PART 1 - GENERAL

1.1 SUMMARY
A. This section includes control panel and enclosure requirements for building control systems.
B. Related Sections
   1. 25 05 53 - Identification
   2. 25 14 00 - Local Control Units
   3. 25 35 26 - Pneumatic Piping Tubing

1.2 REFERENCES
A. NEMA 1 General Purpose - for use in dry indoor locations.
B. NEMA 3R Raintight-for use in outdoor locations subjected to rainfall
C. NEMA 4 Watertight - for use in outdoor locations and where subjected to direct water spray.

1.3 DEFINITIONS
A. Field Equipment Panel – Panel for DDC controllers and related devices
B. Field Terminal Panel – Panel for instruments to be connected to multi-pair conductors going back to a Delta V controller.
C. VAC – Voltage Alternating Current
D. VDC – Voltage Direct Current
E. Wiring Duct – Pathway for wire management inside of panels.
F. Wiring Trough – Wiring enclosure used to manage wiring outside of panels.
G. Refer to 25 06 11 Integrated Automation Definitions.

1.4 SYSTEM DESCRIPTION
A. Field terminal panels shall be used to provide termination of multi-pair cables from the Delta V controller to mechanical systems. They shall contain terminal blocks, relays, I/P transducers, solenoid valves, etc., to connect the Delta V system to field instrumentation, valve and damper actuators, motor control centers, etc. The only exception to this is if the valve actuators or damper actuators are easily accessible, the associated I/P transducers or solenoid valves may be mounted on or near the actuators if a vibration free mounting surface is available. Coordinate field terminal panel locations with the FESO project representative.
B. Field equipment panels shall be used to enclose DDC controllers and related equipment such as transformers, relays and other panel mounted equipment.
C. Both panels are used for interface to:
   1. Air Handler systems
   2. Chiller systems
   3. Boiler systems
   4. Exhaust Fan systems
5. Pumping Systems
6. Monitoring systems

Note: Edit the above list for each project. Make sure each item is appropriate. If the above referenced definitions are not included in the project, consider incorporating them or delete them from the list.

1.5 SUBMITTALS

A. Submit control panel fabrication drawings including: back-panel layout, panel face arrangement, panel name, and panel tag number (if applicable) prior to fabrication or device installation.
   1. Drawings shall show operator interface configuration on panel face and device locations on back-panel. Also include panel tagging schedule or identification detailing nameplate text and size.
   2. Include panel power schematic showing power sources and protection device capacity.
   3. List manufacturer supplied devices in bill of material table.

B. Submit schematic and wiring interconnection drawings including terminal numbers.
   1. Each relay function shall be labeled to match tag name. Terminal blocks shall be uniquely numbered. Field and panel wiring shall be differentiated by solid line for panel and dashed line for field.
   2. Each connection to field device or other remote panel shall be identified per section 25 0553.

Note: Section specific submittal requirements should be defined here but not repeated from other sections.

1.6 QUALITY ASSURANCE

A. Enclosures shall be free of scratches, dents, overspray, oil, etc. at substantial completion. Thoroughly clean interior and exterior of all panels.

B. Install panels according to manufacturer's instructions.

C. Control enclosure interior temperature to manufactures specification where required to protect electronics.

D. Mount controllers and devices to back panel. Do not place on enclosure sides.

E. Locate panels adjacent to equipment served with minimum of 3 ft clearance in front of door. Provide sufficient clearances to allow full door swing and full access to internal components. Remote mounted panels are acceptable where accessibility will be significantly improved.

Note: Section specific quality requirements should be defined here but not repeated from other sections.

PART 2 - PRODUCTS

2.1 ENCLOSURES

A. Manufacturer: Hoffman, Hammond Manufacturing, Cooper B-Line or approved equal.

B. Construction:
   1. Minimum14 gauge steel
   2. Hinged door
   3. Include inner removable mounting panel
   4. Include print pockets on enclosure doors

2.2 WIRING DUCT:

A. Manufacturers: Panduit, or approved alternate.
B. Construction:
   1. Slotted plastic or vinyl (PVC)
   2. Grey or white
   3. Snap-on covers.

2.3 WIRING TROUGH
A. Manufacturer: Hoffman, Hammond Manufacturing, Cooper B-Line or approved equal.
B. Construction:
   1. Minimum 14 gauge steel.
   2. Screw-on cover is acceptable.

2.4 TERMINAL BLOCKS
A. Manufacturer: Entrelec series 5000, M, 4/6 mounted on DIN rail or approved equal
B. Color: Alternating (blue (signal positive)-125.116.01, gray (common ground)-115.116.07, green (shield)-105.001.27) per wire pair. Red (power positive) as needed.

2.5 AC POWER SUPPLIES
A. Transformers for use with digital controllers, actuators, etc.
   1. Input Power: 120 VAC
   2. Output Power: 24 VAC
   3. Minimum capacity 40 VA

PART 3 - EXECUTION
3.1 ENCLOSURES
A. Install enclosures per manufactures recommendations.
B. Provide NEMA type 1 enclosures for dry indoor locations.
C. Provide NEMA type 3R or 4 control panel enclosures in outdoor locations or indoor locations (including maintenance spaces) where water damage is possible.
D. Label enclosures with respective unique ID numbers in accordance with section 25 0553.
E. Mount local control panels at convenient locations adjacent to and independent of equipment served. Install control panels in locations as shown on drawings and with proper clearance.
F. Mount cooling devices (if applicable) on enclosure sides.
G. Mount top of panels between 5 and 6 ft above floor. Mount panels at consistent height.
H. Place equipment panel as-built drawings on door or in sleeve for each panel.
I. Instrument mounting:
   1. Ensure connections can be easily made and ample room exists for servicing each item. Every component in and on enclosures shall be able to be removed individually without affecting other components and without the need to move other components.
   2. Install devices prior to terminating wire or tubing.
   3. Do not install instruments on interior panel sides, except for cooling devices, unless specifically required.
   4. Provide gaskets for instruments penetrating panel exterior and seal in accordance with NEMA standards. Entire enclosure shall meet NEMA standard after installation of required devices.
5. Space controllers according to manufacturer's requirements. Ensure adequate space is allowed for device heat dissipation and maintenance.

J. Knockouts:
1. Distortion of panels is not permitted as a result of machining cutouts or mounting instruments and devices.
2. Cutouts shall be smooth and without irregularity from desired shape.
3. Flame cutting or arc-cutting is not permitted.
4. Align knockouts, sub-panels, and drilling for mounting to keep devices grouped and in vertical and horizontal alignment.
5. Provide rubber grommets in cutouts for wiring or tubing to prevent chaffing or scarring of insulation or jacketing of wiring or tubing.

K. Wiring:
1. To comply with NEC all voltages above 50 volts shall be guarded.
2. Provide flexible sleeves for protection of each wire bundle that passes across door hinge. Allow sufficient slack in wiring bundles so that door can fully open. Provide separate bundles for ac & dc wiring crossing door hinges separated by > 6".
3. Install wire and cabling so that any item may be removed without interrupting circuit power or other terminations.
4. Identify power circuit. Refer to 25 0553.
5. Install wiring along vertical or horizontal runs in wire duct. Angled runs are not allowed.
6. Provide copper grounding as recommended by manufacture.
7. Route wiring parallel and at right angles within panels.
8. Neatly land and terminate stranded conductors in terminal blocks. Do not remove strands of stranded wire out to make wiring fit terminal.
9. Fuses or circuit breakers shall be readily accessible and easily identified. Properly label each fuse or circuit breaker. Install circuit breakers and fuses in clear space as required by NEC.
10. Connect controller network cabling in accordance with manufacturer's connection practices and as shown on drawings.
11. Maintain separation of DC and communication signals from 120V AC terminal strips, wire, cable, and devices by 6" minimum space.

L. Pneumatic Tubing
1. Do not splice tubing within panel. Use bulkhead bars for circuit extensions.
2. Mount tubing so that tubing run(s) do not interfere with removal of components.
3. Terminate interior pneumatic components to bulkhead bars. Terminate incoming tubing to these bulkheads.
4. Install tubing along vertical or horizontal runs to present neat appearance. Angled runs are not allowed.
5. Label pneumatic tubing.

3.2 WIRING DUCT

A. Install wiring duct along vertical or horizontal runs to present neat appearance.
B. Permanently fasten wire duct into panels using screws.
C. Provide space to allow room for wire labels & removal of wire.
D. Install wiring between devices and terminal blocks in wiring duct except for connections to terminals.
E. Wiring duct fill shall not exceed 40% of wiring duct volume.
3.3 WIRING TROUGH
A. Provide wiring trough above the panel as needed to manage cable entrance to the panel.
B. Route wiring through wire trough to minimize wire tension and allow re-routing of wire when necessary.
C. Only wires of 50V or less allowed in trough unless separated by metal barrier.

3.4 TERMINAL BLOCKS
A. Terminate signal positive to blue, common ground to grey, shield to green, power positive to red as needed.
B. Shield drain wires shall only be grounded at controller. Do not ground drain wires at remote field terminal panels.
C. All multi-pair cable wire pairs, including spares, shall be landed in sequential order.
   1. Connect no more than 1 conductor under each terminal screw, use terminal block jumpers as needed

3.5 AC POWER WIRING
A. Bring 120VAC power into sides or bottom to maintain separation of wiring over and under 50V.
B. Terminate power wiring within 6 inches of enclosure entrance.
C. Include fused disconnect means & separate fuse for each device.
D. Identify power source panel and breaker.

END OF SECTION