Substitutions for specified products are acceptable only if proposed and approved in writing at the time of bid.

3.2 ELECTRICAL COORDINATION

A. Participate in the project scheduling and coordination drawing activities specified in the project specifications.

B. Coordinate power interruptions with the other disciplines. Notify the Owner's Representative of power interruptions three (3) working days in advance. Maintain power to all loads outside of the work area.

3.3 DEMOLITION

A. Protect adjacent building services and materials indicated to remain. Install and maintain barriers to keep dirt, dust and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition is completed.

B. Remove all equipment and materials designated for demolition as follows:

1. Power wiring - remove back to the source or to the first junction box where the circuit continues on to remaining loads.
2. Junction boxes in walls and above ceilings - abandon in place. Install blank cover plates on boxes.
3. Conduits and openings through floors and walls, and boxes in floors - remove completely and firestopped.

3.4 RELOCATION

A. Carefully remove, clean and restore items designated for relocation to a “like new” condition, and store them for reuse.

3.5 SALVAGE

A. Equipment and materials removed during demolition phase shall be offered to Owner for reuse. If the Owner doesn't waiting the materials, the Contractor shall remove from site.

3.6 CLEANUP

A. Remove and legally dispose of demolished items, rubbish and debris from the construction site daily, and at the completion of the work. Failure to do so may result in the cleanup being performed by others and all costs thereof being deducted from the Contractor's final payment.

3.7 EQUIPMENT PROTECTION

A. Protect equipment and materials during shipment, storage and construction against damage and contamination.

B. Items that become damaged or contaminated shall be restored to a “like new” condition or replaced at the Contractor's expense.

3.8 WORK PERFORMANCE

A. Locate equipment as close as practical to the locations shown on the drawings. Should field conditions prevent the installation of equipment or materials as indicated on the drawings, make any deviations only with the prior approval of the Owner's Representative.

B. Install and connect new work to existing work neatly and carefully. Existing work that is disturbed shall be repaired or replaced as necessary to restore it to its prior condition.

C. Coordinate work with the other trades to ensure completion consistent with the project schedule. Do not unduly delay the startup, testing or turnover of project systems.

D. Coordinate work with the other trades to ensure the NEC-required dedicated spaces above and working spaces around electrical equipment is provided, and to ensure access to equipment requiring calibration or maintenance. Working space and access shall be sufficient for an adult to perform maintenance safely without straddling or removing obstructions. Work that encroaches on working space or that impedes maintenance shall be relocated at the Contractor's expense.

E. Coordinate work with the other trades to provide access doors to maintainable electrical equipment (including lighting fixture remote ballasts) located behind walls or above permanent ceilings.

F. Prior to core drilling concrete floors, test for the presence of electrical conduits. Use an impulse induction type scanner capable of detecting both metallic conduits and copper wires in PVC conduits. Tracers that scan for energized cables or that scan for injected high frequency signals are not acceptable. Notify the Owner's Inspection Department prior to all tests. Prior to core drilling, arrange for the Owner's Representative to notify building occupants of the potential for an unscheduled power outage. Conduits damaged during core drilling shall be restored immediately at the Contractor's expense.

3.9 FIELD QUALITY CONTROL

A. Arrange for testing and commissioning of electrical systems, equipment and materials prior to final acceptance of the work. Acceptance tests and commissioning shall be performed per applicable codes, standards and manufacturers' instructions.

B. Provide all test equipment, materials and labor necessary to perform the tests, and coordinate with the other trades for necessary services, such as scaffolding and the uncoupling of motors.

C. Notify the Owner's Representative three (3) working days in advance of tests. The Owner shall witness the tests unless the Owner's Representative waives such witnessing in writing.

D. Notify manufacturers sufficiently in advance of tests for which the manufacturers should be present.

E. Replace any equipment or materials found to be defective or found to be of lesser quality than that specified or shown on the drawings.

F. Provide written test reports, signed and dated, for all tests prior to acceptance of the electrical equipment by the Owner.

G. Provide the training specified in each specification section.

END OF SECTION 260500

SECTION 260526 - GROUNDING AND BONDING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Grounding and bonding components.

1.2 ADMINISTRATIVEREQUIREMENTS

A. Coordination:

1. Notify Owner of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.3 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience with service facilities within 100 miles of Project.

C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

D. Separately Derived System Grounding:

1. Separately derived systems include, but are not limited to:
   a. Transformers (except autotransformers such as buck-boost transformers).
2. Provide grounding electrode conductor to connect derived system grounded conductor to common grounding electrode conductor ground riser. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
4. Where common grounding electrode conductor ground riser is used for tap connections to multiple separately derived systems, provide bonding jumper to connect the metal building frame and metal water piping in the area served by the derived system to the common grounding electrode conductor.
5. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
6. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.

E. Bonding and Equipment Grounding:

1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
3. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
4. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
5. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.

2.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:

1. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding:

1. Use insulated copper conductors unless otherwise indicated.
   a. Exceptions:
      1) Use bare copper conductors where installed underground in direct contact with earth.
      2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:

1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as shown on the drawings.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify existing conditions prior to beginning work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install grounding and bonding system components in a neat and workmanlike manner in accordance with NECA 1.

C. Make grounding and bonding connections using specified connectors.

1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

D. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing where indicated. Bond steel together.

E. Provide bonding to meet requirements described in Quality Assurance.

END OF SECTION 260526

SECTION 260700 - HANGERS AND SUPPORTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.2 SUMMARY

A. ASTM A682 Standard Specification for Steel, Strip, High-Carbon, Cold-Rolled, Spring Quality.

B. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, and services to completely execute the system of conduit hangers and supports as described in this specification.

C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this project, with a minimum structural safety factor of five times the applied force.

1.3 SUBMITTALS

A. Product Data: Provide manufacturer's catalog data for fastening systems.

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

1.5 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENTCOMPONENTS

A. General Requirements:

1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
2. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated, where applicable.
3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
   a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
   b. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
   c. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.

1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
2. Conduit Clamps: Bolted type unless otherwise indicated.
3. Manufacturers:
   a. Cooper Crouse-Hinds, a division of Cooper Industries: www.cooperindustries.com.
   b. Erico International Corporation: www.erico.com.
   c. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
   d. Thomas & Betts Corporation: www.tnb.com.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

1. Manufacturers:
   a. Cooper Crouse-Hinds, a division of Cooper Industries: www.cooperindustries.com.
   b. Erico International Corporation: www.erico.com.
   c. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
   d. Thomas & Betts Corporation: www.tnb.com.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel

(strut) and associated fittings, accessories, and hardware required for field-assembly of supports.

1. Comply with MFMA-4.
2. Channel (Strut) Used as Raceway (only where specifically indicated): Listed and labeled as complying with UL 5B.
3. Channel Material:
   a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
4. Minimum Channel Thickness: 12 gauge.
5. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.
6. Manufacturers:
   a. Cooper B-Line, a division of Cooper Industries: www.cooperindustries.com.
   b. Thomas & Betts Corporation: www.tnb.com.
   c. Unistrut, a brand of Atkore International Inc: www.unistrut.com.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

1. Minimum Size, Unless Otherwise Indicated or Required:
   a. Equipment Supports: 1/2 inch diameter.
   b. Single Conduit up to 1 inch (27mm) trade size: 1/4 inch diameter.
   c. Single Conduit larger than 1 inch (27mm) trade size: 3/8 inch diameter.

F. Anchors and Fasteners:

1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Plastic and lead anchors are not permitted.

2.2 MANUFACTURERS

A. Hilti Corporation

B. B-Line Systems Inc.

2.3 MATERIALS

A. Hangers, Supports, Anchors, and Fasteners - General: Protective zinc coating either Electro-Plated (ASTM B633 SCI or SC3), Pre-Galvanized (ASTM a525 coating designation G90) or Hot-Dip Galvanized after fabrication (ASTM A123). The minimum thickness of zinc coating shall be 0.2 mill (5 micrometers).

B. Provide materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.

C. Supports: Fabricated of structural steel or formed steel members; galvanized.

D. Anchors and Fasteners:

1. Concrete Structural Elements: Use precast inserts, expansion anchors, powder-actuated anchors, or preset inserts.
2. Steel Structural Elements: Use beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.
3. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
5. Solid Masonry Walls: Use expansion anchors or preset inserts.
6. Sheet Metal: Use sheet metal screws.
7. Wood Elements: Use wood screws.

E. Conduit Hangers:

1. Shall have a vertical load limit of 100 lbs, and a horizontal load limit of 25 lbs..
2. Shall be available with either a plain hole for 1/4” bolt or a 1/4-20 thread impression.
3. Shall be available for 3/8” through 2” EMT, rigid, and aluminum conduit.
4. Shall be available pre-assembled with manufacturer's specialty fasteners for connection to building structures like beam, flange, drop wire/rod, wood structure, concrete and acoustical tee grid.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install support and attachment components in a neat and workmanlike manner in accordance with NECA 1.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Do not penetrate or otherwise notch or cut structural members.

E. Equipment Support and Attachment:

1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

F. Secure fasteners according to manufacturer's recommended torque settings.

G. Remove temporary supports.

END OF SECTION 260700

NORSTAR

Norstar
200 South Division Street
Buffalo, NY 14204
PH. (716)847-1098 FX. (716)847-1668
www.norstarus.com

Process Results®
THE ART OF ENGINEERING

Process Results, Inc.
201 South Ann Arbor St.
Saline, MI 48176
PH:734.429.8900 FX:734.429.8901
www.processresults.com

B	ISSUED FOR BID	8/20/14
A	REVIEW	7/22/14
△	*REVISION*	*DATE*

PLOT DATE: 08/21/2014 9:34 AM
DRAWN BY: S. JONES
REVIEWED BY: D. NIETHAMMER
PROJECT MANAGER: D. NIETHAMMER
FILE:

AAHC GEOTHERMAL
ANN ARBOR, MICHIGAN

SPECIFICATIONS

MECHANICAL

SPECIFICATIONS

PROJ. NO.:

SP1.3
SHEET NO.

B
REV