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| Version | Date | Description of Revisions |
| 1 | August 30, 2006 | Approved final document. |
| 2 | February 19, 2010 | Modified ‘Related Sections’ and approved suppliers |
| 3 | March, 2011 | Minor edits |
| 4 | June 3, 2013 | Final Draft – Consolidated Comments Spec Update Project |
| 5 | June 18, 2013 | Incorporation of new Commissioning and Computerized Maintenance Management System Data Requirements Specification cross references. |
| 6 | July 28, 2014 | Changes to reflect renaming of commissioning specification and final review (AV) |
| **7** | **March 2, 2015** | **Updated, Finalized Specification – Reference eDOCS #5630521 v8 (AV) and amended a corporate name for cited products.** |
| 8 | February 10, 2017 | Review of all products with a specified manufacturer. Some of these were removed, others were converted to performance based specifications, and the rest had the list of acceptable manufacturers updated. (CPD PMO, OMM) (AV)  Updated references to standards (ANSI/IEEE C62.45-2002 (R2008), Ontario Electrical Safety Code, 26th edition 2015, CSA-C22.2 No.42-10 (R 2015), CSA-C22.2 No. 144-M91 (R2015), C22.2 NO. 182.3-16, CSA-C22.2 No.55-15, CSA-C22.2 No.111-10 (R2015), CSA-C22.2 N0. 144-M91 (R2015)) (AAM) |

NOTE:

This is a CONTROLLED Document. Any documents appearing in paper form are not controlled and should be checked against the on-line file version prior to use.

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**The on-line copy is the current version of the document.**

# GEneral

## Summary

### Comply with the requirements of Division 1 - General Requirements and Section 16010 - Electrical General Requirements.

### For component and system commissioning activities, refer to Section 01810 – Equipment Testing and Facility Commissioning. It is recognized that overall system commissioning activities highly depend on properly functioning and fully documented components as detailed in this Specification.

### [Products supplied, but not installed under Work of this Section:…]

### [Products installed, but not supplied under Work of this Section: …]

## Measurement and Payment

*[Choose one of the following payment language provisions that best suits the individual project.*

*If this Section is not specifically referenced by an item in the Bid Form, please use the following language:*

### The work of this Section will not be measured separately for payment. All costs associated with the work of this Section shall be included in the Contract Price.

*OR If this Section is specifically referenced in the Bid Form, use the following language and identify the relevant item in the Bid Form:*

### All costs associated with the work of this Section shall be included in the price(s) for Item No(s). \_\_\_ in the Bid Form.

*If the work of this Section is to be measured and paid for by several different methods, please amend the standard wording given above to reflect the different methods of measurement and payment.*]

## Related Sections

### [Under "Related Sections", identify other Sections that are related to, and/or dependent on, the work results or information specified elsewhere. The list should be limited to Sections with specific information that the reader might expect to find in this Section, but is specified elsewhere. For example, if hardware for aluminum entrances is specified in the aluminum entrance Section, a cross-reference would be appropriate in the finish hardware Section. The purpose of this cross-referencing is for information only, to aid in finding those other requirements—not to define the scope of the Section.

### Cross-referencing here may also be used to coordinate assemblies or systems whose components may span multiple Sections and which must meet certain performance requirements as an assembly or system.

### Contractor is responsible for coordination of the Work. Contractor is responsible for being familiar with and incorporating all required elements of cross-referenced Specifications cited.

### This Section is to be completed/updated during the design development by the Consultant. If it is not applicable to the section for the specific project it may be deleted.]

### [List Sections specifying installation of products supplied but not installed under this Section and indicate specific items.]

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: Execution requirements for ...[item]... specified under this Section.

### [List Sections specifying products installed but not supplied under this Section and indicate specific items.]

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: Product requirements for ...[item]... for installation under this Section.

### Section 01250 – Substitutions

### Section 01425 – Computerized Maintenance Management System Data Requirements

### Section 01810 – Equipment Testing and Facility Commissioning

### Section 16010 – Electrical General Requirements

### Section 16031 – Inspection and Testing

### [Division 13 – SCADA and Instrumentation -insert applicable specifications]

### Product requirements for [item]... for installation under this Section.

## References

### American National Standards Institute (ANSI)

#### ANSI/IEEE C62.41.1-2002 (R2008), IEEE Guide on the Surge Environment in Low-Voltage (1000 V and less) AC Power Circuits (Category B where applicable)

#### ANSI/IEEE C62.41.2-2002/Cor 1-2012, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits Corrigendum 1: Deletion of Table A.2 and Associated Text (Category B where applicable)

#### ANSI/IEEE C62.41.2-2002, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000V and Less) AC Power Circuits (Category B where applicable)

#### ANSI/IEEE C62.45-2002 (R2008), IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits

### Canadian Standards Association (CSA)

#### Ontario Electrical Safety Code, 26th edition, 2015

#### CSA-C22.2 No.42-10 (R 2015) General Use Receptacles, Attachment Plugs and Similar Wiring Devices.

#### CSA-C22.2 No. 144-M91 (R2015), Ground Fault Circuit Interrupters.

#### C22.2 NO. 182.3-16, Special Use Attachment Plugs, Receptacles and Connectors.

#### CSA-C22.2 No.42.1-13, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

#### CSA-C22.2 No.55-15 Special Use Switches.

#### CSA-C22.2 No.111-10 (R2015), General-Use Snap Switches (Bi-national standard, with UL 20).

#### CSA-C22.2 N0. 144-M91 (R2015) - Ground Fault Circuit Interrupters

# PRODUCTS

## General

### Equipment Enclosures: Compatible with the room or area environment where the equipment is located and unless otherwise indicated in the Contract Documents, shall be in accordance with Section 16010 – Electrical General Requirements.

### Substitutions for any equipment cited in these Specification Sections are permitted providing they conform to Section 01250 – Substitutions. The Region promotes the consideration of innovative new Products and cost effective Products meeting the requirements of these Specification Sections.

### Finishes: Unless otherwise indicated in the Contract Documents, factory finish all equipment inside and outside with ANSI/ASA #61 grey paint.

## Manual Motor Starters.

### Manual motor starters: Single or multi-pole as indicated in the Contract Documents, quick-make, quick-break, manual reset, trip indicating handle, with one overload device in each ungrounded phase conductor, toggle operated, [with red pilot light indicating that the starter is ON].

### Integral kW (horsepower) manual motor starter: NEMA size M-1 minimum. [Consultant to confirm if EEMAC standards are to be applied and revise the subsection as required. The Consultant will review the standards and approve any references to EEMAC standards in order to meet the Region’s energy efficiency objectives.]

### Individual Magnetic Motor Starters and Contactors

### Motors shall be classified as premium motors (efficient class of motors).

### Magnetic motor starters: [Combination type], [full voltage], [reduced voltage] or [multi-speed type], reversing or non-reversing, NEMA Size 1 minimum, rated for system fault capacity [as indicated]. Intermediate NEMA sizes are not acceptable.

### Overload relays: Adjustable, ambient temperature compensated, manually resettable from enclosure door, one element for each ungrounded phase.

### Overload relay heaters: Field installed, selected to match installed motor nameplate data.

### Contactor: Electrically drawn in and held.

### Reversing starters: Contactors mechanically and electrically interlocked.

### Circuit disconnecting means: Circuit breaker [fusible] [or] [non-fusible] [disconnect switch] as indicated in the Contract Documents.

### Fusible switch fuse holders: Suitable for [HRC1-J] fuses.

### Motor starter circuit breaker: Molded case, with adjustable magnetic only trips. Coordinate with thermal overload device.

### Mechanical interlock: Prevent opening of the door when disconnecting device is in the ON position.

### Control transformer: Fused 120 V secondary winding, un-fused leg grounded.

### Auxiliary contacts: In addition to contacts indicated in the Contract Documents, a minimum of one normally open and one normally closed spare contact with separate poles.

### Operator devices: Heavy duty, industrial, oil tight, functions as indicated in the Contract Documents (pushbuttons, selector switches and indicating lights), rated 120 V AC, wired to terminal blocks.

### Indicating lights: push-to-test clustered [120 V LED lamps] replaceable from the front without disconnecting power.

### Heater and lighting contactors: Similar to magnetic motor starters, but without thermal overload devices.

### Heater and lighting circuit breakers: Molded case, with integral thermal magnetic trips, interrupting rating [18,000 A] RMS symmetrical minimum at [600] V.

### Internal power wiring: Stranded copper, minimum #12 AWG, rated 600 V, sized to accommodate the largest load that the starter is capable of switching.

### Control wiring: Stranded copper, minimum #14 AWG, 600 V rated. Utilize extra flexible conductors for wiring to panel doors. The Consultant will ensure proper distinction between control wiring and power wiring in order to ensure the proper wiring is specified for the appropriate application.

### Wire identification: Oil-resistant, Type Z markers at conductor ends.

### Adhesive cloth or Mylar types will not be accepted.

### Terminal blocks: Compression type, modular, 25 A, 600 V minimum, identified with numbers identical to wire numbers. Supply a minimum of six spare terminal blocks.

### Maximum number of wires under each terminal screw: Two.

### Wiring and schematic diagram: Permanently mounted inside enclosure.

## Control Relays

### General purpose relays: Heavy duty, industrial, NEMA rated, electrically held, 120 V AC coil, minimum 10 A, 120 V AC convertible contacts, a minimum of 1 spare contact.

#### Acceptable Manufacturers:

##### Rockwell Automation Canada Ltd (Allen-Bradley Canada Ltd)

##### Square D Canada

##### Eaton Industries (Canada) Company

##### Omron Canada Inc.

##### ABB Inc.

##### Carlo Gavazzi (Canada) Inc.

##### Approved Equivalent.

### Timing relays: ON delay, OFF delay or Interval type [as indicated], [120 V AC] coil, minimum 10A, 120 V AC convertible contacts, knob adjustable timing, timing range as indicated in the Contract Documents.

#### Acceptable Manufacturers:

##### Rockwell Automation Canada Ltd (Allen-Bradley Canada Ltd)

##### Square D Canada

##### Eaton Industries (Canada) Company

##### Omron Canada Inc.

##### ABB Inc.

##### Carlo Gavazzi (Canada) Inc.

### Approved Equivalent.Double voltage relays: Convertible contacts, [number and type of contacts as determined by Consultant], metal barrier between coil and contact terminations.

### Thermistor relays compatible with the respective motor winding temperature sensors (thermistors).

## Panel boards

### Supply 600 V and 208/120 V panel boards from the same manufacturer.

### Circuit breaker type panel boards: Dead-front design, equipped with double or single row, bolt-on, thermal magnetic, non-interchangeable, molded case branch circuit breakers of the sizes and types indicated in the Contract Documents.

### Ratings: Unless otherwise indicated in the Contract Documents, circuit breaker panel boards and components shall have the following minimum (symmetrical) short circuit ratings:

#### 600 V Power Panel boards [18,000A]

#### 600/347 V Lighting Panel boards [14,000A]

#### 208/120 V Panel boards [10,000A]

### Fusible type panel boards: Dead-front, safety switch type, double row of fusible switches. Minimum assembly rating, 100,000 A symmetrical.

### Fusible switches: Quick-make, quick-break, heavy duty, industrial type with provision for padlocking in the OFF position and fuse holders suitable for High Rupture Capacity fuses type [HRC1-J].

### Bus bars: Tin-plated copper [equipped with solderless lugs for incoming cables where main circuit disconnecting device is not indicated.]

### Doors: With spring latches and cylinder locks keyed alike, two keys per panel board.

### Circuit directory: Framed Plexiglas enclosed legend, located on inside of door.

### 600 V power panel board enclosure size: To accommodate the equivalent of 42 single pole circuit devices minimum.

### Lock-on/lock-out devices: Minimum 10% of 15 A to 30 A circuits provided. Turn over unused devices to Region.

### Isolated ground bus: In designated panels as indicated in the Contract Documents.

### Ground fault protection circuit breakers: Class A type, 120 V, automatic shunt trip, with facilities for testing and resetting as indicated in the Contract Documents.

## Fuses

### Type: Unless otherwise indicated in the Contract Documents, HRC (high rupturing capacity) with fault interrupting capability of 200,000A symmetrical.

### Rating: [HRC1-J] [fast acting] [time delay] 600A maximum rating and [HRC1-L], [fast acting] for circuits exceeding 600A.

## Distribution Transformers

### Supply distribution transformers from the same manufacturer where indicated in the Contract Documents.

### Design: General purpose, dry type, ANN, 60 Hz, low sound level with vibration isolators, rating and voltages as indicated in the Contract Documents. [Two] [Four] [2½%] [5%] primary taps ([2]-FCAN, [2]-FCBN).

### Insulation: Class 185°C minimum with a maximum 80°C temperature rise in 40°C ambient, [epoxy encapsulated in damp, hazardous or outdoor areas.]

### Windings: Copper, delta connected primary, wye connected secondary with neutral grounding provision.

### Mounting accessories: Mounting brackets for wall or ceiling suspension as required.

### Enclosures: Ventilated, sprinkler proof [in office areas and electrical rooms;] and non-ventilated [in plant areas.]

## Convenience and Power Receptacles

### Heavy duty, specification grade, 15A or as indicated in the Contract Documents, [125V][250V][120V] AC, white, [single outlet][duplex], [polarized], [integral solid state ground sensing], [three][four][five] wire grounding.

### Welder receptacles: [Consultant to provide specifications if required, otherwise remove]

## Switch and Receptacle Cover Plates

### Flush mounted switches and receptacles in dry locations: Type 302 [430] stainless steel, 0.8 mm thick, with a brushed finish.

### Surface mounted, dry location switch cover plates: Cast ferrous alloy type, guarded, gasketted, DS32G.

### Wet, damp and corrosive area switch cover plates: Cast ferrous alloy, [epoxy coated,] gasketted, toggle type, DS185.

### PVC conduit system switch cover plates: Gasketted, PVC, toggle type, VSC 15/10 manufactured by IPEX Inc., or E98TSC.

### Receptacle outlet cover plates: Weatherproof, gasketted, cast ferrous or aluminum, with self- closing, spring loaded covers, WLR Series.

### PVC conduit system receptacle cover plates: Gasketted, PVC, with self-closing, spring loaded covers, W Series.

### Multi-gang outlets: [Except in office and finished areas,] multiple single-gang covers only. Multi-gang covers are not acceptable.

## Uninterruptible Power Supplies (UPS)

### Type: On-line, no-break, batteries continuously in circuit, with static bypass, suitable for powering the loads as indicated in the Contract Documents.

### Rating: Minimum kVA rating as indicated in the Contract Documents, [120][208] V AC, single phase, 60 Hz input, 120 V AC, single phase, 60 Hz output.

### Voltage regulation: ±5% maximum for line or load changes from 0 to 100% under any battery condition.

### Surge protection: Comply with the requirements of category B, ANSI/IEEE C62.41.1-2002, C62.41.2-2002/Cor 1-2012, C62.41.2-2002 and ANSI/IEEE C62.45-2002.

### Frequency: Input synchronized with supply, output 60 Hz ±0.5%.

### Total harmonic distortion: 5% maximum.

### Battery: Sealed, maintenance free, with a minimum 5-year life, rated to supply full load output at the rated voltage for a minimum of [10] minutes.

### Metering: Indicate the following:

#### AC Input Current

#### AC Output Current

#### AC Output Voltage

#### Output Frequency

#### DC Voltage

### Fault indication: One normally open and one normally closed, voltage free, common fault contact, 2 A, 120 VAC, for remote indication. Indicate individual faults locally.

### Input and output connections: Alternatives to hard wired connections to be considered for ease in replacement. Output from receptacles is not acceptable.

## Occupancy Sensors

### Occupancy sensors: Dual or quad element, passive infrared detectors, 3 wire, 120 V AC, rated to switch 1200 W [600 W] [electronic ballasted] fluorescent or incandescent loads, 30 second to 20 minutes field adjustable ON-time, field adjustable ambient light sensing, built-in OFF-AUTO-ON override switch.

## Flashing Lights

### Non-hazardous areas: 120 V AC, heavy duty, weatherproof, red lens, LED.

### Explosion proof areas: 120 V AC, approved for use in specific area, red lens, LED.

## Horn

### Non-hazardous area: 120 V AC, low current, high decibel, vibrating, heavy duty, weatherproof, field adjustable output range, 78-103 dB at 3040 mm.

### Hazardous area: 120 V AC, low current, high decibel, vibrating, 100 dB at 3040 mm.

## Smoke Detectors

### Design: Dual ionization chambers, 85 dB at 300 mm piezo electric alarm, visual power on and alarm indicator.

### Supply: 120 V, single phase, 60 Hz.

### Auxiliary contacts: Form C, rated 120 V AC, 2A minimum.

## Main Power Failure Relay (Three Phase)

[Consultant to provide details]

## Switches

### 15 A, 120 V, single pole, double pole, three-way, four-way switches as indicated in the Contract Documents in accordance with CSA-C22.2 No.55-15 and CSA-C22.2 No.111-10 (R2015).

### Manually-operated general purpose alternating current switches with the following features:

#### Terminal holes approved for No. 14 AWG wire.

#### Silver alloy contacts.

#### Urea or melamine molding for parts which are subject to carbon tracking.

#### Suitable for back and side wiring.

#### Ivory toggle – office areas.

#### Brown toggle – non office areas.

### Use switches from the same manufacturer throughout the Work.

## Receptacles

### Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, in accordance with CSA-C22.2 No.42-10 (R2015)with the following features:

#### Ivory, brown urea molded housing.

#### Suitable for No. 14 AWG for back and side wiring.

#### Break-off links for use as split receptacles.

#### Eight back wired entrances, four side wiring screws.

#### Triple wipe contacts and riveted grounding contacts.

#### Manufacturer’s specification grade.

### Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with the following features:

#### Ivory, brown urea molded housing.

#### Suitable for No. 14 AWG for back and side wiring.

#### Four back wired entrances, 2 side wiring screws.

#### Manufacturer’s specification grade.

### Other receptacles with the amperage and voltage as indicated in the Contract Documents.

### Use receptacles from the same manufacturer throughout the Work.

### Receptacles shall be sized according to the related lighting panel branch circuit breaker.

## Selector Switch

.1 Maintained unless otherwise indicated, labeled as indicated, heavy duty, 30mm diameter oil-tight standard operators, contact arrangement as indicated.

.2 Provide number of positions and contact arrangement as shown on the drawings.

.3 Contact blocks: Heavy duty silver to silver butting type contacts, and on low voltage (24 VDC or less) circuits: gold plated contacts rated 0.5 A at 115 VAC.  Make before break where required.

.4 LOCAL-REMOTE switches shall be make-before-break.

.5 Electrical rating: Equal class, division and group rating of the area.

.6 Where the contact blocks switch analog (4-20 mA) and 24 VDC or less, provide contact material of gold or gold flashing over silver.

.7 [Manufacturer: Refer to the Bill of Materials on the panel drawings. Consultant to confirm and amend as required]

## Special Wiring Devices

### Ground fault receptacles shall be supplied and installed as shown on the Contract Drawings and in accordance with the Ontario Electrical Code for wet areas.

### Ground fault receptacles shall in accordance with CAN/CSA-C22.2 NO. 144-M91 (R2015), Ground Fault Circuit Interrupters.

### Supply and install 240/208V receptacles where shown on the Drawings. Breaker style GCCI or short cord with GFCI incorporated.

### Special use switches shall be in accordance with CSA-C22.2 No.55-15, Special Use Switches.

## Cover Plates

### Cover plates for wiring devices shall be in accordance with CSA-C22.2 No.42.1-13, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

### Use cover plates from the same manufacturer throughout the Work.

### Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

### Stainless steel, 1 mm thick cover plates, with a thickness of 2.5 mm for wiring devices mounted in flush-mounted outlet boxes.

### PVC cover plates for wiring devices mounted in surface-mounted FS (Fitting Shallow) or FD (Fitting Deep) type conduit boxes.

### Receptacles and switches in unfinished areas shall be complete with cover plates to match related boxes.

### Cover plates shall be provided for all blanked off outlets.

### One piece gang plates shall be used at locations where more than one device is to be mounted adjacent to each other.

### Weatherproof, double lift, spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated in the Contract Documents.

### Weatherproof cover plates complete with gaskets for single receptacles or switches.

# EXECUTION

## Manual Motor Starter Installation

### Provide manual starters as indicated in the Contract Documents.

### Flush-mount manual starters in concealed conduit areas.

## Individual Magnetic Motor Starter and Contactor Installation

### Provide starters and contactors as indicated in the Contract Documents.

### Connect auxiliary control devices.

## Panel board Installation

### Provide panel boards of type and size indicated in the Contract Documents.

### Terminate and connect field wiring.

### Provide fusible panel boards complete with fuses.

### For ground fault protected circuits, wire in accordance with the manufacturer's recommendations.

## Fuses

### Install fuses in mounting assembly before energizing circuit.

### Verify that the fuses physically match mounting devices. Where fuses and holders do not match, replace the holder.

### Provide sizes and types of fuses in accordance with ESA requirements.

## Distribution Transformer Installation

### Provide distribution transformers, mounted in the upright position, as indicated in the Contract Documents. Verify that wall or ceiling is adequate to support transformer. For mounting on block or hollow walls, provide through-bolts with washers or plates. Provide additional bracing as required.

### Install transformer to permit full accessibility to wiring and tap connections. For floor mounted units, allow 150 mm clearance from walls or other equipment to permit adequate ventilation through and around the housing.

### Adjust vibration isolators for optimum noise suppression.

## Convenience and Power Receptacle and Light Switch Installation

### Provide receptacles and light switches as indicated in the Contract Documents. The locations of outlets shown on the electrical drawings are approximate. Measure the work on the Site [or from architectural and structural drawings] when accurate dimensions are required.

### Do not install outlets back-to-back in walls. Offset boxes by a minimum of 150 mm.

### Wire ground fault circuit interrupters in accordance with the manufacturer's recommendations.

### After interior finish is erected, make necessary adjustments without additional charge.

## Switch and Receptacle Cover Plate Installation

### Install cover plates after painting of room surfaces.

## Uninterruptible Power Supply

### Provide UPS as indicated in the Contract Documents.

### Carry out tests and start-up procedures as recommended by the manufacturer. Refer to Section 16031 – Inspection and Testing.

### Train the Region’s staff in all aspects of operation and maintenance of the UPS system.

### Refer to Section 01820 – Demonstration and Training.

## Occupancy Sensors

### Provide occupancy sensors as indicated in the Contract Documents.

### Adjust and calibrate in accordance with manufacturer's recommendations.

## Flashing Lights and Horns

### Provide flashing lights and horns as indicated in the Contract Documents.

### Adjust in accordance with the manufacturer's recommendations.

## Smoke Detectors

### Install smoke detectors as indicated in the Contract Documents.

### Interconnect the smoke detectors as recommended by the manufacturer.

## Installation

### Switches:

#### Install single throw switches with handle in the "UP" position when the switch is closed.

#### Install switches in gang type outlet box when more than one switch is required in one location.

### Mount toggle switches at the height specified in Section 16010 - Electrical General Requirements or as otherwise indicated on the Drawings.

### Receptacles:

#### Install receptacles in a gang type outlet box when more than one receptacle is required in one location.

#### Mount receptacles at the height specified in Section 16010 - Electrical General Requirements or as otherwise indicated on the Drawings.

#### Where the split receptacle has one portion switched, mount vertically and switch the upper portion.

## Cover plates:

### Protect the stainless steel cover plate finish with paper or plastic film until painting and all other work has been completed.

### Install suitable common cover plates where wiring devices are grouped.

### Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

## Commissioning

### For all commissioning activities on systems where components of this Section are integral to functionality, refer to Section 01810 – Equipment Testing and Facility Commissioning. All inspection and testing activities shall be completed in accordance with the Contract Documents and Section 16031 – Inspection and Testing and provided to the Consultant prior to the start of commissioning activities.

**END OF SECTION**