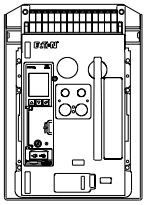
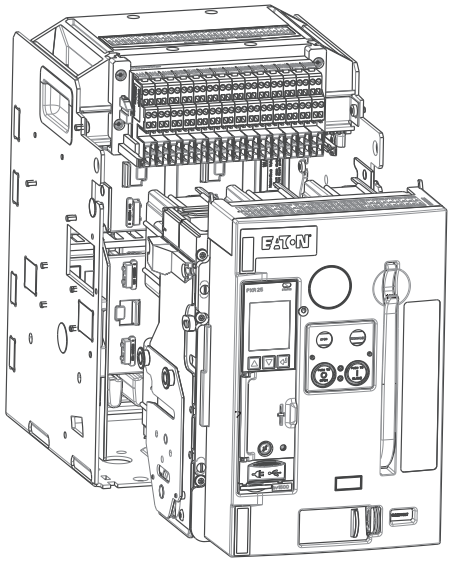
Breaker instruction manual – NF

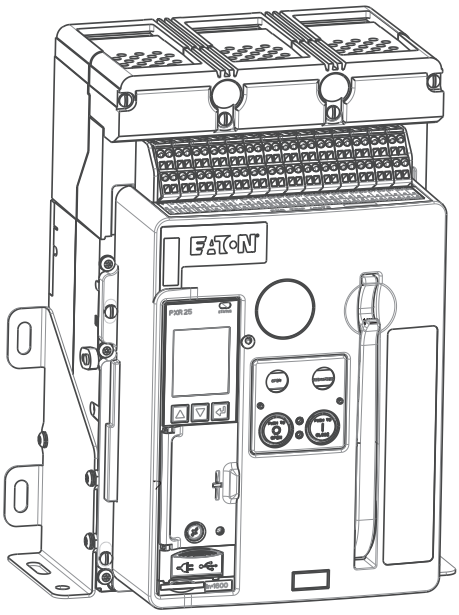
Instructions apply to:



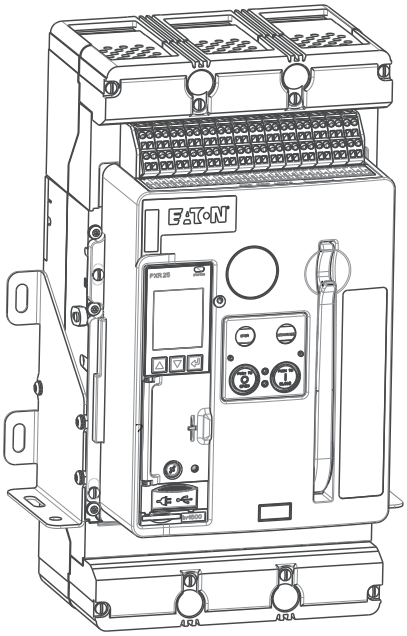
UL489 : PD-NF, Series NRX
IEC : PD-NF, IZMX16



Typical drawout circuit breaker and cassette



Typical fixed circuit breaker (rear connect)



Typical fixed circuit breaker (front connect)

Power Defense™

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Table of Contents

⚠ WARNING

The Warnings and Cautions included as part of the procedural steps in this manual are for personnel safety and protection of equipment from damage. This example of a typical Warning is intended to familiarize personnel with the style of presentation.

⚠ WARNING

Eaton ICCB circuit breakers are provided with safety features. Nevertheless, the voltages, currents, and power levels available around operational equipment are extremely dangerous. Under no circumstances should interlocks and other safety features be made inoperative, as this may result in death, bodily injury, or property damage.

⚠ WARNING

Eaton ICCB circuit breakers should not under any circumstances be applied outside their nameplate ratings. Operation outside of these ratings could result in death, bodily injury, or property damage.

⚠ WARNING

Never attempt to disable any interlocks. Doing so could result in an electrical fault that could result in death, bodily injury, and/or equipment damage.

⚠ WARNING

Failure to inspect, clean, and maintain circuit breakers can reduce equipment life or cause the equipment to not operate properly under faulty conditions. This could result in equipment damage, bodily injury, or even death.

⚠ WARNING

Arc chutes and their cover plates must always be secured properly in place before a breaker is installed in its compartment. Failure to do so could result in equipment damage, bodily injury, or even death.

⚠ WARNING

The circuit breaker mechanism contains stored mechanical energy and moving parts and should be operated with the front cover and arc chutes in place. Parts may move forcefully and without warning. If the front cover or arc chutes have been removed, limit contact to the handle and buttons. Failure to do so may result in serious bodily injury.

⚠ CAUTION

Do not attempt to lift a breaker or cassette with ordinary crane hooks or chains. Damage to vital circuit breaker parts could result. Use two appropriate lifting straps when using any type of lifting device.

⚠ CAUTION

Make certain that the cassette is properly mounted or seated securely on a work table before attempting to have the breaker fully extended on the cassette's drawout rails. Failure to comply could result in the cassette tipping forward resulting in equipment damage and/or bodily injury.

⚠ CAUTION

Do not store equipment on its back. This could result in equipment damage.

⚠ CAUTION

It is important to take care when placing a drawout circuit breaker on its extension rails. If the circuit breaker is not properly seated on the rails, the breaker could fall causing equipment damage and/or bodily injury.

⚠ CAUTION

Inspection and maintenance procedures should be carried out only by personnel familiar with the hazards associated with working on power circuit breakers. Additionally, they should become familiar with the specifics associated with Eaton ICCB circuit breakers as presented in this manual.

⚠ IMPORTANT

Please read and understand these instructions before attempting to unpack, install, operate, or maintain this equipment. Study the breaker and its mechanism carefully before attempting to operate it on an energized circuit.

⚠ IMPORTANT

A circuit breaker stored for any length of time should be operated a minimum of five times before it is placed in service.

⚠ IMPORTANT

The circuit breaker mechanism is interlocked such that charged closing springs are automatically discharged if the circuit breaker is levered into or out of the cell. Discharge takes place between the DISCONNECT and TEST positions.

⚠ IMPORTANT

Different degrees of access to push-buttons on the front of the circuit breaker can be achieved through the use of optional accessory devices.

⚠ IMPORTANT

Before doing any work, make sure a drawout breaker is levered out to the TEST, DISCONNECT, or WITHDRAWN position. During the levering out and levering in of the circuit breaker, be aware of any signs that would indicate that the levering process is not working properly. If working on a fixed circuit breaker, bus systems should be de-energized for convenience and safety. All circuit breakers should be switched to the OFF position and the mechanism springs discharged.

⚠ IMPORTANT

Fixed breakers have an arc hood positioned over the arc chutes/arc chambers that must be removed first. Refer to IL01301014E for installation and removal instructions. After the inspection, reinstall the arc hood.

Section 1: Introduction

Purpose

This instructional manual is intended to generally cover the installation, operation, and maintenance of low voltage power (air) circuit breakers and drawout cassettes. Basic dimensional information is provided for the installation of both the circuit breaker and cassette.

Refer to other documentation for more specific details.

1. MN013003EN – Operating Manual for PXR 20/25 Trip Unit
2. AD013001EN – PXR 20/25 Time Current Curves
3. TD013001EN – Wiring Diagrams for PXR 20/25
4. Accessory field installation instruction leaflets (IL) dedicated to specific items are available for download at www.eaton.com
5. Visit www.eaton.com for additional support documentation.

Safety

All safety codes, safety standards, and/or regulations must be strictly observed in the installation, operation, and maintenance of this equipment.

⚠ WARNING

The warnings and cautions included as part of the procedural steps in this manual are for personnel safety and protection of equipment from damage. This example of a typical warning is intended to familiarize personnel with the style of presentation.

⚠ IMPORTANT

Please read and understand these instructions before attempting to unpack, install, operate, or maintain this equipment. Study the breaker and its mechanism carefully before attempting to operate it on an energized circuit.

All possible contingencies that may arise during installation, operation, or maintenance, and all details and variations of this equipment do not purport to be covered by these instructions. If further information is desired by purchaser regarding a particular installation, operation, or maintenance of particular equipment, contact the local Eaton representative.

⚠ WARNING

Eaton ICCB circuit breakers are provided with safety features. Nevertheless, the voltages, currents, and power levels available around operational equipment are extremely dangerous. Under no circumstances should interlocks and other safety features be made inoperative, as this may result in death, bodily injury, or property damage.

Safe practices

To protect personnel associated with the installation, operation, and maintenance of this equipment, the following practices must be followed.

1. Only qualified electrical personnel familiar with the equipment, its operation, and the associated hazards should be permitted to work on, install, or operate the equipment.
2. Always be certain that the primary and secondary circuits are de-energized or the circuit breaker is open and removed to a safe work location before attempting any maintenance.
3. For maximum safety, only insert an open, completely assembled breaker into an energized cell.
4. Always ensure that drawout circuit breakers are in one of their designed cell positions, such as CONNECT, TEST, DISCONNECT, or WITHDRAWN. A circuit breaker permitted to remain in an intermediate position could result in control circuits being improperly connected, resulting in electrical failures.

Qualified personnel

For the purpose of operating and maintaining power circuit breakers, a person should not be considered qualified if the individual is not thoroughly trained in the operation of the circuit breaker and how it interfaces with the assembly in which it is used. In addition, the individual should have knowledge of the connected loads.

For the purpose of installing and inspecting circuit breakers and their associated assembly, a qualified person should also be trained with respect to the hazards inherent to working with electricity and the proper way to perform such work. The individual should be able to de-energize, clear, and tag circuits in accordance with established safety practices.

General information

The range of low voltage power (air) circuit breakers and switch-disconnectors are designed, manufactured, and tested for use in both switchboard and metal-enclosed switchgear assemblies in accordance with UL1066/ANSI C37501, UL489, and IEC 60947-2 requirements. The Eaton ICCB range is manufactured and tested in an ISO 9002 certified facility.

Eaton ICCB circuit breakers and switch-disconnectors are available in fixed and drawout mounting configurations and offer a variety of different connection solutions. The fixed configuration is designed for front/rear bus connections. The drawout version, in conjunction with its drawout cassette, is a through-the-door design having three breaker positions with the compartment door closed (CONNECT, TEST, DISCONNECT) and one position out of its compartment on extension rails (WITHDRAWN). A drawout cassette is also designed for front/rear bus connections. Continuous current ratings from 630 - 1600 A and interruption capacities up to 85 kA are available depending on the applicable standard. All Eaton ICCB circuit breakers are 100 percent rated.

The fixed configuration is designed for front/rear bus

connections. The drawout version, in conjunction with its drawout cassette, is a through-the-door design having three breaker positions with the compartment door closed (CONNECT, TEST, DISCONNECT) and one position out of its compartment on extension rails (WITHDRAWN).

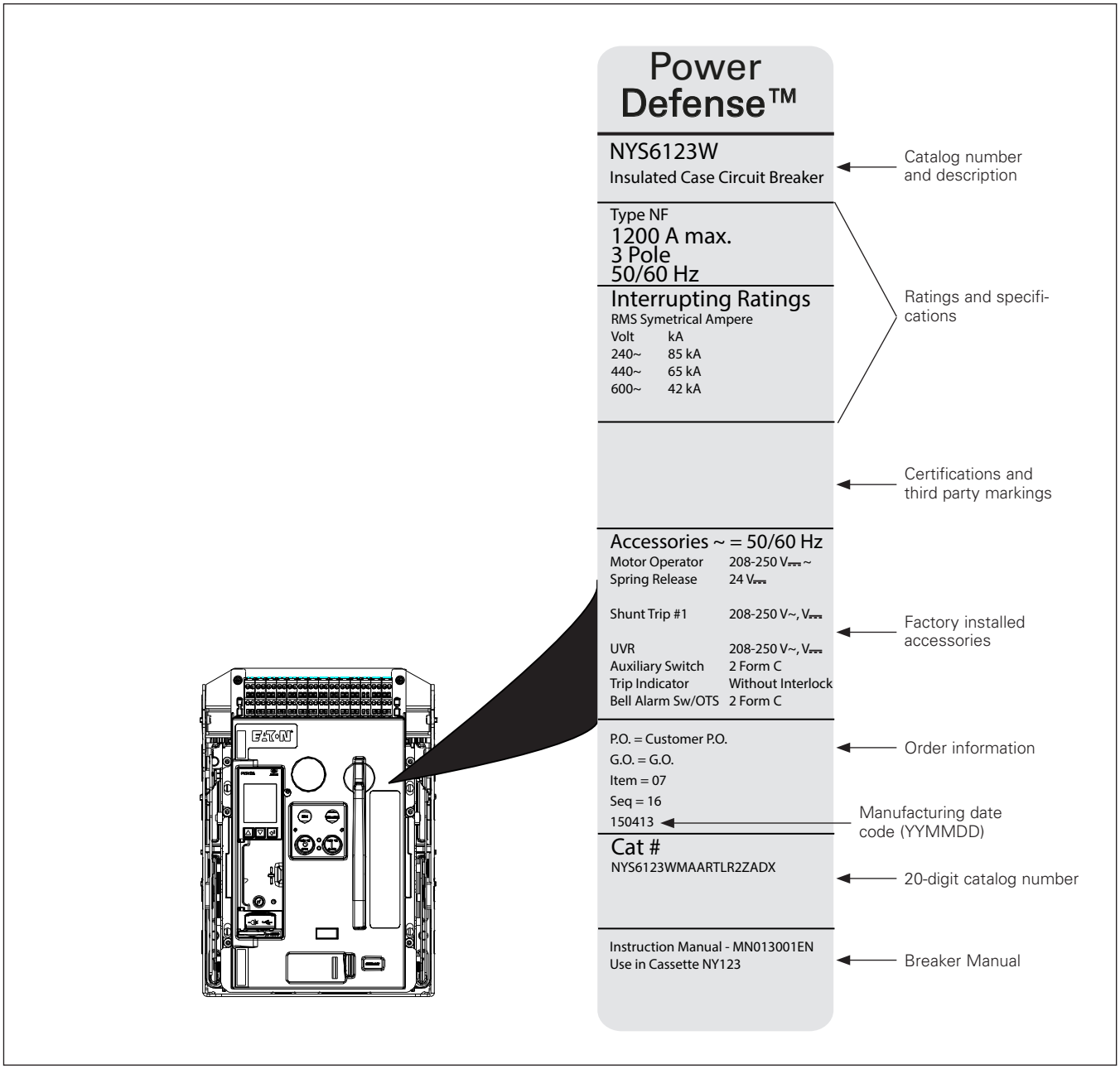
Product labeling and identification

The circuit breaker nameplate, located on the right side of the breaker, provides complete rating information and should always be inspected to ensure the information shown is in keeping with the product ordered (Figure 1). Become familiar with the nameplate.

⚠ WARNING

Eaton ICCB circuit breakers should not, under any circumstances, be applied outside their nameplate ratings. Operation outside of these ratings could result in death, bodily injury, or property damage.

Figure 1. Nameplate location.



The circuit breaker configuration is fully described by a 20-digit catalog number located on the name plate. The drawout cassette can be identified by a 14-digit catalog number. An overview of the catalog number code can be found in the catalog at www.eaton.com. Unique individual circuit breakers are identified by the older information: G.O. item, and sequence numbers. Taken together, these are equivalent to a serial number.

Breaker overview

Figures 2 through 5 highlight the main components that make up a breaker.

⚠ WARNING

The circuit breaker mechanism contains stored mechanical energy and moving parts and should be operated with the front cover and arc chutes in place. Parts may move forcefully and without warning. If the front cover or arc chutes have been removed, limit contact to the handle and buttons. Failure to do so may result in serious bodily injury.

Drawout breaker and cassette

A drawout circuit breaker is used in combination with a drawout cassette (Figures 2 and 3). Mounted on the drawout breaker are the primary disconnect finger clusters and levering mechanism. These components are located on the breaker to allow users easy access when performing product inspection or maintenance. The cassette provides all the necessary drawout circuit breaker interfaces, including primary and secondary connections. Standard flat terminal pads on the rear of the cassette provide for a variety of primary connection configurations. Optional primary adapters are available for front and rear bus or cable connections. For specific details and mounting instructions for primary adapters, refer to www.eaton.com

Fixed circuit breaker

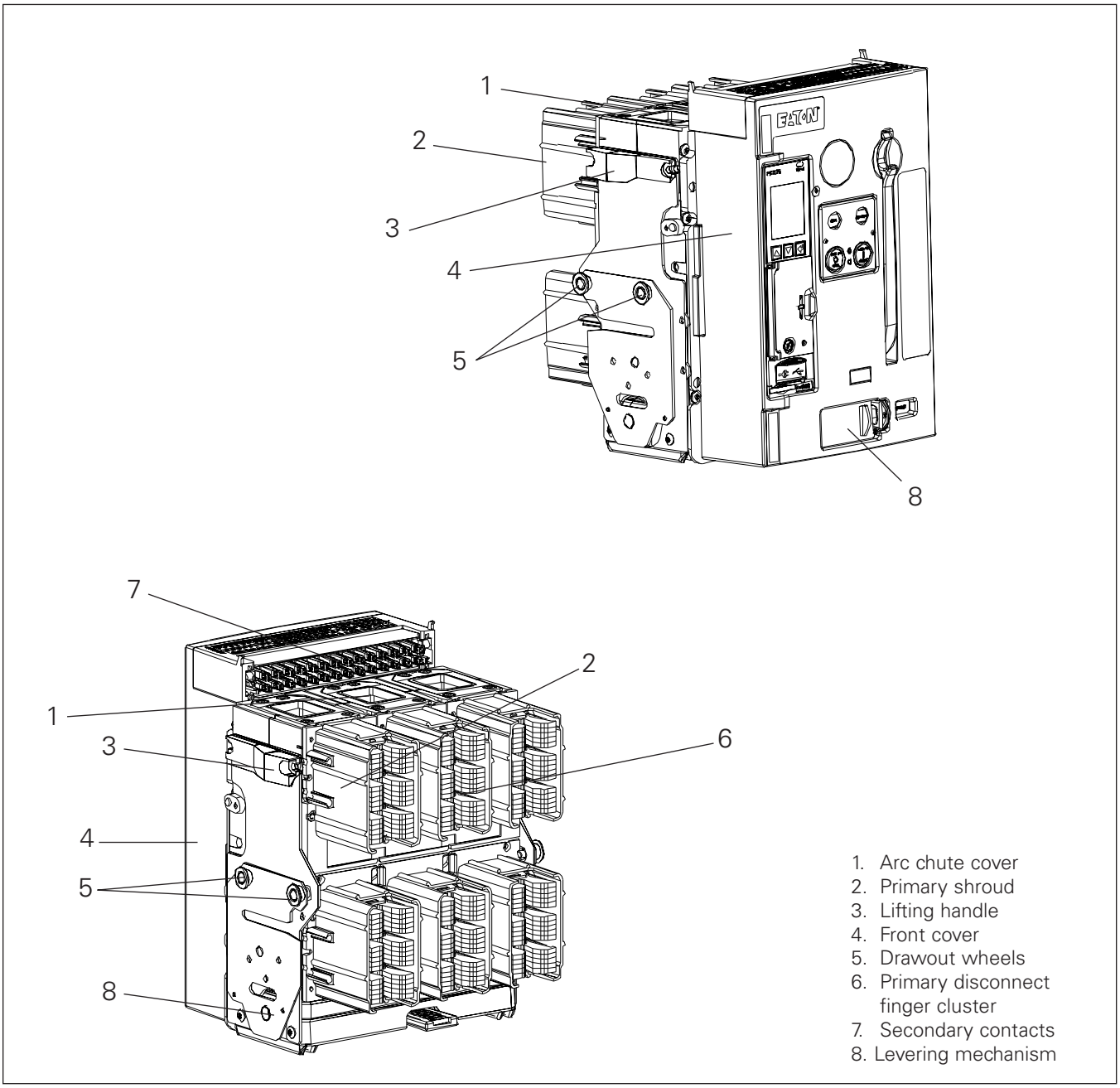
A fixed circuit breaker is rigidly mounted in its structure with no drawout feature. The circuit breaker is available in front and rear-connected configurations (Figure 4).

The breaker can be mounted on a suitable horizontal mounting surface using left and right-side mounting feet. A standard fixed circuit breaker is supplied with flat primary terminal pads on the rear of the breaker that will accommodate a variety of primary connection configurations.

Refer to Sections 5 and 6 for mounting and installation dimensional information. Electronic files of dimensional drawings for customer use are available for download at www.eaton.com

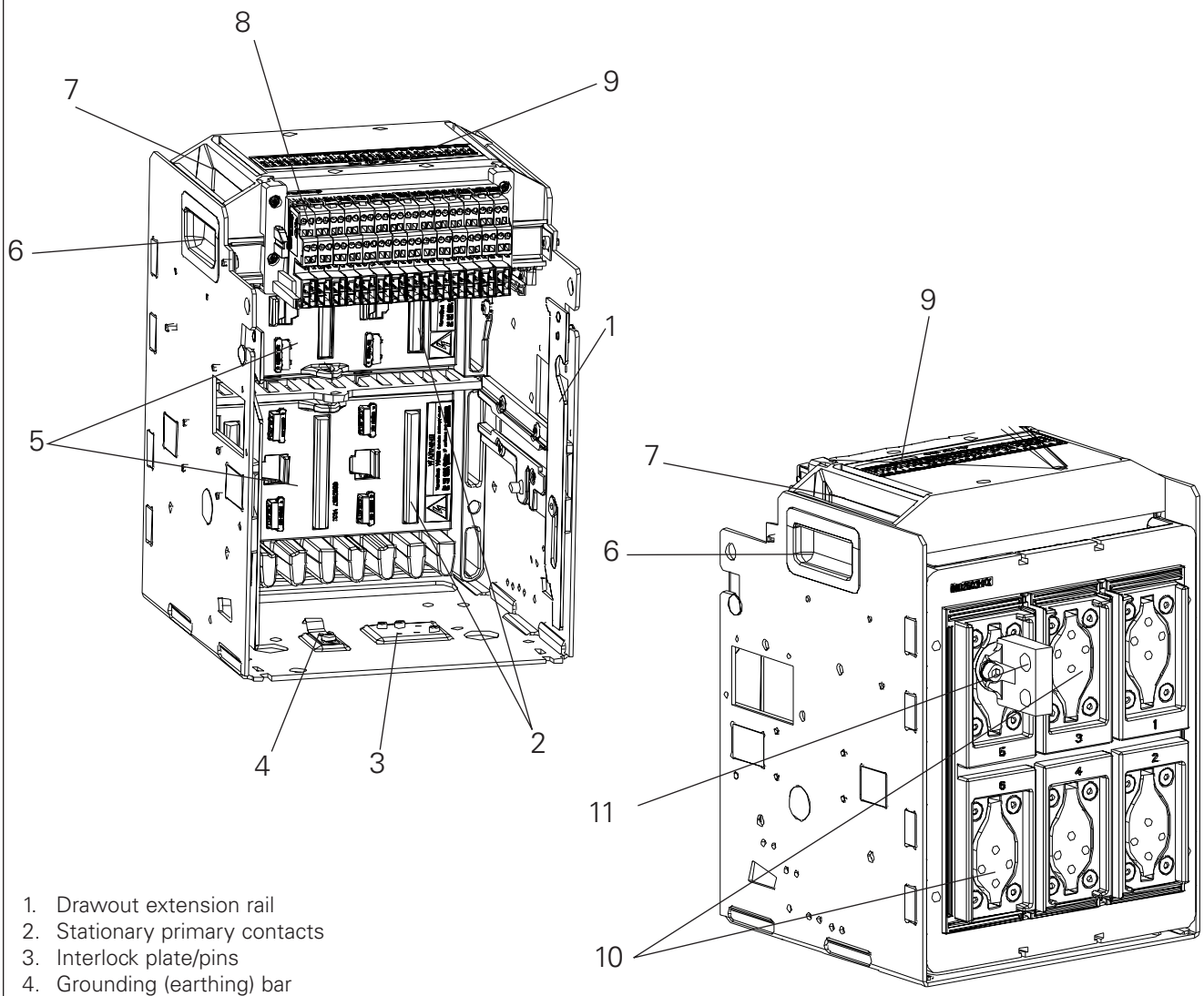
(Continued on Next Page)

Figure 2. Typical type NF drawout circuit breaker (front and rear views).



Note: Refer to Figure 6 for more visual details of front cover.

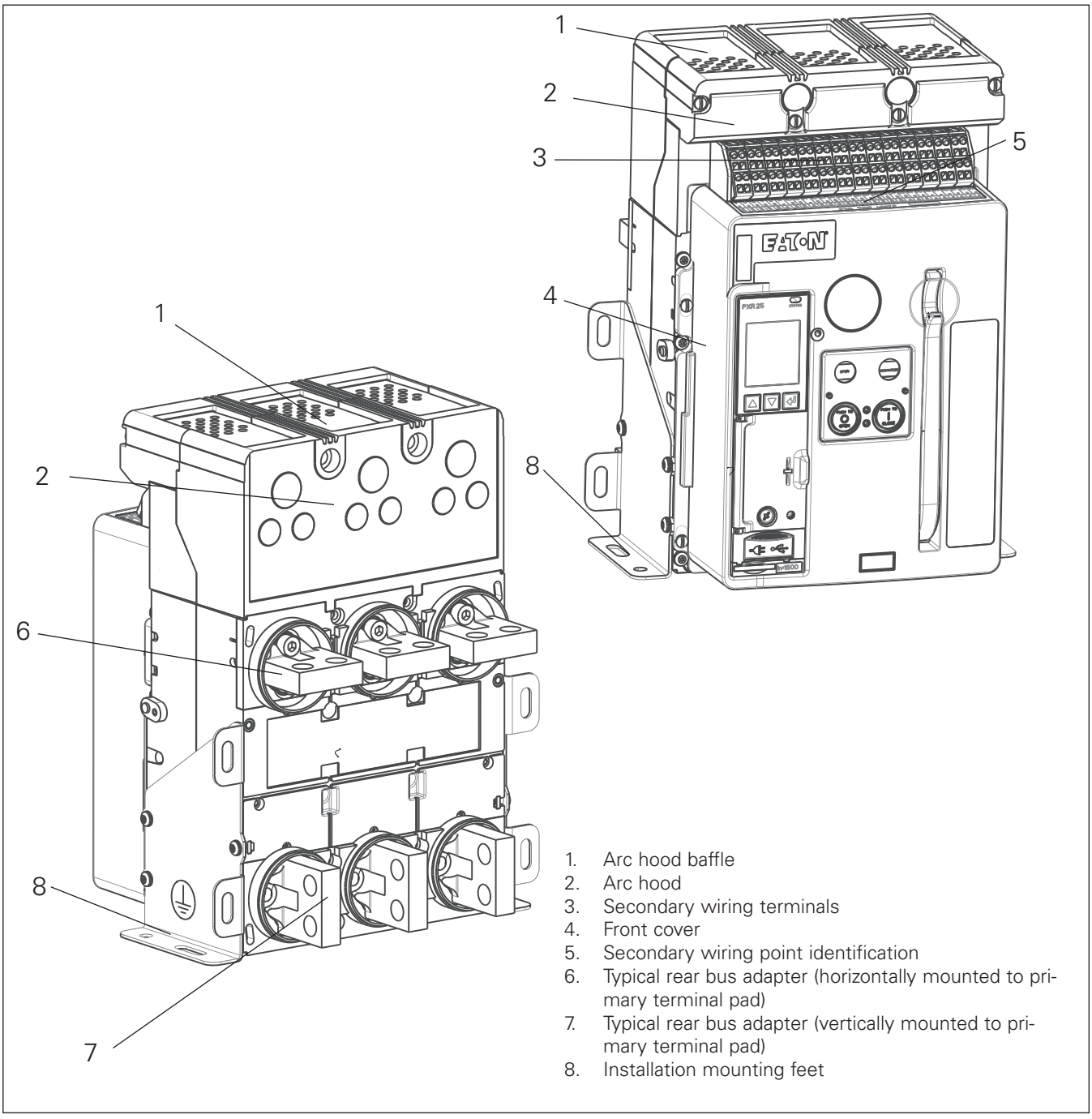
Figure 3. Typical type NF drawout cassette (front and rear views).



1. Drawout extension rail
2. Stationary primary contacts
3. Interlock plate/pins
4. Grounding (earthing) bar
5. Safety shutters (Open) (Optional)
6. Lifting handle
7. Gas ventilation opening
8. Secondary connectors
9. Secondary wiring point identification
10. Primary terminal pad
11. One typical rear bus adapter

Note: Refer to Figure 6 for more visual details of front cover.

Figure 4. Typical type NF fixed circuit breaker (rear connected type).



1. Arc hood baffle
2. Arc hood
3. Secondary wiring terminals
4. Front cover
5. Secondary wiring point identification
6. Typical rear bus adapter (horizontally mounted to primary terminal pad)
7. Typical rear bus adapter (vertically mounted to primary terminal pad)
8. Installation mounting feet

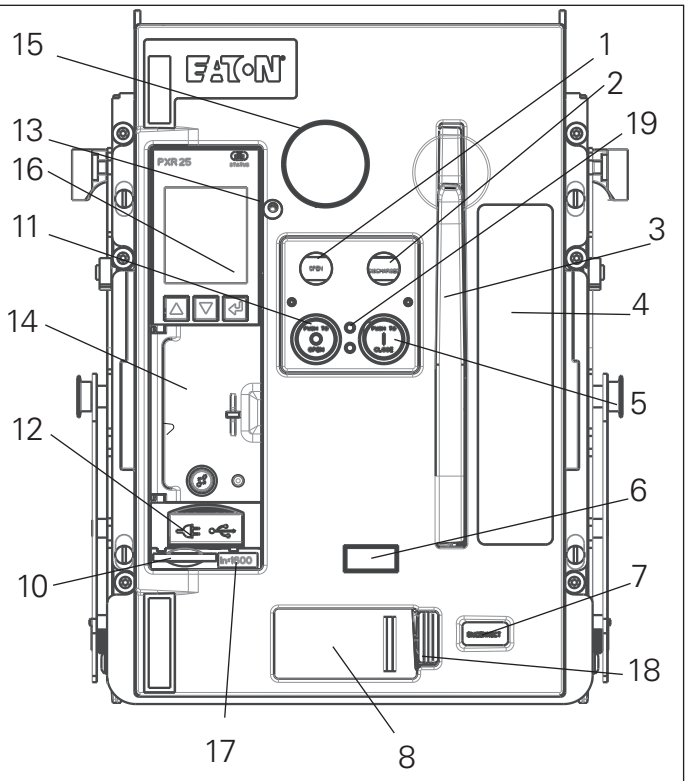
Note: Refer to Figure 5 for more visual details of front cover.

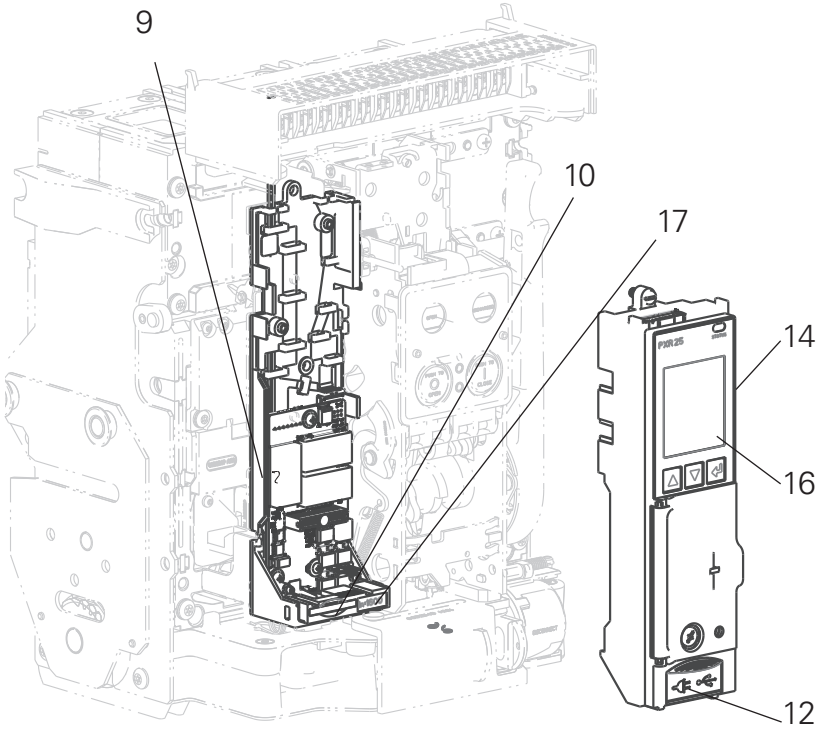
Figure 5. Typical type NF drawout circuit breaker front cover.

1. Contact status
2. Mechanism spring status
3. Charging handle
4. Nameplate
5. Manual ON
6. Operations counter (optional)
7. Position indicator (drawout only)
8. Levering access door (drawout only)
9. Frame rating module (FRM)
10. FRM battery cover
11. Manual OFF
12. USB and aux. power ports
13. Pop-out trip indicator (optional)
14. Trip unit
15. OFF key lock (optional)
16. I_n rating - LCD display on trip unit
17. I_n rating - FRM battery cover
18. Lockable levering access door interlock
19. Pushbutton cover mounting holes

Note: The I_n rating on the LCD display and FRM battery cover should ALWAYS agree.

Note: Frame rating module should NOT be removed.





Section 2: Unpacking, handling, and inspection

Suggested tools

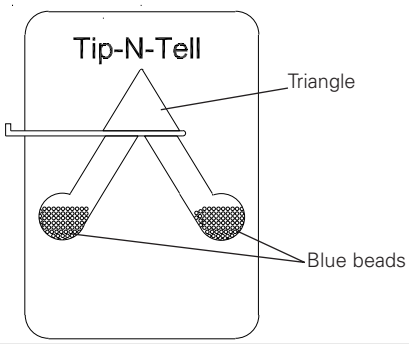
- Flat-blade and Phillips head screwdrivers
- 3/8-inch levering tool or extension/ratchet
- 3 mm Allen head screwdriver
- 1/2 inch socket and ratchet or 1/2 inch wrench

Circuit breaker unpacking and inspection

Inspect the shipping container(s) for obvious signs of external damage. Record any observed damage for reporting to the transportation carrier and Eaton. All reports and claims should be as specific as possible and include the order number and other applicable nameplate information.

Note: The outside of the circuit breakers shipping container includes a transport "Tip-N-Tell" indicator alerting the receiver as to whether or not the shipping container was transported and handled in the required manner. Refer to Figure 6 for details about the indicator before removing the circuit breaker from its container.

Figure 6. Transport indicator.

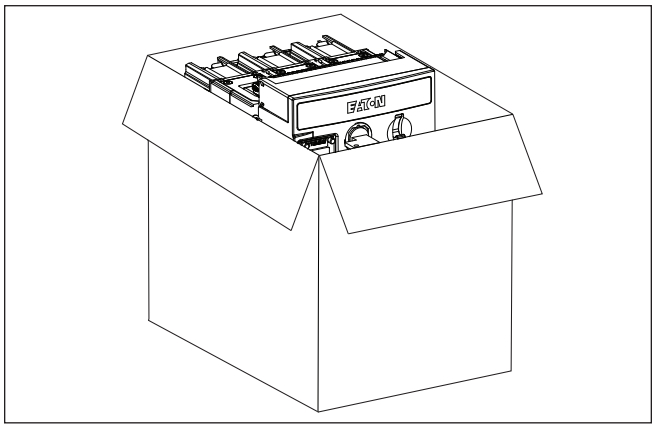


Triangle at top of indicator is partially full or totally full of blue beads. • Transport was not in keeping with instructions (breaker container was tilted or overturned). • Check breaker closely for damage.	Triangle at top of indicator has no blue beads in it. • Breaker container was not tilted or overturned during transport.

When ready to inspect and/or install the circuit breaker, proceed with the following steps:

Step 1: Carefully open the container and remove all packing/shipping material and documentation.

Figure 7. Step 1.



Note: Also follow Step 1 when handling a separately shipped drawout cassette.

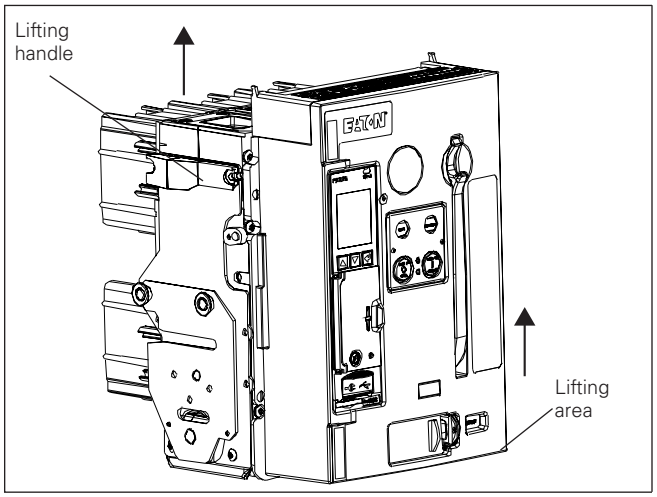
Step 2: Save all packing/shipping material and documentation for future shipments or breaker storage purposes.

Step 3: Move the breaker to a convenient place for closer examination. Drawout breakers are provided with a lifting handle on both sides to assist lifting.

Use an appropriate device to lift the breaker or cassette (Figure 9). If one is not available, it is recommended that a minimum of two people be used to lift/move a breaker or cassette.

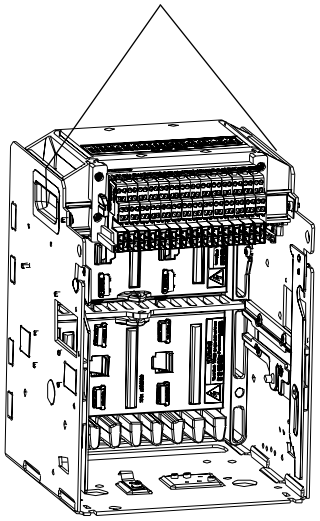
Note: Refer to Figure 10 for additional precautions and lifting procedures.

Figure 8. Step 3.

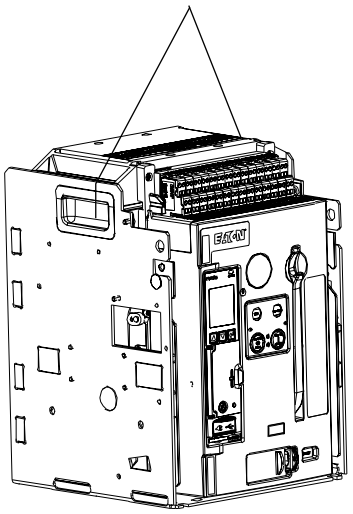


Step 4: Repeat Step 3 for a drawout cassette. The cassette is provided with a lifting indentation on each side.

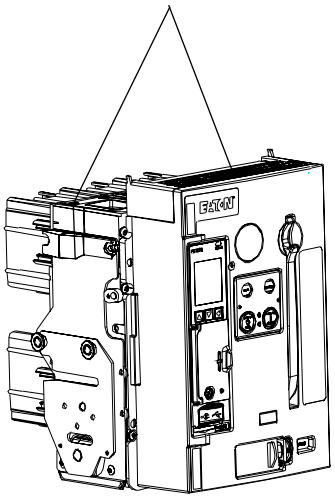
Figure 9. Suggested lifting procedures and precautions.



(Upright cassette)



(Breaker in cassette)

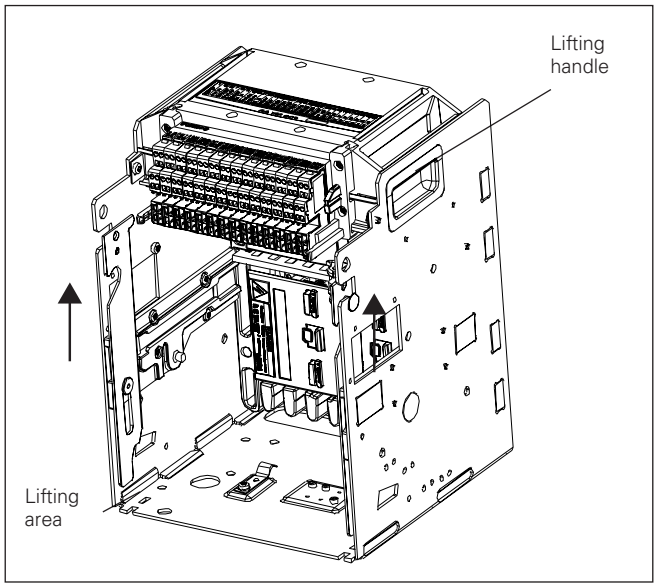


(Breaker only)

Note: When using an appropriate lifting device, attach the lifting harness in the locations shown in Figure 10 that best fits the circumstances.

Step 5: Carefully place a breaker or cassette on a solid work surface capable of handling their weight for examination (Table 1). A drawout circuit breaker can also be examined while withdrawn on the drawout extension rails of an already installed cassette. Fixed circuit breakers already installed in an assembly can be inspected in their installed location.

Figure 10. Step 5.



CAUTION

Do not attempt to lift a breaker or cassette with ordinary crane hooks or chains. Damage to vital circuit breaker parts could result. Use two appropriate lifting straps when using any type of lifting device.

CAUTION

Make certain that the cassette is properly mounted or seated securely on a work table before attempting to have the breaker fully extended on the cassette's drawout rails. Failure to comply could result in the cassette tipping forward resulting in equipment damage and/or bodily injury.

Table 1. Approximate weights.

Item	lbs	kg
Drawout breaker, three-pole	55	25
Drawout breaker, four-pole	72	33
Fixed breaker, three-pole	45	20
Fixed breaker, four-pole	62	28
Drawout cassette, three-pole	32	15
Drawout cassette, four-pole	37	17

Circuit breaker inspection

All circuit breakers, once removed from their shipping containers, should be visually inspected for any obvious damage. Check to make sure that the installed trip unit and nameplate information match the equipment as ordered. All circuit breakers should be operated as described in Section 3 prior to being put into service.

Storing circuit breaker

Store a circuit breaker in its original shipping container with contacts open and springs discharged. Keep it in a clean dry place. Ensure there is ample air circulation and heat, if necessary, to prevent condensation.

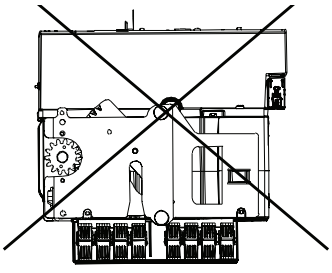
IMPORTANT

A circuit breaker stored for any length of time should be operated a minimum of five times before it is placed in service.

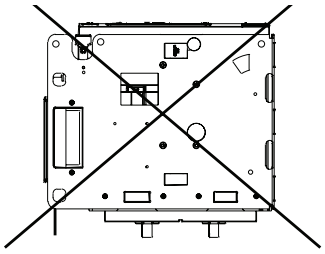
CAUTION

Do not store equipment on its back or side. This could result in equipment damage.

Figure 11.



(Circuit breaker)



(Breaker in drawout cassette)

Section 3: General operation and circuit breaker description

Introduction

⚠ CAUTION

Make certain that the cassette is properly mounted or seated securely on a work table before attempting to have the breaker fully extended on the cassette's drawout rails. Failure to comply could result in the cassette tipping forward resulting in equipment damage and/or bodily injury.

Low voltage circuit breakers are available in both drawout and fixed mounting configurations (Figure 2 and Figure 4) as three-pole or four-pole breakers.

All circuit breakers should be operated manually and/or electrically before they are put into service. This can be done during the installation process or some later date prior to startup.

Installing the drawout circuit breaker in the cassette

In a structure equipped for a drawout circuit breaker, a bolted-in cassette with movable, captive extension rails supports the circuit breaker.

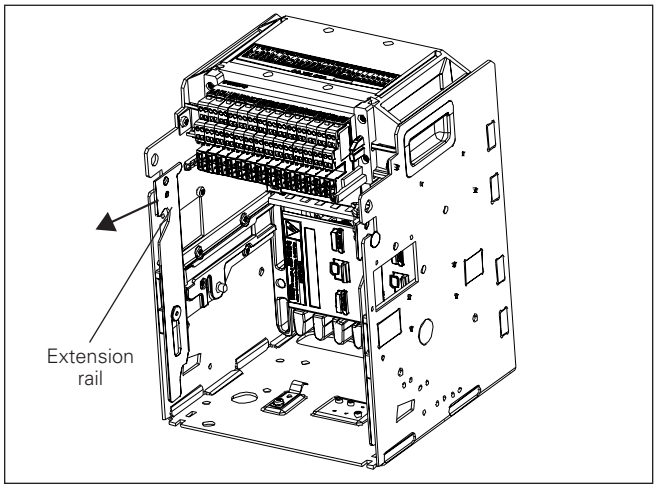
⚠ CAUTION

It is important to take care when placing a drawout circuit breaker on its extension rails. If the circuit breaker is not properly seated on the rails, the breaker could fall causing equipment damage and/or bodily injury.

To install the drawout circuit breaker, proceed first with the following three steps.

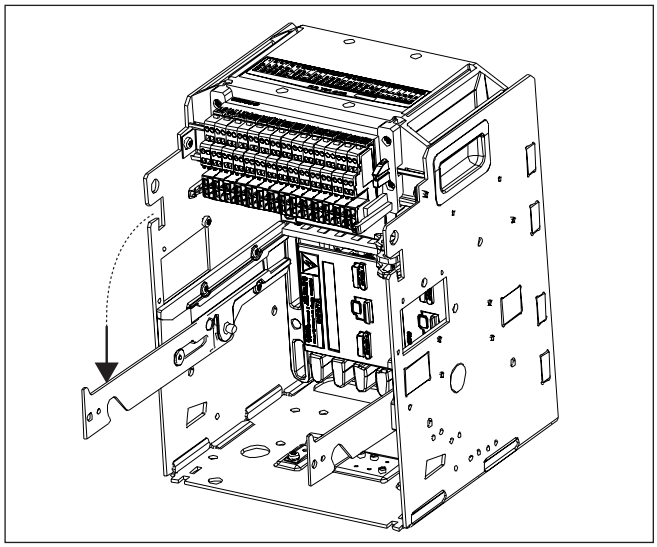
Step 1: Lift the drawout rails located on each side of the drawout cassette all the way up until released. Each drawout rail is provided with a curved cutout to accommodate a gloved hand.

Figure 12. Step 1.



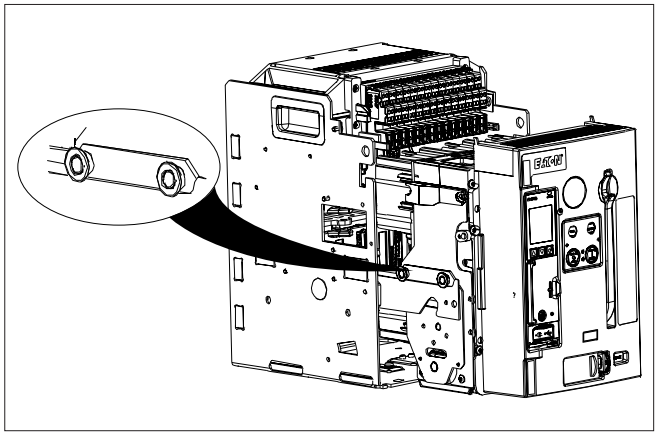
Step 2: Lower both rails down into their extended and locked position.

Figure 13. Step 2.



Step 3: Carefully place the circuit breaker on the extended rails. Be certain that the circuit breaker's metallic support wheels (two on each side of the circuit breaker) are properly seated on the extension rails. With breaker properly seated on the extension rails, slide the breaker fully into the cassette and raise both rails up into the cassette so that they engage the extension rail latch. The breaker is now in the cassette in the DISCONNECT position.

Figure 14. Step 3.



Keep in mind that all drawout circuit breakers are provided with safety interlocks to prevent inserting circuit breakers into incompatible drawout cassettes. Do not force a circuit breaker that does not roll smoothly into the casette.

Step 4: To remove the breaker from the cassette, lower both rails down into their extended and locked position. Using the charging handle, pull the breaker out onto the extension rail.

Rejection interlocks

Drawout circuit breakers come in a variety of continuous current and interrupting ratings. To prevent the insertion of a drawout circuit breaker into a cell with which it is incompatible, rejection interlock key plates are provided for both the circuit breaker and the cassette. One key plate is located on the bottom of the circuit breaker and one is located on the floor of the cassette. Rejection pins must be installed in both plates to complete the interlock scheme. **The switchboard builder is responsible for installing the rejection pins in the appropriate pattern in the rejection plates on both the circuit breaker and cassette.** A rejection pin installation kit, including the instruction leaflet IL01301006E, is supplied by the factory for this purpose.

⚠ WARNING

Never attempt to disable any interlocks. Doing so could result in an electrical fault that could result in death, bodily injury, and/or equipment damage.

Drawout circuit breaker positioning

Drawout circuit breakers have four normal positions:

- WITHDRAWN (**Figure 15**);
- DISCONNECT (**Figure 16**);
- TEST (**Figure 17**); and
- CONNECT (**Figure 18**).

The WITHDRAWN position is outside the compartment on the cassette's drawout rails. The DISCONNECT, TEST, and CONNECT positions are reached by means of the levering mechanism and can be achieved with the assembly door closed.

Figure 15. WITHDRAWN position.

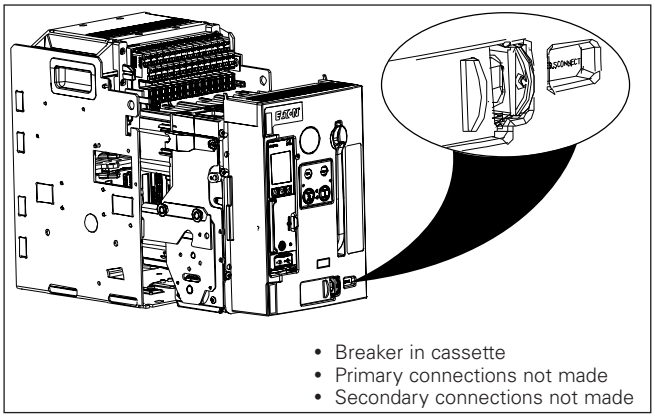


Figure 16. DISCONNECT position.

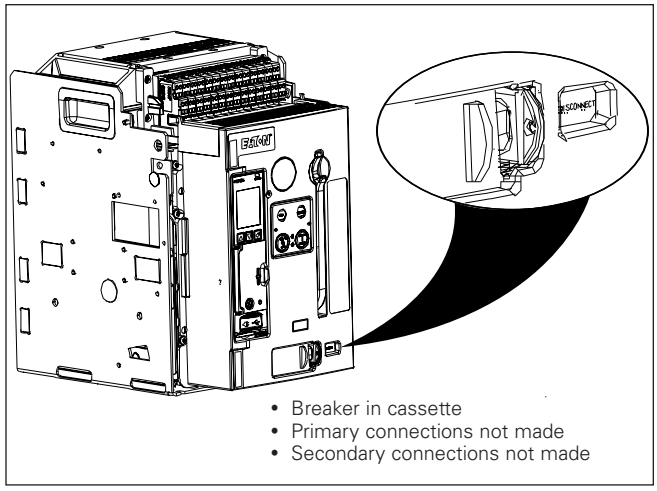


Figure 17. TEST position.

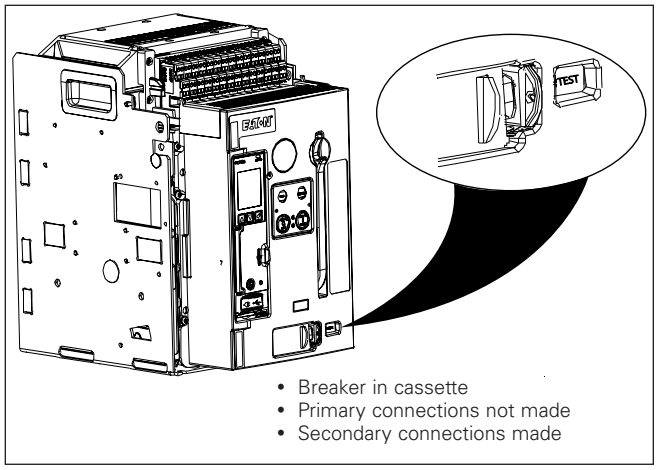
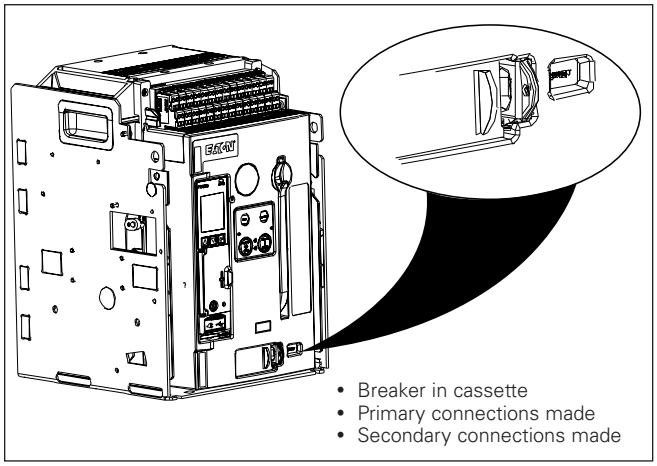


Figure 18. CONNECT position.

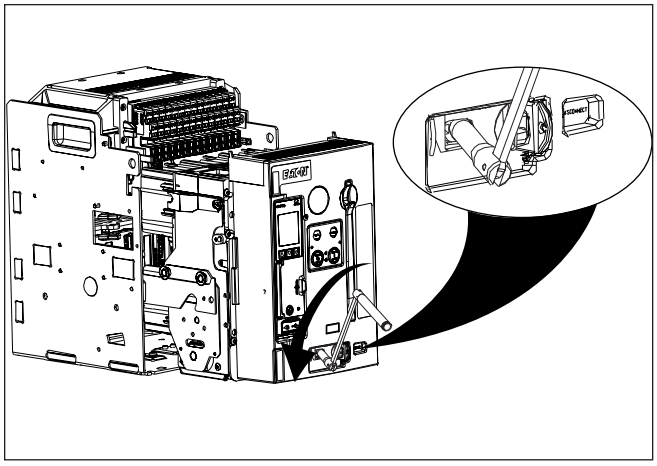


With the circuit breaker sitting solidly on the extension rails in its WITHDRAWN position, proceed with the following five steps to move the circuit breaker through its other positions.

Step 1: Make sure the circuit breaker position indicator, located in the right lower portion of the circuit breaker, indicates DISCONNECT (Figure 16).

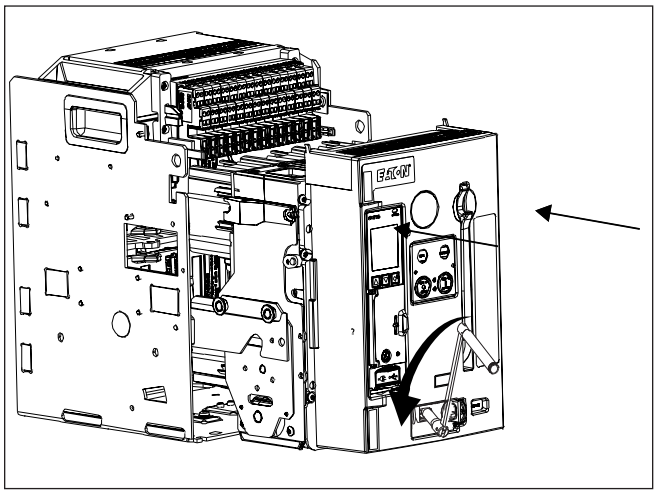
Step 2: If the indicator window indicates anything other than DISCONNECT, use the breaker's 3/8-inch levering tool or 3/8-inch drive extension and rachet to get the circuit breaker in the proper levering position. Slide the levering access door to the left to open it. Insert the levering tool into its compatible front accessible fitting, and rotate it counterclockwise until DISCONNECT is indicated in the window.

Figure 19. Step 2.



Step 3: Carefully push the circuit breaker into its compartment until it stops. The extension rails can now be folded up and latched.

Figure 20. Step 3.

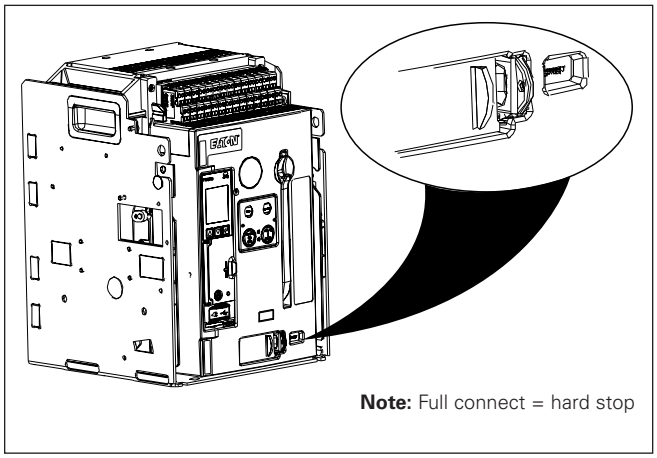


Step 4: The breaker is ready to be levered. With the circuit breaker OPEN, rotate the levering tool clockwise to and through the different available positions (DISCONNECT, TEST, CONNECT).

Note: The position indicator on the lower right portion of the breaker indicates the position as each position is reached. The levering door will not close between positions.

When the breaker reaches the CONNECT and DISCONNECT position, a hard stop is encountered. Discontinue levering to avoid damage due to torquing beyond the maximum of 15 ft-lb (20.4 N•m).

Figure 21. Step 4.



Step 5: To remove the circuit breaker from any position or from the compartment completely, reverse the insertion procedure just described in Steps 1 through 4 by rotating the levering tool in a counterclockwise direction. When the DISCONNECT position is reached, the circuit breaker will no longer move out of the cassette as a result of rotating the levering tool. At this point, the circuit breaker can be pulled out of the cassette onto its drawout rails.

⚠ IMPORTANT

The circuit breaker mechanism is interlocked such that charged closing springs are automatically discharged if the circuit breaker is levered into or out of the cell. Discharge takes place between the DISCONNECT and TEST positions.

Installing fixed circuit breaker

A fixed circuit breaker is solidly mounted in its structure with no drawout feature. The circuit breaker is available in both front-connected and rear-connected configurations (Figure 22). Rear-connected fixed circuit breakers can be mounted on a suitable horizontal or vertical mounting surface using left- and right- side mounting feet. In addition, front-connected fixed circuit breakers can also use the mounting feet for mounting a breaker on a suitable vertical surface. Refer to specific instruction details provided in IL01301030E (Figure 23). Refer to Section 6 for breaker and primary bus stab details and requirements.

Figure 22. Typical mounting configurations.

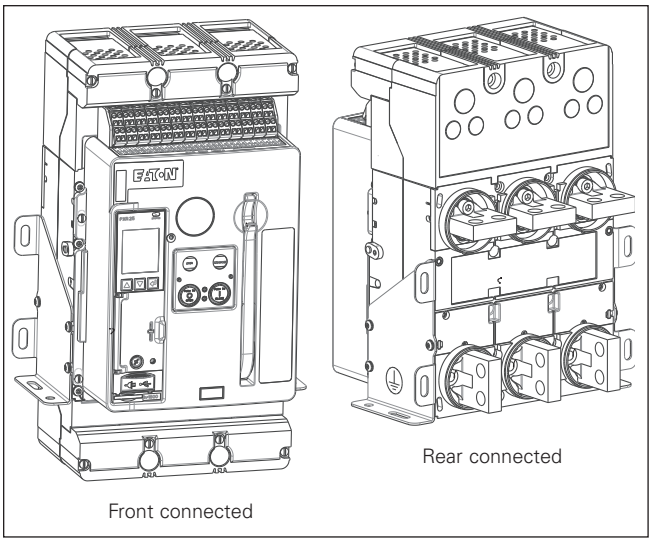
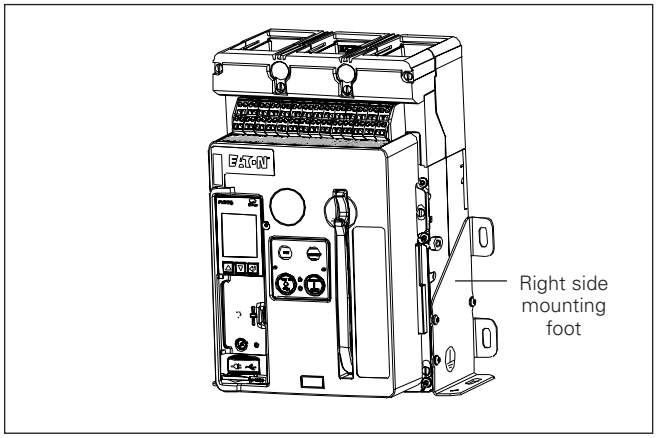


Figure 23. Side-mounted mounting feet.



Basic circuit breaker assembly

Circuit breakers use a rigid frame composite housing construction. This construction provides high-strength structural properties, excellent dielectric characteristics, and arc tracking resistance.

They are available with various connection configurations and specific ratings dictated by the applicable standards (see www.eaton.com

Each pole has one primary contact assembly comprised of a moving portion and a fixed portion. The exact design configuration depends upon the breaker's frame size.

Operating mechanism

The operating mechanism is a two-stage stored energy trip-free mechanism. Energy is stored for a closing operation with sufficient energy remaining to open the circuit breaker after a closing operation.

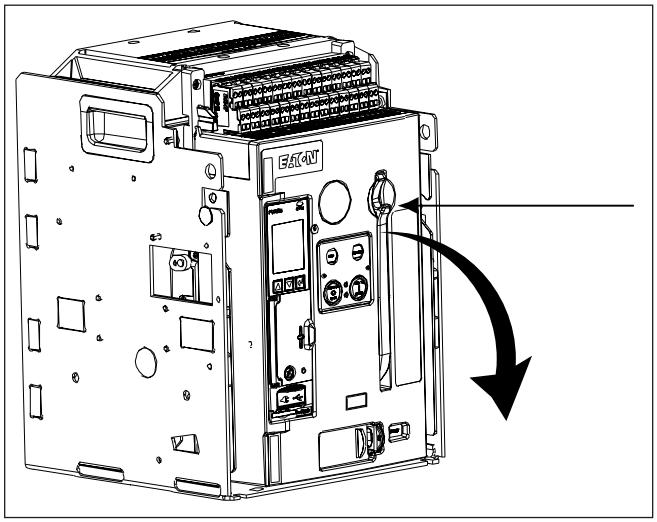
All circuit breakers should be operated manually and/or electrically before they are put into service. This can be done during the installation process or some later date prior to startup. To perform this operational check, follow the procedures outlined in the following section.

Manual operation

On manually operated circuit breakers, the closing spring must be charged by hand. To manually charge the spring and operate the circuit breaker, proceed with the following three steps:

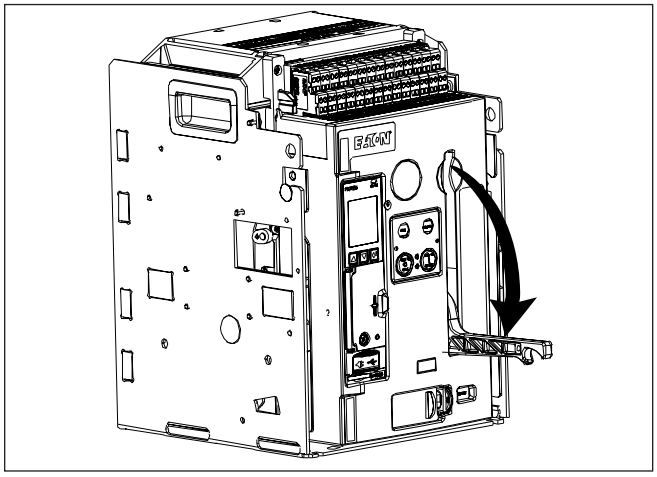
Step 1: Insert one finger in the curved recess behind the charging handle and pull out and down.

Figure 24. Step 1.



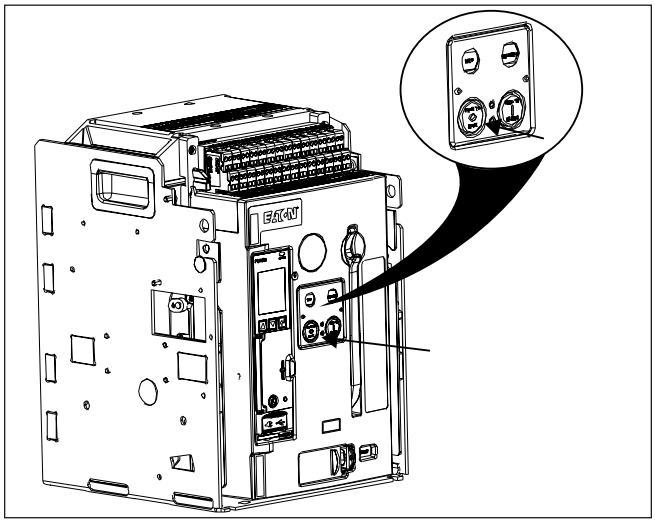
Step 2: It takes approximately seven full downward strokes to complete the charging process. It is possible to manually recharge the spring immediately after closing the breaker, before it has been tripped open. The status of the spring (charged or discharged) is indicated in the mechanism spring status window just above the pushbuttons.

Figure 25. Step 2.



Step 3: Standard manually operated circuit breakers are closed and opened by hand using the Manual ON and Manual OFF buttons located on the front of the circuit breaker. To perform either operation, press and release the appropriate button. The status of the contacts (open or close) is indicated in the Contact Status Window just above the pushbuttons on the front of the breaker.

Figure 26. Step 3.



Optional electrically operated accessories are available to automatically close/trip a manually operated breaker.

Electrical operation

The springs on an electrically operated circuit breaker are normally charged automatically through the use of an electrical operator. The springs can, however, be charged manually as just described in the last section. Electrically operated circuit breakers can also be manually closed and opened through the use of the front mounted ON and OFF buttons.

An electrically operated circuit breaker can be equipped with an optional spring release (closing coil) to close the circuit breaker remotely. The breaker can also be equipped with a shunt trip (opening coil) to open the breaker remotely.

⚠ IMPORTANT

Different degrees of access to pushbuttons on the front of the circuit breaker can be achieved through the use of optional accessory devices.

Anti-pump feature

Circuit breakers have both mechanical and electrical anti-pump features. If the circuit breaker is closed on a fault condition and trips open while the CLOSE signal is maintained (using either the mechanical pushbutton or the electrical close coil), it will not make a subsequent attempt to close until the close command is removed and reapplied.

Note: If the close signal is applied prematurely (before the breaker is completely charged and latched), the close command will be ignored until it is removed and reapplied.
For electrical closing, a latch check switch (LCS) option is available that will block the application of the electrical close command until the breaker is ready.

Section 4: Circuit breaker features and accessories

Introduction
All features and accessories of the drawout and fixed configurations are covered briefly in this section and in Section 5. Details and installation instructions on trip units and individual accessories are covered in their respective IL's.

Arc chambers
An arc chamber, one for each pole, includes an arc chute mounted around a set of primary contacts. The chambers act to quench arcs and channel gases up and out of the breaker during interruption.

Electronic tripping system
Circuit breakers use a three-part tripping system:

- Microprocessor-based trip unit connected to a frame rating module;
- Rogowski coil type current sensors; and
- Trip actuator.

All three parts of the tripping unit are discussed here in general. For detailed information pertaining to the different available trip unit models and other breaker or accessory information, refer to Eaton's website www.eaton.com

See important frame rating module information on next page regarding the tripping system.

Microprocessor-based trip unit
Eaton ICCB circuit breakers utilize the PXR family of electronic trip units whose main features are summarized in Table 2. The Digitrip trip units are also still available for purchase.

The electronic trip units are self-powered devices (Figure 27). The protection settings can be set from the front panel. When the circuit breaker is closed, no external power is required to operate their protective systems. Current signal levels and the control power are derived from the current sensors. All trip units are true RMS current sensing devices.

A functional local test of the trip unit's primary electronic circuitry and the circuit breaker's mechanical tripping action can be performed through the trip unit's USB port (Figure 5).

Figure 27. Installed PXR 520 trip unit.

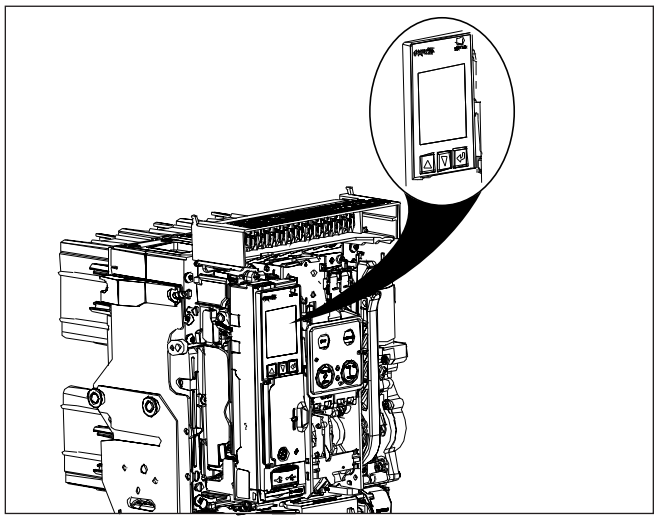


Table 2. Trip units.

Functions	PXR20	PXR 25
LSIG protection	Yes	Yes
Disable (I)	Yes	Yes
GF protection	Option	Option
GF alarm	Option	Option
Display	Yes	Yes
Programmable	No	No
Current metering	Yes	Yes
Power/energy metering	No	Yes
Power quality metering	No	No
Communication	Yes	Yes

Rating plug
A rating plug is not required with PXR trip units. See the frame module description that follows.

Current sensors
Rogowski coil type current sensors are installed on the load terminals at the bottom rear of the circuit breaker. The sensors furnish the trip unit with a signal and the energy required to trip the circuit breaker.

An external neutral current sensor is available for customer installation, and must be ordered separately.

Frame rating module

The PXR frame rating module is mounted just behind the trip unit and stores data related to the breaker's ratings (including the maximum continuous RMS current), manufacturing information, and health of the breaker frame.

The interchangeable trip unit attaches to the permanent frame rating module. Since the PXR trip unit no longer requires a fixed type rating plug, the continuous current (I_n) rating is factory programmed in the frame rating module.

The programmed value of In is shown on the trip unit's LCD display and printed on the battery cover at the lower right corner of the trip unit. The I_n rating displayed and programmed will be equal to or less than the breaker frame's maximum rated current as listed on the nameplate in Figure 1.

The breaker's I_n rating can be re-programmed by interfacing with the USB port on the trip unit. Please contact your Eaton sales representative for details on proper re-programming of the trip unit.

Frame rating modules installed on air circuit breakers with PXR are permanent and SHOULD NEVER BE REMOVED. The frame rating module battery cover with printed I_n rating (see Figure 5) should not be changed without proper reprogramming of the trip unit. The I_n rating programmed from the factory is displayed in the lower left hand corner of the LCD screen whenever power is applied to the trip unit. The I_n displayed on the LCD reflects the actual I_n rating of the breaker, while the value on the battery cover is for reference only when the LCD is not powered. The In rating displayed on the LCD screen and I_n rating printed on the frame rating module battery cover MUST ALWAYS AGREE. See MN013003EN for more information.

Trip actuator

The low-energy trip actuator is a small electromagnetic device that provides the necessary mechanical force to initiate the tripping action of the circuit breaker. The electronic trip unit provides a pulse to the coil of the trip actuator, allowing the mechanical tripping action to take place. The trip actuator is reset by the operating mechanism.

Fixed high instantaneous non-adjustable trip

Circuit breakers have a fixed instantaneous non-adjustable setting. This fixed instantaneous trip will initiate a trip at a high current peak which depends on the circuit breaker type and rating. This setting is always active, regardless of the instantaneous setting.

Non-automatic device

Eaton ICCB are available in a non-automatic configuration. It is derived from the corresponding automatic breaker, but does not include the trip unit, Rogowski coil type current sensors, and the high instantaneous trip feature. The overall dimensions and the capability of mounting most accessory items are maintained. Non-automatic devices are tested in keeping with UL 1066, IEC 60947-2 and UL 489 requirements.

Secondary contacts and connection diagrams

A maximum of 56 secondary wiring connection points are available, each dedicated to specific functions. The number of secondary blocks mounted depends on a number of considerations, such as whether the circuit breaker is electrically or manually operated and how many features are required. All necessary customer secondary connection point are accessible without removing the breaker's front cover. Each connection point is permanently identified.

The customer secondary wiring contact point map is identifiable on the product (Figure 28). For a drawout breaker, this label is on the arc hood of the drawout cassette (Figure 3). For a fixed mount breaker, this is a label applied to the top of the front cover of the breaker (Figure 4).

The connection diagram and specific secondary contact information for the circuit breakers using PXR trip units can be found in the Wiring Diagram document TD013001EN.

Figure 28. Secondary point identification.

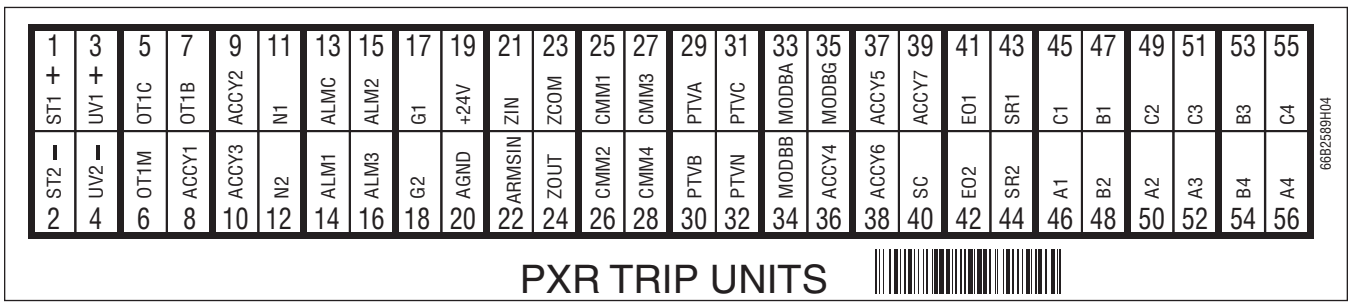


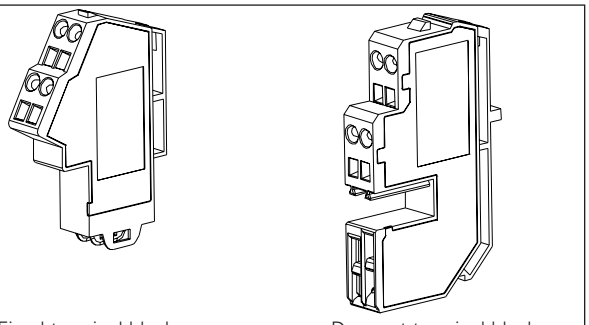
Table 3. Wiring index (TD013001EN).

Wiring topic	
Zone interlock wiring	Figure 1
Ground fault residual 3-phase 4-wire	Figure 2
Source ground fault sensing	Figure 3
Zero sequence ground fault sensing	Figure 4
PXR alarm wiring	Figure 5
Maintenance mode wiring	Figure 6
INCOM communication module (ICAM)	Figure 7
MODBUS communication module (MCAM)	Figure 8
PROFIBUS communication module (PCAM)	Figure 9
ETHERNET communication module (ECAM)	Figure 10
Remote control (SR and ST wiring)	Figure 11
Undervoltage release	Figure 12
Circuit breaker control - type NF frame	Figure 13
Circuit breaker control - type RF frame	Figure 14
NF breaker with external PT module	Figure 15
Typical breaker master connection diagram - NF	Figure 16
Typical breaker master connection diagram - RF	Figure 17

General wiring notes

1. Each contact block on the Secondary Terminal Block contains four independent contacts (Figure 29). A possible 14 terminal blocks will provide 56 contact points for the type NF frame.

Figure 29. Secondary point identification.



Fixed terminal block Drawout terminal block

2. Drawout circuit breakers use Style 67C3246 contact blocks that mount onto an insulated support frame on the cassette.
3. Fixed mounted circuit breakers use Style 67C3247 contact blocks that mount onto an insulated support frame. The customer tension connectors are at an angle.
4. Customer wiring is done using a tension clamp termination on each contact.
5. Contact blocks are individually mounted and hence contact positions may be empty depending on accessories and options ordered.
6. The tension clamp terminals will support solid or flexible conductors, #12/4 mm^2 through #26/0.5 mm^2 AWG and are rated for 600 V, 10 A.
7. The recommended wire strip length is 10 - 12 mm (0.39 - 0.47").
8. The tension clamp terminals also support finely stranded conductors with wire-end ferrules and plastic collars DIN 46228/4, rated connection.
9. The two-point blue plugs house two female crimp contacts, Style 67C3249, with the odd assigned numbers having the coded rib feature on the blue plug (Figure 30).

Table 4. Customer wiring details.

Type of conductor	Tension clamp connection	Recommended strip length or ferrule length
Solid cross section (min-max)	0.5 - 4 mm^2	10 - 12 mm (0.39 - 0.47 in.)
Flexible cross-section (min-max)	0.5 - 4 mm^2	10 - 12 mm (0.39 - 0.47 in.)
American wire gauge (AWG) (min-max)	26 - 12 AWG	10 - 12 mm (0.39 - 0.47 in.)
Flexible cross section with wire end ferrules without plastic sleeve - DIN 46228/1 (min-max)	0.5 - 2.5 mm^2 (26 - 14 AWG)	10 - 12 mm (0.39 - 0.47 in.)
Flexible cross section with wire end ferrules with plastic sleeve - DIN 46228/4 (min-max)	0.5 - 1.5 mm^2 (26 - 16 AWG)	16 - 18 mm (0.63 - 0.71 in.)
Gauge to IEC 60947-1	A3	-

10. For secondary contacts, odd numbers should be treated as positive voltage for any accessory. This will not apply for AC ratings
11. Leads may be removed from the secondary contact plug using extraction tool 68D3288 (Figure 31).

Note: The connector plug must be oriented as shown in Figure 30 before making the connection.

Figure 30. Accessory plug and crimp contact.

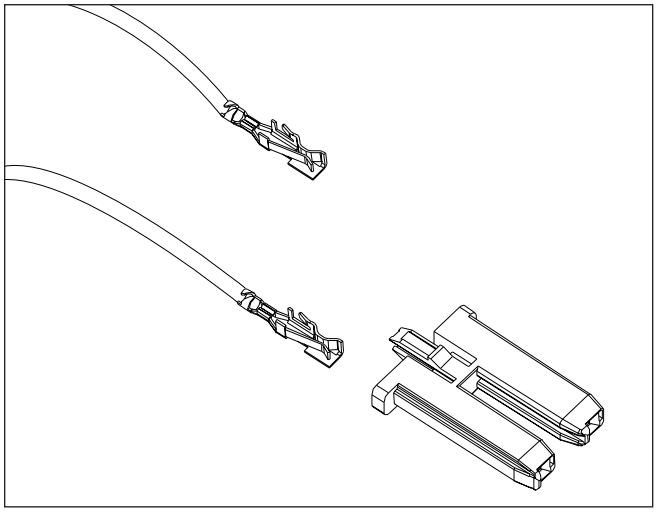
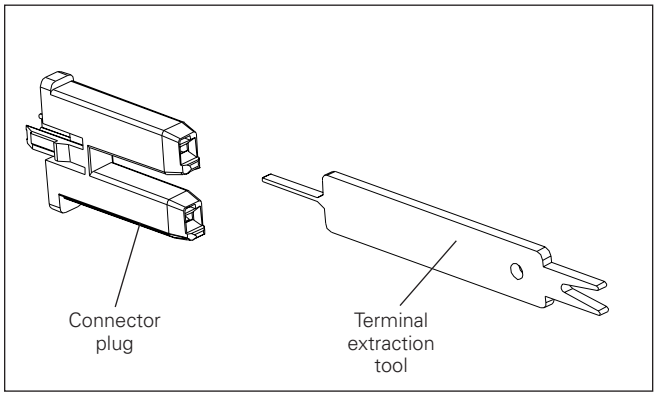


Figure 31. Extraction tool in use.



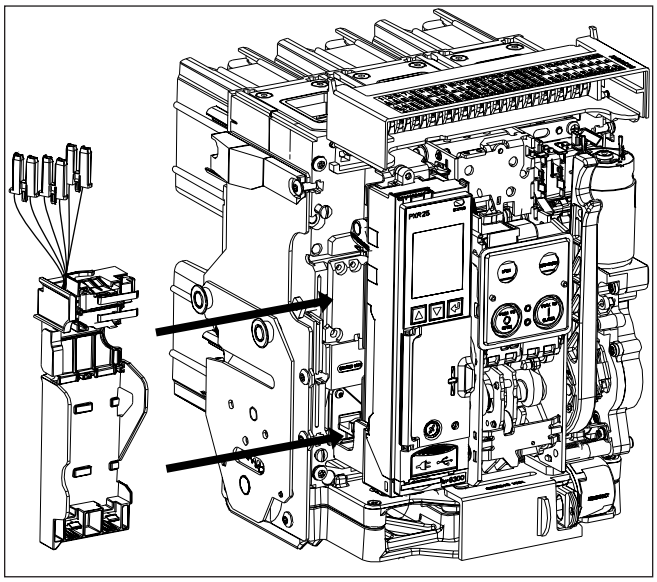
Accessory devices

A variety of accessory devices are available for use with circuit breakers. Unless otherwise stated, they are all considered optional devices in the sense that they are not provided as standard on a manually operated circuit breaker. Available accessories are discussed in general terms. For more detailed information and/or installation instructions, refer to individual instruction leaflets dedicated to individual items.

Circuit breaker accessories are designed to be field installed. The accessories fall into one of three categories:

- Accessory tray devices;
- Other internal electrical devices; and
- Mechanical devices.

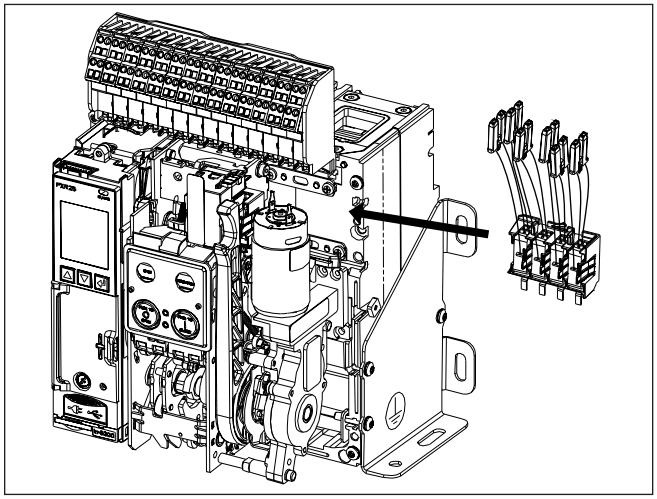
Figure 32. Left accessory tray.



Accessory tray devices

Certain accessory devices are mounted in an accessory tray. The tray is then installed in a left- or right-hand slot located in the upper left- and right-hand sides of the circuit breaker (Figure 32 and Figure 33).

Figure 33. Right accessory tray.



Left accessory tray

The left accessory tray will accommodate a maximum of four optional devices as follows:

- One or two shunt trips (ST);
- One undervoltage release (UVR);
- Combination (one ST and one UVR); and
- Two overcurrent trip switches (OTS).

Right accessory tray
The right accessory tray will accommodate up to two sets of auxiliary switch combinations.

Shunt trip (ST)
The shunt trip opens the circuit breaker instantaneously when its coil is energized by a voltage input.

Undervoltage release (UVR)
The undervoltage release opens the circuit breaker when its supply voltage falls into the range of 35 - 60% of rated voltage. If the release is not energized to 85% of its supply voltage, the breaker cannot be closed electrically or manually.

Overcurrent trip switch (OTS)
An overcurrent trip switch (bell alarm) provides an electrical indication when a circuit breaker trips as a result of the trip unit. Opening as a result of a circuit breaker's manual open button, shunt trip, or undervoltage release does **not** cause the overcurrent trip switch to operate. Overcurrent trip switches are available in two switch combinations only.

Auxiliary switch
An auxiliary switch provides remote electrical indication if the circuit breaker is open or closed. Each switch has one normally open ("a" contacts with the same state as the breaker contacts) and one normally closed ("b" contacts with the opposite state of the breaker contacts) type contact. Auxiliary switches are available in two switch combinations only.

Other internal electrical devices
Internally mounted electrical devices which do not utilize the accessory trays include:

- Spring release;
- Latch check switch; and
- Motor operator.

Spring release (SR)
The spring release (closing coil) remotely closes the circuit breaker when the coil is energized by a voltage input. The spring release activates momentarily when voltage is first applied, and voltage must be removed in order to reset the spring release to activate again. When the spring release is used in conjunction with a spring release latch check switch and voltage is maintained to the spring release, activation of the spring release is delayed until the closing spring is fully charged and the trip latch is reset (not held in the tripped position). After these conditions are met and the spring release has activated, voltage must be removed to reset the spring release to activate again.

Latch check switch (LCS)
A latch check switch indicates when the circuit breaker is "ready to close" (charged and not held tripped). Two versions of the LCS are available:

1. The "spring release LCS", wired directly to the spring release, will not permit activation of the spring release until the circuit breaker is fully charged and the trip latch is reset.
2. The LCS for remote indication consists of one Form C contact wired to the circuit breaker secondary contacts for integration into external control schemes.

Note: Wiring the LCS for remote indication directly in series with the SR accessory is not recommended as this will override the electrical "anti-pump" feature of the spring release.

Motor operator
A motor operator is an electric motor assembly internally mounted in the circuit breaker. It charges the closing springs electrically for remote or local operation. The motor operator can be factory or field installed.

Mechanical devices
The following are optional mechanical type accessories:

- Pop-out trip indicator, non-interlocked and interlocked;
- Operations counter;
- Off key lock;
- Pushbutton cover;
- Prevent close cover;
- Lockout cover;
- Cassette safety shutters;
- Door escutcheon;
- IP55 water resistant cover; and
- Mechanical interlock.

Non-interlocked pop-out mechanical trip indicator
A non-interlocking red, pop-out mechanical trip indicator, located to the right of the trip unit on the breaker's front faceplate (Figure 5), operates by releasing and popping out any time the breaker trips due to an overcurrent condition. It will not prevent the breaker from being reclosed. The indicator is reset manually by pushing it back in.

An optional overcurrent trip switch (bell alarm) can be used in conjunction with the mechanical trip indicator. The overcurrent trip switch operates off the position of the mechanical trip indicator, and is reset when the indicator is reset.

Interlocked pop-out mechanical trip indicator

An interlocked, red, pop-out mechanical trip indicator is an optional feature. It is located in the front of the breaker near the top and to the right of the trip unit (Figure 6). It operates by releasing and popping-out any time the circuit breaker trips due to an overcurrent condition.

Note: The interlocked mechanical trip indicator will prevent the breaker from being reclosed until the red, pop-out indicator is reset or pushed back in.

The indicator is reset manually by pushing it back in. If the interlocked indicator is not reset, the circuit breaker will not close until the indicator is pushed back in.

An overcurrent trip switch (bell alarm), discussed later in this section, that operates off the position of the mechanical trip indicator is also available.

Operations counter

The operations counter is a mechanical device used to indicate the number of circuit operations. It can be viewed through the breaker's front cover (Figure 6).

Off key lock

The off key lock secures the circuit breaker in the OFF position. It can be viewed through the front cover (Figure 5). The customer supplies the key lock. The provisions are available a for Kirk, Castell, Ronis, and CES.

Pushbutton cover

Padlockable covers are available to limit access to the ON and OFF pushbuttons.

Safe-off pushbutton cover

When padlocked, it maintains the OFF button in the actuated position, which prevents closure of the breaker.

Cassette safety shutters

Automatically operated insulating type safety shutters (Figure 3) are available for use with the drawout cassette to cover the fixed primary contacts when the circuit breaker is not in the CONNECT position.

Door escutcheon

The door escutcheon is a molded frame used to seal the space between the circuit breaker and the compartment door cutout. It is supplied with a mounting gasket. Refer to IL01301012E for installation information.

IP55 dust and water resistant cover

A hinged dome-shaped waterproof cover attaches to the metal compartment door to provide protection for the circuit breaker.

Mechanical interlock

Mechanical interlocks are available to interlock the operation of two or three Eaton ICCB's. The mechanical interlock holds one or more circuit breakers tripped (prevents closure) when others are closed. Consult Eaton for details.

Publications

MN013001EN_Table5.

Publication Number	Description
IL0131128EN	Screen navigation guide for 20/25 trip unit
TD013001EN	PXR Wiring diagrams
AD013001EN	PXR 20 & 25 trip units guide
IL01301012E	Door escutcheon
IL01301038E	IP55 dust and Water-resistant cover
IL0131096EN	Auxiliary switch
IL0131087EN	Instructions for Undervoltage Release, Shunt Trip, and Overcurrent Trip Switch
IL0131088EN	Instructions for spring release, latch check switch, and motor operator
IL0131093EN	Instructions for secondary terminal blocks
IL0131089EN	Instructions for source ground and zero sequence ground sensor
IL0131125EN	ECAM instructions for ethernet communications adapter module
IL0131092EN	PCAM instructions for profibus dp communications adapter module
IL0131091EN	MCAM instructions for modbus communications adapter module
IL0131124EN	INCOM communications adapter module
IL01301074E	PT module
IL5721B33	Time Delay Undervoltage Module for use with Undervoltage Release in Eaton Circuit Breakers
IL0131094EN	Neutral current sensor - RF
IL0131090EN	Neutral current sensor - NF
IL0131095EN	Cassette cell switch - RF
IL0131097EN	Cassette cell switch - NF
IL01301039E	Kirk key interlock kit
IL01301040E	Ronis key interlock kit
IL01301049E	CES interlock kit
IL01301050E	Castell key lock accessory
IL01301055E	Operation counter - RF
IL01301011E	Installation Instructions for Operation Counter
IL01301044E	IP20 drawout safety shutters - RF
IL01301013E	Installation Instructions for Drawout Cassette IP20 Safety Shutters
IL01301065E	Pushbutton cover kit - RF
IL01301041E	Push button cover - NF
IL01301019E	Pop-Out Mechanical Trip Indicator - NF
IL01301059E	2-way drawout cable interlock kit - RF
IL01301060E	3-way drawout mechanical interlock kit - RF
IL01301061E	2-way fixed cable interlock kit - RF
IL01301062E	3-way fixed cable interlock kit - RF
IL01301069E	2-way drawout cable interlock - NF
IL01301070E	3-way drawout cable interlock - NF
IL01301071E	2-Way fixed cable interlock - NF
IL01301072E	Installation Instructions for Fixed Circuit Breaker 3-Way Cable Interlock Kit
IL01301063E	Installation Instructions for Lev-in Key Interlocks
IL01301014E	Installation Instructions for Fixed Breaker Arc Hood

MN013001EN_Table5.

Publication Number	Description
IL01301066E	Installation Instructions for Cassette Door Interlock
IL01301073E	Installation Instructions for Cassette Door Interlock
IL01301048E	Installation Instructions for Breaker and Cassette Interphase Barrier
IL01301053E	Installation Instructions for Rear Primary Adapters
IL01301056E	Installation Instructions for Front Connect Adapters
IL0131123EN	65kA fixed front connect extension kit - NF
IL01301016E	Installation Instructions for Drawout Breaker Primary Adapters
IL01301021E	Installation Instructions for Breaker and Cassette Interphase Barriers

Section 5. Dimensional drawings for installation of drawout circuit breakers

General

Section 4 discussed topics and features common to all Eaton ICCB circuit breakers, no matter what the mounting configuration or type. In this section, features unique to the drawout type circuit breaker and drawout cassette not covered elsewhere are discussed.

Drawout cassette

A drawout circuit breaker Figure 2) is used in combination with a drawout cassette (Figure 3). The cassette provides all the necessary drawout circuit breaker interfaces, including automatic primary and secondary connections. Standard flat terminal pads on the rear of the cassette provide for a variety of primary connection configurations. Optional primary adapters are available for front and rear bus or cable connections. For specific details and mounting instructions, refer to IL01301016E.

Refer to Figures 34 through 45 for selected mounting and installation dimensional information. Complete dimensional and installation drawings are available from www.eaton.com

Figure 34. Three-pole drawout cassette - rear/top views in inches (mm).

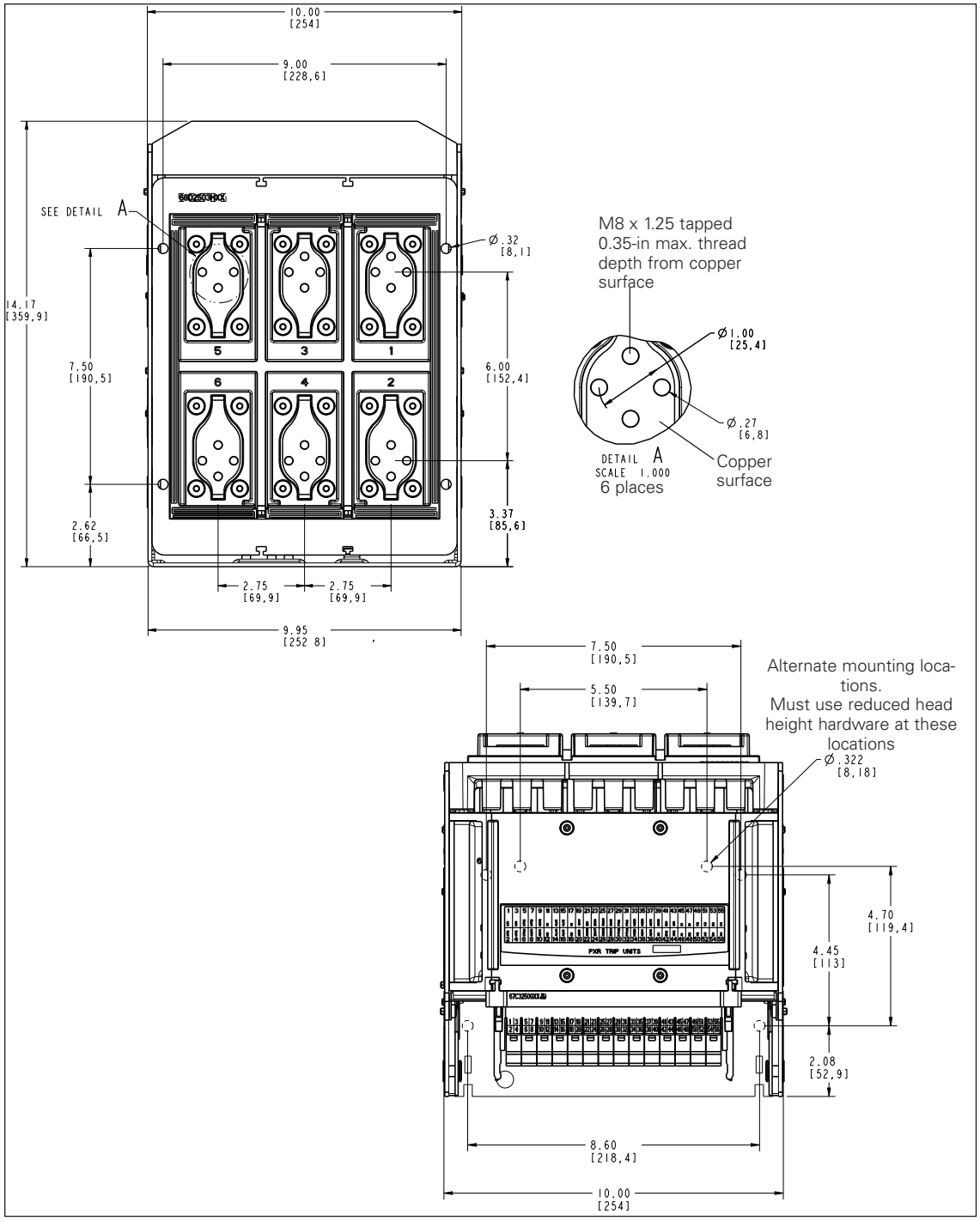


Figure 35. Three-pole drawout cassette - side views CONNECTED and TEST positions in inches (mm).

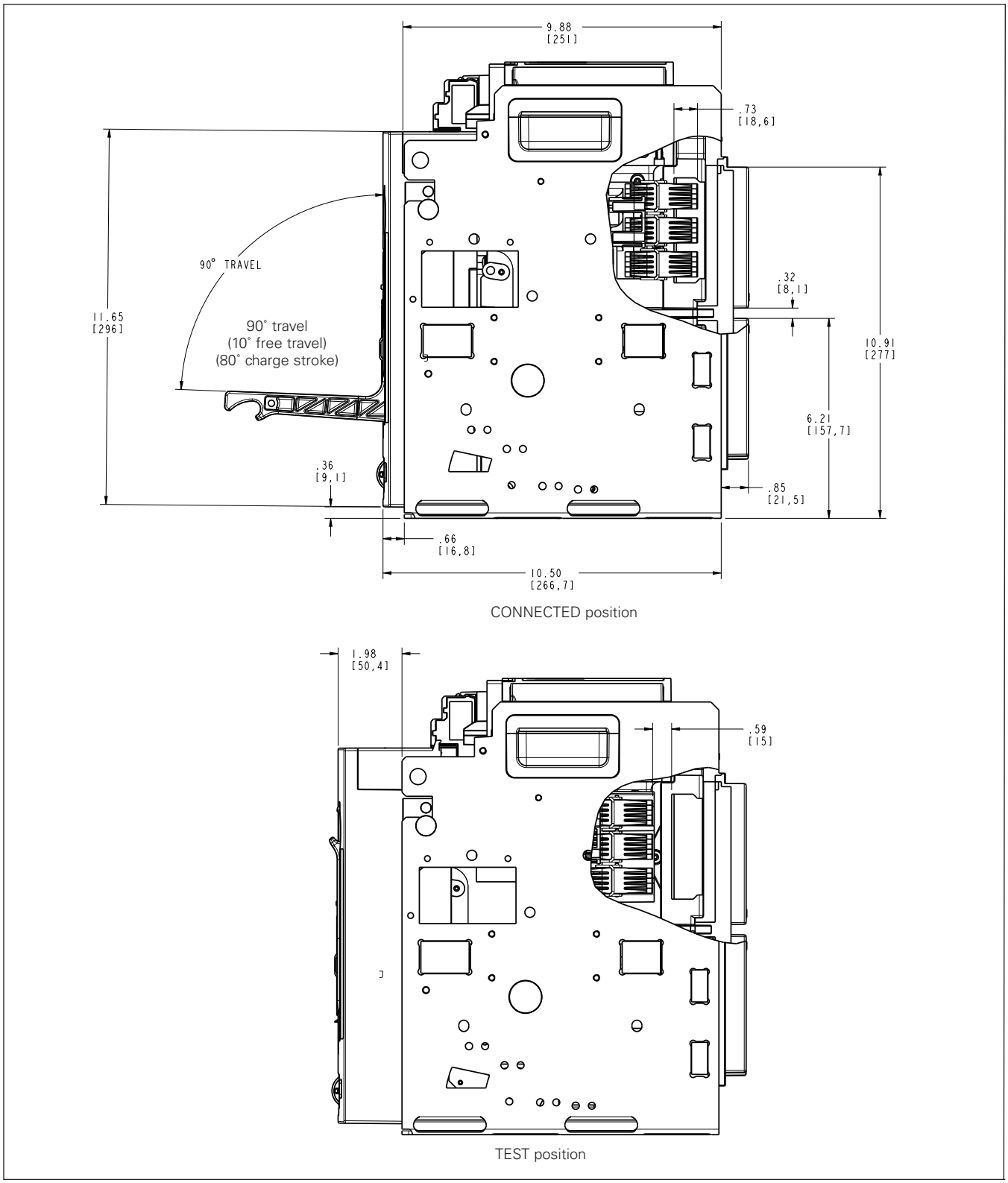
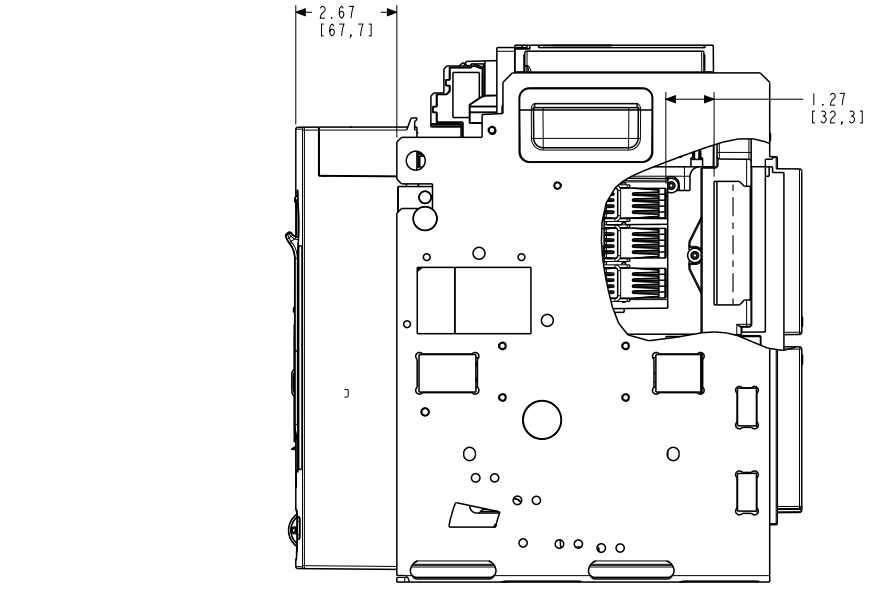
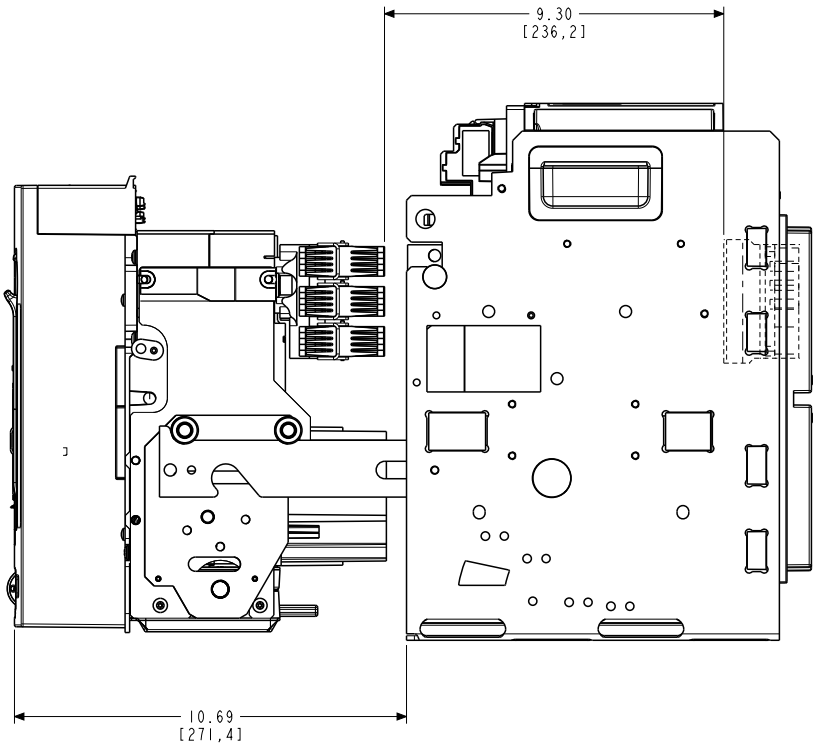


Figure 36. Three-pole drawout cassette - side views DISCONNECTED and WITHDRAWN positions in inches (mm).



DISCONNECTED position



WITHDRAWN position

Figure 37. Three-pole drawout cassette - top/side views with horizontal universal bus adapters in inches (mm).

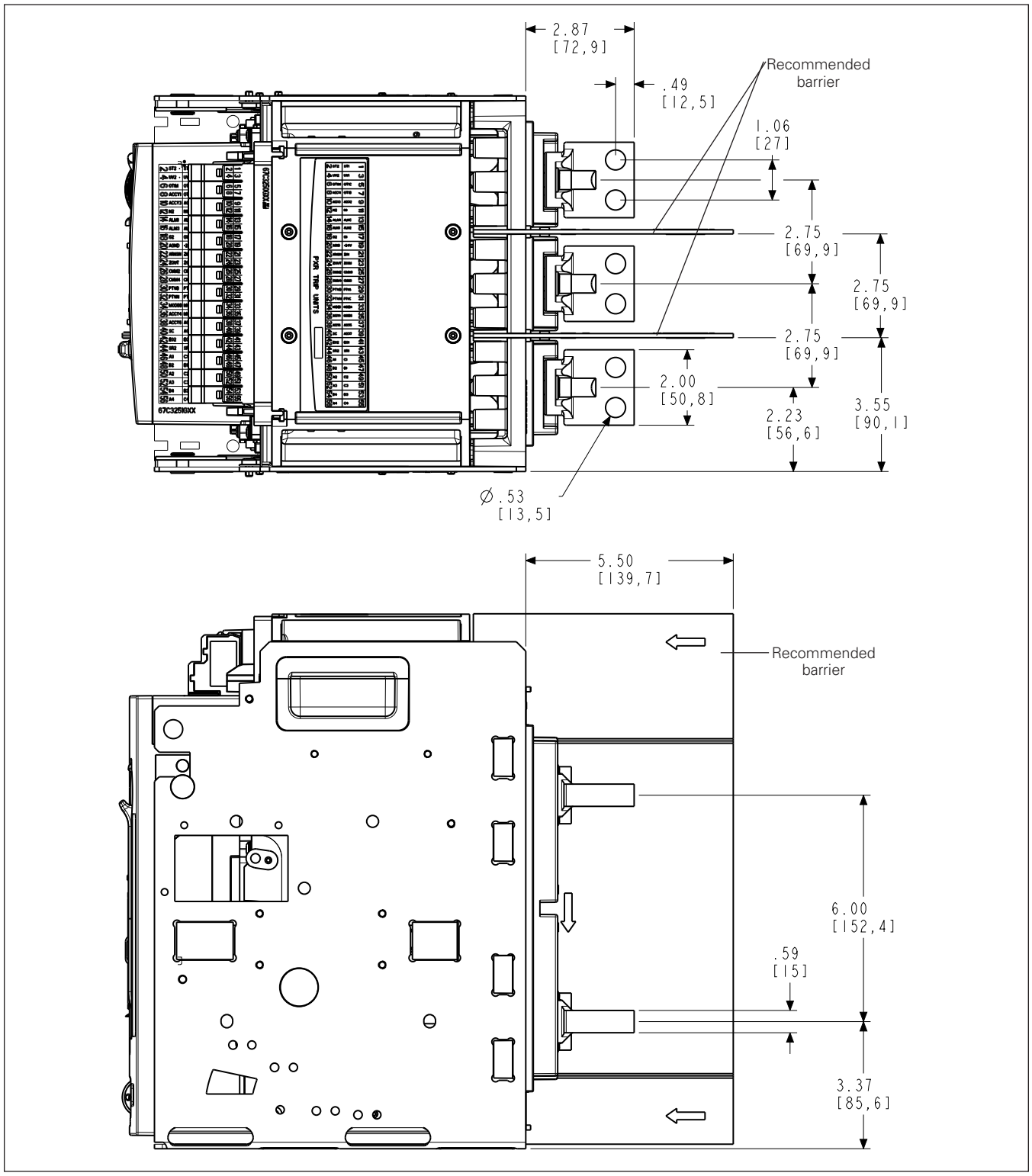


Figure 38. Three-pole drawout cassette - top/side views with vertical universal bus adapters in inches (mm).

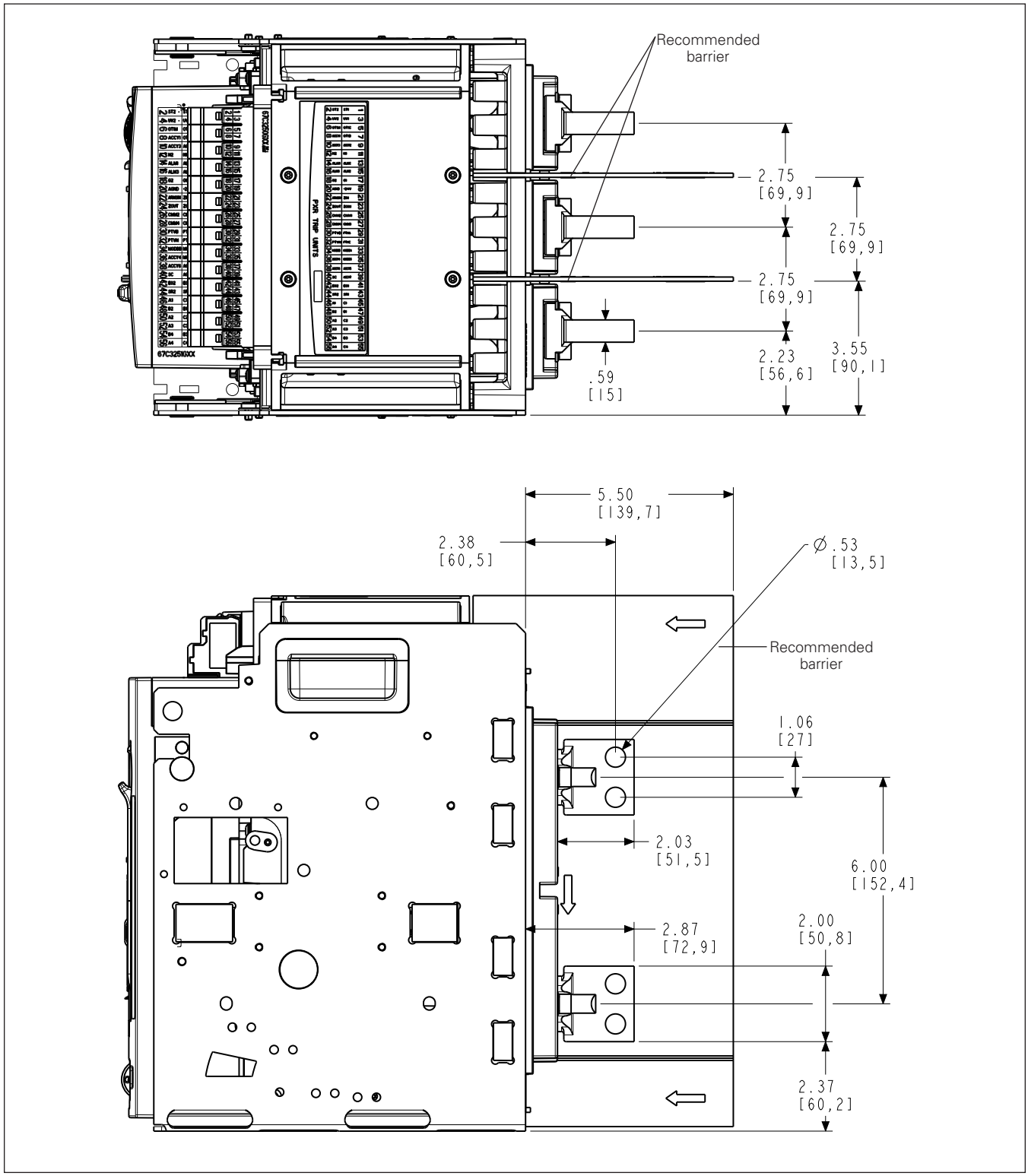


Figure 39. Three-pole drawout cassette - front view door and cassette cutout details in inches (mm).

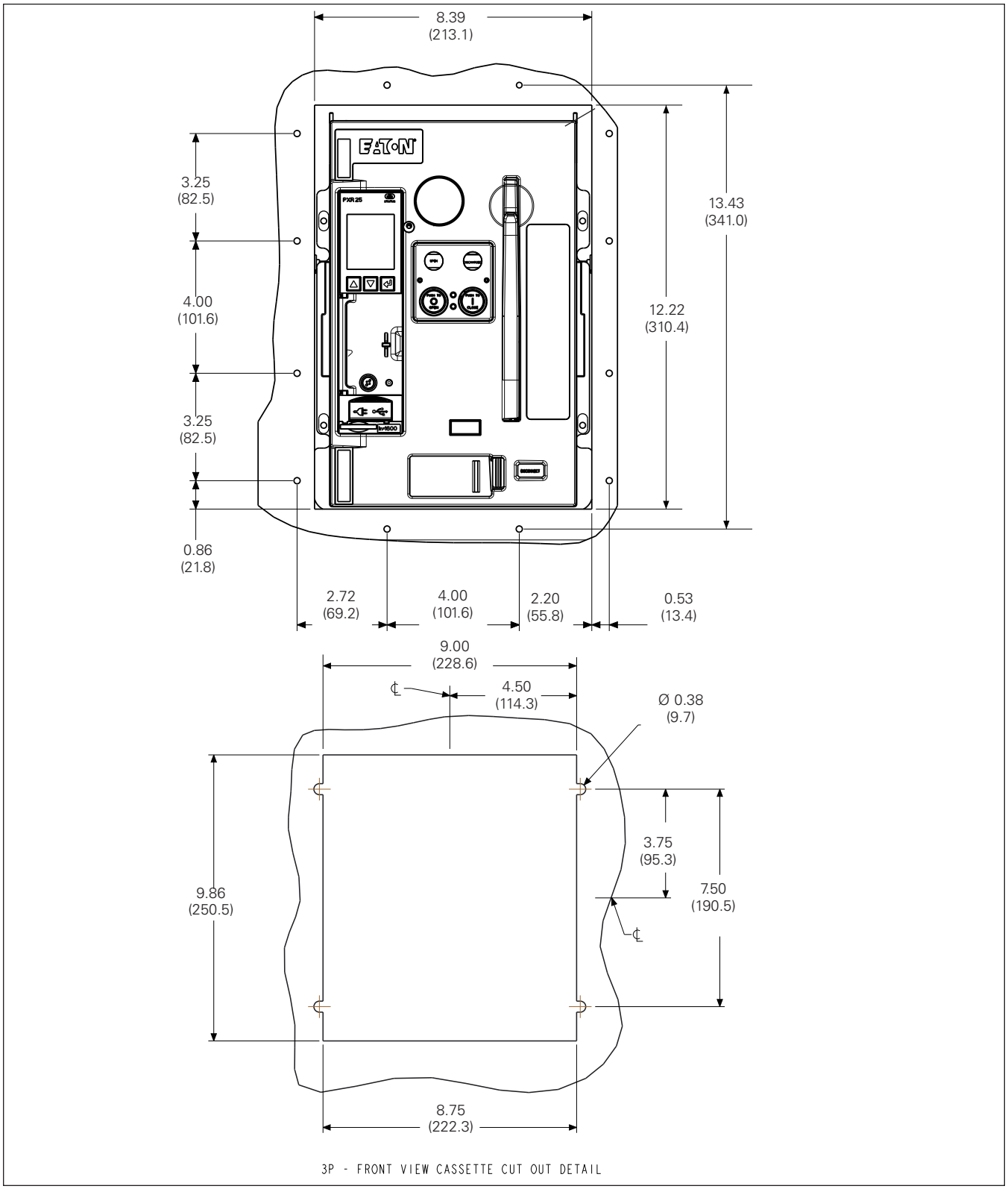


Figure 40. Four-pole drawout cassette - rear/top views in inches (mm).

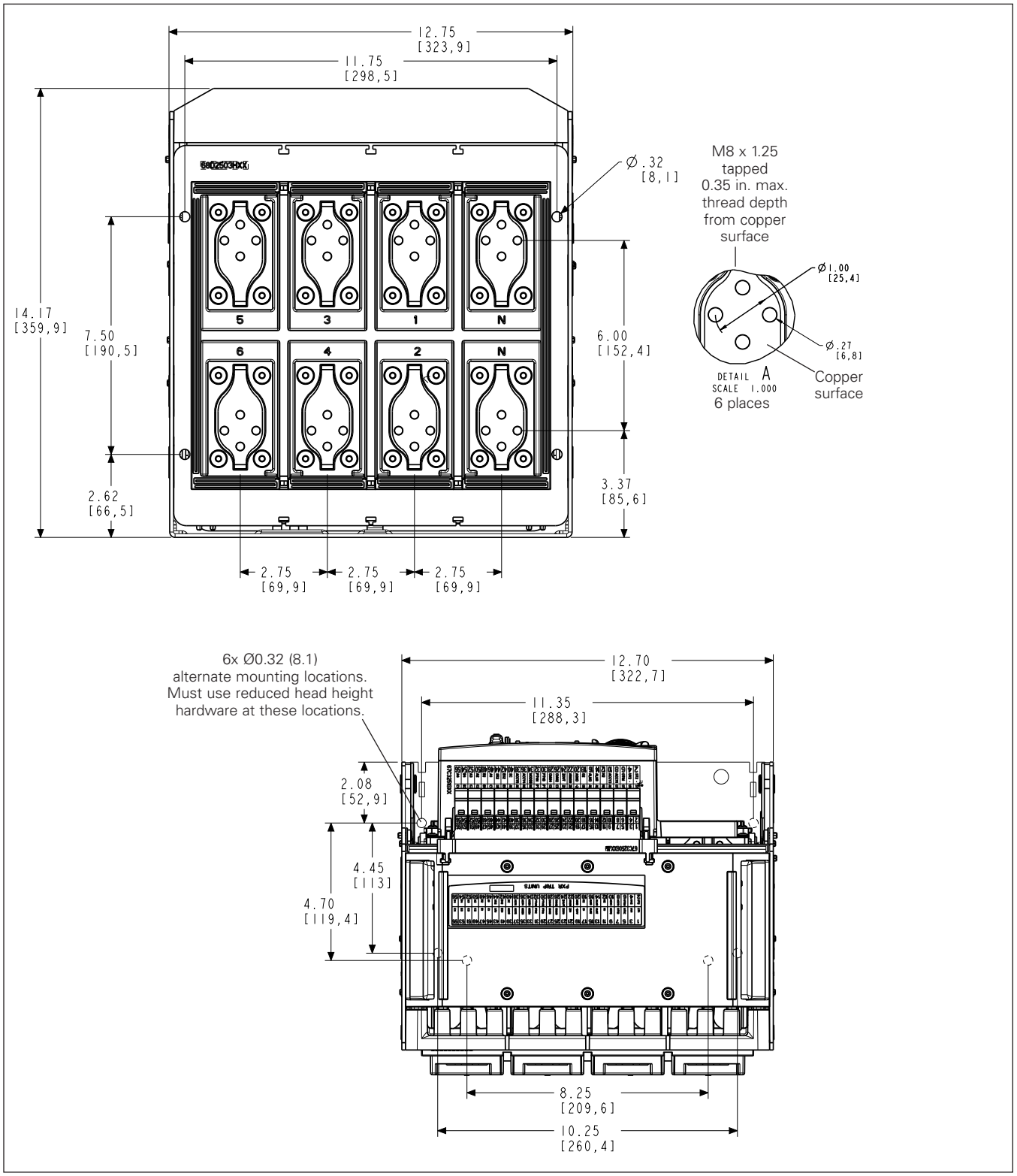


Figure 41. Four-pole drawout cassette - top/side views with horizontal universal bus adapters in inches (mm).

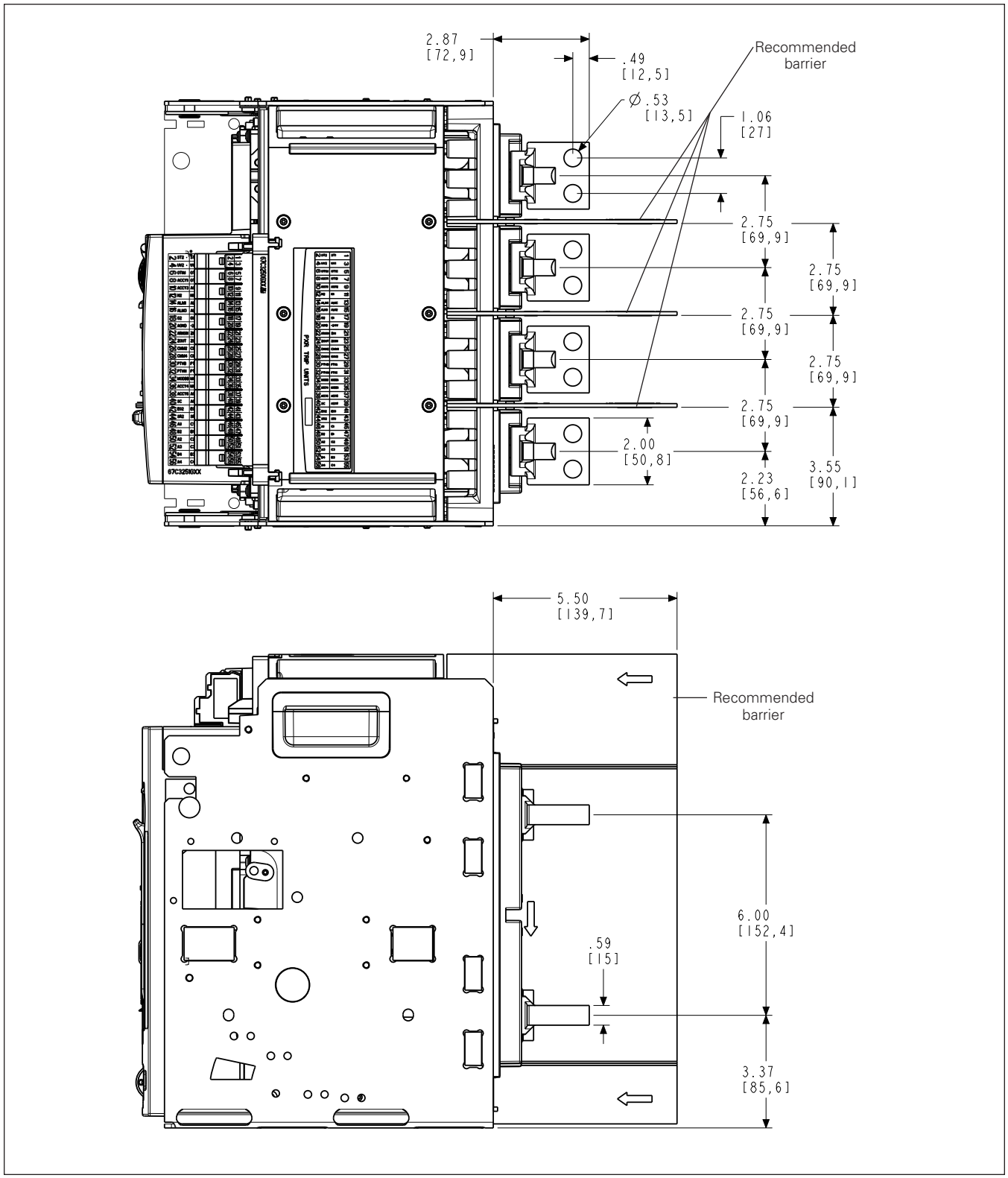


Figure 42. Four-pole drawout cassette - top/side views with vertical universal bus adapters in inches (mm).

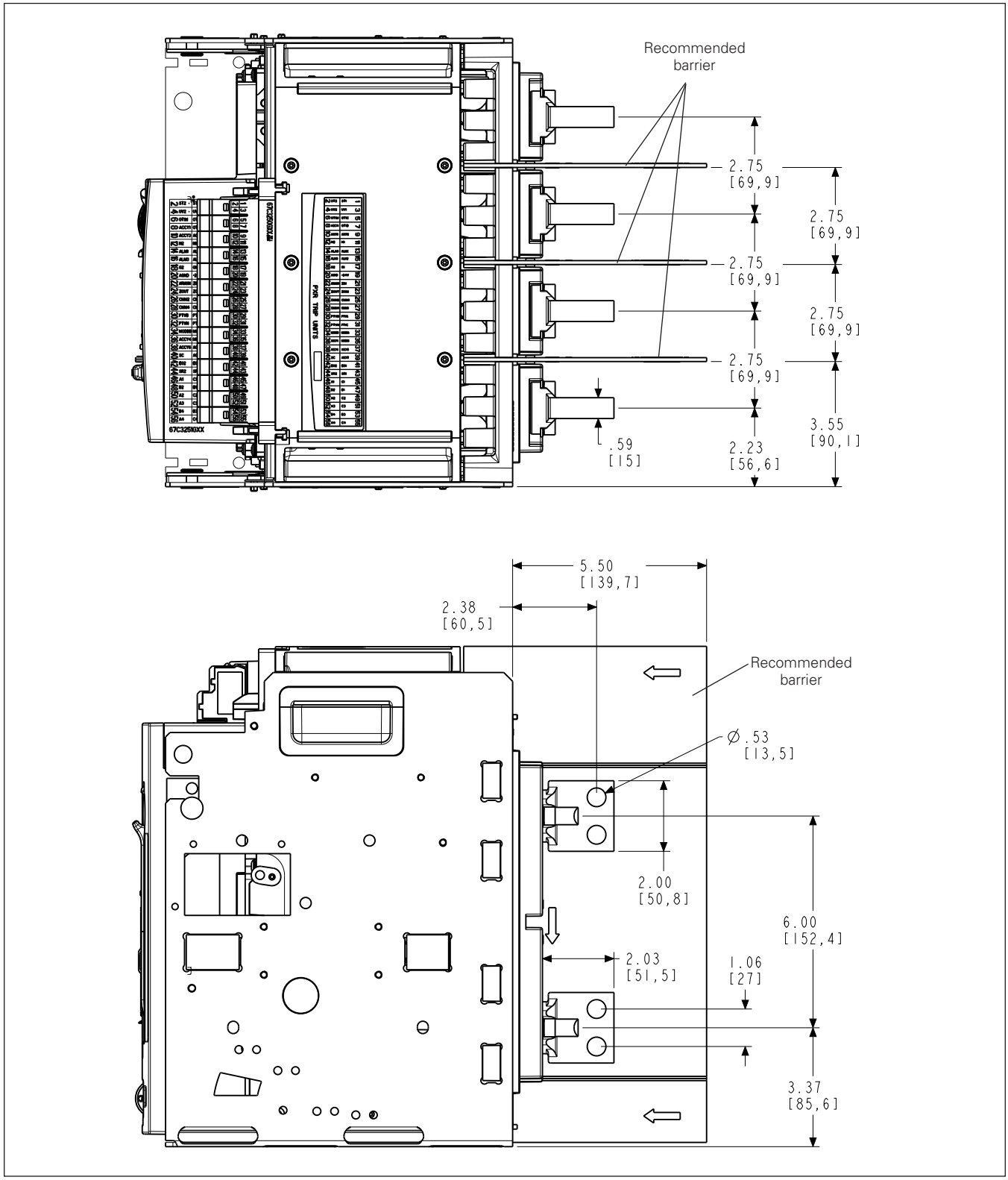


Figure 43. Four-pole drawout cassette - side views CONNECTED and TEST positions in inches (mm).

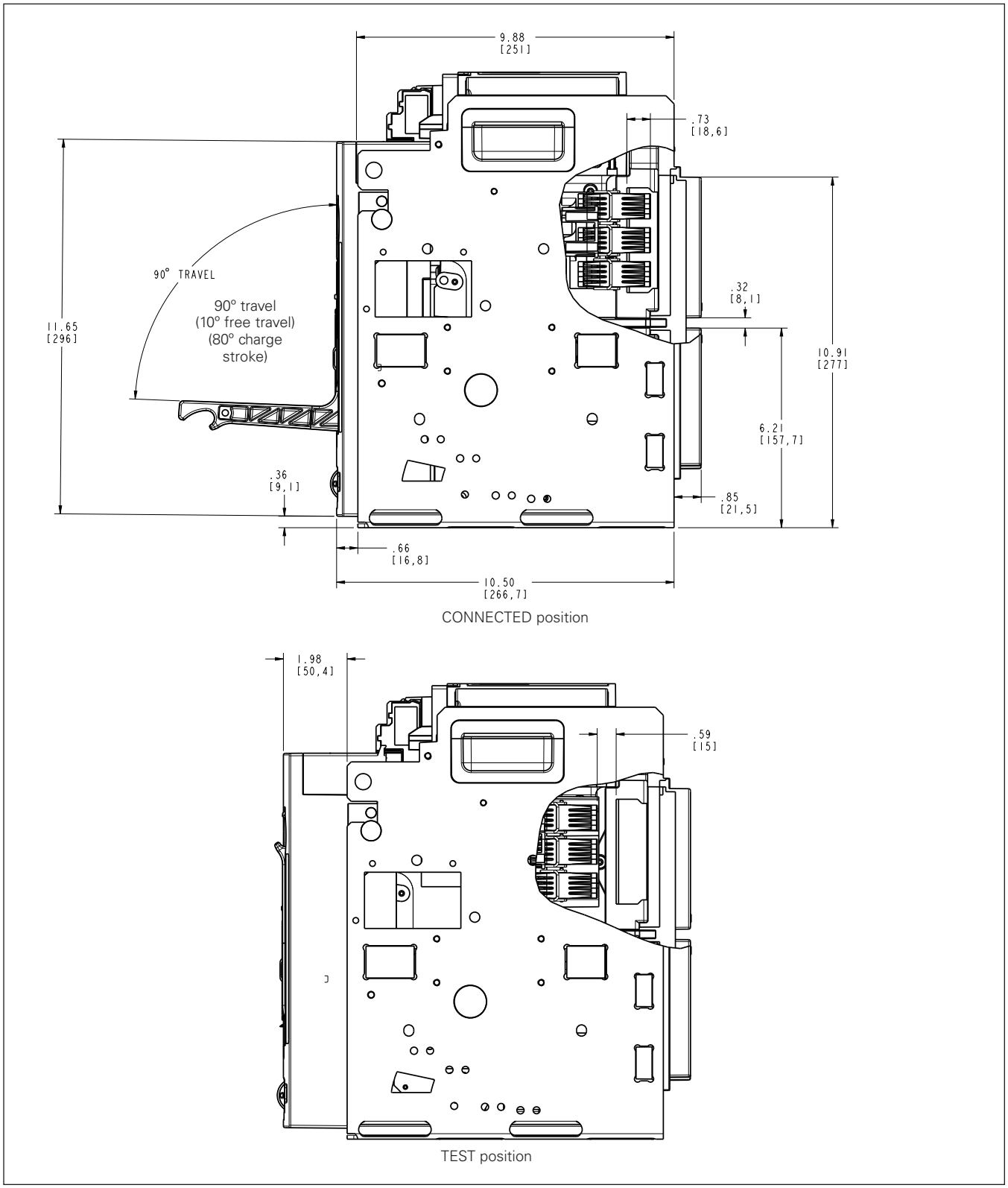
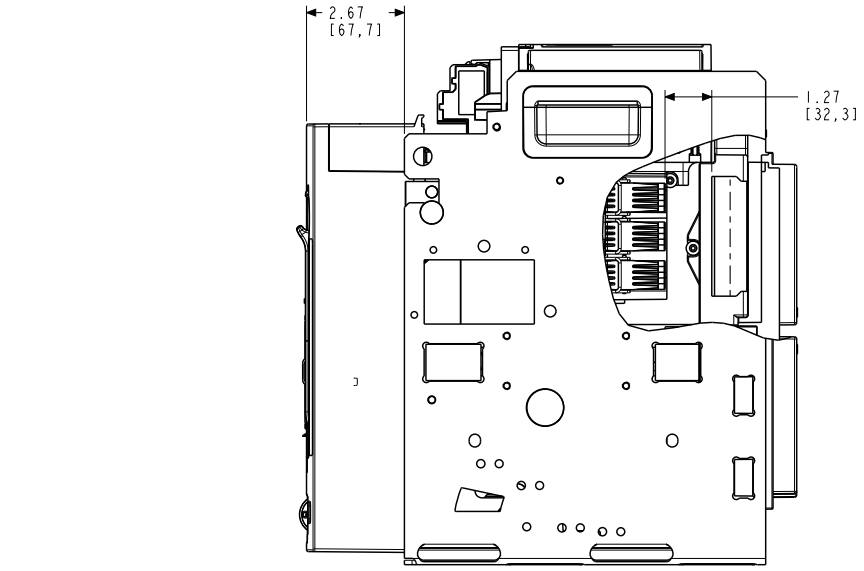
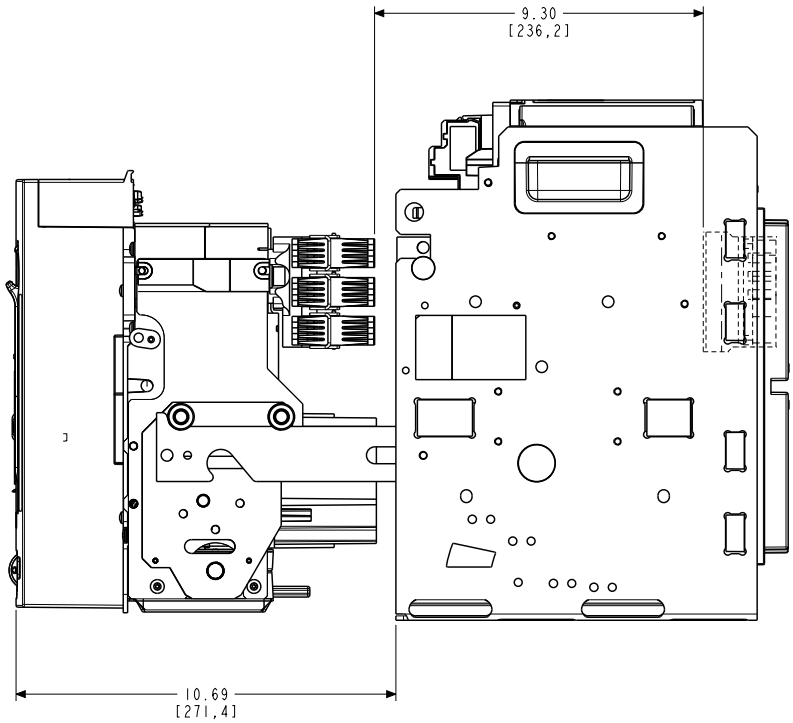


Figure 44. Four-pole drawout cassette - side views DISCONNECTED and WITHDRAWN positions in inches (mm).

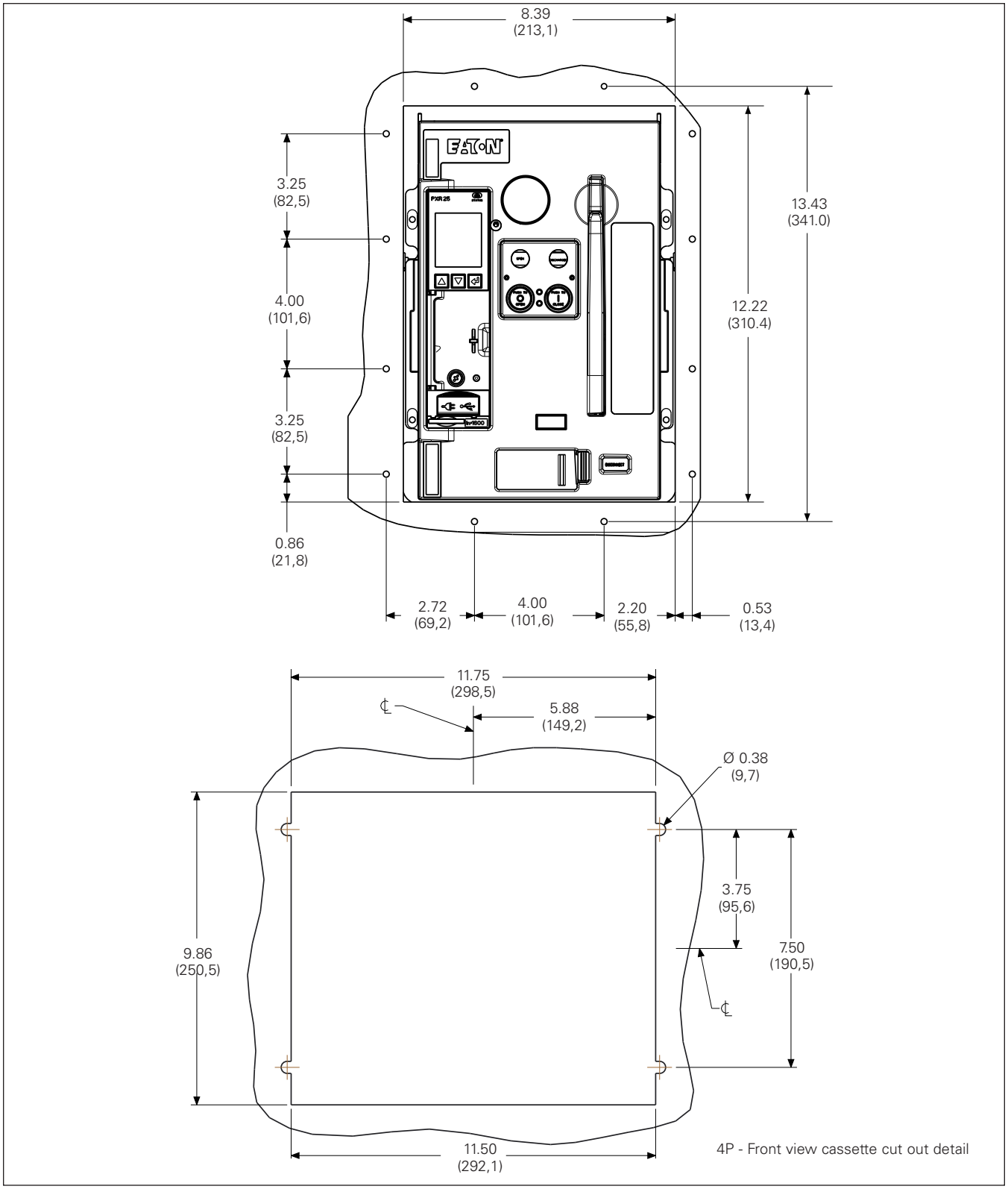


DISCONNECTED position



WITHDRAWN position

Figure 45. Four-pole drawout cassette - front view door and cassette cutout details in inches (mm).



Section 6: Dimensional drawings for installation of fixed circuit breakers

General

Section 3 discussed topics and features common to all Eaton ICCB circuit breakers, no matter what the mounting configuration or type. In this section, features unique to the fixed configuration not covered elsewhere are discussed.

Fixed circuit breaker

A fixed circuit breaker is solidly mounted in its structure with no drawout feature. The circuit breaker is available in both front connected and rear-connected configurations (Figure 46 and Figure 47).

The arc hood and shroud conceal internally mounted straight bus adapters that will accommodate bus or cable adapter connections.

The rear-connected breaker can be mounted on a suitable horizontal mounting surface using optional left and right-side mounting feet. Refer to specific hardware and mounting instruction details provided in IL01301030E. A standard rear-connected fixed circuit breaker is supplied with flat primary terminal pads on the rear of the breaker that will accommodate a variety of primary connection configurations.

Optional primary adapters are available for front and rear bus or cable connections. For specific details and mounting instructions, refer to IL01301015E.

Refer to Figure 48 through Figure 65 for selected mounting and installation dimensional information. Complete dimensional and installation drawings are available from www.eaton.com

Figure 46. Front connected.

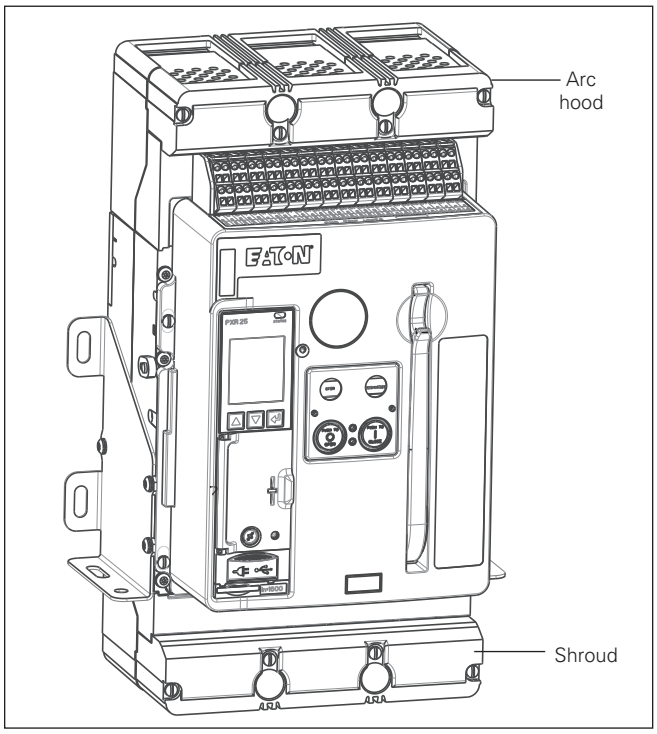


Figure 47. Rear connected.

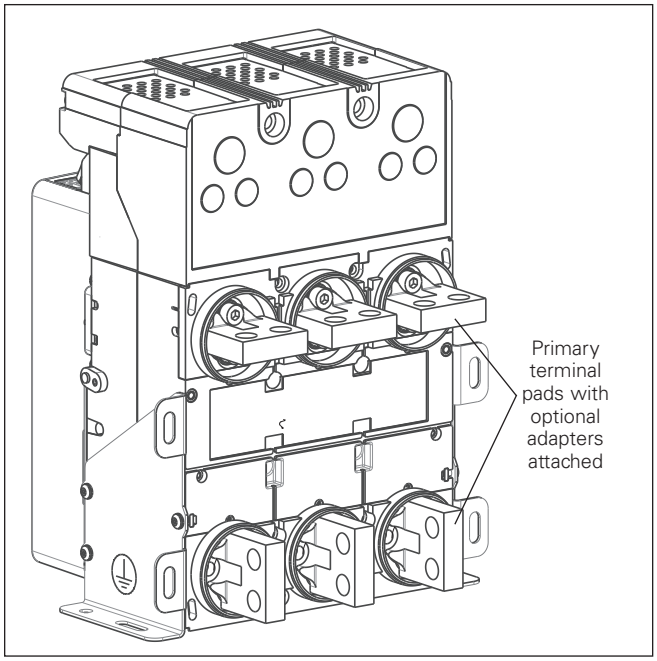


Figure 48. Three-pole fixed breaker overall views and dimensions in inches (mm) (UL 800–1200 A/IEC 630–1600 A).

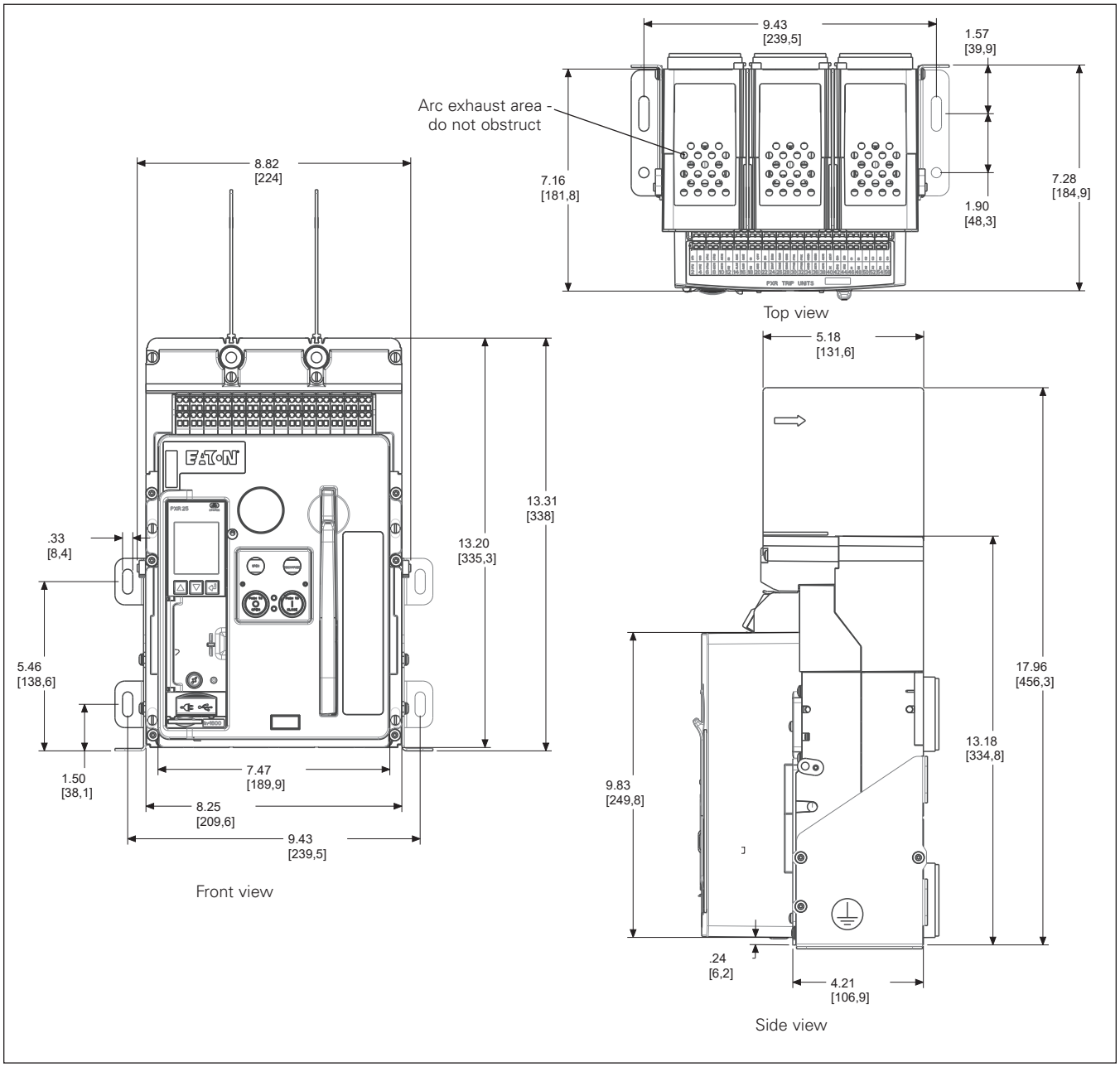


Figure 49. Three-pole fixed breaker overall views and dimensions in inches (mm) (UL 800–1200 A/IEC 630–1600 A).

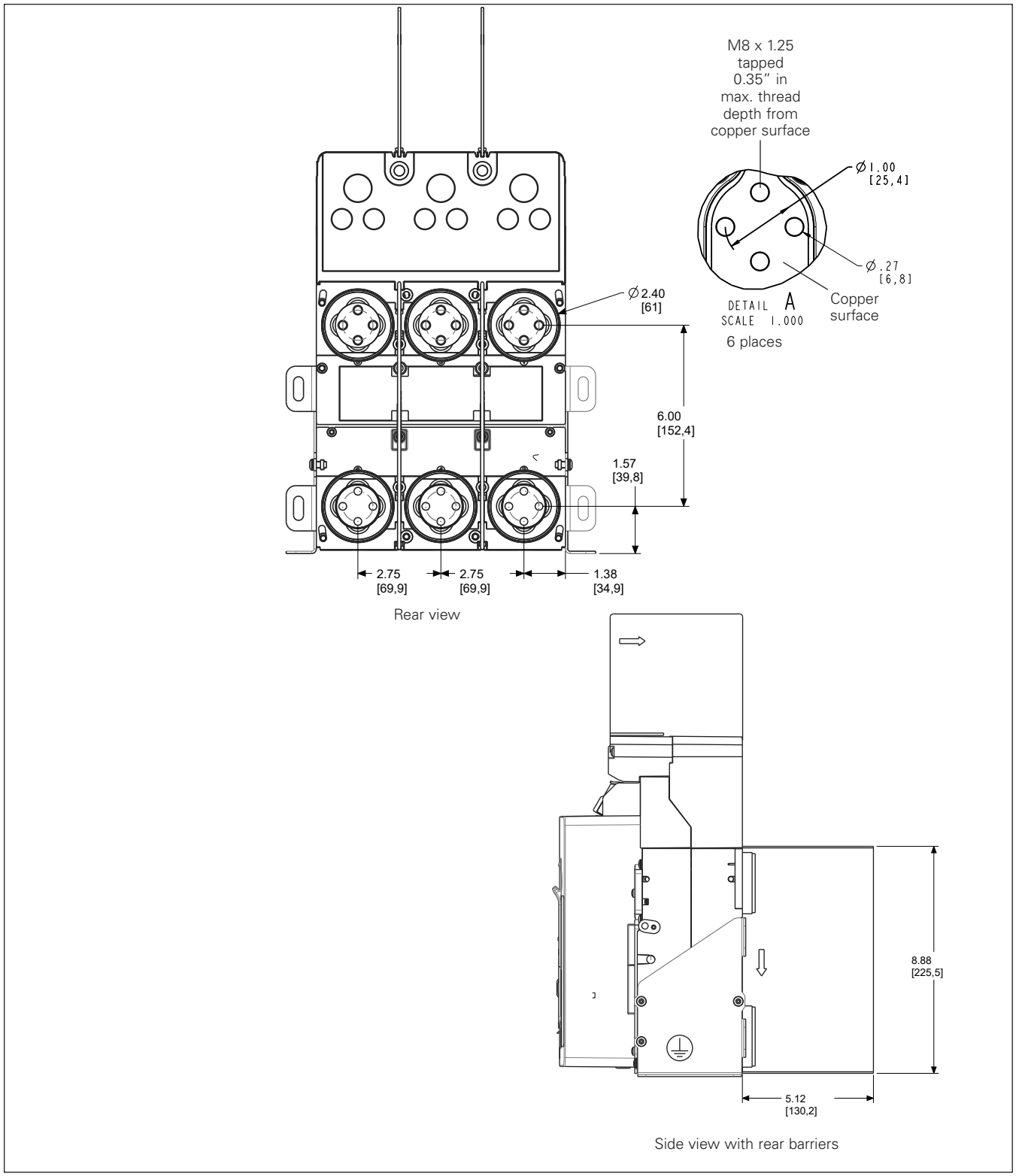


Figure 50. Three-pole fixed breaker foot mount dimensions in inches (mm) (UL 800 –1200 A/IEC 630 –1600 A).

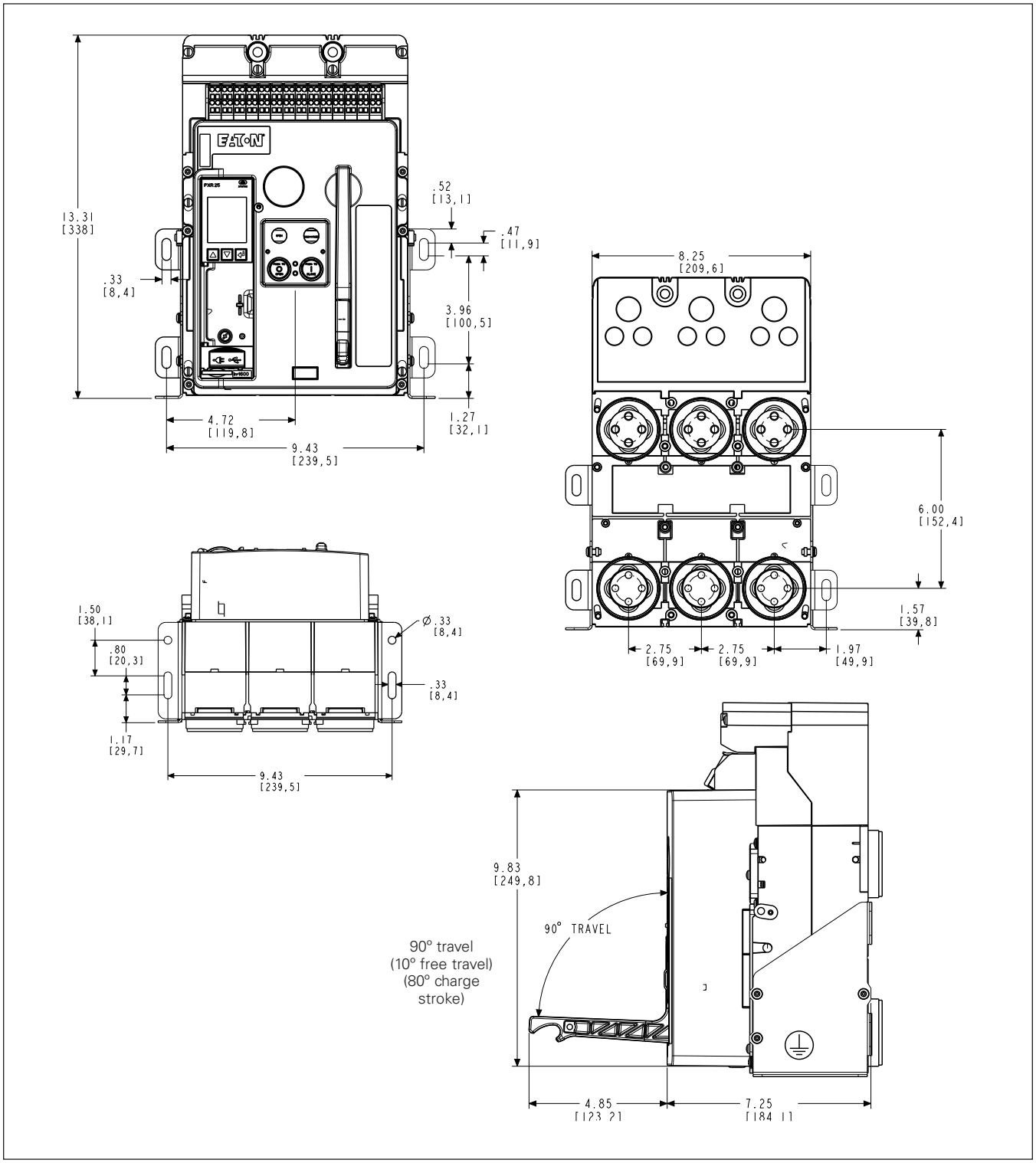
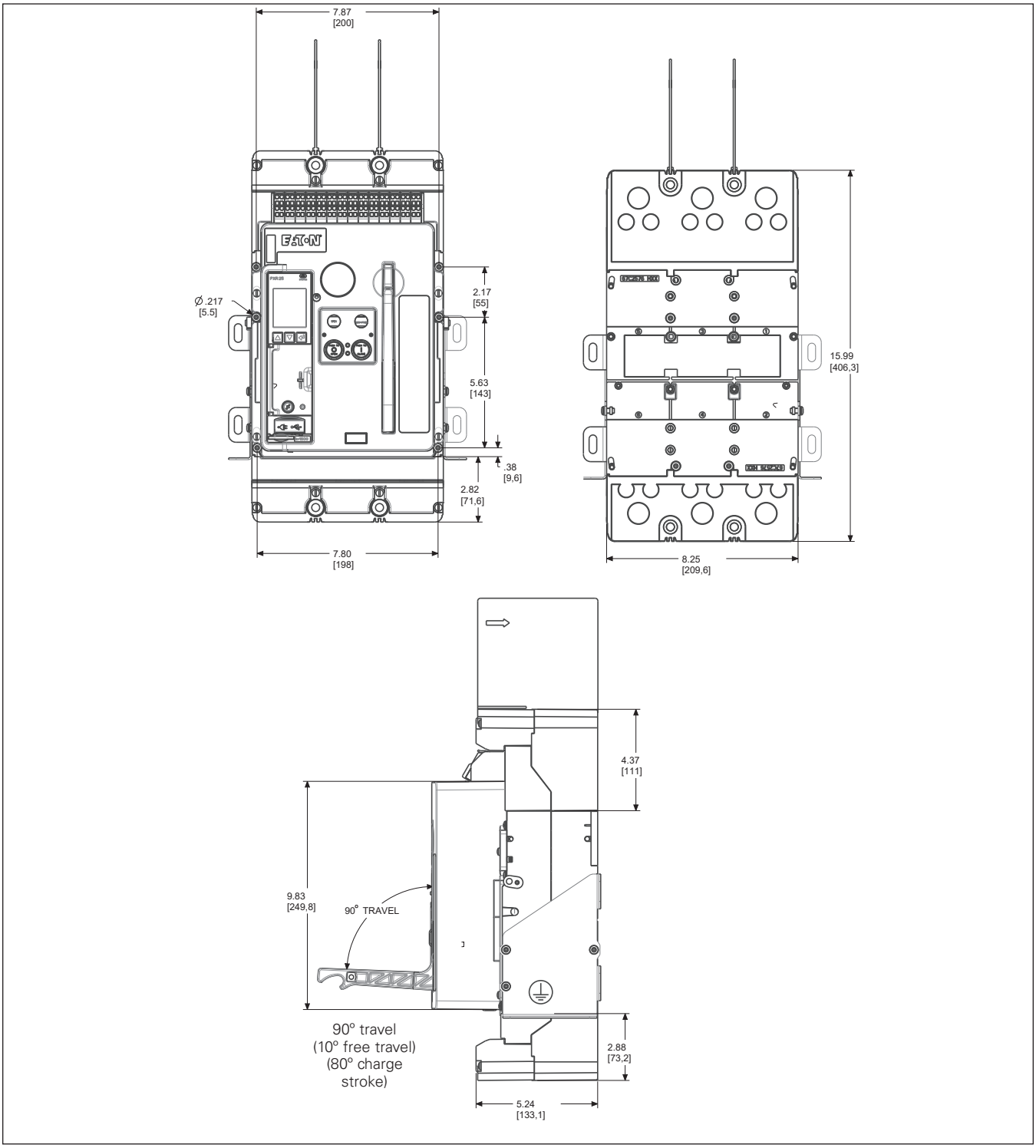


Figure 51. Three-pole fixed breaker, cable connect dimensions in inches (mm) (UL 800 - 1200 A/IEC 630 - 1600 A, 800 MCM, 750 MCM, and 500 MCM lugs).



Note: Refer to www.eaton.com for complete dimensional and installation drawings associated with 800 MCM, 750 MCM, and 500 MCM lugs.

Figure 52. Three-pole fixed breaker parallel bus mounting dimensions in inches (mm) (UL 800 –1200 A/IEC 630 –1600 A).

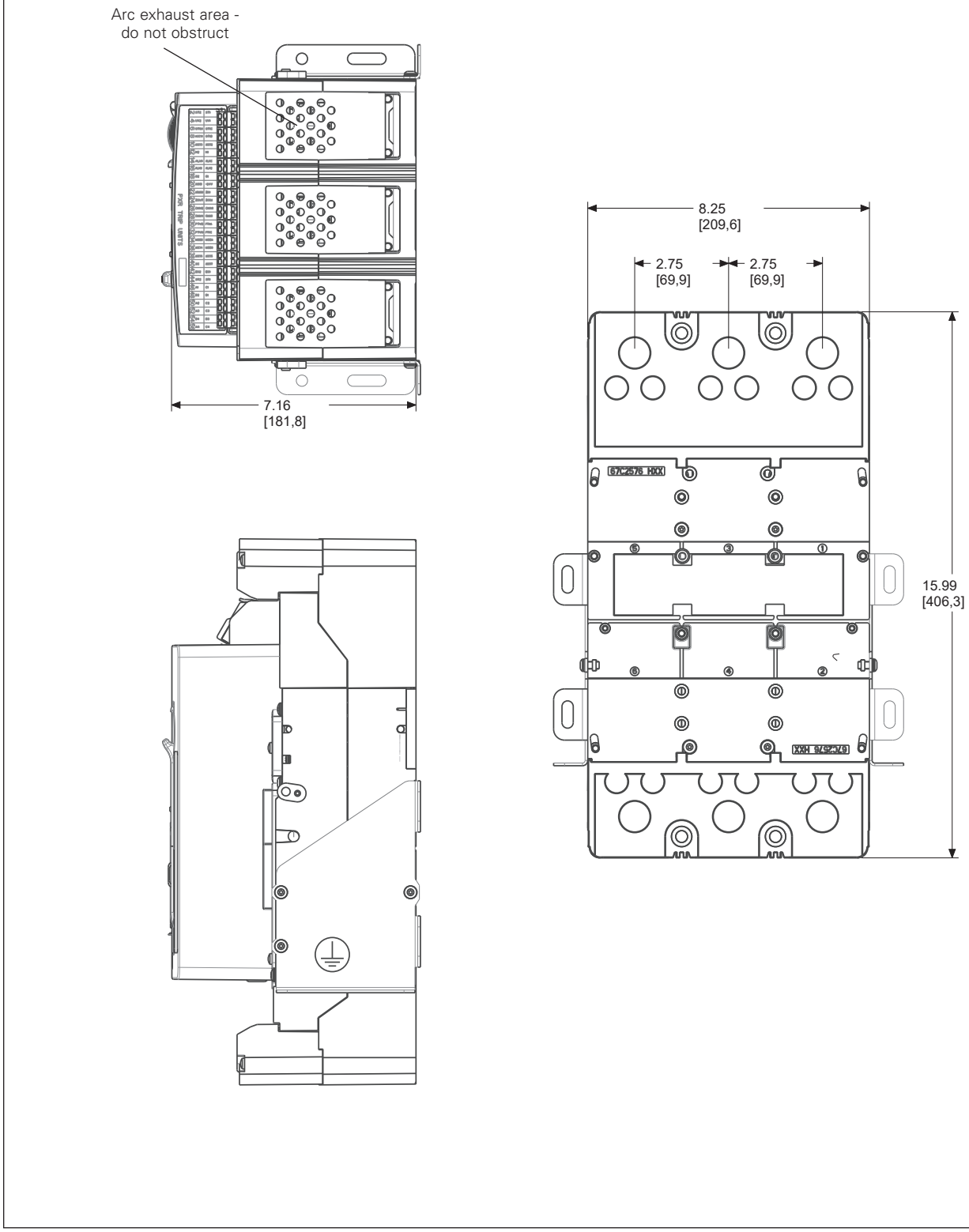


Figure 53. Three-pole fixed breaker vertical universal bus adapters dimensions in inches (mm) (UL 800 –1200 A/IEC 630–1600 A).

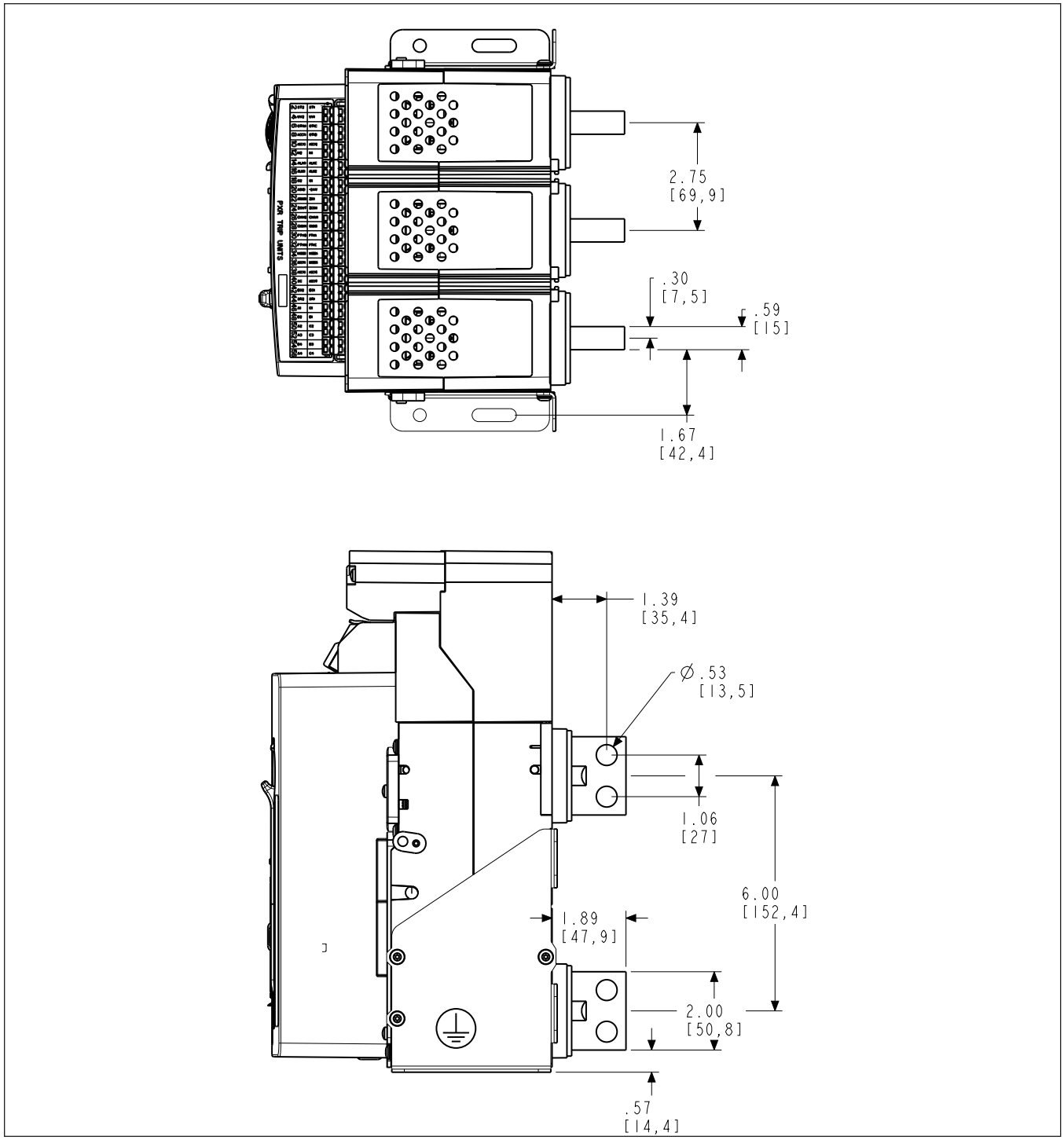


Figure 54. Three-pole fixed breaker horizontal universal bus adapter dimensions in inches (mm) (UL 800–1200 A/IEC 630–1600 A).

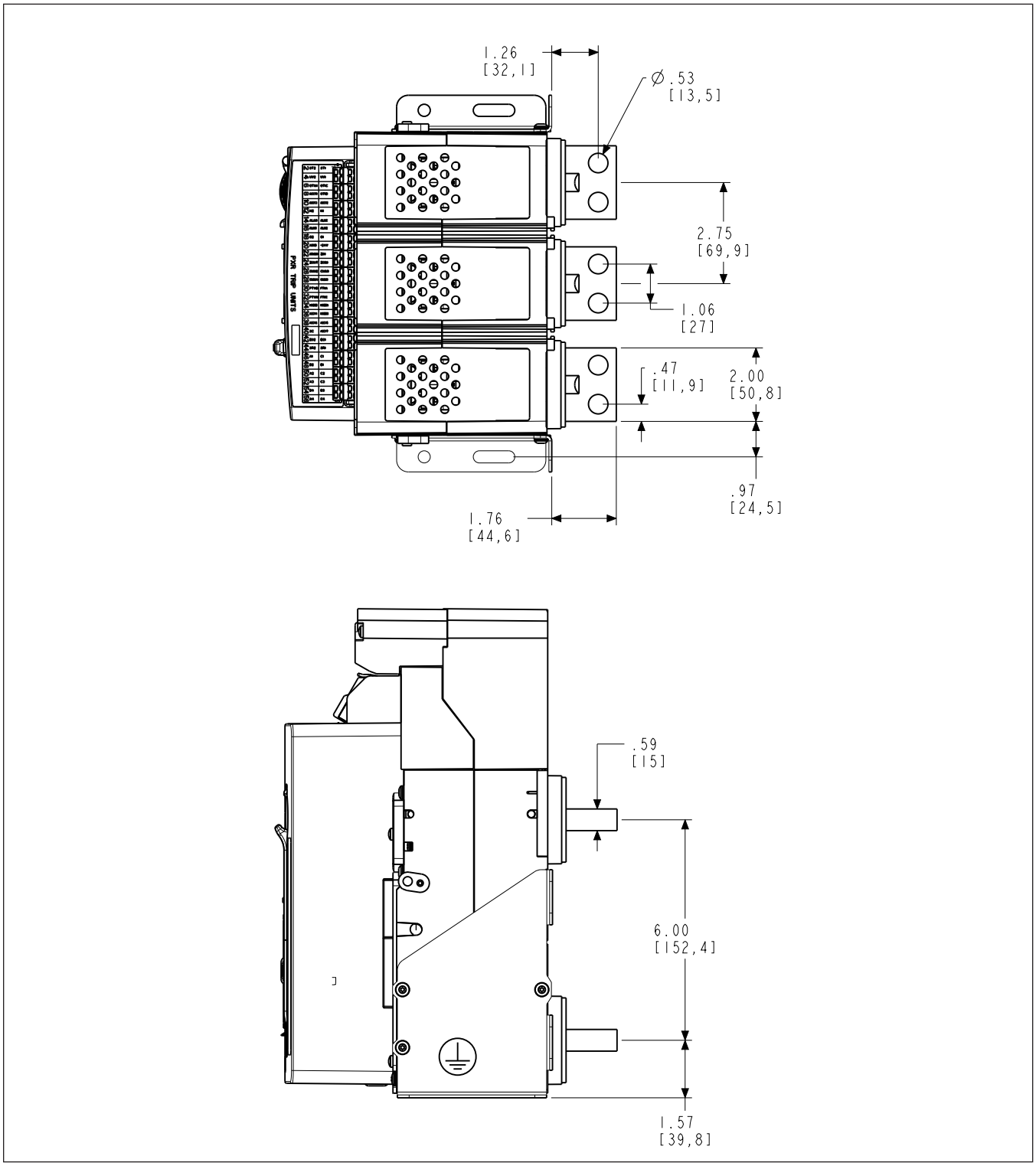
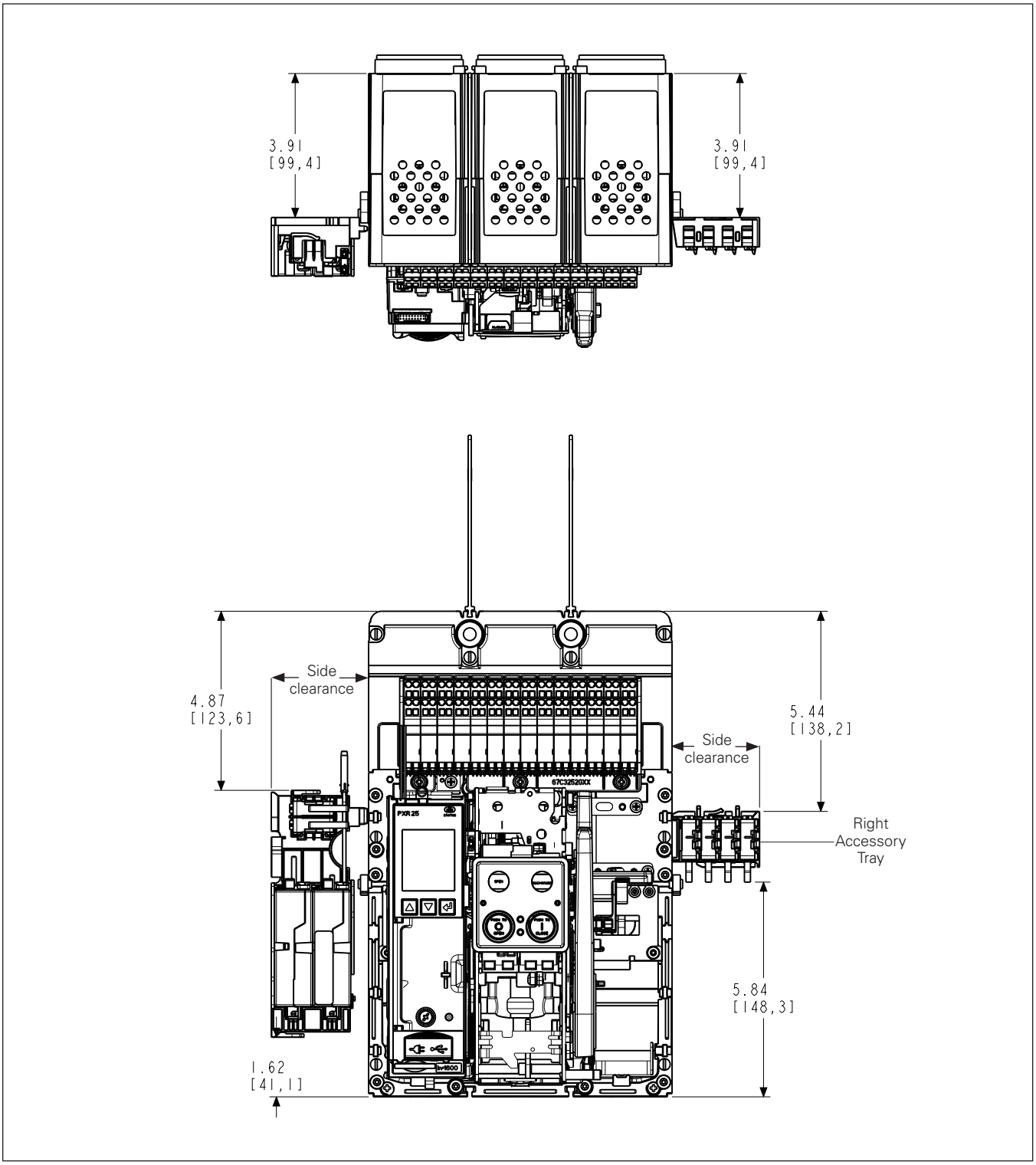


Figure 55. Three-pole fixed breaker accessory tray installation and removal clearance dimensions in inches (mm).



Note: A minimum of 2 in. (50.8 mm) of side clearance is required.

Figure 56. Three-pole fixed breaker - front view door cutout detail dimensions in inches (mm).

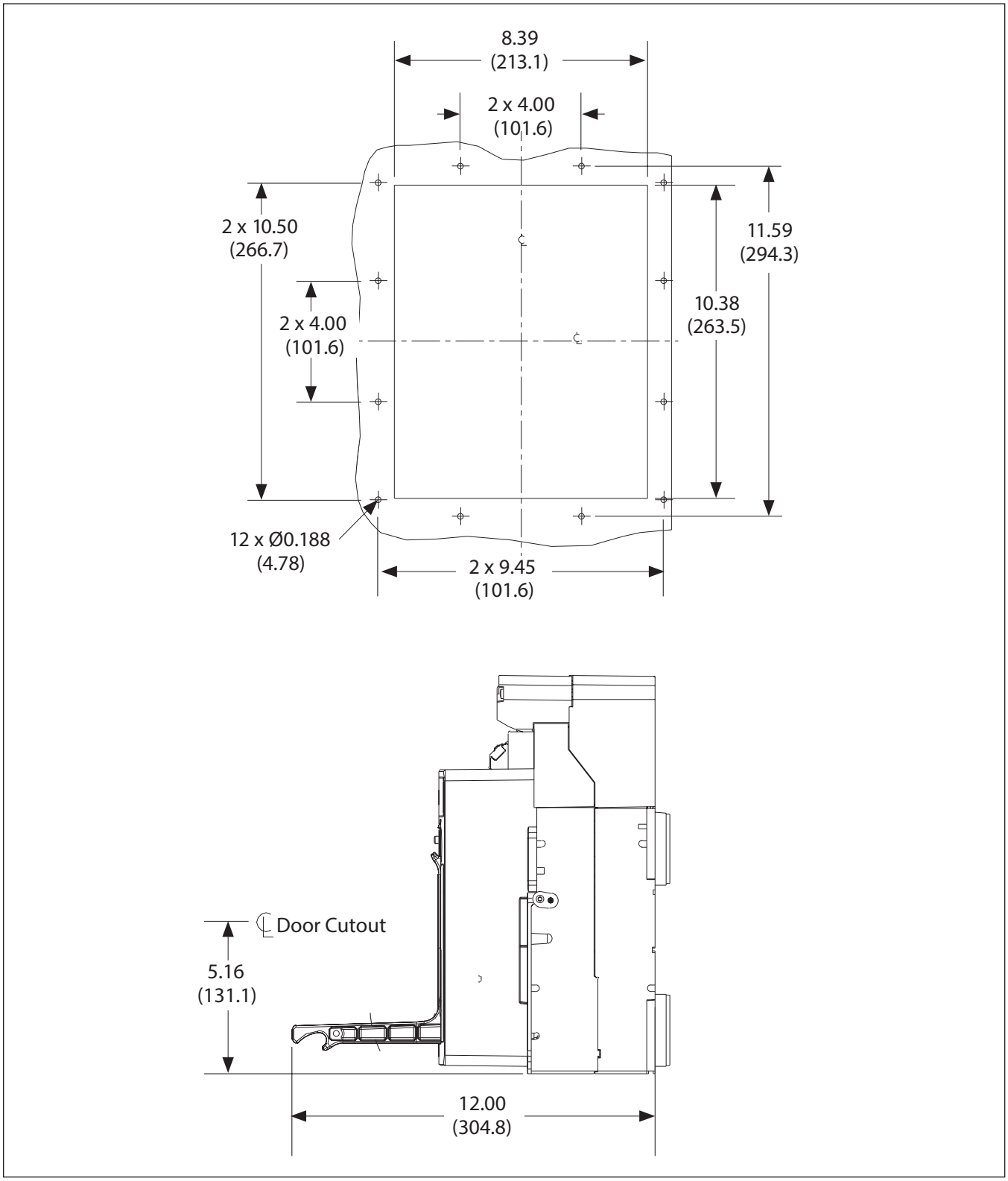


Figure 57. Four-pole fixed breaker overall views and dimensions in inches (mm) (UL 800–1200 A/IEC 630–1600 A).

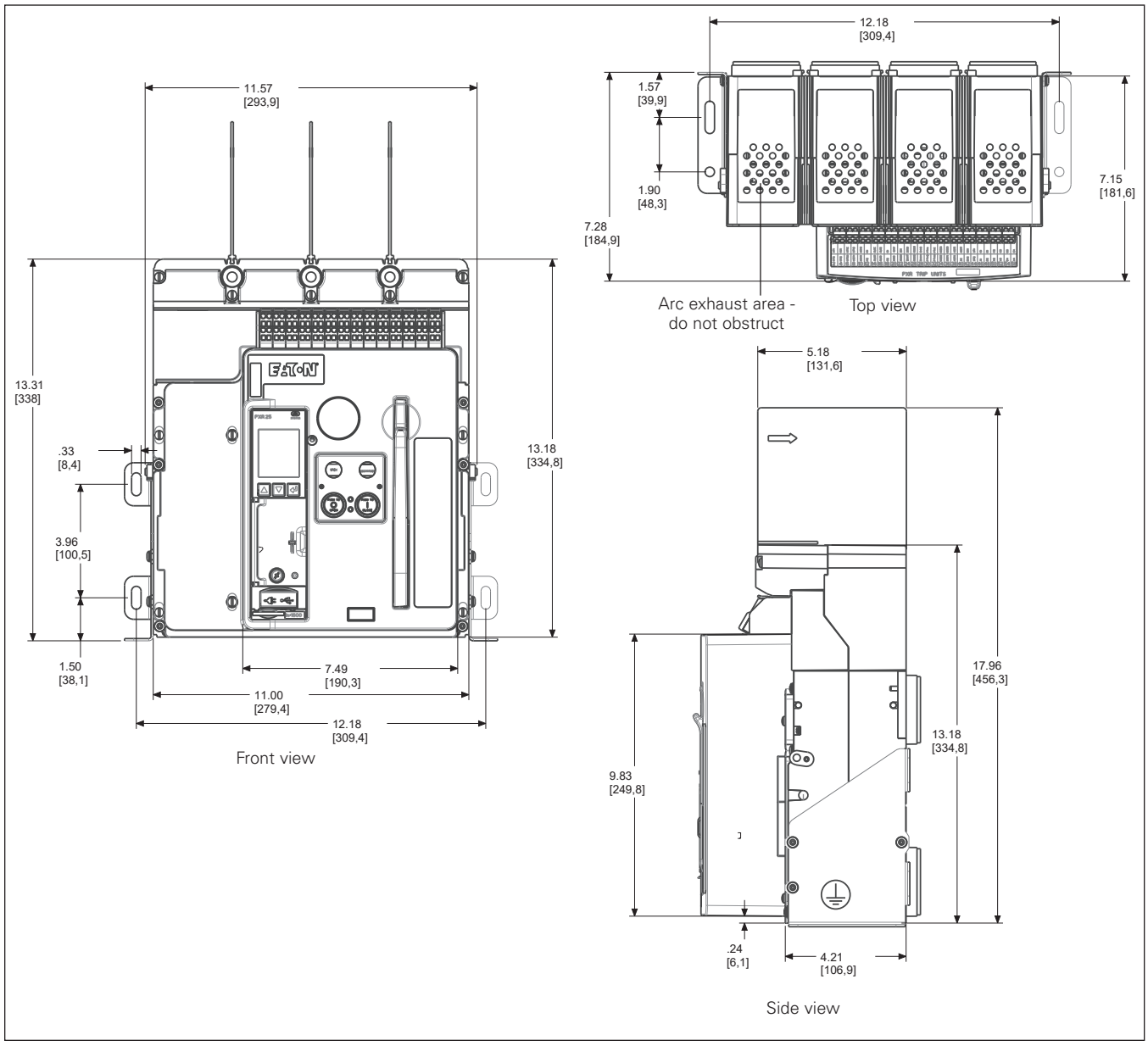


Figure 58. Four-pole fixed breaker overall views and dimensions in inches (mm) (UL 800–1200 A/IEC 630–1600 A).

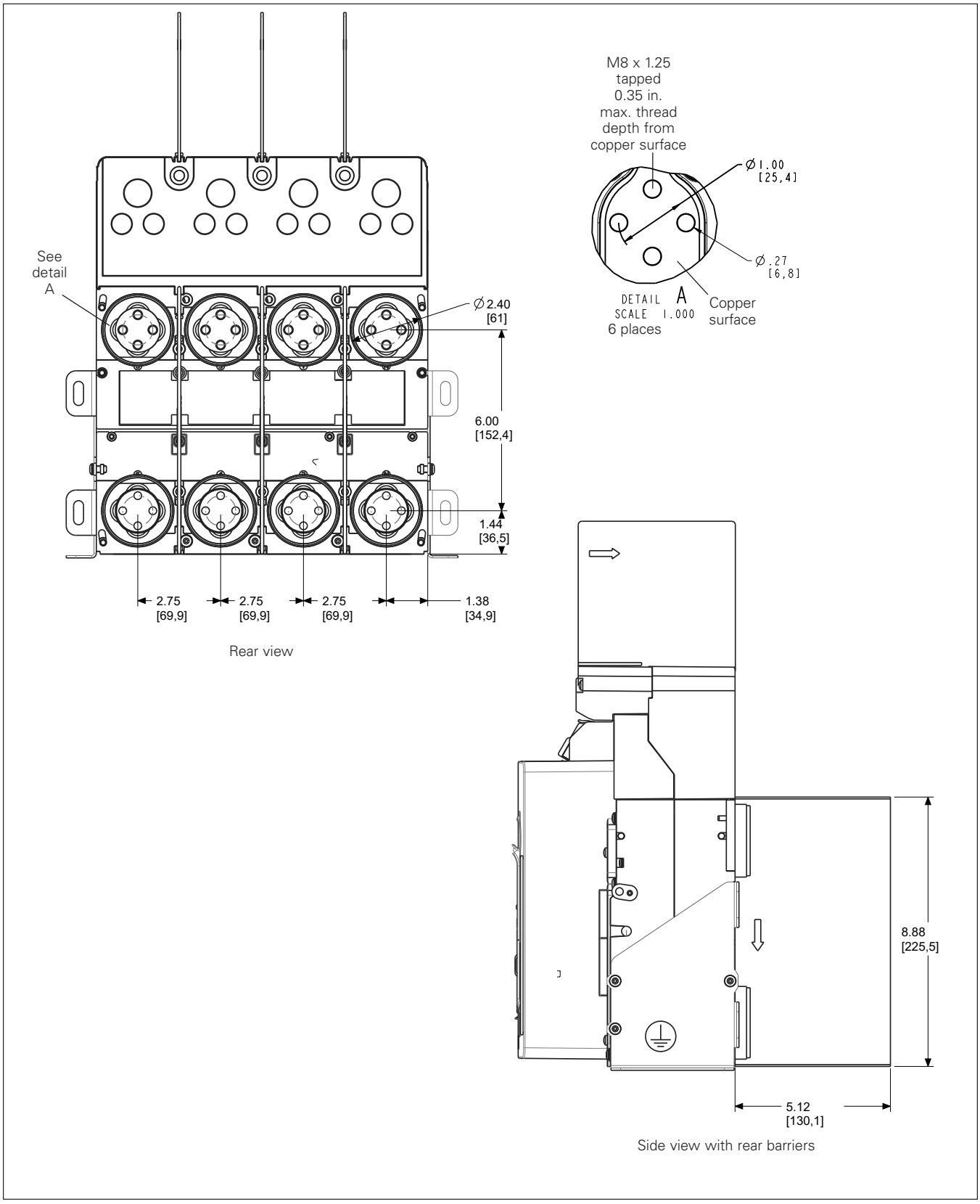


Figure 59. Four-pole fixed breaker foot mount dimensions in inches (mm) (UL 800 - 1200 A/IEC 630 - 1600 A).

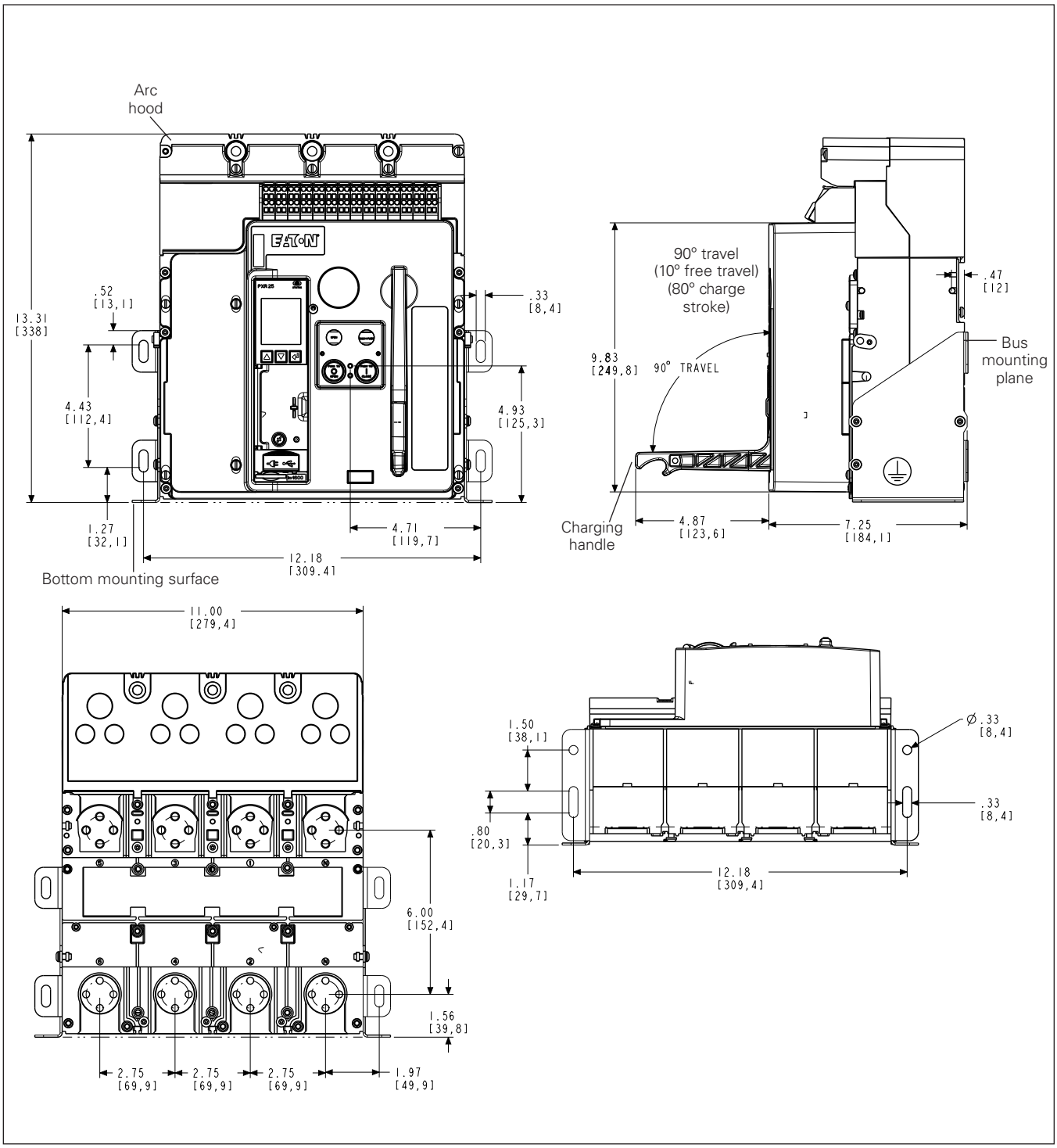
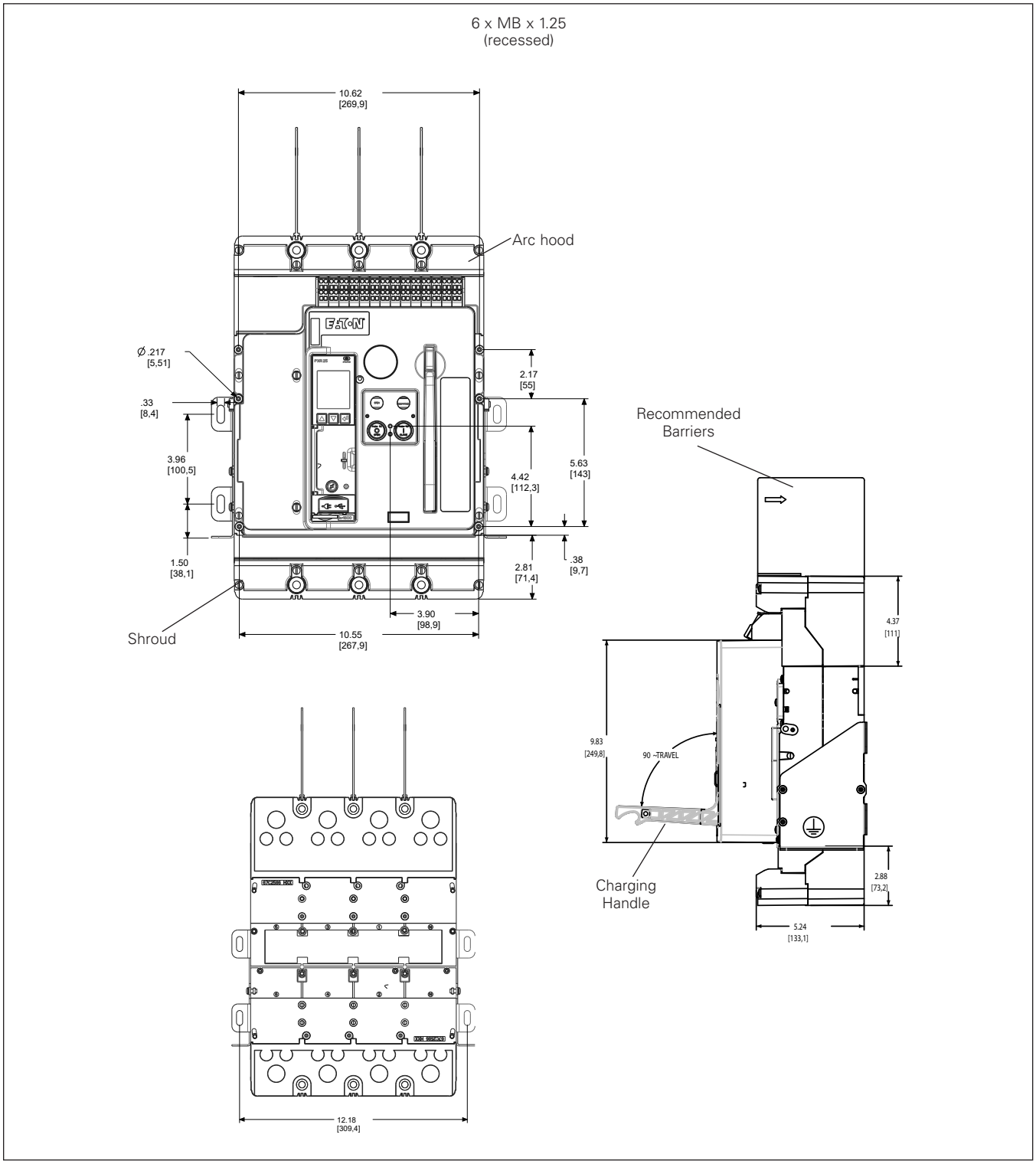


Figure 60. Four-pole fixed breaker surface mount, cable connect dimensions in inches (mm) (UL 800–1200 A/IEC 630–1600 A, 800 MCM, 750 MCM, and 600 MCM lugs).



Note: Refer to www.eaton.com for complete dimensional and installation drawings associated with 800 MCM, 750 MCM, and 500 MCM lugs.

Figure 61. Four-pole fixed breaker parallel bus mounting dimensions in inches (mm) (UL 800–1200 A/IEC 630–1600 A).

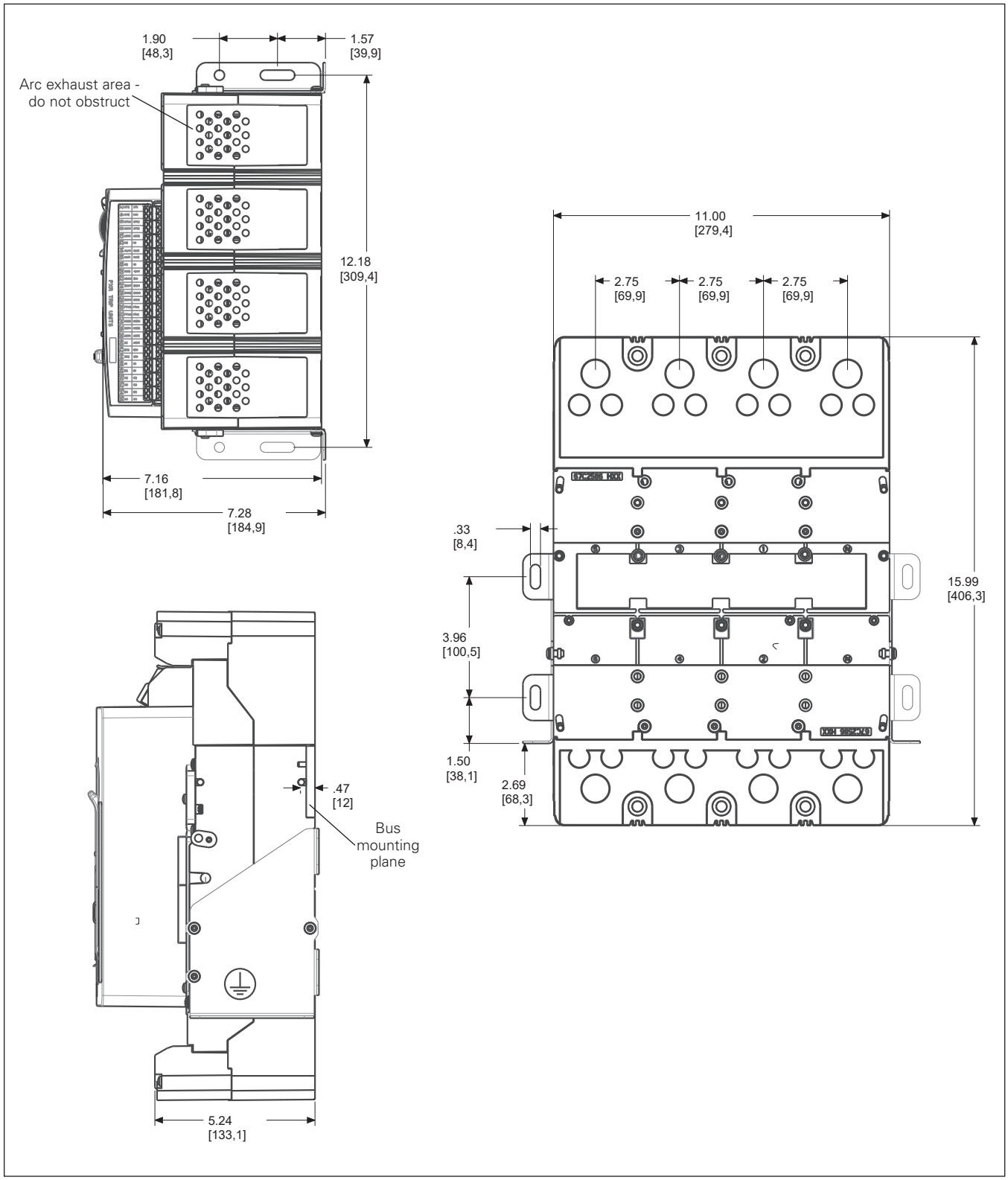


Figure 62. Four-pole fixed breaker universal bus adapters vertical dimensions in inches (mm) (UL 800–1200 A/IEC 630–1600 A) .

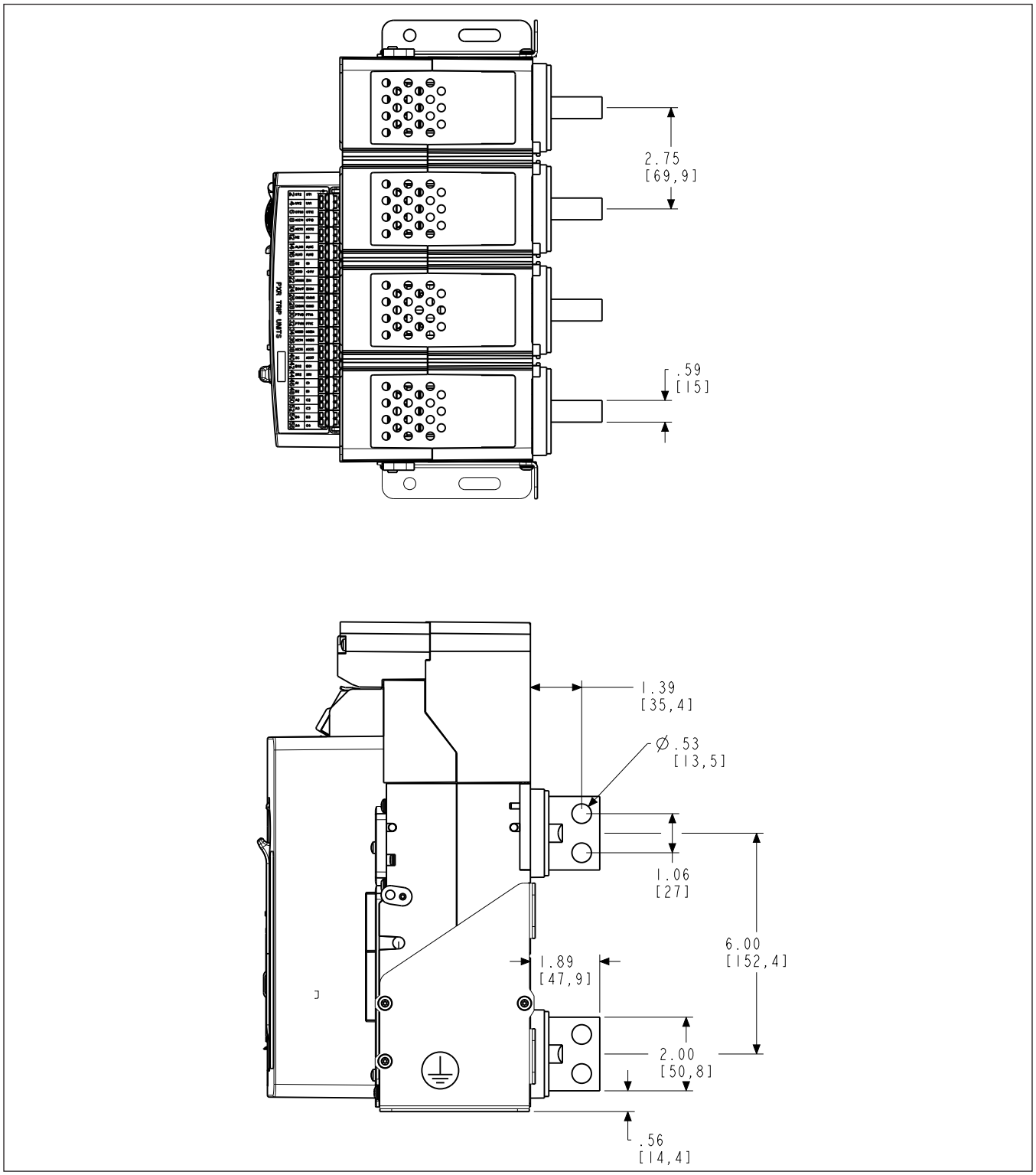


Figure 63. Four-pole fixed breaker universal bus adapters horizontal dimensions in inches (mm) (UL 800–1200 A/IEC 630–1600 A).

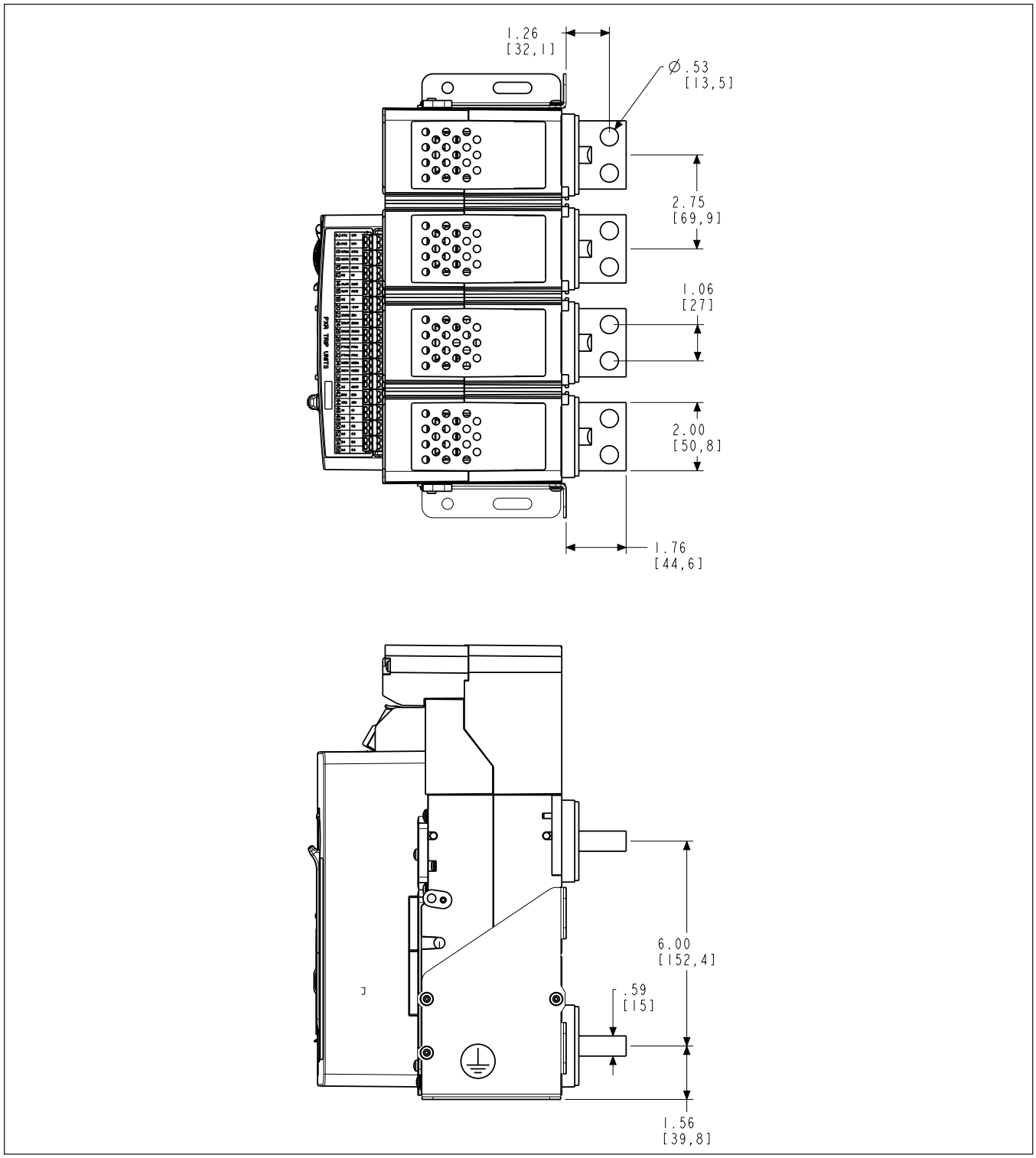
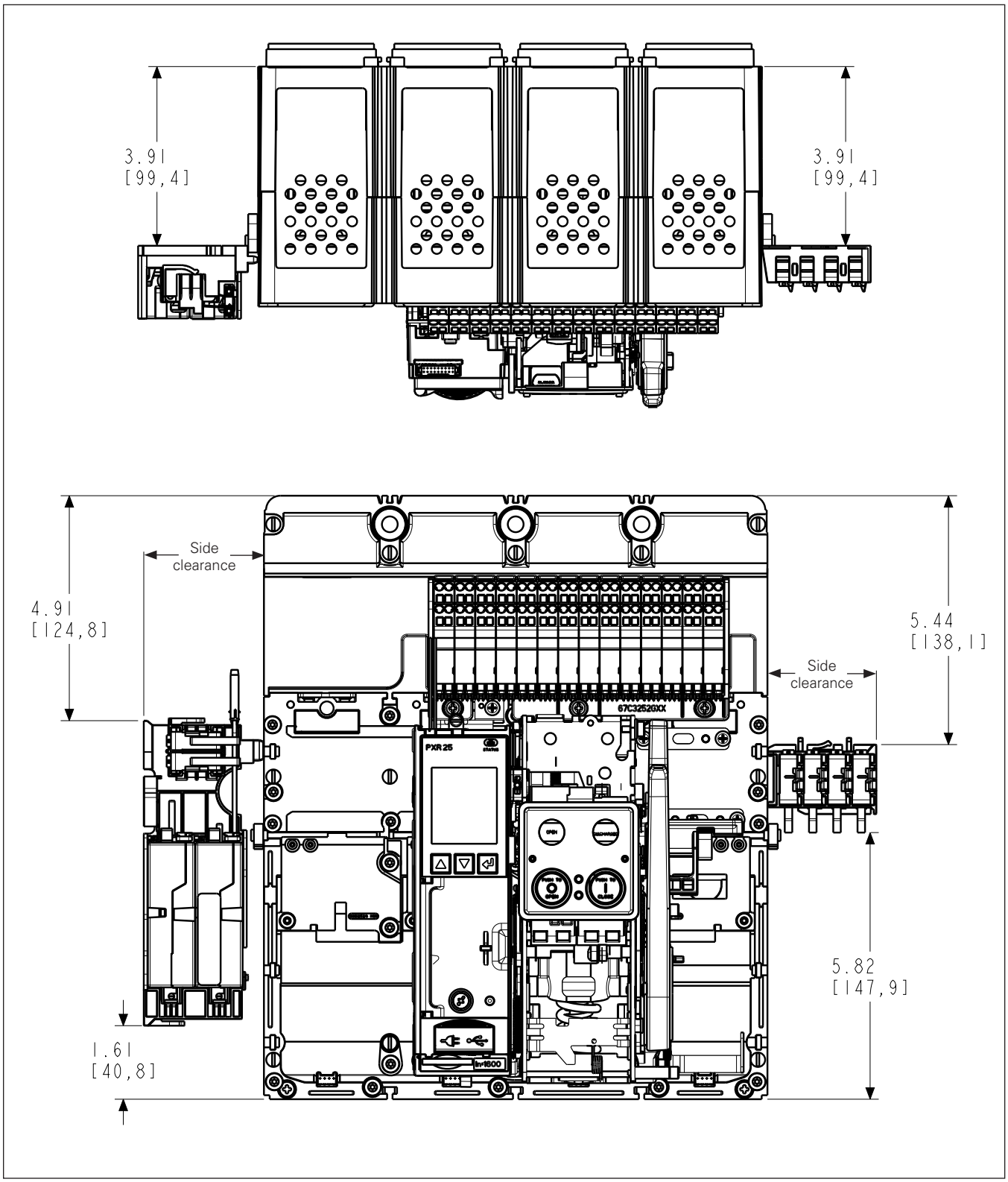
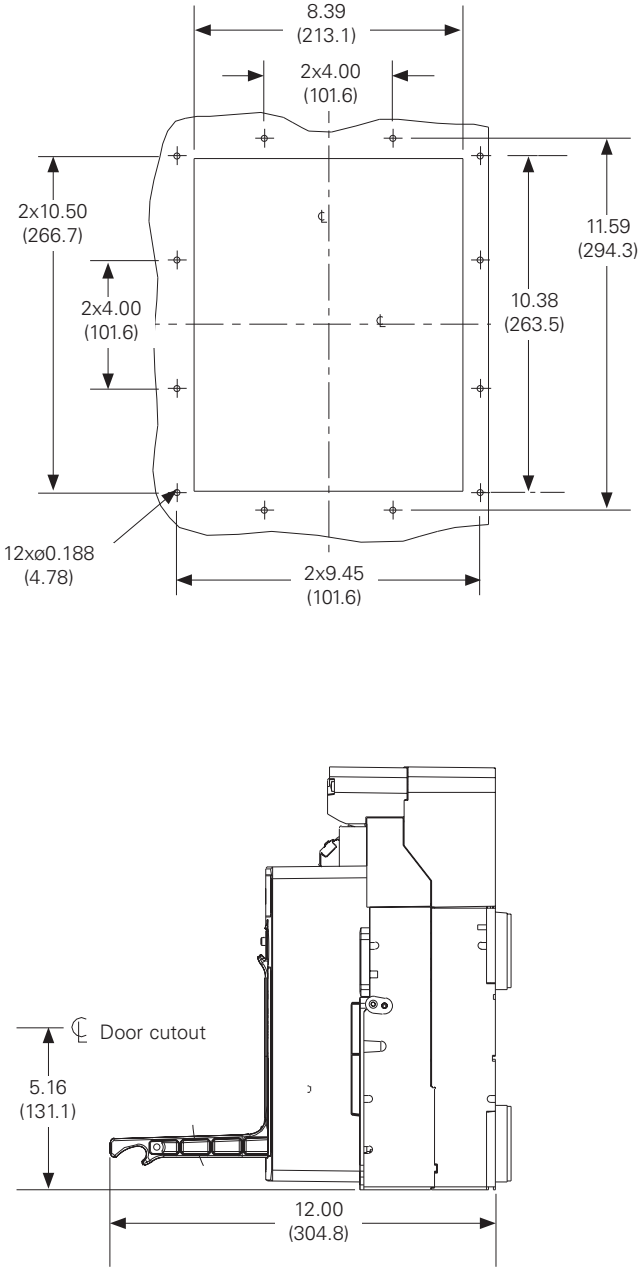


Figure 64. Four-pole fixed breaker accessory tray installation and removal clearance dimensions in inches (mm).



Note: A minimum of 2 in. (50.8 mm) of side clearance is required.

Figure 65. Four-pole fixed breaker - Front view door cutout detail dimensions in inches (mm).



Section 7: Inspection and maintenance

General

⚠ WARNING

Failure to inspect, clean, and maintain circuit breakers can reduce equipment life or cause the equipment to not operate properly under fault conditions. This could result in equipment damage, bodily injury, or even death.

⚠ WARNING

The circuit breaker mechanism contains stored mechanical energy and moving parts and should be operated with the front cover and arc chutes in place. Parts may move forcefully and without warning. If the front cover or arc chutes have been removed, limit contact with the handle and buttons. Failure to do so may result in serious bodily injury.

⚠ CAUTION

Inspection and maintenance procedures should be carried out only by personnel familiar with the hazards associated with working on power circuit breakers. Additionally, they should become familiar with the specifics associated with Eaton ICCB circuit breakers as presented in this manual.

Because of the variability of application conditions and the great dependence placed upon these circuit breakers for protection and the assurance of service continuity, inspection and maintenance activities should take place on a regularly scheduled basis. Since maintenance of these circuit breakers consists mainly of keeping them clean, the frequency of scheduled inspection and maintenance depends to some degree on the cleanliness and humidity of the surroundings. It is recommended that maintenance record sheets be completed for the equipment.

General recommendations

Circuit breaker cleaning activities should be a part of an overall activity that includes the assembly in which the circuit breaker is installed. Loose dust and dirt can be removed from external surfaces using an industrial quality vacuum cleaner and/or lint-free cloth. Unless otherwise indicated, never use high pressure blowing air, since dirt or foreign objects can be driven into areas, such as the breaker mechanism, where additional friction sources could create problems. Never use a wire brush to clean any part of the circuit breaker.

When to inspect

Industry standards for this type of equipment recommend a general inspection and lubrication after the number of operations listed in Table 6. This should also be conducted at the end of the first six months of service, if the number of operations has not been reached.

Table 6. Inspection frequency.

Breaker frame size	Interval (cycles)[1]
800 A and below	1750
Between 800 and 4000 A	500

[1] Cycle = 1 open/close operation.

After the first inspection, inspect at least once a year. If these recommended inspections show no maintenance requirements, the period may be extended to a more economical point. Conversely, if the recommended inspection shows, for instance, a heavy accumulation of dirt or other foreign matter or other electrical damage, the inspection and maintenance interval should be decreased.

What to inspect

⚠ IMPORTANT

Before doing any work, make sure a drawout breaker is levered out to the TEST, DISCONNECT, or WITHDRAWN position. During the levering out and levering in of the circuit breaker, be aware of any signs that would indicate that the levering process is not working properly. If working on a fixed circuit breaker, bus systems should be de-energized for convenience and safety. All circuit breakers should be switched to the off position and the mechanism springs discharged.

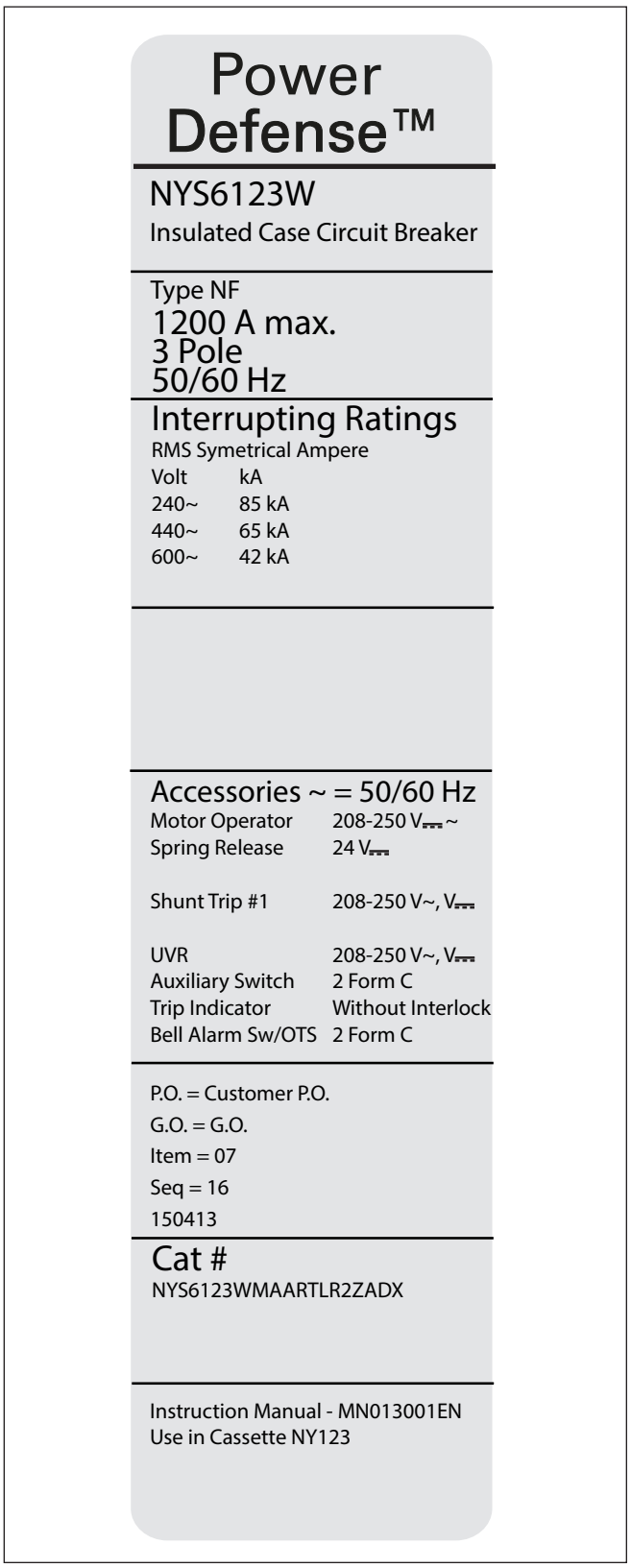
Once the circuit breaker has been cleaned as described previously under the topic entitled "General recommendations," visually inspect it for any signs of damage, missing or loose parts, and unusual wear. Be especially alert for foreign matter that must be removed. On drawout circuit breakers, inspect the primary disconnect finger clusters for signs of wear and erosion (Figure 2). Make appropriate corrections to anything found out of order.

Functional field testing

Eaton recommends that the following three functional tests be performed on Eaton ICCB circuit breakers as part of any maintenance procedure. Circuit breakers should be removed from service and Eaton notified if the circuit breaker fails to perform any of these tests successfully. Provide the number of operations the breaker has performed to date as well as the following nameplate information (Figure 66).

1. G.O. #: It: Seq:
2. Cust. P.O.:
3. Date Code
4. Cat. #:

Figure 66. Typical nameplate.



Manual operation functional test

Perform the following seven steps and verify if the circuit breaker is appropriately opened or closed as indicated by the indicator flags on the front of the breaker (Figure 5).

Step 1: Charge the mechanism springs using charging handle or motor operator.

Step 2: Press the ON pushbutton to close breaker manually.

Step 3: Charge the mechanism springs using either the charging handle or motor operator. (If using motor operator, disconnect the power to motor to prevent automatic recharging).

Step 4: Press the OFF pushbutton to manually open the breaker.

Step 5: Press the ON pushbutton to manually close the breaker.

Step 6: Press the OFF pushbutton to manually open the breaker.

Step 7: Repeat the first six steps three times.

Electrical operation functional test

This test procedure is based on the assumption that the circuit breaker is equipped with both a shunt trip and spring release. If one of the accessories is missing, use the manual button to replace the accessory's function. Perform the following seven steps and verify if the circuit breaker is appropriately opened or closed as indicated by the indicator flags on the front of the breaker (Figure 5).

Step 1: Charge the mechanism springs using the charging handle or motor operator.

Step 2: Close the breaker by applying the rated voltage to the spring release accessory.

Step 3: Charge the mechanism springs using either the charging handle or motor operator. (If using motor operator, disconnect power to motor prevent automatic recharging.)

Step 4: Open the breaker by applying the rated voltage to shunt trip accessory.

Step 5: Close the breaker using the spring release accessory.

Step 6: Open the breaker using the shunt trip accessory.

Step 7: Repeat the first six steps three times.

Trip unit test procedure

The trip unit may be tested via its front panel display interface or through the USB connection to a PC with the PXR Configuration and Test Tool installed. Refer to the Instruction Manual for PXR 20/25 for instructions on testing via the display interface. For testing through the USB interface, refer to the Quick Start Guide for the "Power Xpert Protection Manager" software.

Arc chute inspection

When a circuit breaker experiences a high level fault, or during regularly scheduled maintenance periods, the arc chutes should be inspected for any kind of damage or dirt. Be especially alert for signs of significant erosion within the arc chute.

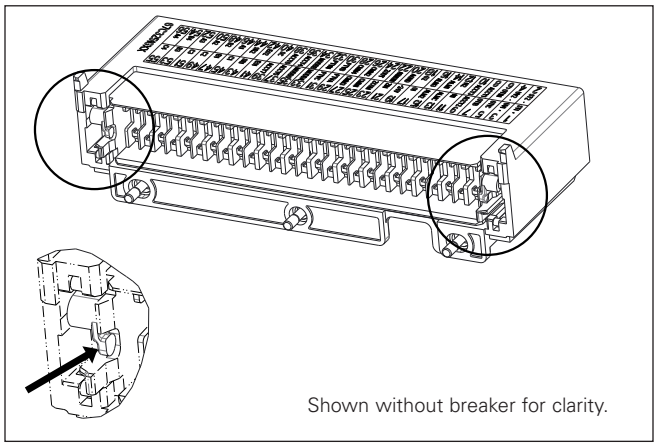
⚠ IMPORTANT

Fixed breakers have an arc hood positioned over the arc chutes/arc chambers that must be removed first. Refer to IL01301014E for installation and removal instructions. After the inspection, reinstall the arc hood.

To remove the arc chutes and inspect both the arc chutes and arc chambers, proceed with the following seven steps.

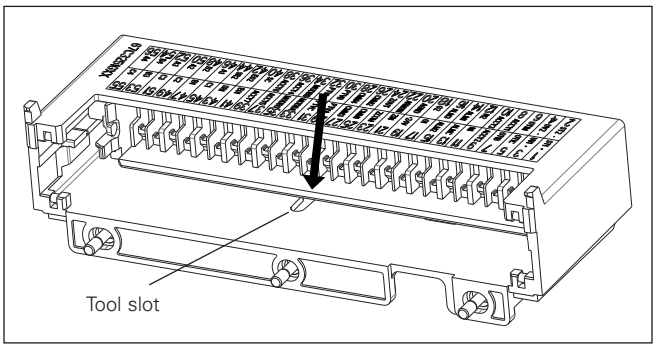
Step 1: (Drawout breakers) Locate the metal latches on each side of the breaker secondary contact assembly. Rotate the latch on one side by using a small tool to press the lower portion of the latch and release the light grey inner cradle which houses the accessory plugs. Push the inner cradle in a small amount to keep the latch disengaged (inner cradle will be angled). While holding the inner cradle in this position, rotate the second metal latch in a similar manner.

Figure 67. Step 1.



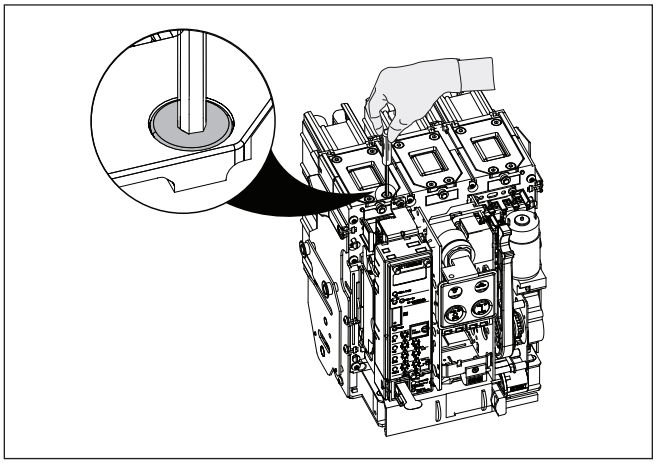
Step 2: (Drawout breakers) Once both latches are released the inner cradle can be compressed until the tool slot is visible. Insert a screwdriver vertically into the slot to hold the inner cradle in place and improve arc chute access.

Figure 68. Step 2.



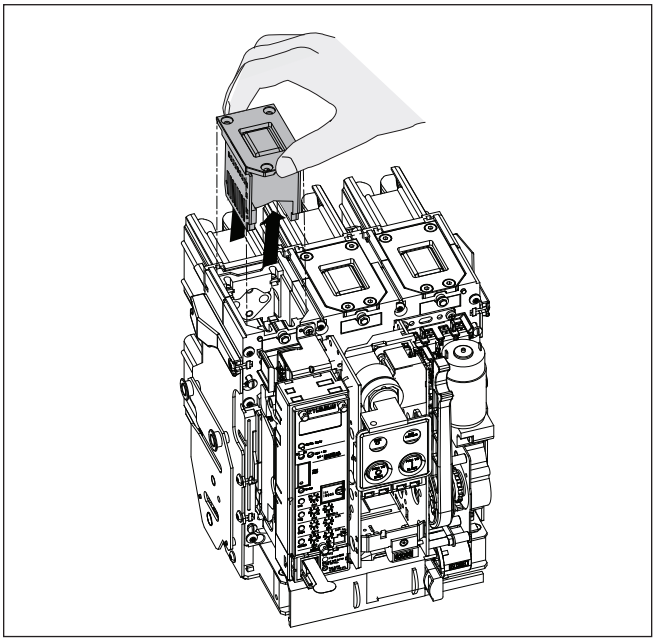
Step 3: Using a 3 mm Allen head driver, remove four top-inserted mounting screws and cover plate from each arc chute.

Figure 69. Step 3.



Step 4: Lift the arc chute up and out of the arc chamber.

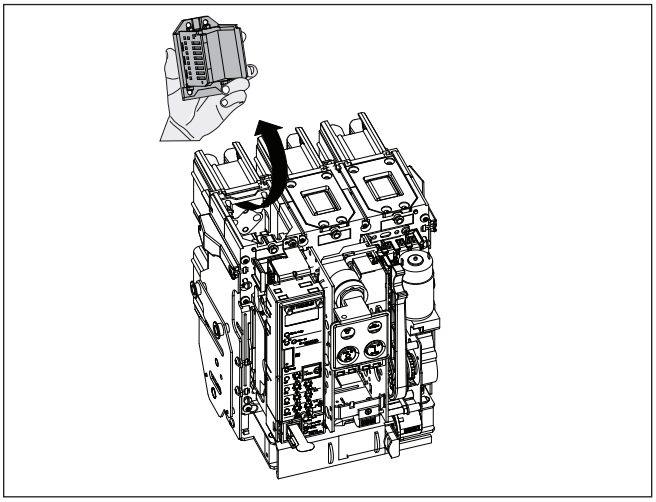
Figure 70. Step 4.



Step 5: Follow the same procedure to remove the remaining two arc chutes.

Step 6: Inspect the arc chutes for obvious damage and turn them over to inspect the inside for obvious damage or dirt accumulation. Eaton ICCB arc chutes cannot be replaced. If damage or dirt accumulation is observed, contact Eaton for additional information.

Figure 71. Step 5.



Step 7: When inspections are complete, secure arc chutes in place with their mounting screws. Remove the screwdriver and verify that the secondary contact assembly inner cradle re-latches.

⚠ WARNING

Arc chutes and their cover plates must always be secured properly in place before a breaker is installed in its compartment. Failure to do so could result in equipment damage, bodily injury, or even death.

Primary contact inspection

With the arc chutes removed, visually inspect each primary contact structure for signs of wear and/or damage with the circuit breaker open. Primary contacts/carrier assemblies cannot be replaced. Contact Eaton for additional information.

Miscellaneous modifications and/or changes

The topics discussed here cover additional actions that relate to updating, maintaining, or repairing Eaton ICCB circuit breakers. Some actions may not be able to be accomplished in the field. In addition, this information does not include most accessory devices that are covered by separate instruction leaflets dedicated to individual devices.

Trip unit replacement

To replace a trip unit, refer to MN013003EN, Instruction Manual for PXR 20/25.

Current sensor replacement

The Rogowski type current sensors are not field replaceable.

Frame rating module replacement

The frame rating module is not field replaceable.

Section 8: Troubleshooting

Introduction

Table 7 will help to determine the probable causes of simple circuit breaker problems and possible corrective actions. Possible problems associated with the electronic trip unit are covered in a companion publication, MN013003EN (PXR). If the problem cannot be resolved with the aid of one or both of these guides, contact the Eaton service center for more in-depth assistance.

Table 7. Circuit breaker troubleshooting guide.

Symptom	Probable cause	Corrective action
The circuit breaker trips open (red fault trip indicator button is out and/or fault indicator LED is lighted) when closed on a load current	Repeated closing on transient (in-rush) current with thermal memory active	Wait for circuit breaker (and loads) to cool before reclosing
	An overload or fault current condition	Use status and fault indicators to help locate and remove overload or fault condition
Circuit breaker opens (fault trip indicator button is not out)	Undervoltage release operates; voltage too low or zero	Check and correct the UVR supply voltage (85 - 110% rated voltage)
	Shunt trip opens	Check control signal(s) to shunt trip; correct if necessary
	Trip latch is defective	Inspect latch condition and engagement before closing; consult Eaton
Circuit breaker cannot be opened remotely, but can be opened locally	Shunt trip control signal absent or too low	Check supply voltage exceeds 70% of rated voltage when signal is applied to shunt trip
	Shunt trip is faulty or improperly installed	Check voltage supplied to shunt trip; make sure ST is seated in its tray; check for ST motion; replace ST if faulty
	Secondary wiring problem	Make sure electrical connections are properly made and verify proper wiring
Circuit breaker cannot be opened locally	OPEN pushbutton locked	Remove lock
	Faulty mechanism or main contacts welded	Contact Eaton
Circuit breaker makes no attempt to close with either local (manual) or remote controls; springs do not discharge	Closing spring not fully charged (check SPRING CHARGED indicator)	Charge spring manually; check voltage to electrical operator; replace operator if faulty
	If equipped with undervoltage release, undervoltage release is not energized or is faulty	Remove left accessory tray containing UVR and retry closing operation; if OK, check voltage supply to UVR (>85%); replace UVR if faulty
	Circuit breaker locked in OPEN position	Check reason for lock
	Drawout position interlock is operating; levering screw	Make sure circuit breaker is at a position that permits closure; check that shutter door over levering screw is fully closed
	Circuit breaker interlocked with another circuit breaker or device	Check for presence of an interlocking scheme (cable or key); check to see if interlocked circuit breaker is CLOSED
Circuit breaker cannot be closed remotely (can be closed locally)	Spring release (closing) coil supply voltage low or SR faulty	Check power supply voltage; replace spring release if faulty
	Secondary contact wiring problem	Make sure electrical connections are properly made and verify proper wiring
Circuit breaker cannot be closed locally (can be closed remotely)	Opening and/or closing pushbuttons locked	Check reason for lock
Circuit breaker does not recharge electrically but will recharge manually	Charging motor supply voltage absent or too low (<85%)	Check charging motor electrical circuit voltage (under load)
	Charging motor faulty	Replace motor assembly
Drawout circuit breaker will not lever in	Cell rejection code plate	Breaker rating not compatible with cassette requirement
	Levering-in screw not fully in DISCONNECT position at insertion	Rotate levering handle counterclockwise to DISCONNECT position, then insert circuit breaker fully into cassette
	Circuit breaker not pushed into cassette far enough	Push circuit breaker in as far as possible
	Protective shutters jammed/locked	Clear problem
	Position detent is engaged	Reset detent system

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