REQUEST FOR PROPOSAL
Request for Proposal Oro Hondo Drive Replacement & Motor Rebuild

RFP Posted:	September 15, 2017
Site Visit:	September 27, 2017 10:00 A.M. **(RSVP by September 22, 2017)**
Questions Posted	October 2, 2017 2:00 P.M.
Questions & Answers Posted:	October 5, 2017 2:00 P.M.
Proposal Due Date:	October 20, 2017 2:00 P.M.

The South Dakota Science and Technology Authority (SDSTA) is seeking proposals to install a new drive for the Oro Hondo Fan owned by Sanford Underground Research Facility, located in Lead South Dakota. Documents included in this Request for Proposal include:

A. Request for Proposal (RFP)
B. Draft contract (2017-33)
C. Division 1 Specifications
D. Bid Security Form (to be submitted with proposal)
E. Payment and Performance Bond Form (informational - to be submitted with contract)
F. Construction Quality Management Program link: https://www.sanfordlab.org/contractors-and-vendors/vendor-registration-guidelines

The Oro Hondo fan at Sanford Underground Research Facility (SURF) will need a significant rebuild to reliably support the Long-Based Neutrino Facility (LBNF). The major items of the rebuild that the contractor will be responsible for are:

1. Procurement of a new 3,000 HP variable frequency drive (VFD)
2. Rebuild of an existing 3,000 HP electric motor (bid as optional)
3. All engineering and logistics support required for these items
4. Complete installation of these items in a 13-day downtime window

More detailed specifications/requirements for this project can be found in the following sections.

1.0 Background

The primary exhaust ventilation for the SURF is provided by an American Davidson centrifugal, direct drive, variable speed fan currently powered by a 3000 HP synchronous motor. The fan is currently running at flows and speeds significantly less than the original design.

The fan was installed new by Homestake Mining Company in 1986. Since then, it has been shut down, the rotor has been cleaned, coated, balanced, bearings replaced, seal rings replaced, and ceramic coatings replaced to preserve the integrity of the steel. This was performed every 8 or 9 years until mine closure in 2002. Prior to starting the fan again in 2010, the fan underwent a significant rebuild. The motor was sent out to be cleaned and inspected plus bearings were replaced. The fan was taken apart with the impeller cleaned, ceramic coated, and balanced.
Since 2012 there have been numerous unplanned fan shutdowns. An unplanned shutdown means the fan shutoff/tripped from the drives internal electrical fault protection. As the underground lab

expands these shutdowns create larger problems for underground operations. To reliably exhaust air from the underground, a new drive will be purchased for the American Davidson fan and the fan's 3,000 hp motor may undergo servicing. The servicing of the motor (and all associated work) will need to be bid as an optional item for this project. This work is scheduled to happen as soon as possible.

Significant lead time needs to be allowed for procurement of the new drive. Once the new drive is on site, the contractor must plan for the most efficient fan shutdown possible to minimize American Davidson fan downtime to 13 days. To minimize the impact of this rehab to underground operations, the backup Spendrup fan (shown to the right in figure 1) will need to operate. Using the Spendrup for this project requires minor ductwork changes performed by SDSTA to isolate the Spendrup ducting from the American Davidson (since they share the same intake shaft). The ductwork transition takes 2 hours to complete. Once the Spendrup is running, the contractor will have 13 days to install the new drive and have the motor refurbished and reinstalled. It is important to note that while the Spendrup fan is running, projected noise levels at the worksite could reach 90 decibels. A photo of the Oro Hondo fan complex is shown in Figure 1 below.

FIGURE 1. ORO HONDO FAN COMPLEX

2.0 Project Information/Specifications/Requirements

The following sections provide additional information on the key aspects of this project. More detailed information can be found in the specifications sections.

2.1 Procurement and Installation of a new 3,000 HP VFD

For this project, the contractor will coordinate the efforts of the drive manufacturer and be responsible for the engineering and procurement of the drive along with all logistical support involved with delivering the drive to the worksite and complete installation and commissioning. Detailed specifications for the drive that will assist the manufacturer in the design process are listed in Appendix A. This drive must be compatible with the existing fan impeller & rehabilitated motor once installation is completed. The WR^2 for the impeller is 257,090 lb-ft^2 and listed in the drawing shown in Appendix C. The nameplate data for this motor is shown in Figure 4 and listed in the drive specifications.

Figure 2 Current 3,000 HP VFD

The current drive is housed in a small metal building just big enough to shelter the drive and provide mechanical access (Figure 2). The building is heated and insulated but it is not air conditioned. When the new drive is installed, it is up to the contractor to ensure the building environment (in all seasons) meets the minimum requirements specified by the drive manufacturer to maintain warranties.

There are no direct access doors to remove this drive. The contractor will be responsible for disconnecting the old drive, including any necessary removal of existing electrical conduits running to the motor room adjacent to this building (Figure 3) that can't be used with the new drive. The contractor will be responsible for the relocation of an existing PLC panel to an adjacent wall that is connected to the back of the drive (Figure 2). Without dictating means and methods, it may be necessary for the contractor to remove the roof of the drive building to lift the old drive out and set a new drive in its place. The contractor will take all reasonable precautions not to damage the existing roof during removal and reinstallation or should plan for replacement in kind. The contractor will be responsible for replacing conduit and conductors to connect the drive to the existing motor next door (following current electrical codes) as well as disposal of the old drive. All conduit runs must be rigid metal conduit that is supported by current electrical code.

Figure 3 Drive and Motor Building Locations

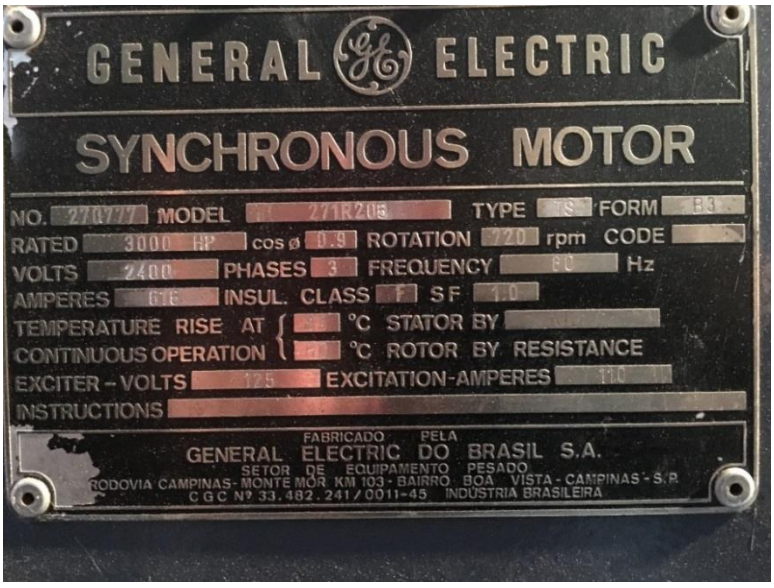


Figure 4 G.E. 3,000 HP Synchronous Motor Nameplate

2.2 Service/Repair of a G.E 3,000 HP Synchronous Motor (Must Bid as Optional)

The service/repair of the motor (including removal and reinstallation and all other associated work) needs to be bid separately as an optional item to this project. This work may be approved depending on pricing. A G.E 3,000 HP synchronous motor powers the Oro Hondo fan and is sheltered by the building shown in Figure 3 above. The motor building, like the drive building, is just big enough to provide mechanical access (Figure 5). To remove the motor, the roof of the building must be lifted off. Whenever the fan has undergone significant maintenance, this motor is serviced. Disconnecting the motor (mechanically and electrically), removing the roof & motor, sending the motor to the service shop, setting the motor back in place, and reconnecting the motor (mechanically & electrically) will be the responsibility of the contractor. The last time this motor was serviced was in 2010 by P&H Mine Pro Services (Joy Global). The motor service must include the following at a minimum:

- Test winding insulation
- Dismantle and inspect the motor
- Clean parts
- Steam clean stator/rotating poles/exciter and bake dry
- Perform electrical tests
- Measure and inspect all mechanical components/fits
- Replace motor bearings
- Ultrasonic testing of the shaft
- Dynamic balance rotating poles to G-2.5 specifications
- Assemble the motor
- Perform quality control checks
- Paint and detail

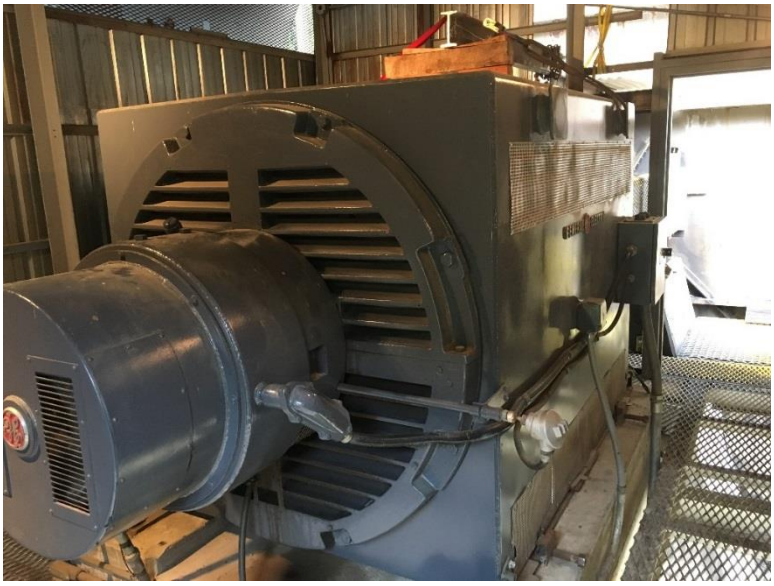


Figure 5 G.E. 3,000 HP Synchronous Motor

2.3 Anticipated Fan Operating Range

SDSTA has the original drawings for the American Davidson fan housing and motor/shaft assembly. The original fan curves and two construction drawings have been included in this RFP (Appendix B & C) to provide general information about the performance & size of the fan including the motor shaft, fan housing, and impeller diameter. A complete set of digital high resolution scans of the original construction drawings can be provided to the contractor post-award.

Once the new drive and rehabilitated motor are installed, the fan will need to produce 255,000 cfm @ 8.84 in. w.g which is listed as the current operation point in Table 1. The fan will run at the current operation point until additional improvements to the fan and underground ventilation path are made. Once ventilation path improvements are completed the required cfm for the underground will need to increase.

Based on the ventilation modeling and a design study, a future fan operational specification was developed for the Oro Hondo fan. The future fan operating point listed in Table 1 is based on the anticipated operating point (Design) of the fan with a second operating point comprising a 20% increase in airflow as a contingency. Table 1 below lists the anticipated operating range of the fan. Once installed, the drive will need to operate efficiently at these points when needed. The new drive must also be capable of supplying the motor with its full rated horsepower (3,000 hp) in the event substantially higher air flows are needed.

Table 1. Anticipated Fan Operating Range

	Operating Range				
	Design		20% Increase		
Scenario	Pressure (in. w.g.)	Airflow (cfm)	Pressure (in. w.g.)	Airflow (cfm)	Air Density
Current	8.84	255,000	-	-	0.062
Future	9.00	400,000	11.00	500,000	0.062

3.0 Proposal Requirements

Your proposal should be provided in digital format as a pdf file with standard letter size format. Please note there is a 30-page limit for your response to proposal requirements. Proposals must contain the following:

3.1 Contact information, including an email address, for the Contractor's designated contact person who can receive and distribute RFP information.

3.2 Contractor description and evidence of qualifications to address the scope described in this document. Provide three examples of projects performed that demonstrate the qualifications and competence for each of the disciplines/requested areas of expertise. Provide contact information for three client references.

3.3 Resumes for all key project staff to include:

- Experience with similar relevant projects.
- Qualifications, including training and certification.

3.4 Description of your management and communication process for working with SDSTA on this project. Provide a description of your safety program and quality control (QC) program (safety and QC manuals will not be included in the 30-page limit). Explain how your safety and QC programs will be implemented for this project.

3.5 Safety records for the past three years (incident/injury records, OSHA 300 logs and EMR data)

3.6 Exceptions to the draft contract or other RFP materials. Disclose any existing relationships and previous work with SDSTA/Sanford Lab.

3.7 Description of your company's approach to cost and schedule control. What tools do you use, and how do you communicate the information to the project team and client?

3.8 Work plan and schedule for completing all scope items in 2.1, including expected durations for tasks and relevant details that define your work process. Provide a separate work plan and schedule for the combined scopes in 2.1 and 2.2.

3.9 Provide a detailed fee proposal for services in 2.1 broken down by task as outlined in the work plan and schedule. Provide a separate fee proposal for the combined scopes 2.1 & 2.2.

with 2.2 scope of work clearly delineated.

3.10 Bid security for the scope in 2.1 must accompany the proposal if the bid exceeds $50,000 (as described in 4.8 below). Bid bond documents will not count against the 30-page proposal limit.

4.0 General Requirements

4.1 The selected Contractor will be required to abide by all applicable federal, state and local laws and ordinances, as amended for time to time. Including, but not limited to, the applicable local laws and ordinances.

4.2 The SDSTA may at its sole and absolute discretion reject any and all, or parts of any and all submissions; re-advertise this solicitation; postpone or cancel at any time this solicitation process; or waive any irregularities in this solicitation or in the submittals received as a result of this solicitation.

4.3 All expenses involved with the preparation and submission of materials to the SDSTA, or any work performed in connection therewith, shall be borne by the Offeror(s). No payment will be made for any responses received, nor any other effort required of or made by the Offeror(s) prior to commencement of work as defined by a contract approved by SDSTA.

4.4 The materials will be evaluated by the Selection Committee appointed by the SDSTA. The Selection Committee will recommend and Offeror by consensus based on the Selection Criteria described in this RFP.

4.5 The SDSTA reserves the right to enter contract negotiations with the selected Offeror. If the SDSTA and the Offeror do not agree to terms of a Contract, the SDSTA may elect to terminate negotiations and begin negotiating with the second-ranked Offeror and so forth. This process will continue until a contract has been executed, or, all submittals have been rejected. No Offeror shall have any claims and/or rights against the SDSTA arising from such negotiation and/or the qualification process.

4.6 The SDSTA reserves the right to contract for all or part of the work program described in the RFP.

4.7 Offeror(s) submitting materials should not submit any information in response to this solicitation which the Offeror(s) considers to be a trade secret or confidential. The submission of any information in connection with this solicitation shall be deemed conclusively to be a waiver of any trade secret or other protection, which would otherwise be available to the Offeror. In the event that the Offeror submits information in violation for this restriction, either inadvertently or intentionally and clearly identifies that information in the submission as protected or confidential, the SDSTA will endeavor to redact and return that information to the Offeror. The Selection Committee will then evaluate the balance of the submission. The redaction or return of information pursuant to this clause may render a submission nonresponsive.

4.8 Bid security: Bids over $50,000 must be accompanied by a bid security as follows:

- Bid Bond: A bid bond of ten percent (10%) of the total amount of the bid including all add alternatives, shall be furnished by the Contractor. A form of Bid Bond is included with the proposal documents.
- Certified Check or Cashier's Check: In lieu of a Bid Bond, a certified check or cashier's check for five percent (5%) of the amount of the bid, including all add alternates, may be furnished. Such check shall be certified or issued by either a stat3e or national bank and payable to the South Dakota Science and Technology Authority.
- Payment and Performance Bond: Upon award of contract, Contractor shall provide a Payment and Performance Bond produced by a South Dakota licensed insurance producer (agent) and issued by a South Dakota licensed surety in an amount not less than the amount of the awarded contract. The Payment and Performance Bond surety or sureties shall meet all requirements of South Dakota law. This bond is to secure the faithful performance of the contract and the payment of those to whom the offeror may become legally indebted for labor, materials, tools, equipment, or services of any kind used or employed by the offeror in performing the work. The surety bond shall be on a form similar to the form of Payment and Performance Bond in the time state shall be cause for consideration by the Owner of awarding the contract to another responsible and responsive offeror, and retention of the bid deposit.
- Power of Attorney: Attorneys-in-fact who sign bid bonds or contract bonds must file with each bond a certified and effectively dated copy of their power of attorney.

4.9 Liquidated Damages: If offeror fails to substantially complete the installation and the American Davison fan returned to full service within the thirteen-day time frame noted in this RFP, Offeror shall be liable for liquidated damages in the amount of $50 per $100,000 of total contract value per day, as provided in Section VI (E) of the Draft contract.

5.0 Selection Criteria

The SDSTA will review all submitted proposals for adherence to this request's requirements and capabilities to identify the proposal providing the best value based on the following criteria:

1. Experience with similar projects
2. Qualifications of project personnel
3. Project understanding and responsiveness
4. ESH Program and Injury Experiences
5. Cost reasonableness

6.0 Selection Process

1. SDSTA will form a selection panel that will review the responses received to this RFP.
2. SDSTA will make a selection based on the submittals or, at their discretion, may ask a short list of offerors to interview prior to finalizing the selection.
3. Offerors will be notified of the selection decision by email within three weeks of the receipt of proposals.
4. Selection decisions are final. There will be no process for appeal or re-evaluation.
5. SDSTA retains the right to request scope adjustments and substitutions of individual team members and engineering disciplines during negotiations.

7.0 Submission Requirements

All offerors are required to attend an onsite pre-proposal conference September 27th, from 10:00 a.m.-12:00 p.m. MT at the Sanford Lab, 630 East Summit Street, Lead South Dakota. Pre-registration is required, email mbaumann@sanfordlab.org by close of business September 22nd to receive instructions and directions. Only companies represented at the pre-proposal conference will be eligible to submit proposals. Contractors' subcontractors are encouraged, but not required, to attend.

Questions are to be submitted electronically to mbaumann@sanfordlab.org by 2:00 P.M. October 2. All questions along with their answers will be emailed to all prospective offerors and posted to the sanfordlab.org website no later than October 5, 2017.

Offerors shall submit an electronic copy (.pdf format) of the proposal no later than 2:00 p.m. October 20, 2017, to: mbaumann@sanfordlab.org. Late submissions will not be accepted.

The proposal period may be extended at the discretion of SDSTA based on the quantity and/or complexity of questions. Any notices of extension of time to respond will be distributed to all prospective offeror by SDSTA.

All communications regarding this procurement between RFP release and contract award shall be directed by email to mbaumann@sanfordlab.org. Communications with other SDSTA staff regarding this procurement in advance of the contract award are not allowed.

Appendix A.

SECTION 262923
VARIABLE FREQUENCY
CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes variable frequency controllers and shaft current mitigation accessories.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers

1. IEEE C62.41 – Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

B. National Electrical Manufacturers Association

1. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).
2. NEMA FU 1 – Low Voltage Cartridge Fuses.
3. NEMA ICS 7 – Industrial Control and Systems: Adjustable Speed Drives.
4. NEMA ICS 7.1 – Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems.

C. International Electrical Testing Association

1. NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 PERFORMANCE REQUIREMENTS

A. The contractor shall bear responsibility for ensuring that the calculations referenced in "Harmonic Mitigation" section below are performed by a qualified individual capable of modeling the effects of all of the VFD's to be installed on the project. This is a performance requirement for the entire project, despite the fact that individual suppliers may choose to submit VFD's as part of their equipment packages. Any equipment submittal containing a VFD submittal will be returned as "Rejected" until the overall calculation has been submitted for review.

B. For the purposes of all calculations and measurements referencing the Institute of Electrical and Electronics Engineers Standard 519, the Point of Common Coupling (PCC) shall be the building side of the utility company transformer.

1.4 SUBMITTALS (All submittals require SDSTA approval)

A. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.

B. Product Data: Submit catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, filters, short circuit ratings, dimensions, and enclosure details. Also including

1. Dimensioned outline drawing
2. Schematic diagram
3. Component list
4. Power and control connection diagram(s).

C. Test Reports: Indicate field test and inspection procedures and test results.

D. Manufacturer's Field Reports: Indicate start-up inspection findings.

E. Harmonic Mitigation Calculations.

F. Harmonic Mitigation Test Results.

1.5 CLOSEOUT SUBMITTALS

A. Provide final equipment submittal information with all noted corrections incorporated.

B. Operation and Maintenance Data: Submit instructions complying with NEMA ICS 7.1. Include procedures for starting and operating controllers, and describe operating limits possibly resulting in hazardous or unsafe conditions. Include routine preventive maintenance schedule.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years' experience.

1.7 DELIVERY, STORAGE AND HANDLING

A. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure, and finish.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Elevation = 4,950 ft.

B. Min outdoor temp = -30F Max outdoor temp = 110 F

C. Relative humidity = 90% taken from national weather data for Lead. However, the drive is housed in a building beneath the discharge of a large mine exhaust fan that exhausts humid air making the humidity around the drive much higher and sometimes condensing.

D. Drive will be installed in a closed, insulated, & environmentally controlled building sufficient to meet manufacturers recommendations.

E. Conform to NEMA ICS 7 service conditions during and after installation of variable frequency controllers.

1.9 WARRANTY

A. Furnish five-year manufacturer warranty for variable frequency controller.

1.10 MAINTENANCE SERVICE

A. Furnish service and maintenance of variable frequency controller for one year from Date of Substantial Completion.

1.11 MAINTENANCE MATERIALS

A. Furnish manufacturers recommended spare parts.

PART 2 - PRODUCTS

2.1 VARIABLE FREQUENCY CONTROLLER

1. Drive may come from any reputable drive manufacturer

B. Product Description: NEMA ICS 7, enclosed variable frequency controller suitable for operating indicated loads. Select unspecified features and options in accordance with NEMA ICS 7.1.

C. Basic Design

1. All drives shall produce adjustable frequency, adjustable voltage output through a three-stage operation.

a. Design to provide an input power factor of 0.95% throughout the speed range

2. The VFDs shall limit harmonic distortion reflected onto the installation distribution system to a voltage and current distortion level as defined by IEEE 519 for general system applications. Harmonic attenuation shall be provided by the addition of components or means described under "Harmonics Mitigation" section.

D. Where shown on the drawings, variable frequency drives shall have the following features:

1. All VFDs shall be rated 2300VAC, 3-phase, 60 hertz, and provide microprocessor-based control of three-phase motors.
2. The VFDs shall have an efficiency that exceeds 97% at 100% speed and load. The efficiency shall exceed 80% at 50% speed and load.
3. The VFDs shall maintain the line side displacement power factor at no less than 0.95, regardless of speed and load.
4. The VFDs shall have a one (1) minute overload current rating of 150%.

5. The VFDs shall be capable of operating a 3,000-horsepower synchronous motor used in a fan application (motor nameplate data provided in scope of work).
6. The VFDs shall be able to start into a spinning motor. The VFDs shall be able to determine the motor speed in any direction and resume operation without tripping. If the motor is spinning in the reverse direction, the VFDs shall start into the motor in the reverse direction, bring the motor to a controlled stop, and then accelerate the motor to the preset speed.
7. Standard operating conditions shall be:

    a. Incoming Power: Three-phase, 2300Vac (+10% to -10%) and 60 hertz
    b. Frequency stability of +/-0.5% for 24 hours with voltage regulation of +/-2% of maximum rated output voltage.
    c. Five (5) cycle carry-over during utility loss
    d. Insensitive to input line rotation
    e. Humidity: 0 to 95% (condensing outside the drive building from large mine exhaust fan)
    f. Altitude: 0 to 5,300 feet above sea level
    g. Ambient Temperature: 0 to 70 °C
    h. Storage Temperature: -20 to 70 °C.

8. G.E. 3,000 HP Synchronous Motor Nameplate Data
    a. No = 270777 Model = 271R206 Type = TS Form = B3
    b. Rated = 3,000 HP cos Ø= 0.9 Rotation = 720 rpm
    c. Volts = 2,400 Phases = 3 Frequency = 60 Hz
    d. Amperes = 616 Insul. Class = F SF = 1.0
    e. Temp Rise at 85 C Stator by RTD
    f. Continuous Operation 80 C Rotor by Resistance
    g. Exciter – Volts = 125 Excitation – Amperes = 110

9. Control Functions

    a. VFDs shall be adjustable from a digital operator keypad located on the front door of the VFD. Parameters shall include:

        1) Programmable speed command (keypad, remote) with local / remote selector switch
        2) Programmable start command (keypad, remote) with local / remote selector switch
        3) Forward and reverse control with selector switch
        4) Programmable maximum and minimum speed limits
        5) Programmable acceleration and deceleration times (2 each)
        6) Programmable critical frequency avoidance lockout zones (5 each)
        7) Programmable electronic overload and torque limits
        8) Programmable multiple attempt restart
        9) Programmable jog and preset speeds
        10) Programmable "Catch a Spinning Motor" function
        11) Programmable output digital relay (4)

12) Programmable analog output (2)
13) Programmable DC Injection Braking Time
14) Full Proportional/Integral/Derivative (PID) process control built in.

10. The VFDs shall have the following system interfaces:

a. Automation System Interface:

Ability to connect to a PLC control system or DDC Building Automation system is required. The flexibility of using optional communication modules is desired. At a minimum, Modbus TCPIP communication for monitoring and drive control is required.

b. Inputs

1) Process control speed reference interface to receive either a 0-10 Vdc, 4-20 mA dc or speed potentiometer signal
2) Remote mode start and stop contacts
3) Remote forward/reverse contacts
4) Remote preset speed contacts
5) Remote external trip contact
6) Remote reset contact
7) Remote jog contact.
8) Minimum of (6) programmable digital and (2) programmable analog inputs shall be provided in addition to above listed items.

c. Outputs for VFD. A minimum of four (4) discrete programmable digital outputs and two (2) programmable analog outputs shall be provided with the following available as a minimum:

1) Programmable relay outputs (4) with one (1) set of Form C contacts each, selectable with the following available feature: Fault, Run, Ready, at Speed, Stopped, Current Limit, and Auto Reverse.
2) Programmable analog output signals (2), selectable with the following available Features: Speed, Load, Kilowatts, Motor Voltage, Motor Amps, Line Voltage, Bus Current, and Speed Reference.

11. Monitoring and Displays

a. The VFDs shall have a digital display for monitoring functions as described in the following:

1) Output current
2) Output frequency
3) Motor rpm (speed)
4) Output voltage
5) Power (KW)
6) Load
7) Elapsed time

8) Trip cause.
9) Flash memory programmed via RS 232 port with windows based configuration software included for advanced programming and trouble- shooting
10) User display functions shall be selectable from a list to avoid displaying unused functions.

12. Protection Functions

a. The VFD shall include the following protective features:

1) Overcurrent protection
2) Overvoltage protection
3) Undervoltage protection
4) Phase loss protection
5) Ground fault protection
6) Adjustable current limit
7) Line-to-line and line-to-ground output short-circuit protection
8) Overload capability shall be 150% of the motor FLA based on the NEC ratings for 60 seconds.
9) DC injection braking
10) Overtemperature protection

13. Diagnostic Features for VFD

a. Fault History - Record and log faults in English language, most recent first, by date, time, item, and description of that item. Store up to 15 faults.
b. Warning History - Record and log the last 15 warnings by date, time, item, and description of that item.
c. Event History - Record and log the last 15 command events by date, time, command, and description of that command.
d. Trend Files - Record 1000 msec of trend data before each of the recorded faults. Display any four (4) of eight (8) parameters both digitally and in four (4) color graphics via the WindowsTM-based program.
e. I/O Monitor - Provide a monitor to aid in troubleshooting by showing digital I/O status.

14. Features to be included in VFD:

a. Integral input disconnect breaker with minimum AIC rating of 65,000Amps or higher as required by Division 16 shall be provided. Operating handle shall protrude through the VFD door and the disconnect device shall not be mounted on the door. The handle shall have provisions for padlocking in the OFF position. Interlocks shall prevent unauthorized opening or closing of the VFD door with disconnect handle in the ON position.
b. AC input line current limiting fuses rated 200,000 AIC
c. Low voltage control to allow VFD to interface with remote dry contacts at a distance up to 500 feet

d. Motor overcurrent relay to provide motor overcurrent sensing of a given level of load current
e. Provide EMI/RFI power line filters to assure compliance to FCC Class A and Class B requirements.
f. Provide IEEE C62.41 rated, factory-mounted transient voltage surge suppressor, selected to meet requirements and to coordinate with system circuit voltage.

15. Enclosures:
    a. Provide the VFD and bypass panels with NEMA 12 rated enclosure.

    b. Provide appropriate ventilation of VFD cabinetry to maintain ambient temperature rating of the drive based upon application.

2.2 HARMONICS MITIGATION

A. Prepare and submit calculations confirming that the line harmonics and notching generated by the VFDs do not exceed the levels for a general system as stated in the Institute of Electrical and Electronics Engineers Standard 519-1992 "Guide for Harmonic Control of Static Power Converters" to a maximum of 5% Total Harmonics Distortion (THD) for voltage and 8% THD for current at Point of Common Coupling (PCC).

    1. The PCC for this project is at building side of the utility company transformer serving this project.

B. Any harmonic calculations shall be done based on the kVA capacity, X/R and impedance of the transformer supplying the VFDs as shown on the drawings or existing, and shall be calculated at the point of common couplings. Drive supply is a 3.0 MVA, 69kV-to-2300V transformer.

C. The combined run-operation of all variable speed drives both old and new that reside on the main switchboard and substation shall be included in the calculations.

D. VFDs shall employ means to limit the noise contributed to the system consisting of:

    1. VFD’s shall be equipped with 18 pulse Rectifiers provided with a manufacturer’s guarantee that it will meet the total Harmonic Distortion Requirements of 8% on current and 5% on voltage per IEEE Standard 519.

2.3 RFI/EMI NOISE EMISSIONS

A. The adjustable speed drive shall be designed to meet the guidelines regarding emissions of Radio Frequency and Electro-Magnetic Interference (RFI/EMI) set by FCC Class A guidelines through the use of a tuned line filter, adjusted as required to prevent electrical distortion back into the building electrical power supply system.

B. The unit shall comply with the FCC Class “A” noise emissions standard. In addition, provide lab test results from an independent test laboratory showing this compliance.

2.4 SOURCE QUALITY CONTROL

A. Shop inspect and perform standard productions tests for each controller.

B. Make completed controllers available for inspection at manufacturer's factory prior to packaging for shipment. Notify the Owner at least seven days before inspection is allowed.

C. Allow witnessing of factory inspections and tests at manufacturer's test facility. Notify the Owner at least seven days before inspections and tests are scheduled.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that building environment can be maintained within the service and ambient temperature and humidity ratings required by the VFD manufacturer

3.2 INSTALLATION

A. Install in accordance with manufacturer's written installation instructions.
B. Install in accordance with NEMA ICS 7.1.

C. Verify that mounting surface for VFDs are ready to service work. Mount VFDs on the wall or at supports in locations identified on the drawings.

D. Tighten accessible connections and mechanical fasteners after placing controller.

E. Install fuses in fusible switches.

F. Select and install overload heater elements in motor controllers to match installed motor characteristics.

G. Install engraved plastic nameplates in accordance with Section 23 05 53.
H. Neatly type label inside controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place label in clear plastic holder.

I. Ground and bond controller in accordance with Section 26 05 26.

J. Controls installer shall provide all wiring and conduit associated with the control signals into and out of the VFD to the DDC EMS and as required for any motor control interlocks.
K. VFD provider shall provide a bearing isolator current diverter rings for all motors attached to VFD's. Manufacturer: In pro-seal or equal.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.16 and NEMA ICS 7.1.

C. Perform power quality analysis per warranty requirements.

3.4 MANUFACTURER'S FIELD SERVICES

A. VFD Start-up: Provide certified factory start-up by a factory authorized service center representative. A certified start-up form shall be filled out for the drive with a copy provided to the Owner, and a copy kept on file at the manufacturer. The following VFD start-up services are to be provided as a minimum:

1. Service center technician shall be responsible for verifying correct installation, power and control wiring connections, starting-up the drive, and checking out for proper operation.
2. Service center technician shall also provide all final adjustments to meet the specified performance requirements.

3.5 DEMONSTRATION AND TRAINING

A. Provide four hours of instruction to be conducted at the project site with manufacturer's representative. Contractor to also provide two sets of VFD operation manuals for use at the training session and then provide to the Owner after completion of the session.

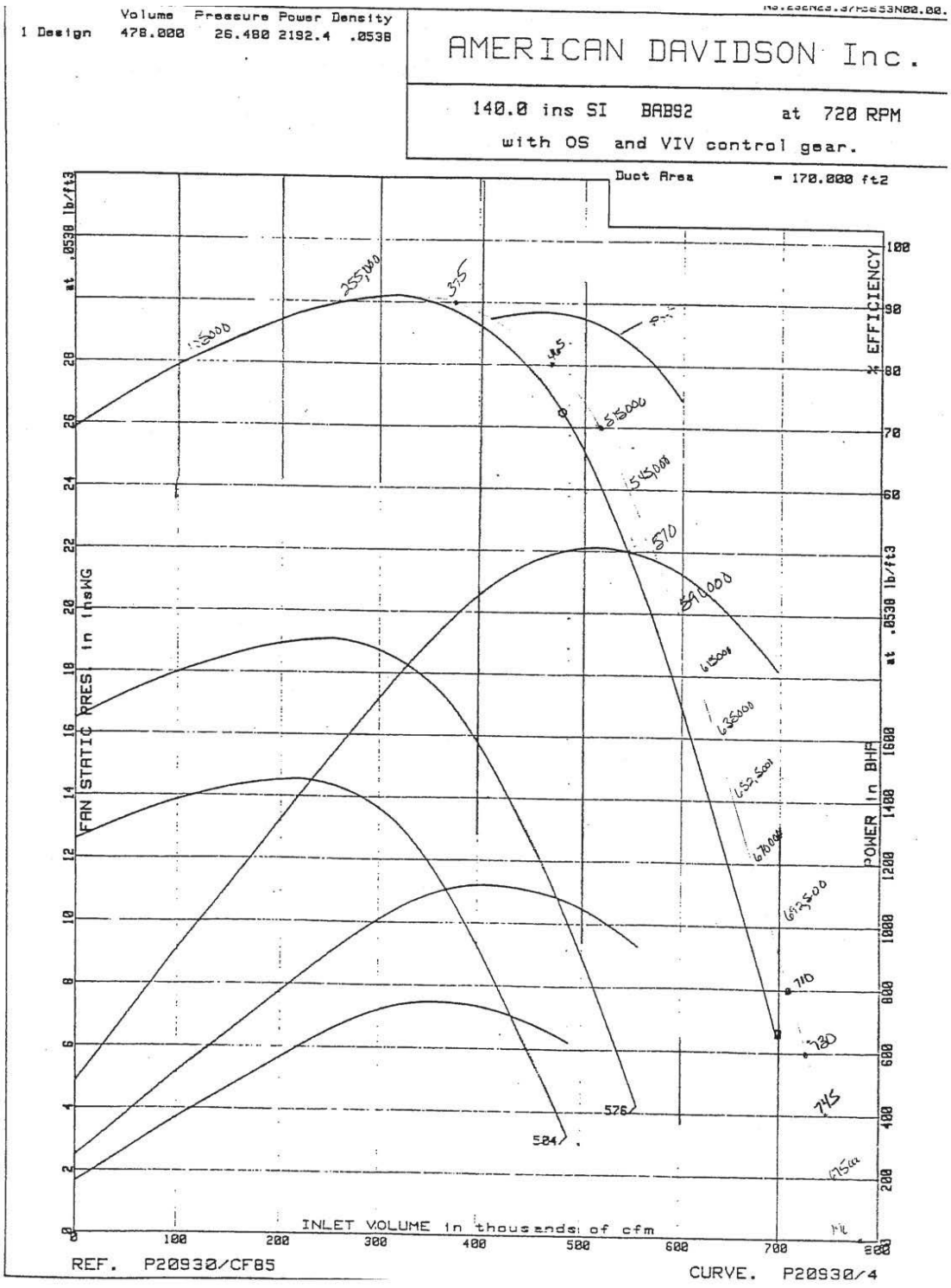
3.6 INDEPENDENT TESTS OF HARMONIC DISTORTION

A. The combined run-operation of all variable speed drives shall be tested by an independent approved agency after installation, startup, balancing, and commissioning.

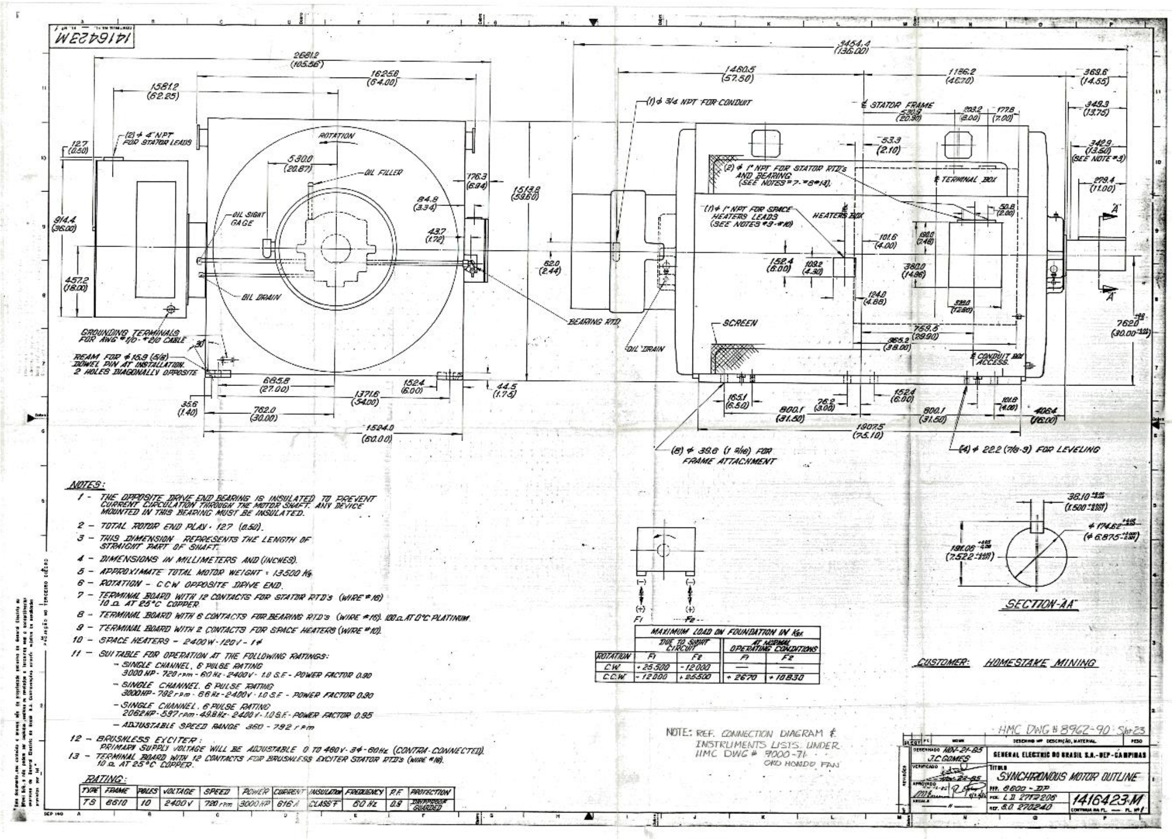
B. The tests shall demonstrate that the VFD when running produces less than 5% Total Harmonic Distortion (THD) for voltage and 8% THD for current per IEEE-519 standards using the building side of the existing utility company transformer.

C. The tests shall be run with the VFD running, but the elevators not running. Then the test shall be run again with the elevators running along with the VFD. Where the test shows that the whole system is unable to comply with the stated criteria, the contractor shall provide at no cost to the owner, corrective harmonic mitigation and a set of retests to prove compliance. Any diagnostic testing performed by the Contractor in determining the primary source of the harmonics shall be borne by the Contractor as part of the corrective action and shall not be backcharged to the owner. Notify the owner two (2) weeks prior to testing so that a witness can be present and submit test results for review.

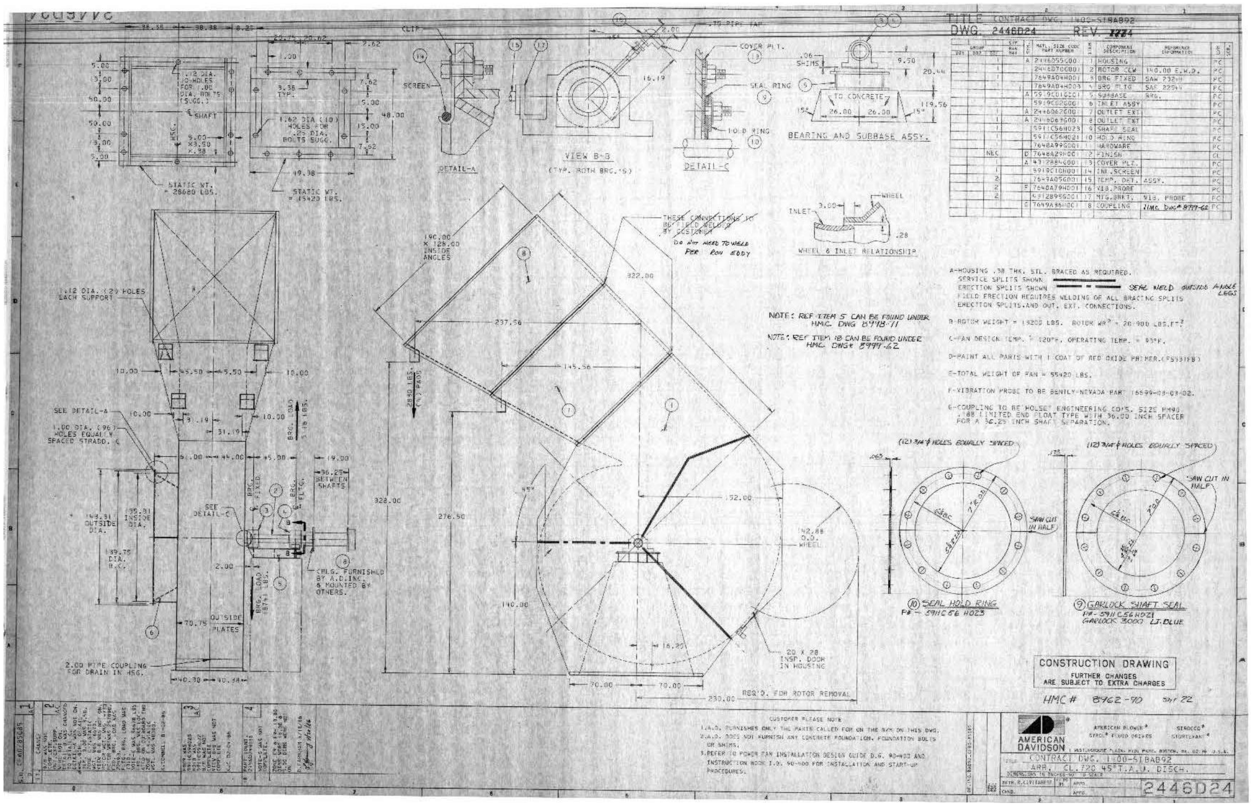
Appendix B
Original Oro Hondo Fan Curve



Appendix C



SYNCHRONOUS MOTOR OUTLINE
1416423-M
GENERAL ELECTRIC DO BRASIL S.A.-DEP-CAMPINAS
CUSTOMER: HOMESTAKE MINING
SECTION-AA
NOTES:
2 - TOTAL ROTOR END PLAY - 12.7 (0.50).
4 - DIMENSIONS IN MILLIMETERS AND (INCHES).
5 - APPROXIMATE TOTAL MOTOR WEIGHT : 13500 Kg
6 - ROTATION - C.C.W OPPOSITE DRIVE END.
10 - SPACE HEATERS - 2400W - 120V - 1φ
RATING:
MAXIMUM LOAD ON FOUNDATION IN Kg
HMC DWG # 8962-90



TITLE CONTRACT DWG. 1400-SIBAB92
DWG. 2446D24 REV.
HOUSING
ROTOR CCW
140.00 E.W.D.
BRG FIXED
BRG FLTG
SUBBASE
INLET ASSY
OUTLET EXT
SHAFT SEAL
HOLD RING
HARDWARE
FINISH
COVER PLT.
INL.SCREEN
TEMP. DET. ASSY.
VIB.PROBE
MTG.BRKT. VIB. PROBE
COUPLING
A-HOUSING .38 THK. STL. BRACED AS REQUIRED.
SERVICE SPLITS SHOWN
ERECTION SPLITS SHOWN
SEAL WELD OUTSIDE ANGLE LEGS
FIELD ERECTION REQUIRES WELDING OF ALL BRACING SPLITS
ERECTION SPLITS.AND OUT. EXT. CONNECTIONS.
E-TOTAL WEIGHT OF FAN = 55420 LBS.
G-COUPLING TO BE HOLSET ENGINEERING CO'S. SIZE HM90
.188 LIMITED END FLOAT TYPE WITH 36.00 INCH SPACER
FOR A 36.25 INCH SHAFT SEPARATION.
DETAIL-A
VIEW B-B
DETAIL-C
BEARING AND SUBBASE ASSY.
WHEEL & INLET RELATIONSHIP
(10) SEAL HOLD RING
(9) GARLOCK SHAFT SEAL
GARLOCK 3000 LT.BLUE
SAW CUT IN HALF
20 X 28
INSP. DOOR
IN HOUSING
REQ'D. FOR ROTOR REMOVAL
CONSTRUCTION DRAWING
FURTHER CHANGES
ARE SUBJECT TO EXTRA CHARGES
HMC # 8962-90
CUSTOMER PLEASE NOTE
AMERICAN DAVIDSON
AMERICAN BLOWER
SIROCCO
CONTRACT DWG. 1400-SIBAB92
ARR. CL.720 45°T.A.U. DISCH.
2446D24