Technical Data **TD0214003E**

Effective March 2018
Supersedes May 2013

Eaton's Omaha Power Center outdoor aisleless construction features

Contents

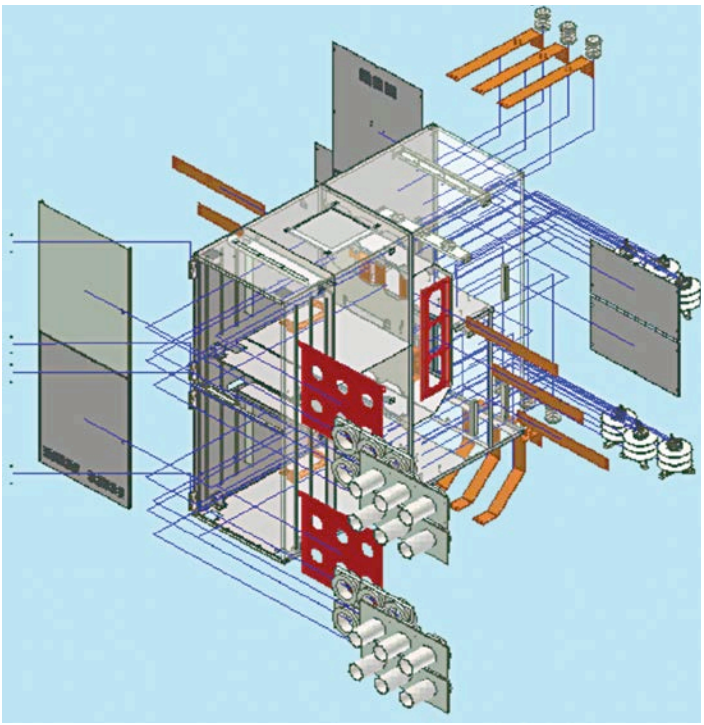
Note: There are a number of outdoor aisleless features standard with the Omaha construction that are not provided by Greenwood.

Powering Business Worldwide

Autodesk Inventor

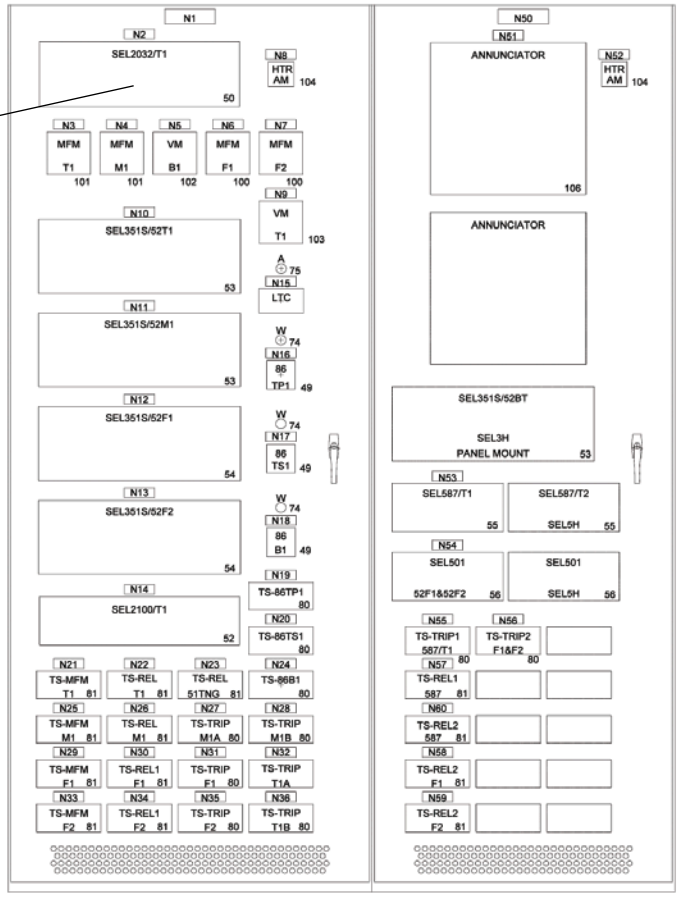
Construction of an Eaton outdoor aisleless switchgear enclosure begins with the use of the best available design tools. Eaton uses Autodesk® Inventor® for development of its designs. Inventor allows Eaton to view the complete assembly from all sides to optimize the design, resolve interferences to ensure components and sub-assemblies fit together properly, and take advantage of the most efficient fabrication and assembly methods.

Customer electrical 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 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.



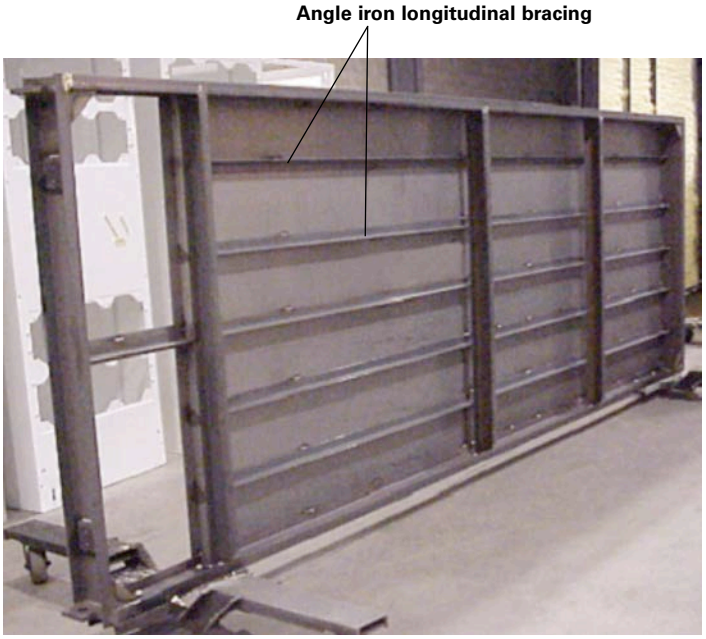
Bill-of-material item description

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

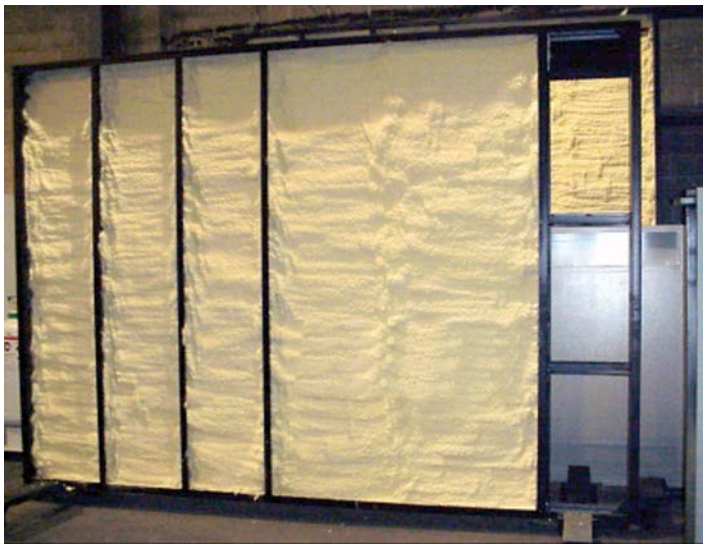
Eaton uses heavy-duty 11-gauge steel for the exterior shell of each Eaton switchgear enclosure. Steel is cut using a high-energy laser. Operation of the laser is completely automated with programming downloaded directly from Eaton's engineering server. The precision of the laser ensures all pieces are cut to the correct size every time. The net result is pieces fit to exacting tolerances to ensure the enclosure is weatherproof. The smooth edges left by laser cutting promote excellent paint adhesion and prevent possible damage to wiring that may pass over or across metal edges.

Eaton switchgear bases are fabricated from structural steel channel sized to meet building and foundation requirements. This allows customers to install the completed enclosure on a concrete pad or piers without the need for additional bracing. Angle iron bracing is provided in each base section to provide additional support and rigidity during shipment, handling, and installation.



Protective coatings

An amine-cured, coal tar epoxy protective coating is applied to the bottom of each Eaton switchgear base to prevent corrosion after installation. Spray-on foam insulation is applied to meet building codes and customer specifications. The outside perimeter of each base is protected with a corrosion-resistant, black epoxy coating that adheres well to structural steel and is resistant to damage from impact. Permanent lifting eyes are integrally welded at the corners of each shipping section to facilitate unloading at the job site. Cutouts are provided for control and power cable entry. A painted steel or aluminum cover plate is installed over each opening.



After fabrication is complete, all metal parts are cleaned under high pressure, followed by application of a protective phosphate coating to improve corrosion inhibition. Each piece is then electrostatically coated with a polyester powder. The powder coating is fully cured in a baking oven so that parts can be assembled immediately after cool down. Powder coating provides superior coverage on edges and hard-to-reach areas and is very resistant to high temperatures. A high gloss finish prevents absorption of dust and dirt and is easy to clean.

The Eaton powder coat provides superior performance and resistance to the following conditions:

- Marring and scratching
- Reverse impact
- Corrosive atmospheres
- Ultra-violet radiation
- Wind borne snow and rain
- Direct impact
- Chipping
- Cracking from bending
- Extreme heat
- Wind borne dust and sand

Following are results of actual ASTM tests that compare performance of the powder coat to polyurethane and acrylic enamel finishes commonly used by other manufacturers.

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-lb	+75 in-lb	+30 in-lb

Reverse impact

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

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 rigid boxes that are bolted together to create 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.

After powder coating, cubicles are bolted together to form a switchgear lineup. Because each cubicle forms a complete box, there are two thicknesses of 11-gauge steel between each vertical section.

Doors, walls, and roof panels

Doors, walls, and roof panels are all fabricated from 11-gauge steel and coated on both sides with Eaton's polyester powder. There is a 2-inch space between each end wall and the side of the switchgear cubicle to prevent condensation from forming on the inside of the switchgear. All roof and wall joints are caulked with a long life silicone sealant. Roof panels are insulated with spray-on foam to prevent condensation forming on the inside surfaces of the roof. The roof panels are bolted together using rubber washers on each side to prevent ingress of moisture around bolt holes. A full-length roof cap is installed over the roof joints to protect weatherproofing materials from direct exposure to the elements. Vent openings are provided at the top of the enclosure as a means to exhaust internally generated heat. Each vent opening is covered by a rain hood and includes a washable and re-usable air filter.

A weatherproof door is provided in front of each switchgear cubicle. The door hinges are designed such that they swing out and away to allow complete access to the door of each switchgear compartment. This feature allows breaker compartment doors to open sufficiently enough for the breaker to be withdrawn without interference. The external doors are flush with the enclosure and a drip shield is installed at the top. The roof overhand prevents melting ice or snow from dripping onto the operating handle and freezing.

All door hardware is non-corrosive stainless steel and designed to be tamper proof. A heavy-duty, three-point latching system is provided with nylon rollers at all interface points. The operating handle is stainless steel and has provisions for padlocking. All exposed exterior hardware is non-corrosive stainless steel. The door gasket is similar to compressible gaskets that are used on automotive doors. An automatically engaging door stop is provided, which is easy to disengage through use of a spring-loaded operating rod.

Weatherproof integrity design test

Eaton's outdoor enclosed design has successfully passed a Rain Test in accordance with requirements contained in IEEE® standard C37.20.2-1999, paragraph 6.2.10. The severity of the test was increased to demonstrate the improved weatherproof integrity under hurricane force wind and rain conditions. The table below compares the IEEE test criteria to the more stringent test conditions used.

Test criteria

Test parameter	IEEE requirement	Eaton test
Water flow rate	7.1 gal/min	15 gal/min
Water pressure	60 psi	120 psi
Distance to water nozzle	10 ft	6 ft
Number of surfaces tested	2	4
Number of joints tested	1	2

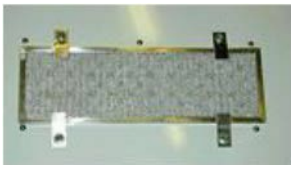
Doors and handles

All door hardware is non-corrosive stainless steel and designed to be tamper proof. A heavy-duty, three-point latching system is provided with nylon rollers at all interface points. The operating handle is stainless steel and has provisions for padlocking. All exposed exterior hardware is non-corrosive stainless steel. The door gasket is similar to compressible gaskets that are used on automotive doors. An automatically engaging door stop is provided that is easy to disengage through use of a spring-loaded operating rod.

3-point latch

Stainless steel handle

Vent



Washable filter

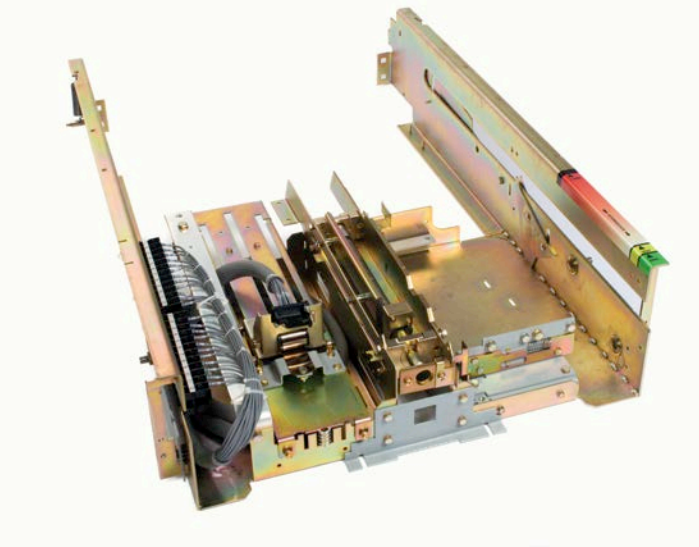
Nylon rollers

Self-engaging doorstop

Compressible gasket

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. 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.



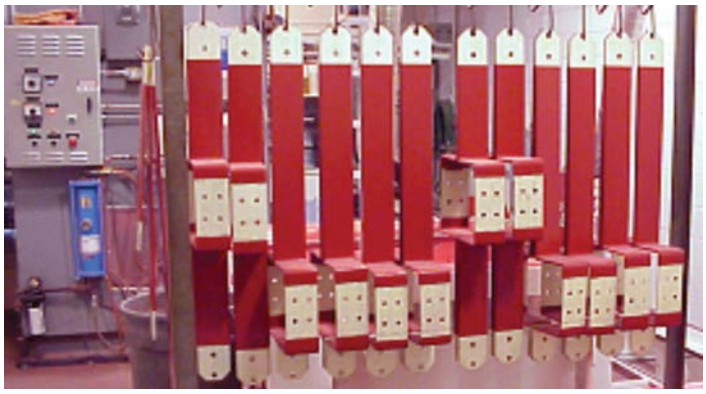
Integral motorized remote racking (MR2)

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 and 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.

Bus bar

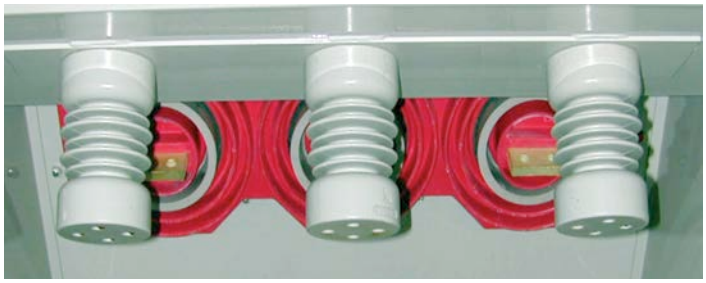
Bus bar for 5 kV through 38 kV metal-clad switchgear is insulated with epoxy using the fluidized bed process. The process is controlled by a PLC that drives automated machinery. This process ensures an even and consistent coating thickness. Final cured thickness is checked with a depth gauge to verify 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.

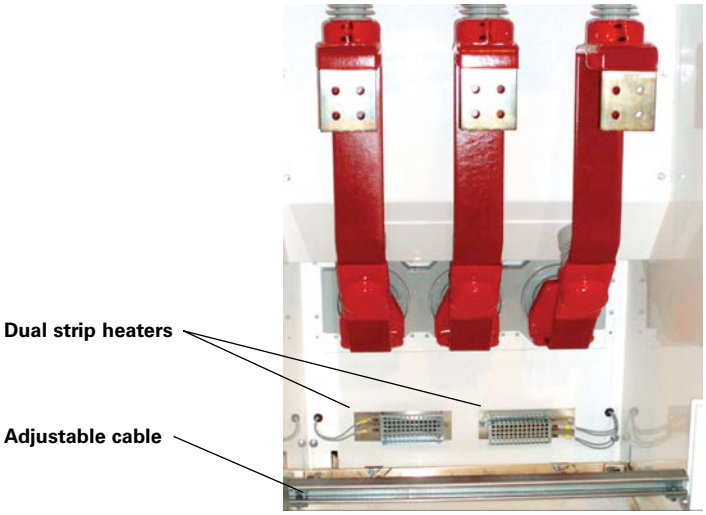
When ground studs are required, they are installed before the bus bar is insulated so they can be integrated into the epoxy bus insulation system.

PVC insert

Ground stud

Vertical bus supports

Power cable terminations are installed at a height to allow easy training of large diameter power cables and to provide adequate space for installation of stress cones. An adjustable cable support is provided to remove tension from the cable terminations. Dual strip heaters are provided in each power cable compartment to prevent formation of condensation. The extra strip heater allows continued protection against condensation, should one strip heater fail, until a failed heater can be replaced during normal maintenance. The strip heaters are energized at half voltage to increase their operating life. All strip heaters are provided with a protective guard to prevent accidental contact with the heating element by operating personnel.

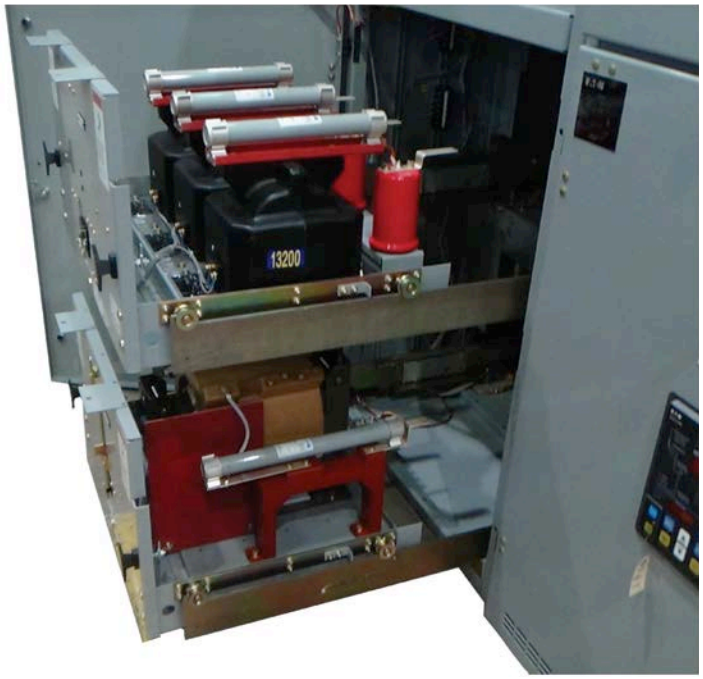


Channels

Eaton 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.

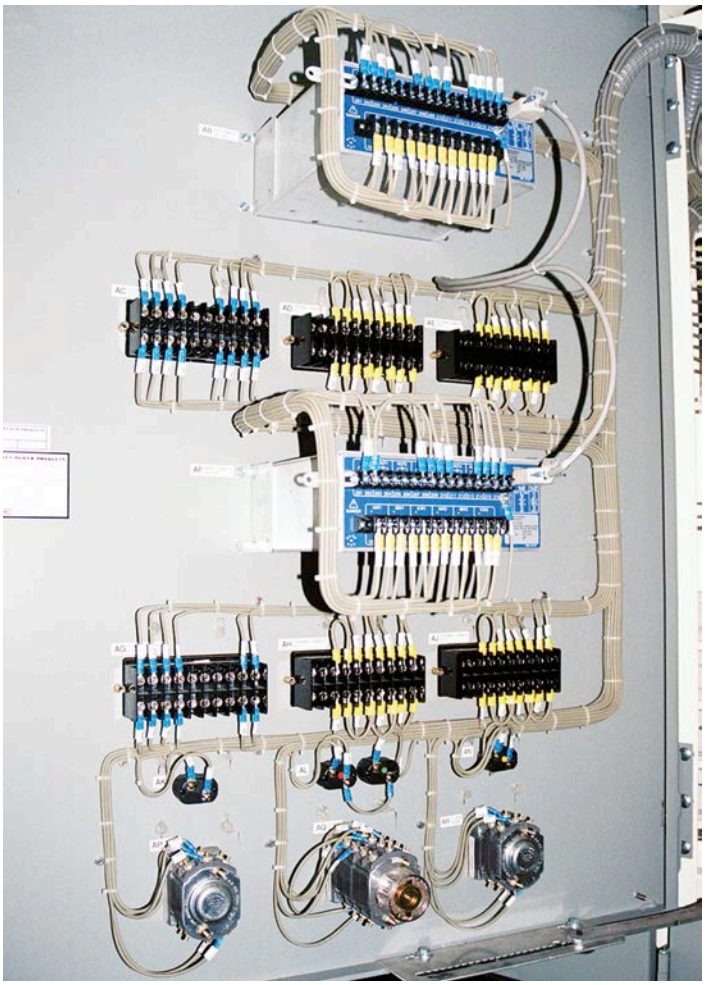
Auxiliary drawer

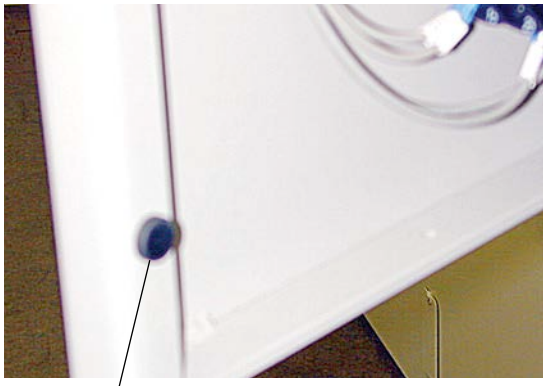
Eaton offers auxiliary drawers that can be engineered for up to four auxiliary drawers per structure. The drawers can be used for installing voltage, control power transformers, or primary fuses. Each drawer can also be configured for use as a battery tray. The auxiliary drawers are designed for horizontal 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.



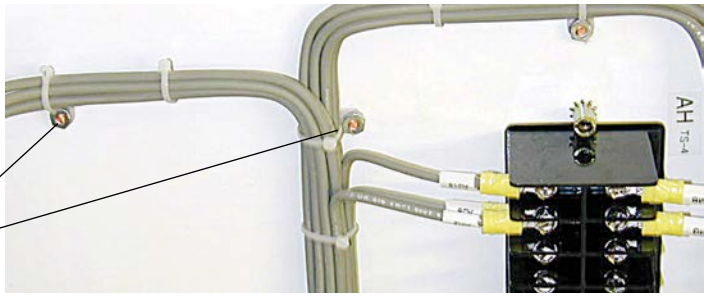
Wiring

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. 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. The wide viewing surface of the sleeve offers improved readability of the markings.





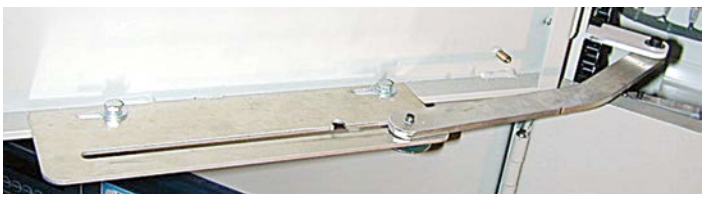
Vibration dampener



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.



Breaker standard feature

Eaton's outdoor switchgear design provides an extendable and retractable steel tube at the top of each cubicle that contains a breaker, as standard. A portable chain hoist can be attached to the tube so the breaker can be removed from its extension rails after it has been withdrawn from the cubicle. This feature eliminates the need to purchase a movable platform and extend the concrete pad in front of the switchgear. The lifting hoist and chain assembly is included as a standard accessory and is typically stored at the switchgear.

Optional cabinet

Eaton can provide an optional weatherproof cabinet for storage of standard switchgear accessories and maintenance items. The cabinet is fabricated from 11-gauge steel and typically mounted at either end of the lineup. It has the same features as the weatherproof doors in the front and rear of the switchgear. These include a lockable stainless steel handle with three-point latching and a door holding mechanism. Following is a list of items commonly stored in the cabinet:

- Breaker racking crank
- Breaker test cable
- Manual breaker charging lever
- Lifting hoist
- Lifting chains
- Breaker lifting yoke
- Remote racking control cable and station
- Breaker extension rails
- Spare fuses
- Other spare parts

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. Inspection of equipment and witness testing by the customer is encouraged and available at no additional charge. 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.

For additional information or to receive a budget estimate and equipment layout drawing for your next indoor metal-clad switchgear project, please contact your nearest Eaton sales representative or visit **Eaton.com/howtobuy**.

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