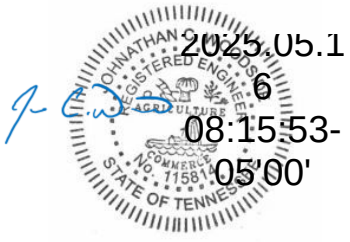
Gresham Smith

# MTSU CAMPUS WIDE CENTRAL PLANT & CAMPUS UTILITIES UPDATES MURFREESBORO, TN

SBC Project Number. 366/009-05-2023
Gresham Smith Project No. 46986.00
Addendum No.: 01
Issue Date: May 16, 2025




To All Bidders:

The following are changes to the Bidding Documents for MTSU Multiple Buildings Mechanical & Controls Update dated 5/2/2025. All bidders shall acknowledge this addendum on their bid form.

**Final RFIs due: 5/19/2025 4:00PM**
**Final Addenda Issued: 5/21/2025 4:00PM**
**Bid Date: 5/28/2025 until 2:00 PM at Office of Campus Planning/Construction Administration (CPCA) Holmes Building 836 Champion Way; Suite 104 Murfreesboro, TN 37132**

Pre-bid RFI Questions:

1. **Question:** The below specifications are missing. Are these needed?
   - 005433 ACH Credits Form
   - 013216 Construction Progress Schedule
   - 260806 Panelboard Check Sheet
   - 260813 Power Circuit Check Sheet

   **Answer:** Yes, these specifications are required for the project.
2. **Question:** Are the 18-pulse drives the only acceptable VFDs?
   **Answer:** 6-pulse drives are acceptable with required passive harmonic filtering and bypass per sheet ME201 and ME202.
3. **Question:** Is a bypass required on the large horsepower VFDs?
   **Answer:** Bypass is required per specification section 230514 2.2 U.

Description:

| Project Manual | Description |
|---|---|
| 005433 ACH Credits Form | Added section in its entirety |

| | |
|---|---|
| **013216 Construction Progress Schedule** | Added section in its entirety |
| **230514 Variable Frequency Motor Controllers** | Updated 6 pulse drives. |
| **260806 Panelboard Check Sheet** | Added section in its entirety |
| **260813 Power Circuit Check Sheet** | Added section in its entirety |

| Project Drawings | Description |
|---|---|
| ME201 – HVAC PIPING CEP / COGENERATION PLANT NEW CONSTRUCTION PLAN | Updated to replace condenser water piping. |
| M207 - HVAC PIPING KEATHLEY UNIVERSITY CENTER AND LEARNING RESOURCE CENTER PLAN | Updated KUC DP sensor to be installed as part of Alternate #2. |

Attachments:

- A52Pre-BidMeetingAgenda

**STATE OF TENNESSEE**
**DEPARTMENT OF FINANCE AND ADMINISTRATION**
**ACH (AUTOMATED CLEARING HOUSE) CREDITS (Not Wire Transfers)**

NAME_____

Federal Identification Number or Social Security Number_____
(under which you are doing business with the State)

I (We) hereby authorize the State of Tennessee, hereafter called the STATE, to initiate credit entries to my (our)*(select type of account)*_____ CHECKING or _____ SAVINGS account indicated below and the depository named below, hereinafter called DEPOSITORY, to credit the same to such account.

This authority is to remain in full force and effect until the STATE has received written notification from me (or one of us) of its termination in such time and in such manner as to afford the STATE and DEPOSITORY a reasonable opportunity to act on it.

**********

Have you ever received payments from the State through ACH? _____ (Yes or No). If yes, do you intend for this account information to replace existing account information currently used by the State? _____ (Yes or No). If yes, please specify account that should be changed: ABA No. _____ Account No. _____. Is this authorization only for certain types of payments? _____ (Yes or No). If yes, please indicate types:

_____

_____

_____

**********

Many banking institutions use different numbers for ACH. Please call your bank for verification of ACH transit and account number.

Bank official contacted: _____ Phone No. _____

**********

DEPOSITORY/BANK NAME _____BRANCH _____

CITY _____STATE _____

ACH TRANSIT / ABA NO. _____ACCOUNT NO. _____

NAME(S) _____
(Please print names of authorized account signatory)

DATE _____SIGNED X _____SIGNED X _____

PLEASE ATTACH A VOIDED CHECK (OR FOR SAVINGS ACCOUNTS, A DEPOSIT SLIP):

PLEASE INDICIATE ADDRESS TO WHICH YOU WOULD LIKE YOUR REMITTANCE ADVICES ROUTED WHEN PAYMENTS ARE PROCESSED:

_____

_____

_____

_____

Contact name: _____

Telephone No.: _____

FOR STATE USE ONLY:
CONTACT AGENCY – _____
CONTACT PERSON _ _____
PHONE NUMBER _ _____

FA-0825 (Rev. 4/96)

## 01 32 00 – CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 – GENERAL

1.01 IDENTIFICATION

A. Identify clearly the Project, SBC Number, and date of issuance or revision on each submitted schedule.

1.02 CONSTRUCTION SCHEDULE FORMAT

A. Use a bar chart or critical path schedule format or other method approved by the Designer. A critical path schedule is recommended to enable meeting requirements for documentation for time extension requests.

B. Utilize a construction scheduling software for development and updates.

C. Outline the orderly progress of the Work as planned from the Notice to Proceed through Substantial Completion on the contractually required date.

D. Categorize the Work by major work area and distinct trade or team. If phases are specified also categorize by phase.

E. Divide work activities into one month or less duration.

F. Provide an identifiable relationship to the schedule of values.

G. Identify projected monthly progress, points of 50% completion and Substantial Completion, and other major milestones.

H. If included in the Work, commissioning and storm water pollution protection plan activities shall be major milestones.

I. If planting that is seasonally sensitive is included in the Work, show such distinctly in a seasonally appropriate time.

J. Transmit the schedule in PDF format when requested by the Owner or Designer.

1.03 INITIAL CONSTRUCTION SCHEDULE

Submit within 21 days of award of the Contract and no later than the date of submission of the first Application for Payment.

1.04 UPDATED CONSTRUCTION SCHEDULE

A. Submit a copy attached to each counterpart of Applications for Payment.

B. Format in a manner similar to the initial progress schedule and as follows:

1. Indicate the initial construction schedule for the Work.

2. Identify the actual progress through the period covered by the current Application for Payment.

3. Indicate the planned progress through Substantial Completion including extensions of time made by Modification.

4. If actual progress falls behind previous projections, indicate the recovery plan so that the Work will be completed on time.

1.05 SUBMITTALS SCHEDULE

A. Submit in writing with the initial construction schedule.

B. The submittals schedule may be incorporated into the construction schedule if clearly identified.

C. Identify submittals to be made.

D. Show date for submission and date by which Designer should respond, allowing sufficient time for review. Designer may require revision of the submittals schedule if times allotted for review are insufficient.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

**SECTION 23 05 14**
**VARIABLE FREQUENCY MOTOR CONTROLLERS**

## PART 1 -GENERAL

### 1.1 SUMMARY

A. This Section includes solid-state, PWM, VFCs for speed control of three-phase, squirrel-cage induction motors.

B. 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 "Surge Protection Devices" for low-voltage power, control, and communication surge suppressors.
   3. Division 26 Section "Fuses" for fuses in fusible switches.

### 1.2 DEFINITIONS

A. BMS: Building management system.

B. IGBT: Integrated gate bipolar transistor.

C. LAN: Local area network.

D. NRTL: Nationally Recognized Testing Laboratory.

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

F. PWM: Pulse-width modulated.

G. VFC: Variable frequency controller.

H. VFD: Variable Frequency Drive. Synonymous with VFC and used interchangeably throughout the project documents.

### 1.3 SUBMITTALS - ACTION

A. Product Data: For each type of VFC, provide 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: For each VFC.
   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 ratings 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 VFC. Provide schematic wiring diagram for each type of VFC.

### 1.4 SUBMITTALS – INFORMATIONAL

A. Coordination Drawings: Floor plans showing dimensioned layout, required working clearances, and required area above and around VFCs where pipe and ducts are prohibited. Show VFC 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. Provide point map as part of the submittal for contractor to map appropriate points to BMS front end.

B. Manufacturer Seismic Qualification Certification: Submit certification that VFCs, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems". Include the following:
   1. Basis of 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.

C. Qualification Data: For testing agency and manufacturer.

D. Field Test Reports: Written reports specified in Part 3.

E. Manufacturer`s field service report.

### 1.5 SUBMITTALS - CLOSEOUT

A. Operation and Maintenance Data: For VFCs, all installed devices, and components to include in emergency, operation, and maintenance manuals. Include the following:
   1. Routine maintenance requirements for VFCs and all installed components.
   2. Manufacturer`s written instructions for testing and adjusting overcurrent protective devices.
   3. Additional items as specified in:
      a. Division 01 Section “Closeout Procedures”.
      b. Division 01 Section “Operation and Maintenance Data”.

B. Load-Current andOverload list (s) as applicable for bypass controllers:

C. Overload-Relay Heaters List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

D. 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.

### 1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: 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 testing 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 1910.17, and that is acceptable to authorities having jurisdiction.

1. Testing Agency 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 VFCs 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. Product Selection for Restricted Space: Drawings indicate maximum dimensions for VFCs, minimum clearances between VFCs, and adjacent surfaces and other items. Comply with indicated dimensions and clearances.

F. Comply with NFPA 70.

G. Comply with IEEE 519-1999.

## 1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver VFCs in shipping splits of lengths that can be moved past obstructions in delivery path as indicated.

B. Store VFCs indoors in clean, dry space with uniform temperature to prevent condensation. Protect VFCs from exposure to dirt, fumes, water, corrosive substances, and physical damage.

C. If stored in areas subject to weather, cover VFCs 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.

## 1.8 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 (non-condensing).
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 Prime Design Professional, Prime Contractor or Construction Manager and Owner no fewer than 14 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 Prime Design Professional`s,Prime Contractor or Construction Manager`s, and Owner`s written permission.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for VFCs, including clearances between VFCs, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

## 1.9 COORDINATION

A. Coordinate layout and installation of VFCs 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.

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 VFCs, installed units, and accessory devices with pilot devices and control circuits to which they connect.

E. Coordinate features, accessories, and functions of each VFC and each installed unit with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

### 1.10 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 not less 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. Baldor Electric Company (Graham).
   3. Danfoss Inc.; Danfoss Electronic Drives Div.
   4. Eaton Corp.; Cutler-Hammer Products.
   5. General Electrical Distribution & Control.
   6. Rockwell Automation Allen-Bradley Co.; Industrial Control Group.
   7. Siemens Energy and Automation; Industrial Products Division.
   8. Square D Co.
   9. Toshiba International Corporation.
   10. Mitsubishi Electric.

### 2.2 VARIABLE FREQUENCY CONTROLLERS

A. Description: NEMA ICS 2, IGBT, PWM, VFC; listed and labeled as a complete unit and arranged to provide variable speed of a NEMA MG 1, Design B, 3-phase, premium-efficiency induction motor by adjusting output voltage and frequency.
   1. 12-pulse output for motors 50 HP and less.
   2. 6-pulse output for motors greater than 50 HP

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. Coordinate thermal rating conditions with controller location and enclosure rating.

D. Output Rating: 3-phase; 6 to 60 Hz, with voltage proportional to frequency throughout voltage range.

E. Unit Operating Requirements:
   1. Input ac voltage as indicated plus or minus 5%
   2. Input frequency tolerance of 50/60 Hz, plus or minus 6 percent.
   3. Capable of driving full load, under the following conditions, without derating:
      a. Ambient Temperature: 0 to 40 deg C.
      b. Humidity: Less than 90 percent (non-condensing).

c. Altitude: 3300 feet.

4. Minimum Efficiency: 96 percent at 60 Hz, full load.
5. Minimum Displacement Primary-Side Power Factor: 96 percent.
6. Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds.
7. Starting Torque: 100 percent of rated torque or as indicated.
8. Speed Regulation: Plus or minus 1 percent.
9. Isolated control interface to allow controller to follow control signal over an 11:1 speed range.

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 250, Class 10 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: Each variable frequency controller and its bypass shall be designed and labeled to withstand the available fault current at the units` location. The Contractor shall contact the Architect to receive these values if they cannot be determined from the drawings. Submittals shall include the available fault current for each controller as well as the AIC withstand rating of each unit.
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 and Restart: To attempt 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 vary starting and continuous torque to at least 1.5 times the minimum torque to insure 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:
1. Maximum Total Harmonic Distortion of Voltage (THDv): 5 percent.

N. VFC Output Filtering: as required coordinated with motor(s) provided

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: Provide VFC with the following:
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. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BMS 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.
3. 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).
4. 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 BACnet communication card for connection to campus' Siemens control system. Interface shall allow all parameter settings of VFC to be programmed via BMS control. Provide capability for VFC to retain these settings within the nonvolatile memory.

T. Manual Bypass: Where indicated for motors less than 50 HP magnetic contactor arranged to safely transfer motor between controller output and bypass controller circuit when motor is at zero speed. Where indicated for Motors 50 HP or greater provide reduced voltage 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: Where indicated for motor less than 50 HP NEMA ICS 2, full-voltage, nonreversing enclosed controller with across-the-line starting capability in manual-bypass mode. Where indicated for motors 50 HP or greater NEMA ICS 2 reduced voltage, nonreversing enclosed motor 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. Isolating Switch: Non-load-break switch arranged to isolate VFC and permit safe troubleshooting and testing, both energized and de-energized, while motor is operating in bypass mode.

W. Integral Disconnecting Means: NEMA KS 1, nonfusible switch with lockable handle.

X.

## 2.3 ENCLOSURES

A. Controllers located indoors in conditioned or ventilated non-hazardous locations: NEMA 1

B. Controllers located outdoors under protective cover: NEMA 3

C. Controllers located outdoors unprotected; NEMA 4, stainless steel.

D. Coordinate mounting conditions with controller and enclosure rating.

## 2.4 ACCESSORIES

A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.

B. Provide a green pilot light for running and a red pilot light for stopping for each controller. Provide a hand-off-auto selector switch for each controller, unless otherwise noted.

C. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty 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.

E. Control Relays: Auxiliary and adjustable time-delay relays.

F. 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).

G. 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.

H. 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.

I. dV/dt filters for motor leads greater than 100 feet in length.

### 2.5 FACTORY FINISHES

A. Finish: For non hazardous indoor locations: Manufacturer`s standard color paint applied to factory-assembled and -tested VFCs before shipping.For outdoor or hazardous locations: Stainless steel.

## PART 3 -EXECUTION

### 3.1 EXAMINATION

A. Examine areas, surfaces, and substrates to receive VFCs 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 VFC installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLICATIONS

A. Select features of each VFC to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; and duty cycle of motor, drive, and load.

B. Select rating of controllers to suit motor controlled.

### 3.3 INSTALLATION

A. Anchor each VFC assembly to steel-channel sills arranged and sized according to manufacturer`s written instructions. Attach by bolting. Level and grout sills flush with VFC mounting surface.

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

### 3.4 IDENTIFICATION

A. Identify VFCs, components, and control wiring according to Division 26 Section "Identification for Electrical Systems."

B. Operating Instructions: Frame printed operating instructions for VFCs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of VFC units.

### 3.5 CONTROL WIRING INSTALLATION

A. Install wiring between VFCs 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 available.
   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.

### 3.6 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 Section “Grounding and Bonding for Electrical Systems”.

C. Tighten electrical connectors and terminals according to manufacturer`s published torque-tightening values. If manufacturer`s torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.7 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:
   1. Test insulation resistance for each VFC element, bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

B. Testing: Owner will engage a qualified testing agency to perform the following field quality-control testing:

C. Testing: Engage a qualified testing agency to perform the following field quality-control testing:

D. Testing: Perform the following field quality-control testing:
   1. Perform each electrical test and visual and mechanical inspection 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.

E. Manufacturer`s Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including pretesting and adjusting VFCs.

F. Test Reports: Prepare a written report to record the following:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

### 3.8 STARTUP SERVICE

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

B. Verify that electrical wiring installation complies with manufacturer`s submittal and installation requirements in Division 26 Sections.

C. Complete installation and startup checks according to manufacturer`s written instructions.

### 3.9 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges as required by the coordination study required under Division 26.

### 3.10 CLEANING

A. Clean VFCs internally, on completion of installation, according to manufacturer`s written instructions. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

### 3.11 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner`s maintenance personnel to adjust, operate, and maintain VFCs.
   1. Refer to additional requirements in Division 01 Section "Demonstration and Training".
   2. Refer to additional requirements in Division 01 Section "Closeout Procedures".

| ISSUED: | DATE: |
|---|---|
| _FINAL ISSUE NAME | _FINAL ISSUE DATE |
| | |
| | |



**END OF SECTION 23 05 14**

## 26 08 06 - PANELBOARD CHECK SHEET

| | | | |
|---|---|---|---|
| SBC Project No: | 366/009-05-2023 | Page | of |
| Institution or Campus: | Middle Tennessee State University | Date: | |
| Building: | | Tests run by: | |
| Installer: | | | |

**System/Unit Identifier:**

Location:

| ITEM | PANEL | PANEL | PANEL | PANEL |
|---|---|---|---|---|
| Room sprinkler | | | | |
| Pipes above panel | | | | |
| Room air conditioned | | | | |
| NEC code space | | | | |
| Conduits secured | | | | |
| Fire caulking | | | | |
| Ground buss | | | | |
| MCB/MLO | | | | |
| kAIC rating | | | | |
| Panel Manufacturer | | | | |
| Panel model number | | | | |
| Panel circuits ID | | | | |
| Wire colors | | | | |
| One wire per breaker | | | | |
| Wires neatly terminated | | | | |
| Spare breakers off | | | | |
| Panel clean | | | | |
| | | | | |
| **Measurements** | | | | |
| A amps | | | | |
| B amps | | | | |
| C amps | | | | |
| N amps | | | | |
| Ground amps | | | | |
| A-N volts | | | | |
| B-N volts | | | | |
| C-N volts | | | | |
| A-B volts | | | | |
| A-C volts | | | | |
| B-C volts | | | | |
| N-G volts | | | | |
| | | | | |

## 26 08 13 - POWER CIRCUIT CHECK SHEET

| | | | |
|---|---|---|---|
| SBC Project No: | 366/009-05-2023 | Page | of |
| Institution or Campus: | Middle Tennessee State University | Date: | |
| Building: | | Tests run by: | |
| Installer: | | | |

**System/Unit Identifier:**

Location:

| Floor | Room | Panel | Ckt. | Device | Volts | Wiring | GFI/ARC msec/mA | V-Drop @ Load % | Imp/ohms Hot Leg | Coments |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
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Drawn By: Author
Checked By: Checker
Approved By: Approver

## HVAC PIPING CEP/COGENERATION PLANT NEW CONSTRUCTION KEYNOTES

1 INSTALL SCHWP-G. INSTALL 16" AND 20" RESILIENT SEATED ISOLATION VALVES AT PUMP INLET AND OUTLET. CONTRACTOR SHALL MODIFY EXISTING PIPING AT PUMP INLET AND OUTLET AS REQUIRED FOR NEW PUMP INSTALLATION. CONTRACTOR SHALL MODIFY/EXTEND EXISTING CONCRETE PAD AS REQUIRED TO EXTEND BEYOND EQUIPMENT FOOTPRINT. MINIMUM 4" TALL OR AS REQUIRED TO MATCH EXISTING.

2 PROVIDE SCHWP-G WITH MOTOR RATED VFD, NEMA 1 WITH BYPASS AND HARMONIC FILTERS. CONNECT PUMPS/VFDS FOR SCHWP-G TO EXISTING SWITCHBOARD NEW CIRCUIT BREAKER IN PLACE OF EXSITING CEIRCUIT BREAKER REMOVED.

3 INSTALL RESILIENT SEATED BUTTERFLY ISOLATION VALVES AT CHILLER CHWS&R AND CTWS&R.

4 INSTALL 10" AND 12" RESILIENT SEATED BUTTERFLY ISOLATION VALVES AT SCHWP-F CHWS&R.

5 INSTALL 16" AND 18" RESILIENT SEATED BUTTERFLY ISOLATION VALVES AT SCHWP-E CHWS&R.

6 INSTALL 16" AND 18" RESILIENT SEATED BUTTERFLY ISOLATION VALVES AT SCHWP-B CHWS&R.

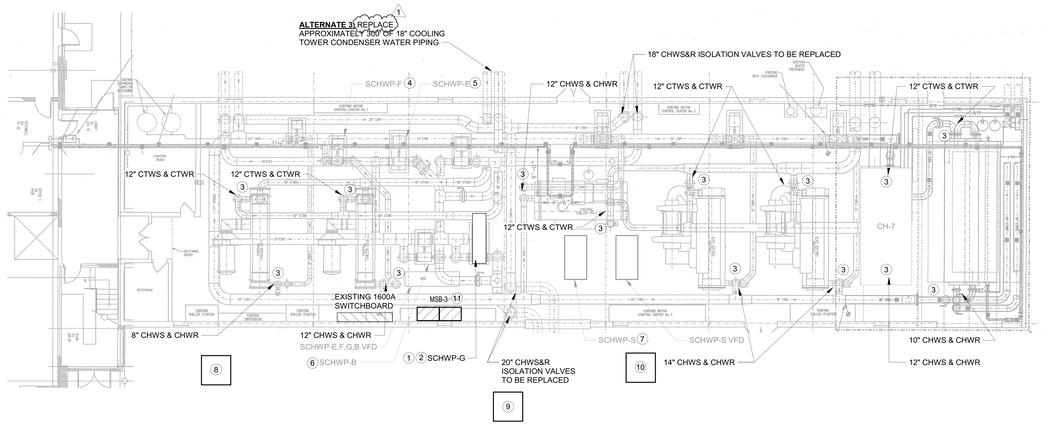
7 INSTALL 20" AND 24" RESILIENT SEATED BUTTERFLY ISOLATION VALVES AT SCHWP-S CHWS&R.

8 ALTERNATE 1: REPLACE EXISTING UTILITY TRANSFORMER 131903 RATED 750KVA FEEDING SOUTH TOWER MCC FROM UTILITY CIRCUIT C-3. COORDINATE SCOPE OF WORK WITH MIDDLE TENNESSE ELECTRIC. PROVIDE ALL NECESSARY ELECTRICAL EQUIPMENT FOR A COMPLETE AND FULLY FUNCTIONAL SYSTEM.

9 ALTERNATE 1: REPLACE EXISTING UTILITY TRANSFORMER 131906 RATED 750KVA FEEDING MCC #3 FROM UTILITY CIRCUIT C-2. COORDINATE SCOPE OF WORK WITH MIDDLE TENNESSE ELECTRIC. PROVIDE ALL NECESSARY ELECTRICAL EQUIPMENT FOR A COMPLETE AND FULLY FUNCTIONAL SYSTEM.

10 ALTERNATE 1: REPLACE EXISTING UTILITY TRANSFORMER 131911 RATED 750KVA FEEDING CHILLER 5 FROM UTILITY CIRCUIT C-1. COORDINATE SCOPE OF WORK WITH MIDDLE TENNESSE ELECTRIC. PROVIDE ALL NECESSARY ELECTRICAL EQUIPMENT FOR A COMPLETE AND FULLY FUNCTIONAL SYSTEM.

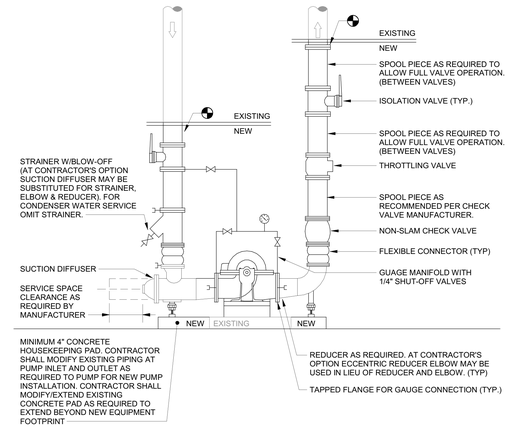
11 NEW 1600A SWITCHBOARD MSB-3. SWITCHBOARD SHALL BE SQUARE D QED-2 TYPE OR EQUAL. MAIN CIRCUIT BREAKER SHALL INCLUDE LSIG SETTINGS. NEUTRAL TO GROUND BOND SHALL MATCH EXISTING SERVICE ENTRANCE EQUIPMENT. ALL FEEDER CIRCUIT BREAKERS SHALL INCLUDE ADJUSTABLE LSI TRIP SETTINGS. PROVIDE SURGE SUPPRESSION ON SWITCHBOARD PER SPECIFICATIONS. REFER TO PANEL SCHEDULE THIS SHEET. CONTRACTOR SHALL VERIFY EXISTING UTILITY TRANSFORMER SIZE PREVIOUSLY FEEDING THE DEMOLISHED MOTOR CONTROL CENTER. UTILITY TRANSFORMER SHALL BE SIZED AT A MINIMUM TO ACCOMODATE THE 1600A SWITCHBOARD. COORDINATE SIZE REQUIREMENTS WITH UTILITY COMPANY. IF EXISTING UTILTY TRANSFORMER IS NOT OF ADEQUATE SIZE NOTIFY THE ENGINEER OF RECORD FOR COORDINATION. CONTRACTOR SHALL INCLUDE A SEPARATE LINE ITEM COST IN THE INITIAL BID FOR TRANSFORMER REPLACEMENT AS PART OF THIS SCOPE OF WORK.



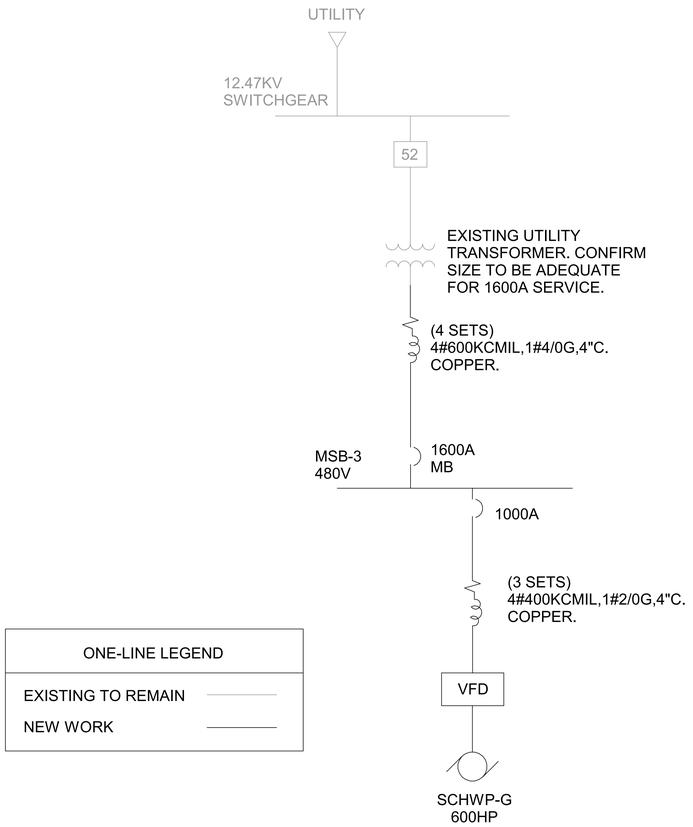

## 1 CEP / COGENERATION LOWER NEW CONSTRUCTION PLAN
NOT TO SCALE

**NOTE:**

1. IN LIEU OF SUCTION DIFFUSER CONTRACTOR MAY USE LINE SIZE STRAINER IN HORIZONTAL WITH MINIMUM FIVE EQUIVALENT STRAIGHT PIPE DIAMETERS BETWEEN STRAINER AND PUMP SUCTION INLET WITH ECCENTRIC REDUCER AT PUMP SUCTION AS REQUIRED.
2. SUPPORT PIPING INDEPENDENT OF PUMP AS INDICATED.
3. AT CONTRACTORS OPTION IF PUMP DISCHARGE ISOLATION VALVE IS SUITABLE FOR THROTTLING SERVICE SEPARATE THROTTLING VALVE MAY BE OMITTED.




## 2 SPLIT CASE PUMP PIPING NEW CONSTRUCTION
NOT TO SCALE




## 3 PARTIAL ONE-LINE DIAGRAM
NOT TO SCALE

### Switchboard: MSB-3

**Location:**
**Supply From:** UTILITY TRANSFORMER
**Mounting:** FREE STANDING
**Enclosure:** NEMA 1

**Volts:** 480/277 Wye
**Phases:** 3
**Wires:** 4

**Bus SC Rating:** 65000A
**Available Fault Mains Type:** MCB
**Mains Rating:** 1600 A

**Notes:**

| CKT | Circuit Description | # of Poles | Frame Size | Trip Rating | Load (kVA) | Remarks |
|---|---|---|---|---|---|---|
| 1 | SCHWP-G | 3 | 1000 A | 1000 A | 600.26 | |
| 2 | Spare | 3 | 1000 A | 600 A | 0.00 | |
| 3 | Spare | 3 | 400 A | 400 A | 0.00 | |
| 4 | Spare | 3 | 100 A | 60 A | 0.00 | |
| 5 | Spare | 3 | 100 A | 60 A | 0.00 | |
| 6 | Spare | 3 | 100 A | 30 A | 0.00 | |
| 7 | Spare | 3 | 100 A | 30 A | 0.00 | |
| 8 | VFD 6 (MATCH EXISTING) | 3 | 400 A | 100 A | 0.00 | |
| 9 | Space | 1 | -- | -- | -- | |
| 10 | Space | 1 | -- | -- | -- | |
| 11 | Space | 1 | -- | -- | -- | |
| 12 | Space | 1 | -- | -- | -- | |
| 13 | Space | 1 | -- | -- | -- | |
| 14 | Space | 1 | -- | -- | -- | |
| 15 | SPD | 3 | 100 A | 30 A | 0.00 | |
| | | | | **Total Conn. Load:** | 600260 VA | |
| | | | | **Total Amps:** | 722 A | |

| Load Classification | Connected Load | Demand Factor | Estimated Demand | Panel Totals | |
|---|---|---|---|---|---|
| Other | 600260 VA | 100.00% | 600260 VA | | |
| | | | | **Total Conn. Load:** | 600260 VA |
| | | | | **Total Est. Demand:** | 600260 VA |
| | | | | **Total Conn.:** | 722 A |
| | | | | **Total Est. Demand:** | 722 A |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MIDDLE TENNESSEE STATE UNIVERSITY

# CAMPUS WIDE CENTRAL PLANT AND CAMPUS UTILITIES UPDATES

SBC PROJECT NO.: 366/009-05-2023
1301 E. MAIN ST, MURFREESBORO, TN, 37132

JONATHAN C. WOODSIDE REGISTERED ENGINEER 120744 STATE OF TENNESSEE
2025.05.16 08:15:34-05'00'

Revision

| No. | Date | Description |
|---|---|---|
| 1 | 5/16/25 | Addendum 1 |

HVAC PIPING CEP / COGENERATION PLANT NEW CONSTRUCTION PLAN

**ME201**

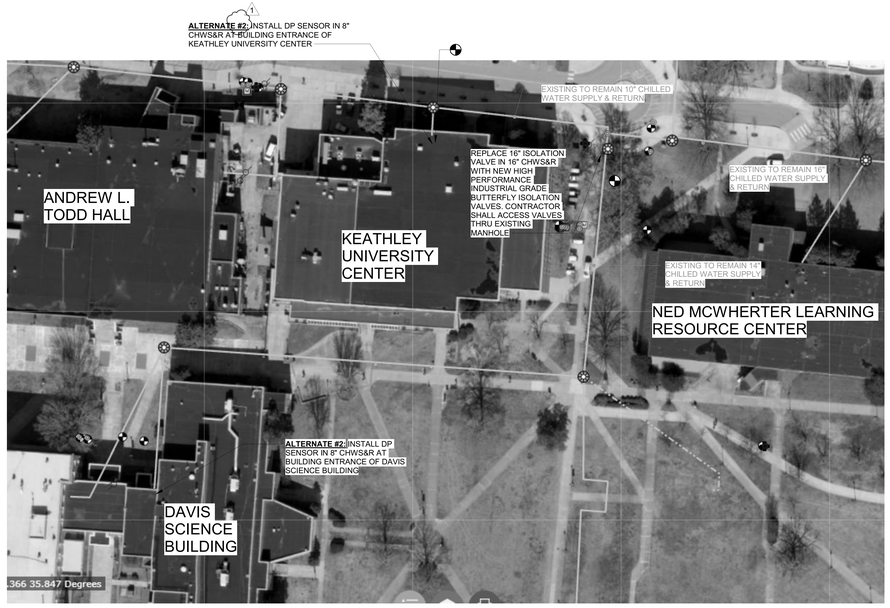
46986.00
5/2/2025

This Line is 3 Inches When Printed Full Size

Drawn By: Author
Checked By: Checker
Approved By: Approver

## GENERAL NOTES

1. SIDEWALKS AND STREETS ADJACENT TO THE PROJECT SITE SHALL BE KEPT OPEN TO THE EXTENT POSSIBLE. IF A ROAD OR SIDEWALK CLOSURE IS NECESSARY, THE CONTRACTOR SHALL PROVIDE THE UNIVERSITY WITH WRITTEN NOTIFICATION A MINIMUM OF SEVEN (7) CALENDAR DAYS PRIOR TO THE CLOSURE
2. WHILE THE CONTRACT DOCUMENTS INDICATE UTILITY LOCATIONS IN GENERAL, CONTRACTORS AND OTHERS NEEDING UNDERGROUND UTILITY LOCATIONS SHALL CONTACT TENNESSEE ONE CALL (811) PRIOR TO DIGGING. IT IS STRONGLY RECOMMENDED THAT THE "REFRESH" OPTION BE USED. THIS SERVICE IS NOT EXACT, AND THEREFORE CONTRACTORS SHALL EXCAVATE CAREFULLY IN ALL MARKED LOCATIONS, INCLUDING THE USE OF HAND EXCAVATION WHERE WARRANTED. UTILITY LOCATIONS SHALL BE MARKED BY STAKING OR PAINTING AND SUCH MARKINGS SHOULD BE REFRESHED AS NECESSARY. IT IS CONTRACTORS RESPONSIBILITY FOR THE DURATION OF THE PROJECT TO PROTECT CAMUPUS UTILITIES WITHIN AREAS WHERE THE WORK IS BEING CARRIED OUT.
3. THE ACTUAL LOCATION OF ALL UTILITIES INSTALLED AND/OR EXTENDED DURING THE PROJECT SHALL BE RECORDED ON THE AS-BUILT DRAWINGS MAINTAINED AT THE SITE AND FORMALIZED AFTER THE PROJECT COMPLETION. THE UNIVERSITY SHALL BE NOTIFIED OF ALL LINES DISCOVERED DURING THE COURSE OF THE PROJECT.
4. ALL UTILITY OUTAGES OR OTHER INTERRUPTION OF SERVICE NECESSARY FOR PROJECT. THE CONTRACTOR SHALL COORDINATE ALL UTILITY DISRUPTIONS WITH THE UNIVERSITY AT START OF PROJECT FOR PLANNING AND PROVIDE THE UNIVERSITY WITH WRITTEN NOTIFICATION OF FOURTEEN DAYS (14) PRIOR TO INTERRUPTION. THE UNIVERSITY'S APPROVALS MUST BE OBTAINED, BUT WILL NOT BE UNREASONABLY WITHHELD.
5. THE CONTRACTOR SHALL REPAIR OR REPLACE ANY UTILITY DAMAGED BY THE CONTRACTOR THROUGH NEGLIGENCE OR OTHER INAPPROPRIATE ACTION. REPAIR OR REPLACEMENT OF ESSENTIAL UTILITIES SHALL COMMENCE WITHIN THREE (3) HOURS OF THE DAMAGE AND OF NON-ESSENTIAL UTILITIES WITHIN TWENTY-FOUR (24) HOURS. IF THESE TIMELINES ARE NOT MET, THE UNIVERSITY AT ITS SOLE DISCRETION MAY CONTRACT SEPARATELY TO EFFECT NECESSARY REPAIRS AND THE COST OF SUCH REPAIRS WILL BE BACK CHARGED TO THE CONTRACTOR. THE CONTRACTOR SHALL BE NOTIFIED AT THE BEGINNING OF THE PROJECT WHICH ARE ESSENTIAL UTILITIES.
6. CONTRACTOR SHALL REPAIR ANY DAMAGES, INCLUDING BUT NOT LIMITED TO SURFACE INFRASTRUCTURE, HARDSCAPING, AND LANDSCAPING TO MATCH ORIGINAL SURFACE INFRASTRUCTURE, HARDSCAPING, AND LANDSCAPING PRIOR TO COMPLETION OF CONSTRUCTION. REPAIR ALL SIDEWALKS, CURB, STREET AND APPURTANCES TO PRE-CONSTRUCTION CONDITIONS.




1 LOOP F ISOLATION VALVE AND DP SENSORS
NOT TO SCALE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MIDDLE TENNESSEE STATE UNIVERSITY

# CAMPUS WIDE CENTRAL PLANT AND CAMPUS UTILITIES UPDATES

SBC PROJECT NO.: 366/009-05-2023
1301 E. MAIN ST, MURFREESBORO, TN, 37132

JONATHAN C. WOODSIDE
REGISTERED ENGINEER
STATE OF TENNESSEE
NUMBER 115811
2025.05.16 09:15:15-05'00

Revision

| No. | Date | Description |
|---|---|---|
| 1 | 5/16/25 | Addendum 1 |

HVAC PIPING KEATHLEY UNIVERSITY CENTER AND LEARNING RESOURCE CENTER PLAN

**M207**

46986.00
5/2/2025

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