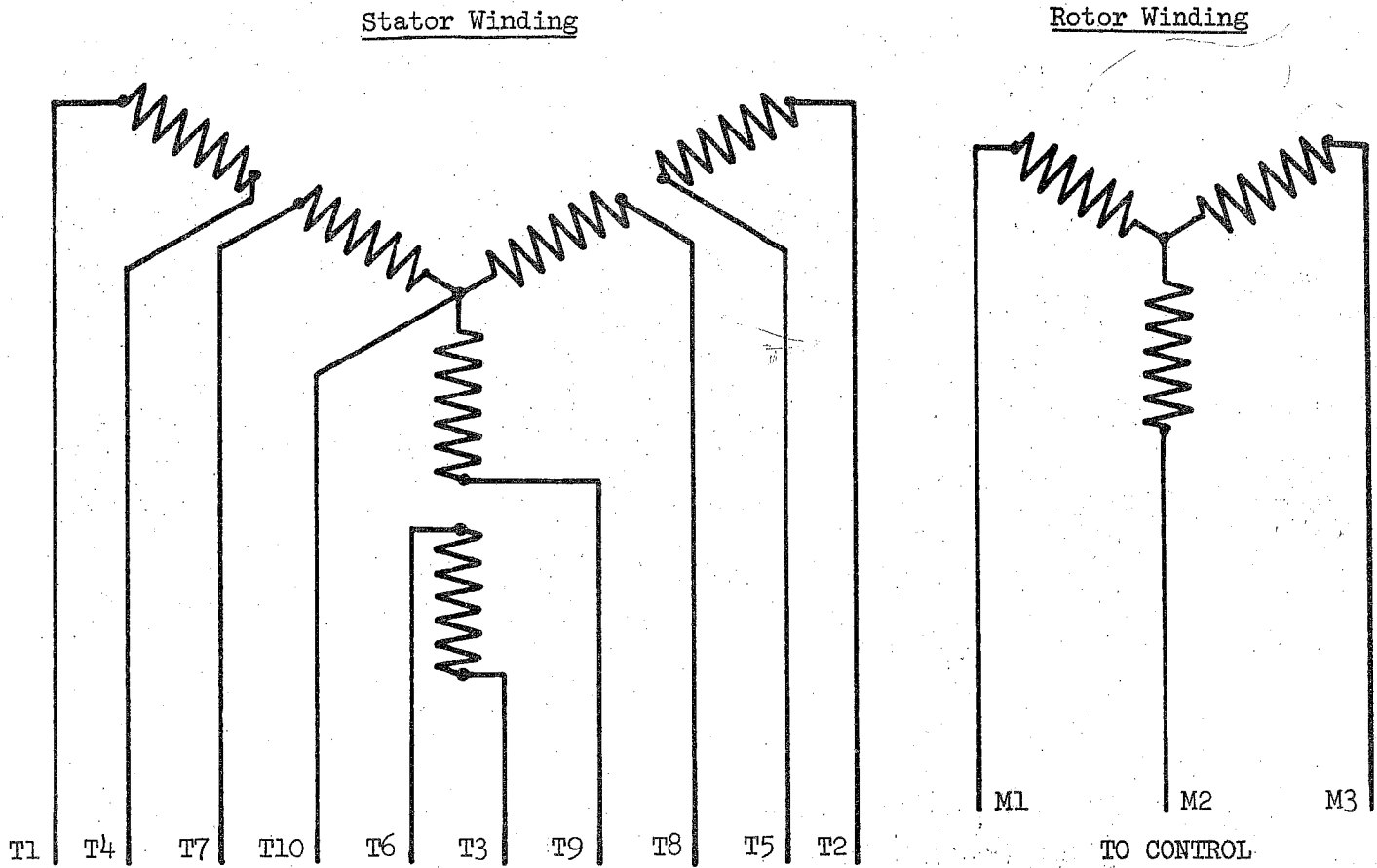
1197

CONNECTION DIAGRAM FOR WOUND ROTOR INDUCTION MOTOR



*NOTE: When specified bring out neutral lead and mark as shown.

EXTERNAL CONNECTION DIAGRAM FOR WOUND ROTOR INDUCTION MOTOR



HIGHER VOLTAGE

Line Terminals - T1, T2, T3
 Connect - T4 & T7, T5 & T8, T6 & T9

LOWER VOLTAGE

Line Terminals - T1 & T7, T2 & T8, T3 & T9
 Connect - T4, T5, T6, Together And To T10, When Supplied

SECTION VIII-LUBRICANT RECOMMENDATIONS

We recommend the use of turbine type oil with minimum viscosity index of 90. Oil to contain rust and oxidation inhibitors. The recommended oil viscosity for each bearing of a machine is stamped on a lubrication name plate mounted on the machine adjacent to each bearing. Recommended oil changes are shown in Figure 9.

Consult chart of various oil suppliers (Figure 10) and select one of recommended type and viscosity. If local supplier does not have the recommended oil

list, use an oil equal to one shown on chart. Where extreme range of operating temperatures are encountered, consult local oil supplier for specific recommendations as to type and grade of oil.

RECOMMENDED OIL CHANGES	
OPERATING TEMPERATURE OF BEARING IN DEGREES F.	TIME — BASED ON AVERAGE SERVICE CONDITIONS
100 To 140	At Least Once a Year
140 To 180	At Least Every 6 Months
180 To 200	At Least Every 3 Months

Figure 9 — Recommended oil changes.

VISCOSITY RANGE S.S.U. @ 100° F. 95 to 120

MANUFACTURER	BRAND OR TRADE NAME	MANUFACTURER	BRAND OR TRADE NAME
Std. Oil Div. of Amer. Oil Co.	Amer. Spindle Oil C.	Stewart-Warner Corp.	Alemite Hi-Speed 'B'
N.Y. & N.J. Lub. Co.	A-#88 Special #1	Shell Oil Co.	Tellus #23
Crescent Oil Co., Inc.	Clingolene SP	Socony Mobil Oil Co.	Mobil Velocite Oil D or C
DX Sunray Oil Co.	#579 DX Cherokee Oil Exl.	Gulf Oil Corp.	Gulf Harmony #41
Continental Oil Co.	Conoco HY COM II	Humble Oil & Refining Co.	Spinesstic 38
Sinclair Refining Co.	Sinturilite A	Union Oil Co. of Calif.	Red Line Turbine Oil #90
Cities Service Oil Co.	Pacemaker Oil #0	Magnolia Petroleum Co.	Mobil Vel. Oil #10 or C
Skelly Oil Co.	Skelvis INH #100	Sun Oil Co.	Sunvis 911
Standard Oil Co. of Ohio	Sohispin #100 or #125		

VISCOSITY RANGE S.S.U. @ 100° F. 145 to 175

MANUFACTURER	BRAND OR TRADE NAME	MANUFACTURER	BRAND OR TRADE NAME
Std. Oil Div. of Amer. Oil Co.	Amer. Industrial Oil #15	Kendall Refining Co.	Kenoil 043 R & O
Union Oil Co. of Calif.	Red Line Turbine Oil #150	Shell Oil Co.	Tellus #27
Crescent Oil Co., Inc.	Clingolene SP	Socony Mobil Oil Co.	Mobil DTE Oil Light
Magnolia Petroleum Co.	Mobil DTE Oil Light	Gulf Oil Corp.	Gulf Harmony #44
DX Sunray Oil Co.	#580 DX Cherokee Oil L(R&O)	The Atlantic Refining Co.	Atlantic Hytherm Oil C or Atlantic-Ideal C.
Sinclair Refining Co.	Duro 150 or 160	Humble Oil & Refining Co.	Nuto #42
Cities Service Oil Co.	Pacemaker Oil #1	Texaco, Inc.	Regal Oil A (R&O)
Skelly Oil Co.	Skelvis INH #150	Std. Oil Co. of Calif. Western Operations, Inc.	Chevron OC Turbine Oil 9
E. F. Houghton & Co.	Hydro-Drive MIH Light	Continental Oil Co.	Conoco Hycum #15 or Turb. Oil-Lt.
Pure Oil Co.	Puropale RX Light Code 4190	Ashland Oil & Refining Co.	Ashland ETC Oil K-15
Standard Oil Co. of Ohio	Sohivis #43	Sun Oil Co.	Sunvis 916
Phillips Petroleum Co.	Magnus Grade Light		
Tidewater Oil Co.	Veedol Aturbrio #50		
Pennzoil Div. S. Penn Oil Co.	Penn Turb. & Dynmo Oil Lt. Code 23501		

VISCOSITY RANGE S.S.U. @ 100° F. 195 to 225

MANUFACTURER	BRAND OR TRADE NAME	MANUFACTURER	BRAND OR TRADE NAME
Std. Oil Div. of Amer. Oil Co.	Amer. Industrial Oil #21	Stewart-Warner Corp.	Alemite Industrial Oil #1
N.Y. & N.J. Lub. Co.	A-#89 - Special	The Atlantic Ref. Co.	Atlantic Ideal Oil D
Crescent Oil Co., Inc.	Clingolene SP	Gulf Oil Corp.	Gulf Harmony #47
DX Sunray Oil Co.	#581 DX Cherokee Oil M(R&O)	Humble Oil & Refining Co.	Nuto #46
Continental Oil Co.	Conoco Turb. Oil Lt.-Med.	Texaco, Inc.	Regal Oil B (R&O)
Sinclair Refining Co.	Duro 200	Std. Oil Co. of Calif. Western Operations, Inc.	Chevron Ind. Oil 45X
Cities Service Oil Co.	Pacemaker Oil #2	Union Oil Co. of Calif.	Chevron OC Turbine Oil 11
Skelly Oil Co.	Skelvis INH*SAE 10W	Std. Oil Co. of Ohio	Red Line Turb. Oil #225
E. F. Houghton & Co.	Hydro-Drive MIH 10	Shell Oil Co.	Sohivis #47
Pure Oil Co.	Puropale RX Med. Code 4191	Socony Mobil Oil Co.	Tellus #29
Penn Div. South Penn Oil Co.	Penn Turb & Dynamo Oil-Med Code 23502	Magnolia Petroleum Co.	Mobil DTE Oil Medium
Kendall Refining Co.	Kenoil 047 (R&O)	Ashland Oil & Refining Co.	Mobil DTE Oil Medium
Tidewater Oil Co.	Veedol Aturbrio #58	Sun Oil Co.	Ashland ETC Oil K-20
			Sunvis 921

VISCOSITY RANGE S.S.U. @ 100° F. 285 to 325

MANUFACTURER	BRAND OR TRADE NAME	MANUFACTURER	BRAND OR TRADE NAME
Union Oil Co. of Calif.	Red Line Turb. Oil #300	Continental Oil Co.	Conoco Turb. Oil Med.
Crescent Oil Co., Inc.	Clingolene SP	Socony Mobil Oil Co.	Conoco HY COM 31
Skelly Oil Co.	Skelvis INH-SAE 20	Duro 295 or 300	
E. F. Houghton & Co.	Hydro-Drive MIH 20	Pacemaker Oil #3	
Pure Oil Co.	Puropale Rx Heavy-Med Code 4192	Sohivis #52	
Phillips Pet. Co.	Magnus Grade Medium	Veedol Aturbrio 60	
Kendall Refining Co.	Kenoil 058 R & O	Penn Turb. & Dynamo Oil	Heavy Med-Code 23503
Shell Oil Co.	Tellus #33	Alemite Ind. Oil #2	
Socony Mobil Oil Co.	Mobil DTE Oil Heavy Med.	Gulf Harmony #53	
Magnolia Petroleum Co.	Mobil DTE Oil Heavy Med.	Atlantic Hytherm Oil F or Atlantic Ideal Oil F	
Std. Oil Div. of Amer. Oil Co.	Amer. Ind. Oil #31	Chevron OC Turb. Oil 15	
N.Y. & N.J. Lub. Co.	A-#90 #1	Ashland ETC Oil K-30	
DX Sunray Oil Co.	#582 DX Cherokee Oil H (R&O)	Sunvis 931	
Humble Oil Co.	Nuto #50 or Teresstic #52		

VISCOSITY RANGE S.S.U. @ 100° F. 360 to 410

MANUFACTURER	BRAND OR TRADE NAME	MANUFACTURER	BRAND OR TRADE NAME
Std. Oil Div. of Amer. Oil Co.	Amer. Industrial Oil #35	Texaco, Inc.	Regal Oil PC (R&O)
Crescent Oil Co., Inc.	Clingolene SP	Continental Oil Co.	Conoco CPS Oil 30
DX Sunray Oil Co.	#562 DX Seminole Oil (R&O)	Cities Service Oil Co.	Pacemaker Oil #4

Figure 10 — Chart of oil suppliers.

Equipment List & Equipment Templates

PROD424 University Water Pump Station - Valves

Description	Size	Facility	Process Area	Equipment	Function Area	Unit Number	Asset Type	Tag	Manufacturer	Model#	Serial#
UNIVERSITY TANK		PROD	424	TNK	5	1	Water Storage Unit	PROD424TNK501			
UNIVERSITY TANK REPLENISHING (ALTITUDE) VALVE #2	10	PROD	424	VLV	5	2	Water Valve	PROD424VLV502			
UNIVERSITY ALTITUDE VALVE #2 ISOLATION VALVE #2		PROD	424	VLV	9	85	Water Valve	PROD424VLV085			
UNIVERSITY ALTITUDE VALVE #2 ISOLATION VALVE #1		PROD	424	VLV	9	86	Water Valve	PROD424VLV086			
UNIVERSITY HSP #1 CONTROL VALVE		PROD	424	VLV			Water Valve				
UNIVERSITY HSP #1 CHECK VALVE		PROD	424	VLV	1	1	Water Valve	PROD424VLV1011			
UNIVERSITY HSP #1 DISCHARGE VALVE		PROD	424	VLV	1	2	Water Valve	PROD424VLV1012			
UNIVERSITY HSP #1 SUCTION VALVE		PROD	424	VLV	1	3	Water Valve	PROD424VLV1013			
UNIVERSITY HSP #2 CHECK VALVE		PROD	424	VLV	1	648	Water Valve	PROD424VLV648			
UNIVERSITY HSP #2 DISCHARGE VALVE		PROD	424	VLV	1	649	Water Valve	PROD424VLV649			
UNIVERSITY HSP #2 SUCTION VALVE		PROD	424	VLV	1	650	Water Valve	PROD424VLV650			
UNIVERSITY ALTITUDE VALVE #3 ISOLATION VALVE #1		PROD	424	VLV	9	722	Water Valve	PROD424VLV722			
UNIVERSITY ALTITUDE VALVE #3 ISOLATION VALVE #2		PROD	424	VLV	9	723	Water Valve	PROD424VLV723			
UNIVERSITY ALTITUDE VALVE #1 ISOLATION VALVE #2		PROD	424	VLV	9	196	Water Valve	PROD424VLV196			
UNIVERSITY ALTITUDE VALVE #1 ISOLATION VALVE #1		PROD	424	VLV	9	197	Water Valve	PROD424VLV197			
UNIVERSITY HSP #3 CHECK VALVE		PROD	424	VLV	1	737	Water Valve	PROD424VLV737			
UNIVERSITY HSP #3 DISCHARGE VALVE		PROD	424	VLV	1	738	Water Valve	PROD424VLV738			
UNIVERSITY HSP #3 SUCTION VALVE		PROD	424	VLV	1	739	Water Valve	PROD424VLV739			
UNIVERSITY HSP #4 CHECK VALVE		PROD	424	VLV	1	740	Water Valve	PROD424VLV740			
UNIVERSITY HSP #4 DISCHARGE VALVE		PROD	424	VLV	1	741	Water Valve	PROD424VLV741			
UNIVERSITY HSP #5 CHECK VALVE		PROD	424	VLV	1	743	Water Valve	PROD424VLV743			
UNIVERSITY HSP #5 DISCHARGE VALVE		PROD	424	VLV	1	744	Water Valve	PROD424VLV744			
UNIVERSITY TANK REPLENISHING (ALTITUDE) VALVE #1	10	PROD	424	VLV	9	850	Water Valve	PROD424VLV850			
UNIVERSITY TANK REPLENISHING (ALTITUDE) VALVE #3	10	PROD	424	VLV	9	851	Water Valve	PROD424VLV851			

PROD424 University Water Pump Station - Instrumentation

Description	Measurement	Type	Facility	Process Area	Equipment	Function Area	Unit Number	Asset Type	Tag	Manufactu	Model#	Serial#
UNIVERSITY HSP #1 FLOW INSTRUMENT	Flow		PROD	424	FI	1	1	Plant Equipment	PROD424FI101			
UNIVERSITY HSP #2 FLOW INSTRUMENT	Flow		PROD	424	FI	1	2	Plant Equipment	PROD424FI102			
UNIVERSITY HSP #3 FLOW INSTRUMENT	Flow		PROD	424	FI	1	3	Plant Equipment	PROD424FI103			
UNIVERSITY HSP #4 FLOW INSTRUMENT	Flow		PROD	424	FI	1	4	Plant Equipment	PROD424FI104			
UNIVERSITY HSP #5 FLOW INSTRUMENT	Flow		PROD	424	FI	1	5	Plant Equipment	PROD424FI105			
UNIVERSITY INLET FLOW INSTRUMENT	Flow		PROD	424	FI	9	1	Plant Equipment	PROD424FI901			
UNIVERSITY TANK LEVEL INSTRUMENT	Level		PROD	424	LI	5	1	Plant Equipment	PROD424LI501			
UNIVERSITY SL8 DISCHARGE PRESSURE INSTRUMENT	Pressure		PROD	424	PI	9	1	Plant Equipment	PROD424PI901-8			
UNIVERSITY SL7 SUCTION PRESSURE INSTRUMENT	Pressure		PROD	424	PI	9	2	Plant Equipment	PROD424PI902-7			
UNIVERSITY HSP #1 SUCTION PRESSURE SWITCH	Pressure		PROD	424	PI			Plant Equipment				
UNIVERSITY HSP #1 SUCTION PRESSURE GAUGE	Pressure		PROD	424	PI			Plant Equipment				
UNIVERSITY HSP #1 DISTRIBUTION PRESSURE GAUGE	Pressure		PROD	424	PI			Plant Equipment				
UNIVERSITY HSP #2 SUCTION PRESSURE SWITCH	Pressure		PROD	424	PI			Plant Equipment				
UNIVERSITY HSP #2 SUCTION HEADER PRESSURE GAUGE	Pressure		PROD	424	PI			Plant Equipment				
UNIVERSITY HSP #2 SUCTION PRESSURE GAUGE	Pressure		PROD	424	PI			Plant Equipment				
UNIVERSITY HSP #2 DISCHARGE PRESSURE GAUGE	Pressure		PROD	424	PI			Plant Equipment				
UNIVERSITY HSP #2 DISTRIBUTION PRESSURE GAUGE	Pressure		PROD	424	PI			Plant Equipment				
UNIVERSITY HSP #5 DISTRIBUTION PRESSURE GAUGE	Pressure		PROD	424	PI			Plant Equipment				
UNIVERSITY HSP #3 SUCTION PRESSURE SWITCH	Pressure		PROD	424	PI			Plant Equipment				
UNIVERSITY HSP #4 SUCTION PRESSURE SWITCH	Pressure		PROD	424	PI			Plant Equipment				
UNIVERSITY HSP #5 SUCTION PRESSURE SWITCH	Pressure		PROD	424	PI			Plant Equipment				
GROUND STORAGE TANK LEVEL	Pressure		PROD	424	PI			Plant Equipment				
ELECTRICAL ROOM TEMPERATURE INSTRUMENT	Temperature		PROD	424	TI	9	1	Plant Equipment	PROD424TI901			
CONTROL ROOM TEMPERATURE INSTRUMENT	Temperature		PROD	424	TI	9	2	Plant Equipment	PROD424TI902			
UNIVERSITY RTU	RTU-PLC		PROD	424	RTU	9	1	Plant Equipment	PROD424RTU901			

PROD424 University Water Pump Station - Equipment

Description	Size	Facility	Process Area	Equipment	Function Area	Unit Number	Asset Type	Tag	Manufacturer	Model#	Serial#
UNIVERSITY RTU AIR CONDITIONER		PROD	424	ACOND	9	2	Plant Equipment	PROD424ACOND902			
UNIVERSITY RTU AIR CONDITIONER		PROD	424	ACOND	9	3	Plant Equipment	PROD424ACOND903			
UNIVERSITY RTU AIR CONDITIONER		PROD	424	ACOND	9	4	Plant Equipment	PROD424ACOND904			
UNIVERSITY RTU AIR CONDITIONER		PROD	424	ACOND	9	5	Plant Equipment	PROD424ACOND905			
UNIVERSITY HSP #1 MOTOR	500hp	PROD	424	MOTR	1	1	Plant Equipment	PROD424MOTR101			
UNIVERSITY HSP #2 MOTOR	300hp	PROD	424	MOTR	1	2	Plant Equipment	PROD424MOTR102			
UNIVERSITY HSP #3 MOTOR	300hp	PROD	424	MOTR	1	3	Plant Equipment	PROD424MOTR103			
UNIVERSITY HSP #4 MOTOR	300hp	PROD	424	MOTR	1	4	Plant Equipment	PROD424MOTR104			
UNIVERSITY HSP #5 MOTOR	500hp	PROD	424	MOTR	1	5	Plant Equipment	PROD424MOTR105			
UNIVERSITY EXHAUST FAN MOTOR		PROD	424	FAN	9	1	Plant Equipment	PROD424MOTR901			
UNIVERSITY HSP #1 PUMP	7000gpm	PROD	424	PMP			Water Pump	PROD424PMP101			
UNIVERSITY HSP #2 PUMP	3500gpm	PROD	424	PMP	1	2	Water Pump	PROD424PMP102			
UNIVERSITY HSP #3 PUMP		PROD	424	PMP	1	3	Water Pump	PROD424PMP103			
UNIVERSITY HSP #4 PUMP	3500gpm	PROD	424	PMP	1	4	Water Pump	PROD424PMP104			
UNIVERSITY HSP #5 PUMP	7000gpm	PROD	424	PMP	1	5	Water Pump	PROD424PMP105			
UNIVERSITY SUMP PUMP #1		PROD	424	PMP	9	1	Plant Equipment	PROD424PMP901			
UNIVERSITY CATHODIC RECTIFIER		PROD	424	RCTF	5	1	Plant Equipment	PROD424RCTF501			
UNIVERSITY HSP #1 STARTER		PROD	424	STR			Plant Equipment				
UNIVERSITY HSP #2 STARTER		PROD	424	STR			Plant Equipment				
UNIVERSITY HSP #3 STARTER		PROD	424	STR			Plant Equipment				
UNIVERSITY HSP #4 STARTER		PROD	424	STR			Plant Equipment				
UNIVERSITY HSP #5 STARTER		PROD	424	STR			Plant Equipment				
UNIVERSITY MAIN SWITCHGEAR		PROD	424	SWG	9	1	Plant Equipment	PROD424SWG901			
UNIVERSITY STATION 480V TRANSFORMER TX-1		PROD	424	XFMR	9	3	Plant Equipment	PROD424XFMR903			
UNIVERSITY STATION 480V TRANSFORMER TX-2		PROD	424	XFMR	9	4	Plant Equipment	PROD424XFMR904			
UNIVERSITY STATION 120/208V TRANSFORMER TX-3		PROD	424	XFMR	9	5	Plant Equipment	PROD424XFMR905			
UNIVERSITY STATION 120/208V TRANSFORMER TX-4		PROD	424	XFMR	9	6	Plant Equipment	PROD424XFMR906			
UNIVERSITY STATION CONTROL PANEL SCP		PROD	424				Plant Equipment				
UNIVERSITY STATION SECURITY CABINET		PROD	424				Plant Equipment				
UNIVERSITY STATION HSPCP-1		PROD	424			1	Plant Equipment	PROD424SWG101			
UNIVERSITY STATION HSPCP-2		PROD	424			1	Plant Equipment	PROD424SWG102			
UNIVERSITY STATION HSPCP-3		PROD	424			1	Plant Equipment	PROD424SWG103			
UNIVERSITY STATION HSPCP-4		PROD	424			1	Plant Equipment	PROD424SWG104			
UNIVERSITY STATION HSPCP-5		PROD	424			1	Plant Equipment	PROD424SWG105			
UNIVERSITY STATION VCP-1		PROD	424				Plant Equipment				
UNIVERSITY STATION VCP-2		PROD	424				Plant Equipment				
UNIVERSITY STATION VCP-3		PROD	424				Plant Equipment				
UNIVERSITY STATION VCP-4		PROD	424				Plant Equipment				
UNIVERSITY STATION VCP-5		PROD	424				Plant Equipment				
UNIVERSITY STATION HTCP-1		PROD	424				Plant Equipment				
UNIVERSITY STATION HTCP-2		PROD	424				Plant Equipment				
UNIVERSITY STATION HTCP-3		PROD	424				Plant Equipment				
UNIVERSITY STATION HTCP-4		PROD	424				Plant Equipment				
UNIVERSITY STATION HTCP-5		PROD	424				Plant Equipment				
UNIVERSITY STATION LEVEL RELAY PANEL		PROD	424				Plant Equipment				
UNIVERSITY STATION ALTITUDE VALVE CONTROL PANEL		PROD	424				Plant Equipment				
UNIVERSITY STATION REPLENISHMENT VAULT SUMP PUMP CONTROL PANEL		PROD	424				Plant Equipment				
UNIVERSITY STATION 480V MOTOR CONTROL CENTER		PROD	424				Plant Equipment				
UNIVERSITY STATION DICONNECT SWITCH A/C-1		PROD	424				Plant Equipment				
UNIVERSITY STATION DICONNECT SWITCH A/C-2		PROD	424				Plant Equipment				
UNIVERSITY STATION DICONNECT SWITCH A/C-3		PROD	424				Plant Equipment				
UNIVERSITY STATION DICONNECT SWITCH A/C-4		PROD	424				Plant Equipment				
UNIVERSITY STATION DICONNECT SWITCH EXHAUST FAN		PROD	424				Plant Equipment				
UNIVERSITY STATION 120/240V PANEL BOARD LA		PROD	424				Plant Equipment				
UNIVERSITY STATION 120/240V PANEL BOARD LB		PROD	424				Plant Equipment				
UNIVERSITY STATION 120/240V PANEL BOARD LU		PROD	424				Plant Equipment				
UNIVERSITY STATION 120/240V PANEL BOARD LD		PROD	424				Plant Equipment				
UNIVERSITY STATION 120/240V PANEL BOARD LC		PROD	424				Plant Equipment				

UNIVERSITY STATION SUMP PUMP CONTROL PANEL		PROD	424				Plant Equipment				
UNIVERSITY STATION CAMERA-1		PROD	424				Plant Equipment				
UNIVERSITY STATION CAMERA-2		PROD	424				Plant Equipment				
UNIVERSITY STATION CAMERA-3		PROD	424				Plant Equipment				
UNIVERSITY STATION CAMERA-4		PROD	424				Plant Equipment				
UNIVERSITY STATION CAMERA-5		PROD	424				Plant Equipment				
UNIVERSITY STATION SECURITY PANEL-1		PROD	424				Plant Equipment				
UNIVERSITY STATION SECURITY PANEL-2		PROD	424				Plant Equipment				
UNIVERSITY STATION UPS		PROD	424				Plant Equipment				
UNIVERSITY STATION UPS EXTERNAL BYPASS		PROD	424				Plant Equipment				
UNIVERSITY STATION CABLE TRAY		PROD	424				Plant Equipment				
UNIVERSITY STATION BUILDING LIGHTS		PROD	424				Plant Equipment				
UNIVERSITY STATION BUILDING EXTERNAL LIGHTS		PROD	424				Plant Equipment				
UNIVERSITY STATION BUILDING EMERGENCY LIGHTS		PROD	424				Plant Equipment				
UNIVERSITY STATION BUILDING EXIT LIGHTS		PROD	424				Plant Equipment				
UNIVERSITY STATION BUILDING RECEPTACELS		PROD	424				Plant Equipment				
UNIVERSITY STATION ELECTRICAL MANHOLE - 1		PROD	424				Plant Equipment				
UNIVERSITY STATION ELECTRICAL MANHOLE - 2		PROD	424				Plant Equipment				
UNIVERSITY STATION ELECTRICAL HANDHOLE - 1		PROD	424				Plant Equipment				
UNIVERSITY STATION ELECTRICAL HANDHOLE - 2		PROD	424				Plant Equipment				
UNIVERSITY STATION ELECTRICAL HANDHOLE - 3		PROD	424				Plant Equipment				
UNIVERSITY STATION ELECTRICAL HANDHOLE - 4		PROD	424				Plant Equipment				
UNIVERSITY STATION ELECTRICAL HANDHOLE - 5		PROD	424				Plant Equipment				

University Pump Station

Transformer Template

Structural		
	Description	Value
MANUFACTURER	Manufacturer	
MODEL	Model	
SERIAL NUMBER	Serial	
Name Plate		
	Description	Value
KVA		
PRIMARY VOLTAGE		
SECONDARY VOLTAGE		
PRIMARY F.L. AMPS		
SECONDARY F.L. AMPS		
DISCONNECT/BREAKER RATING VOLT (PRIMARY)		
DISCONNECT/BREAKER RATING VOLT (SECONDARY)		

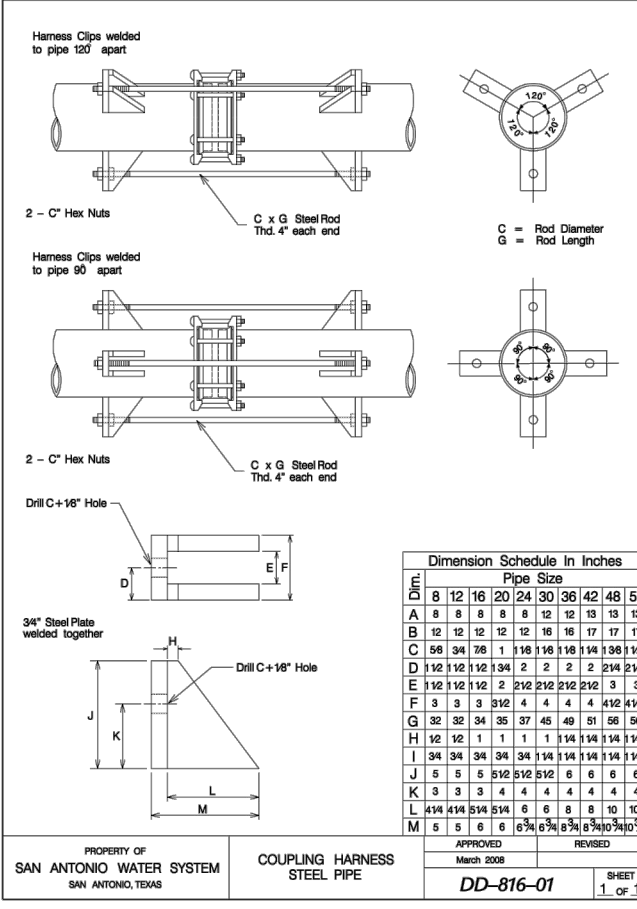
University Pump Station		
Disconnect Template		
Structural	Description	Value
MANUFACTURER	Manufacturer	
MODEL	Model	
SERIAL NUMBER	Serial	
Name Plate	Description	Value
CAT. NO.	CAT. #	
F.L. AMPS	FULL LOAD AMPS	
PHASE	Phases	
VOLT	VOLTAGE	
For: Disconnect, MCC, Incoming		

University Pump Station		
Instrumentation Template		
Structural	Description	Value
MANUFACTURER	Manufacturer	
MODEL	Model	
SERIAL NUMBER	Serial	
Name Plate	Description	Value
Scale	x to y	
UOM	ft, gal, mgd, %, ect.	
For: Flow, Level, Pressure and Temperature		

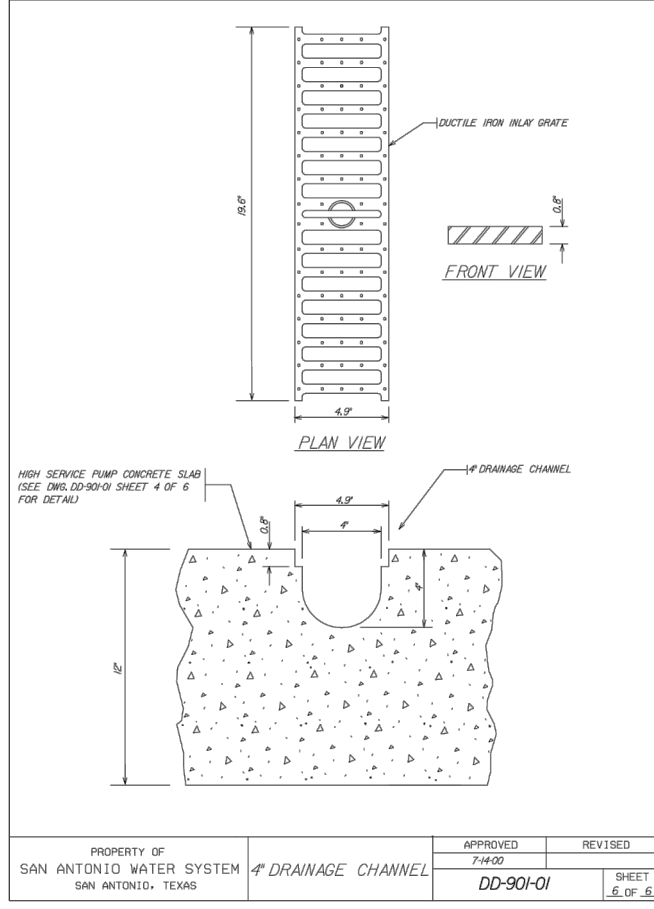
University Pump Station		
Electric Motor Template		
Structural	Description	Value
MANUFACTURER	Manufacturer	
MODEL	Model	
SERIAL NUMBER	Serial	
Name Plate	Description	Value
CODE:	Code	
DUTY		
F.L. AMPS	FULL LOAD AMPS	
FRAME	Motor Frame	
H.P.	Horsepower	
HZ	Hertz	
INSULATION	INSULATION CLASS	
LOWER BRG	LOWER BEARING	
ROTOR BARS		
RPM	Revolutions per Minute	
SERVFACT	Service Factor	
SHAFTSIZE		
STATOR SLOTS		
TYPE/STYLE	Type or Style	
UPP END BR	UPPER END BEARING	
PHASE	Phases	
VOLT	VOLTAGE	

University Pump Station		
Pump Template		
Structural	Description	Value
MANUFACTURER	Manufacturer	
MODEL	Model/ Category Number	
SERIAL NUMBER	Serial	
FLOW	GPM	
TDH	Total Dynamic Head	
DISCHARGE	Discharge Size	
Name Plate	Description	Value
IMP DIA	Impeller Size	
VOLT	Voltage	
PHASE	Phases	
HP	Horse Power	
For: Centrifugal, Turbine, Self-Priming		

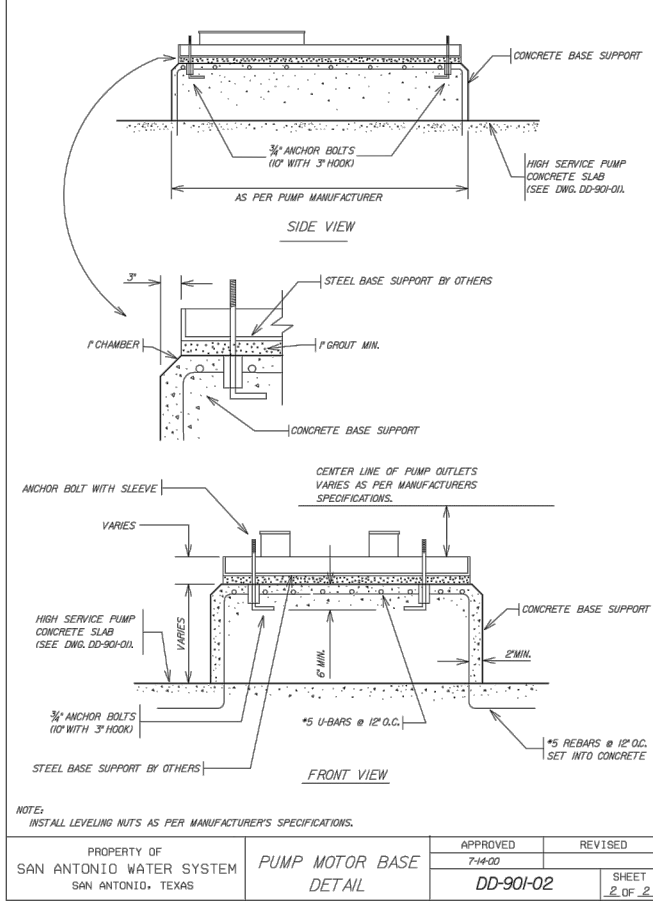
University Pump Station		
Switchgear Template		
Structural	Description	Value
MANUFACTURER	Manufacturer	
MODEL	Model	
SERIAL NUMBER	Serial	
Name Plate	Description	Value
CAT. NO.	CAT. #	
DIAGRAM	DIAGRAM #	
F.L. AMPS	FULL LOAD AMPS	
HP/LOAD	HORSEPOWER/LOAD	
HZ	Hertz	
POWER FU	POWER FUSE CAT #	
VOLT	VOLTAGE	
MS HP	Motor Starter Horse Power	
MS MANUF	Motor Starter Manufacturer	
MS NEMA	Motor Starter NEMA Size	
MS PHASE	Motor Starter Phases	
MS VOLT	Motor Starter Voltage	
For: Switchgear, Disconnect, MCC, Incoming		



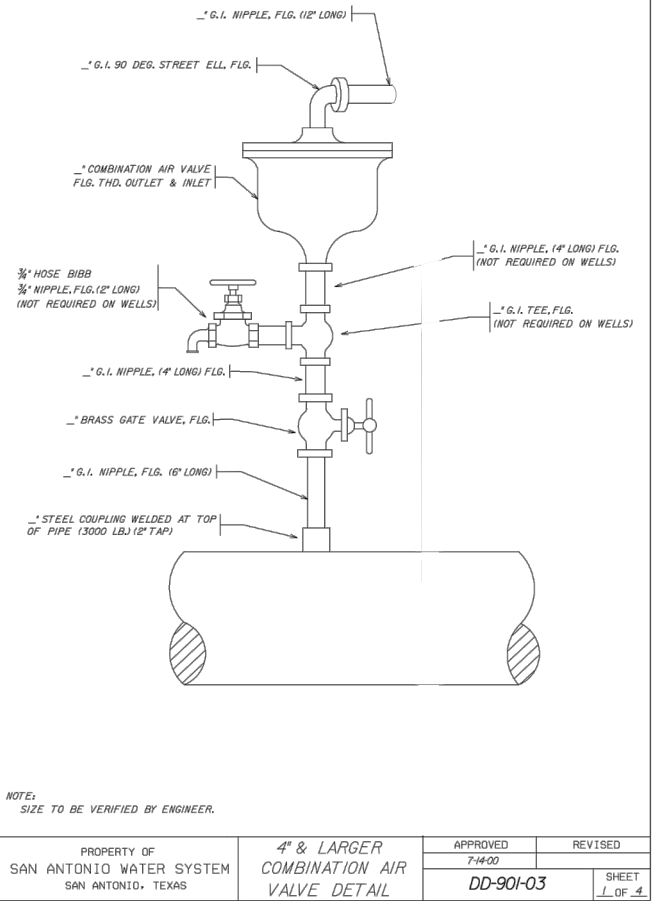
1 - COUPLING HARNESS STEEL PIPE
N.T.S.



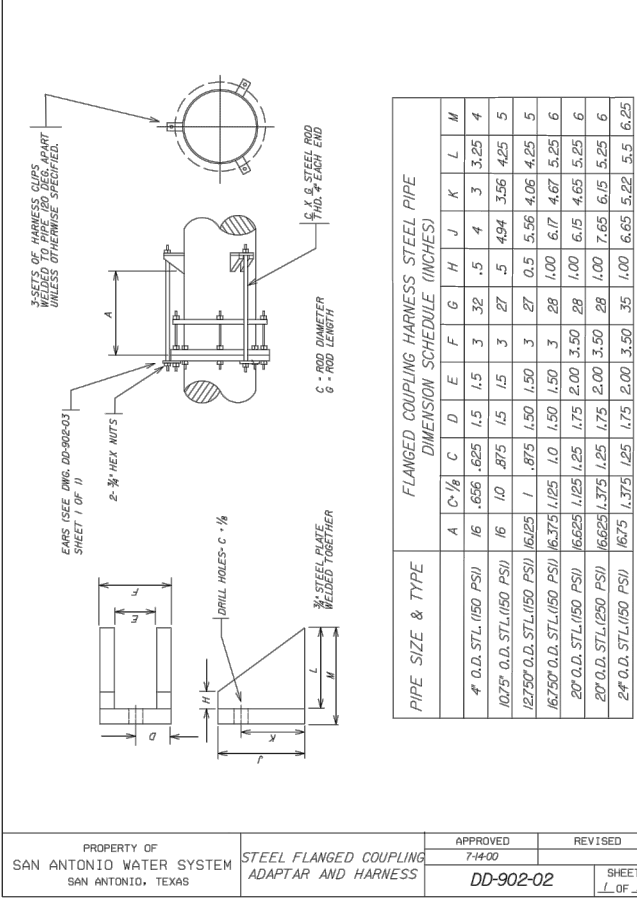
2 - 4" DRAINAGE CHANNEL
N.T.S.



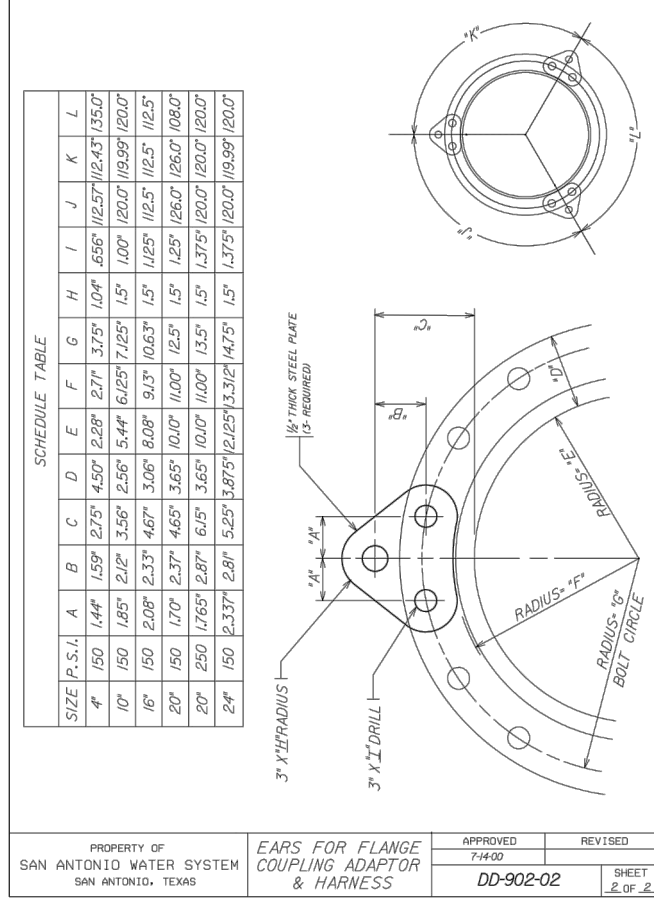
3 - PUMP MOTOR BASE DETAIL
N.T.S.



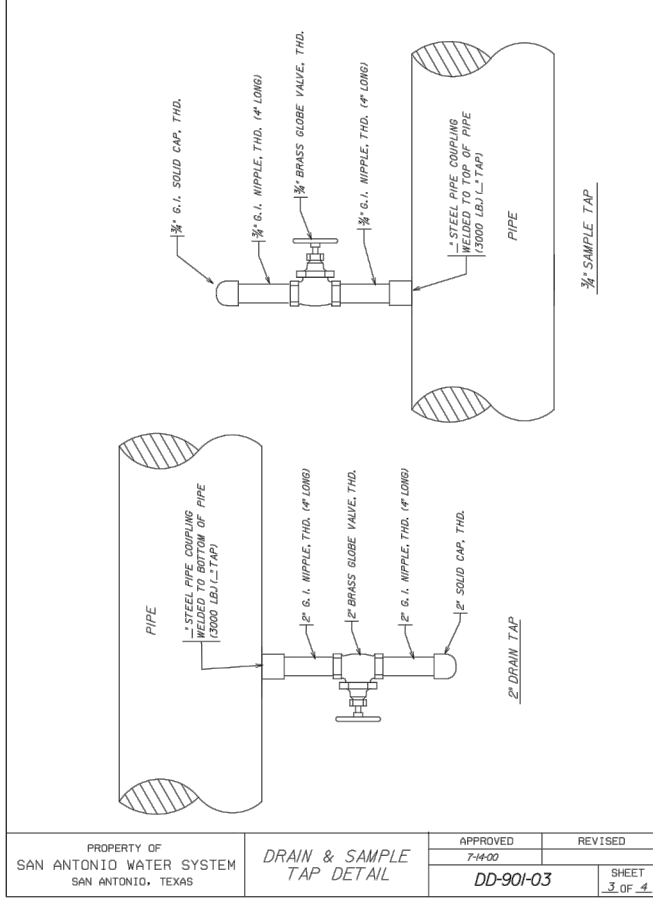
4 - 4" & LARGER COMBINATION AIR VALVE DETAIL
N.T.S.



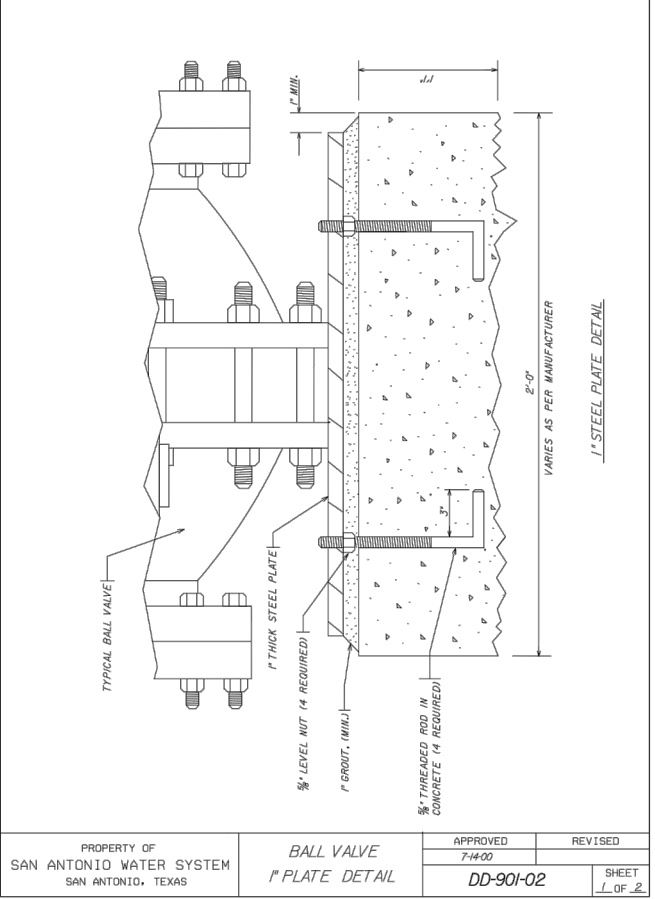
5 - STEEL FLANGED COUPLING ADAPTOR & HARNESS
N.T.S.



6 - EARS FOR FLANGE COUPLING ADAPTOR & HARNESS
N.T.S.



7 - DRAIN & SAMPLE TAP DETAIL
N.T.S.



8 - BALL VALVE 1" PLATE DETAIL
N.T.S.

App. DIB

Revisions

Date 3/10/14

No. 3

ADDENDUM NO. 3

Freese and Nichols, Inc. Texas Registered Engineering Firm F-2144

DAVID T. BENNETT

101935

03-12-14

SWB12322

Date: 01/22/14

Designed by: DIB

Drawn by: NC

Checked by: RLC

Scale: N.T.S.

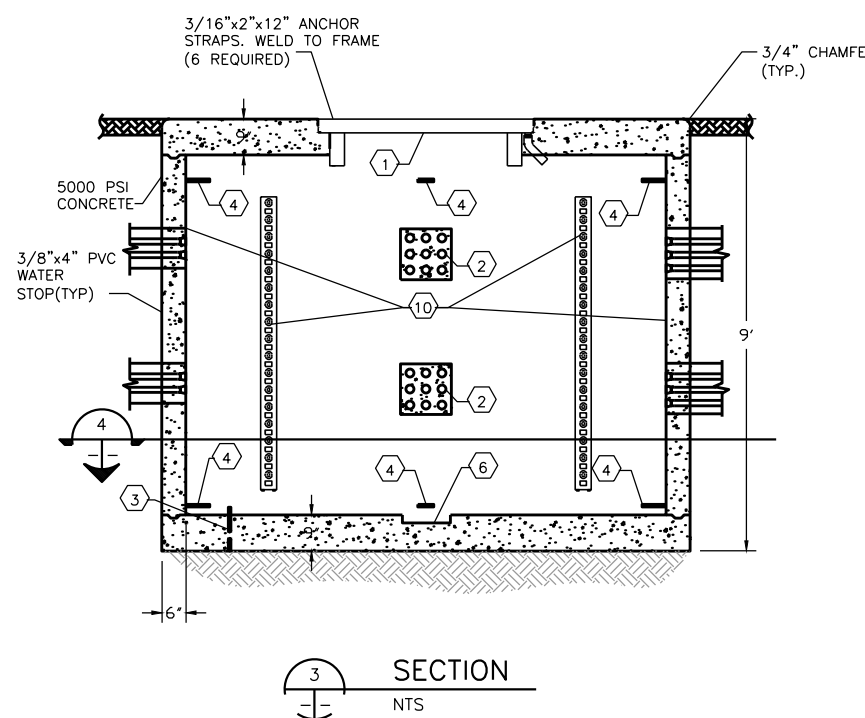
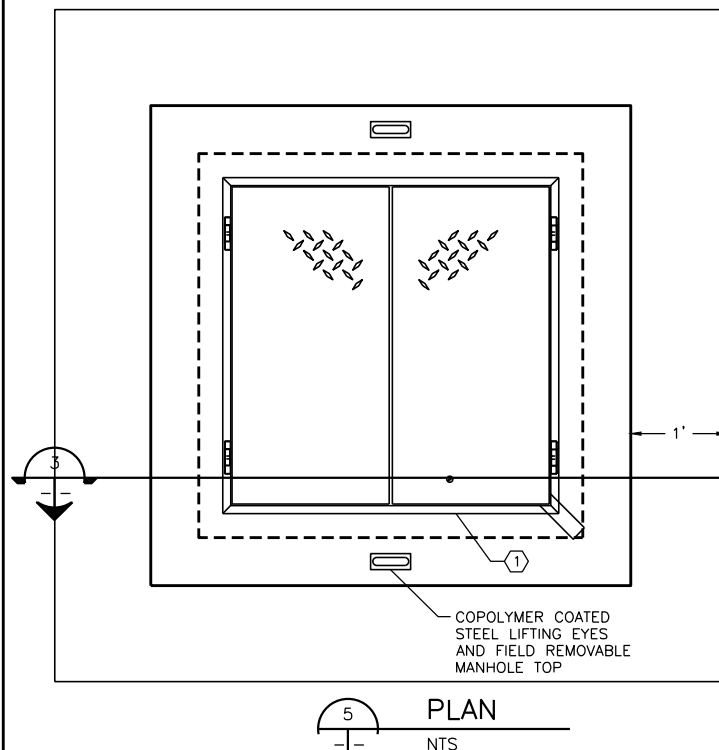
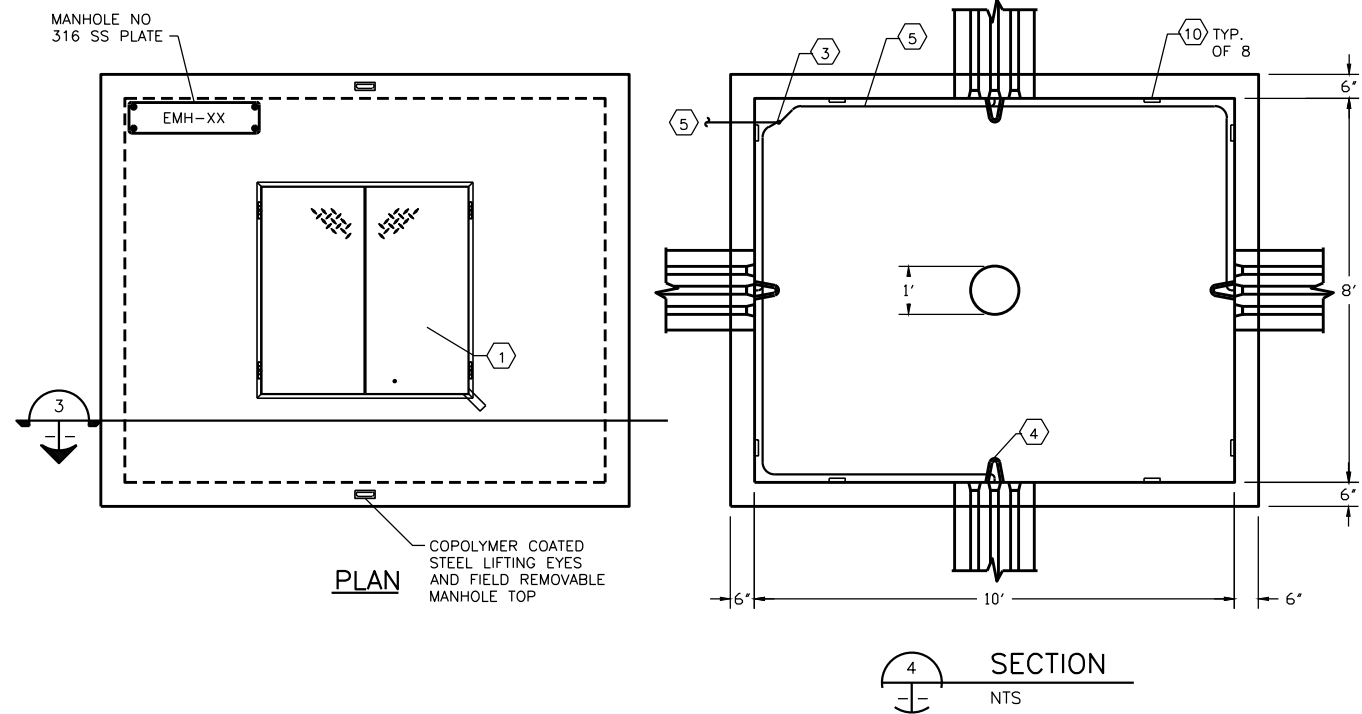
Freese and Nichols, Inc. 4040 Broadway Street, Suite 600 San Antonio, Texas 78209-6350 Phone - (210) 298-3800 Fax - (210) 298-3801

SAN ANTONIO WATER SYSTEM

SAWS JOB NO. 12-6002

UNIVERSITY PUMP STATION IMPROVEMENTS PROJECT

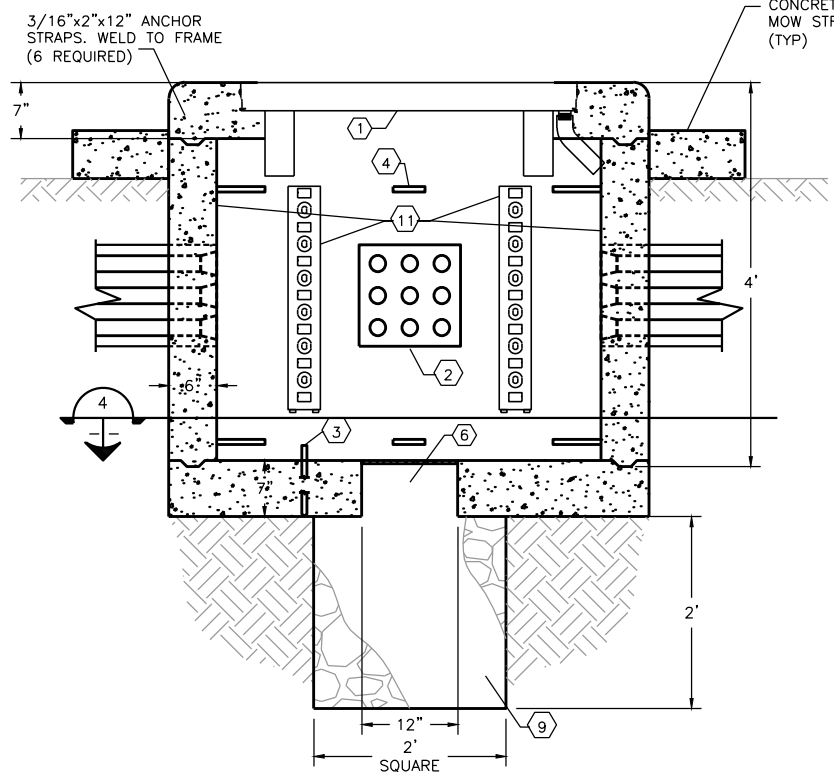
MISCELLANEOUS DETAILS



- NOTES BY SYMBOL "⊠":
1. MANHOLE COVER SHALL BE AS SPECIFIED, AND SHALL BE STAMPED ELECTRICAL OR COMMUNICATION AS REQUIRED BY CONTRACTOR.
 2. ALL CONDUITS SHALL BE TERMINATED IN MANHOLE WITH BELL ENDS AND CENTER ON THE ENTERING WALL.
 3. 3/4"Ø X 10'-0" STAINLESS STEEL (ONLY AT TRA, COPPER CLAD STEEL OTHERWISE) GROUND ROD.
 4. PROVIDE PULLING IRONS AS SPECIFIED.
 5. #4/0 BARE STRANDED TINNED COPPER CONDUCTOR TO MAIN GROUND GRID.
 6. MANHOLES SHALL BE EQUIPPED WITH 12" DEPRESSION.
 7. MANHOLE EXTENSIONS SHALL BE USED WHENEVER BOX IS BELOW EXISTING GRADE.
 8. ANCHORS SHALL BE 316 SS OR FIBERGLASS AS SPECIFIED.
 9. MANHOLE SHALL BE 12" ABOVE GRADE WHEN LOCATED IN GRASSY AREAS, CONTRACTOR SHALL PROVIDE A 12" MOW STRIP 6" TALL AROUND MANHOLE.
 10. MOUNTING RACKS SHALL BE AS SPECIFIED.
 11. REFER TO SPECIFICATION 16600 "UNDERGROUND SYSTEM" FOR ADDITIONAL INFORMATION.

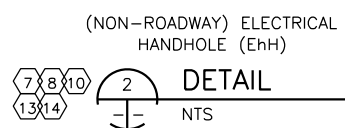
THESE MANHOLE DETAILS SHALL ONLY BE USED FOR 5KV & 15KV SYSTEMS

(NON-ROADWAY) ELECTRICAL MANHOLE (EMH)



- NOTES BY SYMBOL "⊠":
1. HANDHOLE COVER SHALL BE AS SPECIFIED, AND SHALL BE STAMPED ELECTRICAL OR COMMUNICATION AS REQUIRED BY CONTRACTOR.
 2. ALL CONDUITS SHALL BE TERMINATED IN HANDHOLE WITH BELL ENDS AND CENTER ON THE ENTERING WALL.
 3. 3/4"Ø X 10'-0" STAINLESS STEEL (ONLY AT TRA, COPPER CLAD STEEL OTHERWISE) GROUND ROD.
 4. PROVIDE PULLING IRONS AS SPECIFIED.
 5. #4/0 BARE STRANDED TINNED COPPER CONDUCTOR TO MAIN GROUND GRID.
 6. HANDHOLES SHALL BE EQUIPPED WITH 12" SUMP OPENING.
 7. HANDHOLE EXTENSIONS SHALL BE USED WHENEVER BOX IS BELOW EXISTING GRADE.
 8. ANCHORS SHALL BE 316 SS OR FIBERGLASS AS SPECIFIED.
 9. TO BE FILLED WITH PEA GRAVEL.
 10. HANDHOLE SHALL BE 12" ABOVE GRADE WHEN LOCATED IN GRASSY AREAS, CONTRACTOR SHALL PROVIDE A 12" MOW STRIP 6" TALL AROUND HANDHOLE.
 11. MOUNTING RACKS SHALL BE AS SPECIFIED.
 12. SHALL BE PLASTIC GRATE.
 13. HANDHOLES SHALL BE EQUIPPED WITH SUMP.
 14. REFER TO SPECIFICATION 16600 "UNDERGROUND SYSTEM" FOR ADDITIONAL INFORMATION.

(NON-ROADWAY) ELECTRICAL HANDHOLE (EhH)



App.	ER	Freese And Nichols, Inc. Job No.
Revisions		SWB12322
Date	3/10/14	ADDENDUM NO.3
No.	1	



Date: 03/10/2014
 Designed by: MA
 Drawn by: JH
 Checked by: VKG
 Scale: N.T.S.

GAI
 Gupta & Associates, Inc.
 consulting engineering
 Registration No. F-2993
 13460 Camino Real, Suite 200
 San Antonio, TX 78258
 Tel: 972-992-7661
 Fax: 972-992-7123
 Email: info@gaiengineering.com

Freese & Nichols
 4040 Broadway Street, Suite 600
 San Antonio, TX 78209-0550
 Tel: 210-298-2500
 Fax: (210) 298-2501
 Email: info@freeseandnichols.com

SAN ANTONIO WATER SYSTEM

SAWS JOB NO. 12-6002
 UNIVERSITY PUMP STATION
 IMPROVEMENTS PROJECT
 ELECTRICAL
 STANDARD DETAILS - V

SAN ANTONIO WATER SYSTEM
University Pump Station Improvements Project
Project No. 12-6002
Solicitation No. B-14-002-DD
Mandatory Pre-Proposal Meeting and Site Visit
February 28, 2014 at 10:00 a.m.
SAWS Customer Service Building, Conference Room 137

NOTE: THE PRE-PROPSAL MEETING NOTES ARE PROVIDED FOR REFERENCE ONLY AS FOLLOWS:

Introduction

- The meeting was Facilitated by: Diana Dwyer (SAWS Contract Administrator), Juan Rodriquez (SAWS Project Engineer), and David Bennett (Freese & Nichols).
- This is a mandatory pre-proposal meeting and site visit. Only those firms represented at the meeting by signing in on the sign-in sheet and initialing at the site visit may submit as a prime contractor for this project.
- Estimate construction cost is \$4,450,000.
- Calendar days for this project are 540 for substantial completion and 570 for final completion. (Note: This was changed per Addendum No. 3 to be 600 calendar days for final completion.).
- If you have not done so already, please register through SAWS Vendor Registration Program on the SAWS website at www.saws.org to ensure access to the latest information including the posting of Addendums.
 - 2 Addendums have been issued to date.

Texas Water Development Board (Tier III) Funding Requirements

- This project will receive funds from the Texas Water Development Board.
- Additional TWDB forms will be required, please reference the Proposal Checklist.
- Respondents should review and be familiar with the following documents within the specifications:
 - TWDB Supplemental Conditions
 - Wage and Labor Standard Provisions
 - DBE-0210 Guidance Manual
 - SAWS Frequently Asked Questions
 - Wage Decisions

Certified Payroll

- One aspect of TWDB funding includes certified payroll, which is required for this project.
- The selected contractor will be required to submit payroll through the Labor Compliance Program using the LCP Tracker software on a weekly basis within 7 days of work week ending through their website.
- Contractor must determine job classification for each subcontractor and employee and pay accordingly.

- Contractor is required to post Department of Labor wage decisions at the job site.
 - SAWS and TWDB will conduct interview with subcontractors and employees at the job site. Interviews are private and confidential.
 - Please ensure subcontractors and employees know their job classification.
 - Site visits are random and unannounced.
- The prime contractor is responsible for payroll submission regardless of the tier.

Evaluation Process (*found on page SIR-1 of the Supplementary Instructions to Respondents*)

- This project is being procured through an alternative delivery method, specifically, Request for Competitive Sealed Proposal (RFCSP).
- SAWS will use the evaluation criteria outlined on page SIR-1 to select the contractor that will provide the best value to SAWS:

Proposal Packet Preparation

- In order to submit a proposal for this project, it is a requirement that Respondents have previous experience as outlined in Section B, on page SIR-1 of the Supplementary Instructions to Respondent.
- Respondents should ensure that the proposals submitted address each item requested by SAWS on pages SIR-1 through SIR-4.
 - Failure to do so may result in reduced points or a non-responsive proposal.
- Responses should be project specific, whenever possible. “Boilerplate” responses are not recommended.
- References provided to SAWS must include valid contact information previously verified by the Respondent.
- Please note Addendum 1 included a revised Price Proposal. YOU MUST USE THIS ONE. (NOTE: Addendum 3 includes a revised Price Proposal. Contractor to use this version.)
- Addendum 3 will included a revised Proposal Checklist. As an acknowledgement of Pollution Abatement Compliance form was not included.

Small Minority and Women-Owned Businesses (SMWB)

- The aspirational SMWB goal for this project is 17%.
- However, since this is a RFCSP, each Respondent’s Good Faith Effort Plan (GFEP) will be scored based on the criteria outlined on pages, SIR-3 thru SIR-4 of the Supplementary Instructions to Respondents.
 - Failure to do so may result in reduced points or a non-responsive proposal.
- Questions re: SMWB may be addressed by Marisol Robles. Her contract information is located below.

Proposal Packet Preparation

- Utilize the Proposal Checklist included within the specifications when preparing the proposal. This will ensure that all required information and necessary documents are included.
 - And, that documents in the copies are not included.

- Price Proposal is lump sum with allowances. However, it does include 10% mob/demob. Double check your final numbers.
- SAWS requires one (1) original and seven (7) copies along with a CD of the original (excluding the financial statement and price proposal).
- Proposals should not exceed 50 pages. This page limit does not include required forms such as the table of contents, financial statement, GFEP, price proposal and any other required documents.
- Proposals should be sent in a box or large envelope with the price proposal included in a completely separate envelope.

Additional Contract Requirements

- Review Section 5.7 of the General Conditions for insurance requirements, which will include Pollution Liability and Builder's Risk.
- Review Supplemental Conditions for this project that include an explanation of rental rates as it relates to change orders and defines substantial completion.
- Review Special Conditions
- Liquidated damages for this project are \$1000.00 a day.

Questions Regarding Submittals

- Questions regarding the SMWB Program, the Good Faith Effort Plan or any DBE forms, may be sent directly to SAWS Program Manager, Marisol Robles up until the submission deadline.
 - Her email address is Marisol.Robles@saws.org and her phone number is 210-233-3420.
- All other questions should be sent in writing to Diana Dwyer by email or fax no later than **Friday, March 7 by 4:00 p.m.**
 - Diana's email address is Diana.Dwyer@saws.org and her fax number is 210-233-5218.
- Addendum #3 will be posted **Wed. March 12**
- Contractors should not contact the SAWS project engineer, the consultant for this project or any other SAWS staff up until Board award.

Proposal Deadline

- The deadline for submitting proposals is **Tuesday, March 18, 2014 no later than 2:00 p.m.**
- Late proposals will not be accepted and will be returned unopened.
- If mailing proposals, ensure that sufficient time is allowed for the package to reach SAWS.
- If proposals will be delivered in person to SAWS, Respondents should allow sufficient travel time, as well as time to check in at the guard station.

Project Overview and Additional Discussion Items

- The project scope as outlined in the RFCSP advertisement was reviewed. The scope of work includes:
 - Construction of a new ten (10) million gallon per day (MGD) high service pump to supplement the current pump capacity to the station. Work shall include, concrete foundation slab, piping, valves, flow meter and other related appurtenances.

- Demolition of existing electrical building, electrical equipment, low and medium voltage wiring, SCADA controls, and other related appurtenances related to this work.
- Construction of new electrical building to contain new and existing electrical equipment, MCC's, switchgear, power panels, security, SCADA controls and other related appurtenances.
- Installation of monopole antenna tower for SAWS Information System (IS) communication system.
- Replace existing electrical low and medium voltage wiring, CPS transformer, and other related electrical appurtenances.
- Replace existing valves at various locations, two (2) vertical pump motors, and other related water appurtenances.
- Construction of new concrete pavement driveway, automatic gate, frontage fence and gate replacement, site security, lighting, and other related appurtenances.
- Critical Items for the project include:
 - Pump station must remain operational at all times.
 - Shut-downs must be planned and coordinated for low-demand time of year as required per the specifications.
 - Coordination with Hausman Road construction.
 - On-site security guard will be required per Addendum #1.
- The geotechnical report is included in Appendix D of the Contract Documents and is provided for reference only.
- Contractors are reminded to review the TWDB Supplemental Conditions and review Section B of the SIR to ensure your firm is qualified to submit.

Questions during the Meeting

1. Question: Can contacts for the Hausman Road Contractor be provided?
Answer: All communication with the Hausman Road Contractor will need to go through the SAWS' Inspector.
2. Question: Who will be the SAWS Inspector?
Answer: The SAWS inspector is Michelle Pfeil.
3. Question: Can clarification be provided for on-site storage of materials?
Answer: The Contractor may store materials on site within the designated Contractor's Staging Area as shown on sheet C-2 and per requirements stated in General Note #3, Sheet C-2.
4. Question: Can requirement for street cut permits be clarified?
Answer: CoSA ROW permit will be required for site improvements along the Hausman Road ROW. Street cut permits may not be required, but are included in contract documents "as required" if needed for the construction.

5. Question: Can SAWS provide approved security guard companies?

Answer: The only approved security provider is US Security Associates.

6. Question: Can clarification be provided for the antenna tower foundation?


Answer: The antenna tower (monopole) base and foundation design is to performed by the Contractor per Specification Section 13515, 2.12.B.

Sign-In Sheet

Mandatory Pre-Proposal Meeting
 San Antonio Water System (SAWS) University Pump Station Improvements Project, Job No. 12-6002
 Solicitation No.: B-14-002-DD
 February 28, 2014 at 10:00 a.m.

	Print Name	Respondent's Initials for On-Site Visit	Company	Address	Phone	Fax	E-mail	Contractor Type
1	Kevin Little	KL KL	WEBBER	4242 Medical Dr. SA, TX.	832- 702-6093	281- 442-5910	Klittle@wwebber.com	<input checked="" type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
2	Anthony Bonacorsi	AB AB	Webber	4242 Medical Dr. SATX	210-612- 9192	281-442 5910	Anthony.Bonacorsi@ wwebber.com	<input checked="" type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
3	JOSE K. Campos	JK JK	WEBBER	4242 MEDICAL DR. SUITE 1200, SAN ANTONIO TX 78229	832-349 -0382		JOSE.CAMPOS@ wwebber.com	<input checked="" type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
4	SOHAIL SHAKIL	SS SS	WEBBER	4242 MEDICAL DR. SUITE 1200 SA TX 78229	832-302- 5798		Sohail.Shakil@ wwebber.com	<input type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
5	Luis Chaparro	LC LC	SgD	1077 Central Parkway South suite 200 SA, TX 78232	210-805-5472		luis.chaparro@ schneider-electric.com	<input type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
6	ROD LUNKWITZ	RL	ARCHER WESTERN	1411 GREENWAY DR IRVING, TX	975038	972.457.8501	rlunkwitz@ walshgroup.com	<input checked="" type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
7	Mike Watson	MW	Pepper Lawson Waterworks	3701 Kirby Dr, suite 1133 Houston TX 77098	866-536-7992	866-265-6220	waterworksbid@ pepperlawson.com	<input checked="" type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
8								<input type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
9								<input type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier

	Print Name	Respondent's Initials for On-Site Visit	Company	Address	Phone	Fax	E-mail	Contractor Type
10	MIKE PAWTER		MGC CONTRACTORS	223 LUCINDA DR NEW BRAUNFELS TX 78130	210-694 0565	602 470 4000	TXBIDS@ MGCCONTRACTORS. COM	<input checked="" type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
11	KIRBY ANDERSON							<input checked="" type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
12	John Miller	GKM	BSE	2727 N St. Mary's 78212	210 735 1051	735-1646	John@bistateelectric.com	<input type="checkbox"/> General Contractor <input checked="" type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
13	Nelson Froboese	NF	Alterman	SAN Antonio TX 1407 Jones Mottsboegen	210-510-8150		NFroboese@ GO Alterman.com	<input type="checkbox"/> General Contractor <input checked="" type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
14	Weldon MAHAN		Prime Controls	144 Windy Meadows Dr. Schertz - 78154	214-277-2400		Wmahan@PrimeControls.com	<input type="checkbox"/> General Contractor <input checked="" type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
15	Diana Dwyer		SAWS	2800 U.S. Highway 281 N. 78212	210- 233- 3372	210-233- 5218	diana.dwyer @saws.org	<input type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
16								<input type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
17								<input type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
18								<input type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
19								<input type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
20								<input type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier

	Print Name	Respondent's Initials for On-Site Visit	Company	Address	Phone	Fax	E-mail	Contractor Type
21	Charles L Hazlewood	CLH	Shannon-Monk, Inc.	10030 BRAUN Rd. SAN ANTONIO TX 78254	O-210-688-9461 C-210-269-7192	210-688-7275	chazlewood@shannon-monk.com orcwanke@shannon-monk.com	<input checked="" type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
22	Jamie Vickers	JV	Cunningham Constructors & Associates	P.O. Box 69 Walburg TX 78623	O (512) 863-2131 F (512) 869-0728	(512) 869-0728	jvickers.cca@gmail.com dporter.cca@gmail.com	<input checked="" type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
23	WAYLAN SIMMONS		LAMBDA CONSTRUCTION I, LTD.	211 SEBSE'S CIRCLE NEW BRAUNFELS TX 78132	O (330) 677-5880 C (210) 601-6891	330-677-1557	waylanesatx.ir.com	<input checked="" type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
24								<input type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
25								<input type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
26								<input type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
27								<input type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
28								<input type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
29								<input type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier
30								<input type="checkbox"/> General Contractor <input type="checkbox"/> Sub-Contractor <input type="checkbox"/> Supplier

QUESTIONS AND ANSWERS

1. **Question:** I have looked thru the contract documents and cannot find a physical address listed for the Pump Station. Can you please point me in the right direction if it is in the documents and I have overlooked it? If not, can you please include it so the bond and insurance companies can accurately quote the project.

Answer: The project address is 7098 W Hausman Rd, San Antonio, TX, 78249.

2. **Question:** Is this pump station on the waste water side? Or the clean water? Emerson has our Ovation operating at the Waste Water Treatment Plants and we would like to be allowed to provide a quotation. The purpose of this quote information would be to save SAWS money.

Answer: The University Pump Station pumps potable water.

3. **Question:** I work for a 100% solids high performance epoxy coatings company named Warren Environmental. My supervisor was forwarded a link to this project and I was wondering if there was actually any high performance work to be done, and if there is how much there might be. I could not see from the description on the site if there was any coatings work. It looks to be a big job and was hoping you could provide some help.

Answer: All of the existing piping and pumps are to be recoated, as well as the new piping and pump. See Addendum No. 3, Part 3, #2.

4. **Question:** Concerning the referenced project Invitation for Competitive Sealed Proposals, please clarify the following in the next addendum:
Cantilever Sliding Gates: Specification Section 02829/2.02.A specifies operators for a 20' Gate. Drawings Sheet C-3 requires 25' gate openings. Please clarify if gate operator size should be increased (and provide a corrected model number) or if gate openings should be decreased.

Answer: The specification has been revised. See Addendum No. 2, Part 1, #1.

5. **Question:** In review of section 11210 for the Horizontal Split Case Pumps We have reviewed the specification and requested the following revisions. Please let me know if there are any questions on the comments and when we could see an addendum. This specification review was actually completed some months ago but I was not certain if it had already been reviewed on your end.

Answer: SAWS and Consultant has received and reviewed the recommendations provided by the recipient; however, the project shall proceed as per plans and specifications.

6. **Question:** I didn't see the specs on the fabricated steel pipe, will you be posting them on the website?
- Answer:** See SAWS Standard Construction Specification 816 for steel pipe installation and SAWS Standard Material Specification for Steel Pipe. All SAWS Standard Specifications are referenced in the table of contents as a part of the contract documents.
7. **Question:** System Controls & Instrumentation (SCI) respectfully requests to be added to the approved Process Control System Integrator (PCIS) list for the SAWS University Pump Station Improvements project, if you have any questions please don't hesitate to contact me.
- Answer:** System Controls & Instrumentation will not be added to the specifications for this project.
8. **Question:** RLC Controls, Inc. would like to submit a qualifications package to become an approved PCSI as stated in section 13300-8 for the University Pump Station Project. RLC Controls is highly qualified to perform as the PCSI and has done so on other SAWS projects. RLC Controls, Inc. (Richardson Logic Control) has been an approved PCSI for every project that has come out at SAWS for over the last 2 years. We were an approved PCSI for the SAWS Naco Pump Station Project that just bid last week. So are hoping this is just an oversight. We will be working at SAWS providing the (PCSI) SCADA and Instrumentation for the SAWS Dos Rios Digester Mixing Project No. 11-6502 and have worked with SAWS in the past on the Interconnect Flow Control Project. RLC has been in business for over 20 years providing Process Control Systems Integration and would like to be considered for this project. Please let me know if SAWS will accept a qualifications package for consideration. If so – I will send over ASAP.
- Answer:** RLC Controls, Inc. will be added to the specifications for this project, See Addendum No. 3, Par 2, #5.B.
9. **Question:** Hope all is going well. I apologize for the large email but Siemens is not listed as approved manufacturer in any of the sections on this project and we would like the opportunity to be able to quote. I suspect that Siemens was inadvertently omitted and is acceptable to GAI since all the other manufacturers are listed and the work we have done together in the past. We are extremely acceptable to the San Antonio Water System and have a large installed base with them. I do apologize again but our contractors do require us to provide them a formal approval. We appreciate your response via email and this may include allowing us approval on specific items below. We also request that you please include approval in an addendum. If there is some particular reason why Siemens was not approved, I would also greatly appreciate you letting me know that as well so

that I may directly address and as always I do appreciate you allowing me to assist GAI and yourself on these projects. In accordance with the prior approval clause in the specifications, we respectfully submit the following items for acceptance to bid on the above project. Documentation is provided for each series listed. Individual catalog numbers have not been identified due to complexity of project. We understand that all products are subject to shop drawing review and exact items in each product type will be identified at that time for project compliance.

Section 16195 Power Meters

Siemens "Siprotec" Series Protective Relays and Siemens "9610" Power Quality Meter, with all required options. Units will be provided with all ratings, types, options and accessories as specified. Product literature is attached.

Section 16345 Medium Voltage Metal Clad Switchgear

Siemens "GMSG" Series with all required options. Units will be provided with all ratings, types, options and accessories as specified. Product literature is not attached but can be sent in separate email if requested do to size.

Section 16430 Padmount Transformers

Siemens with all required options. Units will be provided with all ratings, types, options and accessories as specified. Product literature is not attached but can be sent in separate email if requested do to size.

Section 16461 Distribution Dry Type Transformers

Siemens "DTDT" series, with all required options. Units will be provided with all ratings, types, options and accessories as specified. Product literature is not attached but can be sent in separate email if requested do to size.

Section 16196 Low Voltage AC Surge Protective Devices

Siemens "TPS3" Series, with all required options. Units are UL1449 3rd Edition listed. Units will be integrally mounted type units per the drawings and application. Units will be provided with all ratings, types, options and accessories as specified. Product literature is attached.

Section 16470 Panelboards

Siemens "P" Series with all ratings, types, applications, and accessories as specified. Product literature is attached.

Additional features exceeding specified manufacturer's:

Siemen's panelboards standard design has bus bracing of 200,000 AIC. Panel is rated to lowest AIC of the breakers installed.

The following can be done to a Siemen's standard P1 panelboard in the field with no modifications:

- Change from top feed to bottom feed
- Add feed-thru lugs
- Add an integral bus-mounted SPD
- Add a sub-feed breaker up to 250 amps

- Change from Main Lugs to Main Breaker
- Change from Main Breaker to Main Lugs

Section 16475 Low Voltage Enclosed Circuit Breakers and Disconnect Switches:
Disconnect Switches: Siemens “VBII” Series with all ratings, types, applications, and accessories as specified will be provided. Product literature is attached.

Enclosed Circuit Breakers: Siemens “ECB” Series. Units will be provided with all ratings, types, options and accessories as specified. Product literature is attached. Siemen's molded case circuit breakers with all ratings, types, applications, and accessories as specified. Exact catalog numbers and types will be selected based upon the exact project requirements and specifications. *Product literature has not been sent but can if requested as the family of circuit breakers available to Siemens is extremely large and the file is 7MB.*

Section 16480 Low Voltage Motor Control Centers
Siemens “tiastar” series, with all required options. Units will be provided with all ratings, types, options and accessories as specified. Product literature is not attached but can be sent in separate email if requested do to size.

Section 16482 Medium Voltage Motor Control Centers
Siemens “Simovac” series, with all required options. Units will be provided with all ratings, types, options and accessories as specified. Product literature is attached.

Section 16487 Electrical Manufacturer's Provided Control Panels:
2.01 Material Manufacturers - Siemens Assembly with all required components including but not limited to the following:

Control Stations: Siemens “Class 52” Series 30MM devices s applicable for the application with all ratings and accessories as specified. Product literature is attached.

Control Relays: Siemens “Sirius” Series control, latching, time, or on/off delay type as required. Units will be provided with all ratings, types, options and accessories as specified.

2.06 Motor Controllers - Siemens "Class 14" Series magnetic motor starters as applicable for the horsepower rating and application with all accessories as specified. Product literature is attached.

Please let me know if request needs to be forwarded. If you have any questions concerning the attached request, please contact me.

Thanks very much for any consideration you provide us. We appreciate the opportunity to work with you on this project and with many projects in the future. If I can be of any assistance on this project or any other matter, please do not hesitate to call me anytime.

Answer: See Addendum No. 3, Part 2- Technical specification, # 8, 9, 10, 11, 12, 13, 14, 15, 16, and 17.

10. **Question:** Will the Excavation/Backfill/Construction of the Crawl Space (sheet C-3) and the Foundation Plan (sheet C-4) fall under the Heavy/Highway wage rates?

Answer: Yes. The prime contractor should reference the prevailing wage rates identified in the Heavy and Highway Wage Decision, Number TX140016, issued 1/3/14 included within the specifications when classifying the work of employees or subcontractors for all work performed as part of this project.

11. **Question:** Do you have a list of approved security companies for security personnel?

Answer: Contractor shall provide an armed security guard during all times that work is being performed on the site by Contractor or his subcontractors. The guard should be a commissioned guard from a SAWS Security approved security contractor. The only approved security provider is US Security Associates.

12. **Question:** Please provide a copy of the Device schedule from the specs, we noticed a special electronic electrode cleaning unit is needed and listed.

Answer: The device schedule is not required. See Addendum No. 3, Part 2- Technical specifications item number 6.D.

13. **Question:** We have the following request for spec change and/or clarification below:
Comments to Section 11210 noted below: Section 11210, Item 1.02: Acceptable Manufacturers are listed with Flowserve included. Flowserve does not have a selection. After review and to better meet conditions in the specification we would request that American Marsh be admitted as an acceptable manufacturer. American Marsh selection curve attached for SAWS and engineering review.

Answer: No additional pump manufacturers will be included.

14. **Question:** We have the following request for spec change and/or clarification below:
Comments to Section 11210 noted below: Section 11210, B. Pumping Conditions, Maximum Operating Head: We request a maximum operating head of 267 to be allowed.

Answer: The maximum operating head will remain at 240.

15. **Question:** General Note 3 on Drawing C-1 states that “no storage of materials shall be allowed” on site as the entire site is in the Floodplain. However, Drawing C-2 clearly indicates a Construction Staging Area with silt fence around the perimeter and General Note 3 states that “contractor shall store materials within the staging area at their own risk.” Considering that off-site materials storage, including demolished items and spoils,

could be very costly, please clarify these seemingly contradictory notes and identify the specific items, if any, may be stored on site.

Answer: The Contractor may store materials on site within the designated Contractor's Staging Area as shown on sheet C-2 and per requirements stated in General Note #3, Sheet C-2 BMP's to be installed in accordance with City and TCEQ requirements. Equipment may be allowed up to 180 days as long as the equipment is mobile during a storm event. Floodplain permit shall be required and will need to submit a grading plan and SWPPP.

16. **Question:** Please provide the Statement of Special Inspections for this project (Note 1 on S-2).

Answer: Special Inspections will not be required for this project. See Addendum No. 3, Part 3, #4.

17. **Question:** Please provide specification and thickness for rigid insulation between 4" Block and 12" CMU (various details on A-5).

Answer: See Specification 04220, Concrete Unit Masonry, Section 2.01.

18. **Question:** The Supplemental Condition to Article V. Contract Responsibilities, states the "contractor shall be responsible for all cost associated with" COSA ROW application, obtaining street cut permits as required and keep the permit active during the course of work. Please confirm these contract documents to not require any street cuts and therefore this paragraph is not applicable to this project. If this is an incorrect assumption please identify where "street cuts" are required.

Answer: CoSA ROW permit will be required for site improvements along the Hausman Road ROW. Street cut permits may not be required, but are included in contract documents "as required" if needed for the construction.

19. **Question:** Special Conditions SC-4, 5, and 11 place the responsibility of coordination with the Hausman Road expansion project and any other contractors within the project area, solely on the University Pump Station Improvements Project prime contractor. Please provide the appropriate contact information for each prime contractor or other entity responsible for the Hausman Road project and any other projects that are within our project area so we may ensure there are no impacts to the completion of this project.

Answer: All communication with the Hausman Road Contractor will go through the SAWS' Inspector.

20. **Question:** Special Condition SC-13 requires a “commissioned guard from a SAWS Security approved security contractor”. Please provide a list of approved contractors along with specific contact information.

Answer: See the response to Question #11.

21. **Question:** Spec 01030 indicates that all shut downs must not be performed between the months of March and October. Estimating a Notice to Proceed date sometime mid-summer the contract duration of 540 days to Substantial Completion does not provide contractor enough time to perform all shutdowns prior to 30-day Operational Test. For example, if NTP is 6/16/14 then Substantial Completion would be 12/8/15 and Operational Testing would need to begin on, or before, 11/8/15 which only allows 7 consecutive nights for all required shut downs. Please consider adding 90 days additional time to the contract, or NTP, so as to provide ample time to complete shut downs prior to Operational Test and Substantial Completion.

Answer: See revised Price Proposal in Addendum No. 3.

22. **Question:** Spec 01380-2.01F calls for two 24”x30” glossy photos for each photo selected by SAWS. What is the total number of 24”x30” glossy photos to be provided by the contractor?

Answer: See Addendum No. 3, Part 2, #2.

23. **Question:** Spec 01650-3.04A calls for 30-day Operational Test. Please confirm test is to be complete prior to Substantial Completion.

Answer: Per Specification 1650, Section 3.04.A, the 30-day Operational Test is a condition of Final Acceptance. The test is to be completed after Substantial Completion, prior to Final Completion.

24. **Question:** Spec 01650-3.04D states contractor shall be on site for 30 days operational test to assist in the operation and maintenance of the System. Please confirm if that is 24 hrs per day or only during normal construction hours, Monday thru Friday 7 to 4.

Answer: During the 30-day Operational Testing, the Contractor is required on site once per day or as conditions require.

25. **Question:** Have all existing isolation valves to be utilized for the Work been exercised and tested to confirm they are in good working order?

Answer: Existing valves are to be removed and replaced as a part of this Project. Addendum No. 4 will address this.

26. **Question:** It appears the Proposal Checklist is from a previous project as there are items under Background, Experience and Qualifications that do not apply to this project and are

not required in the Supplementary Instructions to Respondents. Please correct and re-issue the Proposal Checklist.

Answer: See Addendum No. 3 for the revised Proposal Checklist.

27. **Question:** Due to most underground conduit runs being short distances reducing potential pulling tension on cables is it acceptable to allow the use of PVC conduit bends up to 32 degrees, instead of the specified maximum of 20 degrees per 16110 – 3.02 B. 2.

Answer: The maximum bend allowed for underground PVC conduit shall be limited to 32 degrees, instead of specified maximum of 20 degrees per 16110-3.02 B.2.

28. **Question:** Section 16110 – 3.14 C. requires a minimum size of 2” for all underground conduit. Duct Bank Plan Sheets E – 06, E – 07 and E – 07A detail 1” conduit size for some underground conduit. Please advise.

Answer: It is acceptable to provide 1 inch conduits where shown on drawings, otherwise all other underground conduits shall be a minimum of 2 inch per Specifications #16110-3.14C.

29. **Question:** Please advise where electrical manhole (EMH) and electrical handhole (EHH) sizes are located within the project documents.

Answer: See new sheet EZ-05 issued under Addendum No. 3 Part 3, #12.

30. **Question:** On sheet ED-01 note 6, it tells me “approximate location of underground duct bank. Contractor shall demolish existing duct banks. Not all underground electrical duct banks are shown.” Do you want us to demo the wire in the conduit and remove conduit above ground to approximately 2 feet below ground or do you want us to completely remove the ductbank from the site. With that said if you haven’t listed or told us on the drawings, how are we supposed to figure this out without locations drawn on drawings.

Answer: See Addendum No. 3, Part 3, #10.

31. **Question:** On sheet E-22 detail 1 Pole Mounted Security Dish and CCTV Camera Detail. You are asking for a 3” diameter rigid schedule 40 galvanized steel pipe but on top of the pole where the camera is you are asking for a 2” galvanized cap. Please explain or is the cap the wrong size.

Answer: See Addendum No. 3, Part 3, #9.

32. **Question:** On sheet E-10, transformer Tx-2 doesn’t indicate the wire size for the transformer on the medium voltage side. Please size the wire and conduit.

Answer: See Addendum No. 3, Part 3, #6.

33. **Question:** On sheet E-18, EF-1 has a note #6 but there are no notes on the page to reference it. There are only 3 notes on the page. 1 – 3. Please verify.

Answer: See Addendum No. 3, Part 3, #8.

34. **Question:** On sheet E-11 there is a transformer that is called TX-4, but on sheet E-18 on the one line for the MCC-1, I think the transformer called TX-LB (30 KVA). Please verify. Same thing happens with Transformer TX-3, I think it is called on the one line as TX-LA. Please verify.

Answer: See Addendum No. 3, Part 3, #7.

35. **Question:** On sheet E-09, note 8, “all wires shall be cable tray rated.” This means any cable that enters the basement shall be cable tray rated. Should we have two different cable trays? One for the medium voltage cables and one for the low voltage and controls excluding the 4-20ma circuits. Should all the 4-20 ma circuits be in a conduit or a divider in the cable tray?

Answer: See Addendum No. 3, Part 3, #5.

36. **Question:** Can you clarify spec section 13310 2.01 H.3? There does not appear to be an instrument device schedule and cleaning electrodes are not shown on the drawings. We just want to confirm that these are not required.

Answer: See Addendum No. 3, Part 2, Item 6.D.

End of Questions and Answers