SafeGear® Motor Control Center
Arc Resistant Metal-Clad Construction
Sample Specification
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SafeGear® Motor Control Center
Arc resistant Metal-Clad construction

1. General

Scope

A. The seller shall furnish the Arc-Resistant Motor Control Center (MCC) lineup as specified herein and as shown on the drawings for medium voltage 7.2kV, free-standing, metal-clad MCC with contactors.

B. The seller shall develop interlocks as required to implement the control strategies described and the protective relay philosophy indicated on the drawings.

C. Motor Control Center (MCC) shall be located indoors.

References

A. The metal-clad MCC and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of UL, IEEE, ANSI and NEMA.

B. Applicable Codes and Standards. The applicable codes and standards listed below should be considered as part of this specification. The latest revision in effect at time of inquiry shall apply for all standards referenced.

<table>
<thead>
<tr>
<th>UL</th>
<th>347 5th Edition</th>
<th>Medium-Voltage AC contactors, controller and control centers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50/50E</td>
<td>Enclosure for Electrical Equipment</td>
</tr>
<tr>
<td>IEEE</td>
<td>C37.20.2</td>
<td>Standard for Metal-Clad Switchgear</td>
</tr>
<tr>
<td></td>
<td>C37.20.7</td>
<td>Guide for Testing Metal-Enclosed Switchgear Rated up to 38 kV for Internal Arcing Faults</td>
</tr>
<tr>
<td>CSA</td>
<td>C22.2 No. 253-09</td>
<td>Medium-voltage AC contactors, controllers, and control centers</td>
</tr>
<tr>
<td></td>
<td>C22.2 No. 14</td>
<td>Industrial Control Equipment</td>
</tr>
<tr>
<td>PEMEX</td>
<td>NRF-146</td>
<td>Tableros de Distribucion en Media Tension</td>
</tr>
</tbody>
</table>

It shall be the manufacturer’s responsibility to be knowledgeable of these standards and codes.

Submittals

A. The following information shall be submitted to engineering during the drawing approval process.
1. Front View Elevation
2. Floor Plan
3. Top View
4. Single Line
5. Schematic Diagram
6. Component List
7. Conduit Entry/Exit Locations
8. Assembly Ratings, including:
   a. Short-circuit rating
   b. Voltage
   c. Continuous Current
   d. Basic Impulse level for equipment over 600 V

B. Unless otherwise specified, submit 2 copies of the above information.

9. Major component ratings including:
   a. Voltage
   b. Continuous Current
   c. Interrupting Ratings
10. Cable terminal sizes
11. Wiring Diagrams
12. AC Elementary Diagrams
Submittals after order completion

A. The following information shall be submitted for information purposes:
   1. Final as-built drawing and information
   2. Certified production test reports
   3. Installation information including equipment anchorage provisions
   4. Seismic Certification

B. Unless otherwise specified, submit 2 copies of the above information.

C. The manufacturer of the MCC must be the same manufacturer of the contactor assembly

Qualifications and quality assurance

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of 5 years.

Delivery, storage and handling

A. Equipment shall be handled and stored in accordance with manufacturer’s instructions.

B. Shipping groups shall be designed to be shipped by truck. Indoor groups shall be bolted to shipping bases. Contactors and accessories shall be packaged and shipped separately.

C. MCC equipment being stored prior to installation shall be stored to maintain the equipment in a clean and dry condition.

Operation and maintenance data

A. Unless otherwise specified, 2 copies of the equipment operation and maintenance manuals shall be provided. The seller shall also provide manual on a CD-ROM, which contains all manuals and drawings in PDF format.

B. Operation and maintenance manuals shall include the following information:
   1. Instruction books and/or leaflets
   2. Recommended Parts List
   3. Drawings and Information

Accesories

Provide the next accessories if they are required:

A. Racking crank
B. Contactor lift truck for the purpose of moving contactors from cell to cell.
C. Test jumper(s).

D. ABB SmartRack remote racking device.
E. Ground device.
F. Touch-Up paint, 12oz can, ANSI #61 color.
G. Mini fuses, fuse holders and mini breakers.
H. Heaters
I. Touch-Up paint, 12oz can, ANSI #61 color.

Spare parts

Provide the next accessories if they are required:

A. MV power fuses.
B. Primary and secondary potential transformer fuses.
C. Lamps and push buttons
D. Test Plugs
2. Products

MCC assembly and ratings

A. The metal-clad MCC shall consist of an indoor lineup for up to 7.2 kV.
B. The MCC described in this specification shall be designed for operation up to 7.2 kV, three phase, 3-wire, 60Hz system.
C. The MCC described in this specification shall contain factory assembled and operational tested contactors and accessories.
D. UL Labeled equipment shall be provided to the full extent that UL labels are applicable.
E. Each MCC shall have the following ratings, with continuous current ratings as specified on single line drawing.

<table>
<thead>
<tr>
<th>Type of construction</th>
<th>Type 1 Gasketed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arc-Resistant Accessibility Type</td>
<td>2B</td>
</tr>
<tr>
<td>Short-time withstand current (main bus)</td>
<td>50kA (2 sec)</td>
</tr>
<tr>
<td>Rated main bus current</td>
<td>1200 \ 2000 \ 3000 A</td>
</tr>
<tr>
<td>Rated Contactor Current</td>
<td>400 &amp; 720 A</td>
</tr>
<tr>
<td>Insulation Level/Power Frequency/ Lighting Impulse</td>
<td>7.2/20/60 kV</td>
</tr>
<tr>
<td>Rated main bus current</td>
<td>1200 \ 2000 \ 3000 A</td>
</tr>
</tbody>
</table>

F. MCC shall be certified for IBC.

Construction

A. The MCC assembly shall consist of individual vertical sections housing different combinations of contactors and auxiliaries, bolted to form a rigid metal-clad switchgear assembly. Two high arrangements are allowed to maximize space savings. Metal side sheets shall provide grounded barriers between adjacent structures and solid removable metal barriers shall isolate major primary sections of each circuit. Refer to drawings for any size limitations.
B. The stationary primary contacts shall be silver-plated and bolted within insulating bushings. A metal shutter shall automatically cover the stationary primary disconnecting contacts when the contactor is in the disconnected-test position and while removed from the cell.
C. Cubicles designated as future on the one line drawing shall be furnished with bus, current transformers, metering and relaying as per one line diagram. The cubicle shall be equipped for a future contactor element.
D. All metal work shall be free from burrs and sharp edges, and all exterior walls and doors shall be hem bent for strength and safety.
E. Each front door (Contactor & PT modules) shall be provided with a formed steel hinged door with screws and view window for observing the contactor or PT position. Each door shall have provisions for padlocking.
F. Instrument compartments shall be completely isolated from high voltage compartments.
G. The MCC shall be capable of extension from either end at a future date without modification to existing structural members.
H. The depth of the finished equipment shall be sufficient to allow for entrance, bending, and termination of power cables. Individual units shall be provided for either bottom or top entrance as specified.

Bus and bus supports

A. The main bus shall be copper and have epoxy Hysol insulation as standard. The bus supports between units shall be polymer.
B. The MCC shall be constructed so that all buses, bus supports and connections shall withstand stresses that would be produced by currents equal to the momentary ratings of the equipment.
C. All bus joints shall be silver/tin plated, bolted and insulated with epoxy molded boots secured with nylon fasteners.
D. The bus shall be braced to withstand fault currents equal to the close and latch rating of the contactors.
E. The temperature rise of the bus and connections shall be in accordance with IEEE standards and documented by design tests.
F. A tin plated copper ground bus shall extend the entire length of the switchgear.
G. The main bus pass through insulators and main bus stand-off insulator supports shall be polymer.
H. Compression type cable lug shall be furnished in cable compartments as shown on the single line drawings.
Surge arresters

A. Distribution class surge arrestors shall be provided as detailed on the single line diagram.

Wiring / terminations

A. The MCC manufacturer shall provide suitable terminal blocks for secondary wire terminations and a minimum of 20% spare terminal connections shall be provided. MCC secondary control wire shall be (minimum) #14 AWG (#12 for CT circuits) type SIS, 41 strand extra flexible, stranded copper or larger rated 600 volt, 90 degrees C, furnished with wire markers at each termination.

B. All control wiring shall be UL listed and have a VW-1 flame retardant rating. Wires shall terminate on terminal blocks with marker strips numbered in agreement with detailed connection diagrams.

C. Exposed wiring shall be suitable protected against contact with sharp edges. Throughout the assembly it must be neatly bundled and secured with nylon wire ties. Where control wiring passes from cubicle to door, it must be wrapped with suitable protection so as to prevent damage. Holes cut to allow control wires to pass from cubicle to cubicle will have a rubber grommet for protection.

D. Each control wire shall be marked at both terminations to agree with wiring diagrams. Plastic wire markers of either the slip on or heat shrink variety shall be provided.

E. Incoming cable lugs of the type and size shall be indicated on the single line drawings.

Contactors

A. The contactors shall be horizontal draw-out type, capable of being withdrawn. The contactors shall be operated by mechanical actuator mechanism. The primary disconnecting contacts shall be silver-plated copper.

B. Each contactor shall contain three vacuum interrupters separately mounted in a self-contained, self-aligning pole unit. The contactor front panel shall be removable when the contactor is withdrawn for ease of inspection and maintenance.

C. The secondary contacts shall be silver plated and shall automatically engage in the contactor operating and test positions.

D. Interlocks shall be provided to prevent closing of a contactor between disconnected and connected positions to trip contactors upon insertion or removal from the housing and to discharge stored energy mechanisms upon insertion or removal from the housing. The contactor shall be secured positively in the housing between and including the operating and disconnected positions.

E. Control voltage shall be selected with a rated auxiliary voltage of 115/120 or 230/240 VAC or 120/125 or 240/250 DC

F. Each contactor shall be complete with control switch and red and green indicating labels to indicate contactor contact position.

G. Control voltage circuit shall be fused or protected with a molded case circuit breaker. Fuse blocks shall be dead front, fingersafe type.

H. Each contactor shall have a minimum of 3 ‘a’ and 3 ‘b’ auxiliary contacts.

I. The continuous current capacity of each contactor shall be either 400 A or 720 A as dictated on the single line drawing.

J. The contactor bushings shall be mono-block epoxy.

K. The contactors shall have an opening time of 10-60 ms for the 400 A version and 35-85 ms for the 720A version.

L. Contactors of the same type, rating and control circuits shall be electrically and mechanically interchangeable.

M. The contactor shall have the following ratings:

<table>
<thead>
<tr>
<th>Contactor model</th>
<th>HCV-5HA</th>
<th>HCV-5HAL (Latched Type)</th>
<th>HCV-6KAU</th>
<th>HCV-6KA-LU (Latched Type)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Voltage</td>
<td>2400/4200/6900 V (7.2 kV Max)</td>
<td>2400V/4200/6900 V (7.2 kV Max)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated Current</td>
<td>400 A</td>
<td>720 A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interrupting Capacity</td>
<td>7000A RMS Symmetrical @5000V Max.</td>
<td>4500A RMS Symmetrical @7200V Max.</td>
<td>7200 A</td>
<td></td>
</tr>
<tr>
<td>Closing Time</td>
<td>50-110ms</td>
<td>80-120 ms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opening Time</td>
<td>10-60 ms</td>
<td>35-85 ms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated Control Voltage AC</td>
<td>115/120 or 230/240 V 50/60 Hz</td>
<td>100-240V AC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated Control Voltage DC</td>
<td>120/125 or 240/250 V</td>
<td>100-240V DC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N. Manual provisions shall be provided for contactor closing and tripping as an option. These provisions shall be mounted and easily accessible at the front of the contactor.
Protective relays

A. The MCC manufacturer shall furnish and install, in the metal-clad MCC, the quantity, type and rating of protection relays as indicated on the drawings and described hereafter in this specification. Unless otherwise approved, protective relays shall be manufactured by ABB and be of the Relion family.
B. In general, microprocessor based, multi-function and solid-state relays shall be provided.
C. Relays shall operate from the 5 A secondary output of current transformers.

Auxiliary devices

A. Current transformers shall be furnished as indicated on the contract drawings. The thermal and mechanical ratings of the current transformers shall be coordinated with the contactors. Their accuracy rating shall be equal to or higher than the IEEE standard requirements. The standard location for the current transformers on the load side shall be rear accessible to permit adding or changing current transformers. Shorting terminal blocks shall be provided on the secondary of all the current transformers.
B. Voltage and control power transformers of the quantity and ratings shown in the single line drawings shall be supplied. Voltage transformers shall be mounted on draw-out trucks with racking operations similar to contactor operation. The primary connections shall utilize solid bus bars or NATVAR. PT contacts shall use Delrin® arc quenching or any other recognized technology.
C. A mechanical interlock shall be provided to require the contactor to be open before the CPT truck or CPT primary fuse truck can be withdrawn.

MCC enclosure

A. The MCC shall consist of contactor and auxiliary units assembled to form a rigid, self-supporting, metal-clad structure. In each unit, major circuit components shall be completely enclosed by grounded metal barriers, including a front barrier as part of the contactor.
B. Each vertical section shall be provided with space heaters.
C. Power for space heaters, lighting, receptacles, and contactor control power shall be supplied by the owner.

Nameplates

A. Engraved nameplates shall be furnished for all main assemblies as indicated on the drawings. Nameplates shall be laminated plastic and secured with screws.
B. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.
C. The manufacturer shall not remove, reuse, alter or replace original equipment nameplates or equipment tags associated with equipment or components supplied by the manufacturer's suppliers and sub-suppliers.

Finish

A. All module side, floor and roof sheets shall be galvanized.
B. All doors/end panel assemblies shall be cleaned, rinsed and phosphatized prior to painting.
C. The MCC shall be painted ANSI 61 Gray as standard, other colours can be provided.
Accesories

A. Provide the following accessories with the MCC proposal:
   1. Contactor Lift Truck
   2. Racking handle and special tools required for maintenance
   3. Test plugs for ABB FT-1 Test Switches
   4. Test Jumper and Test Station

B. Provide a manual Ground and Test Device with the following characteristics:
   1. The ground and test device is a manual type.
   2. The G&T must feature the following:
      a. Terminal Set Barriers designed to prevent access to the ungrounded terminal set. A padlocking provision must be provided as a secure means to prevent the barrier from being inadvertently moved and exposing the ungrounded terminal set
      b. The device must be able to be inserted and withdrawn from the contactor compartment using the same mechanism as the contactor. This includes using the same lift truck and racking tools and being provided with a position indicator.
      c. The device must be equipped with mechanical interlock that coordinates with the contactor compartment. The device is blocked from being inserted into a contactor compartment where the required ratings exceed those of the G&T device.

3. Execution

Factory testing and examination

A. The following standard factory tests shall be performed on the contactor element provided by the manufacturer. All tests shall be in accordance with the latest IEEE standards.
   1. Alignment test with master cell to verify all interfaces and interchangeability.
   2. Contactors operated over a range of minimum to maximum control voltage.
   3. Factory setting of contact gap.
   4. One-minute dielectric test per IEEE Standards.
   5. Final inspections and quality checks.

B. The following production tests shall be performed on each contactor cubicle:
   1. Alignment test with master contactor to verify interfaces
   2. On-minute dielectric test per ANSI standards on primary and secondary circuits.
   3. Operation of wiring, relays and other devices verified by an operational sequence test.
   4. Final inspection and quality check.

C. The manufacturer shall supply 2 certified copies of factory test reports.

Installation

A. The installation contractor shall install all equipment per manufacturer’s recommendations and contract drawings.