Low-voltage power distribution and control systems > Switchgear >

Arc Quenching Magnum DS low-voltage switchgear

Contents

Powering Business Worldwide

Arc Quenching Switchgear

Arc Quenching Switchgear

Product Description

When the Arc Quenching Device (AQD) receives a trigger signal from the Eaton Arc Flash Relay, it produces a lower impedance arc in a controlled micro-environment within the arc containment vessels located in the AQD. The lower impedance arc collapses the voltage and immediately extinguishes the unintended arcing fault as the current begins to flow into the AQD. This quenching operation occurs in less than 4 ms. The arcing continues safely contained inside the AQD until the upstream power circuit breaker trips. See white paper *"Current limiting arc flash quenching system for improved incident energy reduction,"* WP019003EN.pdf, for more information.

Arc Quenching Switchgear is available in various enclosure constructions to meet specific application requirements. Please see the following design guides for additional information.

Application Description

The Arc Quenching Device (AQD) can be located on the line- or the load-side of the main low-voltage circuit breaker in an Arc Quenching Switchgear (AQS) lineup. With the switchgear energized and the Arc Quenching System active, the entire AQS lineup will be C37.20.7 arc-resistant regardless of the location of the AQD. However, the incident energy of the lineup is affected by the location of the AQD.

Load-side Application

The standard AQS application includes the AQD mounted on the load-side of the low-voltage main circuit breaker. See **Figure 20.5-1**.

In this application, the lineup will carry two different incident energy levels while the Arc Quenching System is active (indicated by the illumination of the white light above the AQD). The incident energy on the line side of the low-voltage main breaker will be determined by the clearing time of the upstream overcurrent protective device. The incident energy on the load-side of the low-voltage main breaker will be determined by the arc quenching time of the Arc Quenching System. Typically, the load-side incident energy in this application will be less than 1.2 cal/cm^2. See **Figure 20.5-2**.

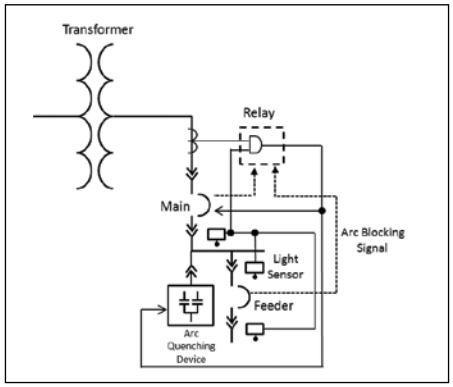

Figure 20.5-1. AQD Load-Side Application

If the Arc Quenching System is inactive (either due to a malfunction, loss of control power, disconnection of the AQD, or if the upstream LV main device is open), the white indicator light above the AQD will cease to be lit. In this case, the incident energy on the line-side of the main low-voltage breaker will remain the same (as determined by the clearing time of the upstream overcurrent protective device). Furthermore, when the main breaker is closed with the AQS inactive, the incident energy on the load-side of the low-voltage breaker will increase, determined by the total clearing time of the Eaton Arc Flash Relay (EAFR) tripping the low-voltage main breaker.

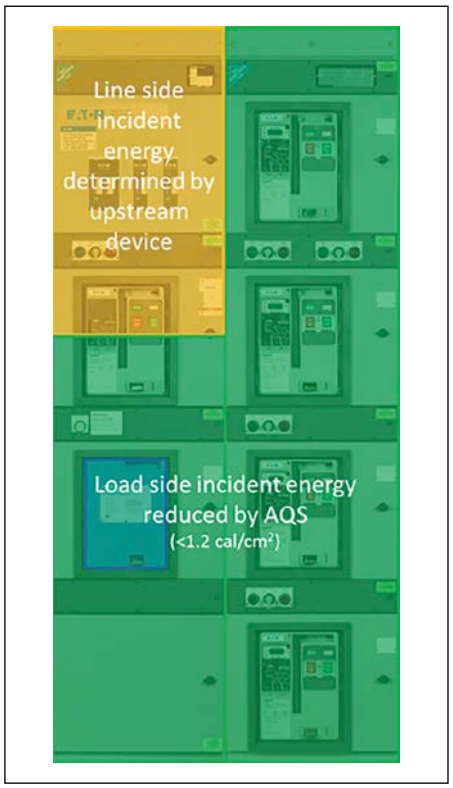

Figure 20.5-2. Standard Application Incident Energy

AQD Load-side Application Example

AQD Line-Side Application

The substation AQS application includes the AQD mounted on the line-side of the low-voltage main circuit breaker, and must include a wired trip signal from the EAFR to the upstream medium-voltage circuit breaker with a verified clearing time of less than 30 cycles. See **Figure 20.5-3**. It is not possibleto shunt-trip an upstream medium-voltage switch unless the switch is rated to interrupt full available fault current within 30 cycles or less.

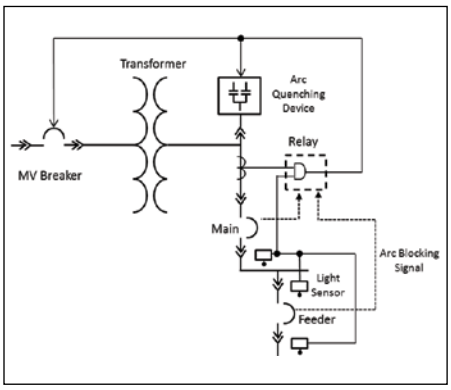

Figure 20.5-3. AQD Line-Side Application

In this application, the entire low-voltage switchgear lineup will carry a single incident energy level while the Arc Quenching System is active (indicated by the illumination of the white light above the AQD).The incident energy of the entire lineup, including the line-side of the low-voltage main breaker, will be determined by the arc quenching time of the Arc Quenching System.Typically, the incident energy of the entire low-voltage switchgear lineup in this application will be less than 1.2 cal/cm^2. See **Figure 20.5-4**.

If the Arc Quenching System is inactive (either due to a malfunction, loss of control power, or disconnection of the AQD), the white indicator light above the AQD will cease to be lit. In this case, the incident energy of the entire low-voltage switchgear lineup (on the line-side and load-side of the low-voltage main breaker) will be determined by the total clearing time of the Eaton EAFR tripping the upstream medium-voltage breaker.

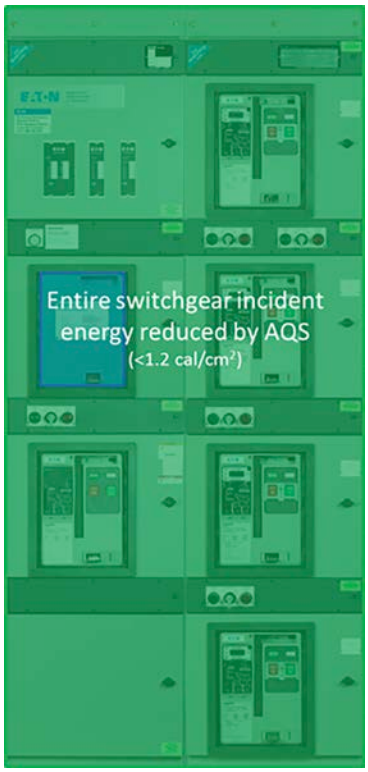

Figure 20.5-4. Substation Application Incident Energy

Notes for Line- and Load-Side Applications

After switchgear installation, it is highly recommended to perform an arc flash study and label the switchgear with the calculated incident energy.

The Arc Quenching System is electrically interlocked with the main breaker to prevent closing the main if the health contact of either the EAFR or AQD is open, either because the device is still powering up or if there is an error.

The Arc Quenching System requires approximately 30 seconds of boot time on power-up. For applications in which the primary bus could become energized with the main breaker of the protected switchgear closed, an external control power source is recommended. Alternatively, a UPS internal to the switchgear can be specified to ensure that the Arc Quenching System is operational prior to energizing the switchgear primary bus.This will provide protection in the unlikely event that an arc occurs in the switchgear while energizing.

Ratings

- Short-circuit withstand rating up to 100 kA at 635 Vac
- <4 ms arc quenching time
- >25% reduction in peak fault current
- >44% reduction in peak system stress
- Complete system self-supervision with health status communicated via Modbus and dry contacts
- Available in rear access and front access switchgear configurations
- Anti-nuisance trip technology

Enclosure Configurations

Arc Quenching Switchgear is available in various enclosure constructions to meet specific application requirements:

Traditional Arc-Resistant Construction

- Active arc-resistant protection and incident energy reduction under normal operating conditions
- Traditional passive arc-resistant protection if the AQD is removed and arc-resistant breaker cell provisional cover installed

NEMA 1 Construction

- Active arc-resistant protection and incident energy reduction without the need for ducts, plenums or special enclosure construction
- Reduced installation costs and reduced overhead clearance requirements compared to traditional arc-resistant switchgear

NEMA 3R Construction

- Industry-exclusive NEMA 3R arc-resistant protection
- Arc-resistant protection and incident energy reduction for outdoor switchgear

Standards and Certifications

- Tested to ANSI/IEEE C37.20.7,Type 2B test guide in NEMA 1 construction
- AQD is a UL recognized component per UL 2748
- Arc Quenching Switchgear designed to UL 1558, ANSI C37.20.1, CSA C22.2 No. 31-10, and C37.51

Arc Quenching Switchgear Layout Guide

The location of the Arc Quenching Device (AQD) and the Eaton Arc Flash Relays (EAFR) is critical for proper design of a lineup of Arc Quenching Switchgear (AQS). Providing adequate instrument compartment space for the required AQS components must also be considered in the design.

AQD Location

The AQD is installed in a specialized Magnum cassette that must be located in the same structure as the low-voltage main breaker. Typically, the AQD will be installed in the cell directly above or below the main breaker (see AP019003EN for more details).

If the main breaker is an MDN 4000 and the AQD will be on the load side, the MDN 4000 must be located in the B cell. The AQD may be located in the C cell or D cell. If the main breaker is an MDN 4000 and the AQD will be on the line side, the MDN 4000 must be located in the C cell and the AQD must be located in the B cell.

For all other main breakers, the AQD should be located either directly above or below the main breaker, depending upon the desired application.

EAFR Location

The main EAFR-110PLV relay must be located in the same structure as the low-voltage main breaker and the AQD. Adequate instrument compartment door space must be allocated for this device. See **Figure 20.5-5** and **Figure 20.5-6**.

Each low-voltage main breaker requires an EAFR-101C relay. This relay may be located in the same instrument compartment as the EAFR-110PLV relay. Adequate instrument compartment door space must be allocated for this device. See **Figure 20.5-7** and **Figure 20.5-8**.

For every two feeders or tie breakers, an additional EAFR-101C relay is required. The location of these relays within the lineup is not critical; however, they should be located in the same shipping split as the feeder or tie breakers that they are associated with. Adequate instrument compartment door space must be allocated for these devices. See **Figure 20.5-7** and **Figure 20.5-8**.

- One EAFR-110PLV and three EAFR-101C relays can fit on the door of a standard 22-inch wide instrument compartment
- One EAFR-110PLV and five EAFR-101C relays can fit on the door of a standard 30-inch wide instrument compartment
- Five EAFR-101C relays can fit on the door of a standard 22-inch wide instrument compartment
- Seven EAFR-101C relays can fit on the door of a standard 30-inch wide instrument compartment

See **Figure 20.5-9** through **Figure 20.5-12** for door layouts. For non-A cell compartments, two rows of relays can fit on each door.

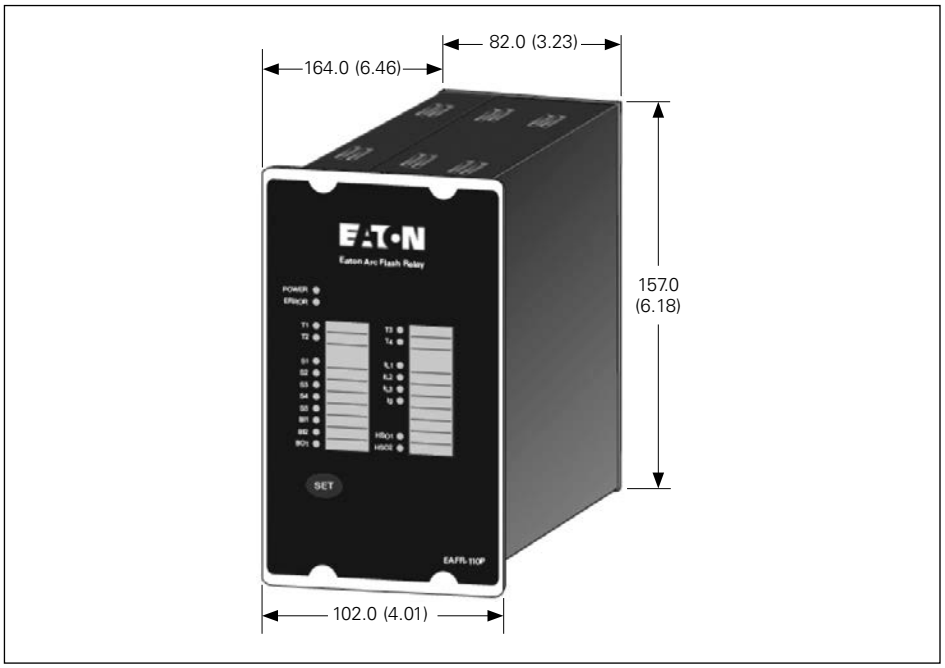

Figure 20.5-5. EAFR-110PLV Dimensions in Millimeters (Inches)

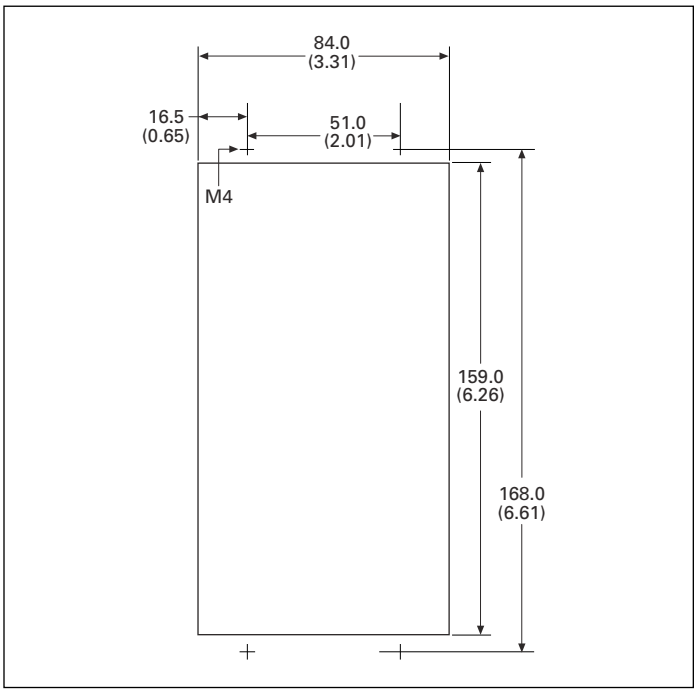

Figure 20.5-6. EAFR-110PLV Cutout for Panel Mounting in Millimeters (Inches)

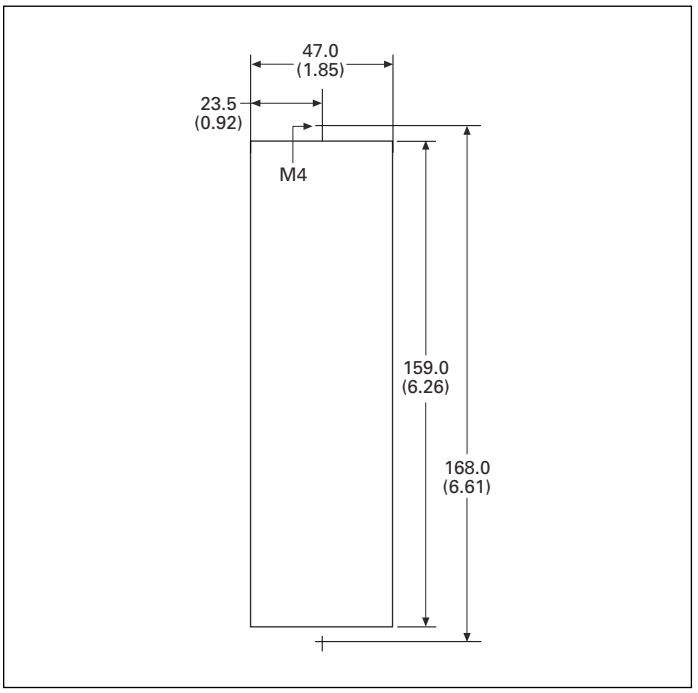

Figure 20.5-8. EAFR-101C Cutout for Panel Mounting in Millimeters (Inches)

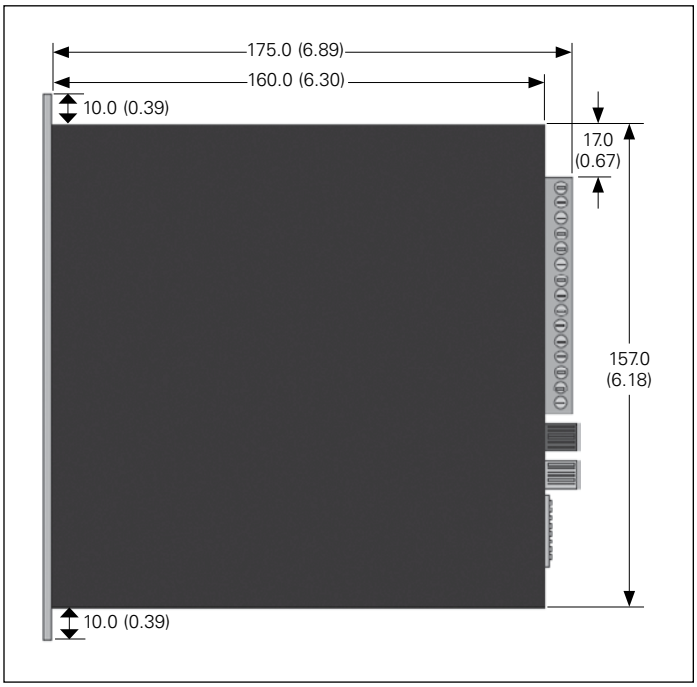

Figure 20.5-7. EAFR-101C Dimensions in Millimeters (Inches)

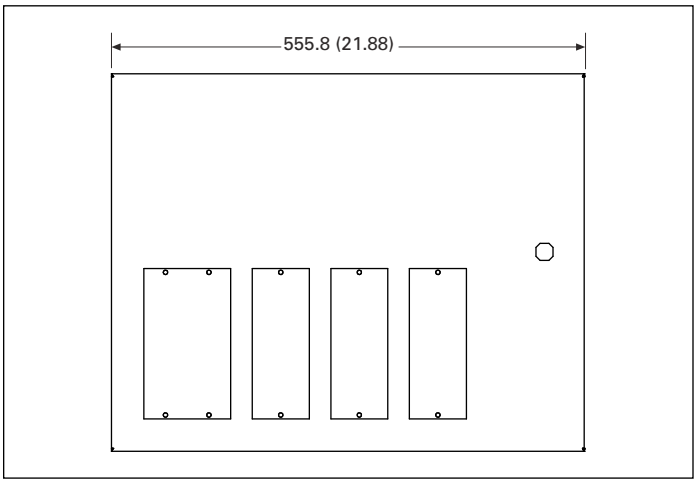

Figure 20.5-9. 22-Inch Instrument Compartment with EAFR-110PLV and EAFR-101C Relays—Dimensions in Millimeters (Inches)

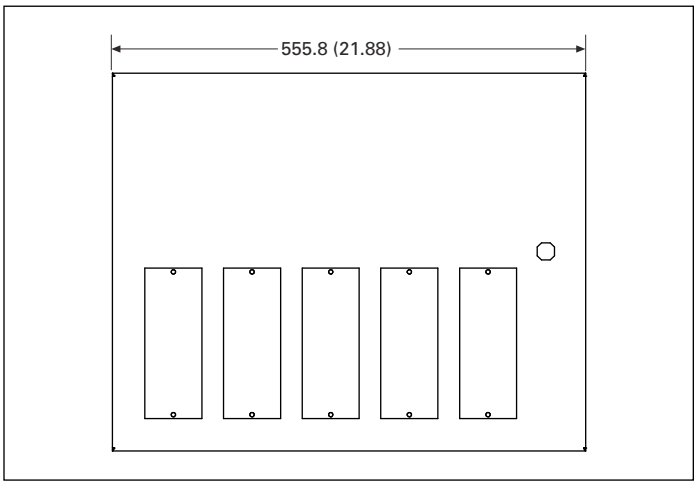

Figure 20.5-10. 22-Inch Instrument Compartment with EAFR-101C Relays—Dimensions in Millimeters (Inches)

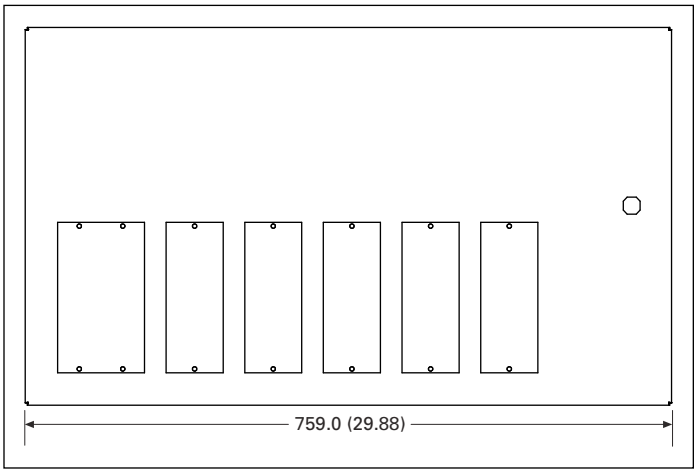

Figure 20.5-11. 30-Inch Instrument Compartment with EAFR-110PLV and EAFR-101C Relays—Dimensions in Millimeters (Inches)

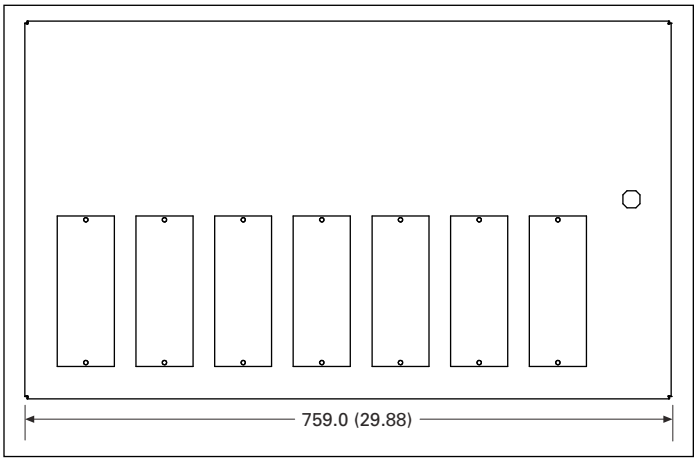

Figure 20.5-12. 30-Inch Instrument Compartment with EAFR-101C Relays—Dimensions in Millimeters (Inches)

Multiple Main Bus Lineups (Main-Tie-Main, Main-Main, etc.)

For Arc Quenching Switchgear lineups with multiple low-voltage main (or generator) breakers and no tie breakers, a single Arc Quenching System (one AQD and all required EAFR relays) may be utilized only if the main breakers are located in immediately adjacent structures (with no structures in between). The AQD may be installed below either main breaker and the EAFR trip signal will be wired to trip both main breakers when an arc flash is detected. The location requirements for the AQD and EAFR relays are the same as described above.

For Arc Quenching Switchgear lineups with main and tie breakers, a complete Arc Quenching System (one AQD and all required EAFR relays) must be included for each main breaker. The EAFR trip signal will be wired to trip both main breakers and AQDs when an arc flash is detected. The location requirements for the AQDs and EAFR relays are the same as described above.

The AQD must be applied within the nameplate ratings of the device. Special consideration must be made for closed transition and paralleled source applications.

Sample Layouts

A	Main metering PXM 4000 meter	(5) EAFR-101C	Instrument	Instrument
B	Main MDN-64N 4000A-DE 1150LSIG	Feeder MDS-616 1600A-DE 1150LSIG	Feeder MDS-616 1600A-DE 1150LSIG	Feeder MDS-616 1600A-DE 1150LSIG
C	(1) EAFR-110-PLV (1) EAFR-101C	Feeder MDS-616 1600A-DE 1150LSIG	Feeder MDS-616 1600A-DE 1150LSIG	Feeder MDS-616 1600A-DE 1150LSIG
D	AQD	Feeder MDS-616 1600A-DE 1150LSIG	Feeder MDS-616 1600A-DE 1150LSIG	Feeder MDS-616 1600A-DE 1150LSIG
Structure	1	2	3	4
Depth (Calc)	78 (72)	78 (78)	78 (78)	78 (78)
Width	30	22	22	22
Overall width	96.00 (2438.4)			

Figure 20.5-13. Single Main, MDN 4000

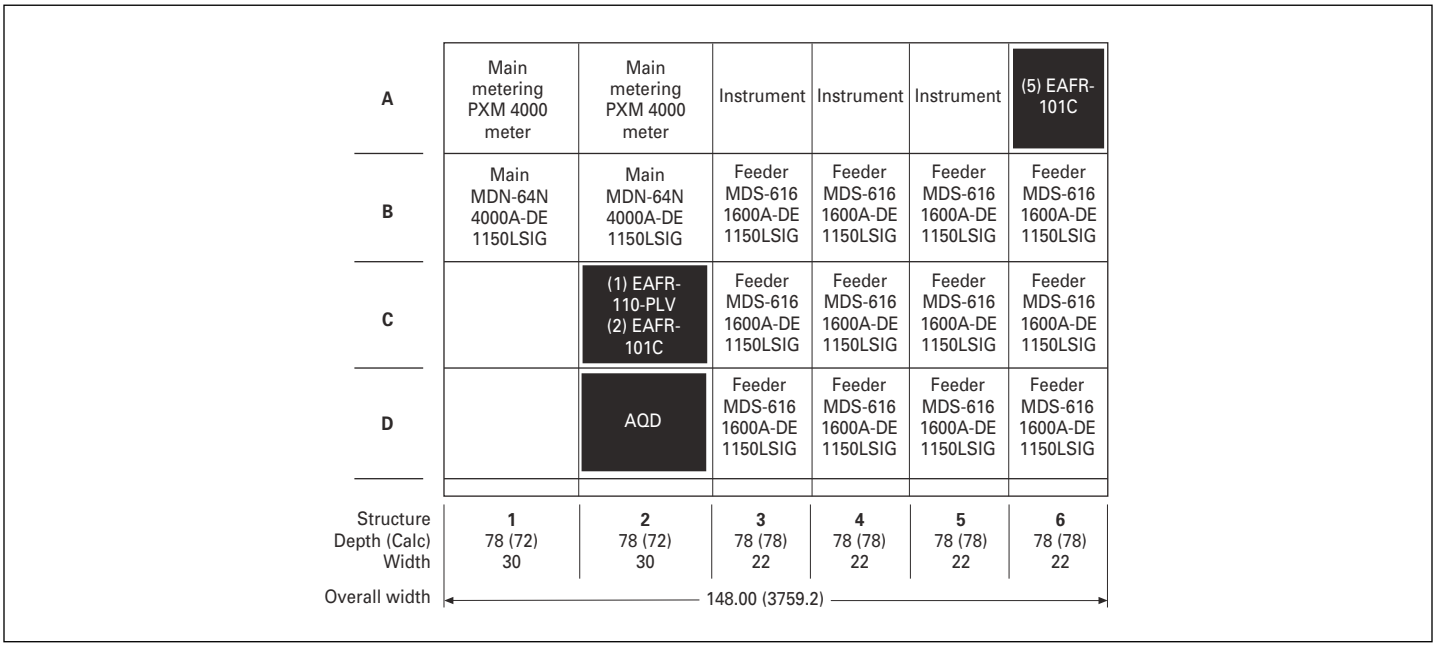

Figure 20.5-14. Main-main, MDN 4000

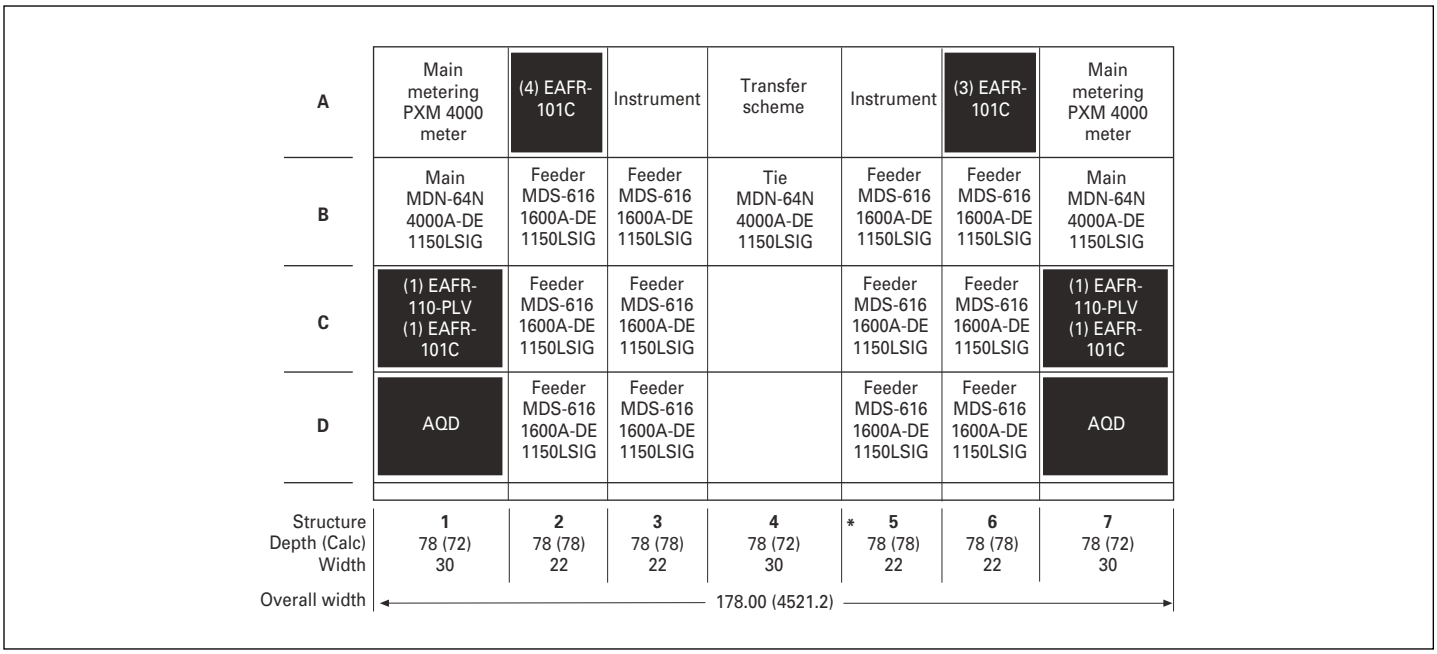

Figure 20.5-15. Main-tie-main, MDN 4000

Note: See other product families for breaker layouts and dimensions.

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

Printed in USA
Publication No. CA019005EN / Z21722
April 2019

Powering Business Worldwide