Technical Data **TD02201001E**

Effective March 2018
Supersedes June 2012

Eaton's Omaha Power Center indoor metal-clad switchgear construction features

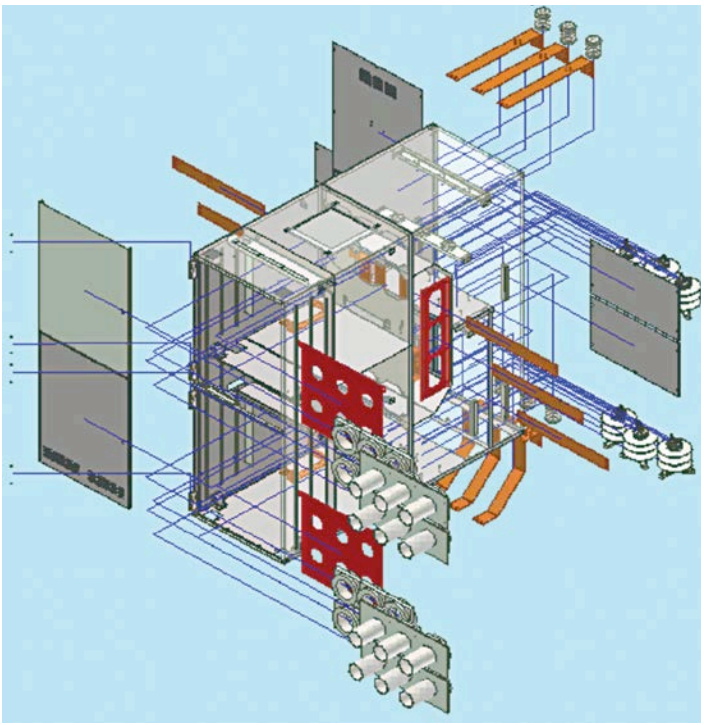
Contents

Powering Business Worldwide

Autodesk Inventor

Construction of Eaton indoor metal-clad switchgear begins with the use of the best available design tools. Eaton uses Autodesk Inventor® for development of its mechanical designs. Autodesk Inventor is a three-dimensional modeling program that will automatically check interferences to ensure all components and sub-assemblies fit together properly. It allows Eaton to view the complete assembly from all sides so they can optimize their design to take advantage of the most efficient fabrication and assembly methods.

Customer drawings can be prepared in AutoCAD® or MicroStation® format and can be supplied in the medium desired by the customer, including drawing files transmitted electronically or on a compact disc. Eaton can also use an FTP site for efficient exchange of technical information during the life of a project.

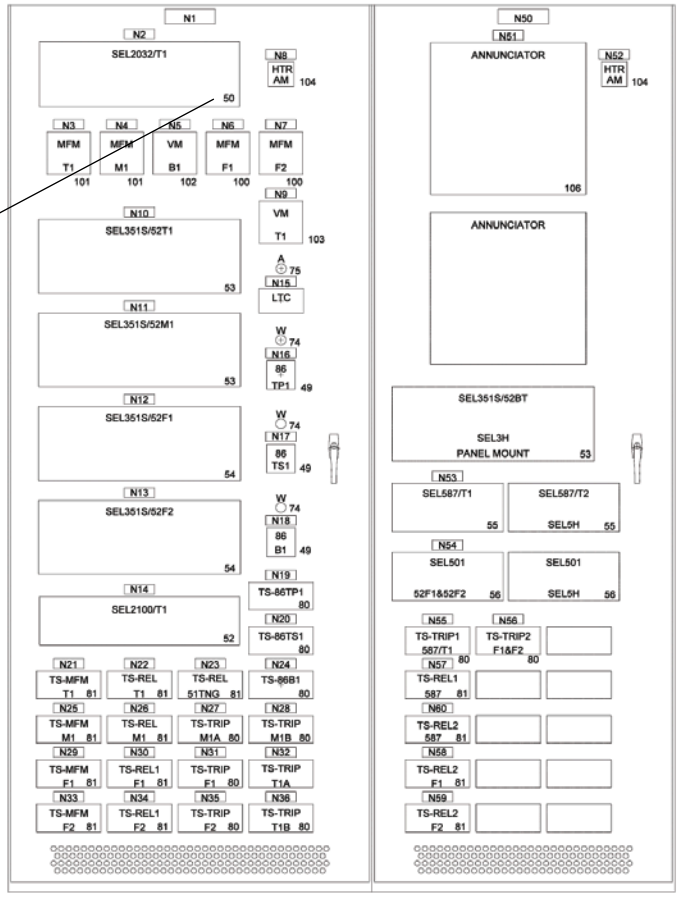


Bill-of-material callouts

Eaton's Omaha Power Center uses bill-of-material callouts on drawings so that customers can easily identify installed components. The callouts reference the bill-of-material item number so that technical information relating to operation, maintenance, or spare parts can be easily located.

Bill-of-material item description

Item	Qty	Description
50	1	Communications Processor Schweitzer SEL2032/T1 Cat. No. 203233X344XXXX Standard with SCADA RTU functions, remote access and plug-in protocol cards. Horizontal panel mount. Standard memory for database and settings storage with archive storage memory. Power supply input 85–140 Vac, output 38–200 Vdc, I/O board with four outputs, 16 inputs and input voltage of 125 Vdc.



Fabrication

Eaton's Omaha Power Center uses heavy-duty 11-gauge steel for fabrication of each switchgear cubicle. Steel is cut using a high-energy laser. Operation of the laser is completely automated with programming downloaded directly from Eaton's engineering server. The precision of the laser ensures that all pieces are cut to the correct size every time. The net result is pieces fit to exacting tolerances to ensure the cubicle is perfectly square. The smooth edges left by the laser allow excellent paint adhesion and prevent possible damage to wiring wherever it passes over or across metal surfaces.

Protective coatings

After fabrication is complete, all metal parts are cleaned under high pressure, followed by application of a protective phosphate coating. Each piece is electrostatically coated with polyester powder. The powder coating is fully cured after 20 minutes in a baking oven so that parts can be handled immediately. Powder coating provides superior coverage on edges and hard-to-reach areas. The table on **Page 4** compares the performance of the powder coat to polyurethane and acrylic enamel finishes in actual ASTM tests.

Pencil hardness (ASTM D3363) (resistance to marring and scratches)

6B … 5B … 4B … 3B … 2B … B … HB … F … H … 2H … 3H … 4H … 5H … 6H …
Softer Harder

Polyester powder	Polyurethane	Acrylic enamel
2H–4H	F–H	B–HB

Chip resistance (ASTM D3170) (resistance to chipping by impact)

3A–3D … 4A–4D … 5A–5D … 6A–6D … 7A–7D … 8A–8D … 9A–9D …
Worse Better

Polyester powder	Polyurethane	Acrylic enamel
5A	4A	3B

Impact resistance (ASTM D2794) (resistance to cracking under impact)

Direct impact

Polyester powder	Polyurethane	Acrylic enamel
+160 in-lbs	+75 in-lb	+30 in-lbs

Reverse impact

Polyester powder	Polyurethane	Acrylic enamel
+160 in-lbs	+40 in-lb	+10 in-lbs

Flexibility (ASTM D522) (cracking under bending)

Polyester powder	Polyurethane	Acrylic enamel
Pass	Pass	Fail

Salt spray (ASTM B117) (resistance to corrosion)

Polyester powder	Polyurethane	Acrylic enamel
2X	1X	1X

Accelerated weathering (QUV340A) (gloss retention and color fastness)

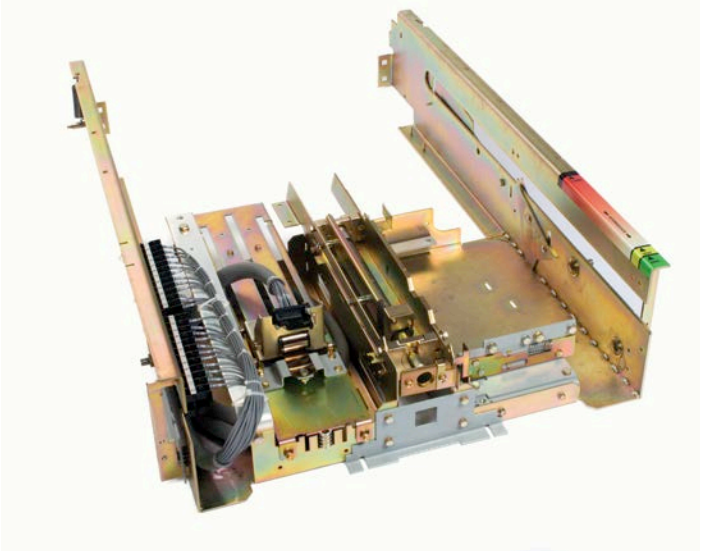
Polyester powder	Polyurethane	Acrylic enamel
10% loss at 2000 hours	10% loss at 1000 hours	10% loss at 1000 hours

Cubicles

Switchgear cubicles are individually welded to form a rigid box that is bolted together to form a switchgear lineup. Welding ensures that each cubicle stays perfectly square during assembly of the lineup and maintains correct alignment of the breaker element to the racking mechanism, secondary contact block, and primary breaker connections. In addition, two thicknesses of 11-gauge steel between vertical sections provide additional protection against the propagation of faults between adjacent cubicles. Cubicles are coated hi-gloss white to enhance interior visibility.

Breaker pan assembly

Eaton's breaker pan assembly for 5 kV, 15 kV, and 27 kV applications has been designed to exceed standard specifications and contains design enhancements to improve quality, safety, and maintenance. The breaker pan assembly includes dedicated positions for "Disconnect", "Test," and "Connect" and a viewing window mounted on the door allows the operator to visually confirm the position of the breaker without entering the equipment. As part of the dedicated "Test" position, the pan assembly contains an automatically engaging secondary that eliminates the need for manual connection of the secondary. An interlock prevents the secondary contacts from carrying current until they are fully seated to prevent arcing that could damage the contacts. Limit switches are available for use with our integral motorized remote racking (MR2) or breaker position indication lights on the front of the switchgear. The only required lubrication for the pan assembly is application of grease to the racking screw.



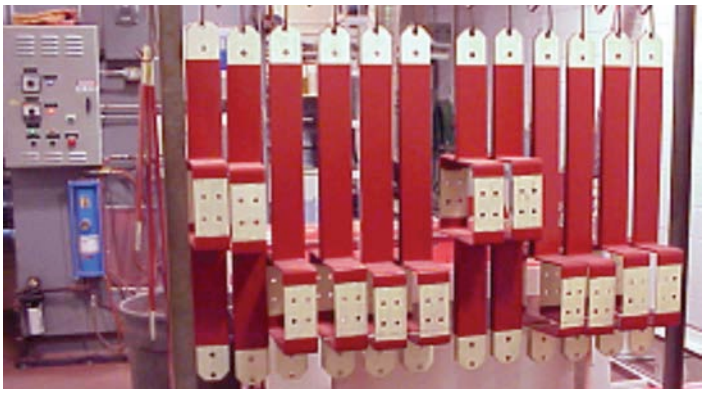
Integral motorized remote racking (MR2)

Eaton's MR2 motorized remote racking system provides a means of remotely racking any VCP-W drawout circuit breaker and/or 5/15 kV auxiliary drawer used in metal-clad switchgear. The MR2 system can also be utilized to open and close the breaker remotely. Each MR2 system consists of a motor that is permanently integrated into the breaker or auxiliary compartment and a pendant that can be used universally between the different MR2 systems. The pendants are accompanied by a 30 ft cord to attach the pendant to the front of the switchgear. If specified, the operation of the MR2 can be performed by utilizing a remotely located HMI with touch screen. Part of the standard offering for MR2 is the incorporation of logic to prevent equipment damage due to interference with a built-in defeat mechanism in order to remove the breaker due to a malfunction. The addition of the MR2 system helps mitigate arc flash exposure for the user by removing the operator from the arc flash zone. The MR2 is also available as an aftermarket purchase and field installation. Contact your Eaton sales rep for a quote.

Bus bar

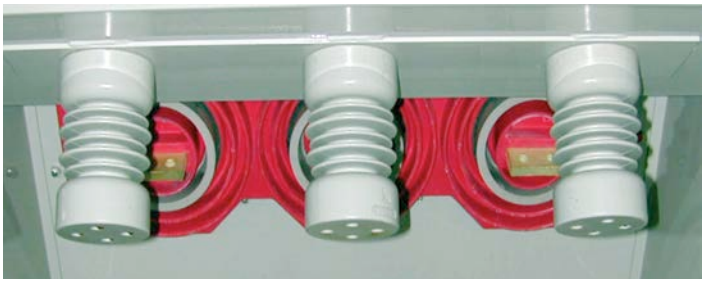
Bus bar for 5 kV through 38 kV metal-clad switchgear is insulated with epoxy using the fluidized bed process. The process is controlled by a PLC that drives automated machinery. This process ensures an even and consistent coating thickness. Final cured thickness is checked with a depth gauge to verify the coating meets specifications. A one-minute dielectric test is used to verify the insulation system complies with IEEE Standards and to ensure no hidden pinholes or voids are present in the insulation. Epoxy adheres directly to the copper bus surface to eliminate any possibility of corona activity. In addition, epoxy is resistant to corrosive atmospheres, scratching, and chipping. The epoxy is colored red to indicate the presence of high voltage.

All copper bus bar is fully silver-plated at the mill to provide a uniform and consistent plating thickness that minimizes electrical resistance at bus joints.



Fully silver-plated copper bars with red epoxy insulation

Medium-voltage bus standoffs and bus feed-thru supports are molded from cycloaliphatic epoxy resin. This material has over 25 years of installed experience at investor-owned utilities in outdoor applications. Cycloaliphatic epoxy resin has proven to be superior to porcelain and is easy to mold to any desired shape.



Cycloaliphatic bus standoffs

A PVC bushing is inserted over the bus at feed-thru supports. This bushing eliminates any space between the insulated bus and the bus support to prevent corona activity.

When ground studs are required, they are installed before the bus bar is insulated so they can be integrated into the epoxy bus insulation system.

PVC insert

Ground stud

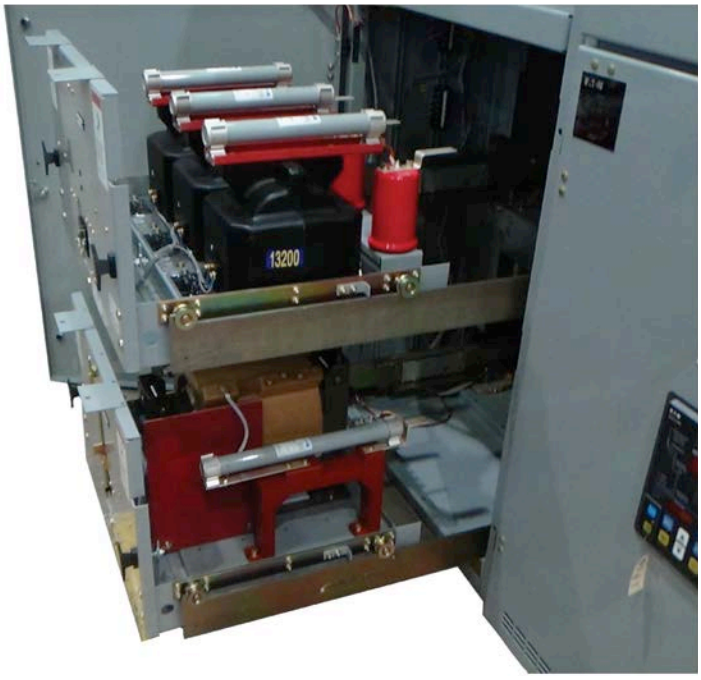
Vertical bus supports

Channels

Eaton's Omaha Power Center welds unistrut channels to the sidewalls of each metal-clad cubicle to accommodate installation of terminal blocks, fuse blocks, circuit breakers, control relays, and other surface-mounted low-voltage devices. After welding the channels into place, they receive the same high-quality powder coating as the enclosure. This system provides great flexibility in location of devices and allows customers to easily add or relocate devices at any time in the future, should that become necessary. This method also eliminates the use of unpainted galvanized subpanels that many manufacturers have standardized on.

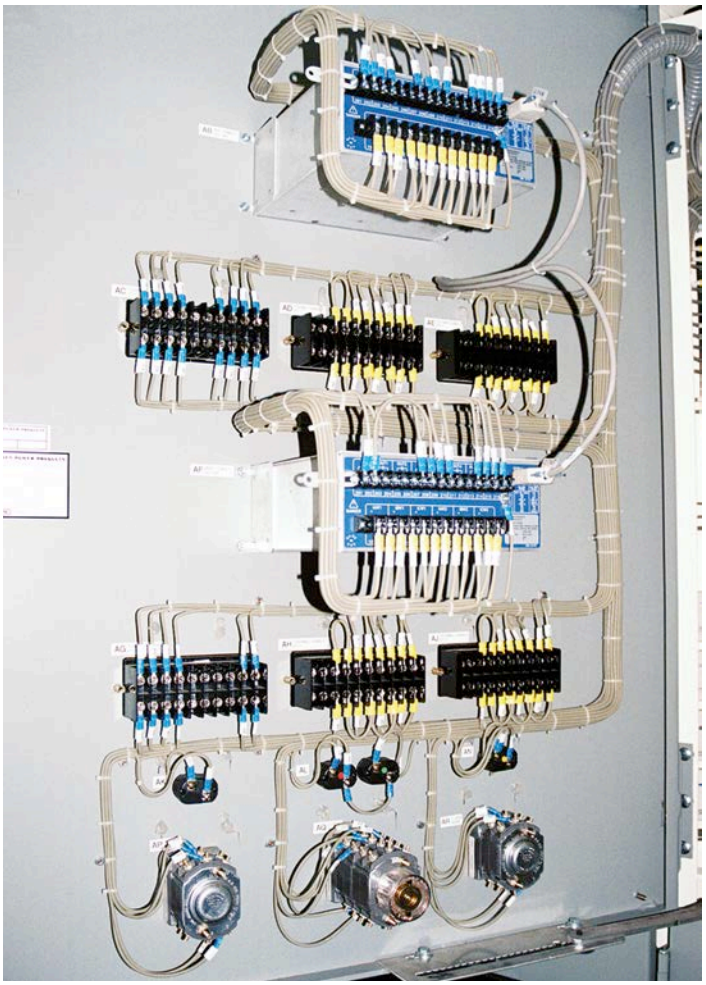
Auxiliary drawer

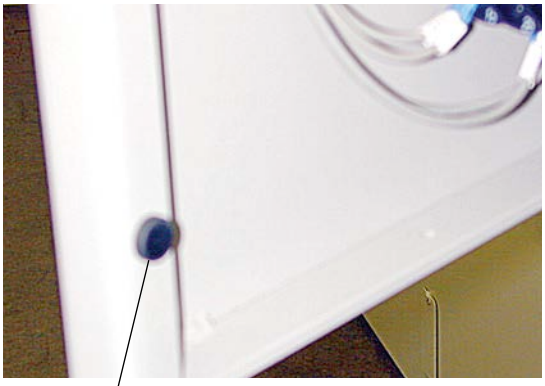
Eaton offers auxiliary drawers that can be engineered for up to four auxiliary drawers per structure. The drawers can be used for installing voltage, control power transformers, or primary fuses. The auxiliary drawers are designed for horizontal drawout and can be left in the "Disconnect" position with the door shut. Auxiliary drawers can be fully withdrawn on extension rails similar to the breakers, thus allowing front access to auxiliary equipment to permit easy testing and fuse replacement. A safety shutter (operated by the drawer) is included in each auxiliary drawer compartment. The safety shutters automatically operate when the auxiliary drawer is withdrawn to protect workmen from accidental contact with the stationary primary contacts. When moved to the fully withdrawn position, primary connections are grounded for added safety.



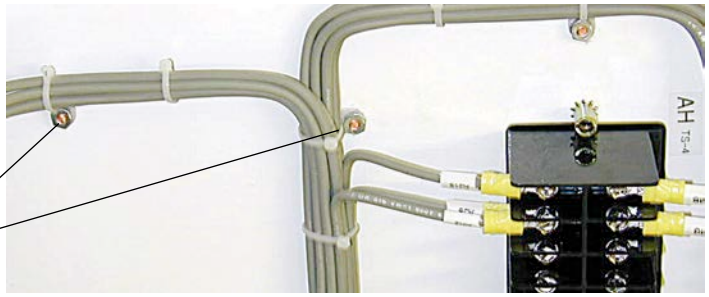
Wiring

Control wire is neatly bundled and carefully trained to allow easy access to terminals and visibility of all wire markers. Wiring across door hinges is protected by heavy plastic wrap. Wire bundles are positioned above the height of the breaker element to prevent interference with the breaker during insertion or removal. Wiring is tied to clamps that are secured by a welded stud and nut. Device doors have a double return at the front and rear edges to maintain door strength and rigidity. Rubber vibration dampeners are installed on the door return to protect the door surface and prevent transmission of vibrations to door-mounted devices. Insulated ring tongue lugs are standard for all control connections. A sleeve type wire marker is installed on each wire that indicates the destination of the wire. Sleeve type wire markers can be rotated so that the marking is always visible.





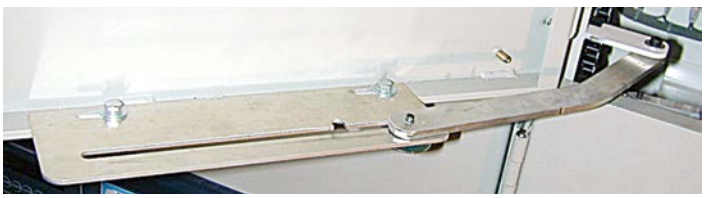
Vibration dampener



Welded hold-on studs

Doors

Front compartment doors are provided with a heavy-duty latch with two positive stops. One stop is used for testing of door-mounted devices, while the other allows safe withdrawal or insertion of breaker elements.



Wireways

Eaton's Omaha Power Center provides an overhead wireway to provide easy access to control and monitoring circuits. Additional wireways and/or alternate locations of the wireway are available to meet specific customer requirements and to allow the isolation of control functions for computer interfaces or other HMI related equipment. Wherever control wire passes across door hinges or through wireways, it is protected by heavy plastic wire wrap or rubber grommets. When two-high switchgear construction is required, Eaton provides an interunit wireway in the center as shown in the picture to the right.

Two-high interunit wireway

Overhead wireway

IEEE standards testing

Eaton metal-clad switchgear has passed all applicable IEEE design tests. Once manufacturing is completed, all equipment is subjected to IEEE standard production testing. In addition, all control and protection circuits are functional tested. At Eaton's Omaha Power Center, inspection of equipment by the customer prior to shipment is available at no extra charge. Witness testing is also available for a nominal cost. During testing, the circuit breakers purchased for a project are used to confirm all breakers operate in their respective cell, both mechanically and electrically, and to verify interchangeability of breakers of the same rating. Breakers are shipped with the switchgear so they are available for startup testing immediately.

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Eaton
1000 Eaton Boulevard
Cleveland, OH 44122
United States
Eaton.com

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