

Bid# 19132 Lake County Jail-Waukegan: Babcox Mechanical Infrastructure Projects - AHU Replacement - Smoke Evacuation - Chiller Demo RFP: RFI's and Responses (1-22) / updated 07/25/2019

RFI-1:

Q: Is the statement, "Submit one (1) original and one (1) CD or Flash Drive with an unprotected electronic version" found in the Submission Information Invitation to Bid doc. On Page 2 a requirement or a request? Will the Bidders packet be disqualified if the electronic version is not submitted August 6th at 11:00am?

A: Bidders will not be disqualified if an electronic version is not submitted.

RFI-2:

Q: Please confirm Base Bid C (Chiller Demo) is the scope of work found on Plan sheets A-1-MPD2B1A, A-1-MPD202A and A-1-MP2B1A?

A: Confirmed, as well as demo scope shown on Architectural drawings.

RFI-3:

Q: In the Babcox AHU Replacement Chiller Demo Specs Issued for Bid 0672019 section 23 31 13 – 19 it states,

"G. Liner:

1. Supply Air Ducts: Fibrous glass, Type I, 1 inch thick.
2. Return Air Ducts: Fibrous glass, Type I, 1 inch thick.
3. Exhaust Air Ducts: Fibrous glass, Type I, 1 inch thick.
4. Supply Fan Plenums: Fibrous glass, Type II, 1-1/2 inches thick.
5. Return- and Exhaust-Fan Plenums: Fibrous glass, Type II, 2 inches thick.
6. Transfer Ducts: Fibrous glass, Type I, 1 inch thick.

In section 23 07 13 – 24 and also states "

B. Concealed or exposed supply, exhaust, return, or outdoor air ducts and plenums shall be one of the following and shall comply with the requirements of ASHRAE 90.1-2010 and International Energy Code 2012:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

Is the Ductwork to be lined or wrapped? Or, is it the Contractors option to line or wrap the ductwork systems?

A: New ductwork shall be wrapped.

RFI-4:

Q: Section 23 21 13 – 20 indicates the following items,

2.13 HEAT TRACING

A. See Division 23 Section "Heat Tracing for HVAC Piping."

2.14 INSTALL ENGINE SILENCER SPECIFIED UNDER DIVISION 26

Please confirm if the above items are to be found in this scope of work and also indicate on the plan set drawings where the Heat Tracing and Engine Silencer are located if they exist?

A: Heat tracing and Engine Silencers are not required; these particular spec sections can be disregarded.

RFI-5:

Q: The following Keynote on Plan Sheet A-1-M406 seems to be a general type statement that is going to be hard to quantify and ensure a correct scope with efficient cost to the owner,

3. CLEAN EXISTING DUCTWORK AND REGISTERS. BALANCE TO DESIGN CONDITIONS. EVALUATE CONDITION OF EXISTING WAVE GUIDES AND REPLACE AS NEEDED.

- a) Are we to clean ALL the Ductwork and Registers on each Level?
- b) In the wing?
- c) Indicated on just this sheet?
- d) Are the Wave Guides indicated anywhere to ensure a correct quantity?
- e) Might it be a savings to the owner to add an Allowance for the ductwork cleaning and a Per Each proposed price to replace A single wave guide used on a per unit price with a proposed change of cost order?

A: We recommend providing an allowance for duct cleaning and a unit price for wave guide replacement.

RFI-6:

Q: Does the roof have a current warranty? If so, what manufacturer/contractor must be used to keep the warranty valid?

A: There is no active warranty. The roof system is believed to be original.

RFI-7:

Q: What are the heights of the ceilings throughout the spaces on floors 3 thru 6 (cell areas)?

A: Ceiling heights in detention areas are 8'0"

RFI-8:

Q: What are the anticipated date ranges for the "shoulder seasons" referenced in the specifications? How many days will we be allowed for each season?

A: This is up to the contractor to determine, please provide a proposed schedule as part of your response.

RFI-9:

Q: Is there gas service available in the penthouse for the temporary air handlers? If so, what line size and pressure is available?

A: Gas service is not available.

RFI-10:

Q: Will the temporary air handlers be required to use return air or make up air?

A: No. The concept is that the temp AHU would be 100% OA, hence the recommendation to do the replacement in the shoulder season thereby minimizing the load on the temp AHU for heating/cooling.

RFI-11:

Q: Are there existing shut off valves at the mains for the replacement work on floors 3 thru 6?

A: Shut off valves were not accessible during the survey and not shown on existing plans, so assume no shut-offs at the main. There are shut off valves at each mixing box.

RFI-12:

Q: Will engineered drawings be required for the sprinkler work?

A: Provide drawings as required by code.

RFI-13:

Q: When working on two air handling units during the spring and fall, can we take both down concurrently or can we only take one down at a time?

A: Two can be taken down concurrently.

RFI-14:

Q: On page 18 of 33 in the "19132 Bid Final" document, it identifies Contractor's Pollution Liability, Professional Liability/Errors and Omissions, Installation Floater/Builders Risk, and Excess/Umbrella Liability. All of these items have been listed as "if applicable". Are these items applicable for this project?

A: This will be decided as part of the contract award.

RFI-15:

Q: There is language regarding liquidated damages at a rate of \$231,000 per month. If an issue arises and the open work is completed after the 14 day grace period but sooner than a month, would the liquidated damages be pro-rated?

A: Yes, damages are intended to be compensated and the estimated based on one month. All compensated damages will be based on actual costs.

RFI-16:

Q:When working in the cell areas on floors 3 thru 6, will prisoners be present or will they be cleared of the area?

A: Inmates will not be present in the work areas.

RFI-17:

Q: How much time will be given each day to contractors on floors 3 thru 6?

A: Normal business hours are 7am-3:30pm.

RFI-18:

Q: What areas will be allowed for crane setup/staging? Can the parking lot to the South of the jail be utilized or will the street need to be used?

A: At this time the only available short and long-term exterior access/staging area is along the east side of the building.

RFI-19:

Q: Section 23 72 00 2.1.A, Will the engineer of record please add to the list of Manufactures "Engineered Air" for the heat-pipe heat exchangers?

A: The designer and county will evaluate and consider qualified substitutions that meet specified performance and other project requirements if submitted for review per Division-1 guidelines for such substitutions. This would be after contracts are awarded. There will be no changes to the specified manufacturers during bidding.

RFI-20:

Q: Section 23 72 00 2.2.A, Will the engineer of record please add to the list of Manufactures “Core Energy Recovery Solutions” for the enthalpy plate exchangers?

A: The designer and county will evaluate and consider qualified substitutions that meet specified performance and other project requirements if submitted for review per Division-1 guidelines for such substitutions. This would be after contracts are awarded. There will be no changes to the specified manufacturers during bidding.

RFI-21:

Q: Division 25 00 00 & Responsibility Matrix, Is the tag “ES” to be the Control Contractor or Equipment Manufacture where referenced on the APPIN Schedule 3 BACnet single line / Responsibility Matrix?

A: ES means Equipment Supplier. The Equipment Supplier is responsible for providing the specified equipment complete with the BACnet Interface Device.

RFI-22:

Q: Please confirm if the above items are to be found in this scope of work and also indicate on the plan set drawings where the Heat Tracing and Engine Silencer are located if they exist.

A: The first part of this question is unclear and no response is provided. There is no heat tracing or engine silencer as part of this project.

1. Table of Contents Addendum items related to Controls:

1. Add the following entry: “SECTION 013250 – BUILDING INFORMATION MODEL (BIM) AND PROVISION OF ELECTRONIC SUBMITTAL DATA - *Refer to BAS Project Manual under separate cover*”
2. Add the following entry: “01 31 13.13 BACNET AND OTHER DEVICE INTERFACES INTEGRATION - *Refer to BAS Project Manual under separate cover*”
3. Change the reference to 25 20 23.82 to the following: “25 20 23.85 Integrated Automation – BACnet Interface Device (Gateways/Native BACnet Devices) – Air Flow Measuring Stations (All Types)”
4. Change the reference to 25 20 23.24.16 to the following: 25 20 26.24.16 Integrated Automation – BACnet Interface Device (Gateways/Native BACnet Devices) – Panelboards (All Types)
5. Add the following entry: “26 05 05 BACNET AND OTHER DEVICE INTERFACES INTEGRATION - *Refer to BAS Project Manual under separate cover*”

2. Division 01 Addendum Items related to Controls:

1. Division 01 is responsible for the scope of Work outlined in this Section 01 31 13.13 found in document entitled 1 APPIN BAS Spec AHU and Smoke Evac IFB set.pdf.
2. Division 01 is responsible for the scope of Work outlined in this Section 01 32 50 found in document entitled 1 APPIN BAS Spec AHU and Smoke Evac IFB set.pdf.

Refer to 01 31 13.13

1. See SOAP Device Installation Details file attached to this Addendum for installation instructions. Division 01 shall co-ordinate the Work to install the new SOAP device.

Refer to 01 32 50

1. Add the following to 2.b: GC shall co-ordinate ceiling grid layout with Mechanical so the terminal units can be serviced. Include ceiling grid layout in BIM.

3. Division 23 Addendum Items related to Controls:

Refer to 23 05 93

1. Add new Clause 3.31 CONTROLS RELATED TAB WORK
 - a. Add Clause 3.31.A Read all water flow meters with Division 25 and Lake County BAS Consultant on site. Provide any calibration changes to Division 25 so the meters read the design flow condition.
 - b. Add Clause 3.31.B Read all air flow meters with Division 25 and Lake County BAS Consultant on site. Provide any calibration changes to Division 25 so the meters read the design flow condition.
 - c. Add Clause 3.31.C Read all duct static pressure sensors with Division 25 and Lake County BAS Consultant on site. Provide any calibration changes to Division 25 so the sensors read the design flow condition.
 - d. Add Clause 3.31.D Read all space static pressure sensors with Division 25 and Lake County BAS Consultant on site. Provide any calibration changes to Division 25 so the sensors read the design flow condition.

Refer to 23 09 00

1. Use 1.3 only when there is no Division 25 Abbreviation.
2. The Work in Division 25 and in 23 09 00 shall form part of the Work. Where there is a conflict, Engineer of Record shall designate which specification clause in which Division shall be followed.
3. There is no requirement for Division 25 to provide a server unless one is needed to access data on the UUKL listed BAS network. The server provided by Division 25 shall be supplied and installed as a UUKL 864 listed device.
4. Remove 1.17 Unit Prices.
5. Change 2.12.H 1.a.10 to read: “Provide BACnet MS/TP BACnet Interface Devices for each air flow station so that the units are presented as a series of AV and BV BACnet objects. See 25 20 23.85 for the list of objects that must be supported. This list is the minimum acceptable. Install and commission per Division 25 20 23.85.”
6. Change 2.12.H 2.a.9 to read: “Provide BACnet MS/TP BACnet Interface Devices for each water flow meter/BTU meter so that the units are presented as a series of AV and BV BACnet objects. See 25 20 23.05.19 for the list of objects that must be supported. This list is the minimum acceptable. Install and commission per Division 25 20 23.05.19.”

Refer to 23 21 23

1. Delete 1.2 B as there are no pumps with VFDs in the Work.

Refer to 23 30 00 (Note this section is tagged as 23 33 00 in the Table of Contents)

1. Change 3.1 Y to read “Wiring of smoke dampers and position feedback shall be done by UUKL 864 listed device provided by Division 26.”
2. Add 3.1.W.5: Device does not have to be a listed device.

Refer to 23 34 16

1. Delete 1.2 B 1 as there are no stick-built fans in the Work.
2. Delete 2.1 F.
3. Change 3.1 G 4 to read “Division 25 is only responsible for communicating to the BACnet/IP ~~Plant Controller~~ Device using BACnet objects and services to access this data. See Responsibility Matrix for details “

Refer to 23 36 00

1. Add 1.2 B 3 “Division 25 Section 25 00 13 – All Trades Work Responsibilities.”

Refer to 23 82 39

1. Add 2.1 D “Provide a BAS or approved equal for each unit heater control unit heater through the BAS-1p HOA.”
2. Add 2.2 M 3 “Provide a BAS or approved equal for each unit heater control unit heater through the BAS-1p HOA.”

Refer to 23 82 19

1. In section 2.3 H add a reference to 25 20 26.29.23.

4. Division 25 Addendum Items:

Refer to 25 06 00 Schedule 1

1. See this Addendum for changes to the BACnet Single Line Diagram.

Refer to 25 09 23.21.23

1. Division 25 shall supply and install a BAS-1p starter for all new pump motors in the Work covered by this Section. See this Section for details. A Franklin Cerus BACnet MS/TP starter is not required.

Refer to 25 09 23.82.39

1. Division 25 shall supply and install a BAS-1p starter for all new unit heater motors in the Work covered by this Section. See this Section for details. A Franklin Cerus BACnet MS/TP starter is not required.

Refer to 25 20 23.36

1. Add the following point to the points list table.

BACnet Hardwired Points List (Typical for each Unit)																
Aux Contact List	Mapped Object List	Read/Write	Object Type	Supply Aux Contact	Install Aux Contact	Power Aux Contact	Wire Aux Contact	Program' Aux Contact	Alarmable	Alarm Limit	Alarm Type	Graphic	Trend	Com'd	Units	Description (acceptable value range)
Air Terminal Units (Hydronic Fan Coils and Constant Air Volume (CAV)) See Drawings for Locations and Quantities																
<u>Leak Detection</u>	<u>LCB#-B629-FCU-MMM-LeakDet</u>	<u>TBD</u>	<u>BI</u>	<u>ES</u>	<u>ES</u>	<u>26</u>	<u>25</u>	<u>ES</u>		<u>TBD</u>	<u>Y</u>	<u>ALC</u>	<u>ALC</u>			
Notes:																
1. In this column, 'Program' refers to the Equipment Supplier's responsibility to enable the aux contact, or to set high/low limits for turning the aux contact on or off.																

Refer to 25 20 23.72.00

1. Division 25 shall allow for the Air-to-Air Recovery Unit to be a BACnet MS/TP device or a stick built device. If Division 23 provides a stick built device, Division 25 shall provide hardwired, field mounted inputs and outputs as shown on the Mechanical Documents and as listed as software points in 25 20 23.72.00.

Refer to 25 20 26.28.16

1. Change 1.01.1.1 to read as follows: "1.01.1.1 Section 25 20 26.24.16 contains the BACnet Interface Device for Switchboards and/or Panelboards that have Trip Units."

5. Division 26 Addendum Items related to Controls:

1. Division 26 is responsible for the scope of Work outlined in Section 26 05 05 found in document entitled 1 APPIN BAS Spec AHU and Smoke Evac IFB set.pdf.

Refer to 26 24.16

1. Note that 25 20 26.24.16, not 25 20 26.28.16, has the BACnet Interface Device information on the Trip Units. Section 25 20 26.28.16 points to 25 20 26.24.16. There is no new power meter in the Work so there is no BACnet Interface Device for a power meter shown in Division 25.
2. Add 1.2 B 3 “Division 25 Section 25 20 26.24.16 Integrated Automation – BACnet Interface Device (Gateways/Native BACnet Devices) – Panelboards (All Types).”
3. Add 1.2 B 4 “Division 25 Section 25 25 26.43.13 Integrated Automation – BACnet Interface Device (Wired Connection) – SPD (TVSS) (All Types).”
4. Add 2.1 I 3: “Provide an aux contact as a dry type contact for this point so no power source is required to permit Division 25 to pick up these points. Division 26 is responsible for power if this is required by the device supplier. Supplier is responsible for commissioning device with Division 25.”
5. Add 2.1 J “Provide BACnet Interface Devices for each Panelboard so that the units are presented as a series of AV and BV BACnet objects. See 25 20 26.24.16 for the list of objects that must be supported. This list is the minimum acceptable.”
6. Add 3.6: “DEMONSTRATION, TRAINING AND COMMISSIONING”
 - a. Add 3.6 A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transient voltage suppression devices. Refer to Division 01 Section "Demonstration and Training."
 - b. Add 3.6 B. “Refer to Division 25 for BAS demonstration and training requirements.”

Refer to 26 28.16

1. Note that 25 20 26.24.16, not 25 20 26.28.16, has the BACnet Interface Device information on the Trip Units. Section 25 20 26.28.16 points to 25 20 26.24.16. There is no new power meter in the Work so there is no BACnet Interface Device for a power meter shown in Division 25.
2. Add 1.2 B 8 “Division 25 Section 25 20 26.28.16 Integrated Automation – BACnet Interface Device (Gateways/Native BACnet Devices) – Enclosed switches and Circuit Breakers (All Types).”
3. Add 1.2 B 9 “Division 25 Section 25 00 13 – All Trades Work Responsibilities.”
4. Add 2.4 B 3 J “Provide BACnet Interface Devices for each Enclosed Switch and Circuit Breaker so that the units are presented as a series of AV and BV BACnet

objects. See 25 20 26.28.16 for the list of objects that must be supported. This list is the minimum acceptable.”

5. Add 3.4 C “Commission the BACnet Interface Device on site per Division 25 20 26.28.16 commissioning requirements.”

Add section 26 29 23

1. See new specification section 26 29 23 issued by Addendum that includes references to BAS Work in 25 20 26.29.23.

Add section 26 43 13

1. See new specification section 26 43 13 issued by Addendum that includes references to BAS Work in 25 25 26.43.13.

6. Drawing Addendum Items:

Refer to -M Drawing A-0-M004 Stairwell Pressurization AHU Schedule:

1. Change Note 1 to read “Provide VFD complete with BACnet MSTP interface. Connect to BAS network.”

Refer to Drawing A-0-M005 Detail 4:

1. GC shall co-ordinate ceiling grid layout with Mechanical so the terminal units can be serviced. Include ceiling grid layout in BIM.

Refer to Drawing A-0-M602 Detail 1:

1. Revise Clause D as follows: WHENEVER SMOKE IS DETECTED BY THE FIRE ALARM SYSTEM (SMOKE DETECTOR OR ZONE SPRINKLER FLOW SWITCH COVERING AT LEAST IN PART THE FLOOR AREA SERVED BY THE AHU), THE FIRE ALARM SYSTEM SHALL CLOSE THE ZONE BINARY INPUT. UPON RECEIPT OF THE BINARY INPUT SIGNAL FROM THE FIRE ALARM SYSTEM, THE UUKL LISTED BAS CONTROLS SHALL EXECUTE THE APPROPRIATE SMOKE EVACUATION SEQUENCE SHOWN IN THE CONTRACT DOCUMENTS.
2. Add Clause N: LOCATE A SPACE STATIC PRESSURE SENSOR IN THE MIDDLE OF EACH FLOOR LEVEL 2, 4, 5 AND 6. RUN LOW SIDE TUBING BACK TO SOAP DEVICE. INSTALL PER DIVISION 25 AND SOAP DEVICE INSTALLATION DETAILS ATTACHED TO THIS ADDENDUM.

3. Add Clause O as follows: ALL REFERENCES IN THE CONTRACT DOCUMENTS TO DDC, BMS OR CONTROLS ARE TO THE UUKL LISTED BAS TO BE SUPPLIED AND INSTALLED IN THE WORK.
4. Add P to read “REFERENCES TO BACNET MEAN TO A BACNET DEVICE. SEE DIVISION 25”.

Refer to Drawing A-1-M402:

1. Add Note 17 as follows: PROVIDE 24 X 24 INSULATED DUCT ACCESS DOORS ON THE SUPPLY AND RETURN DUCT MAINS IN THE MECHANICAL ROOM. ADD DOORS TO THE UPSTREAM AND DOWNSTREAM SIDE OF ALL TURNING VANES IN THIS ROOM.

Refer to Drawing A-0-E001:

1. Add Fire Alarm Note 5 as follows: ELECTRICAL SHALL CARRY THE COSTS FOR SIMPLEX TO INSTRUCT DIVISION 25 ON THE WIRING OF THE EXISTING SMOKE EVACUATION BINARY INPUTS. THESE BINARY INPUTS PROVIDED BY SIMPLEX SHALL TELL DIVISION 25 WHICH HVAC SYSTEMS NEED TO RUN TO SATISFY THE SMOKE EVACUATION SEQUENCES OUTLINED IN THE CONTRACT DOCUMENTS. SIMPLEX SHALL ALSO DIRECT DIVISION 25 ON THE PANEL LAYOUT REQUIREMENTS FOR THE FIREFIGHTERS SMOKE CONTROL STATION PANEL.

Refer to Drawing A-0-E001:

1. Add Note 1 to Mechanical Equipment Schedule as follows: SEE ADDENDUM SECTION 26 29 23 FOR VFD REQUIREMENTS FOR ALL VFDS TO BE PROVIDED IN THE WORK.

Refer to Drawing A-1-EP207:

1. Add Note 7 as follows: SEE DIVISION 25 BACNET SINGLE LINE DIAGRAM SCHEDULE 3 FOR IP DROPS REQUIRED IN THE WORK. ALL CONDUITS SHALL BE ORANGE. IP DROP CABLES SHALL BE PURPLE.

End of Addendum-1 (CONTROLS)

1. Table of Contents Addendum items related to Controls:

1. Add the following entry: “SECTION 013250 – BUILDING INFORMATION MODEL (BIM) AND PROVISION OF ELECTRONIC SUBMITTAL DATA - *Refer to BAS Project Manual under separate cover*”
2. Add the following entry: “01 31 13.13 BACNET AND OTHER DEVICE INTERFACES INTEGRATION - *Refer to BAS Project Manual under separate cover*”
3. Change the reference to 25 20 23.82 to the following: “25 20 23.85 Integrated Automation – BACnet Interface Device (Gateways/Native BACnet Devices) – Air Flow Measuring Stations (All Types)”
4. Change the reference to 25 20 23.24.16 to the following: 25 20 26.24.16 Integrated Automation – BACnet Interface Device (Gateways/Native BACnet Devices) – Panelboards (All Types)
5. Add the following entry: “26 05 05 BACNET AND OTHER DEVICE INTERFACES INTEGRATION - *Refer to BAS Project Manual under separate cover*”
6. Add the following entry: “28 05 05 BACNET AND OTHER DEVICE INTERFACES INTEGRATION - *Refer to BAS Project Manual under separate cover*”

2. Division 01 Addendum Items related to Controls:

1. Division 01 is responsible for the scope of Work outlined in this Section 01 31 13.13 found in document entitled 1 APPIN BAS Spec AHU and Smoke Evac IFB set.pdf.
2. Division 01 is responsible for the scope of Work outlined in this Section 01 32 50 found in document entitled 1 APPIN BAS Spec AHU and Smoke Evac IFB set.pdf.

Refer to 01 31 13.13

1. See SOAP Device Installation Details file attached to this Addendum for installation instructions. Division 01 shall co-ordinate the Work to install the new SOAP device.

Refer to 01 32 50

1. Add the following to 2.b: GC shall co-ordinate ceiling grid layout with Mechanical so the terminal units can be serviced. Include ceiling grid layout in BIM.

3. Division 23 Addendum Items related to Controls:

Refer to 23 05 93

1. Add new Clause 3.31 CONTROLS RELATED TAB WORK
 - a. Add Clause 3.31.A Read all water flow meters with Division 25 and Lake County BAS Consultant on site. Provide any calibration changes to Division 25 so the meters read the design flow condition.
 - b. Add Clause 3.31.B Read all air flow meters with Division 25 and Lake County BAS Consultant on site. Provide any calibration changes to Division 25 so the meters read the design flow condition.
 - c. Add Clause 3.31.C Read all duct static pressure sensors with Division 25 and Lake County BAS Consultant on site. Provide any calibration changes to Division 25 so the sensors read the design flow condition.
 - d. Add Clause 3.31.D Read all space static pressure sensors with Division 25 and Lake County BAS Consultant on site. Provide any calibration changes to Division 25 so the sensors read the design flow condition.

Refer to 23 09 00

1. Use 1.3 only when there is no Division 25 Abbreviation.
2. The Work in Division 25 and in 23 09 00 shall form part of the Work. Where there is a conflict, Engineer of Record shall designate which specification clause in which Division shall be followed.
3. There is no requirement for Division 25 to provide a server unless one is needed to access data on the UUKL listed BAS network. The server provided by Division 25 shall be supplied and installed as a UUKL 864 listed device.
4. Remove 1.17 Unit Prices.
5. Change 2.12.H 1.a.10 to read: “Provide BACnet MS/TP BACnet Interface Devices for each air flow station so that the units are presented as a series of AV and BV BACnet objects. See 25 20 23.85 for the list of objects that must be supported. This list is the minimum acceptable. Install and commission per Division 25 20 23.85.”
6. Change 2.12.H 2.a.9 to read: “Provide BACnet MS/TP BACnet Interface Devices for each water flow meter/BTU meter so that the units are presented as a series of AV and BV BACnet objects. See 25 20 23.05.19 for the list of objects that must be supported. This list is the minimum acceptable. Install and commission per Division 25 20 23.05.19.”

Refer to 23 30 00 (Note this section is not listed in the Table of Contents)

1. Change 3.1 U to read “Wiring of smoke dampers and position feedback shall be done by UUKL 864 listed device provided by Division 26.”

Refer to 23 34 16

1. Delete 1.2 B 1 as there are no stick-built fans in the Work.
2. Delete 2.1 F.
3. Change 3.1 G 4 to read “Division 25 is only responsible for communicating to the BACnet/IP ~~Plant Controller~~ Device using BACnet objects and services to access this data. See Responsibility Matrix for details “

4. Division 25 Addendum Items:

Refer to 25 06 00 Schedule 1

1. See this Addendum for changes to the BACnet Single Line Diagram.

Refer to 25 09 23.21.23

1. Division 25 shall supply and install a BAS-1p starter for all new pump motors in the Work covered by this Section. See this Section for details. A Franklin Cerus BACnet MS/TP starter is not required.

Refer to 25 09 23.82.39

1. Division 25 shall supply and install a BAS-1p starter for all new pump motors in the Work covered by this Section. See this Section for details. A Franklin Cerus BACnet MS/TP starter is not required.

Refer to 25 20 23.36

1. Add the following point to the points list table.

BACnet Hardwired Points List (Typical for each Unit)

Aux Contact List	Mapped Object List	Read/Write	Object Type	Supply Aux Contact	Install Aux Contact	Power Aux Contact	Wire Aux Contact	Program' Aux Contact	Alarmable	Alarm Limit	Alarm Type	Graphic	Trend	Com'd	Units	Description (acceptable value range)
Air Terminal Units (Hydronic Fan Coils and Constant Air Volume (CAV)) See Drawings for Locations and Quantities																
<u>Leak Detection</u>	<u>LCB#-B629-FCU-MMM-LeakDet</u>	<u>TBD</u>	<u>BI</u>	<u>ES</u>	<u>ES</u>	<u>26</u>	<u>25</u>	<u>ES</u>		<u>TBD</u>	<u>Y</u>	<u>ALC</u>	<u>ALC</u>			
Notes:																
1. In this column, 'Program' refers to the Equipment Supplier's responsibility to enable the aux contact, or to set high/low limits for turning the aux contact on or off.																

Refer to 25 20 23.72.00

1. Division 25 shall allow for the Air-to-Air Recovery Unit to be a BACnet MS/TP device or a stick built device. If Division 23 provides a stick built device, Division 25 shall provide hardwired, field mounted inputs and outputs as shown on the Mechanical Documents and as listed as software points in 25 20 23.72.00.

Refer to 25 20 26.28.16

1. Change 1.01.1.1 to read as follows: "1.01.1.1 Section 25 20 26.24.16 contains the BACnet Interface Device for Switchboards and/or Panelboards that have Trip Units."

5. Division 26 Addendum Items related to Controls:

1. Division 26 is responsible for the scope of Work outlined in Section 26 05 05 found in document entitled 1 APPIN BAS Spec AHU and Smoke Evac IFB set.pdf.

Refer to 26 28.16

1. Note that 25 20 26.24.16, not 25 20 26.28.16, has the BACnet Interface Device information on the Trip Units. Section 25 20 26.28.16 points to 25 20 26.24.16. There is no new power meter in the Work so there is no BACnet Interface Device for a power meter shown in Division 25.

2. Add 1.2 B 8 “Division 25 Section 25 20 26.28.16 Integrated Automation – BACnet Interface Device (Gateways/Native BACnet Devices) – Enclosed switches and Circuit Breakers (All Types).”
3. Add 1.2 B 9 “Division 25 Section 25 00 13 – All Trades Work Responsibilities.”
4. Add 2.4 B 3 J “Provide BACnet Interface Devices for each Enclosed Switch and Circuit Breaker so that the units are presented as a series of AV and BV BACnet objects. See 25 20 26.28.16 for the list of objects that must be supported. This list is the minimum acceptable.”
5. Add 3.4 C “Commission the BACnet Interface Device on site per Division 25 20 26.28.16 commissioning requirements.”

Add section 26 29 23

1. See new specification section 26 29 23 issued by Addendum that includes references to BAS Work in 25 20 26.29.23

Add section 26 43 13

1. See new specification section 26 43 13 issued by Addendum that includes references to BAS Work in 25 25 26.43.13.

6. Division 28 Addendum Items related to Controls:

1. Division 26 is responsible for the scope of Work outlined in Section 28 05 05 found in document entitled 1 APPIN BAS Spec AHU and Smoke Evac IFB set.pdf.

7. Drawing Addendum Items:

Refer to Drawing S-0-M001 MECHANICAL COVER SHEET:

1. Add Note 22: “All new BAS controls shall be UL listed for smoke control. All references to BMS shall be to the BAS”.

Refer to Drawing S-0-M002 SCHEDULES:

1. Add Note 5: “All new fans shall be controlled by a separate VFD. Using a single VFD to control more than one fan is not allowed in the Work.”

Refer to Drawing S-0-M501 Fan Installation Detail:

1. Add Note as follows: PROVIDE 24 X 24 INSULATED DUCT ACCESS DOORS ON THE INLET AND OUTLET DUCTS.

Refer to Drawing S-2-FA2B1:

1. Add Fire Alarm Note 4 as follows: ELECTRICAL SHALL CARRY THE COSTS FOR SIMPLEX TO INSTRUCT DIVISION 25 ON THE WIRING OF THE EXISTING SMOKE EVACUATION BINARY INPUTS. THESE BINARY INPUTS PROVIDED BY SIMPLEX SHALL TELL DIVISION 25 WHICH HVAC SYSTEMS NEED TO RUN TO SATISFY THE SMOKE EVACUATION SEQUENCES OUTLINED IN THE CONTRACT DOCUMENTS. SIMPLEX SHALL ALSO DIRECT DIVISION 25 ON THE PANEL LAYOUT REQUIREMENTS FOR THE FIREFIGHTERS SMOKE CONTROL STATION PANEL.

End of Addendum-1 (CONTROLS)

This Schedule applies to all Trades included in the Work of this Bid.

This Schedule contains 33 pages

Note:

**This document has been re-issued in its entirety
as an Addendum.**

This box requires Division 27 to provide conduit and pull wire for Cat 6 cable to within 3 ft. of BACnet Interface Device

BACnet/IP Built-Up or Plant Controller

Devices in this color box are BACnet/IP Controller(s)

Devices in this color box are BACnet MS/TP Controller(s)

Devices in this color box are Proprietary protocol controls by Equipment Supplier

Devices in this color box require stick built controls.

Devices in this color box require Aux Contact controls by Equipment Supplier or Division 25 BAS Contractor.

Work described in this color box shall be done by JCI under a directed contract by Owner that is outside the scope of this project.

Devices in red shall be UL 864 UUKL listed devices

This signifies Work that Simplex shall be responsible for providing in this project.

Devices in this color box are BACnet/IP Controller(s).

Devices tagged with **UL 864 UUKL Listed** shall be listed devices.

Devices in this color box are BACnet MS/TP Controller(s)

Devices tagged with **UL 864 UUKL Listed** shall be listed devices.

New BACnet/IP drop by Contractor. Run purple Cat 6 cable in orange conduit to switch designated by Owner

See Responsibility Matrix that follows for additional details on Work Responsibilities by BACnet Interface Device Type

Lake County Smoke Evac and AHU BACnet Single Line Diagram

BACnet Interface Devices Legend

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Note: This page shows the stick built and aux contact points for the project as a whole. There are references on other pages to stick built and aux contact points wired by Division 25.

New BACnet/IP drop by Contractor. Run purple cable in orange conduit to switch shown below.

BACnet/IP Controller(s) by Division 25

BACnet MS/TP Network wiring by Division 25

Misc. Stick Built/Aux Contact Points wired by Division 25 on Misc. Equipment Supplied by Division 26

BACnet MS/TP Controller supplied and installed by Division 25.

BACnet MS/TP Network connection by Division 25.

Misc. Stick Built/Aux Contact Points wired by Division 25

BACnet MS/TP Controller supplied and installed by Division 25.

Network connection by Division 25.

23 05 19: Flow Meters (ALL TYPES)

BACnet MS/TP Controller supplied and installed by Division 23.

Network connection by Division 25.

Aux Contact wiring by Division 25

Division 26 Stick Built points. See Division 26 page for points list.

Aux Contact in panel provided by Division 23.

Aux Contact wired to BACnet/IP panel by Division 25.

Stick built equipment by Division 25 Controls by Division 25

23 21 23 HVAC Pumps
23 82 39 Unit Heaters
Division 25 shall provide a Franklin BAS1p HOA for controlling these devices. Provide a current sensor to sense amps as a status point. Calculate 24 hour daily kW and kWh from this sensor for each device.

See Drawings for locations and quantities

All Stick built wiring by Division 25

Addendum 1 Revision

See Responsibility Matrix that follows for additional details on Work Responsibilities by BACnet Interface Device Type

Lake County Smoke Evac and AHU BACnet Single Line Diagram

Stick Built and Aux Contact Equipment Specified in All Divisions - **Addendum 1**

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From Division 28 BACnet One-Line Diagram

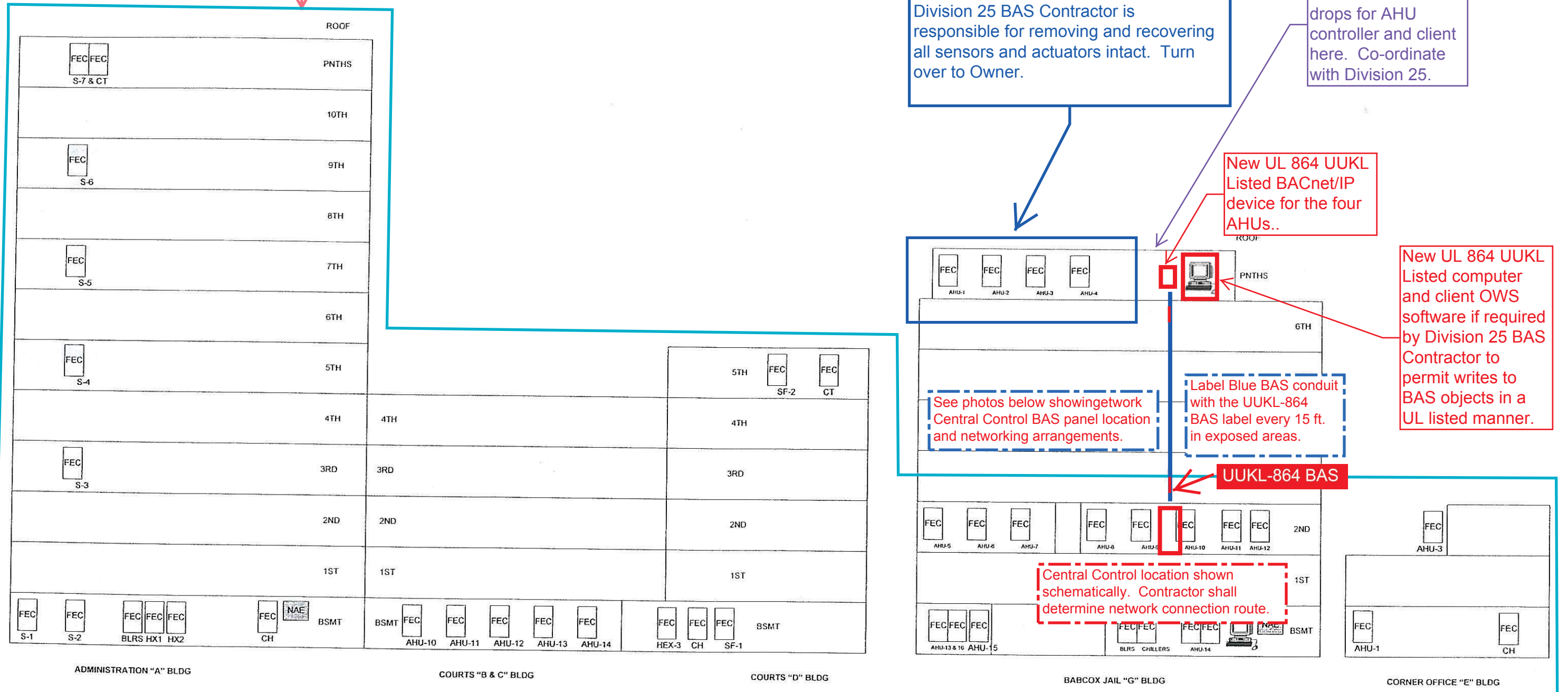
Simplex shall change the existing Fire Alarm Panel programming to allow for all remaining AHUs to shut down if the space zones 1-15 and 31-32 are in alarm so JCI no longer has to perform this function. This will allow the existing non-UL 864 UUKL BAS controls to remain in place.

NETWORK RISER

Owner will engage JCI to remove and recover BACnet MS/TP devices FECs and IOMs only under a separate contract and to re-establish the BACnet MS/TP trunk for the remaining AHUs not in Work Scope.

Division 25 BAS Contractor is responsible for removing and recovering all sensors and actuators intact. Turn over to Owner.

Locate BACnet/IP drops for AHU controller and client here. Co-ordinate with Division 25.



Lake County Smoke Evac and AHU BACnet Single Line Diagram

AHU Plant BACnet Interface Devices Specified in Division 23 Demolition Plan
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AS-BUILTS
10/01/2008

See Responsibility Matrix that follows for additional details on Work Responsibilities by BACnet Interface Device Type

SALES ENGINEER	PROJECT MANAGER	APPLICATION ENGINEER	DATE	DATE	DATE
	Steve Mountz				
JOHNSON CONTROLS			CONTRACT NUMBER		
Systems & Services Division			6010-0189		
Johnson Controls 3007 Malmo Dr Arlington Heights IL 60005 Phone: 847-364-1500 Fax: 847-364-1536			DRAWING NUMBER		
			NET-1		

Note: This BACnet Single Line Diagram is typical for each AHU provided in the Work.

New BACnet/IP client drop by Contractor. Run purple cable in orange conduit to switch shown below. Provide 1900 box and purple RJ 45 jack 48" AFF beside BAS panel.

New BACnet/IP drop by Contractor. Run purple cable in orange conduit to switch shown below.

Division 25 BAS Contractor shall provide a UL 864 UUKL Listed Computer and OWS software if the Contractor's listing requirements does not support the ability to write to BAS point using a non UL listed client device.

UL 864 UUKL listed BACnet/IP connection from OWS and computer to BACnet/IP device controlling the AHUs. This work is by Division 25 BAS Contractor if the Contractor's listing requirements do not support the ability to write to a BAS point using a non UL listed client device.

From Division 28 BACnet Single Line Diram.

Simplex Fire Alarm System will initiate a smoke event notification to the BAS via Simplex Panel Node 3. The BAS shall executed the smoke management Sequence of Operations (typical of 16 zone for 4 AHUs).

From Division 28 BACnet Single Line Diram.

Simplex Fire Alarm System will initiate an AHU shutdown upon the detection of smoke in the ductwork (typical of 4 AHUs).

23 73 13 AHU Plant (Four New AHUs all Types)
 BACnet/IP Built-Up **UL 864 UUKL Listed** Controller supplied and installed by Division 25 BAS Contractor.
 Network connection by Division 27.
 Smoke Detector hardwired interlocks by Division 26.

Note: All BAS Devices shall be UL 864 UUKL listed devices. The VFDs and the Air Flow Measuring Stations do not have to be listed devices.

Addendum 1 Revision

23 34 16 HVAC Fans VFD (AHU Component)
 BACnet MS/TP Controller supplied and installed by Division 25 BAS Contractor.
 Network connection by Division 25 BAS Contractor.

23 34 16 HVAC Fans VFD (Smoke Evac Component)
 BACnet MS/TP Controller supplied and installed by Division 25 BAS Contractor.
 Network connection by Division 25 BAS Contractor.

23 73 13 AHU Stick Built Points
 BACnet **UL 864 UUKL Listed** MS/TP Controller supplied and installed by Division 25 BAS Contractor.
 Network connection by Division 25 BAS Contractor.

Firefighter's Smoke Control Station (by ADI or approved equal)
 BACnet **UL 864 UUKL Listed** MS/TP Controller supplied and installed by Division 25 BAS Contractor. Add MS/TP controller to ADI panel.
 Network connection by Division 25 BAS Contractor.
 Locate in Fire Command Center in Courts Tower. Panel shall show as-built conditions for the 4 new AHUs.

25 14 23.26 Air Terminal Units (including both VAV boxes and Fan Coil Units - All Types)
 BACnet MS/TP **UL 864 UUKL Listed** Controller supplied and installed by Division 25 BAS Contractor.
 Network connection by Division 25 BAS Contractor.

23 85 20 Air Flow Measuring Stations
 BACnet MS/TP Controller supplied and installed by Division 25 BAS Contractor.
 Network connection by Division 25 BAS Contractor.

Stick built AHU points provided by Division 25 BAS Contractor
 See Drawings for points. This includes the Air to Air Energy Recovery Equipment specified in 23 72 00 and the new differential pressure switch called up in the Addendum.

Note: Division 25 BAS Contractor shall refer to Division 26 for the VFD requirements.



Stick built AHU points provided by Division 25 BAS Contractor
 See Drawings for points. See Division 25 for network points.

Stick built AHU VFD points provided by Division 25 BAS Contractor
 Provide the following points:
 -VFD enable/disable BO
 -VFD speed % AO
 -VFD status BI
 -VFD Common Alarm BI
 -VFD Smoke signal to Firefighterverride terminal BI

Stick built AHU VFD points provided by Division 25 BAS Contractor
 Provide the following points:
 -VFD enable/disable BO
 -VFD speed % AO
 -VFD status BI
 -VFD Common Alarm BI
 -VFD Smoke signal to Firefighterverride terminal BI

See Responsibility Matrix that follows for additional details on Work Responsibilities by BACnet Interface Device Type

Lake County Smoke Evac and AHU BACnet Single Line Diagram
 AHU Plant BACnet Interface Devices Specified in Division 23 New Work Plan - **Addendum 1**
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Note that separate BACnet/IP devices are shown for each type of device. Contractor may use one BACnet/IP device so long as the network throughput requirements of the Division 25 spec are met.

New BACnet/IP drop by Contractor. Run purple cable in orange conduit to switch shown below.

New BACnet/IP drop by Contractor. Run purple cable in orange conduit to switch shown below.

Note that separate BACnet/IP devices are shown for each type of device. Contractor may use one BACnet/IP device so long as the network throughput requirements of the Division 25 spec are met.

New BACnet/IP drop by Contractor. Run purple cable in orange conduit to switch shown below.

New BACnet/IP drop by Contractor. Run purple cable in orange conduit to switch shown below.

BACnet/IP Controller(s) by Division 25

BACnet/IP Controller(s) by Division 25

26 28 16 Trip Units/Circuit Breakers (Smoke Evac component)
NOTE THAT TRIP UNITS ARE CALLED UP IN 26 24 16 AND ARE SHOWN IN 25 20 26.24.16. THE 25 20 26.16 POINTS TO THE 25 20 26.24.16 PANELBOARDS SECTION.
Modbus to BACnet integration to BACnet/IP Controller supplied and installed by Division 26.
New Modbus Controller supplied and installed by Division 26.
Modbus integration by Supplier.

26 28 16 Trip Units/Circuit Breakers (AHU component)
NOTE THAT TRIP UNITS ARE CALLED UP IN 26 24 16 AND ARE SHOWN IN 25 20 26.24.16. THE 25 20 26.16 POINTS TO THE 25 20 26.24.16 PANELBOARDS SECTION.
Modbus to BACnet integration to BACnet/IP Controller supplied and installed by Division 26.
New Modbus Controller supplied and installed by Division 26.
Modbus integration by Supplier.

26 43 13 SPDs
Aux Contact provided by Division 26.
Aux Contact wired to BACnet/IP panel by Division 25.

Aux Contact wiring by Division 25

26 29 23 VFDs
BACnet MS/TP Controller supplied and installed by Division 26. or designated Equipment Supplier (e. g., AHU, Chiller Pump, Heating Pump or Fan Supplier).
Network connection by Division 25 or designated Equipment Supplier.
Hardwired interlocks by Division 26 or designated Equipment Supplier..

Addendum 1 Revision

Note: The VFD is not a listed device. The Fireman's Override aux contact on the the VFD also not a listed device. The BAS relay that closes the aux contact on the VFD Fireman's Override shall be a UUKL 864 listed device.

Note: The VFDs and Starters are provided by various Divisions and/or Equipment Suppliers, besides Division 26.

Refer to the other diagrams on this Riser Diagram for VFD provision, installation and networking responsibilities. All VFDs and Starters supplied in BACnet and networking requirements.

Mapping of proprietary points to the BACnet/IP device and proprietary network wiring by Equipment Supplier. Typ of all Devices.

Trip Unit/Circuit Breaker nn
Proprietary network wiring by Equipment Supplier.

Trip Unit/Circuit Breaker nn
Proprietary network wiring by Equipment Supplier.

Mapping of proprietary points to the BACnet/IP device and proprietary network wiring by Equipment Supplier. Typ of all Devices.

Lake County Smoke Evac and AHU BACnet Single Line Diagram

BACnet Interface Devices Specified in Division 26 New Work Plan - **Addendum 1**
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See Responsibility Matrix that follows for additional details on Work Responsibilities by BACnet Interface Device Type

**Addendum 1
Revision**

28 31 13 Fire Alarm
 Existing BACnet/IP Controller supplied and installed by Simplex.
 This Work will be done by Simplex. Simplex shall map any new and modified fire alarm points into the existing BACnet Interface Device installed in a previous contract with the Owner.
 Network connection by Contractor not required.
 Hardwired interlocks by Division 28.
Simplex shall carry the costs to have a qualified technician on site for four days to coordinate all work with Division 25.
Provide instruction to Division 25 on the FSCS Lamacoid panel layout requirements.

Simplex Fire Alarm System will initiate a smoke event notification to the BAS via Simplex Panel Node 3. The BAS shall executed the smoke management Sequence of Operations (typical of 16 zone for 4 new AHUs).

See Division 23 BACnet New AHU Single Line Diram for continuation.

Simplex Fire Alarm System will initiate an AHU shutdown upon the detection of smoke in the ductwork (typical of 4 new AHUs).

See Division 23 BACnet New AHU Single Line Diram for continuation.

Simplex shall change the existing Fire Alarm Panel programming to allow for AHU shutdown if the space zones 1-15 and 31-32 are in alarm so JCI no longer has to perform this function. This will allow the existing non-UL 864 UUKL BAS controls to remain in place.

See Division 23 BACnet Existing AHU One-line Dgram Demolition Sheet for continuation.

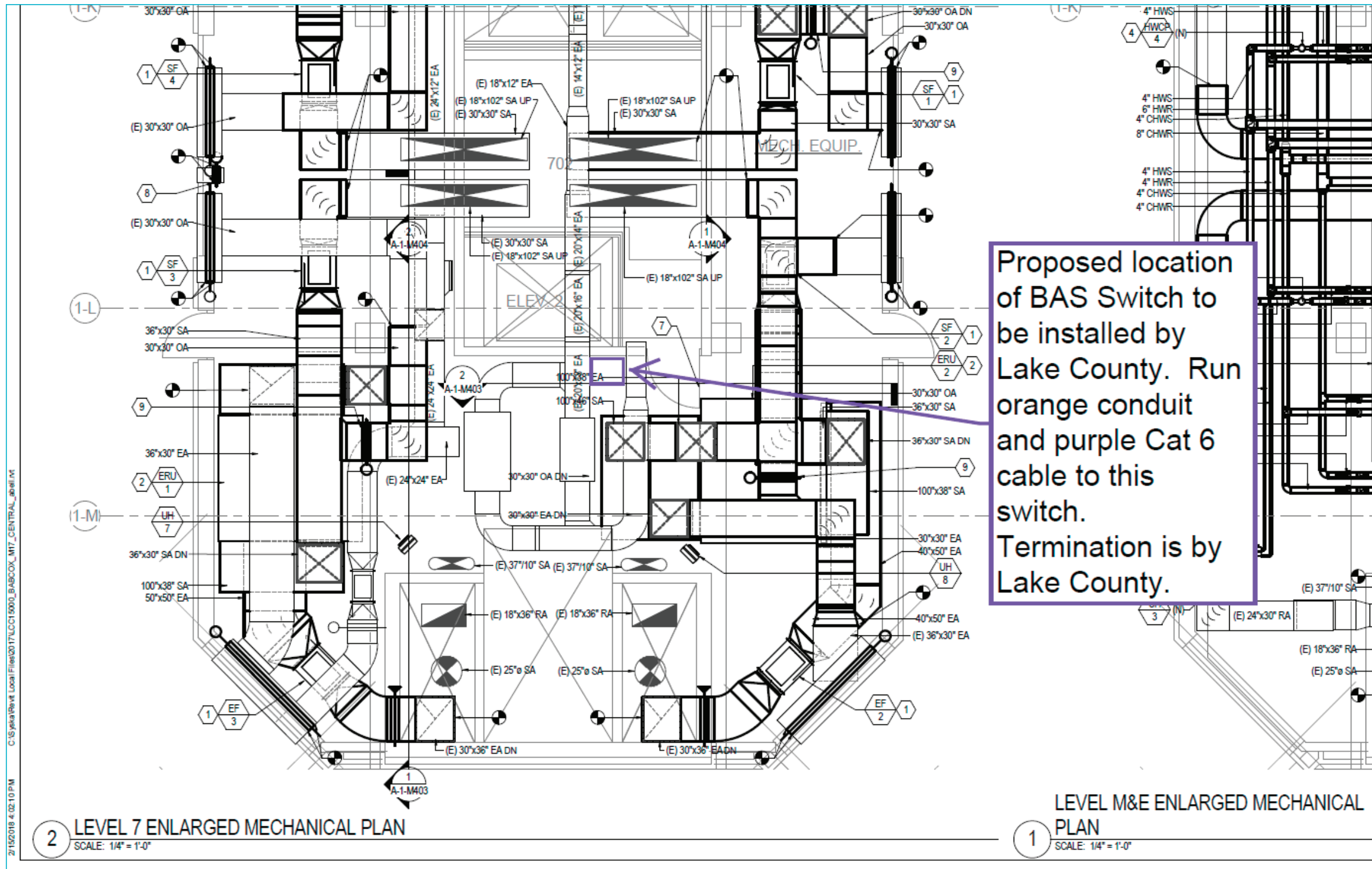
Simplex Fire Alarm System will initiate an AHU shutdown upon the detection of smoke in the ductwork (typical of 4 new AHUs).

Mapping of proprietary points to the BACnet/IP device and proprietary network wiring by Simplex
 Typ of all Devices.

Fire Alarm Device nn
 Proprietary network wiring by Simplex

See Responsibility Matrix that follows for additional details on Work Responsibilities by BACnet Interface Device Type

Lake County Smoke Evac and AHU BACnet Single Line Diagram
 BACnet Interface Devices Specified in Division 28 New Work Plan - **Addendum 1**
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See Responsibility Matrix that follows for additional details on Work Responsibilities by BACnet Interface Device Type

Lake County Smoke Evac and AHU BACnet Single Line Diagram

BACnet Interface Devices Specified in Division 28 New Work Plan

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Simplex
Zones Landing
Points - 32
Zones

This Contractor shall work with Simplex to move the AHUs 1 - 4 Simplex binary inputs to a newly installed, listed BAS panel.

Lake County will arrange with JCI as a separate contract to keep AHUs 5 to 16 on the JCI FEC that is not UUKL listed.

Run new UUKL 864 Listed BAS panel network connection to BACnet/IP panel beside AHUs.

Network connection wiring shall also be listed.

Simplex
Zones Landing
Points - 32
Zones

**Lake County Smoke Evac and AHU
BACnet Single Line Diagram
- ADDENDUM 1**

Central Control BACnet BAS Panels
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Addendum
1 Revision

Addendum
1 Revision

Addendum
1 Revision

Addendum
1 Revision

CARD 16

AUX 7-ZONE 1
AUX 8-ZONE 2
AUX 9-ZONE 3
AUX 10-ZONE 4
AUX 11-ZONE 5
AUX 12-ZONE 6
AUX 13-ZONE 7
AUX 14-ZONE 8

CARD 17

AUX 15-ZONE 9
AUX 16-ZONE 10
AUX 17-ZONE 11
AUX 18-ZONE 12
AUX 19-ZONE 13
AUX 20-ZONE 14
AUX 21-ZONE 15
AUX 22-ZONE 16

CARD 18

AUX 23-ZONE 17
AUX 24-ZONE 18
AUX 25-ZONE 19
AUX 26-ZONE 20
AUX 27-ZONE 21
AUX 28-ZONE 22
AUX 29-ZONE 23
AUX 30-ZONE 24

CARD 19

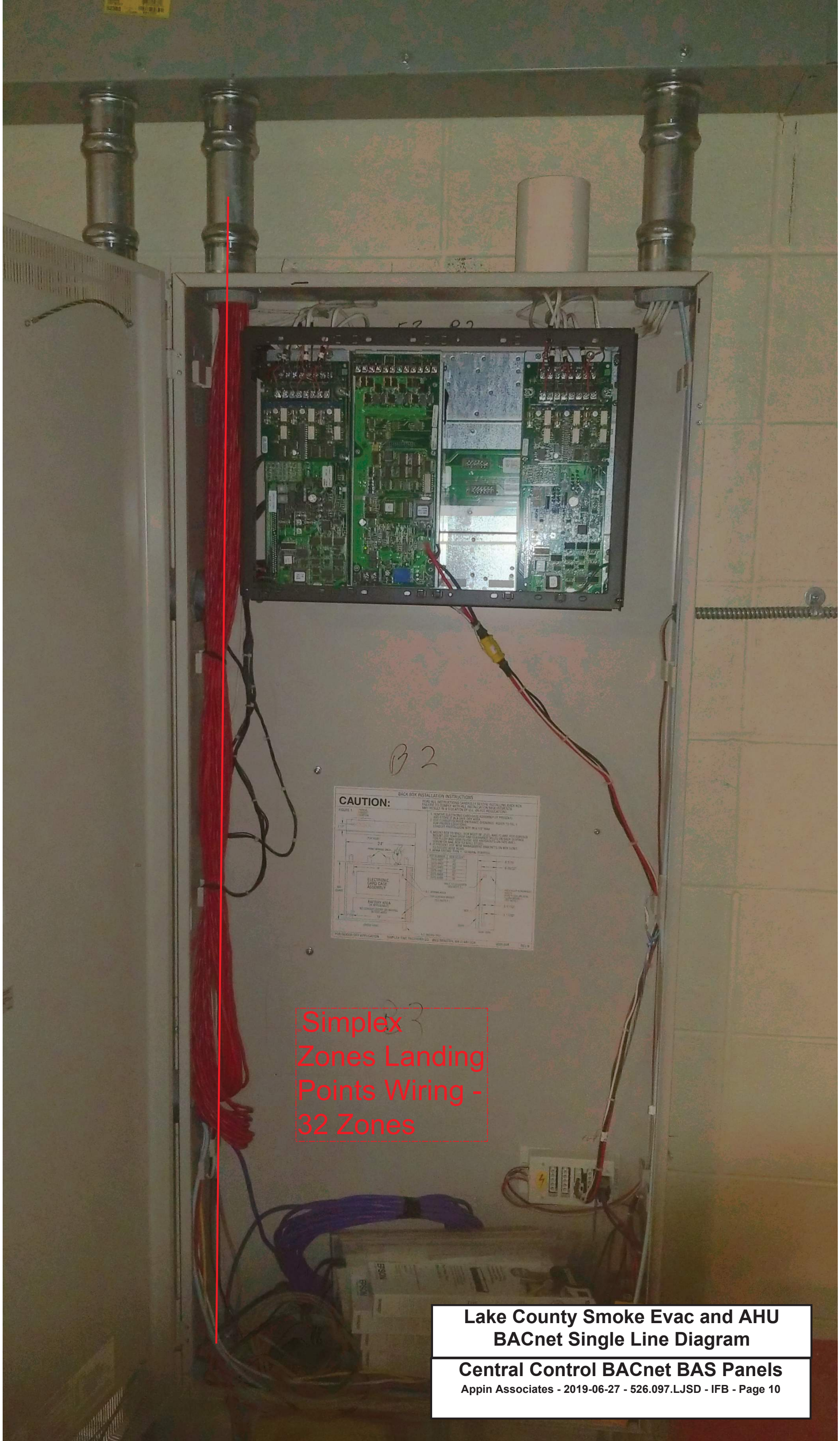
AUX 31-ZONE 25
AUX 32-ZONE 26
AUX 33-ZONE 27
AUX 34-ZONE 28
AUX 35-ZONE 29
AUX 36-ZONE 30
AUX 37-ZONE 31
AUX 38-ZONE 32

Division 25 shall wire the binary inputs for Zones 15 - 30 inclusive from this Simplex panel to the new UUKL 864 listed BAS.

- Zones 15,19,23,27
AHU 1
- Zones 16,20,24,28
AHU 2
- Zones 17,21,25,29
AHU 3
- Zones 18,22,26,30
AHU 4

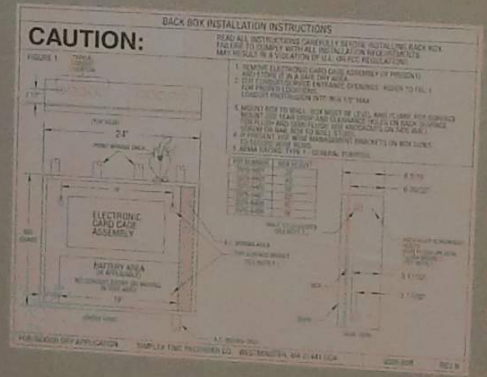
Addendum
1 Revision

Simplex
Zones Landing
Points - 32
Zones



52 82

B2

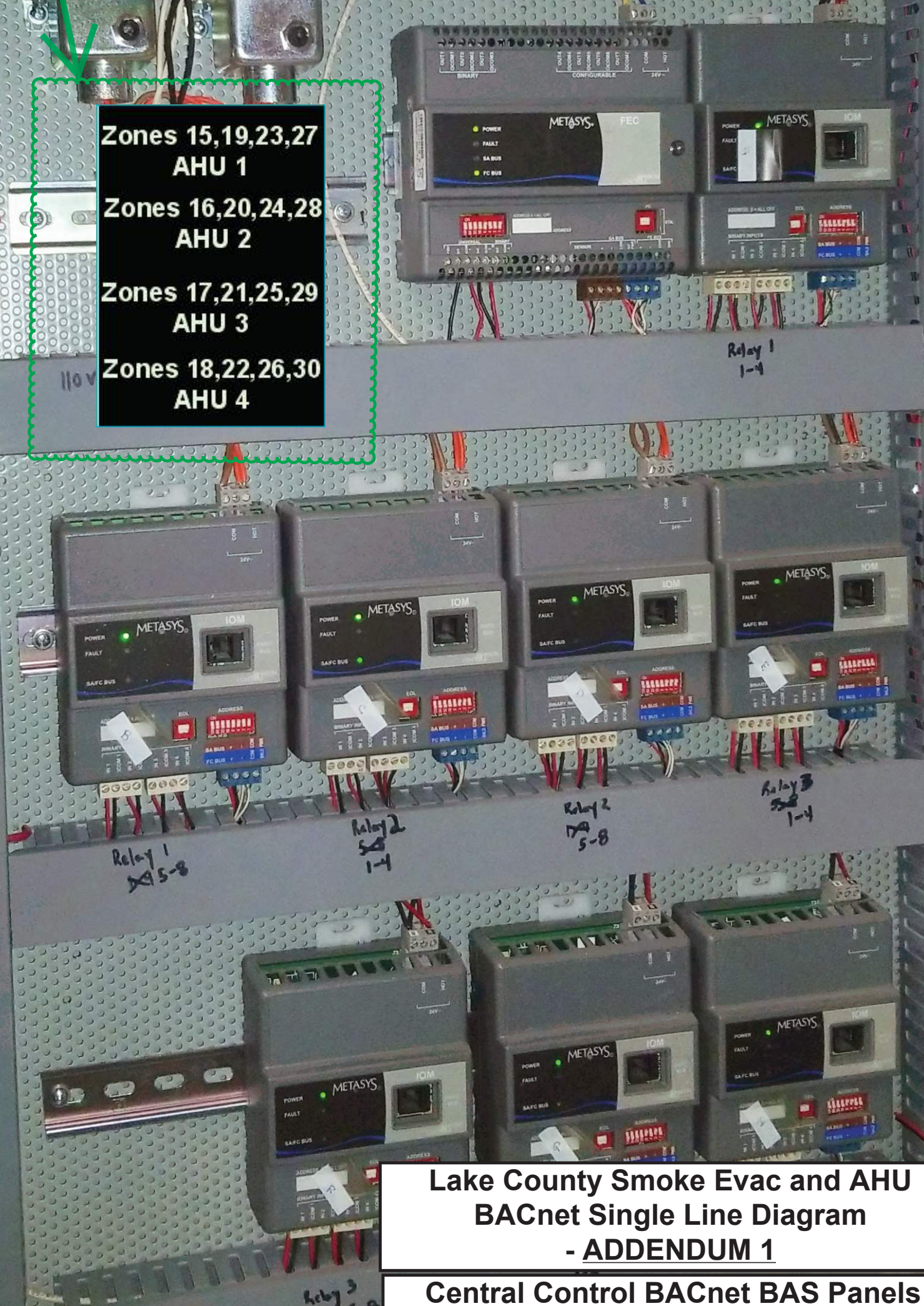


Simplex
Zones Landing
Points Wiring -
32 Zones

**Addendum
1 Revision**

Lake County will arrange with JCI as a separate contract to keep AHUs 5 to 16 on the JCI FEC that is not UUKL listed.

- Zones 15,19,23,27
AHU 1
- Zones 16,20,24,28
AHU 2
- Zones 17,21,25,29
AHU 3
- Zones 18,22,26,30
AHU 4



**Lake County Smoke Evac and AHU
BACnet Single Line Diagram
- ADDENDUM 1**

Work Item	Construction Management					Power Wiring				Communication Wiring			Software and Programming		
Responsibility Matrix: Built-Up BACnet Interface Device Option. See Section 25 00 13 for definitions.	Submit documentation for approval	Participate/ Provide Assistance	Furnish (or provide device)	Install	Commission	Safety and Interlock wiring	From the Panelboard to the Power Drop	From the Power Drop to the Device	From the Supplier's Equipment	From the BACnet Device to the local Equipment	From the BAS to the BACnet Device	BAS Network Connection	BACnet Interface Device	Supplier's Equipment	Supervisory Control
Native BACnet device (all data link/network layer options) required to make the supplier's equipment operational and networkable to the BACnet Internetwork.	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	Specific Division	Specific Division	25
BACnet Interface Device required to convert proprietary protocols and to map proprietary data points/ register values resident in the supplier's equipment control panel to BACnet AV, BV or other Object Types so the BACnet Interface Device will make the supplier's equipment operational and will present to the BACnet Internetwork as a Native BACnet device.	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	Specific Division	Specific Division	25
Any proprietary (non-BACnet) software, computer, printer, cables, USB keys or any other devices required to make the supplier's equipment operational.	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division
Provide programming or configuration of the supplier's control panel and/or BACnet Interface Device to meet the Sequence of Operations.	Specific Division	Specific Division		Specific Division	Specific Division	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Specific Division	Specific Division	Specific Division
Provide control, graphics, trends, alarms, schedules for this BACnet Interface Device on the BACnet Internetwork.	ALC	ALC	ALC	ALC	ALC	ALC	ALC	ALC	ALC	ALC	ALC	ALC	ALC	ALC	ALC
Network connection to the BACnet Internetwork.	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	Specific Division	Specific Division	Specific Division
Any equipment shipped loose or required to be supplied by others to make the supplier's equipment operational.	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division
Equipment control panel(s) integral to supplier's equipment. Integral means that the panel is supplied and installed with the equipment and is powered from a single point of connection. Note that this includes equipment provided by the supplier but may be an OEM panel. Note that this does not include the BACnet Interface Device.	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division
Equipment control panels NOT integral to supplier's equipment. Note that this includes equipment provided by the supplier but may be an OEM panel. Note that this does not include the BACnet Interface Device.	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division
Control panel and BAS device housings and enclosures (Including backboards attached to walls or free standing uni-strut structures).	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division
Variable Speed Drive and other BACnet MS/TP devices integral to supplied equipment excluding power wiring.	26	26	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	Specific Division	25	27 for BACnet/IP and 25 for BACnet MS/TP	Specific Division	Specific Division	25

Work Item	Construction Management					Power Wiring				Communication Wiring			Software and Programming		
	Submit documentation for approval	Participate/ Provide Assistance	Furnish (or provide device)	Install	Commission	Safety and Interlock wiring	From the Panelboard to the Power Drop	From the Power Drop to the Device	From the Supplier's Equipment	From the BACnet Device to the local Equipment	From the BAS to the BACnet Device	BAS Network Connection	BACnet Interface Device	Supplier's Equipment	Supervisory Control
Responsibility Matrix: Built-Up BACnet Interface Device Option. See Section 25 00 13 for definitions.															
Variable Speed Drive and other BACnet MS/TP devices separate to supplied equipment excluding power wiring.	26	26	26	26	26	26	26	26	26	Specific Division	25	27 for BACnet/IP and 25 for BACnet MS/TP	Specific Division	Specific Division	25
Power wiring for fan or pump Variable Speed Drive.	26	26	26	26	26	26	26	26	26	N/A	N/A	N/A	N/A	N/A	N/A
Any power wiring for any external valve(s), damper(s), sensor(s), meter(s), transducer(s) or any other device(s)	26	26	26	26	26	26	26	25	26	N/A	N/A	N/A	N/A	N/A	N/A
Any valve(s), damper(s), sensor(s), meter(s), transducer(s) or any other device(s) required to make the supplier's equipment operational. This includes devices that are called up in the Contract Documents as <u>being external</u> to the supplier's equipment.	25	25	25	25	25 and Specific Division	26	26	25	26	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	Specific Division	Specific Division	25
Any valve(s), damper(s), sensor(s), meter(s), transducer(s) or any other device(s) required to make the supplier's equipment operational. This includes devices that are called up as being <u>supplied with the supplier's equipment with or shipped loose</u> equipment in the Contract Documents.	Specific Division	Specific Division	Specific Division	Specific Division	25 and Specific Division	26	26	25	26	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	Specific Division	Specific Division	25
Any wiring between any valve(s), damper(s), sensor(s), meter(s), transducer(s) or any other device(s) to the supplier's control panel required to make the supplier's equipment operational.	25	25	25	25	25	25	26	25	26	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	Specific Division	Specific Division	25
Any wiring between the BACnet Interface Device and the supplier's control panel and/or equipment.	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division		26	25	26	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	25
Line or low voltage wiring from the BAS panel to the starter or point of connection for controlling the supplier's equipment	25	25	25	25	25	25	26	25	25	N/A	N/A	N/A	25	25	25
Breakers in panelboards required for BAS devices of all types	26	26	26	26	26	26	26	26	26	N/A	N/A	N/A	26	26	26
Starters/HOAs	26	26	26	26	26	26	26	26	26	N/A	N/A	N/A	26	26	26
Line of sight disconnect switches	26	26	26	26	26	26	26	26	26	N/A	N/A	N/A	26	26	26
Line to low voltage transformers	25	25	25	25	25	26	26	26	26	N/A	N/A	N/A	26	26	26
Duct Smoke Detectors	26	26	26	26	26	26	26	26	26	N/A	N/A	N/A	26	26	26
Safety/high limit wiring	25	25	25	25	25	26	26	26	26	N/A	N/A	N/A	26	26	26
LAN connection between the BACnet Interface Device and other BACnet devices that are considered subpanels. The LAN connection may use any BACnet or any proprietary protocol.	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	27 for BACnet/IP and 25 for BACnet MS/TP	26	26	26	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	Specific Division	Specific Division	25

Work Item	Construction Management						Power Wiring			Communication Wiring			Software and Programming		
	Submit documentation for approval	Participate/ Provide Assistance	Furnish (or provide device)	Install	Commission	Safety and Interlock wiring	From the Panelboard to the Power Drop	From the Power Drop to the Device	From the Supplier's Equipment	From the BACnet Device to the local Equipment	From the BAS to the BACnet Device	BAS Network Connection	BACnet Interface Device	Supplier's Equipment	Supervisory Control
Responsibility Matrix: Plant Controller BACnet Interface Device Option. See Section 25 00 13 for definitions.															
Variable Speed Drive integral to supplied equipment excluding power wiring.	26	26	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	Specific Division	25	27 for BACnet/IP and 25 for BACnet MS/TP	Specific Division	Specific Division	25
Variable Speed Drive separate to supplied equipment excluding power wiring.	26	26	26	26	26	26	26	26	26	Specific Division	25	27 for BACnet/IP and 25 for BACnet MS/TP	Specific Division	Specific Division	25
Power wiring for fan or pump Variable Speed Drive.	26	26	26	26	26	26	26	26	26	N/A	N/A	N/A	N/A	N/A	N/A
Any power wiring for any external valve(s), damper(s), sensor(s), meter(s), transducer(s) or any other device(s)	26	26	26	26	26	26	26	25	26	N/A	N/A	N/A	N/A	N/A	N/A
Any valve(s), damper(s), sensor(s), meter(s), transducer(s) or any other device(s) required to make the supplier's equipment operational. This includes devices that are called up in the Contract Documents as <u>being external</u> to the supplier's equipment.	25	25	25	25	25 and Specific Division	26	26	25	26	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	Specific Division	Specific Division	25
Any valve(s), damper(s), sensor(s), meter(s), transducer(s) or any other device(s) required to make the supplier's equipment operational. This includes devices that are called up as being <u>supplied with the supplier's equipment with or shipped loose equipment in the Contract Documents.</u>	Specific Division	Specific Division	Specific Division	Specific Division	25 and Specific Division	26	26	25	26	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	Specific Division	Specific Division	25
Any wiring between any valve(s), damper(s), sensor(s), meter(s), transducer(s) or any other device(s) to the supplier's control panel required to make the supplier's equipment operational.	25	25	25	25	25	25	26	25	26	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	Specific Division	Specific Division	25
Any wiring between the BACnet Interface Device and the supplier's control panel and/or equipment.	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division		26	25	26	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	25
Line or low voltage wiring from the BAS panel to the starter or point of connection for controlling the supplier's equipment	25	25	25	25	25	25	26	25	25	N/A	N/A	N/A	25	25	25
Breakers in panelboards required for BAS devices of all types	26	26	26	26	26	26	26	26	26	N/A	N/A	N/A	26	26	26
Starters/HOAs	26	26	26	26	26	26	26	26	26	N/A	N/A	N/A	26	26	26
Line of sight disconnect switches	26	26	26	26	26	26	26	26	26	N/A	N/A	N/A	26	26	26
Line to low voltage transformers	25	25	25	25	25	26	26	26	26	N/A	N/A	N/A	26	26	26
Duct Smoke Detectors	26	26	26	26	26	26	26	26	26	N/A	N/A	N/A	26	26	26
Safety/high limit wiring	25	25	25	25	25	26	26	26	26	N/A	N/A	N/A	26	26	26

Work Item	Construction Management					Power Wiring				Communication Wiring			Software and Programming		
	Submit documentation for approval	Participate/ Provide Assistance	Furnish (or provide device)	Install	Commission	Safety and Interlock wiring	From the Panelboard to the Power Drop	From the Power Drop to the Device	From the Supplier's Equipment	From the BACnet Device to the local Equipment	From the BAS to the BACnet Device	BAS Network Connection	BACnet Interface Device	Supplier's Equipment	Supervisory Control
Responsibility Matrix: Local Area Network BACnet Interface Device Option. See Section 25 00 13 for definitions.															
Native BACnet device (all data link/network layer options) required to make the supplier's equipment operational and networkable to the BACnet Internetwork.	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	Specific Division	Specific Division	25
BACnet Interface Device required to convert proprietary protocols and to map proprietary data points/ register values resident in the supplier's equipment control panel to BACnet AV, BV or other Object Types so the BACnet Interface Device will make the supplier's equipment operational and will present to the BACnet Internetwork as a Native BACnet device.	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	Specific Division	Specific Division	25
Any proprietary (non-BACnet) software, computer, printer, cables, USB keys or any other devices required to make the supplier's equipment operational.	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division
Provide programming or configuration of the supplier's control panel and/or BACnet Interface Device to meet the Sequence of Operations.	Specific Division	Specific Division		Specific Division	Specific Division	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Specific Division	Specific Division	Specific Division
Provide control, graphics, trends, alarms, schedules for this BACnet Interface Device on the BACnet Internetwork.	25	25	25	25	25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	25	25	25
Network connection to the BACnet Internetwork.	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	Specific Division	Specific Division	Specific Division
Any equipment shipped loose or required to be supplied by others to make the supplier's equipment operational.	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division
Equipment control panel(s) integral to supplier's equipment. Integral means that the panel is supplied and installed with the equipment and is powered from a single point of connection. Note that this includes equipment provided by the supplier but may be an OEM panel. Note that this does not include the BACnet Interface Device.	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division
Equipment control panels NOT integral to supplier's equipment. Note that this includes equipment provided by the supplier but may be an OEM panel. Note that this does not include the BACnet Interface Device.	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division
Control panel and BAS device housings and enclosures (Including backboards attached to walls or free standing uni-strut structures).	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division
Any power wiring for any external valve(s), damper(s), sensor(s), meter(s), transducer(s) or any other device(s)	26	26	26	26	26	26	26	25	26	N/A	N/A	N/A	N/A	N/A	N/A

Work Item	Construction Management					Power Wiring				Communication Wiring			Software and Programming		
	Submit documentation for approval	Participate/ Provide Assistance	Furnish (or provide device)	Install	Commission	Safety and Interlock wiring	From the Panelboard to the Power Drop	From the Power Drop to the Device	From the Supplier's Equipment	From the BACnet Device to the local Equipment	From the BAS to the BACnet Device	BAS Network Connection	BACnet Interface Device	Supplier's Equipment	Supervisory Control
Responsibility Matrix: Single On-Board BACnet Interface Device Option. See Section 25 00 13 for definitions.															
Native BACnet device (all data link/network layer options) required to make the supplier's equipment operational and networkable to the BACnet Internetwork.	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	Specific Division	Specific Division	25
BACnet Interface Device required to convert proprietary protocols and to map proprietary data points/ register values resident in the supplier's equipment control panel to BACnet AV, BV or other Object Types so the BACnet Interface Device will make the supplier's equipment operational and will present to the BACnet Internetwork as a Native BACnet device.	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	Specific Division	Specific Division	25
Any proprietary (non-BACnet) software, computer, printer, cables, USB keys or any other devices required to make the supplier's equipment operational.	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division
Provide programming or configuration of the supplier's control panel and/or BACnet Interface Device to meet the Sequence of Operations.	Specific Division	Specific Division		Specific Division	Specific Division	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Specific Division	Specific Division	Specific Division
Provide control, graphics, trends, alarms, schedules for this BACnet Interface Device on the BACnet Internetwork.	25	25	25	25	25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	25	25	25
Network connection to the BACnet Internetwork.	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	27 for BACnet/IP and 25 for BACnet MS/TP	Specific Division	Specific Division	Specific Division
Any equipment shipped loose or required to be supplied by others to make the supplier's equipment operational.	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division
Equipment control panel(s) integral to supplier's equipment. Integral means that the panel is supplied and installed with the equipment and is powered from a single point of connection. Note that this includes equipment provided by the supplier but may be an OEM panel. Note that this does not include the BACnet Interface Device.	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division
Equipment control panels NOT integral to supplier's equipment. Note that this includes equipment provided by the supplier but may be an OEM panel. Note that this does not include the BACnet Interface Device.	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division
Control panel and BAS device housings and enclosures (Including backboards attached to walls or free standing uni-strut structures).	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division		26	26	26	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division
Any power wiring for any external valve(s), damper(s), sensor(s), meter(s), transducer(s) or any other device(s)	26	26	26	26	26	26	26	25	26	N/A	N/A	N/A	N/A	N/A	N/A

Work Item	Construction Mangement						Power Wiring			Communication Wiring			Software and Programming		
	Submit documentation for approval	Participate/ Provide Assistance	Furnish (or provide device)	Install	Commission	Safety and Interlock wiring	From the Panelboard to the Power Drop	From the Power Drop to the Device	From the Supplier's Equipment	From the BACnet Device to the local Equipment	From the BAS to the BACnet Device	BAS Network Connection	BACnet Interface Device	Supplier's Equipment	Supervisory Control
Responsibility Matrix: Equipment fitted with Stick Built controls. See Section 25 00 13 for definitions.															
External motorised bypass/isolating valves for chiller/boiler	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	26	25	25	25	25	25	25
Motorized Fire/Smoke Dampers	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	26	26	26	26	26	26	26
Motorized Fire/Smoke Dampers Actuators	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	26	26	26	26	26	26	26
Occupancy, vacancy and daylight sensors used to integrate with HVAC devices. These devices are part of the networked lighting control system.	26	26	26	26	26	26	26	26	26	26	26	27	26	26	25
VAV box controllers supplied to VAV box factory (Devices are BACnet MS/TP).	25	25	25	Specific Division	25	26	26	26 spots power for n devices. 25 runs 24 V power to n devices.	26 spots power for n devices. 25 runs 24 V power to n devices.	25	25	25	25	25	25
VAV box controllers site installed (Devices are BACnet MS/TP).	25	25	25	25	25	26	26	26 spots power for n devices. 25 runs 24 V power to n devices.	26 spots power for n devices. 25 runs 24 V power to n devices.	25	25	25	25	25	25
Variable speed drive integral to supplied equipment	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	26	25	25	25	25	25	25
Variable speed drive separate to supplied equipment	23 or 26	23 or 26	23 or 26	23 or 26	23 or 26	26	26	26	26	25	25	25	25	25	25
Air Compressor - Controls	25	25	25	25	25	26	26	26	26	25	25	25	25	25	25
Air Compressor - Process (not for Controls)	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	26	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	25
Thermowells required for sensors	25	25	25	23	25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Current Switches	25	25	25	25	25	26	26	26	26	25	25	25	25	25	25
Control Relays	25	25	25	25	25	26	26	26	26	25	25	25	25	25	25
Damper endswitches	25	25	25	25	25	26	26	26	26	25	25	25	25	25	25
Steam meters	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	26	25	25	25	25	25	25
Hydronic meters	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	26	25	25	25	25	25	25
Water meters not used by utility for metering.	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	26	25	25	25	25	25	25
Natural gas meter	Owner	Owner and 25	Owner	Owner	Owner	Owner	26	26	26	25	25	25	25	25	25
Electrical Meters not used by utility for billing.	26	26	26	26	26	26	26	26	26	26	26	27	26	26	25
Other	Specific Division	Specific Division	Specific Division	Specific Division	Specific Division	26	26	26	26	25	25	25	25	25	25

Responsibility Matrix: Devices shown on Plans and Specifications in the Division that specifies Supplier's equipment. This table does not include the Five BACnet Interface Device Types. See Section 25 00 13 for definitions.

	Supply	Install	Power Wiring	Low Voltage Control Wiring	Line Voltage Controls Wiring	Low Voltage Interlock Wiring	Line Voltage Interlock Wiring
Temperature sensors (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Temperature sensors (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Temperature sensors (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Relative Humidity sensors (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Relative Humidity sensors (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Relative Humidity sensor (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Outdoor air static air sensor probe	E.S.	E.S.	E.S.	E.S.	26	26	26
Air flow stations (in duct) (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Air flow stations (in duct) (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Air flow stations (Annubar) (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Air flow stations (Annubar) (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Air flow stations (Annubar)	E.S.	E.S.	E.S.	E.S.	26	26	26
Pressure sensors (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Pressure sensors (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Pressure sensors (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Gas sensors (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Gas sensors (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Gas sensors (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Liquid level sensors (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Liquid level sensors (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Liquid level sensors (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Liquid level switches (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Liquid level switches (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Liquid level switches (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Liquid flow sensors (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Liquid flow sensors (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Liquid flow sensors (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Low limit switches (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Low limit switches (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Low limit switches (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Thermostats (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26

Responsibility Matrix: Devices shown on Plans and Specifications in the Division that specifies Supplier's equipment. This table does not include the Five BACnet Interface Device Types. See Section 25 00 13 for definitions.

	Supply	Install	Power Wiring	Low Voltage Control Wiring	Line Voltage Controls Wiring	Low Voltage Interlock Wiring	Line Voltage Interlock Wiring
Thermostats (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Thermostats (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Aquastats (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Aquastats (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Aquastats (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Air flow switches (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Air flow switches (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Air flow switches (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Liquid flow switches (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Liquid flow switches (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Liquid flow switches (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Filter switches (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Filter switches (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Filter switches (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Filter Diff. Pressure Sensors (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Filter Diff. Pressure Sensors (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Filter Diff. Pressure Sensors (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Control Dampers (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Control Dampers (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Control Dampers (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Control Damper Actuators (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Control Damper Actuators (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Control Damper Actuators (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Control Valves (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Control Valves (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Control Valves (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Control Valve Actuators (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Control Valve Actuators (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Control Valve Actuators (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Manual Valves (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Manual Valves (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26

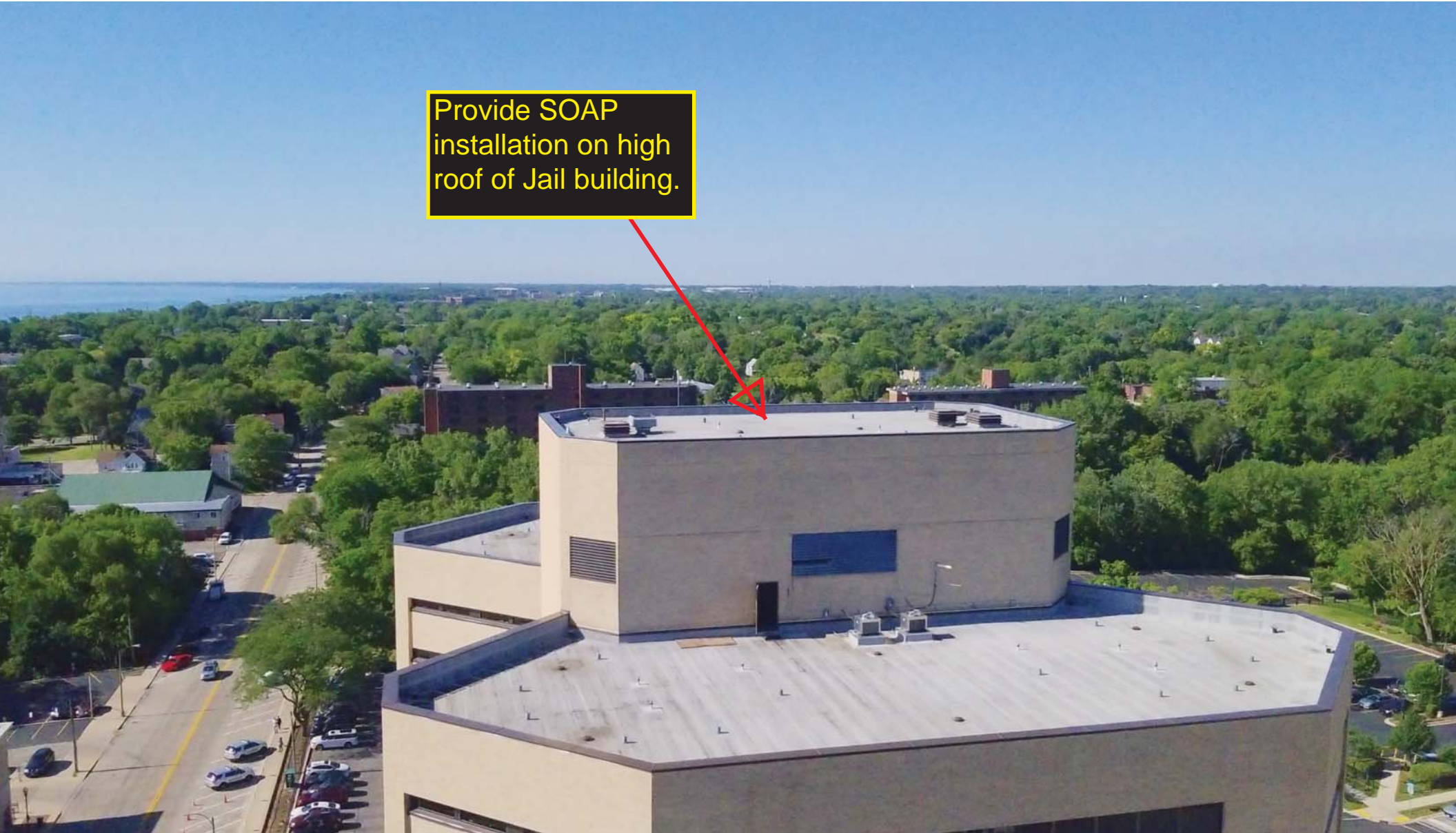
Responsibility Matrix: Devices shown on Plans and Specifications in the Division that specifies Supplier's equipment. This table does not include the Five BACnet Interface Device Types. See Section 25 00 13 for definitions.

	Supply	Install	Power Wiring	Low Voltage Control Wiring	Line Voltage Controls Wiring	Low Voltage Interlock Wiring	Line Voltage Interlock Wiring
Manual Valves (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Motorized Fire/Smoke Dampers	E.S.	E.S.	E.S.	E.S.	26	26	26
Motorized Fire/Smoke Dampers Actuators	E.S.	E.S.	E.S.	E.S.	26	26	26
Occupancy sensors (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Occupancy sensors (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Occupancy sensors (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
VAV boxes	E.S.	E.S.	E.S.	E.S.	26	26	26
Vibration isolation and seismic bracing	E.S.	E.S.	E.S.	E.S.	26	26	26
Variable speed drives (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Variable speed drives (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Variable speed drives (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Air Compressors (Controls)	E.S.	E.S.	E.S.	E.S.	26	26	26
Air Compressors (Process)	E.S.	E.S.	E.S.	E.S.	26	26	26
Thermowells (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Thermowells (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Thermowells (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Current Switches (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Current Switches (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Current Switches (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Current transducers (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Current transducers (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Current transducers (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Voltage transducers (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Voltage transducers (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Voltage transducers (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Control Relays (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Control Relays (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Control Relays (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Damper endswitches (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26

Responsibility Matrix: Devices shown on Plans and Specifications in the Division that specifies Supplier's equipment. This table does not include the Five BACnet Interface Device Types. See Section 25 00 13 for definitions.

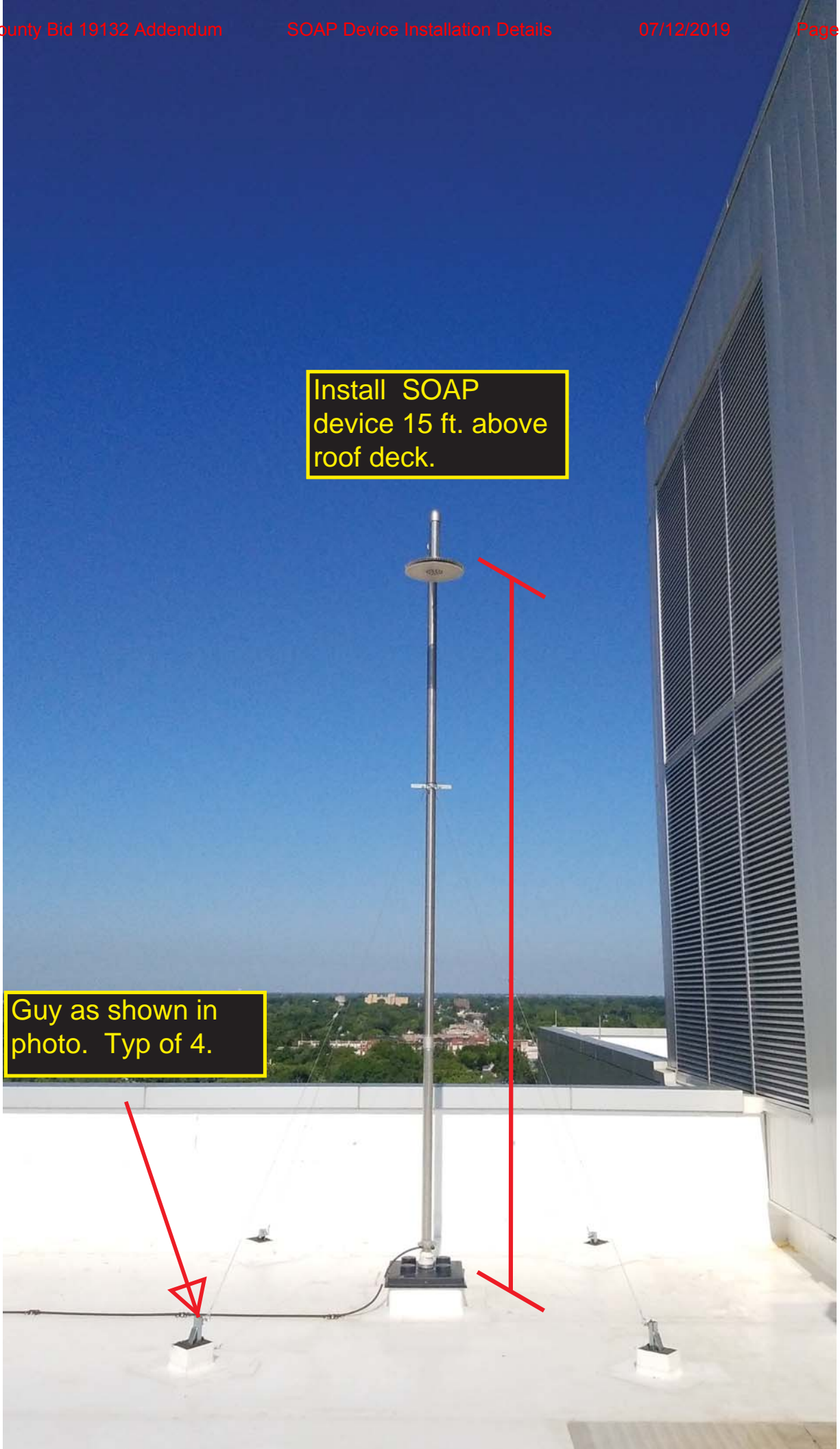
	Supply	Install	Power Wiring	Low Voltage Control Wiring	Line Voltage Controls Wiring	Low Voltage Interlock Wiring	Line Voltage Interlock Wiring
Damper endswitches (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Damper endswitches (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Steam meters (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Steam meters (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Steam meters (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Hydronic meters (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Hydronic meters (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Hydronic meters (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Water meters (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Water meters (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Water meters (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Natural gas meters (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Natural gas meters (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Natural gas meters (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Electrical Meters (integral to supplied equipment)	E.S.	E.S.	E.S.	E.S.	26	26	26
Electrical Meters (shipped loose by equipment Supplier)	E.S.	E.S.	E.S.	E.S.	26	26	26
Electrical Meters (provided by another Division). This applies only if there is a reference to another Division in this Table.	E.S.	E.S.	E.S.	E.S.	26	26	26
Other (ALL OTHER DEVICES IN THE WORK NOT ELSEWHERE SPECIFIED)	E.S.	E.S.	E.S.	E.S.	26	26	26
Non-BAS terminal unit internal or external controls for equipment							
Fan Coils	23	23	26	25	26	26	26
Convectors	23	23	26	25	26	26	26
Radiation (Wallfin)	23	23	26	25	26	26	26
Force Flows (Cabinet Unit Heaters)	23	23	26	25	26	26	26
Unit Heaters	23	23	26	25	26	26	26
Other (ALL OTHER DEVICES IN THE WORK NOT ELSEWHERE SPECIFIED)	E.S.	E.S.	E.S.	E.S.	26	26	26
BAS terminal unit internal or external controls for equipment							
Fan Coils	23	23	26	25	26	26	26
Convectors	23	23	26	25	26	26	26
Force Flows	23	23	26	25	26	26	26
Unit Heaters	23	23	26	25	26	26	26
Radiant panels	23	23	26	25	26	26	26
Radiant in-slab heating controls	E.S.	E.S.	26	26	26	26	26

Provide SOAP
installation on high
roof of Jail building.



Install SOAP device 15 ft. above roof deck.

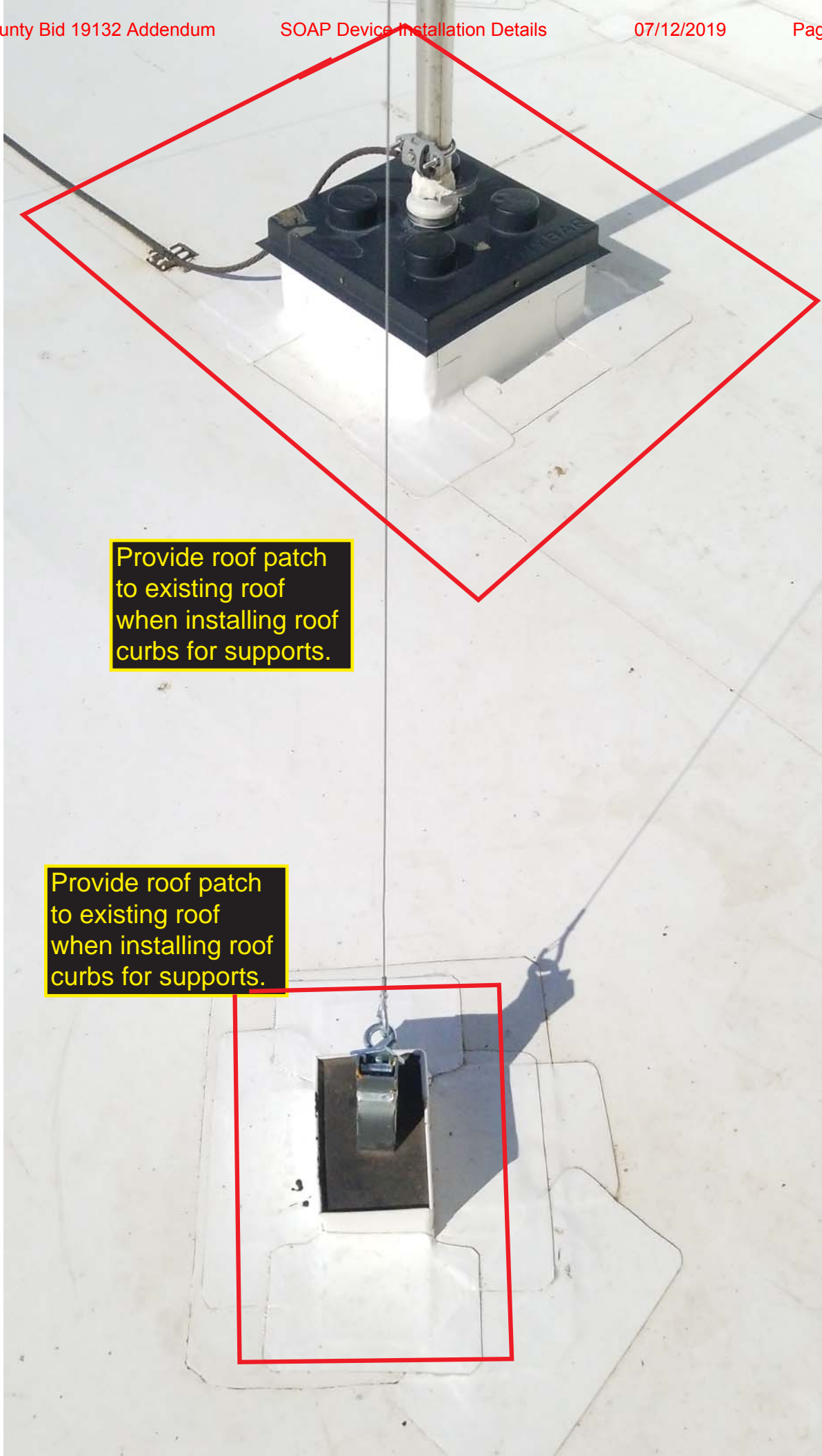
Guy as shown in photo. Typ of 4.





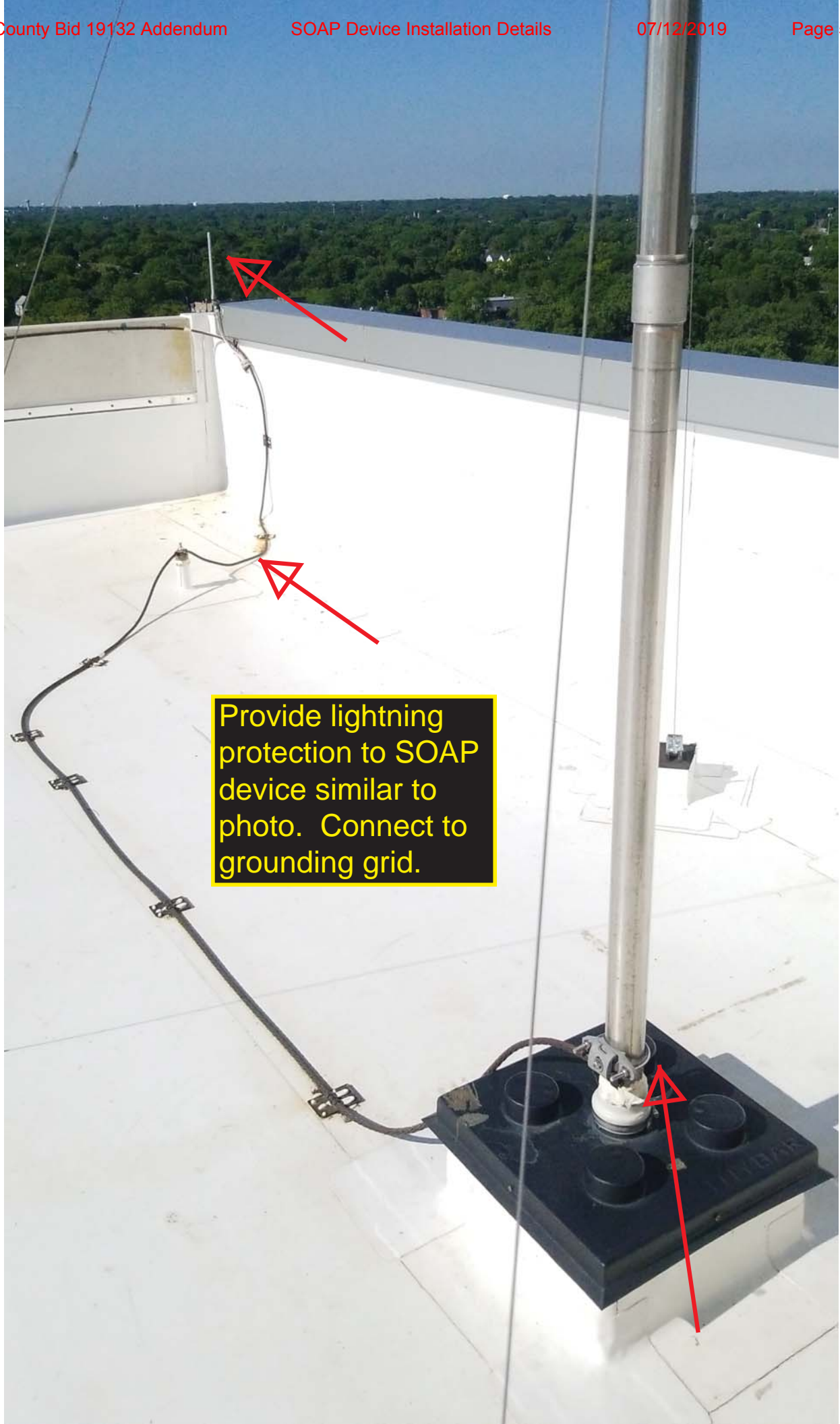
Guy as shown in photo.



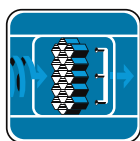


Provide roof patch to existing roof when installing roof curbs for supports.

Provide roof patch to existing roof when installing roof curbs for supports.



Provide lightning protection to SOAP device similar to photo. Connect to grounding grid.



**AIR MONITOR
CORPORATION**

INSTALLATION PROCEDURE

S.O.A.P. – Static Outside Air Probe

INSPECTION & HANDLING.

S.O.A.P.s should be carefully inspected for damage prior to installation. Report damage to your Freight Department, or contact the delivery carrier.

S.O.A.P.s may be handled while in any position. However, it is important not to drop or mishandle the stations such that damage is done to the parallel plates and sensing holes.

WARRANTY

Air Monitor Corporation (hereinafter referred to as "Seller") warrants that at the time of shipment, products sold pursuant to this contract will be free from defects in materials and workmanship, and will conform to the specifications furnished or approved in writing by Seller. No warranty is given that delivered products will conform to catalog sheets, data sheets, and the like, which are subject to change without notice.

Seller will repair or replace, at its option, any products listed under this warranty which is returned freight pre-paid to Seller and within the earlier of one (1) year after start-up or fifteen (15) months after shipment, prove upon test and examination by Seller to be defective within the terms of this warranty. The warranty period for any item repaired or replaced shall be for the time remaining on the warranty period for the original components. Purchaser shall notify Seller in writing of such defect within sixty (60) days of discovery of the defect.

This warranty does not extend to any product sold by Seller which has been the subject of misuse, neglect, accident, damage or malfunction caused by interconnection with equipment manufactured by others, improper installation or storage, or used in violation of instructions furnished by Seller, nor does it extend to any product which has been repaired or altered by persons not expressly approved by Seller. Nor does Seller warrant equipment against normal deterioration due to environment; nor items such as thermocouples, electrodes, and similar items subject to wear or burnout through usage. Adjustments for items or equipment not manufactured by Seller shall be made to the extent of any warranty of the manufacturer or supplier thereof.

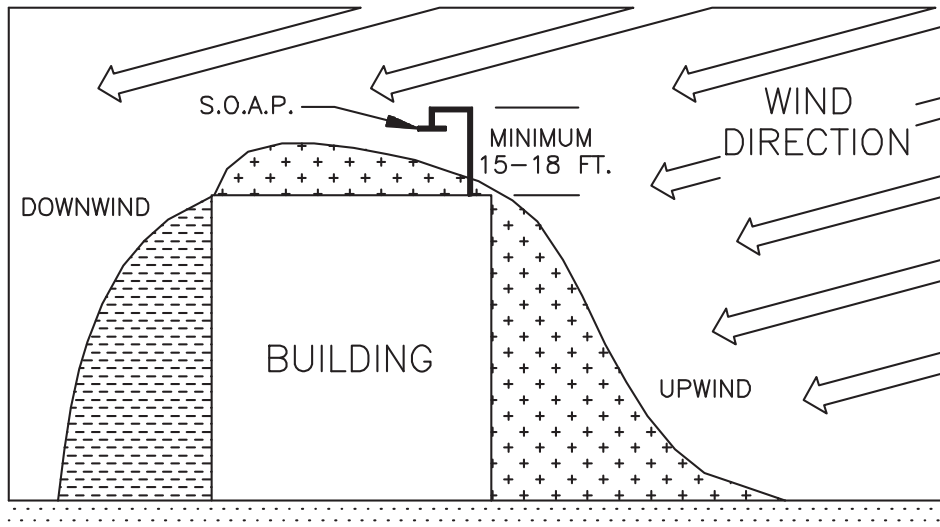
Seller shall not be liable for any special or consequential damages or for loss of damage directly or indirectly arising from the use of the products.

The warranty set forth above is in lieu of all other warranties either express or implied and constitutes the full extent of Air Monitor Corporation's liability to the customer, or any other party for breach of warranty. THERE ARE NO EXPRESS WARRANTIES EXCEPT AS SET FORTH HEREIN. THERE ARE NO IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE, WHICH ARE PARTICULARLY DISCLAIMED.

S.O.A.P. – Static Outside Air Probe

LOCATION OF PROBES.

The location of the S.O.A.P. must be outside the pressure envelope(s) developed by the effect of wind upon the building. The magnitude of the pressure envelopes upstream and downstream of wind direction is shown in Figure 1. Alternate locations would be below grade (like a parking garage) with non-forced ventilation, or a pit in an open space away from buildings (like a lawn area or parking lot).



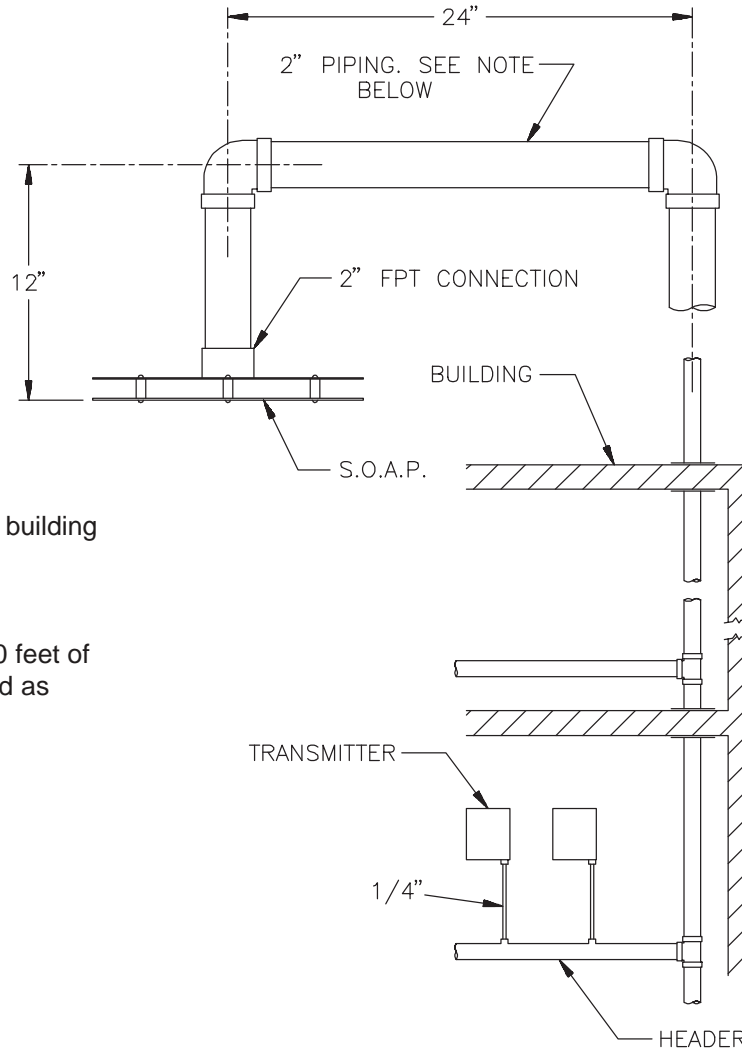
WIND VELOCITY MILES PER HOUR	UPWIND SIDE INCHES W.C.	DOWNWIND SIDE INCHES W.C.
10	0.035	-0.015
15	0.088	-0.025
20	0.14	-0.050
25	0.22	-0.065
30	0.30	-0.090
35	0.42	-0.125
40	0.54	-0.180
45	0.70	-0.260
50	0.85	-0.340
55	1.06	-0.425
60	1.28	-0.540
65	1.70	-0.700

FIGURE 1: Approximate effect of wind velocity on a building.

S.O.A.P. – Static Outside Air Probe

INSTALLATION OF PROBES.

The S.O.A.P. is equipped with a 2" FPT coupling for the signal connection and support of the unit. Two inch piping make-up is recommended for signal transmission to the measuring device.



Two inch piping may be run through the building to provide reference static pressure for differential pressure transmitters.

If the transmitters are located within 200 feet of the 2" headers, 1/4" tubing may be used as signal takeoffs from the header.

CAUTION: After signal piping is completed, signal lines must be leak tested prior to operation.

NOTE: A copy of the S.O.A.P. submittal sheet which includes a pictorial representation of the probe is on Page 4.

S.O.A.P. – Static Outside Air Probe

SUBMITTAL SHEET.

STANDARD CONSTRUCTION	
Casing.	Type 316 stainless steel.
Mounting.	Via 2" pipe nipple.
Connection Fitting.	2" FPT stainless steel.
PERFORMANCE SPECIFICATIONS	
Accuracy.	Within 1% of actual outside atmospheric air pressure.
DIMENSIONAL SPECIFICATIONS	
<u>SIDE VIEW</u>	
<u>BOTTOM VIEW</u>	

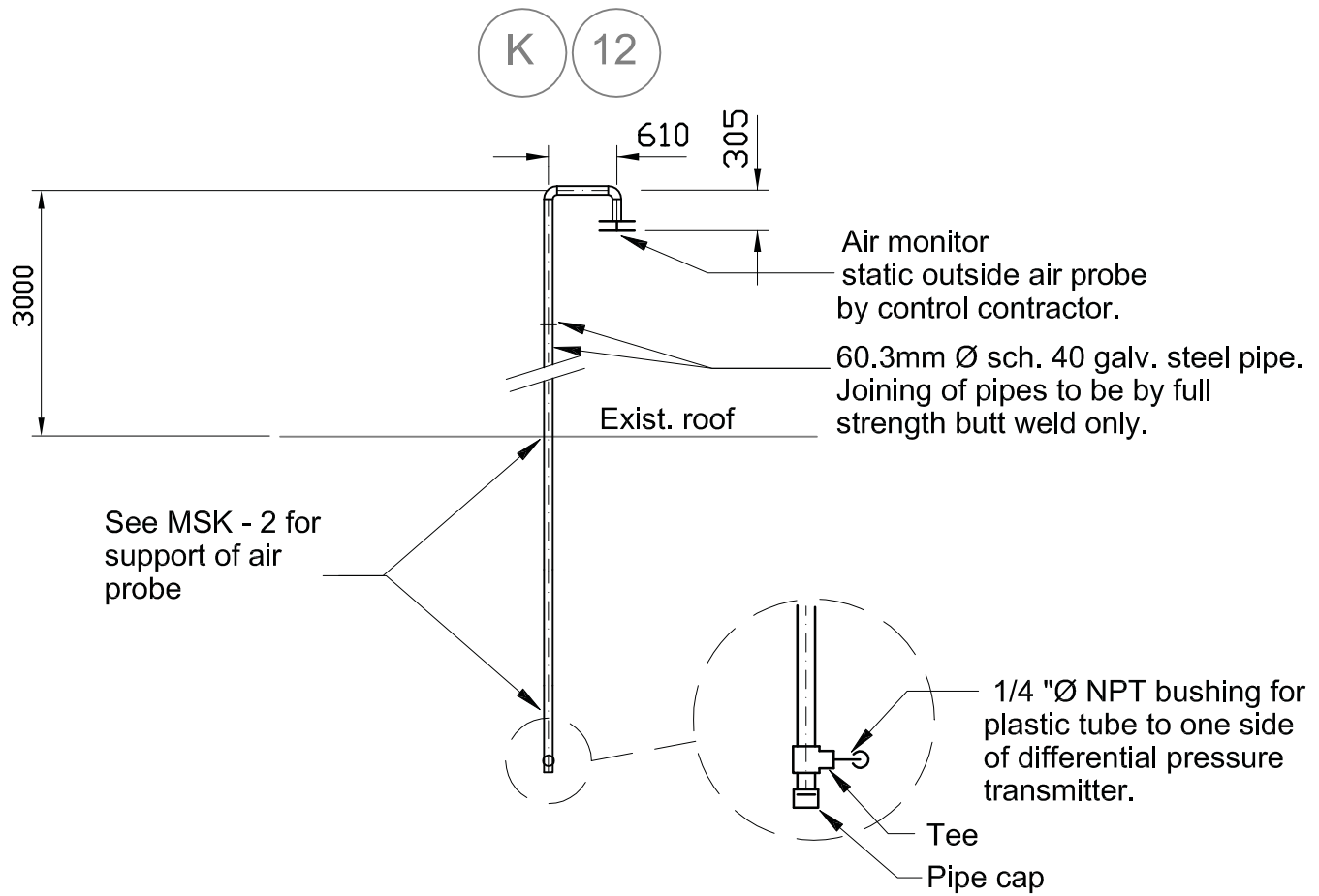
SUB-J009, Rev. 3 (10/05)

CUSTOMER SERVICE. Air Monitor Corporation provides in-house technical support for all our products:
 Monday through Friday, 7 am to 5 pm (pst)
 Phone: 707-544-2706 or 1-800-AIRFLOW / Fax: 707-526-2825

If after contacting the Customer Service Department it is determined that equipment will require return to Air Monitor Corporation for further repair, a Return Authorization number will be issued. A Confirmation of Return Authorization with shipping instructions will be sent via facsimile. Equipment to be returned to Air Monitor should be returned in its original shipping container if possible. If this is not possible, ensure equipment is packaged sufficiently to protect it during shipment.

Caution: All damage occurring during transit is the Customer's responsibility.

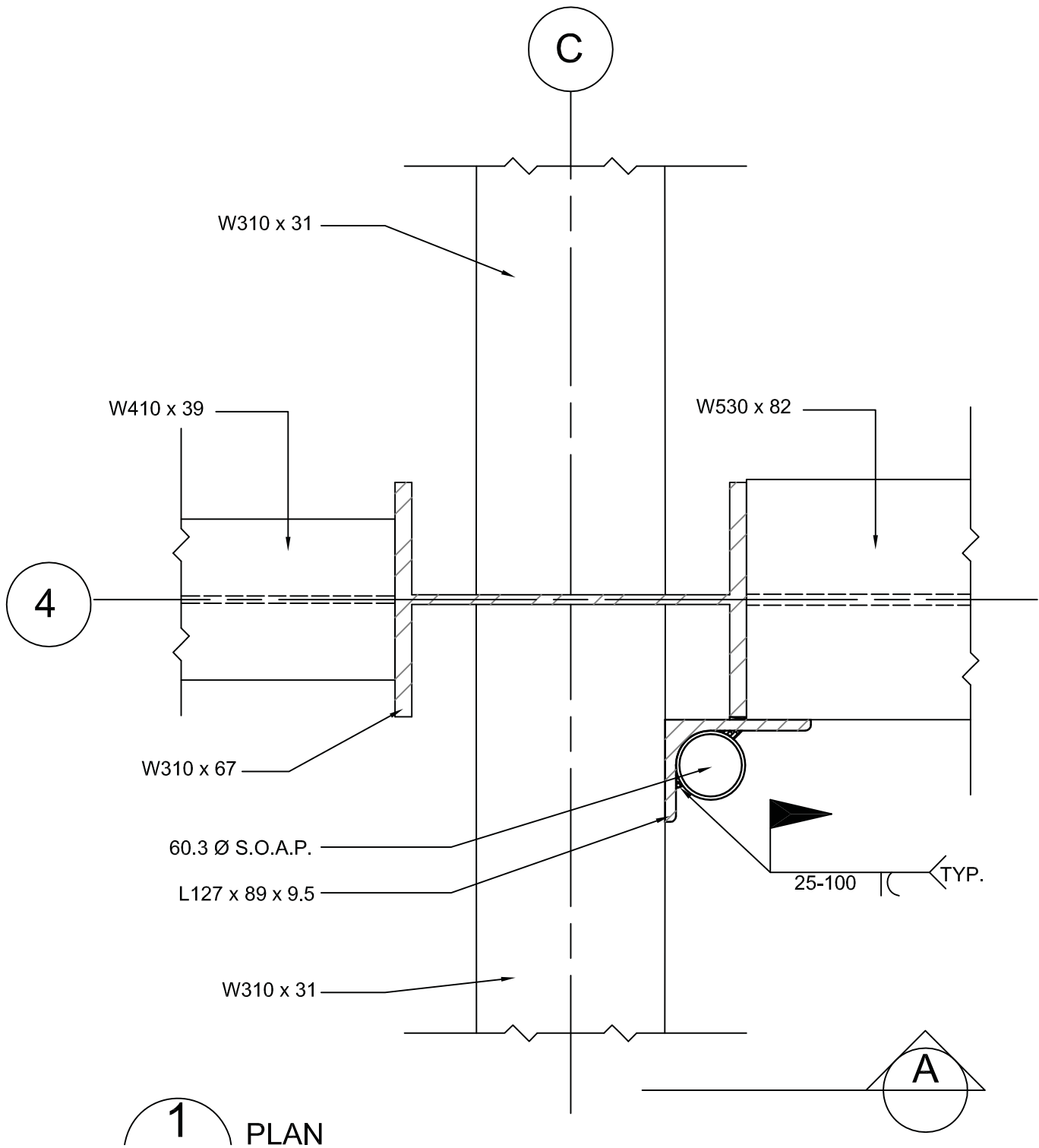
List the Return Authorization (R/A) number on the packing list and clearly mark this number on the outside of each shipping container. Costs associated with the return of equipment to Air Monitor Corporation are the customer's responsibility regardless whether the repair/return is under warranty. Once the Customer Service Department determines that the equipment repair is under warranty, the item will be repaired and returned to the customer at no charge. If the equipment is not under warranty, customer will need to approve a repair quote which will be invoiced along with return shipping charges.



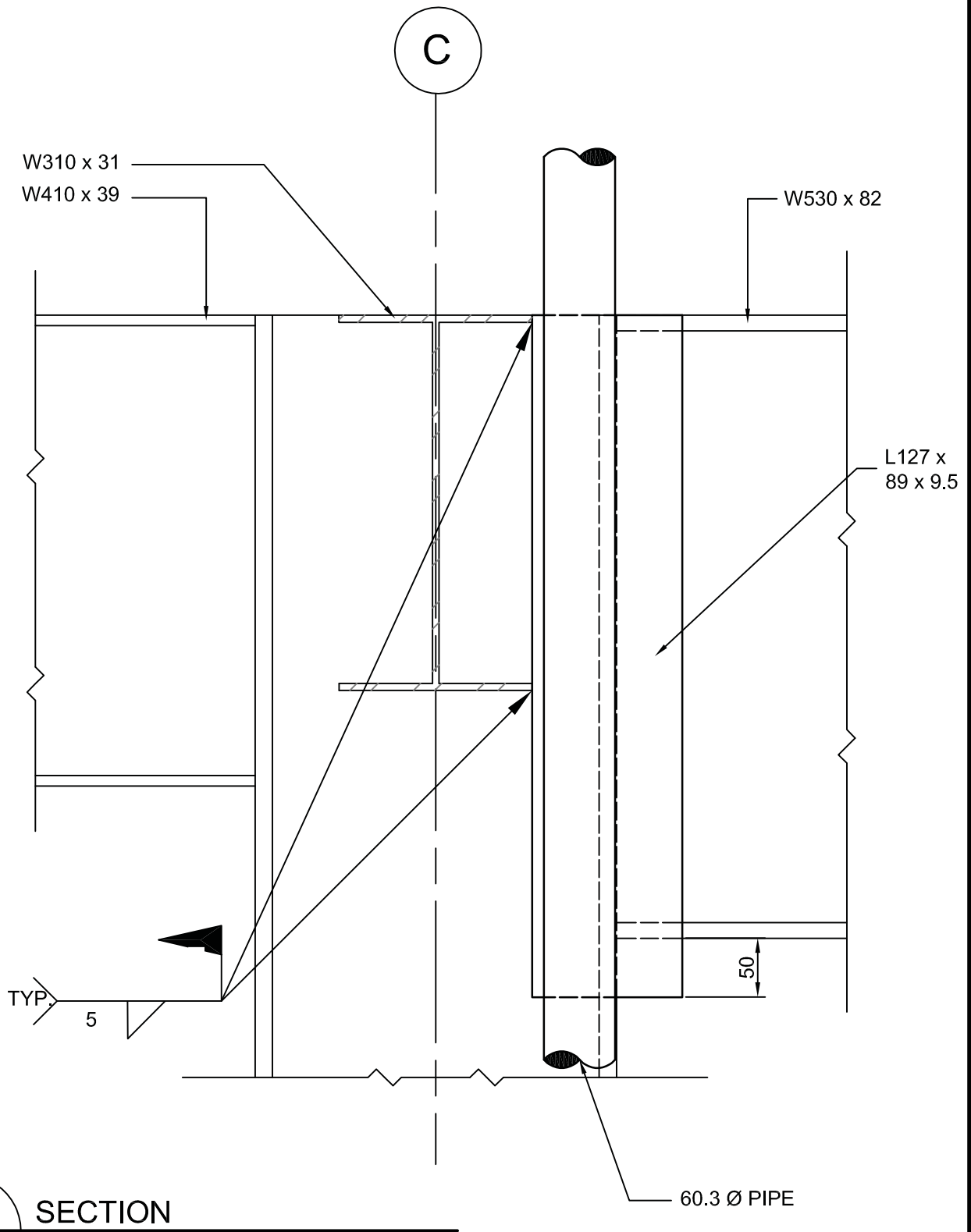
1
DETAIL (S.O.A.P.)

SK-2
NTS

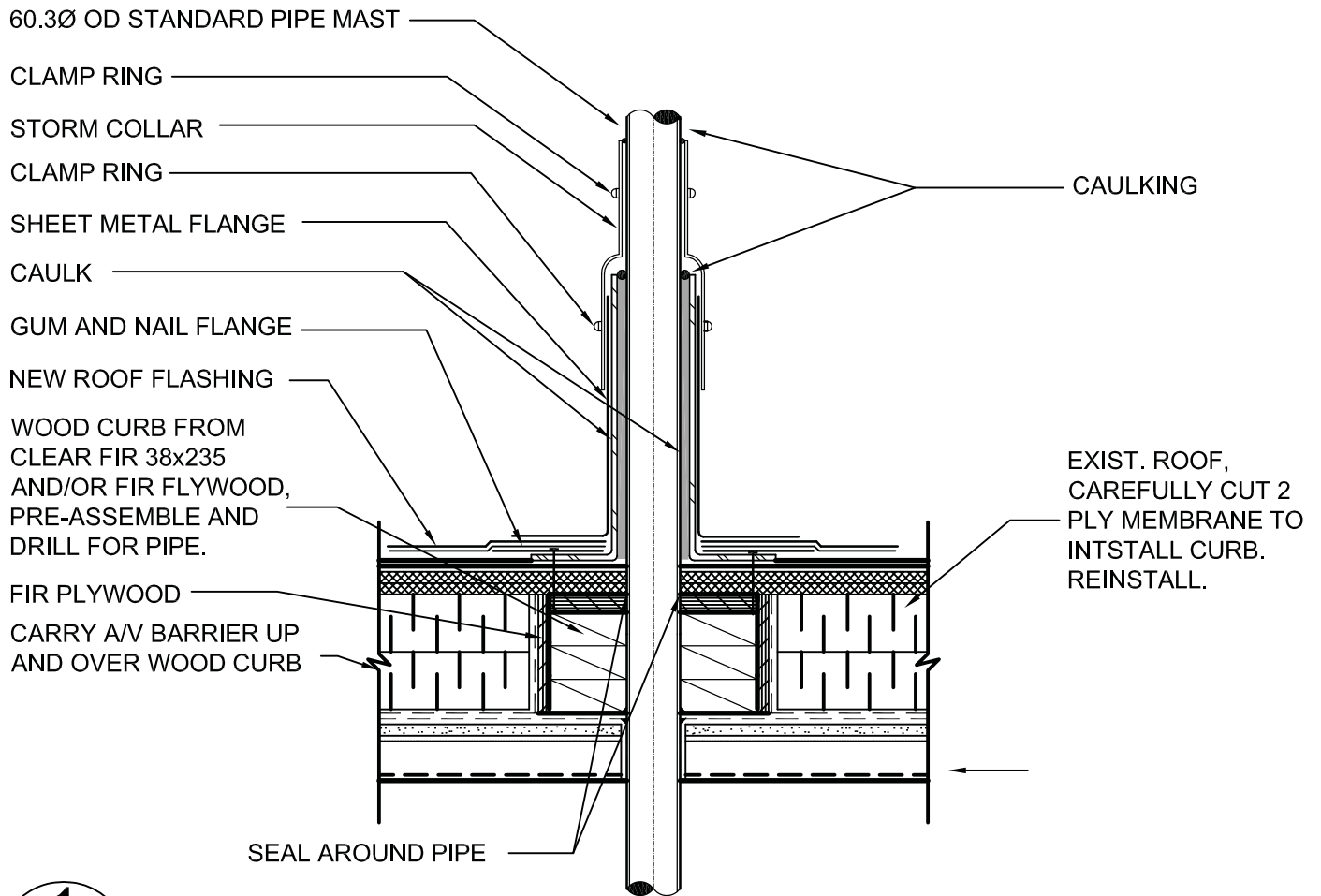
Static Outdoor Air Pressure Installation Detail



Static Outdoor Air Pressure Installation Detail



Static Outdoor Air Pressure Installation Detail



1 SECTION - ROOF DETAIL
 SK-5 SCALE: 1:8

Static Outdoor Air Pressure Installation Detail

**25 20 23.05.19 INTEGRATED AUTOMATION – BACNET INTERFACE DEVICE (GATEWAYS/NATIVE
BACNET DEVICES) – FLOW METERS (ALL TYPES)**

1 - GENERAL

1.01 Controls Coordination Meeting

- 1.01.1 *Designated Controls Contractor* is the Division 25 BAS Contractor.
- 1.01.2 Division 25 BAS Contractor who is providing this BACnet Interface Device shall meet with all other Contractors (and/or Manufacturer's representative) who are supplying equipment to coordinate Work for this BACnet Interface Device.
- 1.01.3 Division 25 BAS Contractor who is providing this BACnet Interface Device shall meet with all Contractors (and/or Equipment Supplier's representatives) who are supplying equipment with the control options as described above, that are to be integrated with the BACnet Internetwork, to coordinate details of the integration.
- 1.01.4 The Owner or his designated representative shall be present at this meeting.
- 1.01.5 Each Contractor and/or Equipment Supplier providing BACnet Interface Device(s) in this section shall provide the Owner and all other effected Contractors, with details of the proposed interface, including:
 - 1.01.5.1 PICS for BACnet equipment detailed the BACnet BIBBs, BACnet Object Types and BACnet services supported.
 - 1.01.5.2 If a gateway provide details on the proprietary protocol used in the Equipment Supplier's equipment and the BACnet protocol to which the proprietary points are being mapped.
 - 1.01.5.3 Hardware and software object list using the object list in this section as a guide. This would include object instances for BACnet, register mapping numbers for Modbus, SNVTs for LonMark or other identifiers.
 - 1.01.5.4 Networking requirements including any network address range restrictions, bus communication speeds and any required network accessories.
 - 1.01.5.5 Communications and power wiring requirements for the gateway and ancillary equipment to be terminated into the BACnet Interface Device (valves, dampers, sensors, etc.).
 - 1.01.5.6 Equipment installation and mounting requirements if the device is not integral to the Equipment Supplier's equipment.
 - 1.01.5.7 AutoCAD files to be used to create the BAS graphics.
 - 1.01.5.8 The purpose of this meeting shall be to insure there are no unresolved issues regarding the integration of these products into the BAS Device Network.
- 1.01.6 Once this information is reviewed and approved, provide a formal Submittal via the Shop Drawing process.
- 1.01.7 Submittals for these products shall not be approved prior to the completion of this meeting.
- 1.01.8 If the Equipment Supplier is providing a BACnet gateway device from an OEM Equipment Supplier, both Equipment Suppliers shall jointly warrant in writing that the gateway can successfully parse the proprietary protocol used by the packaged controls that come with the equipment.
- 1.01.9 The BACnet Interface Device shall permit ALC to plot the BACnet objects into a graphic on his non-UL Front End. Division 25 BAS Contractor shall be able to monitor alarms and events and will be able to have control over objects as permitted by the Equipment Supplier of the BACnet Interface Device(s).

1.02 Shop Drawings

- 1.02.1 Provide product data sheets illustrating the equipment packaged controls interface(s) to be integrated with the BAS system device network in the Work per the list above.

1.03 BACnet Interface Device Type

- 1.03.1 This BACnet Interface Device shall be provided as:
 - 1.03.1.1 Single On-board BACnet Interface Device Type:
 - 1.03.1.1.1 This device is a single onboard BACnet Interface Device. Supplier is responsible for providing and installing this device. Electrical is responsible for providing power to this device is power is not available via the single point of connection. Division 25 is responsible for networking this device with a Designated Controls Contractor supplied BACnet/IP BACnet Interface Device. The Lake County BAS Consultant shall then verify network connectivity to the device. Verifying network connectivity only includes the cost to check that the device responds correctly to the BACnet

WhoIs/IAm and the BACnet WhoHas/IHave services. Division 25 has no requirement to create graphics, set up trends or add schedules..

1.03.1.1.2 The Chiller Plant flow meter shall be supplied and installed by the Chiller Equipment Supplier.

1.03.1.1.3 The demarcation of Work responsibilities between Division 25 and other Divisions for this device shall be as outlined in the BACnet Single Line Diagram and Responsibility Matrix.

1.04 Work By Others for this BACnet Interface Device

1.04.1 References to Division 23 shall be interpreted to mean Divisions 21, 22 and 23 or the Mechanical Subcontractor.

1.04.2 References to Division 26 shall be interpreted to mean Divisions 26, 27 and 28 or the Electrical Subcontractor.

2 - PRODUCTS

2.01 General

2.01.1 Contractor (and/or Manufacturer's representative) equipment that comes with a BACnet Interface Device (a gateway or a native BACnet Interface Device), is responsible for the following:

2.01.1.1 Configuration, programming, start-up and testing of the BACnet Interface Device to comply with this Section.

2.01.1.2 Working with the Lake County BAS Consultant to commission the BACnet Interface Device once it is connected the Intranet at the Place of the Work.

2.02 BACnet Interface Device General Requirements

2.02.1 The BACnet Interface Device Equipment Supplier shall provide a BACnet/IP BACnet Interface Device complete with an Annex J router to support BACnet/IP to act as a client and/or server for all BACnet information from this system to the BAS System.

2.02.2 The device shall support use of a static IP address for remote access through the Owner's firewall. Provision of remote access is not included in the Work.

2.02.3 The device shall have an open Ethernet port for connection to the network infrastructure (network connection to panel by the Owner). Co-ordinate network configuration requirements with the IT department through the Owner.

2.02.4 The BACnet Interface Device shall be a product that is manufactured directly by the Equipment Supplier or may be an OEM product that is supported by the Equipment Supplier.

2.02.4.1 If the BACnet Interface Device Equipment Supplier is providing a device from an OEM Equipment Supplier, both Equipment Suppliers shall jointly warrant in writing that the gateway can successfully parse the equipment protocol. Provide this information as a Shop Drawing.

2.02.5 If the equipment interface is a native BACnet Interface Device, all objects must be represented externally on the network using BACnet objects and services.

2.02.5.1 The exception is objects that are used by the Equipment Supplier to configure the device or to assign administrative passwords or for use by qualified service personnel.

2.02.6 If the equipment interface is a Modbus, LonWorks, or proprietary device requiring a BACnet gateway device, the Division supplying the equipment shall provide a gateway to support mapping all proprietary device points and their present values residing in the gateway device to BACnet AV and BV objects.

2.02.6.1 Device data may be represented internally in the interface as Modbus register mappings, Lon SNVTs or proprietary points, but the data must be represented externally on the network as BACnet objects and services. Device interfaces using proprietary protocols, LonWorks or Modbus are acceptable only on this basis.

2.02.6.2 The exception is objects that are used by the Equipment Supplier to configure the device or to assign administrative passwords or for use by qualified service personnel.

2.02.7 BACnet/PTP devices used as gateways are not allowed in the Work without the written permission of the Owner.

2.02.7.1 The following BACnet Interface Devices may be provided as BACnet/PTP:

2.02.7.1.1 NONE.

2.02.8 The BACnet Interface Device shall support the following BACnet Interoperability Building Blocks (BIBBs):

- 2.02.8.1 Data Sharing - ReadProperty - B (DS-RP-B)
- 2.02.8.2 Data Sharing - ReadPropertyMultiple - B (DS-RPM-B)
- 2.02.8.3 Data Sharing - WriteProperty - B (DS-WP-B)
- 2.02.8.4 Data Sharing - WritePropertyMultiple - B (DS-WPM-B)
- 2.02.8.5 Alarm and Event - Notification Internal - B (AE-N-I-B)
- 2.02.8.6 Alarm and Event - ACK - B (AE-ACK-B)
- 2.02.8.7 Alarm and Event - Information - B (AE-INFO-B)
- 2.02.8.8 Device Management - Dynamic Device Binding - B (DM-DDB-B)
- 2.02.8.9 Device Management - Dynamic Object Binding - B (DM-DOB-B)
- 2.02.8.10 Device Management - DeviceCommunicationControl - B (DM-DCC-B)
- 2.02.8.11 Device Management - TimeSynchronization - B (DM-TS-B)
- 2.02.8.12 Device Management - UTCTimeSynchronization - B (DM-UTC-B)
- 2.02.8.13 Device Management - ReinitializeDevice - B (DM-RD-B)
- 2.02.8.14 Device Management - Restart - B (DM-R-B)

2.02.9 All BACnet Interface Devices shall utilize the BACnet standard profile fault codes enumerated for the applicable device. The fault code values between zero and two fifty five (0 and 255) are reserved for BACnet standard fault codes and all values above two fifty five (255) are open to Manufacturer value added codes.

2.02.10 The BACnet Interface Device shall support the following Object types:

- 2.02.10.1 Analog Input
- 2.02.10.2 Analog Output
- 2.02.10.3 Analog Value
- 2.02.10.4 Binary Input
- 2.02.10.5 Binary Output
- 2.02.10.6 Binary Value
- 2.02.10.7 Device Object
- 2.02.10.8 Multi-state Input
- 2.02.10.9 Multi-state Output
- 2.02.10.10 Multi-state Value

2.02.11 The BACnet Interface Device shall support the required optional properties to comply with the Specification requirements and Control Sequences.

2.03 Water Flow Meters

2.03.1 The BACnet Interface Device shall be represented externally as a BACnet MS/TP device on the Owner’s network.

2.03.2 Provide the following objects at a minimum:

Water Flow Meter BACnet Interface Device Objects (Typical)				
Object Name	Read/Write	Object Type	Alarmable Y/N	Description (acceptable value range)
Total Flow	R	A	Y	gallons liters ³ or meters ³
Flow Rate	R	A	Y	gpm, gph, mgd, l/s, l/m, l/hr or m ³ /hr
Flow Total Reset	W	B	N	Writeable to zero via BACnet WriteProperty
Alarm	R	B	Y	1 = Normal; 0 = Off-Normal

Notes: A= analog, B=Binary, MS=multi-state

2.04 BTU Meters

2.04.1 The BACnet Interface Device shall be represented externally as a BACnet MS/TP device on the Owner’s network.

2.04.2 Provide the following objects at a minimum:

BTU Meter BACnet Interface Device Objects (Typical)				
Object Name	Read/Write	Object Type	Alarmable Y/N	Description (acceptable value range)
Total Energy	R	A	Y	BTU, kW-hrs or ton-hrs
Energy Rate	R	A	Y	Btu/hr, kW or tons
Total Flow	R	A	Y	gallons liters ³ or meters ³
Flow Rate	R	A	Y	gpm, gph, mgd, l/s, l/m, l/hr or m ³ /hr
Supply Temperature	R	A	N	°F or °C
Return Temperature	R	A	N	°F or °C
Delta-T	R	A	N	°F or °C
Energy Total Reset	W	B	N	Writeable to zero via BACnet WriteProperty
Flow Total Reset	W	B	N	Writeable to zero via BACnet WriteProperty

Notes: A= analog, B=Binary, MS=multi-state

3 - EXECUTION

3.01 BACnet Interface Device Installation and Commissioning: BACnet/IP requirements

3.01.1 BACnet/IP BACnet Interface Devices are not allowed in the Work.

3.02 BACnet Interface Device Installation and Commissioning: BACnet MS/TP requirements

3.02.1 The following BACnet Interface Devices described in this Section shall reside on the Owner's network as a BACnet MS/TP device.

3.02.1.1 Meters

3.02.2 The Owner will arrange for the following:

3.02.2.1 The IT department will assist with the commissioning of the network connection with this Contractor and the BACnet Interface Device Equipment Supplier. The Owner and designated personnel are only responsible for providing the termination to the building switch in the Comms room and for ensuring that the IP connection to the Intranet is operational.

3.02.2.2 The Owner will provide the passwords and access levels required for the Work.

3.02.3 The Equipment Supplier of the BACnet Interface Device shall provide the following:

3.02.3.1 Provide a BACnet MS/TP device meet the following requirements. The device shall:

3.02.3.1.1 Operate as a master device on the BACnet MS/TP network.

3.02.3.1.2 All equipment with packaged controls that provide a BACnet MS/TP interface shall have an opto-isolated EIA-485 termination block for connection of the communications cabling. All communications cabling shall only require a two-pair, twisted shielded pair, low capacitance cable following standard MS/TP wiring methods. Each MS/TP network segment shall support a total maximum cable length of 1,220 m [4,000 ft.].

3.02.3.1.3 The BACnet MS/TP device address shall be settable via DIP switch or software, with an address range of at least 0 to 31 per network segment. It shall be possible to connect up to 32 BACnet Interface Devices on any BACnet MS/TP network segment without requiring the use of repeaters.

3.02.3.1.4 Provide information on the baud rate used. The BACnet MS/TP device shall support network data rates of 9,600 bps, 19,200 bps, 38,400 bps, or 76,800 bps. Each BACnet MS/TP device shall be set to a fixed bit rate. Auto-bauding BACnet MS/TP device configuration will not be allowed.

3.02.3.1.5 Configuration of the device with the BACnet Interface Device ID that is unique to the BAS Device Network. Devices with fixed BACnet Interface Device IDs that cannot be changed on site are not allowed in the Work.

3.02.3.1.6 Size the device to provide all the objects listed in the Equipment Supplier's approved Submittal.

- 3.02.3.2 Install and wire the devices connected to the BACnet MS/TP device as shown in the Consultant's Plans and Specifications.
- 3.02.3.3 Provide details of the required alarms, schedules and trends as outlined in the Sequence of Operation.
- 3.02.3.4 Provide a graphic of the equipment to be controls and review the graphics created by ALC Chicago. This information may be provided as a .dwg file or a graphics format file. Provision of paper documents requiring scanning and post processing by Division 25 is not allowed.
- 3.02.3.5 Creation and assignment of passwords and access levels within the device based on instructions from the Owner.
- 3.02.3.6 Participating in the commissioning process as outlined in this Division.
- 3.02.4 ALC Chicago is responsible for the following:
 - 3.02.4.1 Creating, displaying and testing the alarms, schedules and trends. The following minimums apply to this Section:
 - 3.02.4.1.1 A minimum of 10 alarms or an alarm for each equipment fault. Two of which are considered critical.
 - 3.02.4.1.2 A minimum of 1 schedule.
 - 3.02.4.1.3 A minimum of 10 Extended Trends.
 - 3.02.4.2 Creating the Front End graphics using the object list and other materials provided by the Equipment Supplier. The following minimums apply to this Section:
 - 3.02.4.2.1 Emulate the functionality of the supplied equipment local interface (e.g., annunciator panel, LCD display, GUI interface) at the BAS system Front End.
 - 3.02.4.2.2 Provide one master alarm graphic showing the Critical Alarms and all equipment fault alarms.
 - 3.02.4.2.3 A minimum of 1 graphic showing the device. Use the graphics material provided by the Equipment Supplier or create a graphic from the Contractor's available graphics library that most closely matches the device. Emulate the functionality of the supplied equipment local interface (e.g., annunciator panel, LCD display, GUI interface) at the BAS system Front End.
 - 3.02.4.2.4 Provide an additional sub-graphic for each group of fifty (50) BACnet Object Types to be mapped from the BACnet Interface Device to the Front End. Providing this information as a table of BACnet objects that is a sub-graphic to this graphic is sufficient.
 - 3.02.4.2.5 Provide one master alarm graphic showing the Critical Alarms and all equipment fault alarms.
 - 3.02.4.2.6 Where a table of Object Types is not provided in this section, allow for a minimum of 100 objects to be mapped from the BACnet Interface Device to the Contractor's Front End.
 - 3.02.4.2.7 Provide 10 points to be used by Trane to monitor energy and power information in the eView dashboard.
 - 3.02.4.3 Participating in the commissioning process as outlined in this Division.
- 3.02.5 Division 25 shall provide the following:
 - 3.02.5.1 A schedule as to when the networking requirements need to be completed. See the Division 25 section for this information to be provided as a Shop Drawing.
 - 3.02.5.2 Confirmation that the BACnet Interface Device ID and network number are unique BACnet Interface Device ID and network number are unique to the BAS Device Network.
 - 3.02.5.3 Confirmation that the BACnet MS/TP device shall be set to a fixed bit rate. Auto-bauding BACnet MS/TP device configuration will not be allowed.
 - 3.02.5.4 Create a separate BACnet MS/TP network segment for each data rate provided in the Work.
 - 3.02.5.5 Connection of the BACnet MS/TP network cable to the BACnet Interface Device.
 - 3.02.5.6 Connect a shield wire to earth or device chassis at one point along the MS/TP bus prevent ground potential differences on the BAS device network.
 - 3.02.5.7 Each network segment shall be configured as a peer-to-peer token passing BACnet MS/TP network.
 - 3.02.5.8 A network drop from the Contractor's BACnet/IP Level 1/1A panel's MS/TP network to within 1 m [3 ft.] of the BACnet Interface Device location. Install and test this MS/TP connection per this Division.
 - 3.02.5.9 Joint commissioning the network connection to this Contractor's MS/TP network.
 - 3.02.5.10 Exposing all BACnet MS/TP devices and objects in the Designated Controls Contractor supplied BACnet/IP device to which the BACnet MS/TP device is connected.
 - 3.02.5.11 Participating in the commissioning process as outlined in this Division.

- 3.02.6 The BACnet Interface Device to the Equipment Supplier's BACnet, Modbus or proprietary protocol Device shall be jointly commissioned by Division 25, Equipment Supplier, ALC Chicago and Appin Associates to the satisfaction of the Owner. The Work includes the following:
- 3.02.6.1 All parties shall each allow 8 hours of technician on-site time for this Work (excluding travel to and from the Work) for all devices. This is in addition to any other commissioning requirements called up in the Contract Documents.
 - 3.02.6.2 Equipment Supplier must provide written confirmation that the BACnet Interface Device is ready for commissioning.
 - 3.02.6.3 The purpose of this BACnet Interface Device commissioning process is to verify communications with the BACnet Interface Device, not to verify equipment operation. This commissioning process shall be done after the equipment Verification Report has been accepted.
 - 3.02.6.4 The commissioning process shall be overseen by Appin Associates.
 - 3.02.6.5 Provide confirmation via the Shop Drawing process before the Work starts. Any variations shall be approved via the Shop Drawing process.
 - 3.02.6.6 The Work includes the following:
 - 3.02.6.6.1 Complete commissioning of all network visible object types according to the procedures outlined in Section 25 08 00, using the relevant Commissioning Forms for each BACnet Object Types.
 - 3.02.6.6.2 Verify all network visible BACnet Object Types correctly display the same information on the ALC Front End as is being displayed on the equipment local interface. All network visible objects shall be commissioned.
 - 3.02.6.6.3 Commission the BACnet MS/TP network connection to the Division 25 BACnet/IP device.
 - 3.02.6.6.4 Assist ALC Chicago to integrate this system into the building-wide BACnet Internetwork.
 - 3.02.6.6.5 The process shall be overseen by BAS Consultant.
 - 3.02.6.6.6 Other duties as deemed necessary by the Owner to complete the Work within the allocated hours of technician time.
 - 3.02.6.6.7 Allow 8 hours of on-site time for this Work.
 - 3.02.6.6.8 The following special provisions apply to the commissioning Work.
 - 3.02.6.7 NONE.

End of Section

SECTION 262923 - VARIABLE FREQUENCY MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section
- B. Section 25 20 26.29.23 Integrated Automation - BACnet Interface Device (Gateways/Native BACnet Devices) – Variable Frequency Drives (All Types)
- C. Division 25 Section 25 00 13 – All Trades Work Responsibilities

1.2 SUMMARY

- A. This Section includes solid-state, PWM, variable frequency controllers (VFCs) for speed control of three-phase, squirrel-cage induction motors. All loose VFC shall be provided by Divisions 21, 22 and 23 and installed by Division 26.
- B. Related Sections include the following:
 - 1. Division 26 Section "Transient-Voltage Suppression Devices for Low-Voltage Electrical Power Circuits" for low-voltage power, control, and communication surge suppressors.
 - 2. Division 26 Section "Enclosed Switches and Circuit Breakers."

1.3 DEFINITIONS

- A. BAS: Building Automation system.
- B. IGBT: Insulated gate bipolar transistor.
- C. LAN: Local area network.
- D. PID: Control action, proportional plus integral plus derivative.
- E. PWM: Pulse-width modulated.
- F. VFC: Variable frequency controller (equals VFD-variable frequency drive or adjustable speed drive).

1.4 SUBMITTALS

- A. Product Data: For each type of VFC. 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: 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 rating of integrated unit.
 - 2. Wiring Diagrams: Power, signal, and control wiring for VFCs. Provide schematic wiring diagram for each type of VFC.
- C. Coordination Drawings: Floor plans, drawn to scale, 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.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For VFCs, 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 VFCs and all installed components.
 - 2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
- F. 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.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles (160 km) of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.
- B. Source Limitations: Obtain VFCs of a single type through one source from a single manufacturer.
- C. 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.
- D. Comply with NFPA 70.

- 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 maximum dimensions and clearances.

1.6 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.

1.7 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 (1005 m).

1.8 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 Section "Cast-in-Place Concrete. (For floor mounted VFC's)"
- 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. Short-circuit withstand rating shall be same as short-circuit current rating of upstream overcurrent protective device or as indicated in contract documents, whichever is higher.
- F. Coordinate monitoring and control features of VFC's with communication requirements of BAS. Communication between the systems shall be seamless with specified features of the VFC fully integrated into the BAS.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ABB Power Distribution, Inc.
 2. Toshiba International Corporation.
 3. Danfoss

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 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.
 2. Both driven motor manufacturer and drive manufacturer shall have published lists showing compatibility with each other's equipment.
- 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; 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.
- 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 10 performance.
 4. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
 5. Loss-of-phase protection.
 6. Reverse-phase protection.
 7. Short-circuit protection.
 8. Motor overtemperature fault.
- H. 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.
- I. 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.
- J. 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.
- K. 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.
- L. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual speed control potentiometer and elapsed time meter.
- M. 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).

N. 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. 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. Category 5e or 6e connections
 - 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.

O. Communications:

1. Provide a Bacnet MS/TP interface allowing VFC to be used with an external system within a multidrop LAN configuration. Interface shall allow all parameter settings of VFC to be programmed via BAS control. Provide capability for VFC to retain these settings within the nonvolatile memory.
2. Provide a complete list of all alarms, both trouble and shutdown / failure, available for output and display.
3. Remote Monitoring:
 - a. Provide single point of connection passing all monitored parameters and trend data using BACnet MS/TP. Equipment manufacturer shall provide all necessary gateways and network switches. Network switches shall be unmanaged, industrial style and shall have at least four available ports per switchgear.

- b. Include all status, operating values, alarms, and parameters as described by this Specification.
 - c. Provide a data map of the above necessary functions to allow for third party import into a master BAS. The BAS shall also function as the Data Gathering system for electrical power monitoring, logging and trending. Coordinate with BAS Manufacturer in achieving these requirements.
 - d. Manufacturer to provide equipment with all necessary devices to facilitate integration into Building Management System. Communication devices shall be integral to equipment not field mounted.
 - e. Manufacturer to provide equipment to communicate via industry protocols BACnet MS/TP is the only acceptable protocol.
 - f. Manufacturer to submit point mapping list for approval. The point mapping information shall include but not limited to:
 - 1) Communication Protocol
 - 2) Communication Parameters: Baud Rate, Addressing, Bits, Parity
 - 3) Wiring diagrams that show terminations/wiring requirements to facilitate communications to the Building Management System.
 - 4) Contact information for technical support.
4. Manufacturer to provide on-site representation to provide point-to-point verification of integrated points into the Building Management System. Level of support to include verification of communications from equipment to the Building Management System and to ensure integrated point values are correct in both systems.

P. 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).

Q. 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.

R. Integral Disconnecting Means: NEMA AB 1, instantaneous-trip circuit breaker with lockable handle.

S. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.

2.3 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. Control Relays: Auxiliary and adjustable time-delay relays.
- D. 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).

E. 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.

F. 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.

G. Special requirements for VFC controlling Garage Exhaust Fan 'GEF-2' and Stairwell Pressurization Fans 'SPF-1', 'SPF-2', and 'SPF-3': VFC equipment supplier shall provide an analog output to control the VFC through the Fireman's Override hardwired connection to meet the Sequence of Operations shown on the Mechanical Drawings. Division 26 is responsible for hardwiring the Carbon Monoxide controls to the Fireman's Override connection on the VFC. This connection is a hardwired connection from the CO Controller panel to the VFC. This hardwired control cannot be done through the BACnet MS/TP connection. The BACnet MS/TP network connection made by Division 25 shall be used for monitoring the health and performance of the VFD only.

2.4 BACnet Interface Devices

- A. Provide BACnet Interface Devices for each VFD so that the units are presented as a series of AV and BV BACnet objects. See 25 20 26.29.23 for the list of objects that must be supported. This list is the minimum acceptable.

2.5 FACTORY FINISHES

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

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, controller, and load.
- B. Select horsepower 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 mounting surface.
- B. Comply with mounting and anchoring requirements specified in Division 26 Section "Hangers and Supports for Electrical Systems."

3.4 IDENTIFICATION

- A. Identify VFCs, components, and control wiring according to Division 26 Section "Identification for Electrical Systems."
- B. Comply with Lake County standards for unique designations for identification.

3.5 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."

3.6 INSTALLATION OF EQUIPMENT BACNET INTERFACE DEVICE

- A. See Responsibility Matrix for the execution responsibilities for Equipment Supplier, Controls and Electrical Subcontractor.
- B. Equipment Supplier is responsible for supplying and installing the BACnet Interface Device.
- C. Electrical is responsible for power and any control wiring if the device does not have a single point of connection.

3.7 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each enclosed controller 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.

3.8 ADJUSTING

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

3.9 DEMONSTRATION, TRAINING AND COMMISSIONING REQUIREMENTS.

- 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."
- B. Refer to Division 25 for BAS demonstration and training requirements.

END OF SECTION 262923