

## ADDENDUM #2

### 1.1 PROJECT INFORMATION

- A. Project Number: 2019-10348
- B. Project Title: Cooling Tower & Boiler Replacement
- C. Project Location: 701 W. Riverside Ave., Washington
- D. Agency: Spokane Transit Authority

### 1.2 NOTICE TO BIDDERS

- A. The following clarifications, changes, additions, and/or deletions are considered as Addendum #2 and are hereby made a party of the contract documents. All bidders are required to base their bid upon the information furnished in all addendum and as required in the contract documents. The Contractor is required to acknowledge Addendum #2 in their company proposal. Failure to acknowledge addendum on the bid form will result in the bid proposal being declared non-responsive.
- B. The question-and-answer period has now expired. Please use your best judgment as professionals in your field and err on the side of conservative should you have any other questions about the plans, spec, and scope.
- C. The bid due date and time is 3:00pm August 3, 2021. Bids to be delivered/mailed to STA's headquarters located at 1230 W. Boone Avenue.
- D. All communications shall be directed to Jessica Charlton as listed in the bid documents at [jcharlton@spokanetransit.com](mailto:jcharlton@spokanetransit.com) or by telephone at 509-325-6049.

### 1.3 CLARIFICATIONS / GENERAL

- A. **Owner Salvaged Parts:** STA would like to retain select parts from both the cooling tower. The contractor is to include removal of these parts in their bid and shall set aside for STA salvage. STA's project manager will coordinate with staff for their removal from the site. The parts below are to be carefully removed for STA salvaged:



### 1.4 REVISIONS/CLARIFICATIONS TO PLANS AND SPECIFICATIONS SECTIONS

- A. Drawings

Sheet E-201 Partial Electrical Basement Floor Plan. – Conduit and conductors will be required for a boiler room shutdown switch located at both the north and south boiler room doors.

Sheet M-101 Partial Mechanical Basement Floor Demo Plan. Sheet Notes, Add:  
Sheet Note 12 DRAIN PIPING FOR CONSTRUCTION. CAPTURE AND RETAIN GLYCOL FROM EQUIPMENT AND PIPING FOR RECHARGING THE SYSTEM. GLYCOL CANNOT BE DISCHARGED DOWN DRAINS. DISPOSE OF GLYCOL PROPERLY.

Sheet M-201 Partial Mechanical Basement Floor New Plan. Sheet Notes, Add:

Sheet Note 11. FILL THE NEW BOILER WITH WATER AND HYDROSTATICALLY TEST IT TO ENSURE THERE ARE NO LEAKS, FIRE THE BOILER AND PERFORM THE BOIL OUT PROCEDURE FOR A NEW CAST IRON BOILER. ADJUST THE EXISTING BURNER SO IT FIRES CORRECTLY ON THE NEW BOILER. DRAIN THE BOILER AND REFILL WITH THE CAPTURED GLYCOL AND MAKE IT READY TO GO BACK ONLINE.

Sheet Note 12. INSULATE ALL NEWLY INSTALLED PIPING AND CLEAN UP THE JOBSITE.

Sheet Note 13. PROVIDE AND INSTALL CARBON MONOXIDE DETECTOR IN THE BOILER ROOM

Sheet Note 14. PROVIDE AND INSTALL A BREAK-GLASS OR PROTECTED CSD-1 SHUTDOWN SWITCH FOR BOTH BOILERS AT BOTH BOILER ROOM ENTRIES. WIRE SWITCHES INTO BOILER 1 AND BOILER 2 CONTROL PANELS TO SHUT DOWN BOTH BOILERS IF THE SWITCH IS CLOSED.

B. Specifications

235223 – Cast Iron Boilers,

Add: 1.7 PERMIT, A. Contractor shall obtain City Boiler Permit.

Add: 2.2 MANUFACTURED UNITS, A. Description, 3. The contractor must include all parts and pieces necessary for reuse of the existing burner with the new boiler. This may limit the boiler selection to boilers that are compatible.

1.5 QUESTIONS / ANSWERS (from the Pre-Bid Meeting, Emails, and Phone Calls)

**Question 01:** *What kind of building controls are used in the facility/who is the in house control contractor for STA?*

**Answer 01:** The DDC system for the building is an Alerton/ATS Controls system. An upgrade to the system was completed in 2019. STA does have a service agreement with ATS Inland NW, LLC however their services for this project are only expected to be confirmation of function as part of closeout. All other work is part of the contractors purview.

**Question 02:** *The plans state the makeup water line is 1 1/2" however it looks to be 3/4". Please confirm*

**Answer 02:** Reuse existing 3/4" makeup water line up to solenoid valve. Replace water hammer arrestor and solenoid valve to match existing models.

**Question 03:** *I do not see backflow prevention however the plans indicate to reuse it. Please confirm.*

**Answer 03:** The STA Plaza uses an existing central RPBP in the basement to feed make-up water to cooling towers and other HVAC equipment. The cooling tower replacement will not need a new RPBP on its make-up water line.

**Question 04:** *Per conversations with equipment suppliers it is our understanding that there will be a laundry list of parts required to upgrade the existing burner to adapt to the new boiler. Pls advise if this list will be made available prior to the bid date or if a monetary value should be placed covering these unknowns and carried by the bidding contractors.*

**Answer 04:** Our understanding is that the Basis of Design Boiler will require a new burner mounting plate. The burner and boiler controls were recently refurbished. The flame detection is mounted on the burner throat and will move with it. The burner elevation will change for the new boiler burner centerline. The reason for reusing this burner is current lead times for burners. The contractor must include all parts and pieces necessary for integration with the new boiler. This may limit the boiler selection to boilers that are compatible.

**Question 05:** *What model burner is currently installed at the job site?*

**Answer 05:** PowerFlame BCCR3-G-25, Serial no. 059466228, Invoice No. 121092, Max MBH 4718

**Question 06:** *What model boiler are they replacing?*

**Answer 06:** Burnham PF-519 Serial No. 7595201, Gross Output 3099 MBH, Steam Sq. FT. 10025, Water MBH 2695, Gas MBH 3898 MBH, Maximum working pressure Water 50 psi, stea, 15 psi, Minimum Relief Valve Capacity 3099 MBH or lbs/hr.

**Question 07:** *The written specification refers to a seismic and vibration mounting frame being required. The specified frame must be supplied by others.*

**Answer 07:** The mounting frame is not a separate piece of the boiler some boiler manufacturer's may not have a mounting frame or may have a different name for it. See Drawing M-002 for Seismic factors and requirements. The seismic requirement is for stops to be anchored to the floor. If the boiler manufacturer has anchorage provisions or instructions those can be used but our experience is most boilers are designed to be held in place by the weight of the boiler so we included a requirement for the stops. Anchors shall be selected based on the factors on M-002 and will be installed in existing concrete.

**Question 08:** *The boiler schedule indicates one (1) boiler is required. The remarks section of the schedule indicates that the flow rate can be 500 GPM if boilers are operated in series. Is there an existing boiler that will be utilized at the job site? If so, what is the model of that existing unit?*

**Answer 08:** Boiler 2 is existing and will not be replaced. Please look at the mechanical drawings and diagrams that show this boiler. Boiler 2 is same as the existing Boiler 1.

**Question 09:** *The boiler schedule indicates a water boiler is required. There are many items in the written specification that pertains to a steam boiler. What type of unit is required?*

**Answer 09:** A hot water boiler is required.

#### ENCLOSURES:

Division 23 – Section 230923 Variable Frequency Motor Controllers

## SECTION 230923 - VARIABLE-FREQUENCY MOTOR CONTROLLERS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes solid-state, PWM, VFDs for speed control of three-phase, squirrel-cage induction motors.
- B. Variable frequency motor controllers (drives) shall be furnished and installed by instrumentation and controls (DDC) system subcontractor.
- C. Related Sections include the following:
  - 1. Division 26 Section "Electrical Power Monitoring and Control" for monitoring and control of motor circuits.
  - 2. Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits" for low-voltage power, control, and communication surge suppressors.

#### 1.2 DEFINITIONS

- A. BAS: Building automation system.
- B. IGBT: Integrated gate bipolar transistor.
- C. LAN: Local area network.
- D. PID: Control action, proportional plus integral plus derivative.
- E. PWM: Pulse-width modulated.
- F. VFD: Variable frequency motor controller (drive).

#### 1.3 SUBMITTALS

- A. Product Data: For each type of VFD. Include dimensions, mounting arrangements, location for conduit entries, shipping and operating weights, and manufacturer's technical data on features, performance, electrical ratings, characteristics, and finishes.
- B. Shop Drawings:
  - 1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Each installed unit's type and details.
    - b. Nameplate legends.

- c. Short-circuit current rating of integrated unit.
    - d. Listed and labeled for series rating of overcurrent protective devices in combination controllers by an NRTL acceptable to authorities having jurisdiction.
    - e. Features, characteristics, ratings, and factory settings of each motor-control center unit.
  2. Wiring Diagrams: Power, signal, and control wiring for VFDs. Provide schematic wiring diagram for each type of VFD.
- C. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around VFDs where pipe and ducts are prohibited. Show VFD layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.
- D. Manufacturer Seismic Qualification Certification: Submit certification that VFDs, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:
  1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
    - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Qualification Data: For manufacturer and testing agency.
- F. Field quality-control test reports.
- G. Operation and Maintenance Data: For VFDs, all installed devices, and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
  1. Routine maintenance requirements for VFDs and all installed components.
  2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
- H. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.
- I. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that dip switch settings for motor running overload protection suit actual motor to be protected.

#### 1.4 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.
- B. **Testing Agency Qualifications:** An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
  - 1. **Testing Agency's Field Supervisor:** Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- C. **Source Limitations:** Obtain VFDs of a single type through one source from a single manufacturer.
- D. **Electrical Components, Devices, and Accessories:** Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with NFPA 70.
- F. **Product Selection for Restricted Space:** Drawings indicate maximum dimensions for VFDs, minimum clearances between VFDs, and adjacent surfaces and other items. Comply with indicated maximum dimensions and clearances.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver VFDs in shipping splits of lengths that can be moved past obstructions in delivery path as indicated.
- B. Store VFDs indoors in clean, dry space with uniform temperature to prevent condensation. Protect VFDs from exposure to dirt, fumes, water, corrosive substances, and physical damage.
- C. If stored in areas subject to weather, cover VFDs to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; install electric heating of sufficient wattage to prevent condensation.

#### 1.6 PROJECT CONDITIONS

- A. **Environmental Limitations:** Rate equipment for continuous operation, capable of driving full load without derating, under the following conditions, unless otherwise indicated:
  - 1. **Ambient Temperature:** 0 to 40 deg C.
  - 2. **Humidity:** Less than 90 percent (noncondensing).
  - 3. **Altitude:** Not exceeding 3300 feet.

- B. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
  - 1. Notify Construction Manager no fewer than two days in advance of proposed interruption of electrical service.
  - 2. Indicate method of providing temporary electrical service.
  - 3. Do not proceed with interruption of electrical service without Construction Manager's written permission.
  
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for VFDs, including clearances between VFDs, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

#### 1.7 COORDINATION

- A. Coordinate layout and installation of VFDs with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
  
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."
  
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."
  
- D. Coordinate features of VFDs, installed units, and accessory devices with pilot devices and control circuits to which they connect.
  
- E. Coordinate features, accessories, and functions of each VFD and each installed unit with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

#### 1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Spare Fuses: Furnish one spare for every five installed, but no fewer than one set of three of each type and rating.
  - 2. Indicating Lights: two of each type installed.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. ABB Power Distribution, Inc.; ABB Control, Inc. Subsidiary.
  - 2. Danfoss Inc.; Danfoss Electronic Drives Div.
  - 3. Eaton Corporation; Cutler-Hammer Products.
  - 4. General Electric Company; GE Industrial Systems.
  - 5. Rockwell Automation; Allen-Bradley Co.; Industrial Control Group.
  - 6. Siemens Energy and Automation; Industrial Products Division.

### 2.2 VARIABLE FREQUENCY CONTROLLERS

- A. Description: NEMA ICS 2, IGBT, PWM, VFD; listed and labeled as a complete unit and arranged to provide variable speed of an NEMA MG 1, Design B, 3-phase induction motor by adjusting output voltage and frequency.
  - 1. Provide unit suitable for operation of premium-efficiency motor as defined by NEMA MG 1.
- B. Design and Rating: Match load type such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.
- C. Output Rating: 3-phase; 6 to 60 Hz, with voltage proportional to frequency throughout voltage range.
- D. Unit Operating Requirements:
  - 1. Input ac voltage tolerance of 380 to 500 V, plus or minus 10 percent.
  - 2. Input frequency tolerance of 50/60 Hz, plus or minus 6 percent.
  - 3. Minimum Efficiency: 96 percent at 60 Hz, full load.
  - 4. Minimum Displacement Primary-Side Power Factor: 96 percent.
  - 5. Overload Capability: 1.1 times the base load current for 60 seconds; **1.35 times the base load current for 2 seconds. ~~2.0 times the base load current for 3 seconds.~~**
  - 6. Starting Torque: 100 percent of rated torque or as indicated.
  - 7. Speed Regulation: Plus or minus 1 percent.
- E. Isolated control interface to allow controller to follow control signal over an 11:1 speed range.
  - 1. Electrical Signal: 4 to 20 mA at 24 V.
  - 2. Pneumatic Signal: 3 to 15 psig (20 to 104 kPa).
- F. Internal Adjustability Capabilities:



1. Minimum Speed: 5 to 25 percent of maximum rpm.
  2. Maximum Speed: 80 to 100 percent of maximum rpm.
  3. Acceleration: 2 to a minimum of 22 seconds.
  4. Deceleration: 2 to a minimum of 22 seconds.
  5. Current Limit: 50 to a minimum of 110 percent of maximum rating.
- G. Self-Protection and Reliability Features:
1. Input transient protection by means of surge suppressors.
  2. Under- and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.
  3. Motor Overload Relay: Adjustable and capable of NEMA ICS 2, Class 20 performance.
  4. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
  5. Instantaneous line-to-line and line-to-ground overcurrent trips.
  6. Loss-of-phase protection.
  7. Reverse-phase protection.
  8. Short-circuit protection.
  9. Motor overtemperature fault.
- H. Multiple-Motor Capability: Controller suitable for service to multiple motors and having a separate overload relay and protection for each controlled motor. Overload relay shall shut off controller and motors served by it when overload relay is tripped.
- I. Automatic Reset/Restart: Attempts three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Bidirectional autospeed search shall be capable of starting into rotating loads spinning in either direction and returning motor to set speed in proper direction, without damage to controller, motor, or load.
- J. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped.
- K. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
- L. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
- M. Input Line Conditioning: input line reactor
- N. VFD Output Filtering: none
- O. Status Lights: Door-mounted LED indicators shall indicate the following conditions:
1. Power on.
  2. Run.
  3. Overvoltage.
  4. Line fault.
  5. Overcurrent.
  6. External fault.

- P. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual speed control potentiometer and elapsed time meter.
- Q. Indicating Devices: Meters or digital readout devices and selector switch, mounted flush in controller door and connected to indicate the following controller parameters:
1. Output frequency (Hz).
  2. Motor speed (rpm).
  3. Motor status (running, stop, fault).
  4. Motor current (amperes).
  5. Motor torque (percent).
  6. Fault or alarming status (code).
  7. PID feedback signal (percent).
  8. DC-link voltage (VDC).
  9. Set-point frequency (Hz).
  10. Motor output voltage (V).
- R. Control Signal Interface:
1. Electric Input Signal Interface: A minimum of 2 analog inputs (0 to 10 V or 0/4-20 mA) and 6 programmable digital inputs.
  2. Pneumatic Input Signal Interface: 3 to 15 psig.
  3. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BAS or other control systems:
    - a. 0 to 10-V dc.
    - b. 0-20 or 4-20 mA.
    - c. Potentiometer using up/down digital inputs.
    - d. Fixed frequencies using digital inputs.
    - e. RS485.
    - f. Keypad display for local hand operation.
  4. Output Signal Interface:
    - a. A minimum of 1 analog output signal (0/4-20 mA), which can be programmed to any of the following:
      - 1) Output frequency (Hz).
      - 2) Output current (load).
      - 3) DC-link voltage (VDC).
      - 4) Motor torque (percent).
      - 5) Motor speed (rpm).
      - 6) Set-point frequency (Hz).
  5. Remote Indication Interface: A minimum of 2 dry circuit relay outputs (120-V ac, 1 A) for remote indication of the following:
    - a. Motor running.
    - b. Set-point speed reached.
    - c. Fault and warning indication (overtemperature or overcurrent).
    - d. PID high- or low-speed limits reached.

- S. Communications: Provide an RS485 interface allowing VFD to be used with an external system within a multidrop LAN configuration. Interface shall allow all parameter settings of VFD to be programmed via BAS control. Provide capability for VFD to retain these settings within the nonvolatile memory.
- T. Manual Bypass: Magnetic contactor arranged to safely transfer motor between controller output and bypass controller circuit when motor is at zero speed. Controller-off-bypass selector switch sets mode, and indicator lights give indication of mode selected. Unit shall be capable of stable operation (starting, stopping, and running), with motor completely disconnected from controller (no load).
- U. Bypass Controller: NEMA ICS 2, full-voltage, nonreversing enclosed controller with across-the-line starting capability in manual-bypass mode. Provide motor overload protection under both modes of operation with control logic that allows common start-stop capability in either mode.
- V. Integral Disconnecting Means: NEMA KS 1, fusible switch with lockable handle.
- W. Isolating Switch: Non-load-break switch arranged to isolate VFD and permit safe troubleshooting and testing, both energized and de-energized, while motor is operating in bypass mode.
- X. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.

## 2.3 ENCLOSURES

- A. NEMA 1

## 2.4 ACCESSORIES

- A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.
- B. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.
- ~~C. Stop and Lockout Push Button Station: Momentary break, push button station with a factory applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.~~
- D. Control Relays: Auxiliary and adjustable time-delay relays.
- E. Standard Displays:
  - 1. Output frequency (Hz).
  - 2. Set-point frequency (Hz).
  - 3. Motor current (amperes).
  - 4. DC-link voltage (VDC).
  - 5. Motor torque (percent).
  - 6. Motor speed (rpm).
  - 7. Motor output voltage (V).

- F. Historical Logging Information and Displays:
  - 1. Real-time clock with current time and date.
  - 2. Running log of total power versus time.
  - 3. Total run time.
  - 4. Fault log, maintaining last four faults with time and date stamp for each.
  
- G. Current-Sensing, Phase-Failure Relays for Bypass Controller: Solid-state sensing circuit with isolated output contacts for hard-wired connection; arranged to operate on phase failure, phase reversal, current unbalance of from 30 to 40 percent, or loss of supply voltage; with adjustable response delay.

## 2.5 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested VFDs before shipping.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas, surfaces, and substrates to receive VFDs for compliance with requirements, installation tolerances, and other conditions affecting performance.
- B. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFD installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLICATIONS

- A. Select features of each VFD to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; and duty cycle of motor, controller, and load.
- B. Select horsepower rating of controllers to suit motor controlled.

### 3.3 INSTALLATION

- A. Anchor each VFD assembly to steel-channel sills arranged and sized according to manufacturer's written instructions. Attach by bolting. Level and grout sills flush with mounting surface.
- B. Install VFDs on concrete bases.
- C. Comply with mounting and anchoring requirements specified in Division 26 Section "Hangers and Supports for Electrical Systems."

- D. Controller Fuses: Install fuses in each fusible switch. Comply with requirements in Division 26 Section "Fuses."

### 3.4 CONCRETE BASES

- A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.
- B. Concrete base is specified in Division 26 Section "Common Work Results for Electrical," and concrete materials and installation requirements are specified in Division 03.

### 3.5 IDENTIFICATION

- A. Identify VFDs, components, and control wiring according to Division 26 Section "Identification for Electrical Systems."
- B. Operating Instructions: Frame printed operating instructions for VFDs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of VFD units.

### 3.6 CONTROL WIRING INSTALLATION

- A. Install wiring between VFDs and remote devices according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Bundle, train, and support wiring in enclosures.
- C. Connect hand-off-automatic switch and other automatic-control devices where applicable.
  - 1. Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.
  - 2. Connect selector switches with control circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

### 3.7 CONNECTIONS

- A. Conduit installation requirements are specified in other Division 26 Sections. Drawings indicate general arrangement of conduit, fittings, and specialties.
- B. Ground equipment according to Division 26 "Grounding and Bonding for Electrical Systems."

### 3.8 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each enclosed controller element, bus, component, connecting supply, feeder, and control circuit.
  2. Test continuity of each circuit.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:
1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
  2. Assist in field testing of equipment including pretesting and adjusting of solid-state controllers.
  3. Report results in writing.
- C. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- D. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:
- E. Perform the following field tests and inspections and prepare test reports:
1. Perform each electrical test and visual and mechanical inspection, except optional tests, stated in NETA ATS. Certify compliance with test parameters.
  2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

### 3.9 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

### 3.10 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain variable frequency controllers. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 262923