ROCKWELL AUTOMATION® PROCUREMENT SPECIFICATION

**PROCUREMENT SPECIFICATION**

**FLEXLINE**™ **3500 Low Voltage IEC**

**Motor Control Centers**

**NOTICE:** The specification guidelines in this document are intended to aid in the specification of products. Specific installations have specific requirements, and Rockwell Automation does not recommend or intend any specific application from the guidelines that are provided here. Because of the variety of uses for this information, anyone responsible for applying this information is also responsible to help confirm the acceptability of each application and appropriate use of the guidelines. In no event is Rockwell Automation liable for misuse, misapplication, or reliance on these guidelines with any specific application. Rockwell Automation also disclaims indirect or consequential damages that result from the use or application of this information.

**Note:** To download a Microsoft Word (.doc) version of this procurement specification, see <https://www.rockwellautomation.com/en-us/support/product/product-selection-configuration/procurement-specifications.html> under the Motor Control Centers section.**TABLE OF CONTENTS**

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1. **GENERAL**
   1. SCOPE OF SPECIFICATION
      1. This specification defines the minimum requirements for the design, materials, fabrication, assembly, inspection, test, paint, preparation for shipment, and supply of an IEC Motor Control Center.
      2. The equipment must be installed indoors and designed for continuous operation.
      3. The equipment can include, but not be limited to, the package as identified in the accompanying specifications and all accessories that are required for a complete assembly.
   2. REFERENCES
      1. Definitions

The terms that are used in this specification are defined as follows:

|  |  |
| --- | --- |
| **Term** | **Definition** |
| BUYER | The respective client. |
| COMPANY | The respective client or Engineering Firm/OEM. |
| CONTRACTOR | The person or company that agrees to install an IEC motor control center or to provide or install specialized portions of the installation. |
| INSPECTOR | Those individuals who act for the COMPANY on all matters that relate to quality control, any tests, examination, validation, and acceptance of work that is done by any VENDOR. |
| ORIGINAL MANUFACTURER | Organization that has conducted the original design and the associated verification of an assembly in accordance with the relevant assembly standard. |
| ASSEMBLY MANUFACTURER | The organization taking the responsibility for the completed assembly.  Note: The ASSEMBLY MANUFACTURER can be the same or another organization to the ORIGINAL MANUFACTURER |
| VENDOR | The equipment supplier and their subcontractors or suppliers. |
| MODULE (M) | 1M or 1 Module = 192 mm |

* + 1. Codes, Standards, Regulations, or Specifications
       1. Interpret the following codes as the minimum requirements applicable to the subject work, and no statement that is contained in this specification can be construed as limiting the work to such minimum requirements. The latest editions of codes that are listed must govern the work.

1. IEC 61439-1& -2: 2020, Low-voltage switchgear and control gear assemblies –
2. IEC 60204-1: 2016 +AMD1:2021, Safety of machinery - Electrical equipment of machines – Part 1: General requirements
3. AS/NZS 61439.1&.2 2016  
   1. PRE-MANUFACTURE SUBMITTALS
      1. MANUFACTURER Drawings
         1. MCC elevations that show dimensional information including details such as, but not limited to, the following:
4. MCC height (less any removable lifting angles or eyes)
5. MCC width
6. MCC depth
7. Location of shipping splits
   * + 1. Structure descriptions that show the following:
8. Bus ratings
9. Enclosure ratings
10. Short circuit withstand ratings
11. Other information as required for approval
    * + 1. Conduit and cable locations
        2. Required bus splices
        3. Unit descriptions including, but not limited to, starter sizes, circuit breaker frame sizes, circuit breaker continuous ampere ratings, and pilot devices
        4. Nameplate information
        5. Schematic Wiring diagrams
        6. ASSEMBLY MANUFACTURER drawings must be provided in DWG format
        7. ASSEMBLY MANUFACTURER drawings do not need to be stamped if a drawing schedule is provided that lists the drawing numbers, revision levels, and status of drawings (such as Preliminary, Approval, and Final)
      1. Product Data
         1. Data sheets and publications on all major components, including, but not limited to, the following:
12. Motor starters
13. Overload relays
14. Circuit breaker and fuse information, including time current characteristics
15. Variable frequency drives
16. Soft starters
17. Control power transformers
18. Pilot devices
19. Relays
    * 1. Specification Response
         1. All clarifications and exceptions must be clearly identified.
      2. Installation Instructions (User Manual)
         1. Provide a copy of the installation instructions from the ORIGINAL MANUFACTURER including additional requirements from the ASSEMBLY MANUFACTURER:
20. Receiving, handling, and storage instructions
21. General description for reading nameplate data, serial numbers, and short circuit ratings
22. Installation procedures including splicing procedures
23. Conduit and cable installation
24. Installing and removing withdrawable units
25. Operation of operator handles and unit interlocks
26. Checklist before energizing
27. Procedure for energizing equipment
28. Maintenance procedures
    1. FINAL SUBMITTALS
       1. The CONTRACTOR must provide certification that:
          1. The MCC has been installed in accordance with the installation instructions from the ASSEMBLY MANUFACTURER, and with the local codes and standards that govern MCC installations.
       2. Final Drawings
          1. The ASSEMBLY MANUFACTURER must provide final drawings that reflect the “As-Shipped” state of the MCC documents previously sent.
          2. ASSEMBLY MANUFACTURER drawings must be provided in DWG format.
          3. ASSEMBLY MANUFACTURER drawings do not need to be stamped if a drawing schedule is provided that lists the drawing numbers, revision levels, and status of drawings (such as Preliminary, Approval, and Final).
          4. The CONTRACTOR is responsible for any changes to the “As-Shipped” drawings from the ASSEMBLY MANUFACTURER to reflect any field modifications.
       3. Test reports that indicate standard testing are performed by the ASSEMBLY MANUFACTURER.
       4. Maintenance Data
          1. MCC installation instructions.
          2. Installation/operation instructions for major components.
          3. MCC recommended spare parts list and prices.
          4. Name and phone number for a local supplier who can provide spare parts.
    2. QUALITY ASSURANCE
       1. The MCC must be designed, manufactured, and tested in facilities that are registered to ISO 9001 quality standards.
       2. Type testing must be verified by KEMA or DEKRA, and Certificates must be available upon request.
       3. The VENDOR must be fully aware of this specification, plus any referenced document.
    3. CLEANING
       1. At the time of shipment, the equipment must be clean inside and outside.
       2. All waste (such as metal chips or filings, weld stubs, wire fragments, dirt, rags, debris, and any other foreign material) must be removed from the interior of each component. All mill scale, rust, oil, grease, chalk, crayon, or paint marks and other deleterious material must be removed from all interior and exterior surfaces.
    4. DELIVERY, STORAGE AND HANDLING
       1. All openings must be provided with protection to help prevent damage, corrosion, and entrance of foreign matter during storage and shipment.
       2. Each MCC assembly must be divided into a shipping block, if necessary, as designated on the single-line drawings. Each shipping block must be protected during shipment by a plastic wrapping for moisture protection and a rigidly braced framework for mechanical protection. All loose parts must be crated or boxed for shipment and appropriately identified.
       3. Equipment must be shipped in shipping blocks from the ASSEMBLY MANUFACTURER that are fully assembled, prewired, and with all components in place, as far as practicable.
       4. VENDOR must provide handling and installation instructions to BUYER.
    5. WARRANTY
       1. Defective components must be replaced by VENDOR under the terms of the Vendor Warranty for one year.
29. **MOTOR CONTROL CENTER SPECIFICATIONS** 
    1. IEC MCC STRUCTURE
       1. The IEC MCC must consist of one or more shipping blocks that are bolted together to form a rigid, freestanding assembly that is designed so future shipping blocks can be added without significant fabrication or interruption of service.
       2. The MCC must be enclosed on all sides. Use of a key or tool is necessary to remove barriers or open enclosures or to remove parts of enclosures,
       3. Units within each vertical column must be based on module spacing approximately 192 mm high to allow the installation of up to 27 (1Mx1M) modules no less than 40 A per unit.
          1. Any given column can house one or multiple fixed units and withdrawable units.
       4. Each vertical column of the motor control center must be provided with a bottom-mounted horizontal cable compartment that extends the full depth of the column, with front, removable-access cover. In addition, each structure must be provided with a 3M (624 mm) or 4M (816 mm) deep front access vertical cable compartment. For rear access cable compartments, a 1M (192 mm) deep rear cable compartment shall be utilized. All cable compartments must be isolated from all buses and units. Vertical cable compartments must have a separate access door for the full height of the vertical Column.
       5. Painting must be according to standards by the ORIGINAL MANUFACTURER.
30. Before painting, all rough edges must be ground smooth.
31. The external structure is given a corrosion class C2 high according to ISO 12944-6 rust resistant coating and Epoxy-Polyester powder, light gray 7035
    * 1. Cable entrances into the motor control center must be from either the top or bottom. Provide flange for customer cable landing in the field.
      2. When the doors are open, a person on the operating side of the equipment must not be exposed to live parts.
      3. Foam Gasketing for covers are not acceptable. Gasketing shall be formed rubber.
      4. For flexibility of layout, a standard shipping block must be available in widths of 3M (~624 mm) to 10M (~1968 mm)
      5. MCC columns must be 3M (~624 mm) or 4M (~816 mm) deep.
      6. Rear access shall be available for all columns increasing depth by no more than 1M (192 mm)
      7. Columns depth may be staggered, provided the main bus is continuous in the same plane.
      8. Lifting shall be done with removable lifting eyes or with 2” pipe through holes in the lower plinth and strapping.
    1. FORM OF SEPARATION
       1. Internal isolation and separation must exist between the following:
          1. Bus System and the Cable compartment
          2. Bus System and Units
          3. Units and cable compartments
          4. Individual units
       2. Up to Form 4b Type 7 as an option
    2. MOUNTING CONFIGURATIONS
       1. The MCC must be available in front-only or dual-front configurations.
       2. Front-only shipping blocks must be joined and installed side by side.
       3. Dual-front columns must be comprised of two separate columns joined at the rear. The two columns must have separate, power bus systems that provide the same phasing on units, both front and rear. Full use of unit space must be available for the front and rear columns. The horizontal power bus must be linked, front to rear, with an installed bus splice assembly.
    3. CABLE COMPARTMENTS
       1. Horizontal cable compartments must be at the bottom of each MCC column.

1. The bottom horizontal cable compartment must be no less than 192 mm high.

2. Horizontal cable compartments must extend the full width and depth of the MCC.

3. Horizontal cable compartments must have removable front covers that are held in place by screws.

* + 1. Horizontal cable compartments must be isolated from the power bus. Horizontal cable compartments for incoming line sections must maintain isolation from the incoming line area.
    2. The vertical cable compartment must be on the right side or the rear of each column, where used, and must extend from the top main busbar compartment to the bottom horizontal cable compartment.
    3. The vertical cable compartment must be isolated from the power bus and must be independent of unit space.
    4. Vertical cable compartments must not be present for frame-mounted, full-column units.
    5. Vertical cable compartments must be covered with a steel cover or door. Doors must be held in place by door latches.
    6. Optional cable supports for use in vertical cable compartments must be available.
  1. POWER BUS
     1. Incoming Power

1. MCC incoming line voltage must be up to 690V, 3-phase, and 50/60 Hz.
2. 3-wire and 4-wire systems shall be available. If the system is a 4-wire solution, TN-S grounding is required; TN-C is not sufficient.
3. The bus shall not require drilling or holes for splicing.
   * 1. Short Circuit Withstand
        1. The power bus system must be supported, braced, and isolated by bus support.
        2. Bus bracing shall be a minimum of 50 kA rms symmetrical, with 65 kA, 80 kA and 100 kA rms symmetrical available.
4. Horizontal Power Bus
   * + 1. Standard, horizontal power-bus material must be unplated or tin-plated copper per the ORIGINAL MANUFACTURER with a capacity up to 6000 A.
       2. The power bus must be continuous in each column or shipping block.
       3. Horizontal power-bus splicing must be accomplished with a splice kit of the same ampere rating as the horizontal power bus.
       4. To help ensure the reliability of the splice connections, both ends of the horizontal bus splices must have at least two bolts. Bolts must be machine torqued and require no periodic maintenance.
       5. The spacing of the horizontal busbars shall be 33 mm or larger.
     1. Vertical Power Bus
        1. Vertical power-bus material must be unplated or tin-plated copper per the ORIGINAL MANUFACTURER with a capacity up to 2000 A.
        2. Vertical power busbars must be flat with provisions for optimum contact with the unit plug-in stabs utilizing low insertion force.
        3. 3-wire and 4-wire systems shall be available.
        4. Horizontal spacing between the vertical power busbars must be 33 mm or larger.
        5. Options shall be available to split the vertical power bus into lower ampacity stabs with higher density units.
     2. Neutral Bus
        1. The horizontal neutral bus, when specified for 4-wire systems, must be provided across the full width of the MCC and must be located in the same compartment as the horizontal power bus.
        2. The neutral bus must match the material and specifications of the power bus.
        3. The vertical neutral bus must be mechanically joined to the horizontal neutral bus and must have provisions for a neutral contact for withdrawable unit stabs where necessary throughout the length of the column.
        4. The space between the horizontal power busbars and horizontal neutral busbar must be 33 mm or larger.
        5. The space between the vertical power busbar and vertical neutral busbar must be 33 mm or larger.
        6. The neutral bus must be braced the same way as the horizontal and vertical power bus.
     3. Automatic Shutters
        1. Automatic shutters must open as withdrawable units are inserted and must close by using non-gravitational mechanisms when the unit is removed.
        2. Automatic shutters Must be lockable.
   1. PROTECTIVE EARTH CONDUCTOR
      1. The cross-section of protective conductors (PE) in an ASSEMBLY for connection of outer protective conductors shall be determined in one of the flowing ways:
         1. The cross-sectional area of the protective conductor shall be not less than stated in IEC / EN 61439-1, 8.4.3.2.3
         2. Or the cross-sectional area of the protective conductor shall be calculated through a formula from IEC / EN 61439-1, Annex B
         3. Each cable compartment shall have a ground bus, no drilling in the bus is permitted
         4. Where a protective conductor is common to several circuits, the cross-sectional shall be dimensioned in relation to the largest cross-sectional area of the phase conductors.
      2. Terminals for the PE-Conductors
         1. A separate terminal of adequate size shall be provided for the outgoing PE-Conductor(s) for each circuit.
         2. The terminals shall be suitable for the material of the conductors (Cu/Al) and shall have no other function.
      3. Identification of the PE-Conductor
         1. The protective conductor shall be readily distinguishable by:
            1. Shape and /or
            2. Location and / or
            3. Marking and / or
            4. Color (green/yellow must be used)
   2. MAIN INCOMING SECTION
      1. Air Circuit Breaker or Molded Case Circuit Breaker
         1. All main incoming units must be front accessible.
         2. Main ACB must be withdrawable.
         3. All main incoming units must be 3-pole or 4-pole.
         4. The main incoming section must contain removable protective barriers on the line side to help reduce the possibility of accidental contact with line terminals.
         5. The main incoming section must have provisions for power metering with communication capabilities.
   3. UNITS
      1. Unit Design
         1. For flexibility of design and use, a column must accept units of different types, such as VFD, DOL, DOLR, MCB, FCB, FD, and RVSS. Fixed and withdrawable units are permissible in the same column.
         2. VFD units must have Filter, Line & Load reactor options available within the units.
         3. DOLs/DOLRs must be available with electronic overload protection.
         4. In fixed units, line, load, PE, network, and control connections must be made directly within the unit to dedicated terminals.
         5. Units must be of modular dimensions so units of the same size can be interchanged without modification in the structure.
         6. Units shall offer provisions to be uniquely keyed to help prevent accidental insertion.
         7. Units shall have a provision for digital HIM where space allows.
      2. Withdrawable Unit Design Features
         1. Withdrawable units must consist of the unit, unit housing, and unit door/cover.
         2. Withdrawable units must be held securely in the column when inserted.
         3. Withdrawable units must be designed with an interlock to help ensure that units cannot be inserted or withdrawn when the disconnect means is in the ON/I position.
         4. Tools shall not be required to fully remove or insert withdrawable units (with the exception of door latches).
         5. Withdrawable units must have a locking mechanism to secure the unit in a test position.
         6. Detents must be present to help confirm that the unit is secured in one of the operating positions.
         7. Withdrawable units must have withdrawable line, load, control, network, and protective earth (PE) connections. Load connections and up to 60 outgoing control connections from these units must be made in the vertical cable compartment (front or rear access is available).
         8. Withdrawable units must have four operating positions: connected, test, disconnected, and withdrawn.
5. **Connected** - In the connected position, the line, load, control, network, and PE connections must be engaged. To engage the interlock or to turn the disconnect means to the ON/I position, the unit must be fully inserted and the door must be closed.
6. **Test** - In the test position, the control, network, and PE connections must be engaged. Line-side connections must be disconnected. Units can be locked in this position.
7. **Disconnected** - In the disconnected position, the unit remains housed in the column, but power/control connections are not present. It must be an isolated position with PE maintained. Units can be locked in the disconnected position.
8. **Withdrawn** – Withdrawn units are fully removed from the columns and must be isolated from all connections.
   * 1. Operating Handle Mechanism
        1. An industrial, heavy duty, rotary operating-handle mechanism must be supplied for control of the disconnecting means in each unit.
        2. When the unit door is closed, the handle can be engaged with the disconnect means.
        3. The operating handle can be locked in the OFF/O position with up to three 8 mm diameter shackle padlocks.
        4. The operating handle can be modified to enable locking in the ON/I position.
        5. The unit operating handle must be interlocked with the unit door to help prevent opening the unit door unless the disconnect means is in the OFF/O position.
        6. An externally operated defeater must be provided for access to the unit without interrupting service.
        7. The operating handle must be interlocked with the unit so the unit cannot be inserted or withdrawn with the operating handle in the ON/I position.
     2. Unit Disconnect Means
        1. The unit main switch must be available as a circuit breaker or disconnect. Withstand ratings for combination starter units must be based on what short-circuit protective devices and components are selected.
     3. Circuit Breakers
        1. Circuit breakers must be provided as the disconnecting means for units that are specified with a main switch for the circuit breaker unit.
        2. Motor circuit protectors must be used for combination motor-control units.
        3. Motor protection circuit breakers or molded case circuit breakers must be used for feeder units.
     4. Power Stab Assembly
        1. The power cable connection at the plug-in stab must be made with lower maintenance cost, screw or crimp-style connection. There must be no exposed wiring at the back of the unit between the disconnecting means and the plug-in stabs. Unit plug-in power stabs must be free-floating and self-aligning.
     5. Neutral Stab Assembly
        1. The neutral stab assembly must have the ability to be supplied on withdrawable units when a 4-wire TNS system is required. The neutral stab assembly must have the same design and features as the power stab assembly.
     6. Protective Earth Contact
        1. A stainless-steel PE contact must be provided on withdrawable units. This contact must establish a connection with the PE circuit before other connections are made and must be the last withdrawable connection to be disconnected.
     7. Nameplates
        1. Nameplates must be secured by using two steel screws or rivets.
     8. Pilot Devices
        1. Space shall be available for multiple pilot devices (buttons, selector switches) mounted on a unit door / cover. Pilot devices must be equipped with a quick-connect plug to easily connect and disconnect control wiring. If a pilot device is removed, closing plates or plugs must be available to cover the opening in the unit door and provide isolation.
     9. Unit Doors / Covers and Door Latches
        1. Each unit with doors must be able to be opened beyond 90°.
        2. To maintain the external IP enclosure rating, unit doors must either stay attached to the structure when units are removed so they can be reclosed, or a blank door / cover must be provided if the door / cover remains attached to the unit when the unit is removed.
        3. The door must be hinged on the left side so that it opens away from the vertical cable compartment.
        4. Unit doors can be removed from any location on the MCC without other unit doors being disturbed.
        5. Pilot devices and low-profile, external reset buttons for overload relays must be mounted to the unit door / cover.
        6. Door latches must be provided on unit and vertical cable compartment doors to hold the door closed and isolate the column.
        7. Door latches can be locked or released by rotating the latch ¼ turn. The door latch head must indicate the position of the latch.
     10. Control Power
         1. Unit control power must be one of the following: 110V AC; 115V AC: 120V AC;   
            220V AC; 24V DC wired with a minimum size of 1.5 mm2.
     11. Power Wire
         1. Power wire must be copper and rated for 125 °C (257 °F) with a minimum size of 6 mm2.
     12. Communication Networks
         1. Each MCC unit must have network-communication capabilities to retrieve individual unit data and/or provide unit control functionality. Capabilities include DOLs, DOLRs, FCBs, RVSS, VFDs, and Mains.
         2. Withdrawable units within the MCC must maintain the tool-less withdrawable feature, including the communication network connections.
         3. The configuration must allow the removal of multiple units without disrupting communication to remaining units.
         4. Each MCC must communicate on the EtherNet/IP network protocol.
         5. Network cabling must be separated from the bus compartments and outgoing cable compartments.
         6. When a TCP/IP configuration is selected, the managed switches are provided and installed in the MCC columns by the ASSEMBLY MANUFACTURER before shipment.
         7. The network and node assignments of each MCC lineup are preconfigured and tested by the ASSEMBLY MANUFACTURER before shipment.
         8. All network configuration data must be available to the customer before the MCC is shipped.
         9. Network Cabling
9. Network communication cables must be protected with a heavy outer jacket for dielectric strength. There shall be no requirement for special separation, barriers, or internal conduit.
   * + 1. EtherNet/IP communication must be embedded in each unit of the MCC by using “Cable Tray Rated” 600V Ethernet cable and managed switches in each column.

Network Cable Layout:

1. For the EtherNet/IP network, each unit with a network connection must have a cable routed to a switch by the ASSEMBLY MANUFACTUER.
2. The addition or removal of a unit from the system must not interrupt the operation of other units in the system.
   * + 1. Power Supply
3. The network system within the MCC must require a power supply that provides 24V DC.
4. This power supply must be supplied with a buffer for enhanced ride-through performance.
   * + 1. EtherNet/IP System Performance
5. The EtherNet/IP system in the MCC must be designed to operate at 100 megabaud to maximize performance.
6. The EtherNet/IP system in the MCC must be qualified to communicate and perform under normal and adverse electrical environments, for example, contactor electrical operation, contactor jogging duty, and unit short-circuit fault.
7. Each unit must be provided with an EtherNet/IP component. Starter units must be provided with an E300™ Electronic Overload Relays. Contactor units must be provided with an EtherNet/IP POINT I/O™ system. AC drives must be provided with an EtherNet/IP communication module. Solid-state controllers must be provided with EtherNet/IP communication modules and, in some instances, an EtherNet/IP POINT I/O™ system. Fusible disconnect and circuit-breaker feeder circuits must be provided with an EtherNet/IP POINT I/O system.
   * + - 1. The Ethernet switches in the MCC architecture must support an optional,   
            switch-level ring topology (such as Resilient Ethernet Protocol) to provide a level of redundancy to the MCC lineup.
       1. Programming of Parameters
8. The EtherNet/IP address (node address) and subnet address must be programmed by ASSEMBLY MANUFACTURER for each unit as specified by the BUYER. All other parameters are left at the factory default setting.
9. The Ethernet switch in the MCC architecture must support a mechanism to automatically set device Ethernet IP addresses when a new device is connected to a switch port.

**PART 3** **EXECUTION**

3.01 INSTALLATION

* + 1. The BUYER must install the MCC in accordance with instructions from the ORIGINAL MANUFACTURER.
    2. The BUYER must tighten field connections, including but not limited to bus connections and mechanical fasteners to the torque requirements of the ORIGINAL MANUFACTURER.
    3. The BUYER must select and install fuses in fusible switches that are based on field requirements without exceeded design limits.
    4. The BUYER must adjust circuit breaker settings that are based on field requirements.
    5. The BUYER must adjust solid-state overloads to match the installed motor characteristics.

3.02 MANUFACTURER’S SERVICES

* + 1. The ASSEMBLY MANUFACTURER of the MCC must be able to provide an option for the programming for the programmable logic controller, E300 Overloads, RVSS, VFDs and the operator interface if provided within the MCC.
    2. The ASSEMBLY MANUFACTURER of the MCC must provide an option for start-up services as part of the supply of the MCC.

3.03 TRAINING

* + 1. The ASSEMBLY MANUFACTURE shall provide an option for training. The course outline must be submitted as part of the MCC submittals if required.

END OF SECTION

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