UNIVERSITY OF ARKANSAS

*Facilities Management*
*Design and Construction Services*

**ADDENDUM NO. 3**
**April 18, 2019**

**REQUEST FOR PROPOSALS**
**AUTOMATIC TEMPERATURE CONTROLS**
**Indefinite Delivery Indefinite Quantity (IDIQ)**
**UNIVERSITY OF ARKANSAS, FAYETTEVILLE**

The following supplement is hereby made to the project referenced above:

**SECTION 00600 – TECHNICAL SPECIFICATIONS**

**Page 49, Item R: Add section "T." as noted below**

T. Flow Meters:

1. Refer to control diagrams for location and quantities of water flow meters. Flow meter is furnished by ATC Contractor and installed by Mechanical Contractor.

2. Water Flow Meters:

a. Insertion Type Electromagnetic Flow Meters:

1) Water flow meters for chilled and heating water service shall be of the insertion, electromagnetic type with minimum accuracy of 0.25% over the flow range of the application. Flow meter shall have BACnet, LON, or Modbus EMCS interface. Flow meter shall have LCD display for local readout. Flow meter shall have:

a) Analog Output (1):

i. Configurable

ii. Forward and reverse flow capability

b) Digital Outputs (2):

i. Passive, max 30VDC, 100 mA or

ii. Active, 24VDC, 50mA, max frequency 10kHz

c) Communication:

i. BACnet

3. Steam Flow Meters

a. Vortex-Shedding Flowmeters:

1) Description: Flowmeter with sensor and indicator.

2) Flow Range: Sensor and indicator shall cover operating range of equipment or system served.

3) Sensor: Inline type; for installing between pipe flanges and measuring flow directly in gallons per minute.

a) Design: Flow obstruction device, vortex-measurement type for steam.

b) Construction: Stainless-steel body, with integral transmitter and direct-reading scale.

c) Minimum Pressure Rating: 1000 psig.

d) Minimum Temperature Rating: 500 deg F.

e) Integral Transformer: For low-voltage power operation.

4) Indicator: Hand-held meter; either an integral part of sensor or a separate meter.

5) Accuracy: Plus or minus 0.25 percent for liquids and 0.75 percent for gases.

6) Display: Shows rate of flow, with register to indicate total volume in gallons.

7) Operating Instructions: Include complete instructions with each flowmeter.

**RESPONSES TO QUESTIONS SUBMITTED BY PROPOSERS:**

Refer to attached "Response to RFI" document for a list of questions received prior to April 16, 2019 with responses to each question.

This addendum consists of two (2) pages of written documentation plus attachments. Except as modified by this addendum, the original proposal documents shall remain in effect.

This addendum must be acknowledged in the space provided on the Proposal Form.

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# Response to RFI's

| | |
|---|---|
| **Date:** | April 18, 2019 |
| **Project:** | UAF Automatic Temperature Controls IDIQ RFP |
| **Project #** | 04-18-0072 |
| **Ref:** | ATC IDIQ RFP RFI Responses |
| **Submitted By:** | Various ATC IDIQ RFP Proposers |

The following RFI questions have been submitted for the University of Arkansas Automatic Temperature Controls IDIQ RFP. Responses have been provided for each of the questions that have been submitted prior to the deadline for RFI's (Tuesday, April 16, 2019 at 5:00 p.m.)

**Comments**

1. Given that we are to provide VFD's, where can we get an updated schedule showing fan and pump data?

**BERNHARD TME RESPONSE: Price all fans as 10 HP, price all pumps as 20 HP, and price the Energy Wheel as 5 HP.**

2. Addendum #2 specifies that "Variable frequency drives and flow meters shall be furnished by the Contractor as part of this contract." Please provide specifications for the flow meters (steam and water) as well as the Variable frequency drives that are to be used. In addition, please provide a standard size (voltage and horsepower) VFD that is to be used for each system for bidding purposes so that all bidders are pricing the same size flow meters and VFD's.

**BERNHARD TME RESPONSE: Refer to attached 230900.01 for VFD requirements. Price all fans as 10 Hp, price all pumps as 20 Hp, and price the Energy Wheel as 5hp. All VFD's shall be priced as 460V, 3 phase, with bypass.**

3. Addendum #2 specifies the airflow station type and velocity range, but does not provide a duct size for which to provide pricing. Please provide duct sizes for each of the air handling units that require an airflow station for bidding purposes so that all bidders are pricing the same size airflow stations.

**BERNHARD TME RESPONSE: Price 36" x 36" stations for all standard systems.**

4. Addendum #2 provided answers that will require many changes to the controls pricing, drawings, and submittals. Would you please consider extending the bid date by at least two days to Thursday April, 25th? This RFP response requires a significant amount of time to complete and another two days after receipt of the Addendum #2 responses would be very helpful to allow the bidders to provide the most competitive bids to the owner.

**BERNHARD TME RESPONSE: The request for additional bidding time has been considered, however the bid date will be maintained for 2:00 PM on Tuesday, April 23, 2019.**

**END OF RFP RFI RESPONSE**

**SECTION 23 0900.01**

**VARIABLE FREQUENCY DRIVE MOTOR CONTROLLERS**

## PART 1 - GENERAL

### 1.01 SUMMARY

A. Section includes separately enclosed, pre-assembled, combination VFCs, rated 600 V and less, for speed control of three-phase, squirrel-cage induction motors.

### 1.02 DEFINITIONS

A. EMCS: Energy Monitoring and Control System

B. CPT: Control power transformer.

C. EMI: Electromagnetic interference.

D. IGBT: Insulated-gate bipolar transistor.

E. LAN: Local area network.

F. LED: Light-emitting diode.

G. MCP: Motor-circuit protector.

H. NC: Normally closed.

I. NO: Normally open.

J. OCPD: Overcurrent protective device.

K. PCC: Point of common coupling.

L. PID: Control action, proportional plus integral plus derivative.

M. PWM: Pulse-width modulated.

N. RFI: Radio-frequency interference.

O. TDD: Total demand (harmonic current) distortion.

P. THD(V): Total harmonic voltage demand.

Q. VFC: Variable-frequency motor controller.

### 1.03 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. IEEE Compliance: Fabricate and test VFC according to IEEE 344.

### 1.04 COORDINATION

A. Coordinate features of motors, load characteristics, installed units, and accessory devices to be compatible with the following:

1. Torque, speed, and horsepower requirements of the load.

2. Ratings and characteristics of supply circuit and required control sequence.

3. Ambient and environmental conditions of installation location.

### 1.05 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace VFCs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURED UNITS

A. Manufacturers: Subject to compliance with requirements, provide one of the following manufacturer's comparable products, or an approved equal:

1. ABB.
2. Danfoss Inc.; Danfoss Drives Div.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.
5. Yaskawa Electric America, Inc; Drives Division.

B. General Requirements for VFCs: Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508C.

C. Application: variable torque.

D. VFC Description: Variable-frequency power converter (rectifier, dc bus, and IGBT, PWM inverter) factory packaged in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.

1. Units suitable for operation of NEMA MG 1, Design A and Design B motors as defined by NEMA MG 1, Section IV, Part 30, "Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both."
2. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31, "Definite-Purpose Inverter-Fed Polyphase Motors."
3. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.

E. 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.

F. Output Rating: Three-phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage range; maximum voltage equals input voltage.

G. Unit Operating Requirements:

1. Input AC Voltage Tolerance: Plus 10 and minus 10 percent of VFC input voltage rating.
2. Input AC Voltage Unbalance: Not exceeding 3 percent.
3. Input Frequency Tolerance: Plus or minus 3 percent of VFC frequency rating.
4. Minimum Efficiency: 96 percent at 60 Hz, full load.
5. Minimum Displacement Primary-Side Power Factor: 96 percent under any load or speed condition.
6. Minimum Short-Circuit Current (Withstand) Rating: 22 kA.

7. Ambient Temperature Rating: Not less than 14 deg F and not exceeding 104 deg F.

8. Ambient Storage Temperature Rating: Not less than minus 4 deg F and not exceeding 140 deg F

9. Humidity Rating: Less than 95 percent (noncondensing).

10. Altitude Rating: Not exceeding 3300 feet.

11. Vibration Withstand: Comply with IEC 60068-2-6.

12. Overload Capability: 1.1 times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.

13. Starting Torque: Minimum 100 percent of rated torque from 3 to 60 Hz.

14. Speed Regulation: Plus or minus .05 percent.

15. Output Carrier Frequency: Selectable; 0.5 to 15 kHz.

16. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.

H. Inverter Logic: Microprocessor based, 32 bit, isolated from all power circuits.

I. Isolated Control Interface: Allows VFCs to follow remote-control signal over a minimum 40:1 speed range.

1. Signal: Electrical.

J. 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: 0.1 to 999.9 seconds.

4. Deceleration: 0.1 to 999.9 seconds.

5. Current Limit: 30 to minimum of 150 percent of maximum rating.

K. Self-Protection and Reliability Features:

1. Input transient protection by means of surge suppressors to provide three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.

2. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.

3. Under- and overvoltage trips.

4. Inverter overcurrent trips.

5. VFC and Motor Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFCs and motor thermal characteristics, and for providing VFC overtemperature and motor overload alarm and trip; settings selectable via the keypad; NRTL approved.

6. Critical frequency rejection, with three selectable, adjustable deadbands.

7. Instantaneous line-to-line and line-to-ground overcurrent trips.

8. Loss-of-phase protection.

9. Reverse-phase protection.

10. Short-circuit protection.

11. Motor overtemperature fault.

L. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.

M. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.

N. Bidirectional Autospeed Search: Capable of starting VFC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.

O. 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.

P. 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.

Q. Integral Input Disconnecting Means and OCPD: NEMA AB 1, thermal-magnetic circuit breaker with pad-lockable, door-mounted handle mechanism.

1. Disconnect Rating: Not less than 115 percent of VFC input current rating.

2. Auxiliary Contacts: NO/NC, arranged to activate before switch blades open.

3. Auxiliary contacts "a" and "b" arranged to activate with circuit-breaker handle.

4. NC and NO alarm contacts that operates only when circuit breaker has tripped.

**2.02 CONTROLS AND INDICATION**

A. Status Lights: Door-mounted LED indicators displaying the following conditions:

1. Power on.

2. Run.

3. Overvoltage.

4. Line fault.

5. Overcurrent.

6. External fault.

B. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.

1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.

2. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service.

a. Control Authority: Supports at least four conditions: Off, local manual control at VFC, local automatic control at VFC, and automatic control through a remote source.

C. 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.

D. Indicating Devices: Digital display and additional readout devices as required, mounted flush in VFC door and connected to display VFC parameters including, but not limited to:

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 (V dc).

9. Set point frequency (Hz).

10. Motor output voltage (V ac).

E. Control Signal Interfaces:

1. Electric Input Signal Interface:

a. A minimum of two programmable analog inputs: 0- to 10-V dc and 4- to 20-mA dc.

b. A minimum of six multifunction 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. 4- to 20-mA dc.

c. Potentiometer using up/down digital inputs.

d. Fixed frequencies using digital inputs.

4. Output Signal Interface: A minimum of one programmable analog output signal(s) (0- to 10-V dc and 4- to 20-mA dc), which can be configured for any of the following:

a. Output frequency (Hz).

b. Output current (load).

c. DC-link voltage (V dc).

d. Motor torque (percent).

e. Motor speed (rpm).

f. Set point frequency (Hz).

5. Remote Indication Interface: A minimum of two programmable 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.

F. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display VFC status and alarms and energy usage. Allows VFC to be used with an external system within a multidrop LAN configuration; settings retained within VFC's nonvolatile memory.

1. Network Communications Ports: Ethernet and RS-422/485.

2. Embedded BAS Protocols for Network Communications: ASHRAE 135 BACnet.

## 2.03 LINE CONDITIONING AND FILTERING

A. Input Line Conditioning: 3% Line Reactor.

## 2.04 ENCLOSURES

A. VFC Enclosures: NEMA 250, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: Type 1.

## 2.05 ACCESSORIES

A. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in VFC enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: Standard-duty type.

a. Push Buttons: Covered and Shielded types; momentary.

b. Pilot Lights: LED type**;** push to test.

c. Selector Switches: Rotary type.

d. 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.

B. Bypasses are to be provided.

# PART 3 - EXECUTION

## 3.01 INSTALLATION

A. Wall-Mounting Controllers: Install VFCs on walls with tops at uniform height and with disconnect operating handles not higher than 79 inches above finished floor unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Comply with NECA 1.

## 3.02 IDENTIFICATION

A. Identify VFCs, components, and control wiring.

1. Label each VFC with engraved nameplate.

2. Label each enclosure-mounted control and pilot device.

## 3.03 CONTROL WIRING INSTALLATION

A. Install wiring between VFCs and remote devices and facility's central-control system.

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic control devices where applicable.

1. Connect selector switches to bypass only those manual- and automatic control devices that have no safety functions when switches are in manual-control position.

2. Connect selector switches with control circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

**3.04 STARTUP SERVICE**

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

**3.05 ADJUSTING**

A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.

B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to six times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required).

D. Set the taps on reduced-voltage autotransformer controllers.

E. Set field-adjustable pressure switches.

**3.06 DEMONSTRATION**

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, reprogram, and maintain VFCs.

**END OF SECTION**