SECTION 230514

VARIABLE FREQUENCY CONTROLLERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Variable frequency controller.

1.2 RELATED SECTIONS

A. Division 03 - Cast-in-Place Concrete: Housekeeping pads.

B. Section 23 05 13 - Motors.

C. Section 23 05 53 - Mechanical Identification: Engraved nameplates.

D. Section 26 28 13 - Fuses.

1.3 REFERENCES

A. NFPA 70 - National Electrical Code.

B. NEMA ICS 3.1 - Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems.

C. NEMA ICS 7 - Industrial Control and Systems: Adjustable Speed Drives.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Association).

1.4 SUBMITTALS

A. Submit under the provisions of Division 01.

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

C. Product Data: Provide catalog sheets showing voltage, controller size, ratings, and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.

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

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

F. Manufacturer’s Field Reports: Indicate start-up inspection findings.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

A. Submit under the provisions of Division 01.

B. Operation Data: NEMA ICS 3.1. Include instructions for starting and operating controllers and describe operating limits that may result in hazardous or unsafe conditions.

C. Maintenance Data: NEMA ICS 3.1. Include routine preventive maintenance schedule.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with a minimum of three (3) years' documented experience.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site under provisions of Section 23 05 00.

B. Accept controllers on site in original packing. Inspect for damage.

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

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

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Danfoss-Graham.

B. A.B.B.

C. Yaskawa.

D. Substitutions: Under the provisions of Section 01600.

2.2 DESCRIPTION

A. Provide enclosed variable frequency controllers suitable for operating the indicated loads. Conform to requirements of NEMA ICS 7.

B. Select unspecified features and options in accordance with NEMA ICS 3.1.

2.3 RATINGS

A. Rated Input Voltage: Reference drawings.

B. Motor Nameplate Voltage: Reference drawings.

C. Displacement Power Factor: Between 1.0 and 0.95, lagging, over entire range of operating speed and load.

D. Operating Ambient: 0 degrees C to 40 degrees C.

E. Minimum Efficiency at Full Load: 97 percent.

F. Time to Stop: 90 seconds.

2.4 DESIGN

A. Employ microprocessor-based inverter logic isolated from power circuits.

B. Employ pulse width modulated inverter system.

C. Design for ability to operate controller with motor disconnected from output.

D. Design to attempt five automatic restarts following fault condition before locking out and requiring manual restart.

2.5 PRODUCT OPTIONS AND FEATURES

A. Display: Provide integral digital display to indicate output voltage, output frequency, and output current.

B. Status Indicators: Separate indicators for overcurrent, overvoltage, ground fault, over temperature, and input power ON.

C. Volts Per Hertz Adjustment: Plus, or minus 10 percent.

D. Current Limit Adjustment: 50 - 110 percent of rated.

E. Acceleration Rate Adjustment: 0.5 - 600 seconds.

F. Deceleration Rate Adjustment: 0.5 - 600 seconds.

G. Provide HAND-OFF-AUTOMATIC selector switch and manual speed control.

H. Input Signal: 0-10 mV DC.

I. Door Interlocks: Furnish mechanical means to prevent opening of equipment with power connected, or to disconnect power if door is opened; include means for defeating interlock by qualified persons.

J. Safety Interlocks: Provide terminals for remote contact to inhibit starting under both manual and automatic mode.

K. Control Interlocks: Provide terminals for remote contact to allow starting in automatic mode.

L. Manual Bypass: Provide contactor, motor running overload protection, and short circuit protection for full voltage, non-reversing operation of the motor. Include isolation switch to allow maintenance of inverter during bypass operation.

M. Disconnecting Means: Include integral disconnect switch on the line side of each controller.

N. Motors: Motor shall meet NEMA MG-1, Section IV, Part 31.40.4.2.

2.6 FABRICATION

A. Wiring Terminations: Match conductor materials and sizes indicated.

B. Enclosure: NEMA 1.

C. Finish: Manufacturer's standard enamel.

2.7 SOURCE QUALITY CONTROL

A. Shop, inspect, and perform standard production tests for each controller specified in this section.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify the existing conditions prior to beginning work.

B. Verify that surface is suitable for controller installation.

C. Do not install the controller until the building environment can be maintained within the service conditions required by the manufacturer.

D. Verify that field measurements are as indicated on shop drawings.

3.2 PREPARATION

A. Provide concrete housekeeping pad under the provisions of Division 03.

3.3 INSTALLATION

A. Install controller where indicated in accordance with the manufacturer's written instructions and NEMA ICS 3.1.

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

C. Install fuses in fusible switches.

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

E. Provide engraved plastic nameplates under the provisions of Section 23 05 53.

F. Provide neatly typed label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place in plastic holder.

G. The drive shall be interlocked through the motor disconnect switch by an auxiliary contact in the motor disconnect switch.

3.4 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 7.16.2.

3.5 MANUFACTURER'S FIELD SERVICES

A. Prepare and start systems.

3.6 ADJUSTING

A. Make final adjustments to installed controller to assure proper operation of load system. Obtain performance requirements from installer of driven loads.

B. Provide systems demonstration to the owner’s representative.

C. Demonstrate operation of controllers in automatic and manual modes.

3.7 CLEANING

A. Touch up scratched or marred surfaces to match original finish.

END OF SECTION