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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 22, 2011 | Minor edits |
| 4 | June 4, 2013 | Final Draft – Consolidated Comments Spec Update Project |
| 5 | July 10, 2013 | Incorporation of new Commissioning and Computerized Maintenance Management System Data Requirements Specification cross references. Incorporated several enhancements from Newfoundland Labrador Specifications. |
| 6 | July 30, 2014 | Changes to reflect renaming of commissioning specification and final review (AV) |
| 7 | February 4, 2015 | Updated, Finalized Specification – Reference eDOCS #5630494 v8 (AV) and update to supplier official corporate name. |
| 8 | December 3, 2018 | iMCC standards update (MS) |
| 9 | November 30, 2021 | 2.2 Added ABB Electronic and Intelligent Overload Relays (BM, MS) |

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.

**For each project the Consultant is responsible for the correct application of the specifications and for updating and modifying all highlighted items, as well as updating and modifying those sections that are directly applicable to the project. All updates and modifications to this standard document are to be highlighted to the Region for review and acceptance on each project.**

**Notice:** This Document hardcopy must be used for reference purpose only.

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

# GENERAL

## Related Sections

* + 1. Sections:
       1. Section 01810 – Equipment Testing and Facility Commissioning
       2. Section 01820 – Demonstration and Training
       3. Section 16010 – Electrical General Requirements
       4. Section 16225 – Motor Control Centres

## Submittals

### The Contractor shall provide the following O&M documentation: manufacturers’ printed O&M documentation; installation instructions; specifications; operation manuals, including electrical drawings, and plumbing diagrams; sales literature; materials; and training materials as applicable.

### Comply with the requirements of Division 1.

### Provide all necessary licenses, permits, approvals and certificates required in order to complete the work.

### Submittals include but are not necessarily limited to Shop Drawings, Product Data, Samples and other Documents for Review and Submittals for Information Only.

### Indicate:

#### Mounting method and dimensions

#### Dimensioned outline drawings and conduit routing locations

#### Starter size and type

#### Unit description including amperage ratings, enclosure ratings, fault ratings, nameplate information, etc.

#### Layout of identified internal and front panel components

#### Enclosure types

#### Wiring diagram for each type of starter

#### Interconnection power and control diagrams

#### Product Data Sheets on all major components including but not limited to the following:

##### Contactors

##### Circuit breaker and fuse

##### Control power transformers

##### Pilot devices

##### Relay/timers

#### Test procedures shall be per manufacturer’s standards

#### The Contractor shall furnish copies of the manufacturer’s warranties.

* + 1. Include operation and maintenance data for each type and size of starter including:
       1. Service and Contact Information
       2. Starter and Operator Interface User Manuals
       3. Troubleshooting/Service Manuals
    2. Provide final as shipped drawings
    3. Provide a complete list of recommended list of spare parts for each different size and type of starter.

### Provide a complete list of parameters indicating;

#### Digital input assignment to align with schematics and control intent

#### Digital output assignment to align with schematics and control intent

#### Identify digital outputs that are to be controlled from the PAC

#### Analog input assignment to align with schematics and control intent

#### Analog output assignment to align with schematics and control intent

#### Ethernet/IP parameter setup for reading digital inputs from the PAC

#### Ethernet/IP parameter setup for writing digital inputs from the PAC

#### Ethernet/IP parameter assignment for communication with the PAC

#### Ethernet/IP parameter setup for reading power, fault, and/or additional information from the PAC to align with the SCADA software requirements.

### Indicate

#### Starter Firmware revision

#### Starter EDS revision

## Measurement And Payment

.1 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.

## Warranty

### Refer to Division 1, the Articles of Agreement and the General Conditions for warranty details. Where a conflict exists between these requirements and additional requirements within Division 16, the Contractor shall meet the more stringent requirement.

### The warranty for products supplied under this section shall be by a local Canadian distributor in the Province of Ontario.

## References

### NEMA Contactors and motor-starters.

### Underwriters Laboratories

#### CUL

### National Electrical Manufacturer’s Association (NEMA)

### Canadian Standards Association International – CAN/CAS-C22.2 No. 14-05

# PRODUCTS

## Manual Motor Starters

### Manual motor starters shall have a quick-make/quick-break toggle mechanism.

### One or three overload heaters, as appropriate with manual reset.

### Trip indicating handle.

### Pushbuttons: heavy duty, oil or dust tight as indicated, labelled as indicated.

### Indicating light: oil or dust tight as indicated, type and colour as indicated. Control devices mounted on panel door shall such as push-buttons, selector switches, pilot lights shall be according to the Region of York standards. Refer to Division 16 specifications for more details.

### Locking tab to permit padlocking in "ON" and "OFF" positions.

### Enclosure shall be rated NEMA 12 or 4x as indicated on the Contract Drawings.

### Acceptable Manufacturers: Allen Bradley, Eaton, or equivalent.

## Full Voltage Reversing and Non-Reversing Motor Starters

### Magnetic starters shall be equipped with double-break silver alloy contacts.

### Reversing starters shall consist of two (2) contactors and a single overload relay assembled together. The contactors shall be mechanically and electrically interlocked to prevent line shorts and the energizing of both contactors simultaneously

### Coils shall be permanently marked with voltage, frequency and part number

### Power and control terminal provided within starter.

### Control Transformer

#### Single phase, dry type, control transformer with primary Voltage as indicated and 120V secondary, complete with primary and secondary fuses, installed within starter enclosure.

#### Size control transformer for control circuit load plus 20% spare capacity.

### Provide paper copy as built wiring and schematic diagram inside starter enclosure.

### Control schematics to be provided in accordance with the Region of York standards. Provide CAD and PDF versions in electronic format. Files in PDF format shall be combined into a single package.

### Starter to include circuit breaker with level on outside of enclosure and provision for locking in the OFF position with up to 3 padlocks.

### Control devices as required by contract documents. Control devices mounted on panel door shall such as push-buttons, selector switches, pilot lights shall be according to the Region of York standards. Refer to Division 16 specifications for more details.

### Electronic Overload Relays for stand-alone field installed motor starters

#### Overload relay to be self-powered electronic type.

#### Selectable trip class

#### Phase unbalance.

#### NO and NC contacts provided on the relay.

#### Visual trip indication.

#### Overload to provide 5:1 FLA adjustability range.

#### Manual and automatic reset capabilities.

### Acceptable manufacturers: Allen Bradley, Eaton, ABB or equivalent.

### Intelligent Overload Relays for motor starters mounted inside intelligent MCC

#### Provide intelligent overload relays (IOR) where indicated on drawings for each starter and/or where indicated on the drawings for protection, control and monitoring of equipment.

#### The IOR shall be UL Listed and CSA certified. IOR to meet UL 60947-4-1, IEC/EN 60947-4-1 and CSA 22.2 #60947-4-1 standards

#### The relay shall not require external current transformers for applications up to 136 amperes for motors rated less than 600VAC. Where larger motors are involved, external current transformers shall be used.

#### The IOR shall come with LED status Indicators to indicate IOR Fault and Warning conditions.

#### The IOR shall have selectable trip classes from 5 to 30 minimum.

#### The IOR shall have both manual and automatic reset mode.

#### The IOR shall have non-volatile memory back-up.

#### The IOR shall provide the following protection features:

##### Overtemperature Protection

##### Voltage and Current Phase Loss

##### Stall

##### Jam

##### Underload

##### Current imbalance

##### Ground Fault

##### Phase Rotation

##### Overvoltage

##### Undervoltage

##### Voltage Imbalance

##### Frequency Deviation

##### Power Factor Deviation

#### The IOR shall provide the following monitoring features:

##### Current monitoring (Phase, Average, Imbalance)

##### Voltage Monitoring (L-L, L-L avg, Phase Order, Imbalance)

##### Frequency

##### Power (kW, kVA, kVAR, PF, kWh, kVAh, kVARh)

##### Device Status

##### Operating Time

##### Time to Trip

##### Time to Reset

##### PTC Status

##### Run Time

##### Number of Starts

##### Thermal Memory

##### Snapshot Trip

#### The IOR shall have onboard I/O, 4 Digital Input, 3 Relay Output minimum. Additional I/O shall be provided either through IOR expansion modules or stand-alone modules as indicated on the contract drawings.

#### The IOR to have a display unit that can be mounted on the MCC/panel door. Display unit shall be powered from the IOR module. Display units requiring a separate power source will not be accepted. Display unit shall have the following features:

##### Status LEDs that indicate a Fault or waring condition

##### Monitoring window to display current, voltage, power, thermal and other motor system parameters.

##### Ability for customer to program and customize the device using the interface.

##### Fault description on screen if fault event occurs.

##### Reset button.

#### Communication

##### Fully functional communication capabilities for interface with Ethernet/IP

#### Acceptable Manufacturers

##### Acceptable Manufacturers are listed in the following table in no order or preference. The Contractor is responsible for all costs associated with any changes required to the design to accommodate an alternate manufacturer.

|  |  |  |
| --- | --- | --- |
|  | Manufacturer | Model |
| 1 | Allen Bradley | E300 |
| 2 | Eaton | C441 |
| 3 | ABB | UMC100.3 |
| 4 | Or Equivalent |  |

First Named Manufacturer:

|  |  |
| --- | --- |
| Manufacturer | Allen Bradley |
| Model | E300 |
| Control Module | 120VAC, I/O and Protection (193-E10GP-22-120) |
| Sensing Module | Voltage/current/ground fault |
| Communication Module | Ethernet/IP (193-ECM-ETR) |
| Operator Interface Module | Yes (193-EOS-SDS + cable) |
| I/O Digital Expansion Module | 4in/2out (193-EXP-DIO-42-120) |
| Power Supply Expansion Module | 193-EXP-PS-AC (only required if more than one expansion module is added) |

Second Named Manufacturer:

|  |  |
| --- | --- |
| Manufacturer | Eaton |
| Model | C441 |
| Operating Voltage | 120VAC |
| Sensing Capabilities | Voltage/current/ground fault |
| Communication Module | Ethernet/IP (C441R) |
| Operator Interface Module | Yes (C4411 + cable) |
| I/O Digital Expansion Module | 4in/2out (C441R) |

Third Named Manufacturer:

|  |  |
| --- | --- |
| Manufacturer | ABB |
| Model | UMC100.3 |
| Operating Voltage | 120VAC |
| Sensing Capabilities | Voltage/current/ground fault |
| Communication Module | Ethernet/IP (EIU32.0) |
| Operator Interface Module | Yes (UMC100-PAN + cable) |
| I/O Digital Expansion Module | 6in/4out (UMC100.3) + 8in/4out (DX1XX) |

## Wiring

### Unless otherwise specified, minimum sized starter power wiring shall be #12 AWG copper. For motor starter larger than EEMAC Size 1, size conductors in accordance with the Ontario Electrical Safety Code requirements.

### All wiring shall be marked at both ends.

## Finishes

### Apply finishes to enclosure in accordance with Section 16010 – Electrical General Requirements

## Equipment Identification

### Provide equipment identification in accordance with Section 16010 – Electrical General Requirements.

### Provide nameplates indicating system voltage, current, phases and interrupting capacity.

### Warning nameplates: Lamacoid, 5 mm white lettering on red background, indicating

#### Presence of live circuit.

#### Disconnect power before opening.

#### All other warning nameplates as necessary to ensure safe operation.

### Mount on access doors and internal compartment doors or barriers.

## Spare Parts

### Provide the listed spare parts for each different size and type of starter:

#### 1 contactor.

#### 1 contacts, auxiliary.

#### 1 control transformer.

#### 2 fuses.

#### 2 indicating lamps of each type.

# EXECUTION

## Installation

### The following installation requirements are in addition to or deviations from the requirements set forth for instrumentation in Section 16010 – Electrical General Requirements.

### Installation shall be in compliance with all manufacturer requirements, instructions and drawings.

### Ensure correct fuses and overload devices elements are installed.

### The Contractor under the technical direction of the manufacturer’s service representative shall perform the following minimum work.

#### Inspection and final adjustments.

#### Operational and functional checks of starter and spare parts.

### Refer to the contract drawings for I/O allocation and configuration.

### Control schematics to be provided in accordance with the Region of York standards. Provide CAD and PDF versions in electronic format. Files in PDF format shall be combined into a single package.

### Control devices mounted on panel door shall such as push-buttons, selector switches, pilot lights shall be according to the Region of York standards. Refer to Division 16 specifications for more details.

## Start-up

### Upon completion of onsite installation, Vendor shall conduct their own functional tests and assist in functional tests for integration into overall SCADA system with the Region’s SCADA System Integrator to comply with Section 01810 – Equipment Testing and Facility Commissioning.

### Contractor shall retain the services of a qualified manufacturer's employed Field Service Technician to assist the Contractor in installation and start-up of the equipment specified under this section. Field Service personnel shall be factory trained with periodic updates and have experience with the same model of Starter on the job site. Sales representatives will not be acceptable to perform this work. The manufacturer's service representative shall provide technical direction and assistance to the Contractor in general assembly of the equipment, installation as specified in manufacturer’s installation instructions, wiring, application dependent adjustments, and verification of proper Starter operation. The Technician are required to assist in the below during start-up to allow for PAC and/or SCADA System Integration;

#### Configure communications module.

#### Confirmation that all discrete and analog signals (both new and existing) to be transmitted to and from the units are available and functioning correctly.

#### Verification that the units are capable of working as specified.

#### The Contractor is to conduct their own I/O check and equipment verification. Contractor completed and signed off I/O Checksheets and equipment verification sheets are to be completed and submitted to the Consultant for review.

#### Assist SCADA System Integration to complete I/O check to verify field wiring from field device to Starter I/O to the PAC.

#### Verification that all interlocks are functioning as intended and in the correct mode of operation.

#### The equipment testing is to be conducted / witnessed by the facility Start Up Team consisting of the Consultant, the Contractor’s System Integrator, Region PCS Group and Region Operations Group and instrument suppliers as required.

#### Electronic copies of all parameter settings for each drive to be provided.

## Starter Verification

### Conduct manufacturer's recommended tests and start-up procedures.

### IP assignments shall be provided by the Consultant (as obtained from the Region).

### Field check supplied prior to commissioning equipment. As a minimum, the start-up service shall include:

#### Check of control circuits

#### Ensure all connections are tight

#### Perform pre-Power Check

#### Megger Motor Resistances: Phase-to-Phase and Phase-to-Ground

#### Verify system grounding per manufacturer’s specifications

#### Verify power and signal grounds

#### Check connections

#### Verify NEMA rating and construction of panel is suitable for the environment (check temperature, humidity, dust, etc. of installation location)

### Power-up and commissioning checks:

#### Measure Incoming Power Phase-to-Phase and Phase-to-Ground

#### Measure AC Current Unloaded and Loaded

#### Measure Output Voltage Phase-to-Phase and Phase-to-Ground

#### Verify correct overload operation.

#### Verify overload readings with a separate measurement device **For Intelligent IOR**

#### IR Scan under load. Perform thermograms at all connections, plus heat sinks, body, etc. Record ambient temperature and temperature rise above ambient. Compare information will every other subsequent inspection. Compare with the specifications for maximum temperature above ambient and maximum operating temperature.

### All measurements shall be recorded.

### For intelligent overload relays parameter listing shall be provided in printed and electronic copy in PDF format. IOR configuration shall include functionality to upload the parameter file to the IOR and HIM. After commissioning, upload parameter listing into IOR and HIM.

### Measure and record motor amps, under load conditions and compare with full load amps and motor service factor. Report any excessive readings and unbalance. Measure voltage as close to motor terminals as possible while motor is running.

### Set all motor circuit protectors to the minimum level which will consistently allow the motor to start under normal starting conditions.

## Field Quality Control

### The Contractor shall ensure that the starter supplier will provide the services of a factory representative on Site for the purpose of start-up, tuning, calibration and commissioning. Refer to Section 01810 – Equipment Testing and Facility Commissioning.

### Operate switches, contactors to verify correct functioning.

### Perform starting and stopping sequences of contactors and relays.

### Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

## Training

### Provision shall be made for a period of demonstration and training as specified in Section 01820 – Demonstration and Training.

### Train the Region’s staff in aspects of starter operation, maintenance and start-up procedures.

#### Training to include two (2) sessions of four (4) hours duration and to be completed by manufacturer's representative.

#### Training program to include operation, troubleshooting and maintenance.

**end of section**