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| --- | --- | --- |
| Version | Date | Description of Revisions |
| 1 | December 3,2018 | Initial specification release. iMCC standards update. (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

### [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.

### 

### 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.

### [List Sections specifying related requirements.]

### Sections:

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

#### Section 01430 – Operation and Maintenance Data

#### Section 01600 – Material and Equipment

#### Section 01740 – Cleaning

#### Section 01810 – Equipment Testing and Facility Commissioning

#### Section 01820 – Demonstration and Training

#### Division 01 – General Requirements (insert applicable specifications)

#### Division 11 – Equipment (insert applicable specifications)

#### Division 40 – Process Interconnections (insert applicable specifications)

#### Division 15 – Mechanical (insert applicable specifications)

#### Division 16 – Equipment (insert applicable specifications)

#### Design Guidelines Section 17 – Operation Manual Guideline

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

* 1. Submittals
     1. 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.
     2. Comply with the requirements of Division 1.
     3. Provide all necessary licenses, permits, approvals and certificates required in order to complete the work.
     4. Submittals include but are not necessarily limited to Shop Drawings, Product Data, Samples and other Documents for Review and Submittals for Information Only.
     5. Indicate:
        1. Mounting method and dimensions
        2. Dimensioned outline drawings and conduit routing locations
        3. RVSS size and type
        4. Unit description including amperage ratings, enclosure ratings, fault ratings, nameplate information, etc.
        5. Layout of identified internal and front panel components
        6. Enclosure types
        7. Wiring diagram for each type of RVSS
        8. Interconnection power and control diagrams
        9. Product Data Sheets on all major components including but not limited to the following:
           1. Contactors
           2. Circuit breaker and fuse
           3. Control power transformers
           4. Pilot devices
           5. Relay/timers
        10. Test procedures shall be per manufacturer’s standards
     6. The Contractor shall furnish copies of the manufacturer’s warranties.
     7. Include operation and maintenance data for each type and size of RVSS including:
        1. Service and Contact Information
        2. RVSS and Operator Interface User Manuals
        3. Troubleshooting/Service Manuals
     8. Provide final as shipped drawings
     9. Provide a complete list of recommended list of spare parts for each different size and type of RVSS.

### 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

#### Drive Firmware revision

#### Drive EDS revision

## 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:*

.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.

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

.1 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.*]

## 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 40, 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 (UL508C: Power Conversion Equipment)

#### UL

#### CUL

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

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

# PRODUCTS

## General

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

### Design Requirements

#### Modular, solid state, modular Reduced-Voltage Soft Starter (RVSS) consisting of a logic component and an SCR power unit.

#### Suitable for operation on plant electrical power system, controlled locally or remotely as indicated.

#### Obtain motor data and coordinate characteristics of driven equipment with RVSS system, regardless whether motor is supplied under this Contract or by The Region or is part of existing plant.

## RVSS range from 300HP to 3000HP

### RVSS to meet all performance and functional requirements as outlined in this specification.

### Acceptable Manufacturers

#### Acceptable Manufacturers are listed in the following table in no order or preference. The design has been completed around the first named supplier. 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 | MV SMC Flex |
| 2 | Eaton | AMPGARD MV4S |
| 3 | Approved Equivalent |  |

#### The Contractor shall select the appropriate options to suit the application and the requirements of the Section.

#### Where an alternate manufacturer is provided, they shall meet the performance specifications of the first named manufacturer.

## RVSS range from 300HP to 3000HP

First Named Manufacturer:

|  |  |
| --- | --- |
| Manufacturer | Allen Bradley |
| Model | MV SMC Flex |
| Voltage | 4160V, 3 phase [consultant to confirm] |
| HP/KW | 100-3000HP [consultant to confirm] |
| Enclosure Type | NEMA 1/12 [consultant to choose] |
| PF Correction Capacitors | [to be determined by consultant] |
| HIM Module | 20-HIM LCD module |
| \*Intelligent I/O Option | 4 DI and 4 DO |
| Communication | Ethernet/IP adapter 20-COMM-E |

***[\*Note to Consultant– For I/O requirements over and above those provided in the standard drive, the Consultant is to coordinate with the Region and/or Manufacturer for further options.]***

Second Named Manufacturer:

|  |  |
| --- | --- |
| Manufacturer | Eaton |
| Model | AMPGARD MV4S |
| Voltage | 4160V, 3 phase [consultant to confirm] |
| HP/KW | 100-3000HP [consultant to confirm] |
| Enclosure Type | NEMA 1/12 [consultant to choose] |
| PF Correction Capacitors | [to be determined by consultant] |
| HIM module | Programmable keypad/operator with 2 lines x 20 character backlit LCD |
| \*Intelligent I/O Option | 4 DI and 5 DO |
| Communication | EtherNet/IP |

***[\*Note to Consultant– For I/O requirements over and above those provided in the standard drive, the Consultant is to coordinate with the Region and/or Manufacturer for further options.]***

## Manufactured Units

### Enclosure: Compartmentalized, steel, EEMAC 1/12 Design ***[Consultant to confirm]***, completely front accessible to internal components and wiring connections. Enclosure to be of an arc flash resistant design verified to meet IEEE C37.20.7. Enclosure to be of Type 2B with arc-resistance at front, back and sides of the enclosure with the low voltage compartment door open Structure to be reinforced to contain arc flash material and arc faults up to [30kA/40kA] ***[Consultant to confirm].***

### Access doors: Hinged with automotive type door handles and three point latches, key operated with two sets of keys. Interlock door opening mechanism with main disconnecting device operating handle.

### Ventilation openings: Size to dissipate heat at full RVSS capacity, vermin proof screens, sprinkler proof louvers and drip shields.

### Cooling fans: Minimum additional 25% extra capacity. Cooling fans shall be thermostatically controlled and field adjustable.

### Location of expendable parts, (fuses and similar items): Close to front for ease of replacement.

### Conduit/cable entry points: Top and bottom. ***[Consultant to confirm]***

### Cable support: cable support clips.

### Ground bus: Tin plated copper.

### Finish: Exterior, primed and two coats ASA #61 grey factory standard epoxy enamel or powder coat; interior, matte white and in accordance with Section 09901 Factory Applied Protective and Maintenance Coatings.

### Primary Disconnect Device

#### Main power disconnecting device: Isolating switch with current limiting fuses and interlocked input vacuum contactor, rated for full load current of drive.

#### The isolating switch shall be an externally operated manual three-pole type, such that in the open position it grounds and isolates the starter from the line connectors. Integral mechanical interlocks shall prevent entry into the high-voltage areas while the starter is energized and shall block accidental opening or closing of the isolating switch when the door is open or the contactor is closed.

#### The fuses shall incorporate special time/current characteristics for motor service allowing proper coordination with the contactor and overload relay for maximum motor protection.

#### Both the input and bypass contactors must include contact wear indicators or feeler gauges in order to easily check wear with no special tools are required.

### Isolating switch handle: Operable from outside without opening cubicle doors, mechanically interlocked to prevent door from being opened with disconnect in ON position. The isolating switch handle shall have provisions for padlocking in the open position.

### Fuses and similar protection devices: As recommended by RVSS manufacturer.

### Control Transformer: Dry type, fused primary and secondary windings, sized for 125% of maximum system control circuit requirements, including external circuits.

### The RVSS must include a separate low voltage control compartment isolated from the high voltage portion.

### The RVSS shall include low voltage wireways for low voltage wiring.

### Secondary voltage: 120V, 60 Hz.

### The RVSS shall be CSA/cUL listed.

### Spare parts for each type of RVSS shall be provided with the unit. Spare parts shall include, but not be limited to:

#### Fuses of each type used in the complete assembly.

#### Current transformers for each size use.

#### Control power transformer of each size used.

#### Four (4) indicating lamps

#### One (1) of each type of circuit board used.

#### Two (2) SCR units and heatsinks

#### One HIM module

## Performance Requirements

### Environmental conditions: Ambient operating temperature range 0°C to 40°C, humidity range 5% to 95% RH non-condensing, altitude 1000 m maximum above sea level.

### Efficiency: minimum 99.94% with bypass.

### Short Circuit Rating: minimum 50kA RMS Symmetrical.

### The controller to provide selectable operating functions as described below:

#### Soft start to provide a smooth stepless starting, adjustable 0 to 30 seconds.

#### Current limit/initial torque adjustable between 200-600%.

#### Kick Start, adjustable 0-2 seconds.

#### Full voltage start to achieve full inrush current and locked rotor torque.

#### Initial torque adjustable from 5 to 85%.

#### Pump control ramp time adjustable from 0-30 seconds.

#### Soft Stop adjustable from 1-60 seconds.

### Fully rated vacuum bypass contactor to operate when the motor has reached full speed. The vacuum bypass contactor will bypass the SCR power unit and reduce unnecessary heat loss during normal motor operation.

### Overload protection with selectable trip classes.

### The controller to provide diagnostic and protective features including, but not limited to:

#### Overload

#### Stall

#### Jam

#### Temperature Fault

#### Undervoltage

#### Overvoltage

#### Phase Reversal

#### Starts per hour lockout

#### Shorted SCR

#### Ground Fault

### LCD display with keypad for adjustment of parameters.

### Motor: Furnish RVSS to match motor and driven equipment characteristics. Confirm motor details from motor supplier.

### Power Factor Correction Capacitors: Furnish power factor correction capacitors on RVSS’s based on motor data to ensure minimum 0.9 power factor. Power factor correction capacitors shall be automatically disabled when operating on generator power***[Consultant to confirm].***

### Internal components, including printed circuit boards: corrosion protected.

### Resetting after a fault: By reset input and by re-issuing the Run command. Resetting by removing RVSS input power not acceptable.

### Restart after a power outage or low voltage condition: Automatic with ten second delay when powers returns to normal, if run command is maintained.

## Front Mounted Human Interface Module (HIM)

### RVSS shall provide a HIM with integral LCD display, operating keys and programming keys.

### The operator shall be able to scroll through the keypad menu to choose between the following:

#### Monitor

#### Operate

#### Configure

#### Protection Setup

#### Active faults

#### Advanced I/O Setup

#### Network Setup

#### LCD DIM Setup

### The RVSS shall have the necessary I/O interface to meet the status and control functionality as shown on the contract drawings.

## Communication

### Fully functional communication capabilities with integrated Ethernet/IP interface.

## Wiring

### Unless otherwise specified, minimum sized power wiring shall be #12 AWG copper. Refer to Section 16120 Wiring Systems for conductor and other wiring requirements. For units larger than EEMAC Size 1, size conductors in accordance with the Canadian Electrical 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.

### RVSS 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.

# 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.

### Provide the services of a qualified manufacturer's employed Field Service Engineer 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 RVSS 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 RVSS operation.

### 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 RVSS and spare parts.

### The contractor shall certify that he has read the RVSS’s manufacturer’s installation instructions and has installed the RVSS in accordance with those instructions.

## Factory Acceptance Test

### Notify the Consultant three (3) weeks in advance, in writing, of the time, date and place of the factory tests. The initial test may be attended by the Consultant and/or client representatives for RVSS’s 300HP and above. All costs by Consultant and client representatives to be carried by the Contractor. Any subsequent witness tests required to obtain acceptance shall be at the expense of the Contractor, but under the direction of the Consultant. Include all costs applicable to witness testing.

### The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of UL and NEMA standards.

#### The RVSS shall be put through a motor load test before inspection and shipping.

#### Provide a full functionality test of all controls and features before inspection and testing.

#### Dielectric Test (Hi Pot) per NEMA ICS 3 Part 2 at 2000 volts plus 2.25 times nominal voltage, for 60 seconds, phase-to-phase and phase-to-ground.

### The manufacturer shall provide three (3) certified copies of factory test reports.

## 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 406121.30 Process Control System Site Acceptance Testing.

## 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.

## RVSS Verification

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

### Field check RVSS’s 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.

#### Megger bus.

#### 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:

#### Apply medium voltage to the RVSS and perform operational checks.

#### Run the drive motor system throughout the operational range to verify proper performance.

#### IR Scan under load:

#### .1 Perform thermograms at all connections, plus heat sinks, body, etc.

#### .2 Record ambient temperature and temperature rise above ambient.

#### .3 Compare information with every other subsequent inspection.

#### .4 Compare with the specifications for maximum temperature above ambient and maximum operating temperature. Refer to latest ANSI/NETA standards.

#### .5 Provide documentation that the individual that performed the IR scan is a certified Level 2 thermographer.

### All measurements shall be recorded.

### RVSS shall be tuned for system operation.

### RVSS parameter listing shall be provided in printed and electronic copy in PDF format. RVSS configuration shall include functionality to upload the parameter file to the RVSS and HIM. After commissioning, upload parameter listing into RVSS 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 RVSS 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 RVSS operation, maintenance and start-up procedures.

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

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

end of section