

Modular Isolation Power Panels

For Healthcare Facilities



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Section 1: Introduction

1. 1 - Isolation Power Panels

BENDER's Isolated Power Panels provide reliable, isolated, ungrounded power to electrical systems in operating rooms and other critical areas in healthcare facilities. Isolated Power Systems allow for early detection of hazardous current while keeping the system online. The system gives a visual indication of the level of current in milliamperes (mA). When the threshold is reached, a visual and audible alarm is activated.

A hospital grade isolation transformer serves a single operating room, except when supplying power to equipment requiring 150 VAC or higher. A Line Isolation Monitor (LIM) monitors leakage current from all isolated current carrying conductors to ground.

This manual provides instructions on installing and operating isolated power panels. Refer to all relevant national and local codes and standards before proceeding with installation.

Section 2: Safety Instructions



2.1 - General Safety Warning

Hazard of Electric Shock, Burn, or Explosion

Only qualified maintenance personnel should operate or service this equipment. These instructions should not be viewed as sufficient for those who are not otherwise qualified to operate or service this equipment. No responsibility is assumed by BENDER INC. for any consequences arising from use of this document.

Turn **OFF** all sources of electric power before performing any inspections, tests, or service on this equipment. Assume all circuits are live until they have been properly de-energized, tested, grounded, and tagged. Failure to observe these precautions can result in equipment damage, severe personal injury, or death.

Proper operation of this equipment depends on proper installation. Refer to **NFPA 70, NFPA 70E, CSA Z462**, and other relevant standards and codes for installation standards. Neglecting fundamental installation techniques will result in equipment damage, severe personal injury, or death.

Do not make any modifications to the equipment. Failure to observe this precaution will result in equipment damage or personal injury.

Use only manufacturer's and manufacturer recommended accessories with this equipment. Failure to do so may damage the equipment beyond repair.

2. 2 - Using This Manual

Read these instructions carefully and become familiar with the equipment before attempting to install, operate, or service it. Throughout this manual, special messages may appear to warn of potential safety hazards or to call attention to information which clarifies instructions or procedures. Observe all safety messages that appear throughout this manual to avoid possible injury or death. An explanation of these symbols is given below.



DANGER: Indicates a hazardous situation which, if not avoided, will result in death or severe injury.



WARNING: Indicates a potentially hazardous situation which, if not avoided, may result in death or injury.



CAUTION: Indicates a potentially hazardous situation which, if not avoided, may result in injury or equipment damage.



NOTE: Provides additional information to clarify instructions for a product or procedure.

2.3 - Torque Requirements

The following tables provide proper torque specifications for various components with the panel. Please be sure to follow these specification for safe, proper installation

Torque Specifications				
Where Used	Hardware Size & Type	Drive Size	lb-in	N-m
Backboxes				
Barrel Hinge Mounting	#1/4 - 20 Flange Nut	5/16" Hex Drive	125 - 129	14.13 - 14.5
Mounting	5/16" Hardware	1/2" Hex Drive	-	-
Trims				
Transformer Heat Shield (MIX only)	#10-32 Flange Nut	3/8" Hex Drive	25 - 30	2.82 - 3.39
Trim Mounting Hardware	#10 Machine Screw	#2 Phillips Head	10 - 12	1.13 - 1.35
Trim Mounting Hardware (Seismic)	#1/4 - 20 Truss Head	#2 Phillips Head	10 - 12	1.13 - 1.35
Transformer Kits				
Breaker Mounting Bracket	#10-16 Screw	5/16" Hex Drive	35 - 45	3.95 - 5.08
Deadfront Filler Plate Mounting	#6-32 Flange Nut	5/16" Hex Drive	8 - 9	.9 - 1.02
Transformer Mounting Locknut	5/16" Locknut	1/2" Hex Drive	-	-
Transformer Grounding Point	#10-32 Green Flange Nut	3/8" Hex Drive	25 - 30	2.82 - 3.39
Interior Assembly				
Interior to Backbox Mounting	#1/4 - 20 Flange Nut	5/16" Hex Drive	125 - 129	14.13 - 14.5
Deadfront Mounting Screws	-	#2 Square Drive	-	-
LIM Mounting Hardware	#6-32 Flange Nut	5/16" Hex Drive	8 - 9	.9 - 1.02
LIM Connector Plate Mounting	#10-16 Screw	5/16" Hex Drive	35 - 45	3.95 - 5.08
COM465IP Assembly Mounting	#10-16 Screw	5/16" Hex Drive	35 - 45	3.95 - 5.08
EDS441-LNA Assembly Mounting	#10-16 Screw	5/16" Hex Drive	35 - 45	3.95 - 5.08
CMS460 Assembly Mountin	#10-16 Screw	5/16" Hex Drive	35 - 45	3.95 - 5.08
Current Transformer Strip Mounting	#10-16 Screw	5/16" Hex Drive	35 - 45	3.95 - 5.08
Accessory Terminal Block Mounting	#10-16 Screw	5/16" Hex Drive	35 - 45	3.95 - 5.08
GPM - Panel Mount Assembly	#10-16 Screw	5/16" Hex Drive	35 - 45	3.95 - 5.08

Torque Specifications (Wiring)			
Circuit Breaker / Connections	Wire Range	lb-in	N-m
Square D Circuit Breakers			
H-Frame (HDL,HGL,HJL) Main Circuit Breakers	14 AWG to 10 AWG Al/Cu	50	5.00
	6 AWG to 3/0 Al/Cu	120	14.00
QO, QOB, QOU Branch Breaker Connections	14 AWG to 8 AWG Al/Cu	36	4.00
	14 AWG to 6 AWG Al	41	4.60
	12 AWG to 4 AWG Cu	41	4.60
General Electric Circuit Breakers			
THQB	14 AWG to 8 AWG Al/Cu	20	2.26
TEY - Bolt-on Main Circuit Breaker	14 AWG to 10 AWG Al/Cu	35	3.96
	8 AWG Al/Cu	40	4.52
	6 AWG to 4 AWG Al/Cu	45	5.09
Cutler Hammer Circuit Breakers			
BAB, CHF, QC - Miniature Circuit Breakers	14 AWG to 10 AWG Al/Cu	20	2.26
	8 AWG Al/Cu	25	2.83
	6 AWG to 4 AWG Al/Cu	27	3.05
GHC - G-Frame Main Circuit Breaker	14 AWG to 10 AWG Al/Cu	20	2.26
	8 AWG Al/Cu	40	4.52
	6 AWG to 4 AWG Al/Cu	45	5.09
FDB - F-Frame Main Circuit Breaker	14 AWG to 10 AWG Al/Cu	35	3.96
	8 AWG Al/Cu	40	4.52
	6 AWG to 4 AWG Al/Cu	45	5.09
Other			
Terminal Block – Transformer Connection	6 AWG to 2/0 AL	120	13.60
Distribution Block (Dual Voltage Panel)	(2) 14 AWG to 10 AWG CU	35	4.00
Contactors (Control Panels)	Box Lug: 14 AWG to 6 AWG	18-25	2-3
	Power: 14 AWG to 8 AWG		
LIM Connector Plate Terminals	22 AWG - 12 AWG	5	0.60
Ground Bus Bar	(1) 14 AWG to 4 AWG or (2) 14 AWG or 12 AWG CU	30	3.40
	(1) 12 AWG to 4 AWG or (2) 12 AWG or 10 AWG AL		
Terminal Block - X-Ray/Laser Control Panel Wiring	30 AWG - 14 AWG	4.6	0.52

Section 3: Model Types

3.1 - MIP / MIE - Standard Isolation Power Panels

Bender's standard Modular Isolation Power Panel (MIP / MIE) provides power for a single-voltage system with standard features, as well as compatibility with advanced features including fault location and communications. Built-in power receptacles and ground jacks are also available upon request.

Standard Features

- Isolation transformer with corresponding main circuit breaker
- BENDER LIM2010 Line Isolation Monitor (LIM)
- Reference Ground Bus
- Bolt-on style load center
- 16, 2-pole 20A branch circuit breakers (consult factory for alternative configurations)
- Front trim with door in door concealed hinge



3.2 - MIC - X-Ray / Laser Control Isolation Power Panels

Bender's X-Ray / Laser Control Isolation Power Panels (MIC) are designed to feed X-Ray and Laser receptacles at interface of up to 60A (within the power rating of the panel). The system utilizes a PLC to lock-out circuits to ensure power consumption remains within the ratings of the system

Standard Features

- Isolation transformer with corresponding main circuit breaker
- BENDER LIM2010 Line Isolation Monitor (LIM)
- Circuit control lockout via PLC
- Reference Ground Bus
- Bolt-on style load center
- Up to 12, 2-pole 20-60A circuit breakers
- Front trim with door in door concealed hinge



Consult factory for custom panel configurations

3.3 - MIX - Dual System Isolation Power Panels

Bender's Dual System Isolation Panels (MIX) provide two separate voltage outputs from two isolation transformers, separated by a barrier. This system is equivalent to two independent MIP standard isolation power panels in one enclosure. A standard dual system panel consists of the following communications. Built-in power receptacles and ground jacks are also available upon request.

Standard Features

- 2 x Isolation transformer with corresponding main circuit breaker
- 2 x BENDER LIM2010 Line Isolation Monitor (LIM)
- 2 x Reference Ground Bus
- 2 x Bolt-on style load center
- 2 x 16, 2-pole 20A branch circuit breakers (consult factory for alternative configurations)
- Front trim with door in door concealed hinge



3.4 - MID - Dual Voltage Isolation Power Panels

Dual Output Voltage Isolated Power Panels provide two separate voltage outputs using a single isolation transformer. A standard Dual Output Voltage Panel consists of the following:

Standard Features

- Dual Output Isolation transformer with main & secondary main circuit breakers
- 2 x BENDER LIM2010 Line Isolation Monitor (LIM)
- Up to 4 branch circuit breaker for high voltage (208 or 240V) side
- 2 x Reference Ground Bus
- Bolt-on style load center
- 16, 2-pole 20A branch circuit breakers (consult factory for alternative configurations)
- Front trim with door in door concealed hinge



Consult factory for custom panel configurations

Section 4: Components

The following sections describe key components of isolated power panels. These components are standard for the United States unless otherwise noted. Ensure equipment conforms to all national and local codes and standards prior to purchasing.

4.1 - Backbox

The backbox is fabricated from a minimum 14 GA galvanized steel and is designed for flush (recessed) or surface mounting. Flush mounting is standard. Surface mounted backboxes must be requested during the purchasing process. Surface mounted backboxes are finished with a coat of hospital grade ivory baked enamel. All backboxes include an easy-lift-off hinge assembly to ease front trim installation and system maintenance. The backbox meets the requirements of **NEMA Type 1** according to **UL 50**.



4.2 - Front Trim

The front trim is manufactured from a minimum 14 GA, type 304 stainless steel. It contains a door with hidden hinges and flush mounted key lock.

The door provides access to circuit breakers and optional add-on accessories if equipped. Compatible front trims are provided with provisions for future field installation of fault location assemblies and/or recaptacle. Front trims may be used with flush-mounted or surface-mounted backboxes.

For flush mounted panels, the front trim extends 1" (25.4 mm) on all sides of the backbox. For surface-mounted panels, the front trim has the same height and width as the backbox.



4.3 - Transformer Kit

Modular Hospital Grade Isolation Transformer Kits, for Modular Isolated Power Systems, include a transformer which provides isolation between configured primary and secondary voltages and its' corresponding Main Breaker arrangement along with all necessary mounting hardware.

Options for a Secondary Main breaker and/or Selective Coordination are also available upon request.

Isolation transformers used in isolated power systems are special-purpose, low-voltage, dry-type transformers. They are application-specific and designed to fulfill the requirements of **UL 5085 and UL 1047.**



4.4 - Interior Assembly & Loadcenter

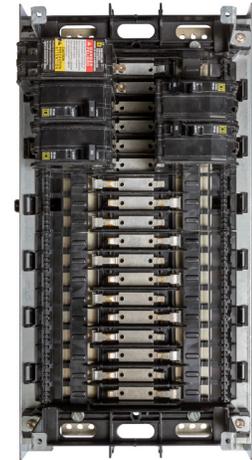
The interior assembly is a single, factory assembled and wired sub-panel that houses the load center populated with circuit breakers, connection points for the Line Isolation Monitor, ground bus bars, as well as any other add-on accessories, such as Fault Location, Current Monitoring, and/or Communications devices.



4.5 - Circuit Breakers

All panels utilize two-pole, thermal magnetic circuit breakers. Panels ordered with selective coordination may include an electronic trip element added to the primary and/or secondary main circuit breakers to achieve 0.1 second system coordination.

The primary and secondary (where applicable) main circuit breakers are sized to protect the transformer coil. The primary main circuit breaker is sized at 125% of rated current. Any supplied secondary main circuit breakers are sized at rated coil ampacity.



NOTE: To maintain compliance with UL 1047, branch breakers must not exceed 60 A.

4.6 - Line Isolation Monitor (LIM2010)

All panels are supplied with one or more Line Isolation Monitors (LIM). The LIM monitors the system impedance to ground of the entire isolated power system. The impedance to ground is used to calculate the total hazard current (THC), given in units of milliamperes (mA).

The factory default THC alarm is set to 5 mA. The value may be changed to 2 mA to meet local certification requirements.



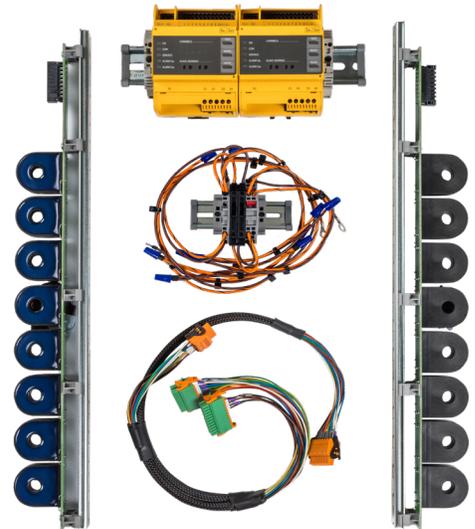
Optional Components

4.7 - Fault Location (EDS441-LNA) Kit(s)

Compatible with Bender's line of Modular Isolated Power Panels; the EDS441LNA Fault Location Modules provide quick and efficient detection of ground fault on individual branch circuits.

Once a ground fault is detected, the accompanying Line Isolation Monitor (LIM2010) activates an alarm and sends out a tracer pulse which is detected by the CT sensors and evaluated by the EDS module. This will alert technicians and staff of the circuit with a resistive ground fault, thereby reducing tedious troubleshooting and system downtime.

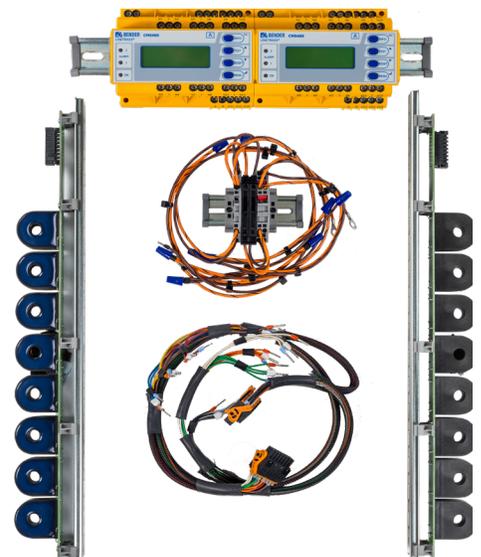
Fault location modules can be pre-installed at the factory or post-installation with easy-to-install upgrade kits. Kits are available to monitor up to 12 or 16 circuits simultaneously.



4.8 - Branch Load Monitoring (CMS) Kit

Compatible with Bender's line of Modular Isolated Power Panels; the CMS460 Modules provide quick and efficient monitoring and evaluation of branch circuit loads. Independent alarm values can be set for each branch circuit to determine when the ampacity threshold is met.

Kits are available to monitor up to 12 or 16 circuits simultaneously and interface via RS-485 communications. The CMS460 kit can be added at the factory or post-installation.



4.9 - System Load Monitoring

STW series current transformers are combined with the LIM2010 Line Isolation Monitor to provide system load current monitoring in Isolated Power Systems for healthcare facilities. Alarm notifications can be set when the total Isolation Transformer ampacity reaches a set threshold. STW3 models may be used on systems with up to 100 A of load current. Load monitoring is indicated on both the LIM2010 display, remote annunciators (MK2000CBM) and via the systems communications bus.

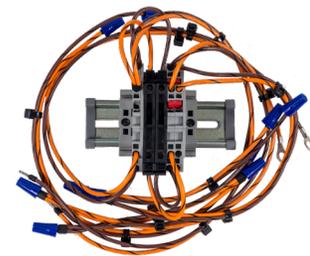


4.10 - Communications Gateway (COM465IP) Kit

Compatible with Bender’s line of Modular Isolated Power Panels; the COM465IP adds remote communication capabilities to Isolated Power Systems. The expansion kit can be added at the factory or post-installation with easy-to-install upgrade kits.

Bender’s COM465IP gives technicians and staff the ability to see the status of their Isolated Power Systems in real-time. The integrated web server can be accessed from any network-connected PC or smartphone.

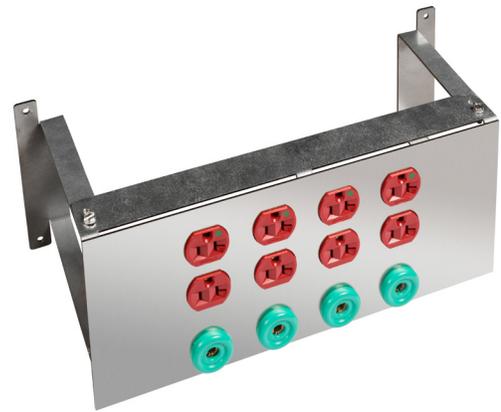
Additionally, the COM465IP acts as a Modbus TCP gateway, providing integration capabilities into building management systems. Only one COM465IP required per 99 device addresses.



4.11 - Ground Power Modules (Receptacle Kits)

Panels may include on-board receptacles and ground jacks as part of an optional accessory kit (receptacle kit). The receptacle kit provides NEMA type receptacles and/or hospital grade ground jacks accessible directly from the front trim. Type and quantity is per project specifications.

The receptacle kit is installed in the interior assembly and may be installed at the factory or on site. Refer to panel add-on user manual for more information on installation, operation, and use.



Section 5: Receiving, Handling, and Storage

5.1 - Receiving

Inspect all equipment immediately upon delivery. If any damage or mishandling has occurred, file a damage claim with BENDER and/or the carrier. Verify packing slip details before filing a shortage claim.

Isolated power panels are typically packaged and shipped as four (4) separate components:

- Backbox
- Interior Assembly
- Transformer Kit
- Front Trim

These system components may be shipped at different times to accommodate the installer project schedule. In many cases, the backbox and interior assembly arrive first to allow sufficient time for preliminary installation.



NOTE: Do not separate the contents of the isolation transformer kit until ready for installation.

5.2 - Handling



WARNING: Due to the heavy load of isolated power equipment, use suitable equipment for lifting and transporting. Failure to do so may result in severe personal injury and damage to equipment.

5.3 - Storage

- Do not store equipment in dusty or damp locations.
- Do not stack interiors, transformers, or any equipment.
- Do not rest or lean front trims against walls.

Section 6: Pre-Installation Requirements

6.1 - General Requirements

Review all code, standards, and project requirements thoroughly before proceeding with installation.

NFPA 99 mandates an isolated power system's total line-to-ground insulation impedance shall exceed 200 k Ω . Excessive leakage current may result in non-conformance with this requirement.



NOTE: In addition to adhering to all national, local, and project-specific requirements, the installer shall thoroughly review and understand all information within this manual and relevant reference material. Applicable material includes, but is not limited to:

- **NFPA 99 - 2012:** Healthcare Facilities Code Chapter 6
 - **NFPA 70:** National Electric Code (NEC), Article 517
 - (Canada) **CSA C22.1:** Canadian Electrical Code (CEC, CE-Code), Section 24
 - (Canada) **CSA Z32:** Applications of Electricity in Healthcare
-

6.2 - Support Requirements

Prior to installation, ensure the proper structural support will be used. Minimum load bearing requirements are listed in the table below. For panels weighing in excess of 500 lb (230 kg), install both horizontal (bottom) and vertical (side) supports.



NOTE: Custom configurations may have special weight and load bearing requirements.

6.3 - Panel Weights

Panel Type	Total Weight (lbs)	Total Weight (kgs)
MIP	370	168
MIE	650	295
MIC	650	295
MID	675	306
MIX	700	317

**Actual panel weight may vary based on configuration*

6.4 - Backbox & Trim Dimensions

Verify backbox dimensions on label. Ensure the wall space required is available before proceeding with backbox installation. Ensure the mounting style (surface or flush) is correct for the application. For reference, standard backbox and trim sizes are listed in the table below. Dimensions are given in inches.

System kVA Rating	Mounting Style	Backbox Part Number	Backbox Dimensions (H" x W" x D")	Front Trim Part Number	Front Trim Dimensions (H" x W")
Up to 5 kVA	Flush	B662406F	66" x 24" x 6"	T6826R	68" x 26"
Up to 10 kVA	Flush	B662408F	66" x 24" x 8"	T6826R	68" x 26"
Up to 15 kVA	Flush	B723012F	72" x 30" x 12"	T7432R	74" x 32"
Up to 25 kVA	Flush	B723014F	72" x 30" x 14"	T7432R	74" x 32"
Up to 5 kVA	Flush	B803606F	80" x 36" x 6"	T8238R	82" x 38"
Up to 10 kVA	Flush	B803608F	80" x 36" x 8"	T8238R	82" x 38"
Up to 5 kVA	Surface	B662406S	66" x 24" x 6"	T6624R	66" x 24"
Up to 10 kVA	Surface	B662408S	66" x 24" x 8"	T6624R	66" x 24"
Up to 15 kVA	Surface	B723012S	72" x 30" x 12"	T7230R	72" x 30"
Up to 25 kVA	Surface	B723014S	72" x 30" x 14"	T7230R	72" x 30"
Up to 5 kVA	Surface	B803606S	80" x 36" x 6"	T8036R	80" x 36"
Up to 10 kVA	Surface	B803608S	80" x 36" x 8"	T8036R	80" x 36"

Section 7: Installation

7.1 - Distance From Finished Floor

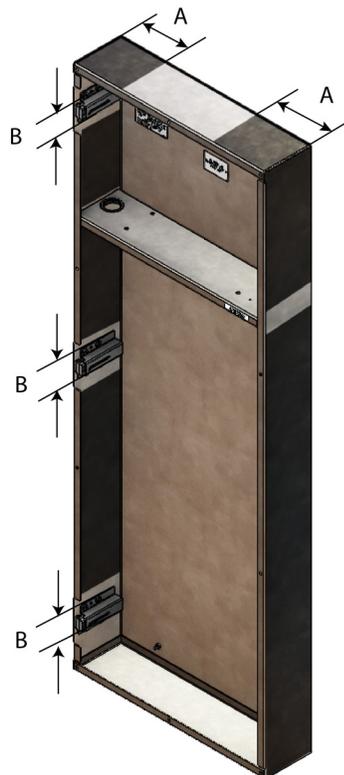
Refer to table below for allowable distances between bottom of isolated power panel and finished floor.

Backbox	Distance from Floor
B662406F (S)	Min - 14" , Max - 30"
B662408F (S)	Min - 14" , Max - 30"
B723012F (S)	Min - 14" , Max - 30"
B723014F (S)	Min - 14" , Max - 30"
B803606F (S)	Min - 2" , Max - 9"
B803608F (S)	Min - 2" , Max - 9"

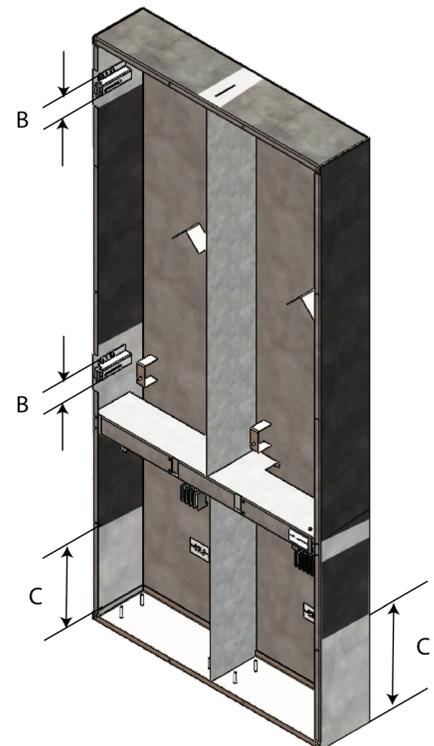
7.2 - Available Conduit Areas

Refer to figures below. Shaded areas are allowable conduit locations.

Dimensions (in)	
A	5"
B	2"
C	16"



MIP, MIE, MID, & MIC Panels



MIX Panels

7.3 - Backbox Mounting



NOTE: Before installing, check the part number to verify the backbox to be installed matches with the appropriate interior, transformer kit, and front trim. Most backboxes are identical in appearance.

The manufacturer recommended mounting method is to secure the backbox to a rigid support structure (strut channel, etc.) using minimum 5/16" commercial grade hardware (not included). Mounting locations are near the four corners of the enclosure sidewalls. Refer to figure on the following page for example location in the top left corner. Note the following requirements for each corner:

Mounting Requirements	
Flush Mount	Surface Mount
Use two (2) 5/16 in. fasteners per corner on the side wall of the back box	Use two (2) 5/16 in. fasteners per corner on the back wall of the back box
Must be 2 in. (51 mm) from the top of the back box	Must be 2 in. (51 mm) from the top of the back box
Must be 2 in. (51 mm) from the front of the back box	Must be 2 in. (51 mm) from the side of the back box
Screws must be 2 in. (51 mm) apart	Screws must be 2 in. (51 mm) apart



NOTE: Recessing enclosure more than 1/8" (3 mm) will impede hinge functionality.

7.3.1 - Backbox Mounting Hardware Locations



CAUTION: Do not over-tighten the mounting hardware. Over-tightening will cause distortion, misalignment of the front trim, and improper hinge functionality. Use shims to mitigate distortion as needed.



Surface Mounted Backbox



Flush Mounted Backbox

7.4 - Conduit Installation



NOTE: Conduit entries are NOT provided by the factory

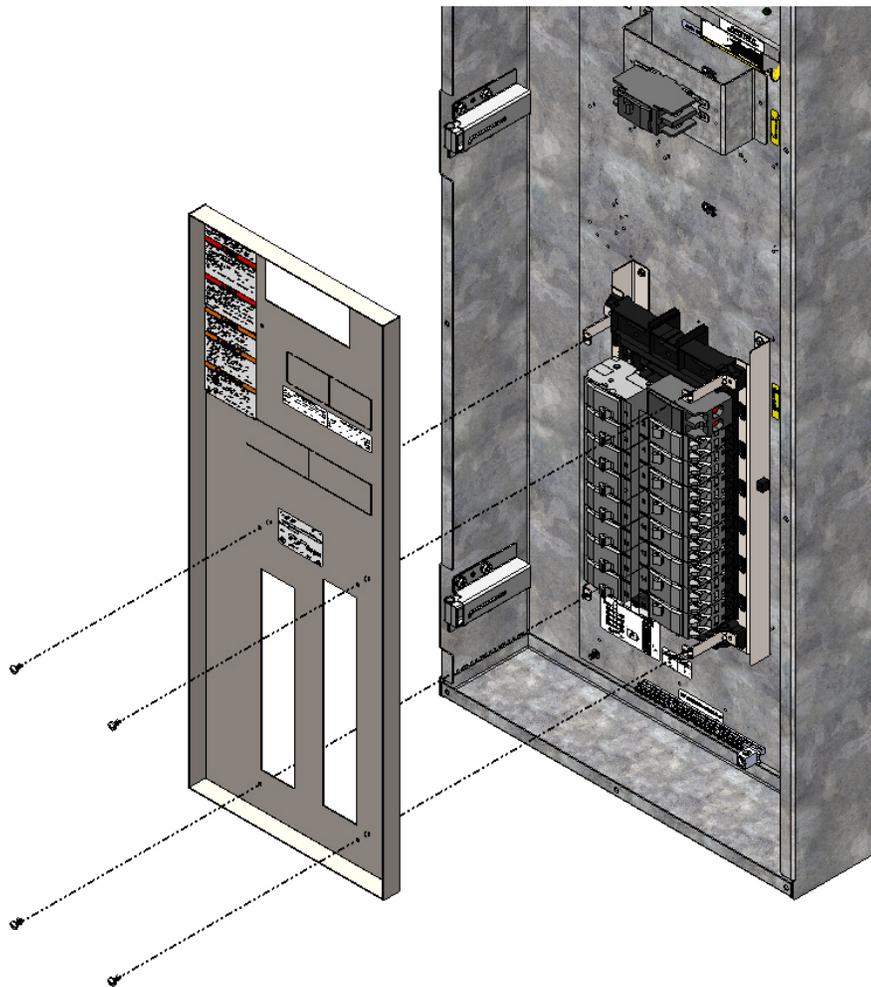
For Canadian applications, refer to Canadian Electrical Code, **section 24-204(2)(f)**.

Before installing conduit, Refer to **Section 7.2** for available areas. Conduit must be metallic type per **NEC Article 517.13**, and itself must qualify as an equipment ground conductor per **NEC Article 250.118**.

- Install conduit properly, using hubs and ring connectors to protect cables and prevent condensation from entering the panel.
- If entering the panel from the top, use an independent conduit support. Do not use the top of the panel as load bearing support.
- Be sure to ground all conduit, stubs, and ring connectors to the panel with approved electrical connections.
- Conduit runs for branch circuits shall be as short as possible to minimize total system leakage current.

7 5 - Interior Deadfront Removal

Remove the four interior deadfront screws using a **#2 square drive** as shown in the figure below. Retain the deadfront and mounting hardware.



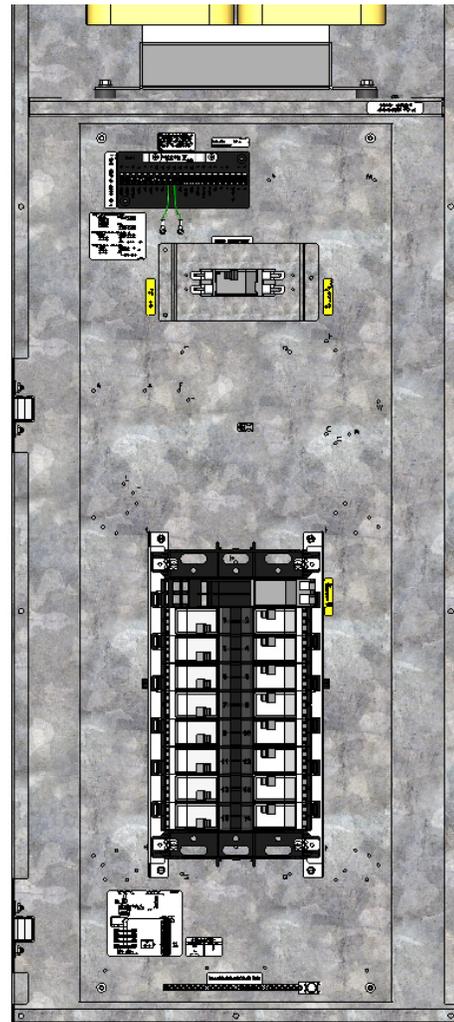
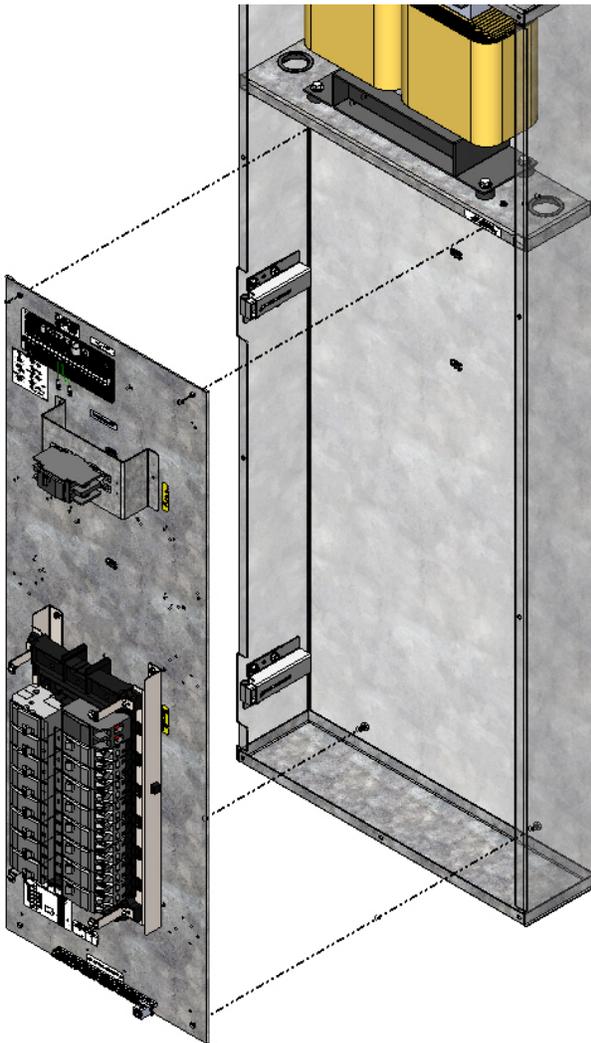
**Deadfront mountint locations may vary based on loadcenter and interior configuration*

7.6 - Interior Installation

All interior assemblies have minimum four (4) mounting slots that fasten to the threaded studs on the rear of the backbox. To install, align the mounting holes to the lower studs, then align to the upper studs. Using a **5/16"** hex drive, secure the interior assembly to the studs using the provided hardware. Use **125 to 129 lb-in** tightening torque. Refer to figure below.



NOTE: For MIX series panels, the leftmost (hinge-side) system must be installed at an angle. With the interior at a 30 degree angle, align the interior with the leftmost studs, then to the studs on the right. The rightside interior may be installed as shown below.



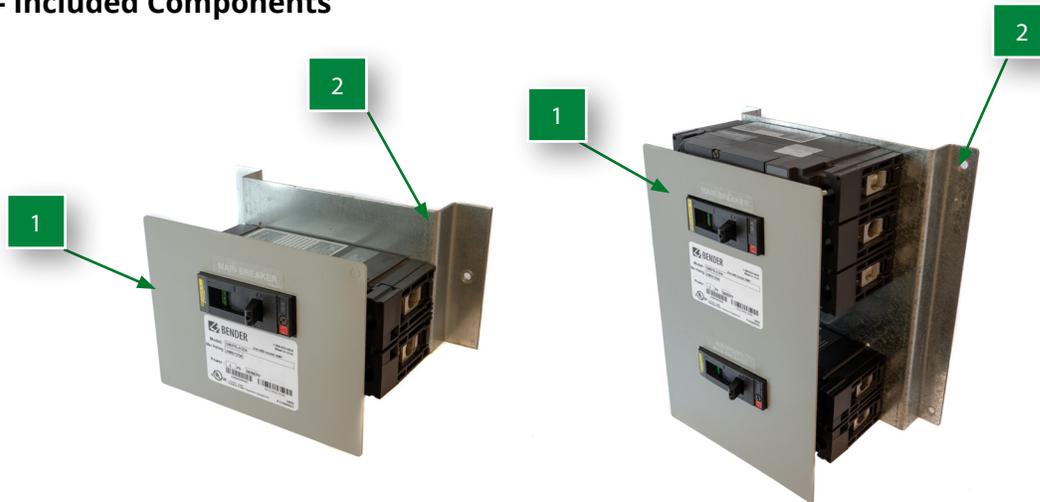
7.7 - Tranformer Breaker Kit Installation

Skip this section if breaker kit was installed at the factory.



CAUTION: Do not separate breaker from sub-plate until ready to install. Ensure model on breaker sub-plate label matches the model number on the isolation transformer label.

7.7.1- Included Components

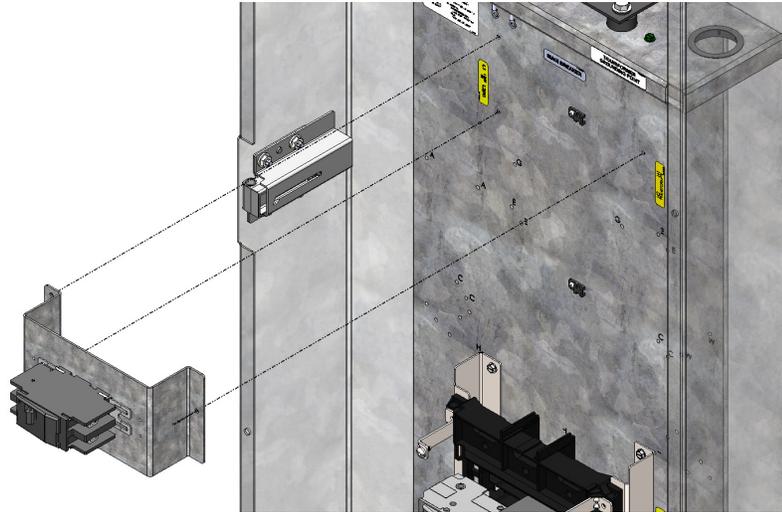


**Visual representation of components may vary based on breaker type and transformer kti configuration*

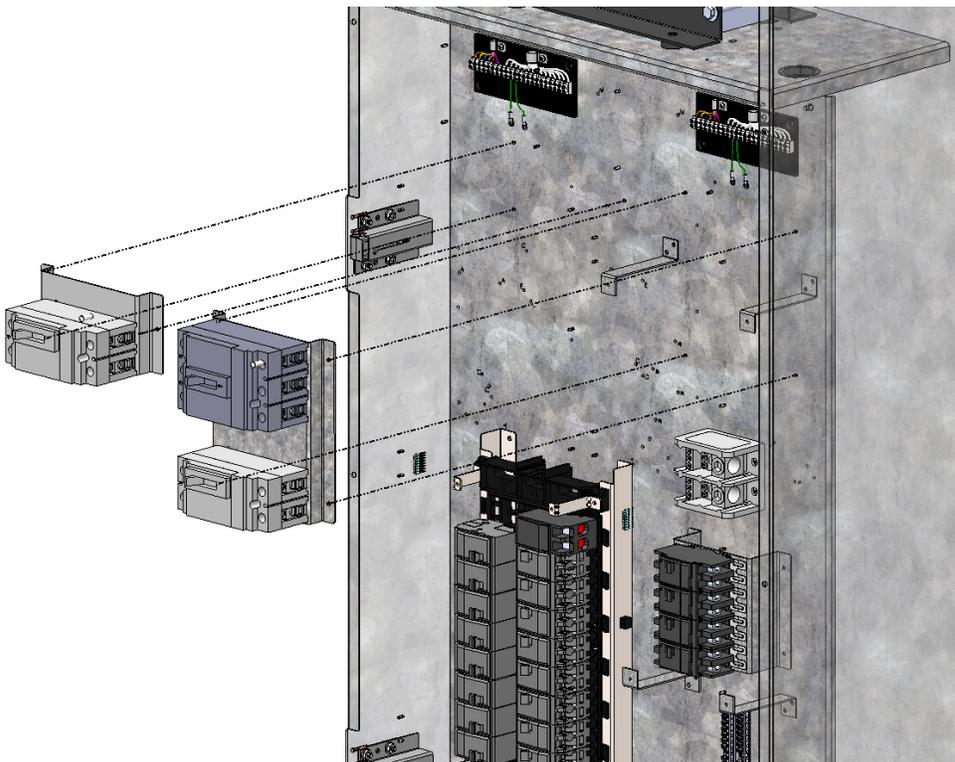
Component	Description
1	Breaker bracket assembly: Breaker(s) affixed to mounting bracket.
2	Breaker deadfront filler plate with system rating label and mounting hardware

7.7.2 - Main Circuit Breaker Installation

Locate the breaker bracket assembly's mounting points on the interior assembly backplate. Using a **5/16"** hex drive, remove the **#10-16** screws located in the mounting holes. Using the same holes and hardware, attach the assembly to the interior backplate. Use **35 to 45 lb-in** tightening torque. Refer to appropriate figure below.



MIP, MIE, MIC, & MIX Panels



MID Panels

7.8 - Transformer Installation



WARNING: Isolation transformers can weigh up to 370 lb (168 kg). Use suitable equipment for lifting, transporting, and installing. Failure to do so may result in personal injury and damage to equipment.

7.8.1 - Transformer Weights

Transformer Weights			
kVA		Weight (lbs)	Weight (kg)
3		80	36
5		100	45
7.5		140	63
10		190	86
15	Single Voltage	250	113
	Dual Voltage	275	125
20	Single Voltage	310	141
	Dual Voltage	330	150
22.5	Dual Voltage	345	156
25	Single Voltage	345	156
	Dual Voltage	370	168

7.8.2 - Mounting

Depending on panel model, transformer(s) are installed in either the top half or bottom half of the enclosure. Refer to figures below and approved submittal drawings for specific locations.

If located on the top half of the enclosure, place transformer on provided transformer shelf. For transformers located in the bottom half of the enclosure, place the transformer on the provided studs.

Orient the transformer(s) in the enclosure to allow the leads to extend from the front to facilitate wiring the primary circuit breaker and panel board lugs.



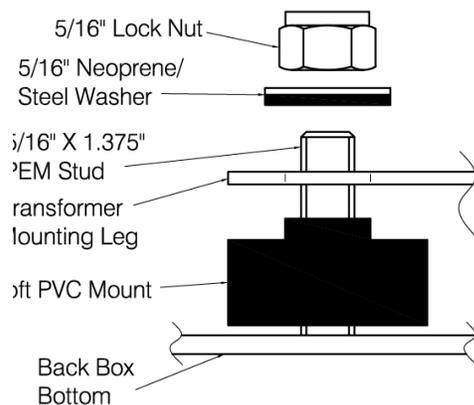
MIP / MIE / MID / MIC Panels



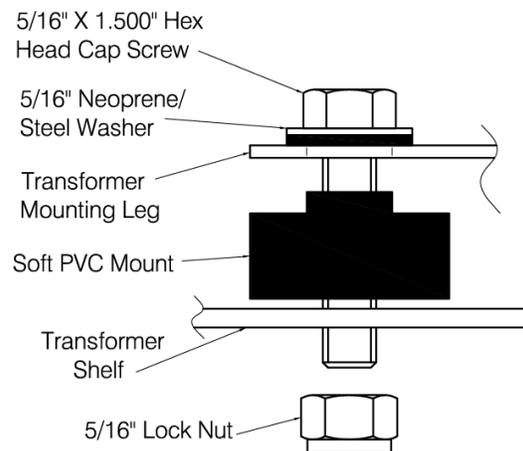
MIX Panels

7.8.3 - Vibration Pads and Mounting Hardware

Mounting hardware and vibration pads are included with each transformer. Install hardware according to the appropriate figure below. Tighten locknut until the vibration pads just begin to compress and stop. Tighten until hardware no longer freely moves. See figure below for proper configuration



MIX Series



All other panels

7.8.4 - Additional Transformer Data

Transformer Temperature Rise	
kVA Rating	Temp Rise ΔU in °C
3	115
5	115
7.5	135
10	135
15	135
20	135
25	135

Transformer Sound Levels	
kVA Rating	Sound Level (dB)
3	27
5	27
7.5	30
10	30
15	35
20	35
25	35

Transformer Current Leakage Ratings		
kVA Rating	MAX. Leakage Current (μA)	
	120V Sec.	208 - 240V Sec.
3	20	30
5	20	30
7.5	25	37
10	25	37
15	30	40
20	35	50
25	35	50

7.9 - Wiring

7.9.1 - General Instructions



HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

This equipment must only be installed and serviced by qualified electrical personnel. Disconnect all power before servicing. Observe all local, state, and national codes, standards and regulations when installing this equipment.

Failure to follow these instructions will result in death or severe injury.

This section provides general information for wiring isolated power panels. After reading this section and ensuring all requirements will be met, locate the appropriate wiring diagram in **Section 7.15** and make all necessary electrical connections.

7.9.2 - Transformer and Incoming Power Wiring (Single Voltage Output Panel)

Isolated power systems require a three-wire incoming power feed (hot/hot/ground or hot/neutral/ground). Standard building construction wire (THHN or equivalent) is acceptable.

Verify the incoming voltage corresponds with the primary voltage (**H1/H2**) listed on the transformer nameplate and breaker sub-panel label.

The incoming power conductors (hot/hot or hot/neutral) are connected to the line side (**L1/L2**) terminals of the primary main circuit breaker.

The incoming ground conductor is terminated to the reference ground bus in the panel.

The transformer's primary leads (**H1/H2**) are connected to the load side (**H1/H2**) of the primary main circuit breaker. For MIX panels, first terminate the transformer leads to the terminal block located in the backbox.

The transformer's secondary leads (**X1/X2**) are connected to the panel board lugs and/or sub-feed lug. For MIX panels, first terminate the transformer leads to the terminal block located in the backbox.

Using the provided **#10-32** green grounding screw, terminate the transformer's ground lead to the threaded hole labeled "Transformer Grounding Point" located in the backbox.

7.9.3 - Transformer and Incoming Power Wiring (Dual Voltage Output Panel)

Verify the incoming voltage corresponds with the primary voltage (**H1/H2**) listed on the transformer nameplate and breaker sub-panel label.

The incoming power conductors (hot/hot or hot/neutral) are connected to the line side (**L1/L2**) terminals of the primary main circuit breaker.

The incoming ground conductor is terminated to the reference ground bus in the panel.

The transformer's primary leads (**H1/H2**) are connected to the load side (**H1/H2**) of the primary main circuit breaker.

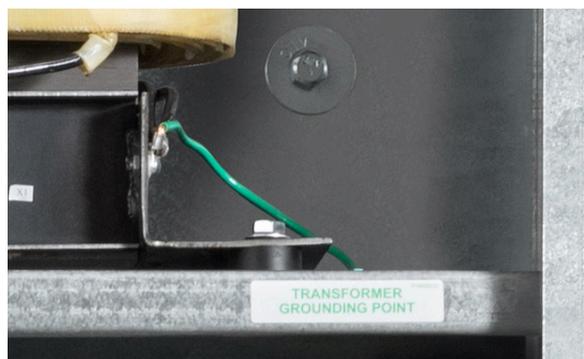
Dual output transformers have 2 sets of outputs leads (**X1/X2**) & (**X3/X4**) for both the low voltage and high voltage secondary sections of the panel.

The (**X1/X2**) leads are connected to the incoming or line side of the secondary main circuit breaker **#1** used on the low voltage section of the panel.

The (**X3/X4**) leads are connected to the incoming or line side of the secondary main circuit breaker **#2** used on the high voltage section of the panel.

Additional factory provided leads (**SMCB #1 LN1/LN2**) & (**SMCB #2 LN1/LN2**) are connected from the secondary main circuit breakers to the panel boards lug and/or subfeed lug on the low voltage section and the distribution terminal block for the high voltage section.

Using the provided **#10-32** green grounding screw, terminate the transformer's ground lead to the threaded hole labeled "*Transformer Grounding Point*" located in the backbox as shown below.



7.10 - Secondary Main Circuit Breaker Installation (if Applicable)

Should your transformer kit be supplied with a secondary main circuit breaker, your panel will need to be field modified to accommodate it. The following instructions are shown using a Square-D circuit breaker but installation will be similar to other loadcenter and circuit breaker brands



Tools Required

- Torque Screw Driver + #2 Square Bit
- Flathead Screwdriver

Step 1

Inspect replacement circuit breaker for any physical defects (cracks, broken clips, etc). If any damage is found; DO NOT USE circuit breaker.



Step 2

Remove any wiring going to the sub feed lug by using a flat head screwdriver to loosen the compression lugs.

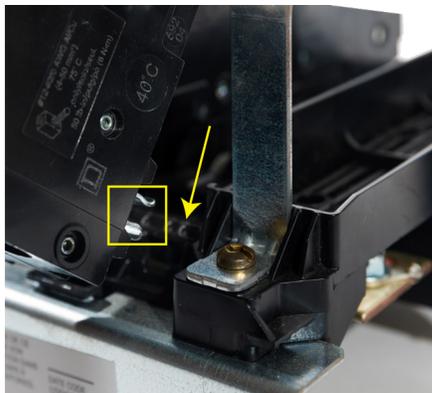
Step 3

Using a #2 square drive, loosen but do not remove the two brass screws holding the sub-feed lug to the loadcenter located to the left of the sub feed lug.



Step 4

Carefully lift up on the subfeed lug as shown and pull up on the subfeed lug until the clips on the bottom are free from the load center rail.



Step 5

Using the mounting clips on the bottom of the circuit breaker; press the clips onto the rail of the load center as shown.

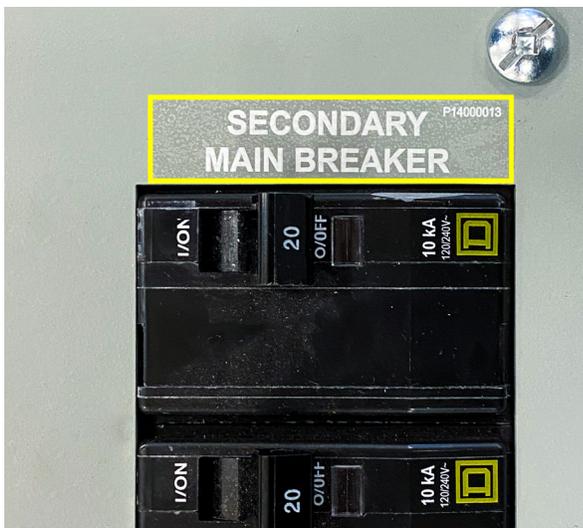


Step 6

Once the breaker is snapped onto the rail of the loadcenter; lower the breaker down into position and snap the remaining clips into place.



Step 7 (for QOB Bolt-On Breakers)
Using the **#2 square drive**, tighten down the brass screws to **22 in-lb**.



Step 8
Apply "Secondary Main Circuit Breaker" Label (PN: P14000013) on to face of dead front as shown and installation is complete.

Step 9
Re-connect any wiring to secondary main circuit breaker and torque binding screws down to **36-45 in-lb**.

7.11 - Branch Circuit Wiring



NOTE: Ensure any isolated power system conductors are kept separate from other system circuits (isolated or grounded). Do not include them in a common conduit or raceway.

To minimize the cumulative system leakage current, ensure the length of any branch circuit conductors is as short as possible.

The manufacturer recommended wire for all branch-circuit, current-carrying conductors is a cross-linked, polyethylene wire with a dielectric constant of 3.5 or less. XHHW and XHHW-2 type wire is a commonly available example. Avoid wire with high carbon fiber filler, as it can contribute to increased system leakage current.

For all panels except MIC series, terminate connections at the circuit breaker. For MIC series panels, terminate connections at the appropriate contactor.

Do not use wire pulling compounds to lubricate conduit.

Identification and location of secondary circuit conductors shall be in accordance with **NEC Article 517.160 (NFPA 70)**

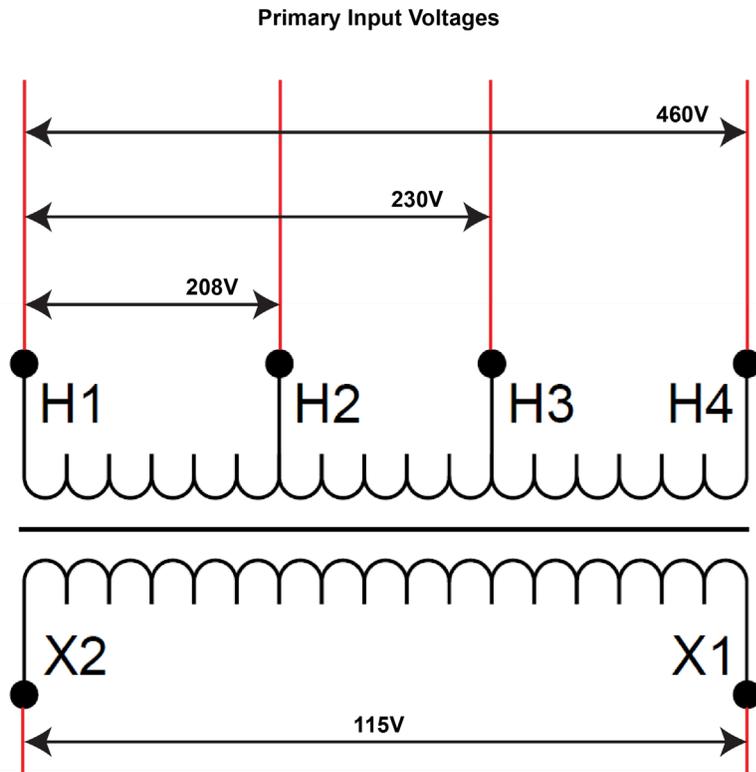
Wire Description		
Use	Color	Termination
Isolated Conductor One (1)	Orange, with at least one distinctive color stripe OTHER THAN white, green, or gray along the entire length of the conductor.	Terminated to the upper pole of the branch circuit breaker and to the silver screw on each receptacle.
Isolated Conductor One (2)	Brown, with at least one distinctive color stripe OTHER THAN white, green, or gray along the entire length of the conductor.	Terminated to the upper pole of the branch circuit breaker and to the brass screw on each receptacle.
Equipment Grounding Conductor	Green, with or without a yellow stripe.	Not applicable

7.12 - Control Transformer Wiring - MIC Panels Only

X-Ray / Laser Control Panels come furnished with a universal control transformer that can be used with 208, 220, or 240V secondary output voltages.

During installation, the multi-tap control transformer must be configured to match the secondary of the panels isolation transformer. The wiring tap configurations are shown below:

Secondary Panel Voltage (V)	Connections
208	H1 & H2
230	H1 & H3
460	H1 & H4



Secondary Output Voltage

7.13 - Grounding

As defined by **NEC Article 517**, the ground bus in the isolated power system is the reference grounding point for the room. Refer to figure below for typical appearance and location.



Connect all ground conductors from the equipment and receptacles in the area served by the isolated power system to the panel's ground bus.

If more than one isolated power system is serving the same area, bond them together using a minimum AWG #10 insulated equipment bonding conductor per **NEC Article 517.14**.

7.14 - Accessories and Add-On Kit Wiring

Refer to the respective installation manual(s) **NAE209512-0** for installing additional equipment.

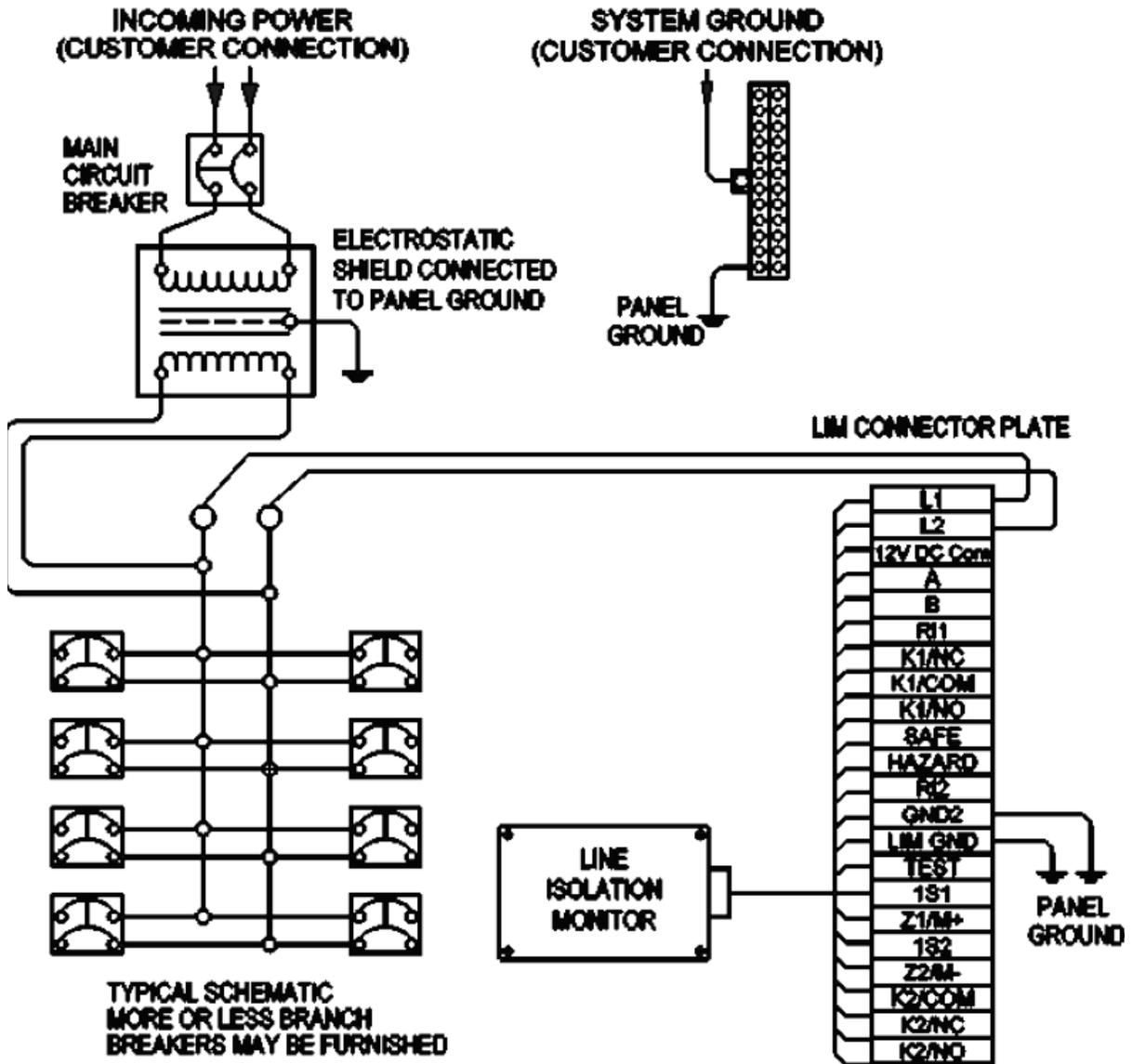
7.15 - Wiring Diagrams



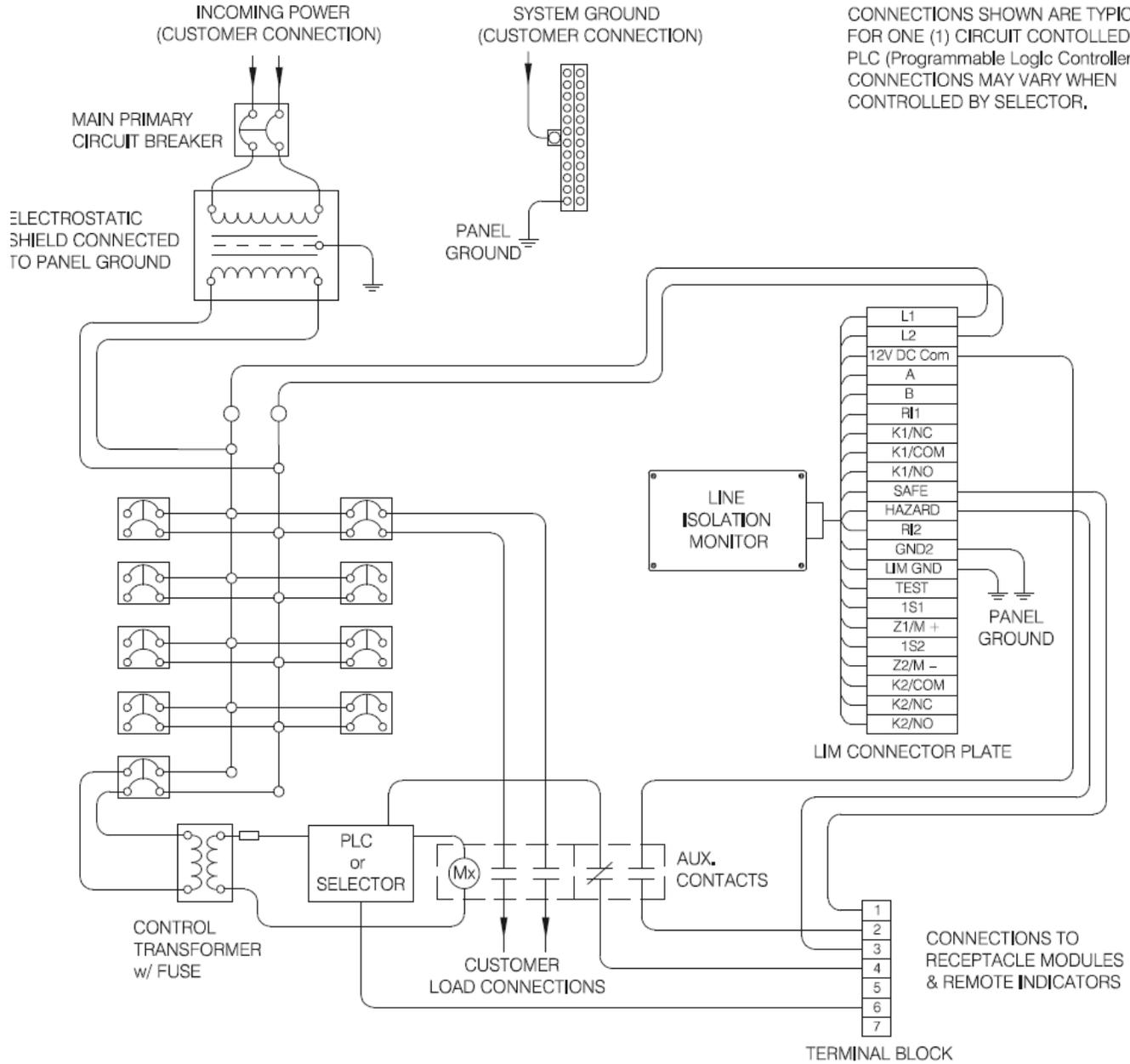
NOTE: *The wiring diagrams in this section do not include connections for accessories or add-on options, such as remote indicators, EDS kits, or receptacle kits. Refer to the respective installation manual for information on wiring additional equipment.*

7.15.1 - MIP, MIE, and MIX Series

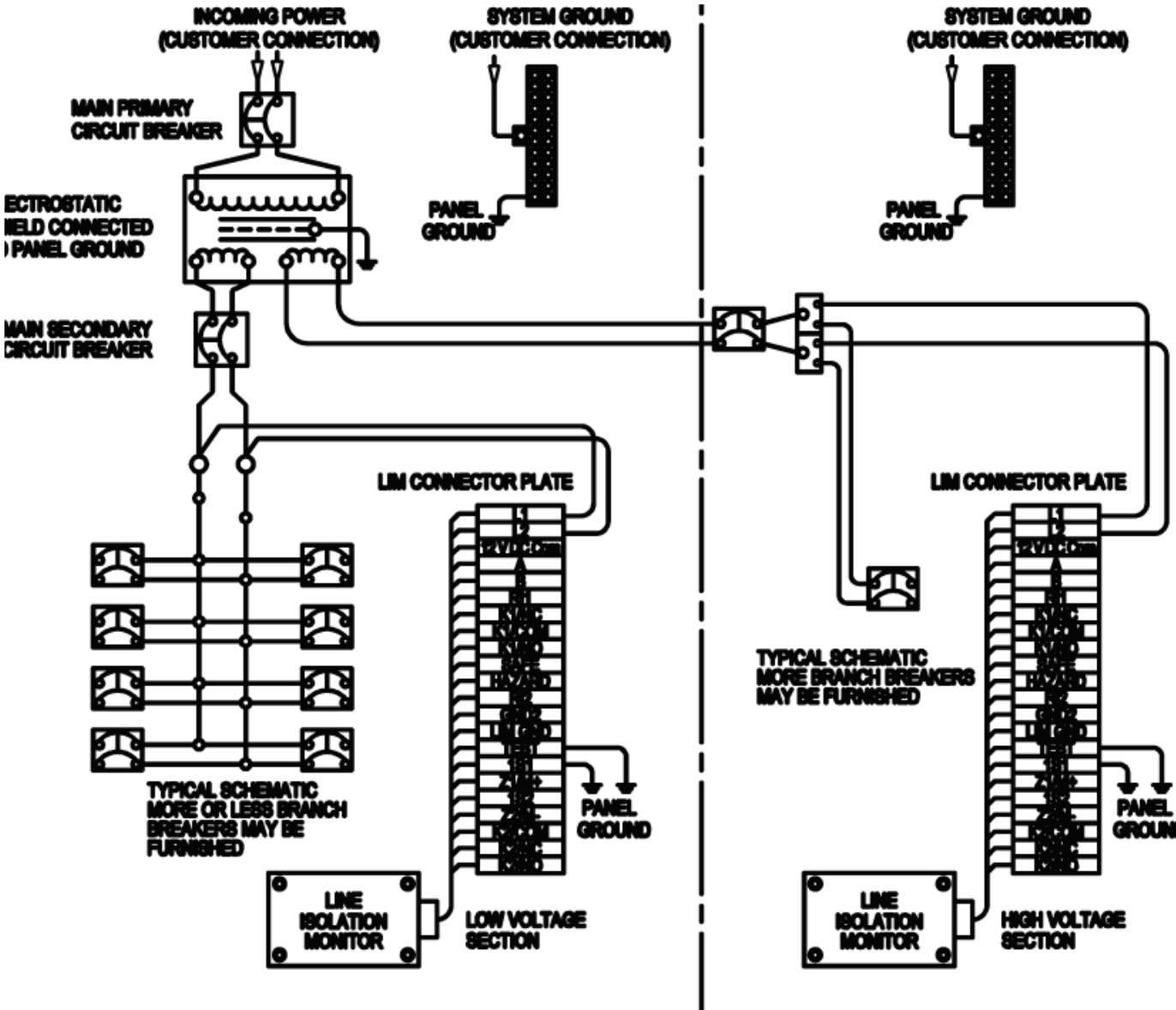
For MIX series dual system panels, wiring schematic shown is for each system.



7.15.2 - MIC Series

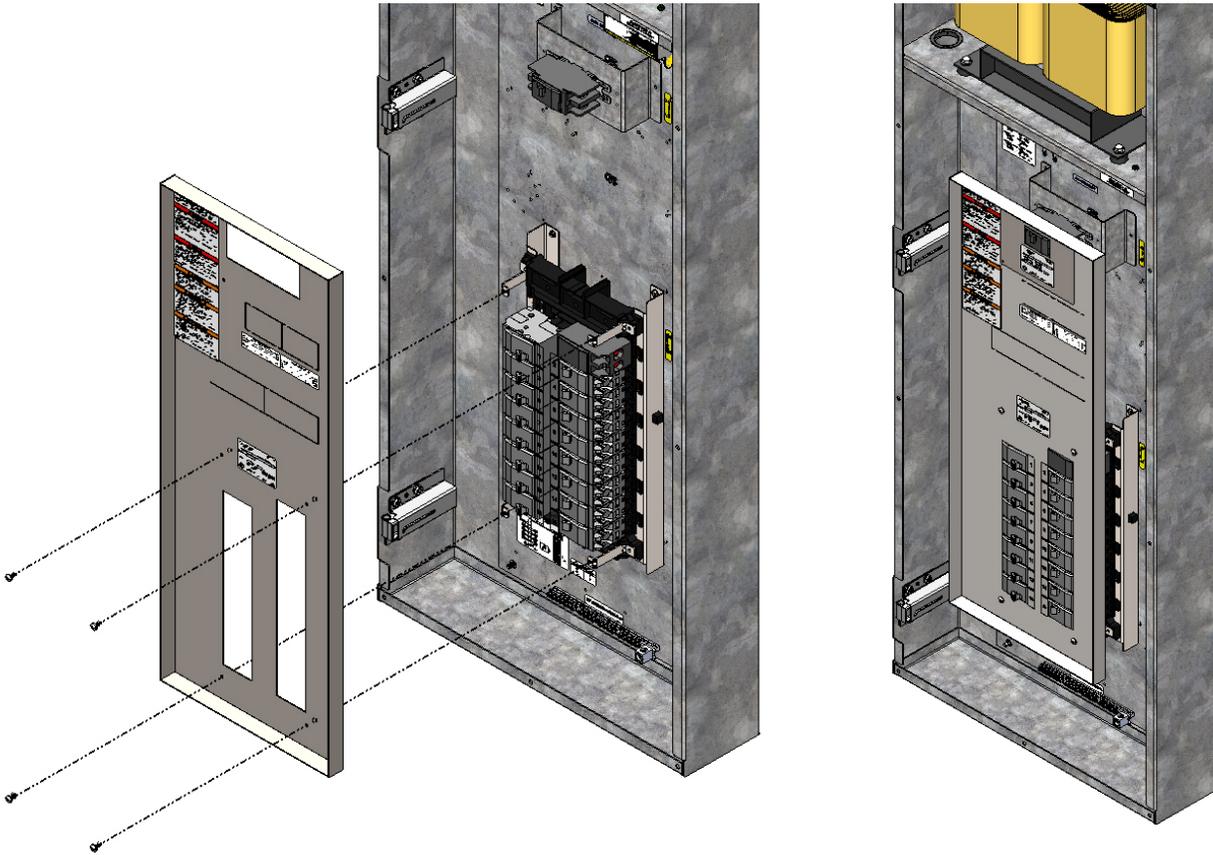


7.15.3 - MID Series



7.16 - ReInstall Interior Deadfront

Align and mount the interior deadfront. Refer to figure below.



7.17 - Install Front Trim

A stainless steel front trim is provided for each isolated power panel. Certain models may have a front trim comprised of more than one section. Before installing, verify the front trim model is compatible with the installed backbox. Refer to compatibility chart shown below.

Each front trim includes a hardware kit attached to the rear of the front trim. Remove this hardware kit and retain for installation.

Mounting Style	Backbox Part Number	Backbox Dimensions (H" x W" x D")	Front Trim Part Number	Front Trim Dimensions (H" x W")
Flush	B662406F	66" x 24" x 6"	T6826R	68" x 26"
Flush	B662408F	66" x 24" x 8"	T6826R	68" x 26"
Flush	B723012F	72" x 30" x 12"	T7432R	74" x 32"
Flush	B723014F	72" x 30" x 14"	T7432R	74" x 32"
Flush	B803606F	80" x 36" x 6"	T8238R	82" x 38"
Flush	B803608F	80" x 36" x 8"	T8238R	82" x 38"
Surface	B662406S	66" x 24" x 6"	T6624R	66" x 24"
Surface	B662408S	66" x 24" x 8"	T6624R	66" x 24"
Surface	B723012S	72" x 30" x 12"	T7230R	72" x 30"
Surface	B723014S	72" x 30" x 14"	T7230R	72" x 30"
Surface	B803606S	80" x 36" x 6"	T8036R	80" x 36"
Surface	B803608S	80" x 36" x 8"	T8036R	80" x 36"

7.18 - Hardware Installation (Seismic Certified Panels Only)



WARNING: Due to the heavy load of isolated power equipment, use suitable equipment for lifting and transporting. Failure to do so may result in severe personal injury and damage to equipment



NOTE: Front Trim Hardware Kit model # **S10200011** must be used in lieu of standard supplied Front Trim hardware Kit **S14000114** and/or **S14000115** for compliance with **IBC 2018** and **OSP-0644-10**

Discard hardware Kit **S14000114** and/or **S14000115** and install contents of **S10200011**.

Install hardware kit **S1400011** according to Installation Bulletin **NAE209501-2**, "Install Front Trim"

Tools Required

- Torque Screw Driver + #3 Phillips Drive
- Flathead Screwdriver

Step 1 - Install U-Type Retaining Nuts

Place U-Type retaining nuts over each mounting hole in the backbox. (More U-nuts may be provided than needed). Use flathead screwdriver as needed to adjust clips into place. See "Install Front Trim" in Instructional Bulletin **NAE209501-2** for further details.



Step 2 - Seismic Certification Label

Place Seismic Certification Label S14000103 as shown on deadfront below circuit breaker opening.

Use caution when applying as this label is "self-destructive" and **CANNOT be removed once applied**



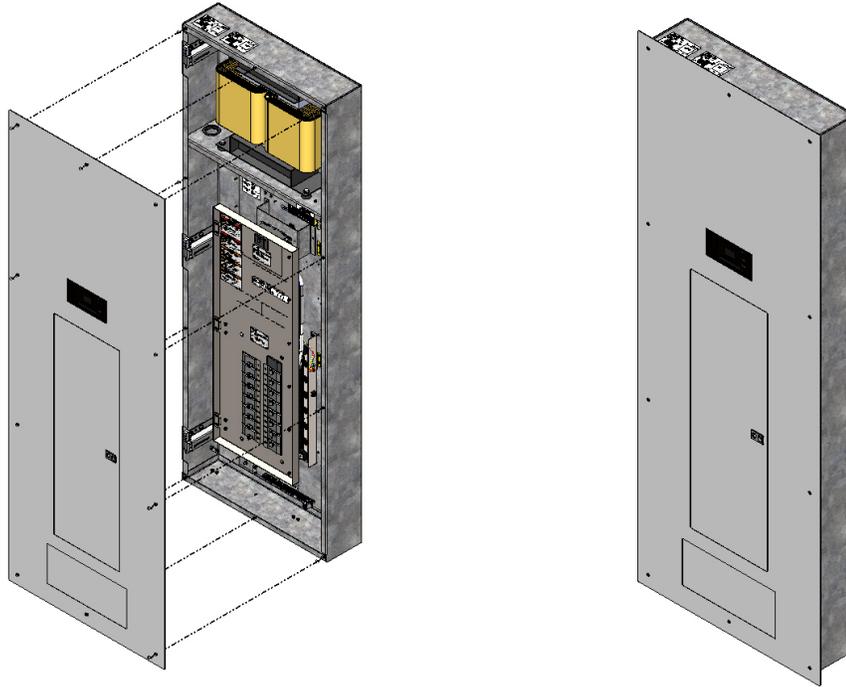
Step 3 - Mount Front Trim

Remove tape protecting backbox hinge and fully extend. Lift the front trim, align, and mate the hinge fittings. See "Install Front Trim" in Instructional Bulletin **NAE209501-2** for further details.

Step 4 - Close Trim Door

Fully close front trim and secure to backbox using the provided **1/4-20 x 1"** Phillips Truss Head Screws. Use a **#3 Phillips Drive** and first tighten all screws by hand in a star pattern. Once tightened by hand, torque all screws to **12 in-lb**.

Note: No washers are used with kit S10200011

**7.11.1 - Install U-Type Retaining Nuts**

Place u-type retaining nuts over each mounting hole in the backbox (more unuts are provided than needed). Refer to figure below.



7.19 - Mount Front Trim

Remove tape protecting backbox hinge and fully extend. Lift the front trim, align, and mate the hinge fittings. Refer to figure below.



CAUTION: Front trims may have sharp edges. Use appropriate PPE when handling. Failure to do so may result in personal injury or damage to equipment.



NOTE: Lifting the front trim from the breaker door opening may provide additional leverage and control. The breaker door key is included with the front trim hardware kit.

MIX series front trims are divided into two pieces. The upper half uses two hinges. The bottom half is secured using hex screws. Instructions for installing the lower half trim are in a later section.

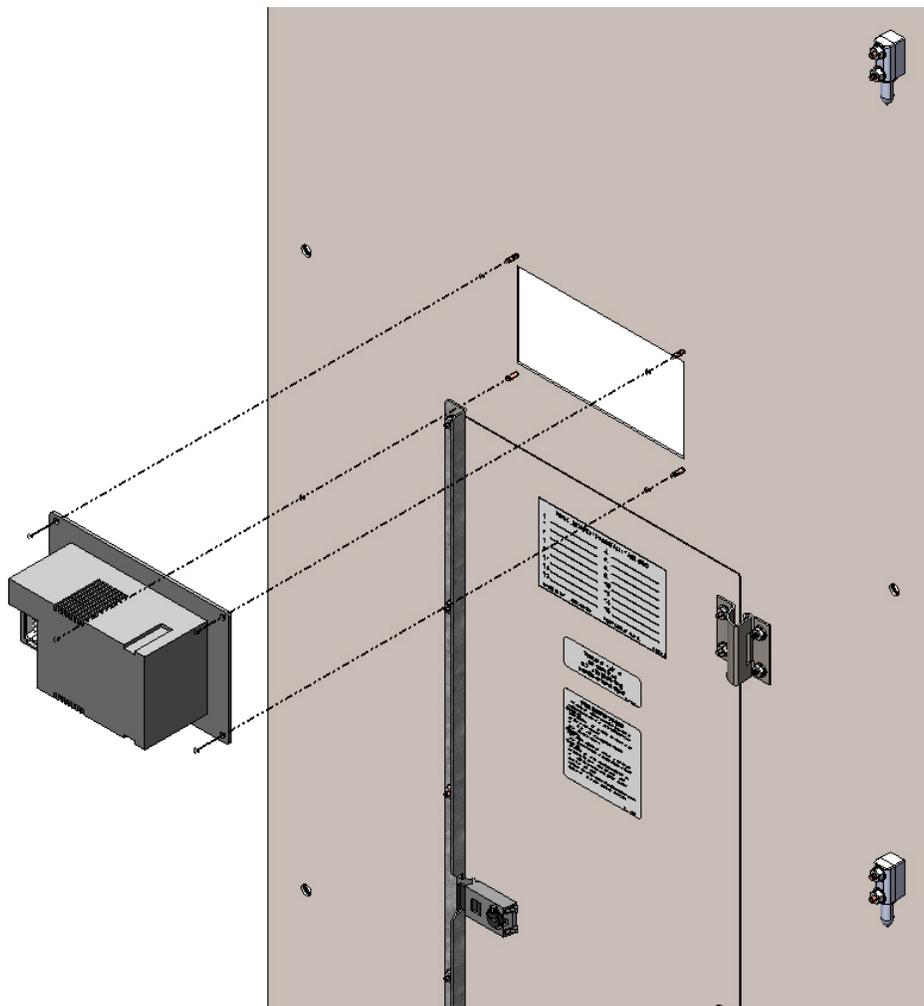


7.20 - Install Line Isolation Monitor



NOTE: The line isolation monitor is packaged with the interior assembly, and all necessary hardware

From the rear of the front trim, position the LIM display through the front trim cutout while aligning the line isolation monitor's four mounting holes to the **#6-32** threaded studs. Secure the LIM to the front trim by tightening the four **#6-32** flange nuts. Use **8 to 9 lb-in** tightening torque. Refer to figure below.



7.21 - Install Transformer Heat Shield (MIX Series Only)

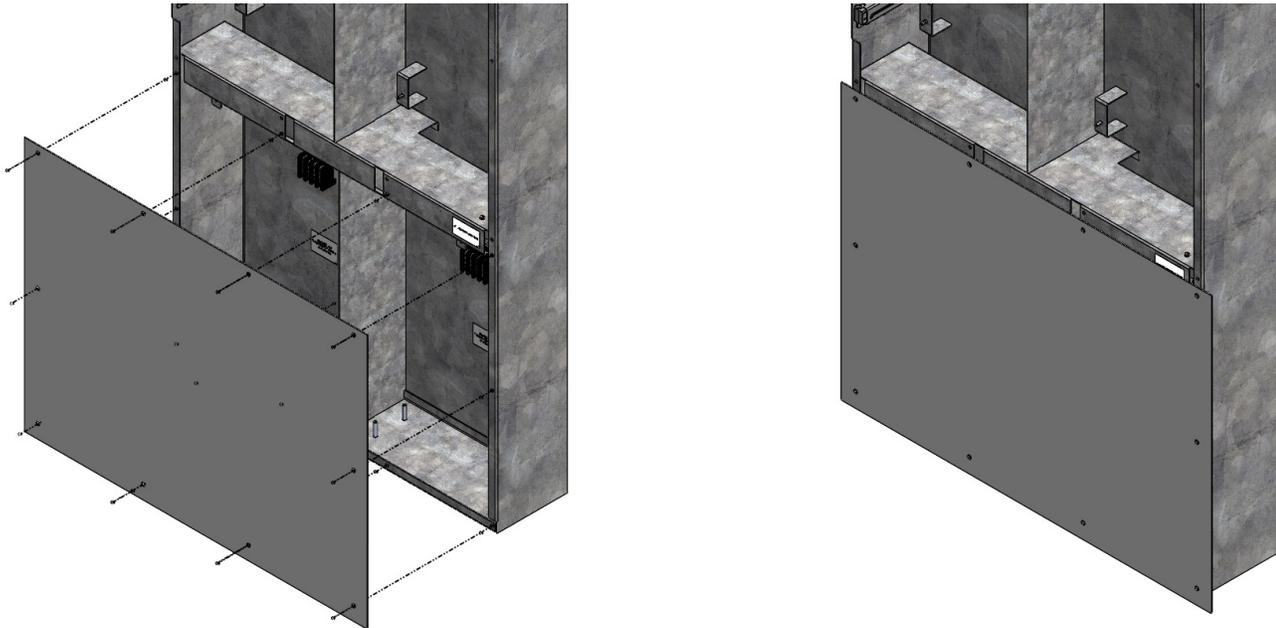
Dual system panels include a heat shield and additional front trim piece. Slide the heat shield into the two slots on the bottom of the backbox as shown below. Secure to backbox using the provided #10-32 hex screws. Use **25 to 30 lb-in** tightening torque.



Completed Installation

7.22 - Install Lower Front Trim (MIX Series Only)

Align the lower front trim to the mounting holes and secure using the provided **#2 phillips-head** front trim panel screws. Use **10 to 12 lb-in** tightening torque.



7.23 - Install Restraining Lanyard (MIX series only)



A lanyard is included with one end preinstalled into the front trim. This lanyard must be attached to the backbox to prevent accidental damage to the LIM harness when opening the front trim.

Locate the connection point on the backbox, which is a preinstalled screw above the lower front trim. Remove the screw, place the open lanyard end above the hole, and reinstall the screw.



CAUTION: The lanyard must be removed from the backbox prior to fully opening the MIX series front trim. Failure to do so may result in damage to equipment.

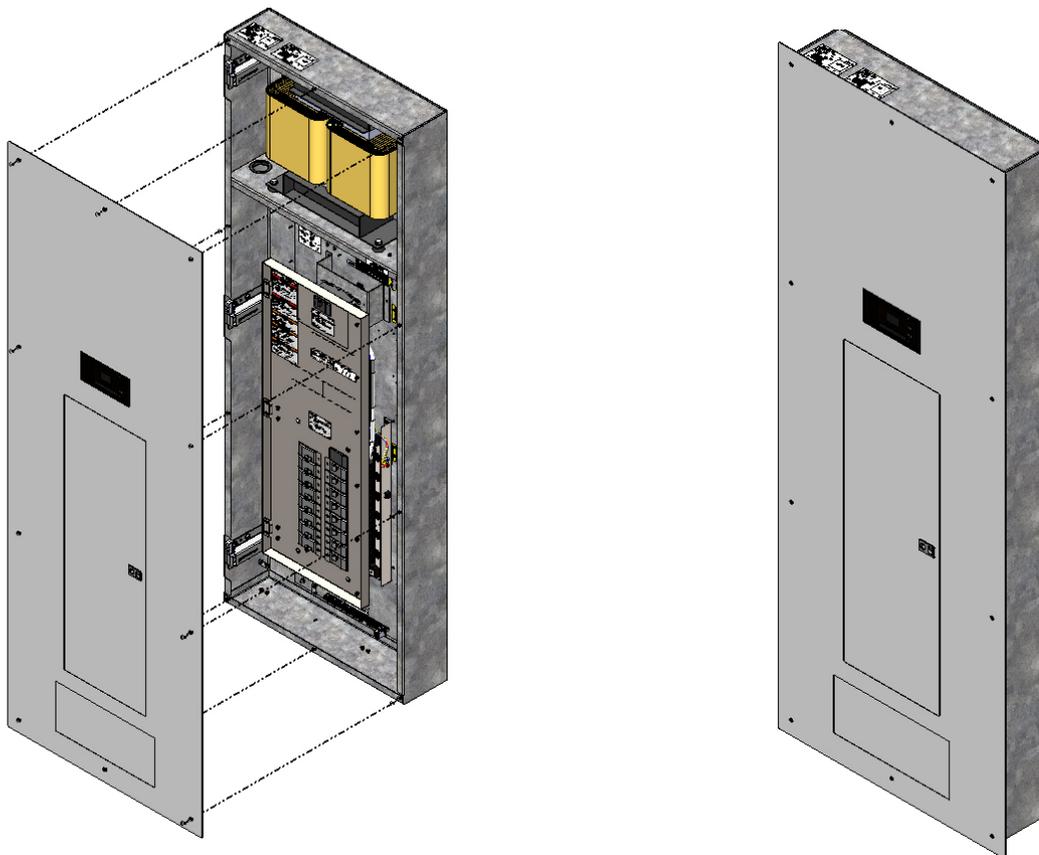
7.24 - Connect Line Isolation Monitor Harness

Once complete, pivot the front trim to a 45 degree angle relative to the backbox. Connect the 15-pin and 12-pin LIM wire harness from the connector plate to the LIM.



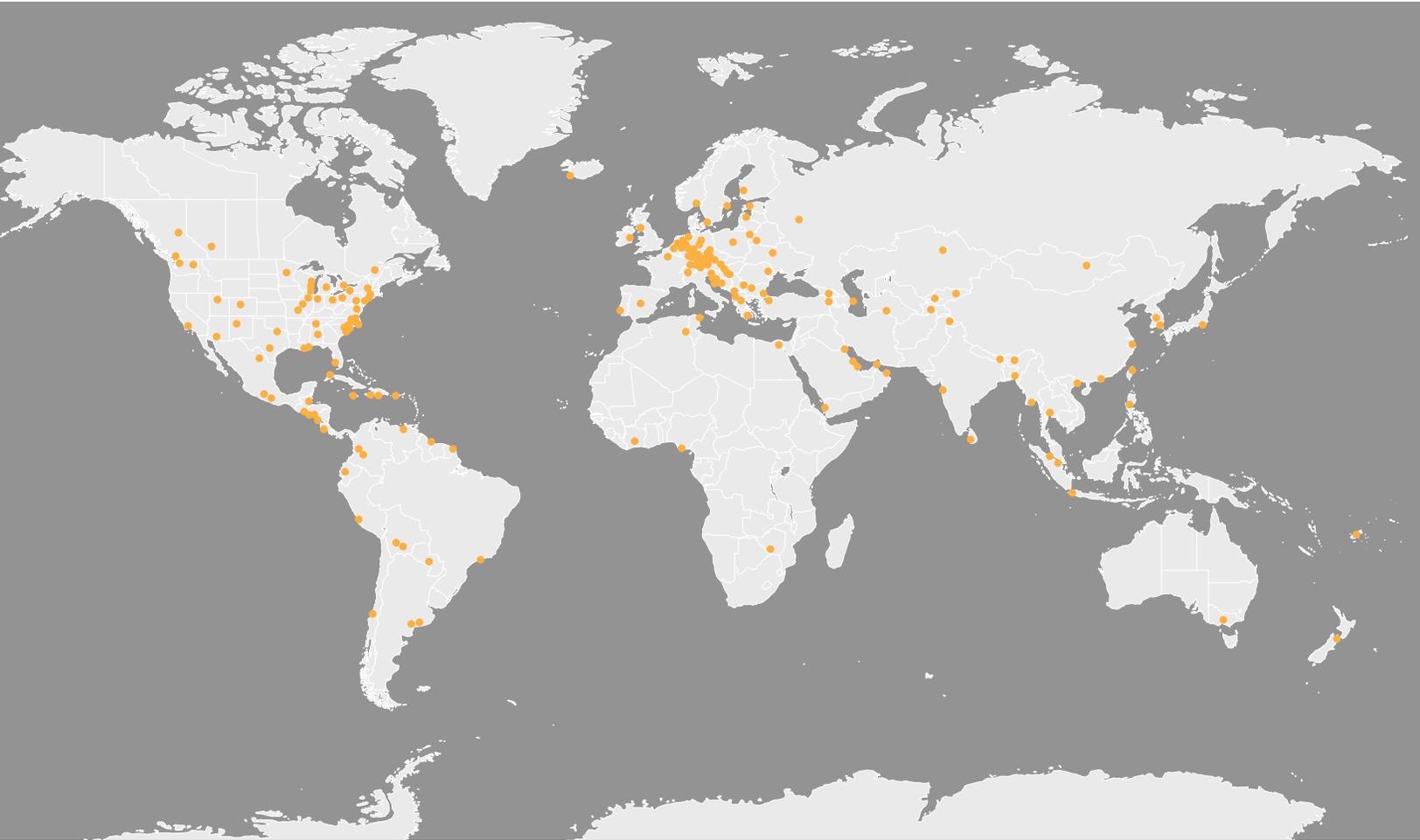
7.25 - Close Front Trim

Fully close front trim and secure to backbox using the provided **#10 Phillips** truss-head stainless-steel screws. Use #2 Phillips-head bit to fasten. Loosely install all screws by hand then tighten in a star pattern. Use **10 to 12 lb-in** tightening torque.



Replacement Components			
Description	Article #	Description	Article #
Backboxes		Interior Components	
MIX Lanyard	P13200165	LIM2010	B92075021
B662406F	B571300005	LIM2010 Connector Plate	B521302130
B662406S	B571300011	COM465IP Module Assembly	S43800012
B662408F	B571300004	EDS441-LNA Kit 1 Module Assembly	S43800002
B662408S	B571300010	EDS441-LNA Kit 2 Module Assembly	S43800001
B723012F	B571300009	CMS460 Kit 1 Module Assembly	S43800007
B723012S	B571300015	CMS460 Kit 2 Module Assembly	S43800006
B723014F	B571300008	COM465IP Module Only	B95061065
B723014S	B571300014	EDS441-LNA Module Only	B91080208
B803606F	B571300007	CMS460 - Module only	B94053018
B803606S	B571300013	Current Transformer Strip - EDS - RIGHT	S43800005
B803608F	B571300006	Current Transformer Strip - EDS - LEFT	S43800004
B803608S	B571300012	Current Transformer Strip - CMS - RIGHT	S43800008
Trims		Current Transformer Strip - CMS - LEFT	S43800009
T6624R (S)	B571300163	EDS to PCB Harness	P43800091
T6826R (F)	B571300041	CMS to PCB Harness	P43800092
T7230C	B571300031	Accessory Terminal Block	S10200800
T7230C (S)	B571300162	STW3	B98021000BI
T7230DR (S)	B571300164	STW4	B98021001
T7230R (S)	B571300165		
T7432C (F)	B571300044		
T7432DR (F)	B571300043		
T7432R (F)	B571300045		
T8036R (S)	B571300158		
T8238R (F)	B571300042		
		Hardware Kits	
		Description	Article #
		Transformer Mounting Hardware	S10200000
		Transformer Kit	S10200006
		GPM - Panel Mounted	S10200004
		Trim Hardware Kit - MIP/MIE/MIC/MID	S10200305
		Trim Hardware Kit - MIX	S10200306
		Interior Hardware Kit	S10200500
		EDS/CMS Hardware Kit	S10200009
		COM Hardware Kit	S10200010
		Seismic Trim Hardware Kit	S10200011
		LIM Mounting Hardware Kit	S10200401
		Hinge Replacement Kit	S10200013

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