

O038-13450

ADDENDUM NUMBER 3 NOTIFICATION

MARCUS CENTER FOR THE
PERFORMING ARTS
PHASE IV HVAC RENOVATIONS
Site #270, Bldg. #50
929 North Water Street
Milwaukee, WI 53202

Project Number: O038-13450

Date of Addendum Notification: February 25, 2013

PROJECT ADDENDUM NOTIFICATION

THIS IS A NOTIFICATION TO BIDDERS THAT ADDENDUM NUMBER 3 IS AVAILABLE TO BIDDERS VIA THE MILWAUKEE COUNTY WEBSITE FOR VIEWING OR DOWNLOADING AT THE FOLLOWING WEBSITE ADDRESS:

<http://county.milwaukee.gov/ConstructionBidsandR23075/Marcus-Center-for-the-Performi2.htm>

END OF NOTIFICATION

ADDENDUM NO 3.

MILWAUKEE COUNTY MARCUS CENTER for the PERFORMING ARTS
929 North Water Street
Milwaukee, WI 53202

HVAC RETROFIT –PHASE FOUR
Building #50
Site #270
Project No.: O 038-13450

Date of Addendum: February 25, 2013.

This Addendum to the Contract Documents is issued to modify, explain or correct the original documents, dated February 04, 2013, and is hereby made part of the Contract Documents. Acknowledge receipt of this Addendum in the space provided on the Bid Form, or bid may be rejected.

CHANGES TO SPECIFICATIONS:

07 72 10 - PRE-ENGINEERED ROOF ACCESSORIES

1. **ADD**; sub-paragraph 2 to paragraph 2.1A;
2. At contractor's option, local shop, manufacturer experienced with engineering, detailing, fabricating & warranting large roof hatches & roof curbs may be utilized. All pre-engineering criteria, minimum standards & materials as set forth within this specification shall comply & be enforced without exception.

23 05 00 - COMMON WORK RESULTS FOR HVAC

1. **ADD**; sub-paragraph C to paragraph 1.12;
C. Contractor is responsible for providing temporary means of cooling Uihlein Hall during construction. Utilize 75-ton air-cooled rental air conditioner (Temp-Air, Watertown, WI or others as available at contractor's option) to maintain maximum 80F space temperature in Uihlein Hall. Contractor responsible for all temporary utility services (power, ducting, etc.) and support needs to accommodate unit. Locate unit on roof of Mechanical Room 701. If contractor has alternate options for unit location, alternate location must receive approval from A/E and Owner (Milwaukee County and Marcus Center).

23 01 30 - DUCT CLEANING

1. **REVISE**; paragraph 3.02A to read as follows:
 - A. Clean ductwork and associated turning vanes/extractors/dampers, coils and associated drain pans, air handling units and associated fans/dampers, fans, plenums, diffusers/registers/grilles/louvers and terminal units described below:

Supply and Return ductwork for air handling units 3S1, 3S2, 3S3, 3S4, 3S5, and 3S6.

These air handling units serve the following areas of the Marcus Center:

- 3S1 – Uihlein Hall House
- 3S2 – Uihlein Hall House
- 3S3 – Uihlein Hall House
- 3S4 – Uihlein Hall House
- 3S5 – Uihlein Hall Stage
- 3S6 – Uihlein Hall Stage

26 05 00 - GENERAL ELECTRICAL PROVISION

1. **ADD**; section in its entirety.

26 05 02 - ELECTRICAL DEMOLITION AND ALTERATION

1. **ADD**; section in its entirety.

26 05 19 - LOW VOLTAGE WIRES, CABLES AND CONNECTIONS

1. **ADD**; section in its entirety.

26 05 19.4 - MOTOR WIRING

1. **ADD**; section in its entirety.

26 05 33 – CONDUITS

1. **ADD**; section in its entirety.

26 05 33.1 - ELECTRICAL BOXES

1. **ADD**; section in its entirety.

26 27 02 - EQUIPMENT CONNECTIONS

1. **ADD**; section in its entirety.

26 27 28 - MOTOR AND CIRCUIT DISCONNECTS

1. **ADD**; section in its entirety.

28 31 00 - MULTIPLEXED ADDRESSIBLE FIRE ALARM SYSTEM

1. **ADD**; section in its entirety.

CHANGES TO DRAWINGS:

ARCHITECTURAL

Sheet A100, New work plan detail #2,

1. **DELETE**; (1) Concrete pad located on column line J, between grid lines 20.1 & 21.1

Sheet A150, RCP plan detail #1,

1. **REVISE**; New work key note # 7 on plan to demo work key note#7. Add the same demo note to the south roof hatch opening. (Demo note # 7 refers to existing roof purlin

to be removed & replaced at the end of construction. Purlin 1 hr fireproofed will need to be completely returned at the end of construction).

Sheet A200, New work plan detail #5.

1. **DELETE;** 8" min dimension from detail
2. **REVISE;** Detail scale from 1 ½" = 1' to N.T.S.

STRUCTURAL

Sheet S100, Partial Roof Framing Plan – Mechanical Room 701

1. **ADD;** sheet in its entirety. Full size version of this drawing is not issued as part of this addendum. The scope of work on this sheet is as shown on attached supplementary drawings ADS-1 (partial plan) and ADS-2 (detail).

MECHANICAL

Sheet M100, Mechanical Room 701 - New Work plan #2.

1. **REVISE;** fan and ductwork associated with fan TX-4 as shown on attached supplementary drawing ADM-1.
2. **ADD;** note to maintain NEC required clearance in front of existing motor control center as shown on attached supplementary drawing ADM-2.

Sheet M400, Schedules.

1. **REVISE;** air handling unit schedule for service locations, total and external static pressures, and revised Note 3 as shown on attached supplementary drawing ADM-3.
2. **REVISE;** fan schedule for airflow on tag AHU-2S5 & 3E6 and total static pressures as shown on attached supplementary drawing ADM-3.
3. **REVISE;** data listed on sound power level data schedule for ducted inlet of Toilet Exhaust Fan TX-4 as shown on attached supplementary drawing ADM-3.
4. **ADD;** motor schedule as shown on attached supplementary drawing ADM-4.

End of Addendum No. 3

**SECTION 26 05 00
GENERAL ELECTRICAL PROVISION****PART 1 - GENERAL****1.01 RELATED REQUIREMENTS**

- A. Applicable provisions of Division 00 and Division 01 shall govern Work under this Section.

1.02 WORK INCLUDED IN THE ELECTRICAL CONTRACT

- A. The mention of an Article, operation or method requires that the Contractor shall provide same and perform each operation in accordance with the conditions stated. The Contractor shall provide material, labor, equipment and transportation to complete the project in compliance with the Contract Documents.
- B. Work shall be installed in accordance with State and Local Inspection Authorities having jurisdiction together with the recommendations of the manufacturer whose equipment is to be supplied and installed under this Contract.
- C. Before submitting a bid, each bidder shall examine the drawings relating to their work and shall become informed as to the extent and character of the work required and its relation to other work in the building.
- D. The Contractor, in conjunction with the Architect's representative, shall establish exact locations of materials and equipment to be installed. Consideration shall be given to construction features, equipment of other trades and requirements of the equipment proper.
- E. Materials shall be suitably stored and protected prior to installation and work shall be protected after installation, during construction and prior to acceptance.
- F. The Contractor shall furnish scaffolding, rigging, hoisting and services necessary for delivery, erection and installation of equipment and apparatus required to be installed by the Contractor. This equipment shall be removed by the Contractor upon completion of the project.
- G. Refer to General Requirement for temporary electrical service.

1.03 DEFINITIONS

- A. The Owner. The individual who the Owner selects as the project representative.
- B. The Architect.
- C. The Engineer. Arnold & O'Sheridan, Inc., Consulting Engineers, Inc., Brookfield, Wisconsin.
- D. Provide. Furnish, install and wire ready for service.
- E. Exposed. Exposed to view in room, corridor or stairway.
- F. Code. National, State and Local Electrical codes including OSHA requirements.
- G. Substitution. Manufacturer or method other than those listed by name in these specifications, on the drawings, or in an addendum.

- H. Signal voltage. NEC class 1, 2, or 3 remote control, signaling, or power limited circuits.
- I. Low voltage. 50 to 600 volts.
- J. Medium voltage. 601 to 35,000 volts.
- K. High voltage. 35,001 volts and greater.
- L. Electrical ductbank. Assembly consisting of electrical conduits encased in concrete.

1.04 ABBREVIATIONS

- A. A/E: Architect or Engineer
- B. ENGR: Engineer
- C. NEC: National Electrical Code
- D. NEMA: National Electrical Manufacturer's Association
- E. NFPA: National Fire Protection Association
- F. OSHA: Occupational Safety and Health Administration
- G. UL: Underwriter's Laboratories
- H. NECA: National Electrical Contractors Standards of Installation.
- I. ANSI: American Society for testing Materials.
- J. IEEE: Institute of Electrical and Electronic Engineers.
- K. ASTM: American Society for testing Materials.
- L. IPCEA: Insulated Power Cable Engineers Association.
- M. FM: Factory Mutual.
- N. ETL: Electrical Testing Laboratories.
- O. FIA: Factory Insurance Association.

1.05 PERMITS AND LICENSES

- A. The Contractor shall prepare and submit applications and working drawings to authorities having jurisdiction over the project. Licenses and permits required shall be secured and paid for by the Contractor. This includes required submittals for the fire alarm system.

1.06 STANDARDS AND CODES

- A. Work shall be installed in accordance with National, State, and Local codes, ordinances, laws, and regulations. Comply with applicable OSHA regulations.
- B. Materials shall have a UL or ETL label where a UL or ETL Standard or test exists.

1.07 DIMENSIONS AND DEFINITE LOCATIONS

- A. The drawings depicting electric work are diagrammatic and show, in their approximate location, symbols representing electrical equipment and devices. The exact location of equipment and devices shall be established in the field in accordance with instructions from the Architect as established by manufacturer's installation drawings and details.
- B. The Contractor shall refer to shop drawings and submittal drawings for equipment requiring electrical connections to verify rough-in and connection locations.
- C. Unless specifically stated to the contrary, no measurement of an electric drawing derived by scaling shall be used as a dimension to work by. Dimensions noted on the electric drawings are subject to measurements of adjacent and previously completed work. Measurements shall be performed prior to the actual installation of equipment.

1.08 DRAWINGS

- A. The Contractor shall keep a detailed up-to-date record, of the manner and location in which installations are actually made, indexing each feeder, pull box and protective device. Upon completion of the project, the contractor shall modify the project electronic drawing and specification files to incorporate this information. Modified documents shall be turned over to the Owner in both electronic and hard paper copy formats. Record drawings shall also include:
 - 1. Field changes of dimension or detail.
 - 2. Changes made by field order or change order.
 - 3. Details not on original contract drawings.
 - 4. Changes to circuit numbers.
 - 5. Junction box locations and conduit runs, with trade sizes indicated, for lighting, power, and electrical systems installed.
- B. As Built Drawings - See General Requirements - Division 1.
- C. In the event of a conflict between the drawings and specifications, this Contractor shall base their bid on the greater quantity, cost or quality of the item in question, unless conflict is resolved by an addendum.

1.09 MATERIALS AND EQUIPMENT

- A. Materials and equipment required shall be new.
- B. Equipment supplied shall be based on materials and equipment of manufacturers specified. No substitutions are allowed except as permitted in this specification.
- C. Items specified shall be the latest type or model produced by the manufacturer specified. If descriptive specification or model number is obsolete, substitute the current product.

1.10 SUBSTITUTIONS

- A. Substitutions shall not be allowed. Where the Contractor wishes to use equipment or methods other than those listed by name, that equipment must be approved by the Engineer. To gain approval for equipment not listed, the Contractor shall submit the following to the Engineer for his review:
 - 1. Documentation from the equipment manufacturer indicating where this equipment meets and does not meet the specifications or drawings as written. This documentation shall state exceptions taken to the specification and the reasons for exceptions. Documentation relative to the

- request shall be submitted on the manufacturer's letterhead and signed by a representative of the manufacturer.
2. **Manufacturer's Cut Sheets:** Cut sheets shall be originals as are contained in the manufacturer's catalog. Photocopies of these sheets will not be accepted for review. (Furnish 3 copies.)
- B. The Contractor shall provide samples of the proposed equipment for the Engineer's review, if requested by the Engineer.
 - C. The Contractor shall furnish other information or materials as requested by the Architect/ Engineer to establish equality.
 - D. The Contractor shall acknowledge that they have reviewed the submission criteria for the request by stamping the submission with a review stamp or acknowledgement by an accompanying letter.
 - E. Equipment and materials submitted for review without proper documentation shall be rejected without review.
 - F. Submittal, including samples, shall be received in the Engineer's office 10 business days prior to bidding.
 - G. Materials, equipment, or methods of installation other than those named, shall be in accordance with the general requirements and similar in composition, dimension, construction, capacity, finish and performance.
 - H. Contractors submitting equipment for approval shall include in their bids incidental costs that may result from the use of equipment. Costs shall include, but not be limited to, additional costs that may be incurred by other contractors whose scope of work is affected by use of the product. The Electrical Contractor shall be responsible for those costs even if they do not become evident until after bidding.

1.11 SHOP DRAWINGS AND EQUIPMENT BROCHURES

- A. Submit to Engineer for review, the manufacturer's shop drawings and equipment brochures in quantities determined by the Architect for the following:
 1. 26 27 28 - Motor and Circuit Disconnects
- B. Shop drawings shall be submitted in advance of construction and installation so as to not cause delay in other Contractor's work.
- C. Data submitted for Engineer's review shall be numbered consecutively, shall be noted to correlate with the electrical drawings and shall bear:
 1. The name and location of the project.
 2. The name of the Contractor.
 3. The date of submittal.
 4. The date of the drawings and the date of each correction and revision.
 5. If more than one type of lighting fixture (or other material) is on a submitted sheet, the proposed equipment shall be conspicuously checked with red pen by the Electrical Contractor.
- D. Shop drawings for different systems and equipment bound separately by specification section and not bound by manufacturer. Submittals which contain different specification section systems bound together shall be returned unreviewed for resubmittal.

- E. The Contractor shall examine shop drawings and equipment brochures prior to submission. The Contractor shall verify that the materials and equipment depicted properly fit into the construction. The Contractor shall also review previously completed work related to the installation of the equipment depicted to insure that it has been properly installed.
- F. No materials or equipment subject to prior review by the Engineer shall be fabricated or installed by the Contractor, without approval. The Engineer's review of shop drawings shall not relieve the Contractor of responsibility for deviations from the requirements of the drawings and specifications, unless prior approval for deviations has been granted.

1.12 MAINTENANCE MANUALS

- A. The Electrical Contractor shall assemble and submit to the Architect for subsequent submission to the Owner, three sets of a Manual of Operation and Maintenance for each of the electrical and communications systems.
- B. Each manual shall consist of a loose leaf bound volume instructing the Owner's personnel in the use, operation and maintenance of the system in question. The manual shall cover phases of operation of the equipment and shall be illustrated with photographs, drawings, and wiring diagrams. Manuals shall accurately describe the operation, construction and adjustable features of the system and its component parts. The manual shall include an equipment parts listing to facilitate the ordering of spare and replacement parts.
- C. If it is desired to provide maintenance manuals in PDF format, the contractor shall provide a written request prior to submitting the manuals indicating which equipment manuals they propose to provide in this format.
- D. Each manual shall contain two sets of shop drawings depicting equipment as installed.

1.13 CLEANING AND PAINTING

- A. Rubbish resulting from this work shall be removed and disposed of on a daily basis in manner as to be acceptable to the Architect.
- B. The Contractor shall clean exposed iron work, the interior and exterior of cabinets and pull boxes, etc., and remove rubbish and debris resulting from the work.
- C. Where painted surfaces of equipment have been damaged or rusted during construction, the Contractor shall repair and paint to match original finish.
- D. Clean other equipment indicated in other sections of the specification for specific equipment.

1.14 TESTS AND ACCEPTANCE

- A. The operation of the equipment and electrical systems does not constitute an acceptance of the work. The acceptance is to be made after the Contractor has adjusted his equipment and demonstrated that it fulfills the requirements of the drawings and the specifications.
- B. After the work is completed and prior to acceptance, the Contractor shall conduct the following tests, tabulate data, date, sign and submit to the Engineer:
 - 1. Standard megger insulation test on each feeder.
 - 2. Ground resistance test.

3. Clamp ammeter test on each feeder conductor with utilization equipment energized. The load current in each phase conductor of the feeder or the portion thereof supplying the panel shall not differ from the average connected load currents in the feeder conductors by more than 7½%. If the load current does differ by more than 7½%, the Contractor shall change phase loading to same or receive written approval from the Engineer that this is not required due to the nature of the load.
- C. Upon completion of the installation, the Contractor shall furnish certificates of approval from authorities having jurisdiction. The Contractor shall demonstrate that work is in perfect operating condition, with raceway and conduit system properly grounded, wiring free from grounds, shorts, and that the entire installation is free from physical defects.
- D. In the presence of the Engineer and the Owner, the Contractor shall demonstrate the proper operation of miscellaneous systems.
- E. Perform other test as specifically stated in other sections of the specification for specific equipment.

1.15 WARRANTY

- A. See General Conditions.

1.16 IDENTIFICATION

- A. Junction and pullboxes smaller than 12" X 12" shall be identified by using a permanent marker on the coverplate indicating originating panelboard, voltage and circuit(s) or system served.
- B. Junction and pull boxes with dimensions 12" X 12" and larger shall be stenciled or provided with permanent labels as follows:
 1. Lighting and Power Feeders and Branch Circuits - 120, 208, 277, 480. Add "EM" for emergency circuits, ex. 120EM
 2. Fire Alarm - FA
- C. Branch wiring shall be color coded per industry standards. Where wires of different systems junction in a common box each cable shall be grouped with its own system and identified using tags or identification strips.
- D. On 3-phase systems, each phase shall be identified at terminals using code markers.
- E. Refer to individual specification sections for more specific or additional identification requirements.

1.17 SPARE PARTS

- A. Requirements for spare parts are outlines in individual specification sections. Spare parts shall be turned over, unopened, to the Owner as part of the maintenance manual submittal.

1.18 PREBID SURVEY

- A. Before submitting his bid the Contractor shall tour the job site to review the following:
 1. The exact configuration of areas requiring demolition, temporary power, relocating, etc.
 2. Site conditions for material storage, staging areas, parking, etc.
 3. Problems with work sequence.

- B. Conditions found that are not shown on the documents but that may affect the scope of the work shall be reported to the Engineer.

PART 2 - PRODUCTS

2.01 FIRESTOPPING

- A. Fire stopping materials shall include, but not be limited to, mortars, sealants and caulks, putties, collars, intumescent wrap strips mastics, and firestop pillows. Materials and methods used shall be recognized by an independent testing agency and shall have flame and temperature ratings assigned by that agency.
- B. Materials using solvents or those requiring hazardous waste disposal shall not be used.
- C. The firestop assemblies shall meet fire test and hose stream test requirements of an independent testing agency.
- D. Acceptable manufacturers.
 - 1. 3M Corporation or equivalent.

PART 3 - EXECUTION

3.01 FIRESTOPPING

- A. Openings in fire rated construction and annular spaces around conduits, cable trays, and other penetrating items shall be protected in accordance with NEC article 300-21 and in accordance with the Wisconsin Administrative Code, Department of Commerce Chapter 51.049. The fire rating of the protective seal shall be at least that of the floor or wall into which it is installed, so that the original fire rating of the construction is maintained.
- B. Wall or floor penetrations openings shall be as small as possible.
- C. Openings and annular spaces required by code to be protected shall be protected whether specifically indicated on the plans or not.
- D. Installation of materials and assemblies shall be in strict accordance with the manufacturer's instructions.

END OF SECTION

**SECTION 26 05 02
ELECTRICAL DEMOLITION AND ALTERATION****PART 1 - GENERAL****1.01 RELATED REQUIREMENTS**

- A. Applicable requirements of Division 0 and Division 1 shall govern work in this section.

1.02 JOB CONDITIONS

- A. The existing buildings shall remain in service during construction. Power outages and interruptions in building systems shall be held to a minimum and shall be done at a time convenient to the Owner. The time of outages shall be scheduled with the Owner and other trades affected by the outage at least ten working days in advance. Demolition work shall be scheduled at periods and times acceptable to the Owner.
- B. Prior to demolition or alteration of structures, the following shall be accomplished:
1. Owner release of structure.
 2. Disconnection of electrical power to equipment and circuits removed or affected by demolition work.
 3. Electrical services rerouted or shut off outside area of demolition.
 4. Coordinate sequencing with Owner and other Contractors.
 5. Survey and record condition of existing facilities to remain in place that may be affected by demolition operations. After demolition operations are completed, survey conditions again and restore existing facilities to their predemolition condition.
 6. Contractor shall dispose of obsolete material.
 7. Contractor shall notify Engineer of existing code violations observed during the course of performing his work. If corrective action needs to be taken that changes the scope of the work, corrective action to proceed only after approved change order.

PART 2 - PRODUCTS**2.01 NOT USED****PART 3 - EXECUTION****3.01 REMOVAL**

- A. Remove or relocate conduit, wire, boxes, fixtures, and electrical equipment that are in the way of construction.
- B. Reconnect circuits and equipment to be continued in service.
- C. Provide temporary wiring to equipment that is to remain in operation during demolition and whose power will be interrupted as a result of demolition.
- D. Remove electrical equipment released from service as a result of construction.
- E. Do not reuse removed electrical equipment except as specifically shown on the drawings.
- F. Where the plans require existing equipment to be removed or relocated, removal shall include equipment associated with the device. Associated equipment shall include but

not be limited to coverplates, backboxes, conduit, fittings, de-energized conductors. In instances where a device is removed but active conductors remain in the backbox and the box is mounted in a wall which is remaining, the backbox may remain and a blank coverplate provided. If removal of the box is specifically indicated on the plans the active conductors shall be intercepted at convenient, accessible locations and rerouted to allow existing box to be removed. When boxes are removed from existing walls which remain, it shall be the Electrical Contractor's responsibility to fill in openings and sand flush with adjacent surfaces. The General Contractor shall be responsible for finish work unless specifically indicated otherwise on the plans.

3.02 DISPOSAL

- A. Dispose of equipment that is removed unless specifically indicated on the drawings.
- B. Raceway, conductors, boxes, cabinets and supporting devices shall become the property of the Contractor and shall be removed from the site and disposed of by the Contractor.
- C. The Contractor shall tour demolition areas with the Owner to determine the status of other equipment to be removed during demolition. Equipment that is to be salvaged for reuse shall be removed by the Contractor and transported to a designated storage area on the site. The Owner shall be responsible for removal of salvaged equipment from the storage area.
- D. Contractor, at his option, may install new conductors in existing raceways provided that the raceways are in place and are properly sized and supported. Existing conduits that are removed from their existing location shall not be reinstalled.

3.03 ASBESTOS REMOVAL

- A. Work involved with asbestos removal, disposal or abatement shall not be considered as part of this project. Work in this regard shall be the responsibility of the Owner. If this Contractor shall discover the presence of asbestos material he shall cease work immediately and notify Owner architect and Engineer of condition.

3.04 ALTERATIONS

- A. The Contractor shall be responsible for work of other trades to facilitate installation of electrical work in the existing building.
- B. Work required by Electrical Contractor which is normally performed by other trades shall be done under direction and at the expense of Electrical Contractor.

END OF SECTION

SECTION 26 05 19
LOW VOLTAGE WIRES, CABLES AND CONNECTORS**PART 1 - GENERAL****1.01 RELATED REQUIREMENTS**

- A. Application requirements of Division 0 and Division 1 shall govern work under this Section.

1.02 SCOPE

- A. Provide wires, cables and connectors as specified herein.
- B. Provide branch wiring and feeder systems to serve lighting, receptacles, motors, and other equipment loads.
- C. The terms "feeders" and "branch circuits" as used in this section are as defined in NEC Article 100.

1.03 RELATED WORK

- A. Section 26 05 33 - Conduits
- B. Section 26 27 26 - Wiring Devices
- C. Section 26 05 26 - Grounding

1.04 QUALITY ASSURANCE

- A. Reference Standards of the following associations:
 - 1. National Electrical Contractor's Association (NECA) - Standard of Installation
 - 2. Insulated Cable Engineers Association (ICEA)

PART 2 - PRODUCTS**2.01 CONDUCTORS**

- A. Copper conductor only.
- B. Conductor insulation shall be rated 600 volts minimum. Insulation color for low voltage (secondary feeders and branch circuits) conductors shall vary to depict the type of conductor. Colors shall be as indicated elsewhere in this section and as required by code.
- C. Single conductor #10 AWG size and smaller for general use wiring may be stranded or solid conductors at the contractor's option, provided with type THWN insulation. Stranded conductors accessible with the use of compression (crimp) connectors. Minimum size shall be #12 AWG on 208 volt systems and #12 AWG for 480 volt systems. Conductors with dual rated insulations are approved provided one of the ratings is THWN.
- D. Single conductor #8 AWG and larger for general use wiring shall be stranded configuration with type THWN insulation. Conductors with triple rated insulations are approved provided the ratings include one of the ratings that are listed.

- E. Conductors installed in wet locations and areas with high humidity shall be type XHHW-2 or USE. Wet locations shall include, but not be limited to, conduits installed in contact with the earth and underground electrical ductbanks.
- F. Conductors shall not be installed at temperatures below the manufacturer's minimum installation temperature.
- G. Unless specifically indicated otherwise, conductor sizes indicated on the plans are based on the ampacities listed for conductors rated at 75 degrees C.
- H. All conductors, whether stranded or solid, shall be terminated using approved methods.
- I. Install 90°c conductor in high ambient temp. Mechanical room, utility rooms and exterior installation.

2.02 JOINTS, TAPS AND SPLICES

- A. CONDUCTORS NO. 10 AWG AND SMALLER
 - 1. 3M Scotch-lok compression type solderless connectors with plastic cover.
- B. JOINTS, TAPS, AND SPLICES IN CONDUCTORS NO 8 AWG AND LARGER
 - 1. Solderless compression type connectors, tool and die applied, of a type that will not loosen (Non Reversing) under vibration or normal strains. Burndy "Hy-Dent" type or equivalent.

2.03 TAGS AND LABELS

- A. BRANCH CONDUCTOR LABELS
 - 1. Sleeve type wrap around adhesive markers with factory printed circuit numbers.
- B. FEEDER CONDUCTOR LABELS
 - 1. Metal tags or flame-resistant adhesive label tags at the Contractor's option. Label shall include conductor source, voltage, and load/equipment served.

2.04 RUBBER INSULATING ELECTRICAL TAPE

- A. Scotch 3M model 23, 30 mil tape.
- B. Plymouth #2117, 30 mil tape.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's written instructions and in accordance with recognized industry practices.
- B. Run wire and cable in conduit, unless otherwise indicated on drawings.
- C. Do not draw conductors into conduits until building is enclosed and watertight and until work that may cause conductor damage has been completed.
- D. Voltage drop for branch circuits and feeder circuit combined shall not exceed requirements of NEC Article 215.

- E. Examine areas and conditions under which conductors are to be installed and notify Engineer in writing of conditions detrimental to proper and timely completion of work.
- F. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 JOINTS, TAPS AND SPLICES

- A. Each tap, joint, or splice in conductors No. 8 AWG and larger shall be taped with two half-lap layers of vinyl plastic electrical tape and a finish wrap of color coding tape, where required by code.
- B. Cable splices shall be made only in distribution and junction boxes.

3.03 WIRE AND CABLE IDENTIFICATION

A. TAGS AND LABELS

1. Install tags and or/labels on conductors and cables in junction boxes, pullboxes, wireways, wiring gutters of panels, and other accessible locations. Labels and tags shall contain information under "products" for branch circuit conductors and feeder conductors.
2. Conductor phase identification. Different conductor insulation colors and electrical tape colors shall be used to identify the different phases of conductors in a given circuit and to identify the neutral and ground conductors. Painted identification is not acceptable. Provide color identification on conductors at accessible locations. Requirements of the Code regarding conductor identification shall always be followed where applicable. In general, colors shall be as follows:
 - a. 120/208 Volt Systems Neutral Conductor - Solid White: Provide additional markings for neutral conductors in the same raceway.
 - b. 120/208 Volt Systems A-Phase, B-Phase, and C-Phase Unswitched Legs: Solid black, solid red and solid blue respectively. Different colors shall be used to identify switched legs.
 - c. 480/277 Volt Systems Neutral Conductor - Solid Gray: Provide additional markings for neutral conductors in the same raceway.
 - d. 480/277 Volt Systems A-Phase, B-Phase, and C-Phase Unswitched Legs: Solid brown, solid orange and solid yellow respectively. Different colors shall be used to identify switched legs.
 - e. Ground Conductors - Solid Green: Provide additional markings for ground conductors in the same raceway.
3. For additions to existing buildings, existing conductor color-coding schemes shall be followed unless in conflict with the codes. If no logical color-coding scheme exists, color-coding indicated above shall be followed.

3.04 BRANCH CIRCUIT CONDUCTORS

- A. Install branch circuits and switched circuits to comply with the circuiting, switching, and functions shown on the drawings.
- B. Conductors shall be size 12 AWG minimum (unless otherwise noted) for branch circuit wiring, including motor circuits.
- C. Conductor shall increase the size of branch wiring one size (i.e., from #12 AWG to #10 AWG) where the distance from the panel to the center of the load is more than 100 Feet long for 120V. circuits and 200 feet ;long for 277V. circuits.
- D. Provide individual neutral conductors for branch circuits serving isolated ground receptacles and computer equipment. (No common neutrals for these circuits.)

- E. Route branch circuits and switch legs as dictated by construction, these specifications, or instruction from Engineer.
- F. Size conduit, outlet boxes, and other raceway system components in accordance with NEC requirements as minimum.
- G. Circuit numbers as shown on drawings are for Contractor to plan his wiring and for estimating purposes and are not necessarily the exact circuit numbers to be used in that panel for that particular load. Exact circuit numbers for each load are to be selected by the Contractor at his option. Balanced load on panelboard bus is to be determining factor in arrangement of circuits. Panelboards average load shall not differ from phase to phase by $\pm 7\frac{1}{2}\%$.

3.05 MOTOR AND EQUIPMENT BRANCH WIRING

- A. Furnish and install motor circuits in accordance with schedules on drawings and code requirements, from source of supply to associated motor starter, and from starter to motor terminal box, including necessary and required intermediate connections.
- B. Conductor and conduit size for motor branch circuits if shown on drawings are sized for motor requirement only. Control wiring is not included in conduit sizes shown on the drawings.
- C. Motors shall have proper conductor sizes in accordance with NEC requirements and nameplate ratings. Contractor is responsible for verification of ratings of motors and installing proper branch circuits.
- D. Obtain manufacturer's wiring diagrams and shop drawings for equipment requiring electrical connections.
- E. Check drawings and specifications of other divisions of work for equipment and work which shall be included.
- F. Motor connections shall be made by compression type connectors using proper tools and fittings.

END OF SECTION

**SECTION 26 05 19.4
MOTOR WIRING****PART 1 - GENERAL****1.01 RELATED REQUIREMENTS**

- A. Applicable provisions of Division 0 and Division 1 shall govern work in this Section.

1.02 SCOPE

- A. Provide connections and wiring to motors as shown on the drawings and in other divisions of the specifications and as specified herein.

1.03 RELATED WORK AND REQUIREMENTS

- A. Section 26 05 19 - Low Voltage Wires, Cables and Connectors

PART 2 - PRODUCTS**2.01 NOT USED.****PART 3 - EXECUTION****3.01 GENERAL**

- A. Motor starters shall be furnished by the Contractor supplying the motor requiring a starter.
- B. This Contractor shall check the drawings and specifications of the other trades to determine the requirements for motor disconnect switches. In each case, the Contractor shall install required disconnect switches. The Electrical Contractor shall provide code required disconnect switches not specifically supplied by others.
- C. Unless otherwise indicated on the drawings or elsewhere in these specifications, motors shall be furnished by others.
- D. Motors shall be set in place and the associated motor starters and controllers shall be turned over to the Electrical Contractor for installation.
- E. Contractor supplying starters and controllers shall index same and provide the Electrical Contractor with written instructions as to proper location in time to permit the installation of a concealed raceway system.
- F. Control wiring, regardless of voltage, shall be the responsibility of the Contractor providing the motor. The Electrical Contractor shall extend the 120 volt circuit to the control transformers and make 120 volt transformer connections. Control transformers shall be supplied by HVAC Contractor. Location of control transformers shall be in close proximity of the heating equipment.
- G. Review the HVAC specifications and provide line voltage wiring and connections to controls and auxiliary equipment specified as to be provided by the Electrical Contractor or Division 26.

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END OF SECTION

**SECTION 26 05 33
CONDUITS****PART 1 - GENERAL****1.01 RELATED REQUIREMENTS**

- A. Drawings and General Provisions of Contract, General and Supplementary Conditions, and Division 1 Specifications, apply to this Section

1.02 SCOPE

- A. Provide conduit systems for power wiring and communications systems as specified. Flexible, modular-wiring systems shall not be used.

1.03 RELATED WORK AND REQUIREMENTS

- A. Section 26 05 19 - Low Voltage Wires, Cables and Connectors
- B. Section 26 05 26 - Grounding

1.04 QUALITY ASSURANCE

- A. National Electrical Contractor's Association (NECA) Standard of Installation.
- B. National Electrical Code (NEC) including local supplements.

PART 2 - PRODUCTS**2.01 CONDUIT FITTINGS - GENERAL**

- A. Fittings for metal raceways shall be steel, and shall be zinc galvanized or cadmium plated.
- B. Fittings for PVC raceways shall be of the type recommended by the raceway manufacturer.
- C. Do not use aluminum or die cast fittings.
- D. Do not use malleable iron.
- E. Do not use running threads.
- F. Do not use indentor type fittings.
- G. Box connector bushings shall have insulated throats. Integral grounding lugs shall be provided where required by code or detailed on the drawings and elsewhere in the specifications.
- H. Termination bushings for conduits that terminate in free air, as at cable trays, communications backboards, in electrical vaults, and in electrical manholes.
- I. For conduits carrying conductors rated 50 volts and below and where no ground connection is required. Termination bushings may be push-on, non-metallic, insulating type as manufactured by Arlington Industries, Inc. Equivalent products by other manufacturers are acceptable.

- J. For conduits carrying conductors rated 50 volts and below where a ground connection is required provide termination bushings with insulated throats and integral grounding lugs.
- K. For conduits carrying conductors rated 51 volts and above. Termination bushings shall have insulated throats. Integral grounding lug shall be provided where required by code or required on the drawings and elsewhere in the specifications.

2.02 GALVANIZED RIGID CONDUIT (GRC) AND INTERMEDIATE METAL CONDUIT (IMC)

- A. Manufactured lengths, heavy wall, rigid steel conduit, protected inside and out by hot-dipped galvanized or electro-galvanized coating.
- B. Minimum conduit size shall be ½ inch.
- C. Connectors and couplings.
 - 1. Threaded.
 - 2. Liquid tight.

2.03 ELECTRICAL METALLIC TUBING (EMT)

- A. Standard lengths and size.
- B. Minimum conduit size shall be ½ inch.
- C. Connectors and couplings. Compression type. With steel bodies and steel nuts. (Cast fittings NOT acceptable).

2.04 PVC COATED RIGID METAL CONDUIT

- A. Galvanized rigid conduit with external coating of 40 mil (0.1 mm) thick polyvinyl chloride. Conduit must be hot dipped galvanized inside and out including threads. The PVC coating bond to the galvanized steel conduit shall be stronger than the tensile strength of the coating itself.
- B. Fittings and Conduit Bodies: Threaded type, material to match conduit. PVC coated fittings and couplings shall have specially formed sleeves to tightly seal to conduit PVC coating. The sleeves shall extend beyond the fitting or coupling a distance equal to the pipe outside steel diameter or two inches (50 mm) whichever is greater.

2.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Galvanized spiral strip flexible steel.
- B. Standard conduit sizes.
- C. Heavy wall, sunlight resistant, PVC jacket.
- D. Minimum size ½ inch.
- E. Connectors and couplings.
 - 1. Liquid tight.
 - 2. Grounding type.
 - 3. Suitable for wet locations.
 - 4. Tapered threaded hub.
 - 5. Non-metallic materials.

2.06 FLEXIBLE METAL CONDUIT

- A. Galvanized spiral strip flexible steel.
- B. Standard conduit sizes.
- C. Minimum size ½ inch with the exception that 3/8 inch diameter may be used to serve individual lighting fixtures installed in a suspended accessible ceiling system.
- D. Connectors and couplings.
 - 1. Threaded.
 - 2. Grounding type.
 - 3. Insulated throat.
 - 4. Two screw clamp type with locknuts.
 - 5. Externally Secured.

2.07 EXPANSION FITTINGS

- A. Copper bonding jumper, Crouse-Hinds Type XJ.

2.08 EXPANSION/DEFLECTION FITTINGS

- A. Copper bonding jumper, Crouse-Hinds Type XD.

2.09 CONDUIT BODIES

- A. Galvanized or cadmium plated.
- B. Threaded hubs.
- C. Removable cover, with gasket.
- D. Corrosion-resistant screws.

2.10 SEALS

- A. Link Seal type as manufactured by Thunderline Corporation.

PART 3 - EXECUTION**3.01 GENERAL**

- A. Requirements.
 - 1. Seal conduits that run through different temperature or atmospheric conditions to prevent condensation or moisture from entering electrical equipment and devices.
 - 2. Install wall entrance seal where conduits or direct burial conductors pass through foundation walls below grade.
 - 3. Install conduit expansion fittings with bonding jumper in following locations:
 - a. Conduit runs which cross a structural expansion joint.
 - b. Conduit runs where movement perpendicular to axis of conduit may be encountered.
 - 4. Locate junction boxes, conduit bodies, and other access covers so as to be accessible to electrical wiring.
 - 5. Cut joints shall be square, reamed smooth, and drawn up tight.
 - 6. Keep conduit plugged, clean, and dry during construction. Before wire pulling begins, pull cleaning plug through conduits to clear of dirt, oil, moisture, and other debris.

7. Install #12 AWG pull wire in empty conduit.
8. Cap spare conduits.
9. Route conduit runs above suspended acoustical ceilings so as not to interfere with ceiling tile removal.
10. Route conduits (including conduits routed above ceilings) parallel to or at right angles with lines of the building construction and structural members except conduit runs routed concealed in poured-in-place concrete floor slabs may be run in a direct line from source to load.
11. Make bends and offsets without kinking or destroying smooth bore of conduit. Arrange bends and offsets in parallel conduits to present a neat symmetrical appearance.
12. Conduit runs that extend through areas of different temperature or atmospheric conditions shall be sealed, drained, and installed in a manner that prevents drainage of condensed or entrapped moisture into cabinets, and equipment enclosures.
13. Conduits shall be routed at least 12" from parallel to steam lines, hot water pipes, flues, or high temperature piping or ducts shall not be closer than 12 inches and not be closer than 12 inches clear when crossing same.
14. Conduit shall not be routed over boiler, incinerator, or other high temperature equipment.
15. Where conduits must cross or follow the same path as water, steam or other fluid piping, electrical conduits shall be installed above, not below, piping.
16. Install bushings with ground lugs and integral plastic linings at equipment with open-bottom conduit entrances.
17. Feeder conduits shall contain only those conductors constituting a single feeder circuit.
18. Feeder conduits shall follow most accessible routes, concealed in construction in finished areas, exposed to the minimum temperature gradient and to minimum temperature fluctuation.
19. Feeder conduits shall not be routed in conduit floor slabs.
- 20.
21. Confine feeder conduit to insulated portions of building, unless otherwise specified.
22. Trapped feeder conduit runs without facilities for continuous drainage are not acceptable.

3.02 CONDUIT LOCATION REQUIREMENTS

- A. Interior conduits for wiring systems rated 50 to 600 volts shall be electrical metallic tubing (EMT). Exceptions to the requirements stated above are as follows:
 1. Conduits in poured concrete construction shall be IMC or GRC regardless of size.
 2. Flexible conduit where required by other paragraphs in this section.
 3. Unless otherwise restricted by codes.
 4. Conduits installed in hazardous locations shall be GRC. See floor plans for hazardous locations.
 5. Conduits in corrosive locations shall be PVC coated GRC. See floor plans for corrosive locations.
 6. Conduits in wet locations shall be IMC or GRC. See floor plans for areas to be treated as wet location.
- B. Interior conduits for wiring systems rated 0 to 50 volts shall be electrical metallic tubing (EMT). Exceptions to the requirements stated above are as follows:
 1. Conduits in poured concrete construction shall be IMC or GRC regardless of size.
 2. Flexible conduit where required by other paragraphs of this section.
 3. Unless otherwise restricted by codes.

4. Conduits installed in hazardous locations shall be GRC. See floor plans for hazardous locations.
 5. Conduits in corrosive locations shall be PVC coated GRC. See floor plans for corrosive locations.
 6. Conduits in security locations shall be IMC or GRC. See floor plans for security locations.
 7. Conduits in wet locations shall be IMC or GRC. See floor plans for areas to be treated as wet location.
- C. Conduit connections at motors and other equipment that vibrates:
1. Flexible metal conduit between 18 inches and 3 feet long for conduit connections at equipment that vibrates.
 2. Liquid-tight flexible metal conduit where flexible connections are required and where conduit is exposed to moisture, dirt, fumes, oil, corrosive atmosphere. Locate so it is least subject to physical abuse. Corrosive areas are identified on the floor plans.
 3. Use double locknuts and insulated bushings with threads fully engaged.
- D. Install conduct expansion fittings for all conduits crossing expansion joists.

3.03 FLEXIBLE CONDUITS

- A. Install fittings designed for use with flexible liquid-tight conduit to ensure continuity of ground throughout the fittings and conduit and prevent entrance of moisture.

3.04 CONCEALMENT

- A. Unless specifically noted otherwise, conduits shall be routed concealed in finished spaces and shall not be visible at any point within the finished space or from the building's exterior. This requirement also applies to new conduits installed in existing construction.
- B. Exposed raceway may be used on remodeling projects only where physically impossible to route concealed in existing construction. In cases where exposed conduit is allowed it shall be equivalent to Wiremold 500 or 700 series as dictated by the wiring quantities. In each case the specific raceway type and routing shall be submitted to the Architect for approval. Where allowed, the general installation requirements are as follows:
1. Raceways shall be routed horizontally along the corners of walls and ceilings, above edges of base molding at floors, or along the tops of window and door frames.
 2. Raceways shall be routed vertically along corners of adjacent walls and along the edges of window and door frames.
 3. Raceways shall not be routed down or across open wall surfaces except in portions of runs not exceeding 12 inches in length.
 4. Raceways shall be painted to match wall finishes. EC is responsible for painting of raceways.
 5. Fittings and boxes used with raceways shall be specifically designed and approved for use with the raceways.
- C. At the contractor's option, conduits may be installed concealed below basement floor slabs or below slabs on grade.
- D. Conduits may be routed exposed in mechanical equipment rooms and utility rooms.

3.05 SUPPORTS

- A. Raceways installed concealed in the stud space of hollow, stud and drywall partitions shall be fastened to steel studs with spring steel clips. Clips shall be utilized as intended by the manufacturer and installed per the manufacturer's instructions. Conduit supports utilizing tie wires shall not be used.
- B. Interior surface mounted conduits attached to walls:
 - 1. Raceways 1 ¼" diameter and smaller. One hole support straps.
 - 2. Raceways 1 ½" diameter and larger. Two hole straps.
 - 3. Light gauge steel framing fastened to wall surface with conduits fastened to steel framing using two piece conduit clamps.
- C. Interior surface mounted conduits attached to underside of structural ceilings and roofs:
 - 1. Two hole support straps.
 - 2. Light gauge steel framing fastened to ceiling surface with conduits fastened to steel framing using two piece conduit clamps.
 - 3. Where underside of roof structure consists of steel trusses, joists, beams, etc., spring steel clips for supporting raceways will be allowed. Clips shall be utilized as intended by the manufacturer and installed per the manufacturer's instructions.
- D. Interior conduit runs suspended from the underside of structural ceilings and roofs:
 - 1. Single Conduit Runs: Threaded rod fastened to structure with conduit attached to rod utilizing steel, yoke type support.
 - 2. Multiple Conduit Runs: Horizontal light gauge steel framing suspended from structure with threaded rods, minimum two per frame, in a trapeze configuration. Conduits fastened to steel framing using two piece conduit clamps.
- E. Exterior, wall mounted, surface raceways. Cast zinc, one hole strap with back plate to stand raceway off wall surface 3/8" minimum.
- F. Provide riser clamps around conduits 1-1/4 inch or larger that are routed between floors.
- G. Conduits shall not be supported by, or attached to the suspension systems for dropped ceiling systems unless specifically detailed on the drawings.
- H. Secure conduits in place with malleable corrosion-proof alloy straps or hangers.
- I. The use of perforated strapping as a conduit hanging method is not acceptable.
- J. The use of tie wires to support conduits is not acceptable.

3.06 FIRESTOPPING

- A. Provide firestopping at conduit penetrations through fire rated construction in accordance with section 16010.

3.07 CUTTING AND PATCHING

- A. Provisions for openings, holes, and clearances through walls, floors, ceilings, and partitions shall be made in advance of construction.
- B. Provide cutting, patching and painting necessary for the installation of electrical systems.

- C. Where conduits need to penetrate concrete or masonry construction install 22 gauge galvanized steel pipe sleeves, 1 inch larger in diameter than the conduit being installed. Sleeves shall extend 2 inches above the floor slab or wall penetrated. Install sleeves before walls or slabs are poured or constructed.
- D. Provide drawings indicating size and location of anticipated floor sleeves for the installation of electrical conduits.

3.08 ADJUSTMENT AND CLEANING

- A. Restore damaged areas on PVC jacketed, rigid conduit with spray type touch-up coating compound or as recommended by manufacturer.

3.09 CONDUIT SYSTEMS

- A. Where raceway systems are required, separate raceway systems shall be provided for each wiring system as follows:
 - 1. 208 volt normal power wiring systems.
 - 2. 480 volt normal power wiring systems.

END OF SECTION

**SECTION 26 05 33.1
ELECTRICAL BOXES****PART 1 - GENERAL****1.01 RELATED REQUIREMENTS**

- A. Applicable requirements of Division 0 and Division 1 shall govern work in this section.

1.02 SCOPE

- A. Provide electrical boxes in accordance with this specification.

1.03 RELATED WORK

- A. Section 26 05 33 - Conduits
- B. Section 26 05 19 - Low Voltage Wires, Cables and Connectors
- C. Section 26 05 29 - Supporting Devices

1.04 QUALITY ASSURANCE

- A. Reference Standards of the National Electrical Contractors Association (NECA), Standard of Installation.

PART 2 - PART 2 - PRODUCTS**2.01 INTERIOR WALL OUTLET BOXES - FLUSH MOUNTED**

- A. Stamped steel, four inch square, 2-1/8" deep minimum, with square corners. Provide with raised device rings, height to match wall finish thickness. Mounting accessories. Larger width boxes shall be provided for ganging requirements indicated on plans.

2.02 INTERIOR WALL OUTLET BOXES - SURFACE MOUNTED - DRY LOCATION

- A. Stamped steel, four-inch square, 2-1/8" deep, with round corners. Provide rounded corner raised box covers with openings for devices being installed. Refer to section 16111 for restrictions on exposed conduit systems.

2.03 INTERIOR WALL OUTLET BOXES - SURFACE MOUNTED - DAMP OR WET LOCATION

- A. Cast malleable iron with threaded conduit hubs. Two inches deep minimum. Internal mounting ears. Boxes shall be coated with electroplated zinc, a dichromate coating, and an aluminum polymer enamel finish. Refer to section 16111 for restrictions on exposed conduit systems.

2.04 EXTERIOR WALL OUTLET BOXES - SURFACE MOUNTED

- A. Cast malleable iron with threaded conduit hubs. Two inches deep minimum. Internal mounting ears. Boxes shall be coated with electroplated zinc, a dichromate coating, and an aluminum polymer enamel finish. Refer to section 26 05 33 for restrictions on exposed conduit systems.

2.05 ELECTRICAL BOXES IN CORROSIVE LOCATIONS

- A. PVC coated cast steel boxes compatible with conduit system installed. Coating shall cover both interior and exterior surfaces. See floor plans for identification of corrosive areas.

2.06 SPECIAL BOXES

- A. Provide special boxes fabricated by the manufacturer of fixtures and other devices where standard outlets are not applicable.

2.07 GENERAL PURPOSE JUNCTION AND PULL BOXES

- A. Fabricate from code gauge galvanized steel, with covers held in place by corrosion resistant machine screws.
- B. Size shall conform to code requirements for number of conduits and conductors entering and leaving box.
- C. Provide with welded seams, where applicable, and equip with corrosion-resistant nuts, bolts, screws, and washers.
- D. Provide safety chain between cover and enclosure for boxes 24" or larger.
- E. Boxes to be sized per NEC 314.

2.08 WEATHERPROOF JUNCTION AND PULL BOXES

- A. Stainless steel or cadmium plated malleable iron cast type with threaded hubs, cast cover, and neoprene gasket.

2.09 BETWEEN STUD BOX SUPPORT BRACKETS

- A. Stamped and fabricated steel bracket designed to support 4" or 4-11/16" electrical boxes between wall studs.
- B. Manufactured by Erico, RBS series or equivalent.

PART 3 - EXECUTION**3.01 INSTALLATION**

- A. Install electrical boxes, in compliance with NEC requirements, in accordance with the manufacturer's written instructions and with recognized industry practices.
- B. Seal conduit at entrance to weatherproof boxes for interior and exterior locations exposed to weather or moisture.
- C. Install knockout closures to cap unused knockout holes where blanks have been removed.
- D. Locate boxes to provide access to electrical wiring. Relocate boxes rendered inaccessible by the installation of work by other trades.
- E. Secure boxes rigidly to the substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry. Do not support from conduit.
- F. Set boxes, in concealed conduit runs, flush with wall surfaces, with or without covers.

- G. Do not install boxes back to back or through wall. Offset outlet boxes on opposite sides of wall a minimum 12 inches.
- H. Set outlet boxes parallel to construction, securely mounted and adjusted to set true and flush with the finished surface.
- I. Do not burn conduit holes, use knock-out punches, or hole saws.
- J. Use "no-bolt" studs where required.
- K. Use handy boxes only where specifically detailed on the drawings.
- L. Boxes shall be sized per code to accommodate the number and size of conduit entrances to the box and to accommodate the number of conductors, splices, fittings within the box. Do not use box extensions to create additional volume to meet NEC requirements for the number of conductors contained in a box.

3.02 INTERIOR OUTLET BOX ACCESSORIES

- A. Provide outlet box accessories for each installation, including but not limited to: mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps, and metal straps for supporting outlet boxes. Accessories shall be compatible with outlet boxes being used and meeting requirements of individual wiring situations.

3.03 OUTLET BOX LOCATIONS

- A. Location of outlets and equipment as shown on drawings is approximate, and exact location is to be verified and shall be determined by:
 - 1. Construction or code requirements.
 - 2. Conflict with equipment of other trades.
 - 3. Equipment manufacturer's drawings.

END OF SECTION

**SECTION 26 27 02
EQUIPMENT CONNECTIONS****PART 1 - GENERAL****1.01 RELATED REQUIREMENTS**

- A. Applicable requirements Division 1 shall govern work in this section.

1.02 DESCRIPTION

- A. Provide power and selected control wiring for equipment including (but not limited to):
 - 1. HVAC motors and panels.
- B. Coordinate equipment requirements with the various Contractors and Owner. Review the drawings and specifications to determine extent of wiring, starters, devices, and other equipment required.

1.03 RELATED WORK AND REQUIREMENTS

- A. Section 26 05 33 - Conduits
- B. Section 26 05 19 - Low Voltage Wires, Cables and Connectors
- C. Section 26 27 28 - Motor and Circuit Disconnects

PART 2 - PRODUCTS

- A. Not Used.

PART 3 - EXECUTION**3.01 HVAC AND PLUMBING CONNECTIONS**

- A. Provide power wiring including circuitry carrying electrical energy from panelboard or other source through starters and disconnects to motors or to packaged control panels. Packaged control panels may include disconnects and starters and overcurrent protection. Provide wiring between packaged control panels and motors. Include starters disconnects and overload protection if not included in packaged control panels.
- B. Provide connection to variable frequency drives (VFD) furnished by others to include wiring from the drive to the motors and interconnecting of included isolation transformers. VFD and transformer setting by Division 23.
- C. Provide 120 volts to each temperature control panel.
- D. Unless otherwise specified, electrical motors and control devices including (but not limited to) aquastats, float and pressure fan powered VAV boxes, switches, electropneumatic switches, solenoid valves and damper motors requiring mechanical connections shall be furnished, installed and wired by Contractor supplying the devices.
- E. Each motor terminal box shall be connected with a maximum 18" piece of flexible conduit to a fixed junction box. A green wire run through the flexible conduit shall

interconnect the motor frame and the rigid conduit system. Use Liquidtight flexible non-metal conduit for connections.

- F. Check for proper rotation of each motor.

END OF SECTION

**SECTION 26 27 28
MOTOR AND CIRCUIT DISCONNECTS****PART 1 - GENERAL****1.01 RELATED REQUIREMENTS**

- A. Applicable requirements of Division 1 shall govern work in this section.

1.02 SCOPE

- A. Provide disconnect switches for the disconnection of motorized equipment and other equipment required by the national and state electrical codes and as specified herein. Code required disconnects shall be provided for all equipment unless included with equipment provided by others. Verify requirements with other trades.

1.03 RELATED WORK

- A. Section 26 28 00 - Low Voltage Overcurrent Protective Devices
- B. Section 26 05 19.4 - Motor Wiring
- C. Section 26 29 00 - Motor Starters
- D. Section 26 24 19 - Motor Control Centers

1.04 SHOP DRAWING SUBMITTALS

- A. Enclosure dimensions, nameplate nomenclature, electrical ratings, and fuse and breaker type listing.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Do not store exposed to weather.
- B. Protect against damage from work of other trades.

PART 2 - PRODUCTS**2.01 ACCEPTABLE MANUFACTURERS**

- A. General Electric, Siemens, Square D, Eaton/Cutler-Hammer.

2.02 DISCONNECT RATINGS

- A. UL listed short circuit rating. 200,000 RMS amps with Class R fuses.

2.03 SAFETY SWITCH CONSTRUCTION

- A. Switches for 250 volt or 600 volt equipment
 1. NEMA heavy duty Type HD.
 2. Horsepower rated or as indicated on drawings
 3. Dual cover interlock.
 4. Visible blades.
 5. Provisions for control circuit interlock.
 6. Pin type hinges.

7. Tin plated copper current carrying parts.
8. Quick make and break operator mechanism.
9. Handle attached to box, not cover.
10. Handle position indication, ON in up position and OFF in down position.
11. Padlock provisions for up to three padlocks in OFF position.
12. UL listed lugs for type and size of wire specified.
13. Spring reinforced fuse clips for Type R fuses where fusible disconnect is indicated or required.
14. Provisions for insulated neutral.
15. Disconnect feeder grounding kit.

2.04 ENCLOSURES

- A. Indoor. NEMA 1 code gauge steel with rust inhibiting primer and baked enamel finish.
- B. Outdoor. NEMA 3R code gauge zinc coated steel with baked enamel finish or NEMA 4 when indicated on drawings.
- C. Corrosive Areas. NEMA 4X Type 304 stainless steel with brushed finish.
- D. Hazardous areas. NEMA 7/9 cast, copper free, aluminum alloy.

2.05 NAMEPLATES

- A. Engraved laminated plastic type. Identify specific name of equipment served.
- B. Letters $\frac{3}{16}$ " high.
- C. White letters on black background.
- D. Identify per equipment controlled.

2.07 SPARE FUSES

- A. Furnish owner with our complete set (3) of spare fuses each with each size or type (e.g. Fen,30A,45A ect.)
- B. Provide spare fuse enclosure sized for single fuses. Locate in Electrical room.

PART 3 - EXECUTION

3.01 GENERAL

- A. Provide disconnect switches for loads required by code. Review HVAC and Plumbing specifications to determine what equipment is furnished with disconnect switches. Install disconnect switches whether furnished under this contract or not. It is the Electrical Contractor's responsibility to determine the need for a disconnect switch requirements for each specific load. The contractors shall include in their bid code required disconnect switches whether indicated on the drawings or not.
- B. Provide label on inside of disconnect cover identifying the types of fuses to be used.

3.02 GROUNDING

- A. If disconnect concentric knockouts are used, the contractor shall provide a grounding bushing or other means to insure ground continuity. Concentric knockouts are not listed for grounding continuity.

3.03 INSPECTION

- A. Examine area to receive disconnect for adequate clearance for installation.
- B. Start work only after unsatisfactory conditions are corrected.

3.04 INSTALLATION

- A. Install in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation," and in accordance with recognized industry practices.
- B. Locate disconnect switches as shown on drawings or required by NEC.
- C. Install on equipment support where feasible, or anchor firmly to wall or structural surface.
- D. Provide control circuit interlock required by NEC.

3.05 ADJUSTMENT

- A. Adjust covers and operating mechanism for free mechanical movement.
- B. Verify overcurrent protection to provide proper operation and compliance with NEC.
- C. Tighten wire and cable connections.
- D. Thoroughly clean enclosure inside and outside of dust and debris before final acceptance.
- E. Touch up scratched or marred surfaces to match original finish.

END OF SECTION

**SECTION 28 31 00
MULTIPLEXED ADDRESSIBLE FIRE ALARM SYSTEM****PART 1 - GENERAL****1.01 SCOPE**

- A. Provide labor, equipment, materials, and performance of operations in connection with the installation of the Fire Alarm System as shown on the drawings and as herein specified.
- B. The installation shall conform to the applicable sections of NFPA-72 Local Code Requirements and National Electrical Code (Article 760).

1.02 RELATED WORK

- A. The work covered by this section of the specifications shall be coordinated with the related work as specified elsewhere under the following project sections:
- B. Section 26 05 00 - Common Work Results for Electrical
- C. Section 26 05 33 – Conduits

1.03 DESCRIPTION OF WORK

- A. Performance Statement: this specification section and the accompanying fire alarm specific design documents describe the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the equipment described and the performance required of the system, as presented in these documents, the Vendor and the Contractor are solely responsible for determining all wiring, programming and miscellaneous equipment required for a complete and operational system.
- B. This section of the specifications includes the furnishing, installation, and connection of the microprocessor controlled, intelligent reporting, fire alarm equipment required to form a complete coordinated system that is ready for operation. It shall include, but is not limited to, alarm initiating devices, auxiliary control devices, power supplies, and wiring as indicated on the drawings and specified herein.
- C. The existing Fire Alarm System shall be configured as a local protective signaling system, as defined in NFPA-72, and shall use/incorporate the following features, as a minimum:
 - 1. The latest intelligent analog, addressable technology (detectors/sensors and modular panel equipment) currently available from the manufacturer
 - 2. Signaling Line Circuits (SLCs), connecting addressable field points to the associated Fire Alarm Control Panel, shall be configured as NFPA style 4 (Class B), with point supervision.
 - 3. Initiating Device Circuits (IDCs) shall be limited to short runs from Monitor Modules to the connected device, unless specifically stated otherwise herein, and shall be configured as NFPA Style B (Class B), with individual zone supervision.

1.04 REGULATORY REQUIREMENTS

- A. The installation shall conform to the applicable sections of the latest edition of the following Codes and Standards:
1. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA):
 - a. NFPA-70 National Electrical Code (NEC) Generally, and Article 760 in particular
 - b. NFPA-72 National Fire Alarm Code
 - c. NFPA 101 Life Safety Code
 - d. IBC International Building Code
 - e. IFC International Fire Code
 - f. IMC International Mechanical Code
 2. STATE OF WISCONSIN – DEPARTMENT OF COMMERCE (COMM):
 - a. COMM 14
 3. NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)
 4. UNDERWRITERS' LABORATORIES, INC. (UL)
 - a. UL-864 Control Units for Fire Protective Signaling Systems
 - b. UL-268 Smoke Detector for Fire Protective Signaling Systems
 - c. UL-217 Smoke Detectors for Single and Multiple Station
 - d. UL-521 Heat Detectors for Fire Protective Signaling Systems
 - e. UL-464 Audible Signaling Appliances
 - f. UL-1971 Visual Signaling Appliances
 - g. UL-38 Manually Actuated Signaling Boxes
 - h. UL-1481 Power Supplies for Fire Protective Signaling Systems

1.05 MANUFACTURER PROVIDED SERVICES

- A. A manufacturer-trained service technician shall provide the following installation supervision. This Technician shall be certified by the equipment manufacturer, and shall have had a minimum of two (2) years of service experience in the fire alarm industry.
- B. The technician's name shall appear on equipment submittals and a letter of certification from the fire alarm manufacturer shall be sent to the project engineer. The manufacturer's service technician shall be responsible for the following items:
1. Pre-installation visit to the job site to review equipment submittals and verify method by which the system shall be wired.
 2. Periodic job site visits to verify installation and wiring of system, and to perform partial system programming – required to permit portions of the existing system to be removed.
 3. Upon completion of wiring, final connections shall be made under the supervision of this technician, and final checkout and certification of the system.
 4. At the time of final checkout, technician shall give operational instructions to the Owner and/or his representative on the system.
 5. Job site visits shall be dated and documented in writing and signed by the Electrical Contractor. Any discrepancy shall be noted on this document and a copy kept in the system job folder that shall be available to the Project Engineer any time during the project.

1.06 QUALITY ASSURANCE

- A. Unless specifically stated otherwise, each item of the fire alarm system shall be listed as a product of a SINGLE fire alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the UL label.
- B. In addition to previously listed UL standards, all control equipment shall be listed under the following UL Standards:
 - 1. UOJZ UL category UOJZ as a single control unit. Partial listing shall NOT be acceptable.
 - 2. UL 864 Transient protection
 - 3. UL 497B Isolated Loop Circuit Protectors. Where fire alarm circuits leave the building, additional
 - 4. Transient protection must be provided for each circuit.
 - 5. UL 1481 Power Limited Applications.

1.07 QUALIFICATIONS

- A. All equipment shall be supplied by a firm which specializes in fire alarm and smoke detection systems. The firm shall be an authorized distributor of the proposed equipment
- B. All work shall be performed by a licensed contractor, who is regularly engaged in the installation and servicing of fire alarm systems and is factory authorized to furnish and install the equipment.
- C. Contractor shall be located within three (3) hours of travel time or less from the site of this project.

1.08 SUBMITTALS

- A. Under the provisions of Section 26 05 00, submit the following for approval prior to ordering any equipment in accordance with requirements. Submit a total of ten (10) sets.
- B. Copies of CAD Files (AutoCAD R14 or DXF Format) for the Fire Alarm floor plans will be made available to the successful bidder for preparation of the required shop drawings and as-builts.
- C. **REQUIRED SUBMITTAL MATERIALS**
 - 1. The following items, and any additional items required per Section 26 05 00, shall be included within the submittal package:
 - a. Although they may be submitted under separate cover, Submittal Brochures / Booklets / Binders and Shop Drawings shall be submitted together, and shall be treated as a complete set.
 - 2. **COVER SHEET:**
 - a. The submittals shall contain a cover sheet, which shall include the following information:
 - 1) Submittal Date
 - 2) Specification Section(s)
 - 3) Fire Alarm Contractor (Contact Name, name, address, and telephone number)
 - 4) Electrical Contractor (Contact Name, name, address, and telephone number)
 - 5) Project Name, Project City, Project State, and Project Address.

3. TABS AND TABLE OF CONTENTS:
 - a. The Table of Contents shall appear immediately behind the Cover Sheet, and shall contain a complete listing of all of the tabs contained within the binder / booklet.
 - b. Tabbed index sheets shall be inserted into each of the binders, such that each binder is clearly sub-divided into sections. Tabbed sections shall be provided, at minimum, for the following:
 - 1) One section for each building – ALL submittal data, which applies to any particular building, shall be located within the tabbed section for the corresponding building. All submittal data within each “building” section shall appear in the same order.
 - 2) One section for manufacturer’s data sheets – divided into sub-sections for the following:
 - a) Panel Equipment (Panels, Panel Components / Modules, Printers, Annunciators, etc.)
 - b) Addressable Field Devices (Initiating and Control / Monitoring / Isolation)
4. EQUIPMENT LIST:
 - a. A complete equipment list of all components, including the following: Quantity, Manufacturer, Part Number, and Description. If the supplier uses different part numbers from those of the actual manufacturer, the actual manufacturer and part numbers as they appear – marked on the shipping box / packages, shall also be identified on this list.
5. PRODUCT DATA:
 - a. Manufacturer’s product data sheets, and equipment description of all system components. These data sheets shall be highlighted or suitably marked, so that included items and options are indicated. On data sheets that include multiple products, products that are not used shall be crossed out.
 - 1) Product Data Sheets shall be organized, in order, corresponding to the FIRST occurrence of the corresponding item on the equipment list
6. SEQUENCE OF OPERATION:
 - a. Complete sequence of operations of all functions of the system. This sequence of operation shall be custom-created for this particular job.
 - 1) In order to satisfy this submittal requirement, it shall be acceptable to include copies of the “Operation” portions of the specifications, including any applicable schedules / other supplementary information. Copied specification pages shall be marked and highlighted, where the programmed operation will differ from the specified operation. Copied specification pages shall be marked “no changes”, where no significant deviation will occur. Other acceptable alternatives shall include written narratives, organized in a logical manner, and Matrix Charts.
 - 2) Where Matrix Charts are provided, such charts shall be organized and labeled clearly, and shall incorporate suitable levels of detail (refer to NFPA-72 (1999) A-7-5-2.2(9) for an example of an acceptable matrix chart). The Leftmost column of the Matrix Chart shall include groupings of initiating devices and other function switches. The Topmost Row shall include groupings of notification appliances and output devices.

7. BATTERY CALCULATIONS:
 - a. These calculations shall clearly illustrate both the Standby and Alarm loads, due to the various field devices and panel components / modules. It is generally recommended to submit such calculations in a "spreadsheet" format. These calculations shall include reserve / additional capacity, as required elsewhere within these specifications. Final results shall indicate both the minimum battery capacity required and the capacity actually provided.
 - 1) It shall be acceptable to provide Maximum/Full-Load calculations for items such as NAC Booster Panels. Where this is done, the calculation sheet shall be marked as, "typical of nnnx, nnnny, nnnnz" (where nnnx, nnnny, nnnnz ... = panel names).
8. SHOP DRAWINGS:
 - a. All submitted drawings shall be created using CAD, and shall be coordinated so that terminal numbering, circuit designation and equipment or device designations are the same on all drawings. All drawings must be submitted and approved by the engineer before ordering or fabrication starts, but such approval will not waive any specification requirements unless specifically stated.
 - b. Each and every sheet of the Shop Drawings shall be clearly and prominently identified as "SHOP DRAWINGS – PREPARED BY: (insert name of contractor firm preparing the shop drawings)", and shall be clearly and visibly different from the Contract Documents / Bidding Drawings. As a minimum, the name and company logo for the Electrical Contractor and the Fire Alarm Equipment Vendor should be added to each sheet, and a revision date shall be inserted on each sheet.
 - c. The submitted Shop Drawings shall include the following types of drawings:
9. PROJECT-SPECIFIC DRAWINGS:
 - a. Project-Specific Drawings. These drawings shall include the following:
10. SYSTEM RISER DRAWING:
 - a. A separate riser drawing shall be furnished for each system. Each System Riser shall illustrate all fire alarm circuits, which serve the facility, and shall incorporate the following information, in a clear, concise format:
 - 1) Point of origin of each circuit (usually a Panel, or a Module within a panel)
 - 2) Circuit type and labeling
 - 3) Area served by each circuit
 - 4) Wire / cable type and size
 - 5) Locations of Panelboards where primary system power is obtained
 - 6) The following information for each Field Device:
 - a) Device Type
 - b) Circuit(s) to which device is connected
 - c) Locations of any End-Of-Line Resistor (EOLR)
 - d) (and the circuit terminated by any such EOLR)
11. BLOCK DIAGRAMS:
 - a. Showing layout and operation of the entire system.
12. FLOOR PLANS:
 - a. These drawings shall consist of edited versions of the Contract Documents, which shall include the following information:
 - 1) Fire Department Response Location(s)
 - 2) Annunciator Location(s)
 - 3) Panel Location(s)

- 4) Locations of new and know existing Junction Boxes
 - 5) Proposed routing of new and known existing raceways
 - 6) Conduit and raceways sizes
 - 7) Wire / cable type and size
 - 8) Device Addresses - The addresses shown on these drawings shall directly correspond to the chart or printout, as specified previously, which spells out specific information about each device, including the field programmable "custom label".
13. TYPICAL DEVICE / MODULE WIRING DETAILS:
- a. Component and module wiring diagrams – intended to illustrate terminations and wiring connections to each typical Field Device (Detectors, Notification Appliances, etc.), and each typical panel component / module utilized within the system. This set of drawings shall only include diagrams for modules and components, which are actually used in the provided system(s).
 - b. These drawings shall incorporate clear labeling / nomenclature, which shall clearly indicate the corresponding field device or module, to which it corresponds.
- D. OMISSION OF ANY OF THE ABOVE MATERIALS FROM THE SUBMITTALS SHALL RESULT IN AN IMMEDIATE REJECTION OF THE SUBMITTALS FOR THIS PROJECT. If the EC/FAC has any questions concerning the preparation of these materials, please contact the Engineer.
- E. PLAN REVIEW/APPROVAL PROCESS:
1. THE FAC SHALL BE RESPONSIBLE FOR PREPARATION AND SUBMITTAL OF DRAWINGS AND OTHER MATERIALS TO THE AUTHORITY HAVING JURISDICTION
 2. .
 - a. If the FAC plans to start work prior to receipt of drawings approved by Authority Having Jurisdiction, then the FAC shall be responsible for any "Permission to Start Construction" forms and associated fees.
 3. Copy the approval shall be supplied to the engineer.
- F. FIRE ALARM WORK PERMIT:
1. THE FAC SHALL BE RESPONSIBLE FOR SCHEDULING, COORDINATING, ATTENDING INSPECTIONS, AND FOR PAYMENT OF ALL ASSOCIATED INSPECTION / PERMIT FEES.

1.09 PROJECT RECORD DRAWINGS

- A. Work shall be done on Auto CAD using the contract drawings provided to the Contractor by DSF in the form of Auto CAD files. A hard copy of same shall also be submitted.
- B. These drawings shall show:
1. Locations and addresses of Initiation Devices, Notification Appliances, isolation devices, status-monitoring devices, supervised signaling devices, and auxiliary control devices.
 2. Circuit and Address information for each field device listed above.
 3. Conduit layout and size
 4. Number/size/type/Color-Code of conductors in each conduit run
 5. Riser diagrams
 6. Location of end-of-line devices
 7. List of custom labels as installed for each address

- C. Riser diagrams shall include location of emergency 120VAC panel, panel designation and circuit number used to feed each fire alarm panel. Also, indicate if panel is backed up by an emergency generator.
- D. Riser diagrams shall include locations (room or area number) of notification, initiating, end-of-line devices and addresses for all addressable field devices.
- E. Also see requirements in Division 1, General Conditions.

1.10 OPERATION AND MAINTENANCE DATA

- A. All operations and maintenance data shall comply with the submission and content requirements specified under section 26 05 00 GENERAL ELECTRICAL PROVISIONS.

1.11 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Receive equipment at job site; verify applicable components and quantity delivered.
- B. Handle equipment to prevent internal components' damage and breakage, as well as denting and scoring of enclosure finish.
- C. Do not install damaged equipment.
- D. Store equipment in a clean, dry space and protect from dirt, fumes, water, and construction debris and physical damage. Make arrangements with the Owner at the pre-construction meeting for storage of equipment on the premises

1.12 SUPERVISION

- A. The system shall report a TROUBLE condition when any supervised circuit becomes disarranged, disconnected, or is manually disabled or overridden. Each supervised circuit shall be independently protected for short-circuit conditions, and shall be arranged so that faults on any one circuit do not prevent the proper operation of any other circuit in the system.
- B. The following devices/circuits shall be supervised, as a minimum:
 - 1. Initiating Device Circuits.
 - 2. Auxiliary manual control circuits.
 - 3. Remote Control Relays / Control Modules.
- C. The system shall have provisions for disabling and enabling all circuits individually for maintenance or testing purposes.
- D. Each independently supervised circuit shall include a discrete LCD readout, to indicate disarrangement conditions per circuit.

PART 2 - PRODUCTS

2.01 ENCLOSURES

- A. All panels and peripheral devices shall be the standard product of a single manufacturer and shall display the manufacturer's name on each component.

2.02 MULTIPLEX/INTELLIGENT FIRE ALARM CONTROL PANEL (FACP) EXISTING:**A. SIGNALING LINE CIRCUITS:**

1. The system must provide communications with intelligent addressable initiating and control devices individually. These devices shall be individually annunciated at the control panel [and FAAP] [and RFCC]. Annunciation shall include the following conditions for each point:
 - a. Alarm
 - b. Trouble
 - c. Open
 - d. Short
 - e. Device missing/failed
2. All intelligent addressable initiation and control devices shall have the capability of being disabled or enabled individually.
3. Systems that require factory pre-programming or EPROMs to add or delete devices shall be unacceptable.
4. The communication format must be a completely digital poll/response protocol to allow t-tapping of the Signaling Line Circuit wiring. Systems that do not utilize full digital transmission protocol are not acceptable.
5. Special-purpose Isolator devices shall be used to provide further isolation / protection of sections of the Signaling Line Circuits. Areas served by Signaling Line Circuits shall be isolated as specified within the "scope" portion of this specification. The following Isolation devices shall be acceptable for use in performing this function:
 - a. Isolator Modules – Field Mounted.

2.03 OPERATION: MULTIPLEX/INTELLIGENT FIRE ALARM SYSTEM**A. AHU SYSTEM INTERFACE**

1. Duct Smoke Detectors and Addressable Control Modules, or Supervised Remote Relays shall be provided as specified below. Duct Smoke Detectors shall be installed in compliance with the manufacturer's recommendations. Each Addressable Control Module or Supervised Remote Relay for AHU and / or Fan shutdown shall be installed within 3 feet of the Temperature Control Panel to which it is connected. The Division 26 EC shall provide all wiring and terminations required for shutdown of the specified AHUs / Fans.
2. The Addressable Control Modules or Supervised Remote Relays provided for this purpose shall be provided with DPDT output contacts. One SPDT set of the DPDT contacts shall be utilized for the specified shutdown function. The second SPDT set of the DPDT contacts shall be available for connection to the temperature controls, to indicate that unit shutdown – due to Duct Smoke – has occurred.
3. The control panel shall provide an output alarm interface to the air handling/energy management system controllers, which in turns shall perform automatic function as specified in the applicable sections of Division 23.
4. On this project, Air Handling Equipment Interface shall be configured as follows:

AHU- 3S1, 3S2, 3S3, 3S4, 3S5, 3S6	LOCATION: Mechanical Room 701
DUCT SMOKE DETECTORS:	One (1) in supply air duct
3E1, 3E2, 3E3, 3E4, 3E5, 3E6	LOCATION: Mechanical Room 701
DUCT SMOKE DETECTORS:	One (1) in return air duct

The associated Fan shall be shut down only upon actuation of the Duct Smoke Detector associated with the particular unit.
All such AHUs / Fans shall remain shut down, until a valid System Reset occurs.

2.04 MULTIPLEX/INTELLIGENT PERIPHERAL DEVICES

- A. All devices shall be supervised for trouble conditions. The system control panel shall be capable of displaying the type of trouble condition (open, short, device missing/failed). Failure of a device shall not hinder the operation of other system devices.
- B. Device Identification
 - 1. Each intelligent device must be uniquely identified by an address code entered on each device at time of installation.
 - 2. The address along with the loop number and end-of-line device if present shall be indicated, and be visible from the ground, on the device in the field using machine generated marking. Contractor shall provide a sample of such labeling scheme before using it.
 - 3. End-of Line devices shall also be identified by means of permanent, machine generated label, affixed to the device.
 - 4. The system must verify that proper type device is in place and matches the desired software configuration.
- C. Intelligent DETECTORS - General
 - 1. Smoke and heat detectors must be approved by the State Engineer prior to installation.
 - 2. Each detector shall incorporate the following features:
 - a. LED(s), which shall flash to indicate communication with the Fire Alarm System, and which also illuminate in a steady manner when the detector is in an alarm status
 - b. A means to allow field function testing of the detector
 - c. A low-profile design / shape
 - d. An insect screen
 - e. Voltage and RF transient suppression techniques, in order to minimize false alarms
 - 3. Smoke detectors shall communicate the actual smoke chamber values to the system control panel.
 - 4. Smoke detectors shall be listed for sensitivity testing from the control panel. Sensitivity test results shall be logged and downloaded to a printer.
 - 5. The detectors shall be plug-in units, which mount to a common base, and shall be UL 268 approved.
 - 6. Each detector shall be compatible with the fire alarm panel and shall obtain its operating power from the SLC, to which it is connected. (Where relay or sounder-equipped bases are used, it shall be acceptable to require a separate 24 VDC or NAC connection.) Each detector shall be reset by actuating the control panel reset switch.
 - 7. If field conditions so require the smoke detection devices shall not be installed until the construction is completed.
- D. Intelligent Detector bases
 - 1. Bases shall be suitable for either smoke or heat detector mounting.
 - 2. Either the base or the head shall contain electronic circuits that communicate the detector's status (normal, alarm, sensitivity status, trouble, etc.) to the control panel over two wires. The same two wires shall also provide power to the base and detector. Contacts between the base and head shall be of the bifurcated type using spring-type, self-wiping contacts.
 - 3. The base shall be lockable. The locking feature must be field-removable when not required.
 - 4. Upon removal of the detector's head, a trouble signal shall be transmitted to the control panel.
 - 5. The detector base shall be sealed against rear airflow entry.

6. Each detector's base or head shall contain LED(s), which shall flash when the detector is being scanned by the control panel. The LED(s) shall turn on steady when the detector is in an alarm condition.
- E. Intelligent DUCT SMOKE DETECTORS
1. Duct detectors shall be of the photoelectric type specified above. It shall be possible to alarm the duct detector by using a remote or local test switch.
 2. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housings front cover.
 3. Detector shall include remote keyed test switch and alarm LED indicator.
 4. In mechanical rooms, alarm LED indicators for duct detectors shall be grouped on a stainless steel cover plate mounted adjacent to the main mechanical room door. Each LED shall be labeled with the detectors loop and address. A floor plan of the room showing the detectors and addresses shall be located adjacent to the cover plate. Provide Plexiglas cover over the plan.
- F. INTERFACE MODULES - GENERAL
1. If external power to Addressable Interface Modules is required, such power shall be 24VDC, and shall be derived from a supervised fire alarm power supply.
 2. Addressable Interface Modules may be provided in either a Class B or Class A supervision version. Match existing conditions.
 3. In the Class B version the wiring shall be supervised by an end-of-line device.
 4. In the Class A version the wiring shall be looped back and connected to the module to allow continual operation of the controlled devices even if the wiring sustains a single break.
 5. The interface modules shall be supervised and uniquely identified by the control panel. Device identification shall be transmitted to the control panel for processing according to the program instructions.

2.05 FIRE RATED POWER LIMITED FIRE ALARM CABLE

- A. Two hour fire rated cable as listed by UL.
- B. UL listed type FPLR-CI fire alarm cable intended for use in power limited fire alarm circuits.
- C. Solid annealed copper conductors.
- D. Fire rated insulation covering.
- E. Copper/polyester tape shield.
- F. Overall jacket, low smoke, zero halogen polyolefin.
- G. Rockbestos Surprenant VITALink CI or equivalent.

PART 3 - PART 3 - EXECUTION

3.01 GENERAL

- A. The complete installation shall be done in a neat, workmanlike manner in accordance with the applicable requirements of NFPA 70 - Article 760 and the manufacturer's recommendations.

- B. Smoke detectors shall not be mounted until the construction is completed, unless they are covered with plastic bags or fitted covers immediately after installation to maintain cleanliness.

3.02 RACEWAYS

- A. NOTE: ALL FIRE ALARM SYSTEM WIRING SHALL BE INSTALLED WITHIN METALLIC CONDUIT UNLESS SPECIFIED.
- B. All wiring shall be in a conduit system separate from other building wiring.
- C. All wiring shall be in minimum ½" steel raceway.
- D. 40% fill factor shall be applied to all conduit sizes.
- E. The contractor shall size conduit and boxes by circular mil size of each cable in each conduit or box. The circular mil sizing can be found on the manufacture's spec sheet, then use the NEC codebook to make calculation to follow NEC Table 370-16(a) for box fill and Chapter 9 for conduit fill.
- F. Use only identified conduit entries or request approval for other penetrations in cabinets; (certain areas require clear space for interior components / batteries). Cabinet shall be grounded to either a cold water pipe or grounding rod.
- G. Existing conduit and surface metal raceway that is ½" in size or larger may be reused if found to have adequate space provided that it only serves the Fire Alarm system and doesn't contain any AC wiring. All existing conduit that is reused MUST be brought up to the current State of Wisconsin Electrical Code and Approved for usage by the Engineer prior to work being done.

3.03 WIRING INTEGRITY

- A. Signaling Line Circuits (SLC), for intelligent addressable devices, shall be Class B, Style 4. Each SLC shall incorporate isolator modules or isolation devices which shall provide independently isolated SLC sub-circuits. A short circuit occurring on isolated sub-circuits shall not interfere with proper operation of the devices on other sub-circuits.

3.04 CONDUCTORS

- A. All wire and cable associated with this system shall be as required by the equipment manufacturer. The following information is intended for estimating purposes only. However, the minimum wire gauges and colors specified shall be strictly adhered to. All cable shall be installed as per NEC Article 760.
- B. Type FPL wiring is required if the system is run in conduit or 'free-air.
- C. All initiation and notification circuit cabling shall be listed Type FPL (300V) in accordance with NEC article 760."
- D. All cables and wires #14 AWG and larger shall be stranded.
- E. Fire alarm wiring shall be held in place at the device box, by means of a two-screw connector, (do not use squeeze or crimp type connectors).
- F. All wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, disarrangement of any components, any open

circuits or grounds in the system, an audible and visual trouble signal shall be activated until the system is restored to normal.

- G. All conductors shall be color-coded. Coding shall be consistent through out the facility. Green wire shall be used only for equipment ground.
- H. Fire alarm risers, notification appliance circuits and interconnections to remote panels (per NFPA 72) shall have a minimum 2Hr fire alarm rating. Wiring installed between the fire alarm control panel and first devices in each of the fire alarm zones, other than the zone FACP is located in, shall be a two hour fire rated cable assembly as required by NFPA 72.
- I. Leave 8-inch wire tails at each device box and 36-inch wire tails at the Fire Alarm Control Panel.
- J. Cable for Intelligent detector Loops shall be 18 to 12 AWG twisted pair with a shield jacket installed in ½" conduit. Shield continuity must be maintained and connected to earth ground only at the control panel.
- K. SLC wiring must not be in the same conduit with AC power wiring or other high current circuits. T-taps or branch circuit connections are allowed for all class B SLCs.
- L. All splices or connections shall be made within approved junction boxes and with approved fittings. Boxes shall be red and labeled "FIRE ALARM SYSTEM" or "FA" by decal or other approved markings.

3.05 DEVICE MOUNTING

- A. Unless otherwise noted on the drawings, plans, specifications or by the Architect or Engineer; the recommended mounting heights, and requirements are as follows:
- B. Smoke Detectors
 1. The location of detectors shown on the plans is schematic only. The detectors must be located according to code requirements.
 2. Duct smoke detector installation to be by this contractor and installed in the locations shown on the mechanical plans. Ensure that the duct smoke detectors are in serviceable locations. Consult with the mechanical designer for alternate locations if these are shown in non-serviceable locations. When locations on mechanical plans are not available, install in locations called for that provide accessibility for service. Do not install within four feet of a fan discharge

3.06 IDENTIFICATION

- A. Attach the label containing the address and SLC designation to:
 1. Each addressable detector. Label shall be visible and readable from the floor, 3/16" minimum character size (¼" is recommended).
 2. Each manual pull station. Label shall be placed on the top part
 3. Each Addressable Module. Label shall be attached to the faceplate
- B. Label shall consist of black writing on white or clear background.
- C. All junction boxes shall be painted red and labeled "Fire Alarm" or "FA".
- D. All circuits must be labeled with the name of circuit and the area being served by the circuit.

- E. Wire/cable splices in junction boxes shall be labeled indicating where the wire/cable is coming from and where it is going.
- F. All conductors terminated in control panels, annunciator panels and extension panels shall be labeled.
- G. All labels shall be permanent, and be machine generated. NO HANDWRITTEN OR NON-PERMANENT LABELS SHALL BE ALLOWED. Submit a sample for approval before using any labeling schemes.
- H. Label size shall be appropriate for the conductor or cable size(s) and design. All labels to be used shall be self-laminating, white/transparent vinyl and be wrapped around the cable (sheath). Flag type labels are not allowed. The labels shall be of adequate size to accommodate the circumference of the cable being labeled and properly self-laminate over the full extent of the printed area of the label.
- I. Adhesive type labels not permitted except for phase and wire identification.

3.07 TESTING

- A. Before proceeding with any testing, all persons, facilities and building occupants whom receive alarms or trouble signals shall be notified by the contractor to prevent unnecessary response or building occupant distress. At the conclusion of testing, those previously notified shall be notified that testing has been concluded.
- B. The manufacturer's authorized representative shall provide on-site supervision of installation of the complete fire alarm system installation, perform a complete functional test of the system, and submit a written report to the Contractor attesting to the proper operation of the completed system prior to final inspection.
- C. Contractor shall pre-test each and every device in the system before the system is considered ready for final inspection.
- D. The completed and pre-tested fire alarm system shall be fully tested in accordance with NFPA-72 by the Contractor in the presence of the Engineer, Owner's representative and the local Fire Marshal.
- E. Upon the completion of a successful test, and prior to the final request for payment the Contractor shall:
 - 1. Certify the system to the Owner in writing
 - 2. Complete the NFPA 72 record of completion form
 - 3. Provide as built and O&M manuals.
 - 4. Provide a signed statement that the Owner had received the specified system operation and maintenance training
- F. The final payment will not be processed unless these documents are complete and are on hand.

3.08 WARRANTY

- A. The Contractor shall warrant the completed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of two (2) years from the date of substantial completion of the project.
- B. At the end of the project, the Contractor shall post the warranty period along with the company's name and telephone number inside the fire alarm panel.

- C. Any occupied facility shall not be without a UL and an NFPA approved and fully operational fire alarm system for a period longer than two (2) hours. Emergency response shall be provided within two (2) hours of the notification, to the contractor, of the failure of the system to perform operationally per UL and NFPA standards. Non-emergency service calls shall be responded to within twenty-four (24) hours of the notification to the contractor.
- D. Emergency situations may include, but not limited to
 - 1. System can't be acknowledged or reset
 - 2. System is non-responsive to commands
 - 3. System in non-responsive to actuated alarm devices
 - 4. Malfunction of notification/initiating circuit(s)
 - 5. System going into alarm/trouble without indicating the source
 - 6. System is dead (no power), etc.
- E. Repairs and/or replacement arising from emergency situations shall be completed within twenty-four (24) hours of the time of notification. Other than emergency, actual repairs and /or replacement shall be provided within seventy two (72) hours of the time of notification during normal working hours, Monday through Friday, excluding holidays. If the repairs involve parts that are not shelve items and require lead time, the contractor shall inform the Owner within twenty-four (24) hours from the time of notification of the exact time when the repairs will be completed.
- F. If repair and/or replacement cannot be made within the prescribed time, then other means and methods of protection shall be provided to insure the safety of the building's occupants during which time the system is not in compliance with the standards. This may involve up to and include hiring Owner approved qualified personnel to stand a fire watch, all at the contractor's expense.
- G. Warranty service for the equipment shall be provided by the system supplier's factory trained representative. Further, Warranty shall include all parts, labor and necessary travel.

3.09 TRAINING

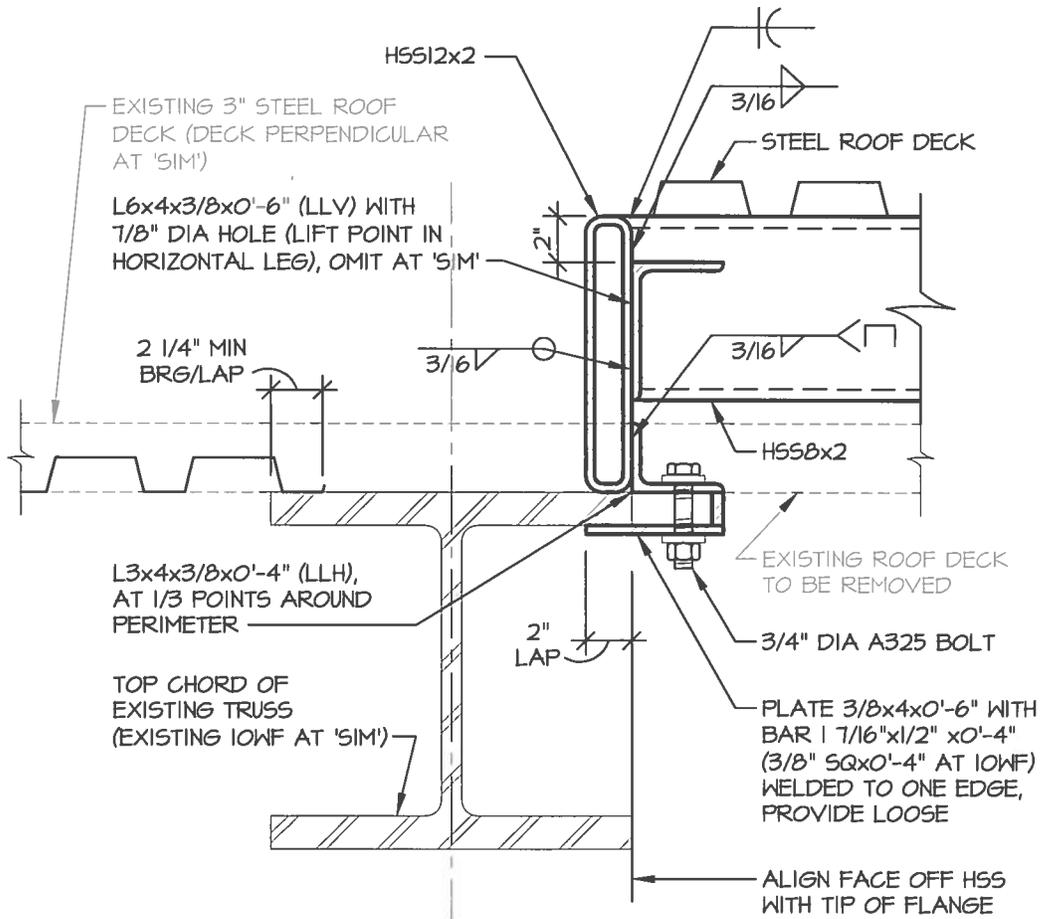
- A. The Contractor through his/her supplier shall provide, as part of this contract, a minimum of three (3) hours system operation training for owner, the Architect/Engineer, and fire department personnel. The training session shall consist of the following sessions:
 - 1. Two (2)-hour sessions for the purpose of training personnel who will need to operate the system – primarily, Level 1 and Level 2 system operators / users.
 - 2. A single (1)-hour session for the purpose of training personnel who will need to administrate and maintain the system. This training session shall familiarize these "power-users" with High-Level functions, and shall also familiarize Electrical Department personnel with an overview of the as-built drawings and equipment configuration / basic troubleshooting.
- B. All training sessions shall be coordinated and scheduled by the Prime Contractor, and shall be conducted at a time to be stipulated by the owner. All training and other indoctrination shall be completed prior to final inspection.
- C. Training shall not take place until all systems are 100% operational as determined by the Owner. The purpose of training is to fully prepare the facility maintenance staff for complete operational responsibility of the fire alarm system.

- D. The facility maintenance staff shall be fully trained and be given the capability by the product Vendor and installing Contractor to modify, to program, to fully repair, to service, and to maintain the system after (and if desired, during) the warranty period.
- E. The above training shall include, but not be limited to, providing and reviewing all programming software, access codes, and licenses that allow the Owner to add or to delete any points (i.e.: The mapping of devices), and to change a heat detector to a smoke detector. To meet this requirement, provide the necessary configuration and/or access code (hardware and/or software key). If the Vendor cannot meet this requirement, the product is not acceptable

3.10 SPECIAL CONSIDERATIONS

- A. The contractor must maintain the existing fire alarm system operational during the construction period. During periods of construction where dust or dirt may contaminate the existing detectors, the contractor shall cover the detectors to avoid nuisance alarms and trouble-calls.
- B. Individual zones and/or devices of the existing fire alarm system can be bypassed by the contractor during construction under the following requirements:
 - 1. The Superintendent of Buildings and Grounds is notified of which zones and/or devices are inoperative and for how long in writing, hand delivered.
 - 2. The contractor covers all manual-pull stations that are not active and post temporary fire alarm notification procedures next to each inactive manual-pull station.
 - 3. Ensure the fire alarm system is fully operational before leaving the job site.

END OF SECTION



2
S100

PERIMETER OF REMOVABLE ROOF SECTION

SCALE: 1 1/2"=1'-0"

Marcus Center for the Performing Arts
HVAC RETROFIT - PHASE FOUR
 929 North Water Street - Milwaukee, Wisconsin

ARNOLD AND O'SHERIDAN INC

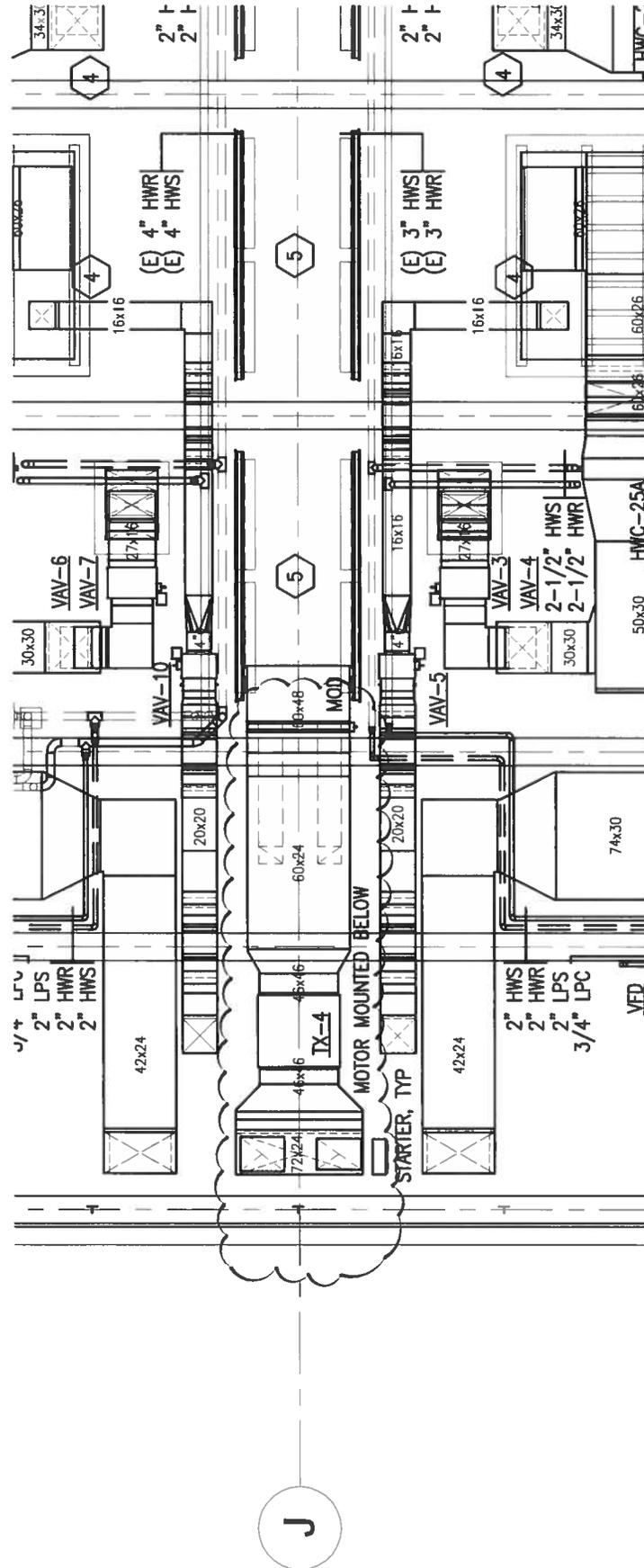


MILWAUKEE COUNTY DEPARTMENT OF
 TRANSPORTATION AND PUBLIC WORKS
 CITY CAMPUS 2711 W. WELLS ST. 2ND FLOOR MILWAUKEE, WISCONSIN

ADD#3-02/21/2013

0038-13450

ADS-2



PARTIAL MECHANICAL FLOOR PLAN- ROOM 701

SCALE: 1/8" = 1' - 0"

ADDENDUM DRAWING REVISES ORIGINAL DRAWING 2/M100 OF THE 2-04-2013 CONTRACT DOCUMENT

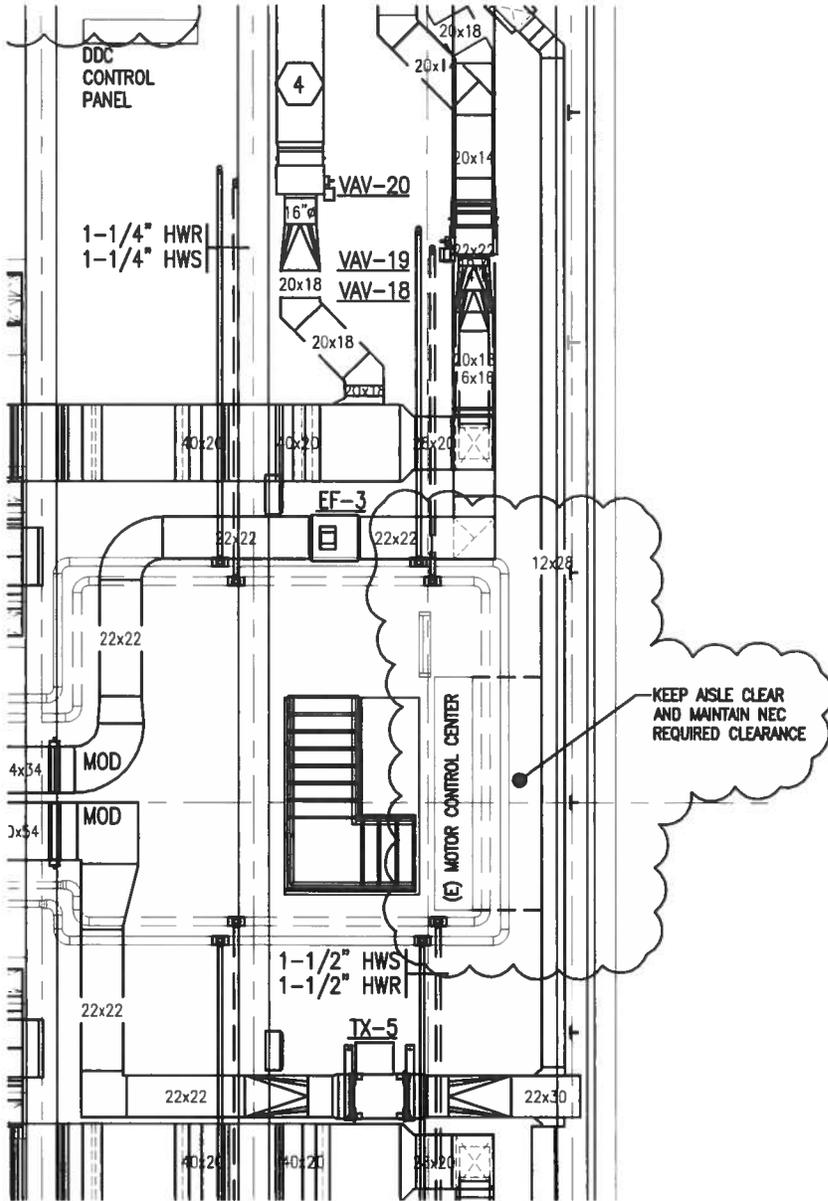
Milwaukee County Marcus Center for the Performing Arts
 HVAC RETROFIT-PHASE FOUR
 929 North Water Street - Milwaukee, Wisconsin

Cervantes Consulting Engineers, LLC
 3190 W. Southland Drive, Milwaukee, Wisconsin 53211
 Phone: 414.761.4500 Fax: 414.761.4113
 Project No. 12-0210

MILWAUKEE COUNTY DEPARTMENT OF
 TRANSPORTATION AND PUBLIC WORKS
 CITY CAMPUS 2711 W. WELLS ST., 2ND FLOOR MILWAUKEE, WI 53233

REVISIONS

DATE	PROJECT	SITE	BUILDING
02/21/2013	O 038-13450	270	50



PARTIAL MECHANICAL FLOOR PLAN- ROOM 701

SCALE: 1/8" = 1' - 0"

Milwaukee County Marcus Center for the Performing Arts
 HVAC RETROFIT-PHASE FOUR
 929 North Water Street - Milwaukee, Wisconsin

Cermates Consulting Engineers, LLC
 114 W. Southeast Drive, Milwaukee, Wisconsin 53112
 Phone: 414-751-5502 - Fax: 414-751-4103
 Permit No. L12110



MILWAUKEE COUNTY DEPARTMENT OF
 TRANSPORTATION AND PUBLIC WORKS
 CITY CAMPUS - 2711 W. WELLS ST. - 2ND FLOOR - MILWAUKEE, WISCONSIN

REVISIONS

DATE
 02/21/2013
 PROJECT
 0 038-13450
 SITE
 270
 BUILDING
 50

AIR HANDLING UNIT

TAG	LOCATION	SERVICE	AIR FLOW		MIN.	MOTOR			ELECTRICAL			COILS			BASIS OF DESIGN		
			(CFM)	(CFM)		ESP (TWC)	RPM	BHP	HP	PH	VOLT	VFD	FILTER	PRE-HEAT		COOLING	HUMIDIFIER
AHU-																	
S51	MECHANICAL ROOM 701	UHLEN HALL HOUSE	20,000	8,250	2.85	1.72	988	12.1	20	3	480	YES	30	SH-C-6A	CC-16A	HL-1	MCQUAY VISION MODEL CAH86GGDDC OR EQUAL
S52	MECHANICAL ROOM 701	UHLEN HALL HOUSE	20,000	8,250	2.85	1.72	988	12.1	20	3	480	YES	30	SH-C-6B	CC-16B	HL-2	MCQUAY VISION MODEL CAH86GGDDC OR EQUAL
S53	MECHANICAL ROOM 701	UHLEN HALL HOUSE	20,000	8,250	2.75	1.65	966	12.1	20	3	480	YES	30	SH-C-6C	CC-16C	HL-3	MCQUAY VISION MODEL CAH86GGDDC OR EQUAL
S54	MECHANICAL ROOM 701	UHLEN HALL HOUSE	20,000	8,250	2.75	1.65	988	12.1	20	3	480	YES	30	SH-C-6D	CC-16D	HL-4	MCQUAY VISION MODEL CAH86GGDDC OR EQUAL
S55	MECHANICAL ROOM 701	UHLEN HALL STAGE	10,000	3,425	2.0	0.75	1280	5.82	7.5	3	480	YES	30	SH-C-2A	CC-19A	HL-5	MCQUAY VISION MODEL CAH21DDC OR EQUAL
S56	MECHANICAL ROOM 701	UHLEN HALL STAGE	10,000	3,425	2.0	0.75	1280	5.82	7.5	3	480	YES	30	SH-C-2B	CC-19B	HL-6	MCQUAY VISION MODEL CAH21DDC OR EQUAL

NOTES: (1) ESP TO EXCLUDE P.D. OF UNIT COMPONENTS FURNISHED BY UNIT MANUFACTURER SUCH AS COILS AND FILTERS

(2) PROVIDE AIR HANDLING UNITS (AHL-S51, AHL-S53 AND AHL-S55) WITH SPARE VARIABLE FREQUENCY DRIVES

(3) PROVIDE AIR HANDLING UNITS, AHL-S53 & AHL-S55 WITH CONDENSATE PUMP, LITTLE GIANT MODEL VOL-45ULS, \$3 GPM, FLOAT SWITCH, 185 WATT MOTOR AND 1 GALLON TANK.

FAN SCHEDULE

TAG	LOCATION	SERVICE	AIR FLOW (CFM)	FAN		WHEEL		FAN		FAN			ELECTRICAL			BASIS OF DESIGN
				TYPE	DRIVE	TYPE	DIAMETER (IN)	CLASS	TSP (TWC)	RPM	BHP	HP	PH	VOLT	VFD	
AHU-S51 & S52	MECHANICAL ROOM 701	SUPPLY	20,000	CENTRIFUGAL	BELT	PLENUM	36.5	2	2.85	988	12.1	20	3	480	YES	MCQUAY VISION MODEL CAH86GGDDC OR EQUAL
AHU-S53 & S54	MECHANICAL ROOM 701	SUPPLY	20,000	CENTRIFUGAL	BELT	PLENUM	36.5	2	2.75	966	12.1	20	3	480	YES	MCQUAY VISION MODEL CAH86GGDDC OR EQUAL
AHU-S55 & S56	MECHANICAL ROOM 701	SUPPLY	10,000	CENTRIFUGAL	BELT	PLENUM	27	2	2.05	988	5.82	7.5	3	480	YES	MCQUAY VISION MODEL CAH21GGDDC OR EQUAL
REF-S51 & S52	MECHANICAL ROOM 701	RETURN RELIEF	20,000	CENTRIFUGAL	BELT	PLENUM	33	2	0.90	1071	7.12	10	3	480	YES	MCQUAY VISION MODEL CAH86GGDDC OR EQUAL
REF-S53 & S54	MECHANICAL ROOM 701	RETURN RELIEF	20,000	CENTRIFUGAL	BELT	DNDR	27	1	0.90	1111	7.04	10	3	480	YES	MCQUAY VISION MODEL CAH86GGDDC OR EQUAL
TX-4	MECHANICAL ROOM 701	TOILET EXHAUST	8,000	CENTRIFUGAL	BELT	CENTRIFUGAL	-	1	0.75	813	2	2	3	480	NO	GREENHECK MODEL BSQ-306-20 OR EQUAL
TX-5	MECHANICAL ROOM 701	TOILET EXHAUST	5,000	IN LINE	BELT	MIXED FLOW	-	L	0.66	1043	0.99	1.5	3	480	NO	GREENHECK MODEL OE-20 L-10 OR EQUAL
EF-3	MECHANICAL ROOM 701	TOILET EXHAUST	-	IN LINE	BELT	CENTRIFUGAL	-	-	-	-	-	-	-	-	NO	EXISTING AND REINSTALLED

NOTE: 1. REF-S53 & REF-S54 MOUNTED ON THE SAME EQUIPMENT RAILS AS AHU-S53 & S54.

SOUND POWER LEVEL DATA

COMPONENT	SOUND POWER BY OCTAVE BAND RE 10-12 WATTS					
	63 HZ	125 HZ	250 HZ	500 HZ	1000 HZ	2000 HZ
TOILET EXHAUST FAN: TX-4	82	85	81	73	71	68
DUCTED INLET	82	85	81	73	71	68
CASING	82	85	81	73	71	68
TOILET EXHAUST FAN: TX-5	86	78	74	70	66	63
DUCTED INLET	86	78	74	70	66	63
DISCHARGE	75	80	72	73	71	65

ADDENDUM DRAWING REVISES ORIGINAL DRAWING M400 OF THE 2-04-2013 CONTRACT DOCUMENT

MOTOR SCHEDULE										
UNIT	DEMOLITION					NEW WORK				REMARKS
	HP	VOLTS	PHASE	HP	VOLTS	PHASE	VOLTS	PHASE		
351	10	480	3	20	480	3				
352	10	480	3	20	480	3				
353	10	480	3	20	480	3				
354	10	480	3	20	480	3				
355	5	480	3	7.5	480	3				
356	5	480	3	7.5	480	3				
3E1	7.5	480	3	10	480	3				
3E2	7.5	480	3	10	480	3				
3E3	7.5	480	3	10	480	3				
3E4	7.5	480	3	10	480	3				
TX-4	2	480	3	2	480	3				
TX-6	1.5	480	3	1.5	480	3				
EF-3	1	480	3	1	480	3			EXISTING	
P-8	3	480	3	3	480	3				

NOTE: 1. MECHANICAL CONTRACTOR SHALL BE RESPONSIBLE FOR ALL NECESSARY ELECTRICAL WORK REQUIRED AS PART OF DEMOLITION OF EXISTING MECHANICAL EQUIPMENT AND SHALL BE RESPONSIBLE FOR ALL ELECTRICAL WORK NECESSARY TO INSTALL AND PROVIDE ALL REQUIRED ELECTRICAL POWER TO NEW EQUIPMENT.

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REVISIONS

DATE
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 PROJECT
 O 038-13450
 SITE
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ADM-4