



INSTALLATION, OPERATIONS AND MAINTENANCE MANUAL

ReliaGear™ SB

Switchboard





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Warranty and general information

Read the following hazard classifications carefully, and fully inspect the equipment for any identifiable hazards prior to installation, operation, or maintenance. The following classifications listed below will appear throughout this document or on labels located on the equipment. These are standard symbols defined by ANSI Z535.4-2011 which were established for recognition of potential hazards which pose risk to life and property. The classification is based on the probability and severity of injury if the hazard is not avoided. Please follow instructions, warnings, labels, and codes for proper installation, operation, and maintenance of equipment and devices. Only Qualified Persons, as defined by NFPA 70, should provide installation, operation, and maintenance on this equipment and devices.

Danger symbol/Warning symbol

The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists that will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential physical injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.



Danger indicates a hazardous situation which, if not avoided, will result in death or serious injury.



Warning indicates a hazardous situation which, if not avoided, could result in death or serious injury.



Caution indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.



Notice is used to address practices not related to physical injury.

Warranty

This document is based on information available at the time of its publication. While efforts have been made to ensure accuracy, the information contained herein does not cover all details or variations in hardware and software, nor does it provide for every possible contingency in connection with installation, operation, and maintenance. Features may be described herein that are not present in all hardware and software systems. ABB assumes no obligation of notice to holders of this document with respect to changes subsequently made.

ABB makes no representation or warranty, expressed, implied, or statutory, with respect to, and assumes no responsibility for the accuracy, completeness, sufficiency, or usefulness of the information contained herein. No warranties of merchantability or fitness for purpose shall apply.

Receiving, handling and storage

Receiving

Prior to shipment, the ReliaGear™ SB switchboard is given a final inspection and packaged using precautions to minimize the possibility of shipping damage. The switchboard may be divided into sections and shipped on multiple skids. Upon receiving the switchboard, remove all packaging and check the packing list against the equipment received to validate a complete shipment.

Additionally, all equipment should be thoroughly inspected for any damage sustained in transit. If damage is noted or if indication of rough handling is visible, file a claim for damage with the carrier immediately. Information about damaged parts, including the part number, case number, and purchase order number, should accompany the claim.

If such items are packed in a switchboard section instead of a separate crate, the list will indicate the appropriate section number in which they are stored.

Loose items are packed in various sections as needed. Large items, such as withdrawable circuit breakers and circuit breaker lifting devices, will always be packaged separately.

Filing a claim

Regarding claims for damaged shipments, shortages, or incorrect material, the following is an excerpt from the published Supplemental Terms and Conditions of Sale for products of ABB: "Title and risk of loss shall pass upon delivery of the products to the carrier at the f.o.b. point and invoices shall be payable without deduction for losses in shipment. It is the Purchaser's responsibility to file claims with the carrier for loss or damage in transit."

Claims for shortages or incorrect material must be made in writing within 30 days after receipt of the shipment by the Purchaser, and the failure to give the Company such written notice within the 30-day period shall be unqualified acceptance of the products and a waiver by the Purchaser of all claims for shortages or incorrect material."

Handling



Caution: Use extreme care in handling. The switchboard may be top-heavy.

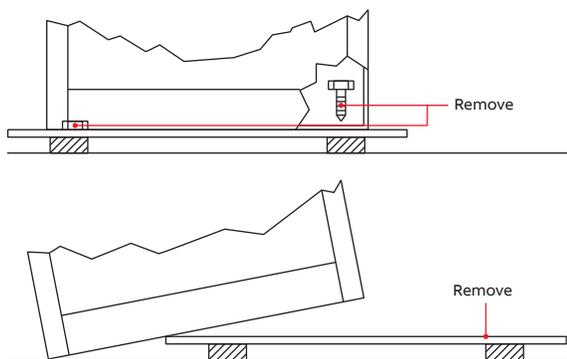
The switchboard should remain bolted to the shipping skids until it is placed in its final position. If the switchboard is fitted with lifting hooks (see Figure 2), an overhead crane or hoist may be used. Construction rollers on a flat, stable surface or a forklift truck may also be used to move the switchboard into position. Make sure to confirm that all lifting and handling equipment capacities are sufficient to support the weight of the switchboard. Also, ensure that the forklift tines extend beyond the depth of the switchboard and a belt is used to secure the switchboard to the forklift, as it may be top heavy. (See Figure 4)

The switchboard can be tipped five degrees without any removal of circuit breakers or warranty issues. If the switchboard is tipped at an angle exceeding five degrees, the following must be performed to maintain the warranty of the switchboard:

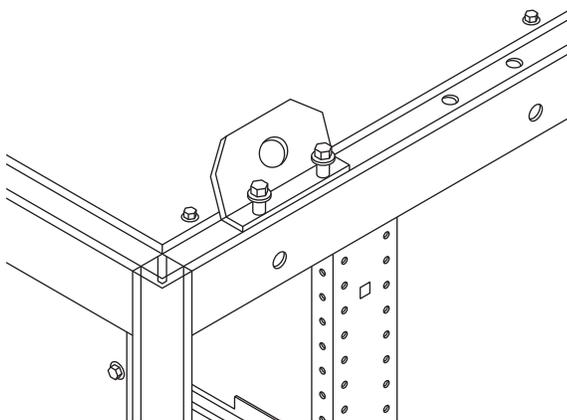
1. Removal of all circuit breakers
2. Dielectric test performed to ensure that all red insulators are not damaged
3. All rework and testing must be supported by ABB Engineering Services

- 01 Removing the switchboard from the skids
- 02 Lifting hooks as installed
- 03 Lifting the switchboard with a crane or hoist

Remove the switchboard from the skids when placing it in the installation location. To remove the switchboard from the skid, first remove the shipping bolts, then carefully slide the equipment so the rear is off the skid and resting on the floor, as shown in Figure 1. Tilt the entire equipment slightly to the rear to release the skid. Be careful when sliding and tilting the switchboard; due to its height and weight, the equipment can become top heavy if tilted too far. Slide the switchboard into place by pushing on its frame. Blow out any dust or loose particles of packing material that may have collected on the device parts. Remove all protective blocking on relays, devices, or circuit breakers, as well as any temporary shipping supports.



- 01 **Crane / Hoist**



- 02

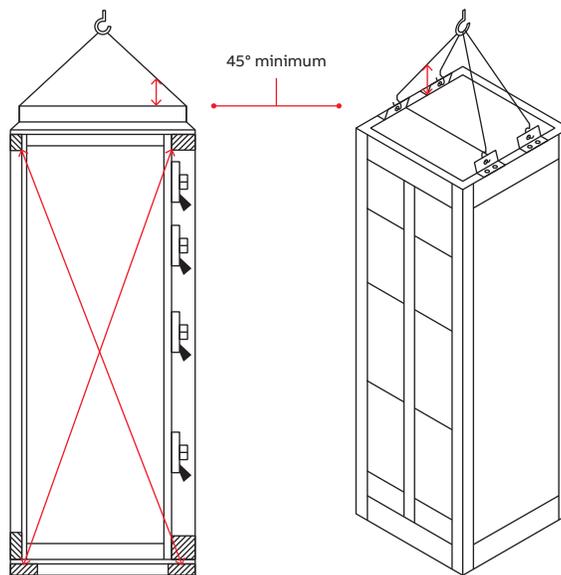
CAUTION

Caution: The weight of the switchboard can vary. Check the weight of the section against the capacity of the crane when lifting.

Observe the following points when lifting the equipment:

- Do not pass cables or ropes through support holes
- Always use load-rated, inspected, and approved shackles or safety hooks to attach hoisting equipment to the lifting points.
- Rig slings so that the legs are no less than 45° from horizontal, as shown in Figure 3

Lifting slings, spreaders, blocking, and other lifting equipment is not included with the switchboard.



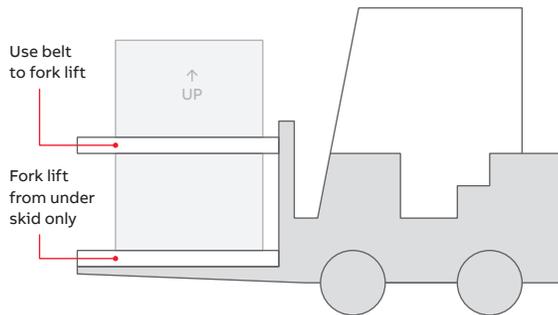
- 03

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04
Lifting the switch-
board with a forklift

Forklift

Only trained personnel should operate the forklift. Make sure the switchboard is on a solid surface and be aware of wet floors and other hazardous conditions. The switchboard load should be properly distributed to avoid damage to the equipment. Follow any operational procedures and do not exceed the lifting capacity of the forklift.

Before lifting, ensure that the forks/blades of the forklift are fully inserted under the switchboard and that they extend under the entire skid (Figure 4). The switchboard may be top heavy and should be secured to the forklift with a safety strap. The strap must be located properly to stabilize the equipment and should not be placed over any components that may be damaged by the strap. Lift the switchboard slowly to the minimum height necessary to move the equipment safely.



* Use a strap to secure the switchboard to the forklift.

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04

Storage

If it is necessary to store the equipment for any length of time, observe the following precautions to prevent corrosion or breakage:

- Keep the switchboard in an upright position and store on a flat, stable surface
- Store the switchboard in a clean, dry, rodent-free area in moderate temperature. Cover the equipment to prevent deposits of dirt or other foreign material on movable parts and electrical contact surfaces (heavy-duty plastic is recommended for covers). Until they are properly installed, outdoor switchboards are not weatherproofed
- If the switchboard is stored in cool or damp areas, apply heat to keep it dry. On both indoor and outdoor switchboards, a space heater should be installed inside the lineup to minimize internal humidity.

CAUTION

Caution: Remove all cartons and other miscellaneous packing materials from inside the units before energizing any heaters or lamps.

Installation: Switchboard location and requirements

Before installation

Before any installation work is performed, study all drawings furnished by the supplier. These include arrangement drawings (front, end, and plan views), connection diagrams, and schedule of equipment. Any material external to the equipment that may be required to meet any local codes (such as mats, screens, or railings) is not included. Installations in damp areas may have additional requirements in the National Electrical Code (NEC).

Positioning

When locating the switchboard, confirm that the installation location and positioning conforms to all applicable codes for aisle, working space, and placement requirements (refer to NEC article 110.26). In general, the working space in front of and behind the switchboard should be enough to open all doors, remove circuit breakers, and conduct inspection and maintenance activities. Service entrance equipment should be placed close to the building's incoming connections.

Make sure the installation location is clean and dry before placing the switchboard. Prepare connections between sections before placing the sections in their final locations. Consult the manufacturer provided documentation for any construction specific clearance, rear access, or front access space needed around the switchboard. Remove the switchboard from the skids when it is ready to be placed in its final location (see Handling, page 5).

Clearances

A clearance of one inch between the back and sides of the switchboard and any walls or obstructions is required.

Front access

The space in front of the switchboard must be enough to allow the doors to open, circuit breakers to be installed and removed, and in front access switchboards, for field connections to be inspected and maintained. See the supplier documentation provided with the switchboard for specific front access information.

Rear access

A larger clearance behind the switchboard may be needed for rear access so that field wiring terminals can be maintained. See the supplier documentation provided with the switchboard for specific rear access information.

Foundation requirements

Indoor equipment

The floor or foundation must be strong enough to support the weight of the switchboard and the shock stress caused by opening of the circuit breaker under fault conditions. The shock loading is approximately 1-1/2 times the static load. If the foundation is subject to vibrations, special mounting provisions must be installed to prevent transmitting vibrations to the equipment.

NOTICE

Notice: For seismically certified equipment, refer to the installation instructions on page 10.

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05
Indoor switchboard
bolted to the floor

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06
Indoor switchboard
mounted on floor
channels

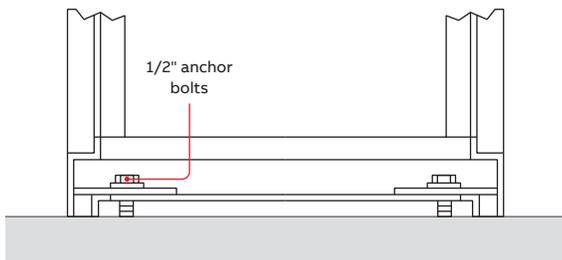
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07
Outdoor switchboard
installation

The switchboard must be bolted directly to the floor, as shown in Figure 5. The floor must be level or floor channels must be used to avoid misalignment of sections, doors, and other subsystems.

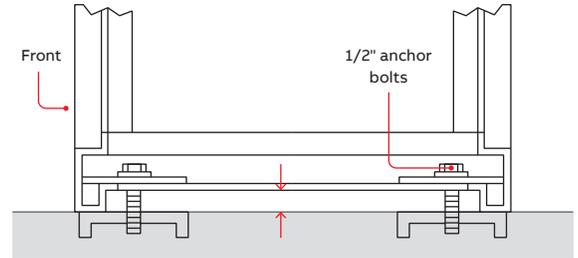
If steel floor channels are used, embed them in a level concrete slab, with the top surface of the channels flush with the finished floor. To avoid distortion of the switchboard structure, the steel channels must be level and aligned with each other before the equipment is anchored.

The recommended foundation construction and method of mounting the switchboard to the foundation are shown in Figure 6. Channels should be grouted after installation. If using a housekeeping pad, be sure to verify device handle elevations according to NEC 490.41.

Regardless of which installation method is used, the mounting surface must be level to within .25" over a 10' span to prevent distortion of the switchboard structure, to assure proper mechanical and electrical connections between shipping splits, and to assure proper interfacing to other close-couple equipment. Anchor bolts and channels are to be provided by the purchaser.



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05

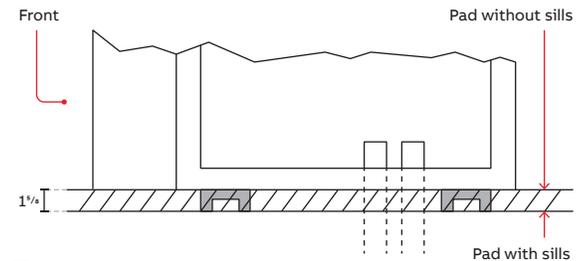


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06

Outdoor Equipment

It is recommended to have outdoor equipment installed on a smooth, level concrete pad.

When optional channel sills are supplied with the switchboard, set them on the pad and fill them with grout, as shown in Figure 7.



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07

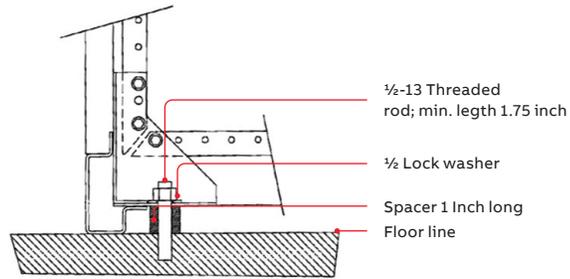
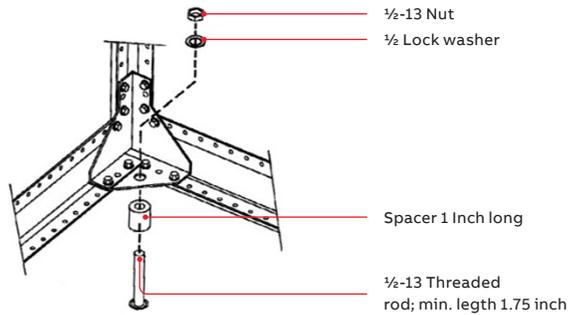
—
08
Installation of seismically certified switchboards without floor sills

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09
Alternate installation of seismically certified switchboards without floor sills

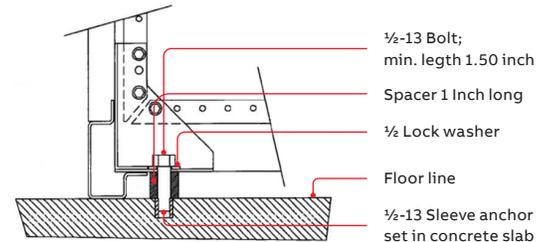
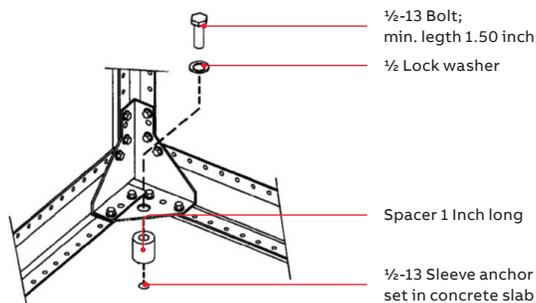
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10
Installation of seismically certified switchboards with floor sills

Seismically certified equipment

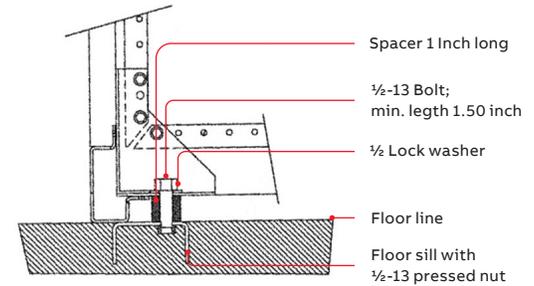
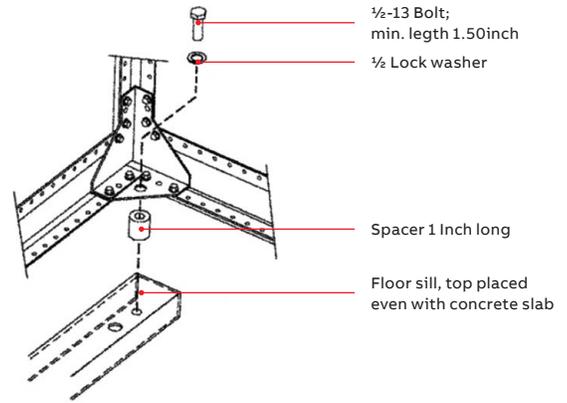
For seismically certified switchboards of IBC-2018 and IEEE-693-2018, follow the previous instructions with the following modifications. Locate the seismic kit shipped with each section before installation. The kit for each section is located at the rear of the switchboard section attached to the horizontal bus. The kit should contain four 1-inch spacers per section. These spacers should be installed around the four ½”-13 Grade 5 bolts as shown in Figure 8 or Figure 9 for switchboards without floor sills, these spacers should be installed as shown in Figure 10.



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08



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09



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10

Conduits

When the foundation channels are being installed, any conduits or sleeves required for power and control cables that are to enter the equipment from underneath should be located and installed within the available space shown on the floor-plan drawings. Consider installing conduits or sleeves that might be required for future connections also. Conduit stubs should extend above the floor enough to prevent water from entering. Conduits should only be installed within the marked conduit areas of the manufacturer’s drawings in order to comply with NEC wire bending space requirements. Conduit sleeves should be installed only after the switchboard is in place as they may interfere with placement of the switchboard.

The lowest live metal part in the switchboard will be approximately 8 inches above the bottom of the switchboard (not including floor sills), according to NEC Table 408.5. Conduits, including the conduit sleeves, cannot extend more than 3 inches above the bottom of the enclosure according to NEC 408.5. Note that the switchboard must be lifted over any conduit stubs previously installed in the foundation. Terminate the conduits at the switchboard with the appropriate conduit connectors, sized according to NEC requirements. Conduits may require grounding or electrical connection to the switchboard controller. Before cabling, ensure that the markings on the cable comply with markings on the switchboard.

Torque specifications

Switchboards are furnished with medium carbon steel hardware with the tensile strengths listed in Table 1. Similar hardware must be used for any additional bolting. For both copper and aluminum connections, use a torque wrench when tightening to the nominal values given.

Use flat and lock washers for all connections. Do not place washers under the heads of carriage bolts.

For equipment wiring terminal torque values see Table 3. For device terminal torque values reference the appropriate device installation guide.

Electrical clearances

Maintain the minimum clearances listed in Table 2 except at terminals of circuit breakers and switches. A through-air spacing of not less than ½ inch is acceptable at a circuit breaker or a switch, other than a snap switch, and between grounded dead metal and the insulated neutral of a 277/480 VAC three-phase, four-wire panelboard or switchboard. Where neutral-to-phase is involved, spacing may be based on the normal voltage between them.

Table 1: Tightening torques for supplied hardware

Bolt size [in]	Tensile strength [psi]	Torque [lb-ft]
¼-20	120.000	4
5/16-18	120.000	9
3/8-16	120.000	16
½-13	60.000	39
½-13 with 21/4 Belleville Washer	60.000	35
5/8-16	60.000	80

Table 2: Minimum clearances for live parts

Voltage involved		Minimum spacing through air and over surface between live parts and grounded metal					
Greater than	Maximum	Through air		Over surface		mm	(in)
		mm	(in)	mm	(in)		
0	130	12.5	(½)	19.0	(¾)	12.5	½
130	250	19	(¾)	31	(1-¼)	12.5	½
250	600	25	(1)	50	(2)	25 ^a	1 ^a
600	1000	25	(1)	50	(2)	25 ^a	1 ^a

^a A through air spacing of not less than 12.5 mm (½ inch) may be used:
 1. At a circuit breaker or a switch, other than a snap switch;
 2. Between uninsulated live parts of a meter mounting base and grounded metal; and
 3. Between grounded metal and the neutral of a 3-phase, 4-wire switchboard.

Note 1 – Exceptions to these minimum spacings covered in UL891 8.1.16.2-8.1.16.6.
 Note 2 – The SI units are minimum values and are not a direct conversion from the corresponding values in inches.

Reference: NMX-J-118/2-ANCE-2019 CSA C22.2 No. 244:19, UL891

Neutral-to-ground spacing should be based on the same spacing required for the other conductors.

A through-air spacing of not less than ½ inch is acceptable at a circuit breaker or a switch, other than a snap switch, and between grounded dead metal and the insulated neutral of a 277/480 VAC three-phase, four-wire panelboard or switchboard. Where neutral-to-phase is involved, spacing may be based on the normal voltage between them. Neutral-to-ground spacing should be based on the same spacing required for the other conductors.

Table 3: Equipment wiring terminal torque values

Hardware type	Hardware size	Cable size [AWG/MCM]	Torque [lb-in]	
Slot ≤ ¼"	#8	18 - 8	12	
		18 - 10	20	
	#10 and larger	8	25	
		6 - 3	35	
Slot ≥ ¼"	#10 and larger	2	40	
		18 - 10	35	
	#10 and larger	8	40	
		6 - 4	45	
	Hex, Hex with slot	#10 and larger		50
			18 - 8	75
6 - 4			110	
3/16		3 - 1	150	
		1/0 - 2/0	180	
		3/0 - 4/0	250	
Internal hex size	5/16	250 - 400	325	
		500 - 750	375	
			500	
	3/8		120	
	1/2		200	

Installation: Multiple switchboard sections

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11
Top and bottom bolted connection, two connections on each depth frame member

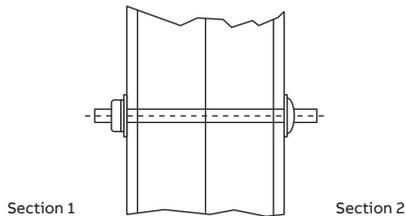
—
12
Vertical bolted connection, two connections on each height frame member

—
13
Locations of the eight bolted joints used to connect two sections

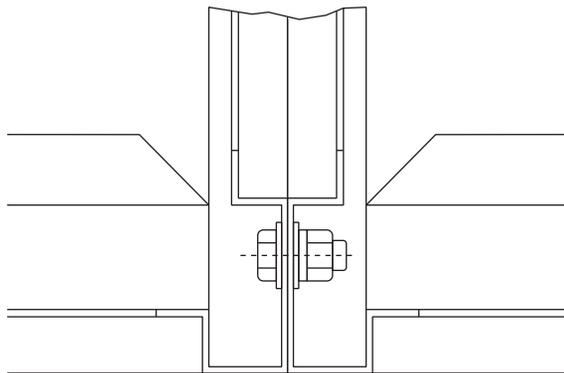
Joining section frames

The joining of the sections involves two bolted connections each on the top and bottom depth frame members (Figure 11). In addition, two bolted connections are made on each vertical frame member (Figure 12).

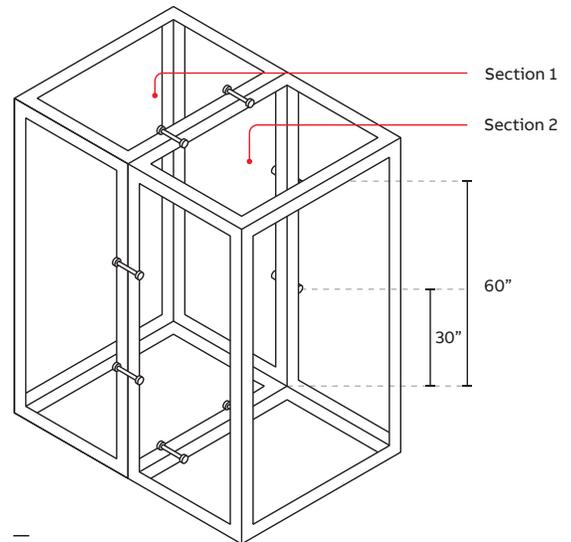
The vertical connections are located one-third and two-thirds up from the bottom of the switchboard. For a 90-inch switchboard, the connections are made 30 inches and 60 inches from the bottom of the equipment (Figure 13).



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11



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12



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13

Straight splices

The following splicing instructions apply to individually mounted main/feeder, utility or incoming lug pull sections to individually mounted main/feeder, utility or incoming lug pull sections, as well as to individually mounted main/feeder, utility, or incoming lug pull sections to group-mounted distribution sections. Be sure to align the sections according to the drawings provided by the supplier for the specific installation.

To connect straight splices, first remove the single $\frac{1}{2}$ "-13 Grade 5 bolt and washers from the left connection, shown in Figure 14a. Keep in mind the other two bolts may have to be loosened. Rotate each phase splice counterclockwise as shown in Figure 14b, starting with the rear-most splice working forward. With all splices for one phase in position, as shown in Figure 15a, reinsert the $\frac{1}{2}$ "-13 Grade 5 bolt and washers on each phase and torque all bolts according to Table 1 in Torque Specifications. See Figures 16 through 20 for additional information based on bus ampacity.

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14a
Straight Splice –
Shipping position

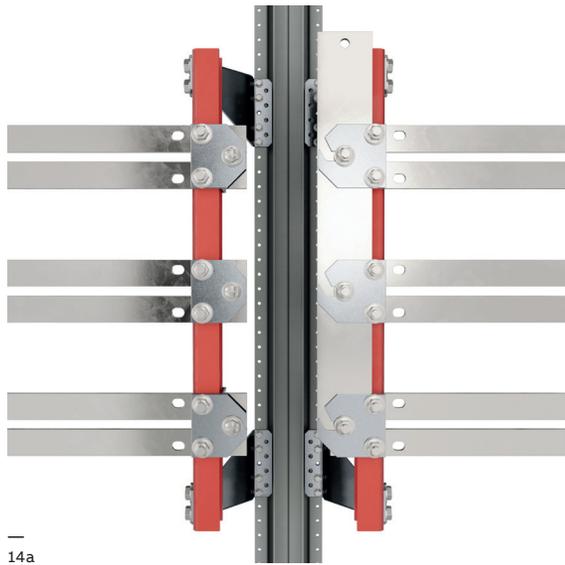
—
14b
Straight Splice
– Rotating the
splice plates

—
14c
Straight Splice –
Final position

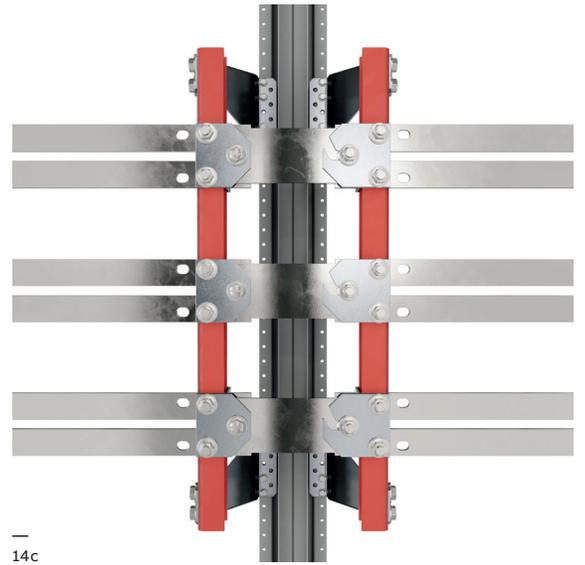
Splice diagrams

Use the diagrams in Figures 14a through 42 for individually mounted main/feeder, utility of incoming lug pull sections to individually mounted main/feeder or utility sections. The diagrams are organized as follows:

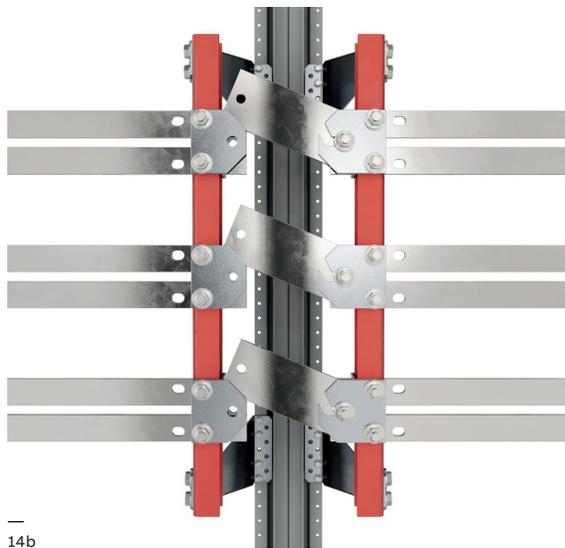
Straight splices	14a–14c
Main bus splices	Figures 15–20
Offset main bus splices	Figures 21–25
Neutral bus splices	Figures 26–28
Neutral offset bus splices	Figures 29–34
Ground bus splices	Figure 35
ReliaGear/Evolution to Spectra bus splices	Figures 36–42



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14a

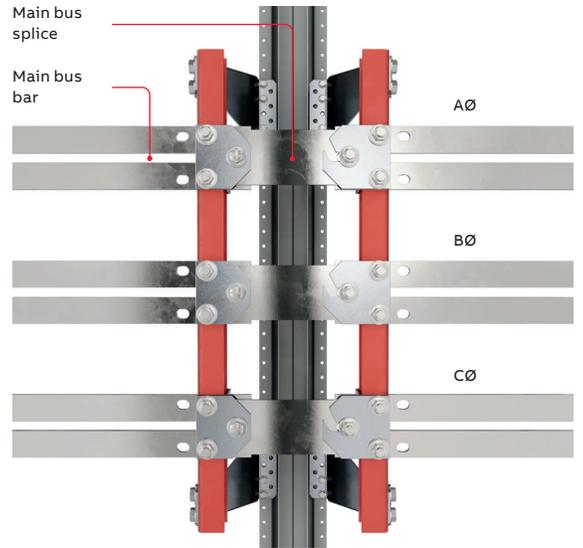
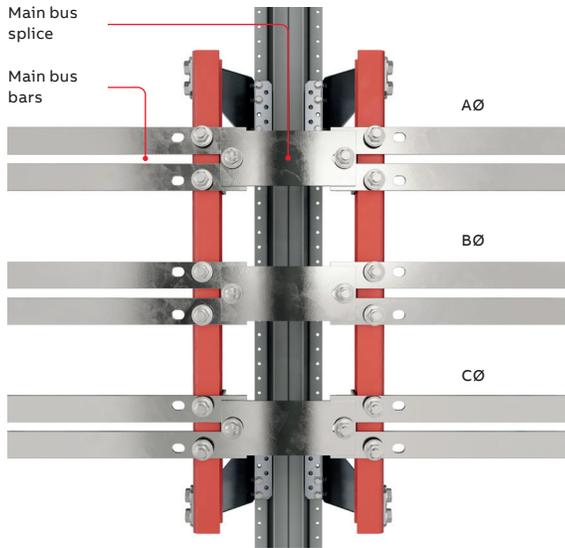


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14c



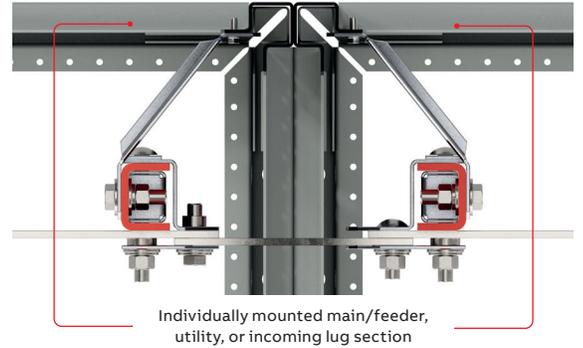
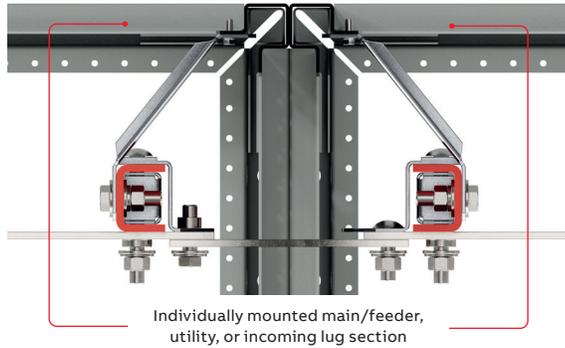
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14b

—
15
Main bus splice – Front and Top Views for two individually mounted main/feeder, utility, or incoming lug pull sections with 400 - 3000A aluminum or copper main bus



—
16
Main bus splice - ISO View for two individually mounted main/feeder, utility, or incoming lug pull sections with 400 - 3000A aluminum or copper main bus. The Main Bus Hardware (#4) and Splice Pivoting Hardware (#7) may need to be loosened prior to rotating the Splice Bar(s) (#5) into place

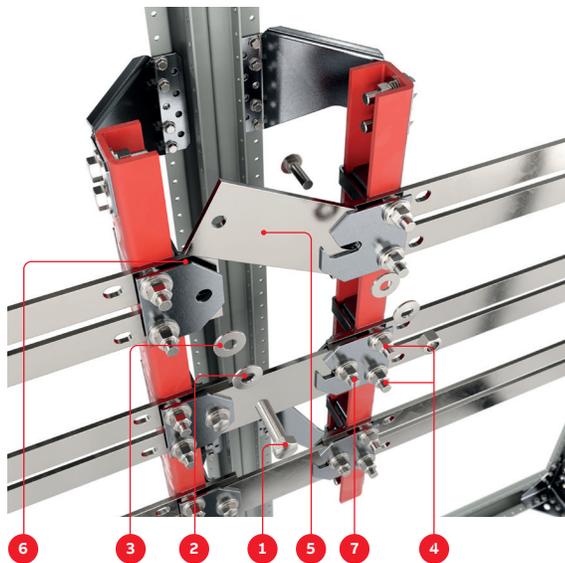
—
17
Main bus splice – Front and Top Views for individually mounted main/feeder, utility, or incoming lug pull sections with 4000A aluminum or copper main bus



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15

—
17

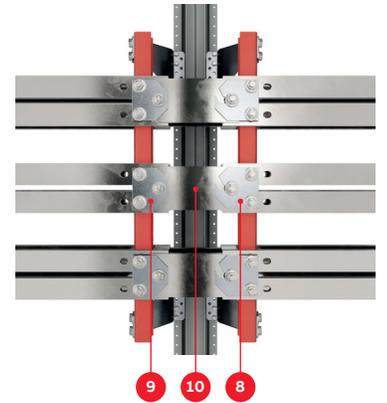
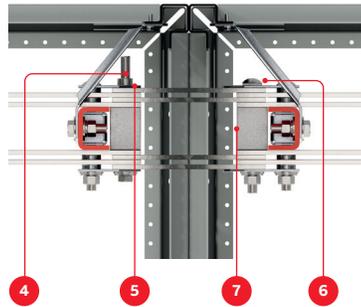
A-phase, B-phase, C-phase, and indicate each main bus assembly with the splice joint in between



- 1. Hexagonal bolt
- 2. Belleville washer
- 3. Flat washer
- 4. Main bus hardware
- 5. Splice bar
- 6. Press nut
- 7. Splice pivoting hardware

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16

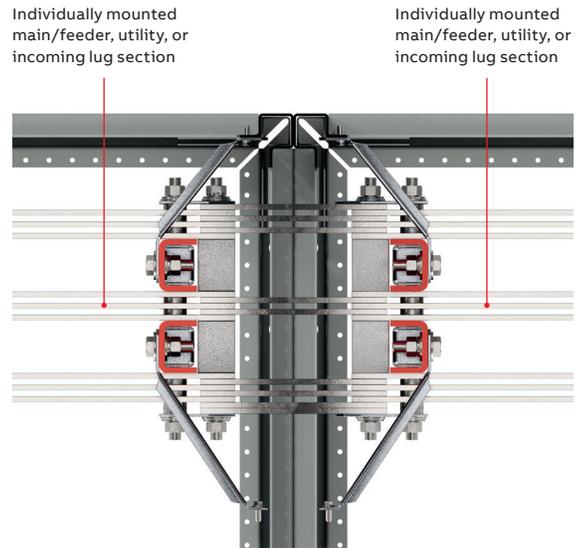
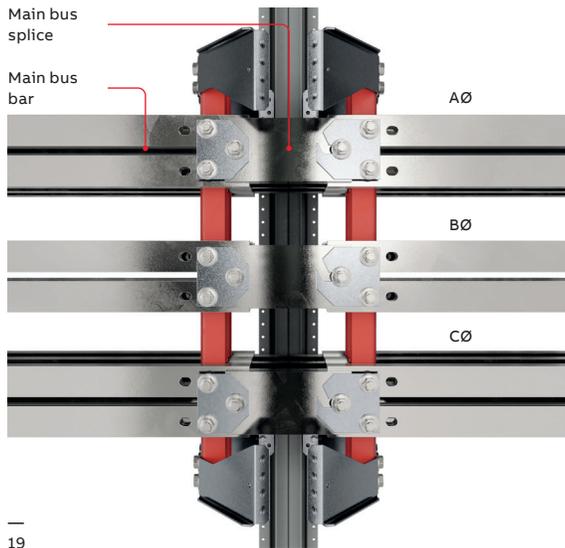
—
18
Main bus splice - ISO
View for two individually
mounted main/feeder,
utility, or incoming
lug pull sections with
4000A aluminum or
copper main bus



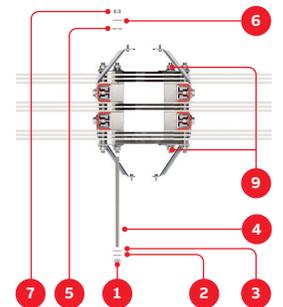
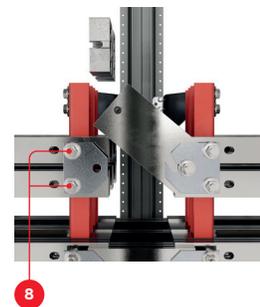
- 1. Hexagonal bolt
- 2. Belleville washer
- 3. Flat washer
- 4. Press nut
- 5. Rear left splice locator
- 6. Rear right splice locator
- 7. Collector / spacer
- 8. Front right splice locator
- 9. Front left splice locator
- 10. Splice bars
- 11. Main bus hardware
- 12. Splice pivoting hardware

—
19
Main bus splice – Front
and Top Views for
individually mounted
main/feeder, utility,
or incoming lug pull
sections with 5000 -
6000A aluminum or
copper main bus

—
20
Main bus splice - ISO
View for two individually
mounted main/feeder,
utility, or incoming
lug pull sections with
5000 - 6000A aluminum
or copper main bus
(up to 100kAIC)



—
19



- 1. Nut
- 2. Belleville washer
- 3. Flat washer
- 4. Full threaded rod
- 5. Flat washer
- 6. Belleville washer
- 7. Nut
- 8. Main bus hardware
- 9. Splice pivoting hardware
- 10. Splice bars
- 11. Aluminum collector/spacer

—
20

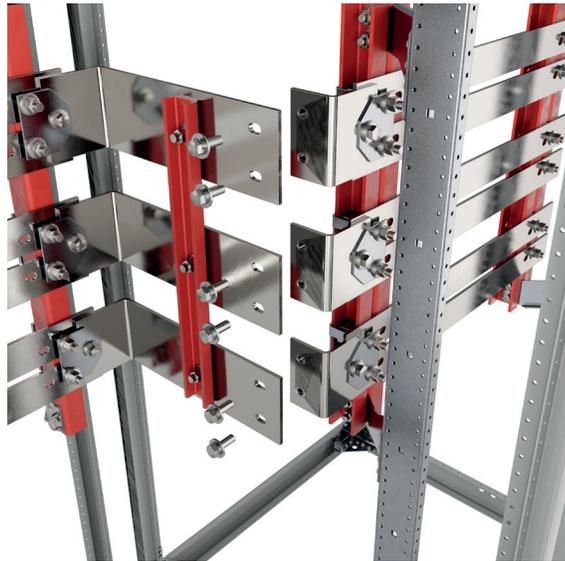
—
21
Offset Main Bus
Splice - Alignment of
sections

—
22
Offset Main Bus Splice
- Adjustment detail

—
23
Offset Main Bus
Splice - Top View

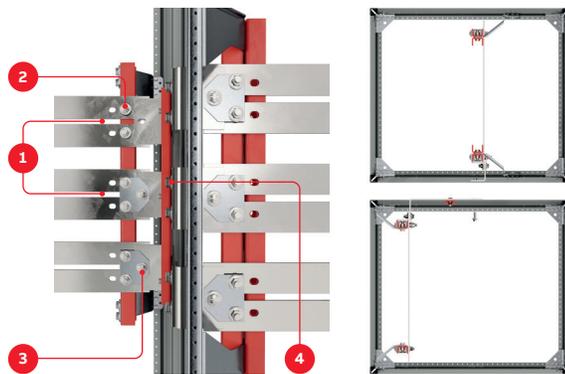
—
24
Offset Main Bus Splice
- Top View of aligned
and bolted sections

The offset splice assembly consists of two bus bar sets, already installed from the factory. One of the two sets is installed on the left section and the other is installed on the right section. Align the sections and proceed to insert the provided ½”-13 Grade 5 bolts on each phase as shown in Figure 21 and torque accordingly. Refer to Table 1 for the correct torque value.



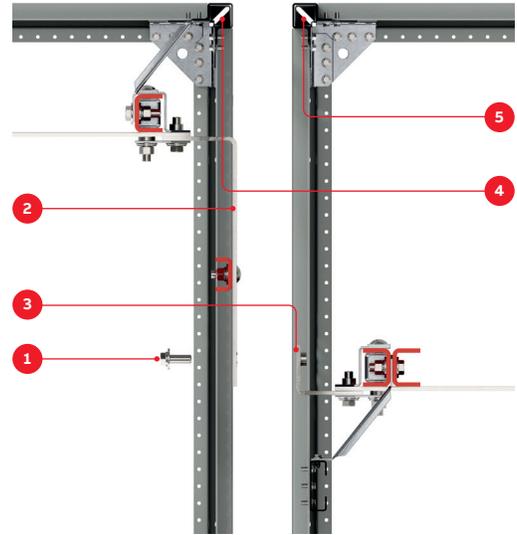
—
21

The following Figures 22 through 25 are applicable for 400A, 600A, 800A, 1000A, 1200A, 1600A, 2000A, 2500A, 3000A and 4000A bus configurations.



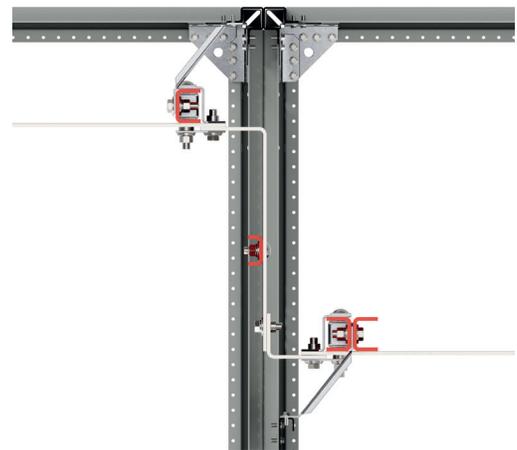
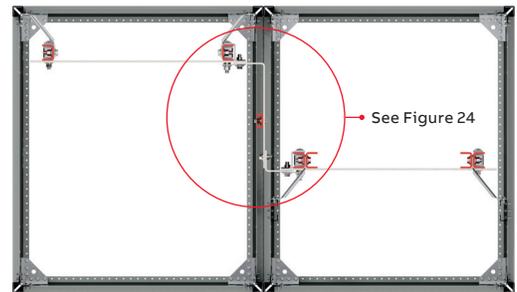
1. Splice locator 3. Splice securing hardware
2. Slot in splice bar 4. Offset splice bars

—
22



1. ½”-13 Bolt with washer
2. Left side splice bars
3. Right side splice bars with press nut
4. Left section
5. Right section

—
23



—
24

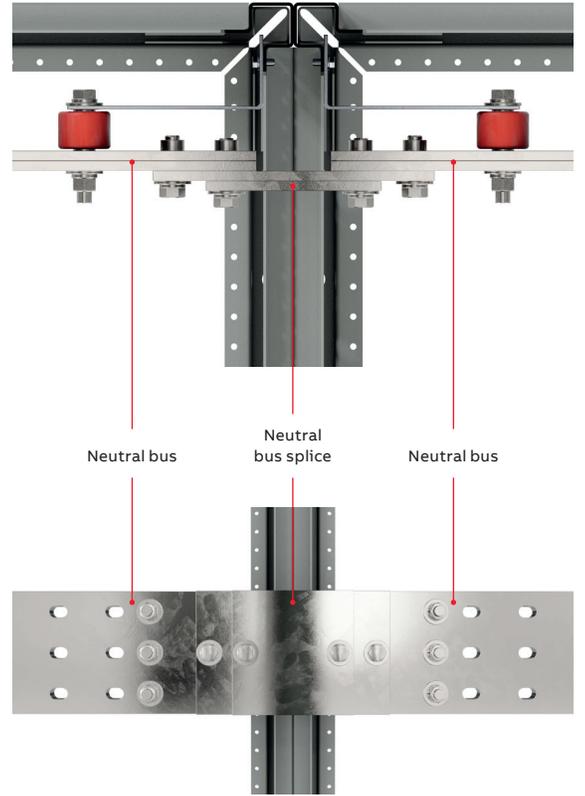
—
25
Offset Main Bus Splice
— ISO View of aligned
and bolted sections



—
26
Neutral Bus Splice – Top View
of two individually mounted
main/feeder, utility, or
incoming lug pull sections
with 400 - 1200A aluminum
or copper neutral bus

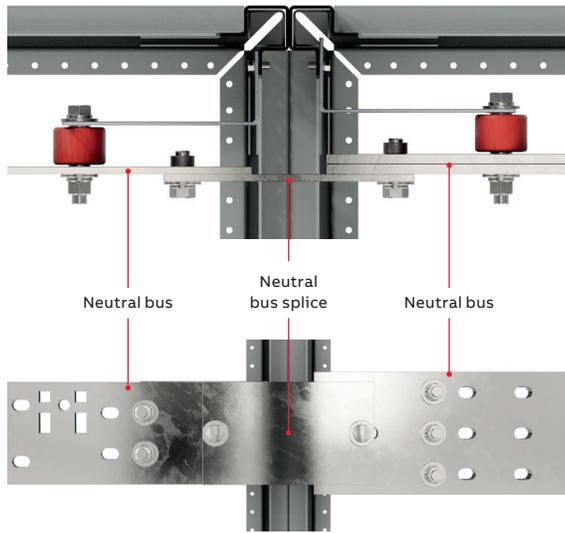
—
27
Neutral Bus Splice – Top
View of two individually
mounted main/feeder,
utility, or incomin
lug pull sections with
1600 - 4000A aluminum
or copper neutral bus

—
28
Neutral Bus Splice – Top
View of an individually
mounted main/feeder,
utility, or incoming
lug pull section to an
individually mounted
main/feeder utility
section with 5000 -
6000A copper neutral bus

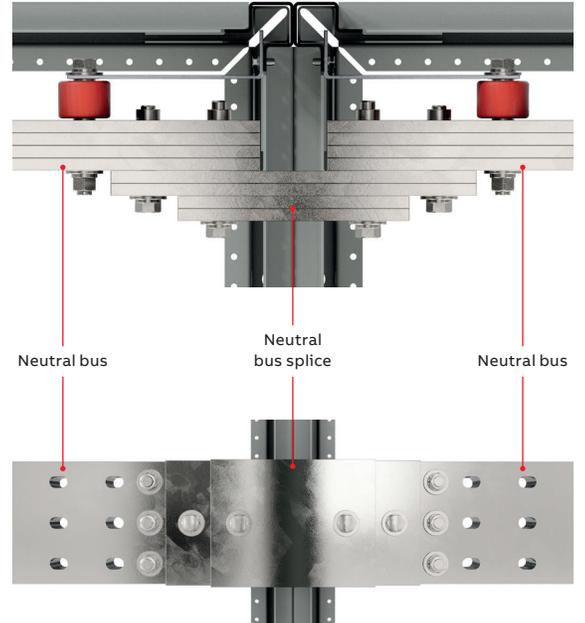


—
27

25
Neutral splices are secured and shipped rotated vertically on the neutral bus. To join to the adjacent section, the 1/2"-13 Grade 5 bolt must be removed, and the splice must be rotated 90 degrees to the horizontal position to connect to the adjacent neutral bus. Reinstall bolt and torque according to Table 1. The following images show neutral bus splice connections for all ampacities.



—
26



—
28

—
29
Neutral Offset Bus Splice
– ISO View positioning
(left), splice in place
and torqued (right),
for 400A, 600A, 800A,
1000A, and 1200A bus.
(enlarge and straighten)

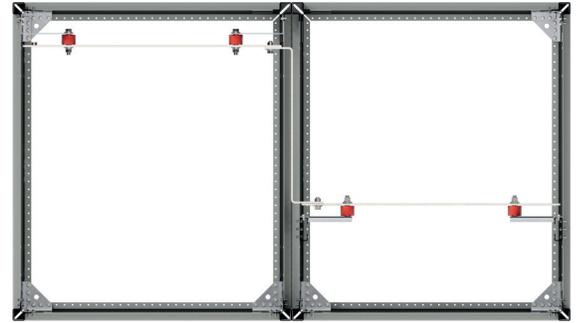
—
30
Neutral Offset Bus Splice
– Detailed ISO View,
for 400A, 600A, 800A,
1000A, and 1200A bus

—
31
Neutral Offset Bus
Splice – Top View, for
400A, 600A, 800A,
1000A, and 1200A bus

—
32
Neutral Offset Bus Splice
– ISO View positioning
(left), splice in place
and torqued (right), for
1600A, 2000A, 2500A,
3000A, and 4000A

—
33
Neutral Offset Bus Splice
– Detailed ISO View, for
1600A, 2000A, 2500A,
3000A, and 4000A bus

The offset neutral bus splice assembly consists of a 'Z' shaped bus bar that connects two neutral buses. This offset splice bar ships braced to the neutral bus. With the sections joined as shown in Section 3 Joining Section Frames, proceed to detach the bar from the neutral bus. Position the 'Z' shaped busbar as shown in Figure 29. Proceed to insert the provided ½"-13 Grade 5 bolts, and torque accordingly. Refer to Table 1 for the correct torque value.



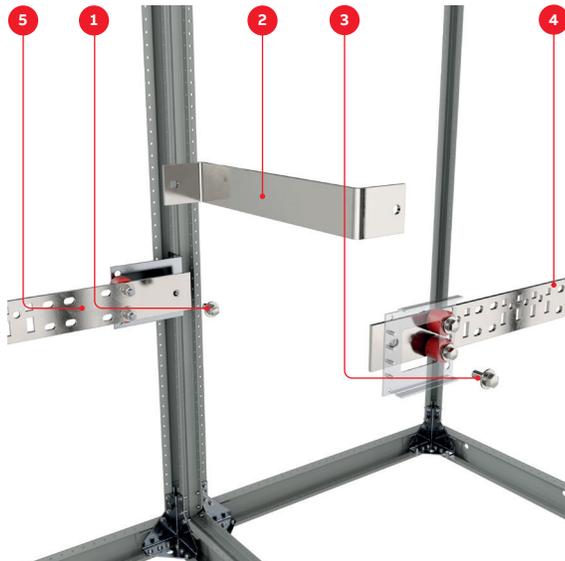
—
31



—
29



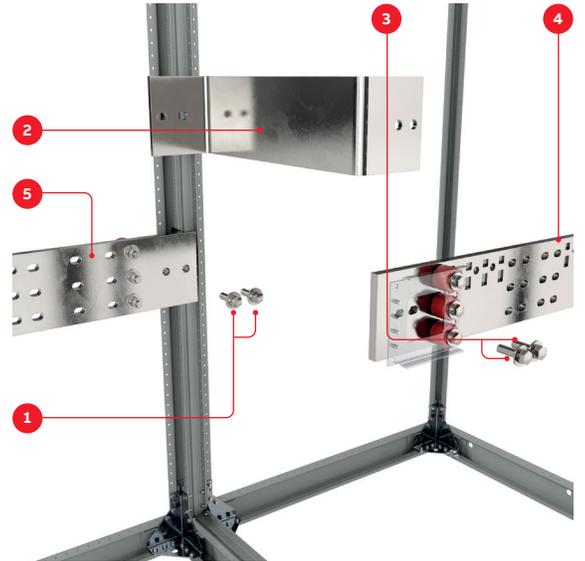
—
32



1. ½"-13 Bolt with washers
2. Splice bar
3. ½"-13 Bolt with washers

—
30

4. Right side neutral bus
5. Left side neutral bus

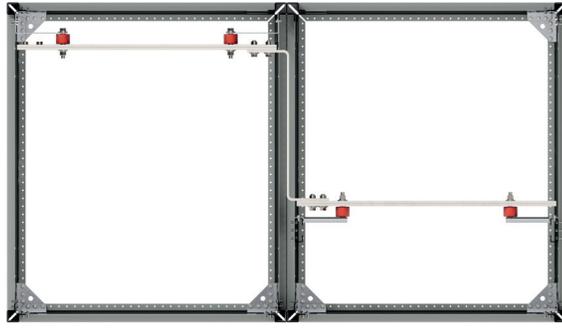


1. ½"-13 Bolt with washers
2. Splice bars
3. ½"-13 Bolt with washers

—
33

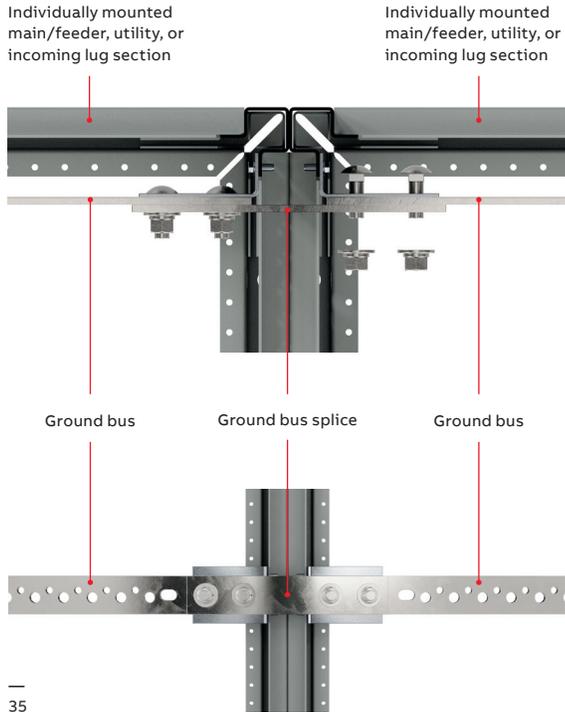
4. Right side neutral bus
5. Left side neutral bus

—
34
Neutral Offset Bus
Splice – Top View, for
1600A, 2000A, 2500A,
3000A, and 4000A bus



—
34

—
35
Ground Bus Splice –
Top and Front Views
for an individually
mounted main/feeder,
utility, or incoming
lug pull section to an
individually mounted
main/feeder utility
section with 400 - 4000A
aluminum or 400 - 6000A
copper ground bus

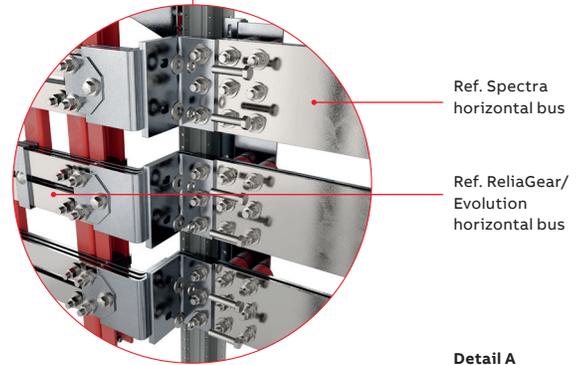
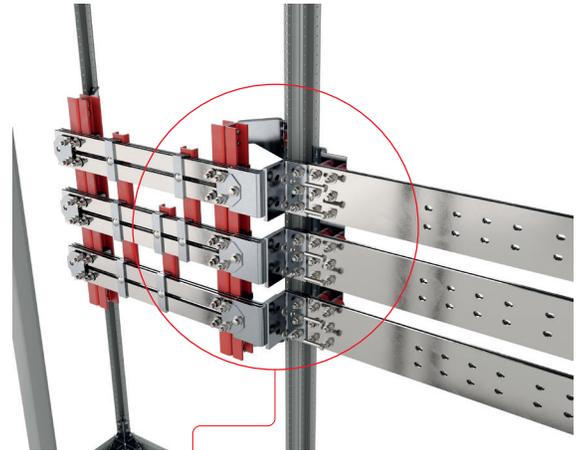


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35

—
36
Splicing ReliaGear/
Evolution and Spectra
bus – ISO View of 3000A
bus configuration
(shown for reference)

Splicing ReliaGear/Evolution and Spectra Bus
The following images concern the splicing of ReliaGear/Evolution bus to Spectra bus or vice versa. Only ½”-13 Grade 5 hardware should be used in splicing ReliaGear/Evolution bus and Spectra bus.

Splices ship attached in their position as shown



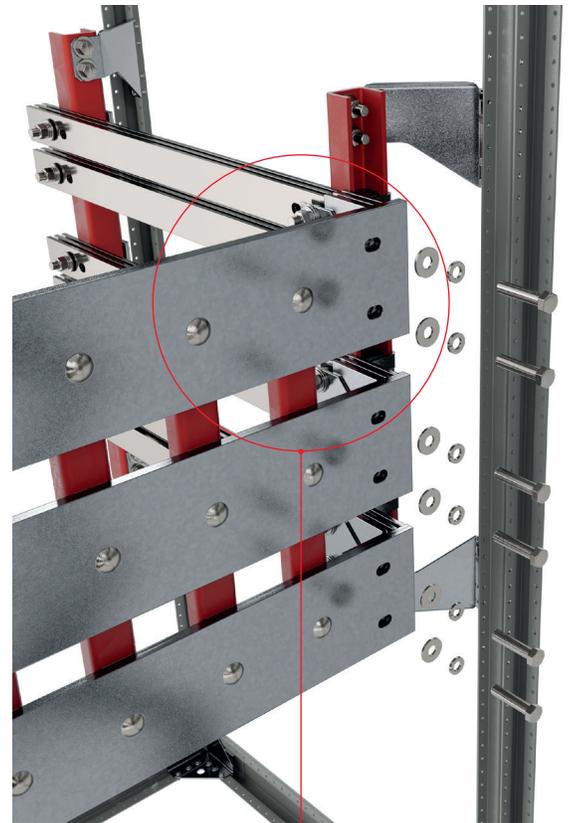
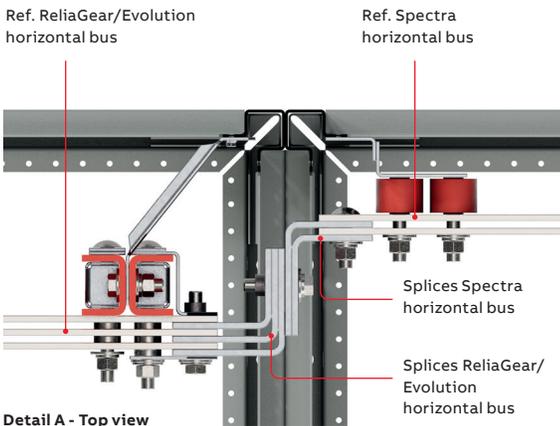
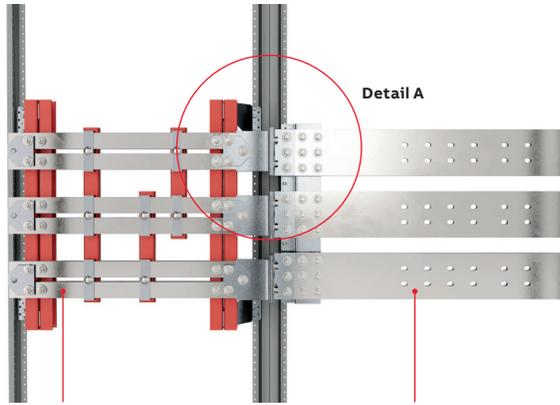
Detail A

—
36

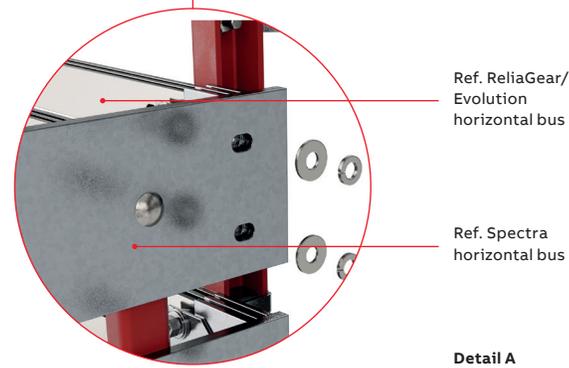
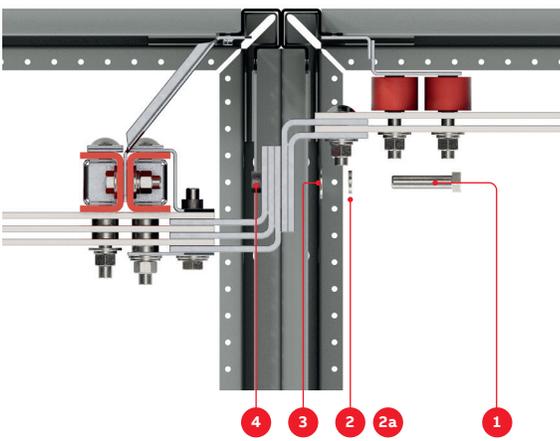
—
37
Splicing ReliaGear/
Evolution and Spectra
bus – Top and Front
Views of 3000A bus
configuration (shown
for reference).

—
38
Splicing ReliaGear/
Evolution and Spectra
bus – ISO View of 3000A
bus configuration
(shown for reference)

—
39
Splicing ReliaGear/
Evolution and Spectra
Bus – ISO View of 6000A
bus configuration
(shown for reference)



—
37



—
39

- 1. ½"-13 Hexagonal bolt
- 2. ½" Lock washer
- 2a. ½" Belleville washer

- 3. ½" Flat washer
- 4. ½"-13 Press nut

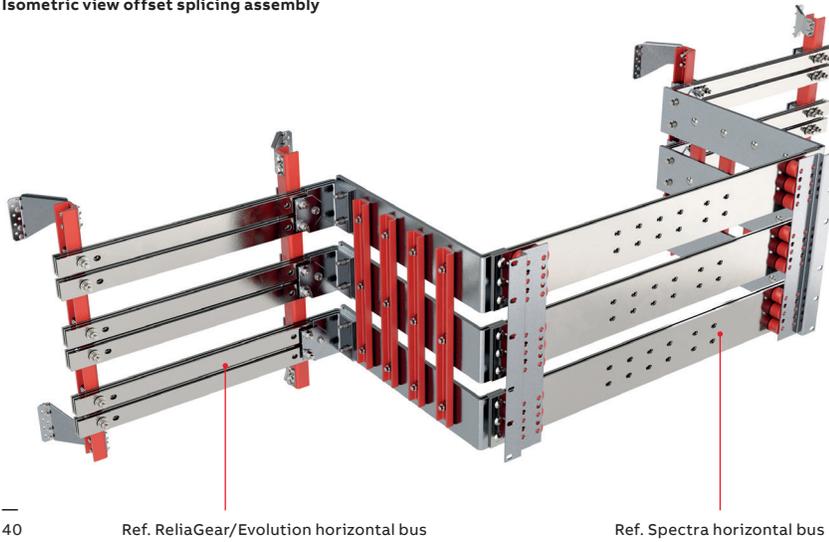
—
38

—
40
Splicing ReliaGear/
Evolution and Spectra
bus – ISO View of 3000A
offset bus configuration
(shown for reference)

—
41
Splicing ReliaGear/
Evolution and Spectra
bus – Top View of 3000A
offset bus configuration
(shown for reference)

—
42
Splicing ReliaGear/
Evolution and Spectra
bus – 3000A offset
bus configuration
splice components

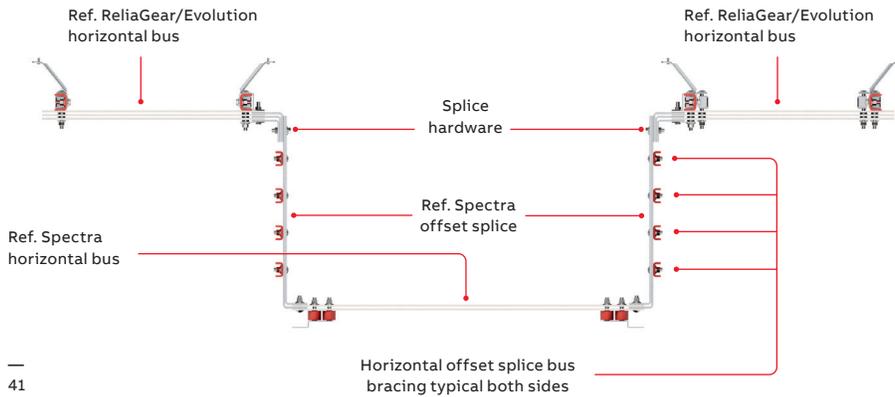
Isometric view offset splicing assembly



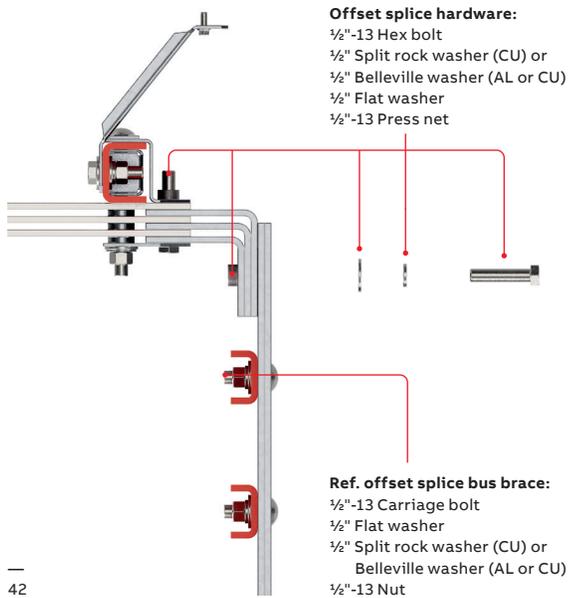
—
40

Ref. ReliaGear/Evolution horizontal bus

Ref. Spectra horizontal bus



—
41



—
42

Installing and removing withdrawable power circuit breakers

—
43
Rejection pin mounting
used in cradle

—
44
Rejection pin mounting
used on SACE® Emax 2
circuit breaker

General

Inspection and preparation of circuit breakers

Before installing, operating, or removing a circuit breaker, refer to 1SDH001000R0002 for preparation, inspection, and test. Check thoroughly for damaged or loose parts and for any dirt or foreign matter which may be in the circuit breaker.

Circuit breaker installation

To install a circuit breaker, proceed as follows:

1. Before installing check the contact areas on each primary disconnect bar or cluster of fingers for foreign matter that may have accumulated. Clean these areas if necessary. Be sure that a thin film of lubricating grease covers the contact areas before putting a circuit breaker in the compartment.
2. Check to see that the circuit breakers match their respective compartments. Each circuit breaker is assigned a part or mark number. This number is shown on the circuit breaker sheets of the summary, the front view drawings, and on the identification card on the circuit breaker shipping carton. The circuit breaker may also be identified using the 20 digit catalog number.
3. To locate the circuit breaker in the proper compartment, refer to the circuit breaker location list on the front view drawing. Find the proper circuit breaker by the identification card on the circuit breaker carton. All identical circuit breakers will have the same mark and catalog number.

Rejection feature

Draw-out circuit breakers of the same type and ratings are interchangeable in their equipment compartments. Draw-out circuit breakers of different type or short-circuit rating are intentionally made noninterchangeable to prevent inserting the wrong type circuit breaker into a draw-out compartment. Unique "rejection hardware" is affixed to each circuit breaker and its cradle. When the wrong type circuit breaker is inserted into a compartment, the pins on the circuit breaker and in the cradle interfere, thus preventing the wrong circuit breaker from being racked onto the primary stabs.



1. Cradle pins (not shown)

—
43



1. Circuit breaker pins (shown)

—
44

NOTICE

Notice: If a circuit breaker is rejected by the rejection pins, check the circuit breaker type and rating against the job drawing.

In addition to the rejection pins previously described, ReliaGear SB cradles will reject SACE® Emax 2 circuit breakers which are not configured for cradle mounted kirklock interlocks if so equipped.

A non-kirklock ready SACE® Emax 2 circuit breaker will be equipped with a bracket on the lower right hand corner which will interfere with the cradle kirklock lever.

An SACE® Emax 2 circuit breaker can be modified in the field such that it can be made kirklock ready thus removing the interference.

Please see 1SDH001000R0748 for guidance. A kirklock ready circuit breaker can be applied in a cradle that has no cradle mounted kirklock interlock equipped without issue.

Installing the circuit breakers**Prior to installation**

Prior to lifting a circuit breaker to its intended compartment location, observe the following precautions:

1. Check the compartment to ensure that it is free of foreign objects.
2. Verify that the circuit breaker is the correct type for that compartment.
3. Ensure that the circuit breaker is OPEN.
4. Apply a thin fresh coat of lubricating grease to the circuit breaker's primary disconnects.
5. Ensure that the position indicator on the circuit breaker is in the DISCONNECTED position and is correctly positioned for initial engagement. To do this, open the racking handle door and insert the racking handle and rotate it fully counter-clockwise.

Installation procedures

To install the SACE® Emax 2 circuit breaker, proceed as follows:

1. Carefully place the circuit breaker in front of the section in which it is to be installed.
2. Open the circuit breaker compartment door by rotating the door latch assembly ¼ turn clockwise.
3. Attach the appropriate lifting beam, Table 4, to the circuit breaker's lifting plates as shown in Figure 45. The carabineers of the lifting beam should be securely closed on the circuit breaker's lifting plates. See 1SDH001000R0002 for guidance on proper use of the circuit breaker's lifting plates.

CAUTION

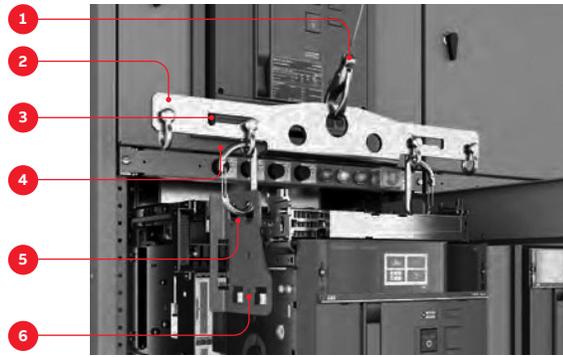
Caution: When using the switchboard circuit breaker lifting device, do not unwind the cable completely from the drum. To lift the circuit breaker, turn the device operating crank clockwise. To lower the circuit breaker, turn the device operating crank counter-clockwise.

NOTICE

Notice: E2.2 and E4.2 circuit breakers share a common lifting beam. The lifting beam has two unique positions for the carabineers to properly lift each of these circuit breakers as detailed in Figure 45.

—
45
Attaching lifting beam to SACE® Emax 2 circuit breaker

—
46
Alignment of SACE® Emax 2 circuit breaker with cradle



- 1. Circuit breaker lifting device hook
- 2. Lifting beam
- 3. E2.2 Carabiner position (shown)
- 4. E4.2 Carabiner position
- 5. Carabineers
- 6. Circuit breaker lifting plates

—
45

—
Table 4: SACE® Emax 2 lifting beams

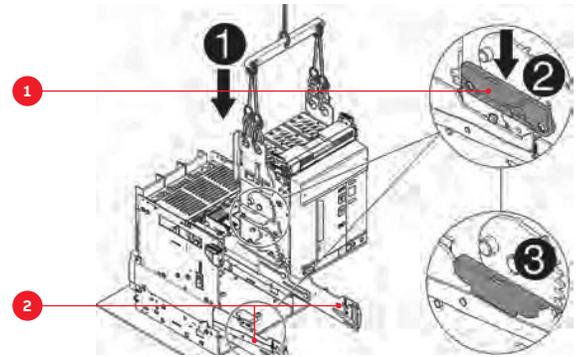
Catalog number	Poles	Description
ELD3E242	3	E2.2 or E4.2 lifting beam
ELD3E62	3	E6.2 lifting beam

4. Using the switchboard circuit breaker lifting device or a suitable lifting mechanism and the appropriate lifting beam, raise the circuit breaker above the elevation of the cradle draw-out rails.



Warning: Do not stand under the circuit breaker during the lifting or lowering operation.

- 5. Engage the cradle rail release levers and withdraw the rails to their stop.
- 6. Slowly lower and guide the circuit breaker to align with the circuit breaker compartment. Prior to lowering the circuit breaker onto the rails, be sure the circuit breaker racking plate (see Figure 46), are aligned with the cradle draw-out rails.



- 1. Circuit breaker racking plate
- 2. Cradle draw-out rails

—
46

7. With both sides of the circuit breaker aligned with the grooves in the cradle, slowly lower and guide the circuit breaker to allow the racking plates on both sides to align with the rails. Remove the lifting beam and the circuit breaker lifting plates. The circuit breaker is now positioned on the draw-out rails.

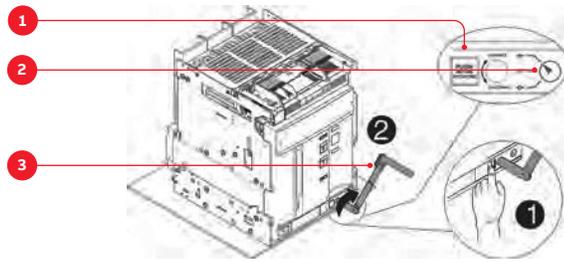
8. Move the circuit breaker into the compartment to the DISCONNECT position. If an incorrect circuit breaker has been installed, the interference pins on the circuit breaker will interfere with the rejection pins in the compartment prior to reaching the disconnect position.

9. Slide rails back into compartment. Close the compartment door and rotate latch ¼ turn counter-clockwise.

10. Engage the racking handle by pressing the "Push to operate" button to open the racking shaft door, then insert the manual racking handle.

11. Rotate the handle clockwise as far as it will go. As you rotate the handle clockwise, the circuit breaker will travel from the DISCONNECT position to the TEST position. The SACE® Emax 2 racking mechanism provides a positive position interlock which disables the racking mechanism at each of the positions (CONNECT, TEST and DISCONNECT). Therefore, once reaching the TEST position, the racking mechanism will be locked out; to proceed to CONNECT, again press the "Push to operate" button and resume turning the racking handle as far as it will go. The circuit breaker position can be seen on the indicator, located on the circuit breaker front cover.

—
47
Engage the racking shaft
with the racking handle



1. "Push to operate" racking mechanism button
2. Circuit breaker position indicator
3. Racking handle

—
47

Removing the circuit breakers



WARNING

Warning: Do not stand under the circuit breaker during the lowering operation.



CAUTION

Caution: When using the switchboard circuit breaker lifting device, do not unwind the cable completely from the drum. To lift the circuit breaker, turn the device operating crank clockwise. To lower the circuit breaker, turn the device operating crank counter-clockwise.

To remove the SACE® Emax 2 circuit breaker, proceed as follows:

1. Open the circuit breaker by pressing the OFF OPEN button.
2. Press the "Push to operate" button to enable the racking mechanism and insert the racking handle. Rotate the handle counterclockwise until the circuit breaker travels from CONNECT to TEST, as shown by the position indicator. Upon reaching TEST, again press the "Push to operate" button to enable the racking mechanism and resume turning the handle counterclockwise until reaching DISCONNECT. This operation should be performed with the door closed. If the circuit breaker closing spring is fully charged, press the "Discharge" button to discharge the energy.

3. Open the compartment door and fully extend the draw-out rails. Move the circuit breaker out until the rail stops. This is the WITHDRAWN position. The SACE® Emax 2 circuit breaker has an interlock which prevents the circuit breaker from being able to move to the DISCONNECT position if the circuit breaker's mechanism's spring is in the Charged state.

4. Attach the circuit breaker lifting plates, the lifting beam and lifting device securely and raise the circuit breaker off draw-out rails.

5. Push the draw-out rails back into the compartment.

6. Pull the circuit breaker forward until the primary disconnects clear the compartment.

7. Lower the circuit breaker onto a flat surface free of protrusions that could damage the circuit breaker's internal parts.

8. Close the circuit breaker compartment door. If the circuit breaker will be removed from the compartment for an extended period of time.

An optional dead front cover is available and may be ordered and installed to prevent access when the breaker is removed. Order catalog number 31018103569A001 for SACE® Emax 2.2, 4.2 and 6.2 and catalog number 3100323960A001 for SACE® Emax 1.2.

Installation: Accessories and devices

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48
Cable Brace – Front View,
tying the main cables
to the cable brace

For circuit breakers and accessories, refer to the individual instruction manuals provided with each device (refer to document numbers on page 36).

Circuit breaker installation and removal of group mounted molded case circuit breakers

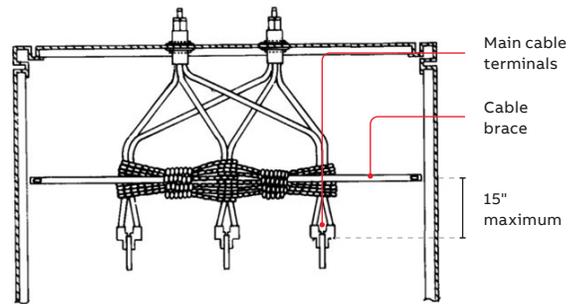
To install a group-mounted molded case circuit breaker, refer to the following [video](#).

Cable brace

To install the main cables when a cable brace is provided, follow these steps. Align the conduit holes linearly directly over, or as close as possible, to the braces. Consider installing any conduits or sleeves that may be required for future connections also. Run and bend the main cable in the most convenient orientation, ensuring that the main cable has been located directly up against the cable braces before it connects to the main cable terminals. Lash the main cable as shown in Figure 43, using a 3/8-inch nylon rope or a polyester braided rope having a minimum tensile strength of 2000 lb. Make six revolutions around the A and B phase main cables and six revolutions around the B and C phase main cables. Continue wrapping the cord around the main cable lashing and around the cable braces, if applicable, between the phases. Tie a knot to the cable brace or cable as the last revolution is completed. All revolutions must be as tight as possible to prevent whipping during a short circuit event. For GenTower connections, it is recommended that all cables outside the equipment be secured together with at least six revolutions and a span of 15 inches between secured lengths. The rope is not provided.



Warning: The equipment must be adequately grounded so that all parts of the equipment, other than live parts, are at ground potential. Failure to observe this precaution can result in serious injury or death.



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48

During and after the cable installation, observe the following rules:

- To prevent heating, avoid closed loops of steel around a single conductor or group of conductors that does not include all the conductors of the circuit, including the neutral
- If the conductors must pass through separate holes in a piece of steel, cut slots between the holes
- Do not allow cables carrying high currents to come near instruments or meters, as this may affect their accuracy
- Use the minimum length of cable necessary to make the connections. The increased resistance of longer cables generates unnecessary heat
- Inspect main cable lashing annually

For ReliaGear busway installation into ReliaGear SB switchboards, see busway publication GEH5660.

Ground

The ground bus is factory installed and is bolted to the uprights of the rear frame structure either at the top or the bottom of the enclosure. It is arranged so that connections to the source ground can be made in any unit. A ground lug is included in each complete equipment for tying the switchboard to the station ground. Ground-sense relays are recommended for protection of the switchboard.

Neutral

The neutral bus is factory installed and bolted to the uprights of the frame either at the top or bottom of the enclosure. It is arranged such that connections to the source neutral can be made in any unit. All neutrals, auxiliary neutrals, and grounds will come pre-installed in all units.

Ground-fault protection field connection and testing

When ground-fault protection is provided, all field connections must be made correctly to insure proper functioning of the ground-fault protection system.

NOTICE

Notice: As noted in NEC 230.95(c), the ground fault protection system shall be performance tested when first installed. The test shall be conducted in accordance with approved instructions which shall be provided with the equipment. A written record of this test shall be made and shall be available to the authority having jurisdiction.

Observe the following rules when connecting and testing ground-fault protection systems, as illustrated in Figures 50 and 51.

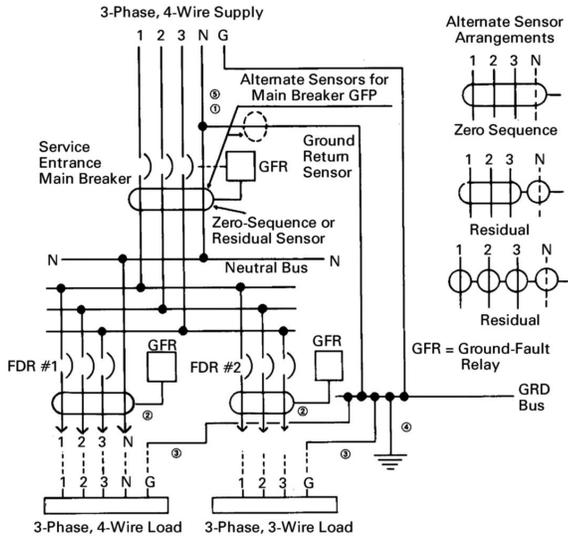
- In a service entrance section, bond the neutral conductor to the switchboard ground bus with a main bonding jumper (ground strap). Locate this grounding point on the neutral conductor on the supply side of any ground-fault sensors involving the neutral conductor. Do not make grounding connections to the neutral conductor on the load side of the service disconnect
- On load feeders, run all phase conductors (and neutral, if used) through the sensor window(s), with all in the same direction with respect to sensor polarity
- Do not run equipment ground conductors through ground-fault sensors. Connect them directly to the switchboard ground bus, not to the neutral bus
- Connect the service grounding electrode (water pipe, etc.) to the lug provided on the switchboard ground bus for this purpose
- Whenever a service is derived from a grounded neutral supply, the grounded neutral conductor must be brought into the service-entrance equipment, even if the grounded conductor is not needed for the load supplied by the service. This is required to provide a low-impedance ground-fault current return path to the neutral to assure operation of the overcurrent device, for safety to personnel and property
- Refer to publication 1VAL386401-HT for instructions on conducting performance test of new installations of ground-fault protection systems.

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49
Typical single-source
ground-fault protection
using ground-fault relays

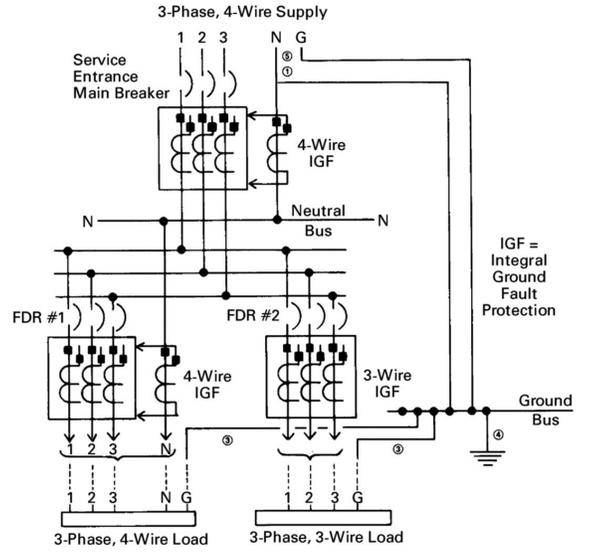
—
50
Typical single-source
ground-fault protection
using integral
ground-fault trips.

Fuse selection

Select the proper fuses for each circuit based on load characteristics and available short-circuit current at the line terminals of the switchboard. Select a fuse for which the rating of the combination fuse and switch equals or exceeds the available short-circuit current. Removable link-type fuses are not recommended.



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49



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50

Testing and inspection

WARNING

Warning: The equipment must be de-energized during cleaning, inspection and while tests are in progress. Failure to do so may result in serious injury or death.

After the equipment has been installed and all connections made, test and inspect the switchboard before energizing.

Although the equipment and devices have been inspected at the factory, perform a final field test to be certain that the equipment has been properly installed.

Check all terminals, connections, and hardware for correct torque values.

Key interlocks

After initial installation of the switchgear equipment, all necessary interlock keys should be inserted into the appropriate locks and all spare keys should be stored in a location in accordance with the owner's established procedures.

CAUTION

Caution: Refer to the key interlock schematic included in the summary furnished with the equipment to determine the sequence of operation and the correct number of operating keys required. This precaution is necessary since the improper use of spare keys will defeat the interlocking scheme.

Energizing equipment

In addition to these mechanical checks, use a megohmmeter to test the switchboard. Open all switchboard devices, remove all instrumentation and control fuses, and isolate the neutral from ground. All scraps of wire, plaster, dust, and other foreign material must be removed. Vacuuming is recommended. Use a megohmmeter developing 500 volts. Conduct electrical insulation resistance tests from phase to phase, phase to ground, phase to neutral, and neutral to ground. For additional details consult ANSI/NEMA PB 2.1.

If any switchboard tested under the above conditions shows resistance values less than 1 megohm, inspect it for possible tracking on insulation or insulation breakdown.

After thorough cleaning and inspection, if the megohm reading is still low, it may still be safe to energize the equipment. When restoring flooded or wet equipment to service, for example, the accepted practice is to require a minimum of 1 megohm before energizing. Under damp or humid conditions, it is considered good practice to operate the equipment at lower-than-rated voltage for a short time, if possible, to improve the low reading.

Instructions for inspection and testing of low-voltage power circuit breakers are given in the individual instruction manuals provided with each circuit breaker. Directions for testing devices such as relays, instruments, and meters are found in the instruction manual furnished with each device. Protective relays must be coordinated with other relays in the system; therefore, these relays are set by the purchaser. General instructions on setting relays are provided in the relay instruction manuals.

The equipment should be energized in sequence by first energizing the main devices, then the feeder devices, and finally the branch-circuit devices. Turn each device on with a firm positive motion.

Arcing energy reduction functions

Per the NEC clause, 240.87, when the circuit rating is 1200A or higher, an arc energy reduction function is required.

Reduced energy let through (RELT)

The RELT functionality is achieved by leveraging the 2I protection of the SACE® Emax 2 circuit breaker. The 2I tripping curve is designed to mitigate against arc flashes. This protection can be adjusted from 1.5 to 15 x In, with a maximum setting of 18 kA. The clearing time of the 2I protection is between 25 and 42ms at 60 Hz (+5 ms for 50 Hz). Easy activation and I/O assignment, including positive feedback, can be implemented using the RELT Ekip Signaling 2K-3 module.

To learn more about the feature, please see [9AKK107991A1097](#)

Prior to operation the 2I setting must be activated and NEC 240.87 requires field testing be completed for arc mitigation protections. Please see [9AKK107991A2520](#) for setup and test instruction.

For general wiring diagrams please see [1SDM000019A1002](#)

Field testing of RELT function**• Step 1: Test position**

Turn the RELT switch to the "TEST" position.

Observations to be made:

1. Pilot lamp will glow
2. Switch will return to the "NORMAL" state and the Pilot lamp will turn off

• Step 2: ON position

Turn the RELT switch to "ON" position.

Observations to be made:

1. Pilot lamp will glow
2. Switch will remain in "ON" position
3. At the same time, the circuit breaker trip unit will keep flashing "2I Protection Active"

• Step 3: Normal position

Turn the RELT switch back to "NORMAL" position.

Observations to be made:

1. Pilot lamp will keep glowing for 15 seconds and at that point there will not be any indication on the circuit breaker trip unit

For any other energy reduction solutions, consult factory. To test and commission these features, see project documentation for specific operation and behavior.

Zone selective interlocking (ZSI)

ZSI is used to minimize circuit breaker trip times closest to the fault while still maintaining circuit breaker selectivity. The protection is provided by connecting all the zone selectivity outputs of the trip units belonging to the same zone and taking this signal to the trip unit input that is immediately upstream.

Each circuit breaker that detects a fault reports it to the circuit breaker upstream; the circuit breaker thus detects the fault but does not receive any communication from those downstream and opens without waiting for the set delay to elapse. It is possible to enable zone selectivity if the fixed-time curve has been selected and the auxiliary supply is present.

Prior to operation, ensure that circuit breakers utilizing ZSI protection are properly configured. NEC 240.87 requires field testing be completed for arc mitigation protection. Please see ZSI setup instructions guide for setup and test instructions [9AKK107991A2521](#).

For order-specific wiring diagrams, please review the As-Built documentation.

Modified differential ground fault (MDGF)

For each circuit breaker in a MDGF protection scheme, the equipment is fashioned with corresponding compartment-mounted phase current transformers, neutral mounted current transformer, a compartment-mounted summing current transformer and a secondary disconnect terminal block. The summing current transformers are interconnected to form a loop with an output connected to the secondary disconnect terminal block of the circuit breakers.

For generic wiring diagram, please see [1SDM000019A1001](#). To ensure proper functionality the following wiring limitations are adhered to:

- Phase and neutral current transformers to primary side of auxiliary current transformer wire to be 14 AWG, twisted pair with a maximum one-way length of 30 feet
- Summing to summing current transformer wiring to be 14 AWG, twisted pair with a maximum loop length of 31,000 feet
- Summing current transformer to secondary disconnect terminal wiring to be 16 AWG, twisted pair with a maximum one-way length of 49 feet

To ensure intended functionality of a given circuit breaker within the MDGF scheme, the circuit breaker rated current, rating plug and phase and neutral current transformers need to have matching primary current ratings.

The summing current transformer's primary current rating is to match the secondary current rating of the phase and neutral current transformers.

NEC 240.95 requires that all ground fault protection schemes be performance tested prior to going into service. For field testing procedures please see [1VAL106901-HT](#).

For order-specific wiring diagrams, please review the As-Built documentation.

Cooling fan control module

51 Front mounted auxiliary ventilation compartment

General

The SACE® Emax 2 circuit breaker compartment in ReliaGear SB will be provided with a front mounted auxiliary fan cooling compartment for 6000A applications, Figure 51.

In ReliaGear SB 6000A applications, the fan control is initiated by the "Alarm Warning lw1" feature of the trip unit which signals a fan control circuit to turn the fans on or off.

Remote monitoring of the fan control circuit is available, contacts provided and must be wired by the customer.

NOTICE

NOTICE: Variations of the fan control circuit may be provided. Operators should review and understand the record drawings and documents provided with the equipment from the factory to confirm final fan control circuitry.

Table 5 provides the current threshold values that EKIP Touch or Hi-Touch trip unit's "Alarm Warning lw1" function should be programmed to initiate the fan cooling system. Refer the Cooling Fan Installation and Trip Unit Programming Guide 1VAL106902-MB for more information.

Load reduction contact is provided within the equipment section. These contacts are provided for customer connections in the event of a cooling fan failure.

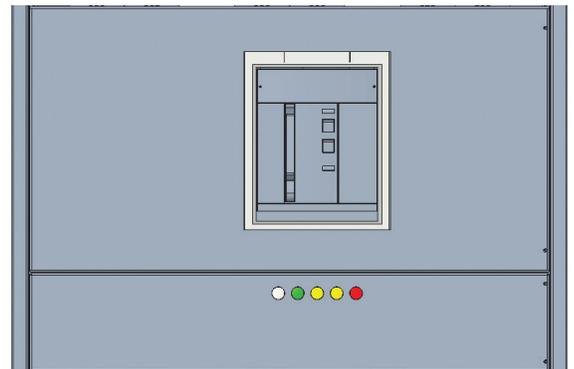
Operation of the switchboard, for an extended period, above the threshold limits shown in Table 5 without a properly working fan cooling system will not create an unsafe condition but is not recommended.

Table 5: Current alarm 2 settings for cooling fan system

Circuit breaker	Current threshold (A)	Alarm warning lw1
		Up set point
E6.2	5600	0.93

NOTICE

NOTICE: The circuit breaker(s) referenced in Table 5 must be configured with the "Alarm Warning lw1" trip unit option and this function must be set per Table 5 for proper operation of the fan cooling system.



- (1) SACE® Emax 2 Circuit Breaker
- (2) Front Mounted Auxiliary Fan Cooling Compartment
- (3) Power Indicating Light
- (4) Fan Control Switch
- (5) Fan On Indicating Light(s)
- (6) Fan Failure light

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Operation

A two position Illuminated Fan Control Switch, Figure 51, is provided to allow an operator to select the mode of operation for the cooling fan system. The fan control switch is provided with a pad-lockable hasp to allow an operator to lock-out/tag-out the fan control switch. The two positions of the fan control switch are "AUTO" and "ON".

AUTO operating mode

With the green ON/AUTO switch in the AUTO position, the control power to the fan cooling system is available (as indicated by the white POWER light) but the ON/AUTO switch itself will be only be illuminated when the circuit breaker is calling for fan cooling. This is the normal operating mode for the fan cooling system.

If the current exceeds the values shown in Table 5 for 60 seconds, the green ON/AUTO switch light will be illuminated to indicate a call for cooling. If the fans are operating normally, each yellow FAN ON Indicating Light will be illuminated. If a fan is rotating below the normal RPM range, then a failure has occurred then the corresponding yellow FAN ON indicating light will not be illuminated and the red Fan Failure Light will be illuminated and the load shedding contact will close.

If the current drops below the values shown in Table 5 for 60 seconds or more, the ON/AUTO switch will not be illuminated indicating that a call for cooling is no longer required.

ON operating mode

When the green ON/AUTO switch is in the ON position, the green ON/AUTO switch light will be illuminated to indicate a manual call for fan cooling without having to exceed the values shown in Table 5.

Test procedure

To test the fan cooling system and the circuit breaker configuration, turn the green ON/AUTO switch to the "ON" position, the following events will indicate a functioning fan cooling system.

- Green ON/AUTO switch light will be illuminated
- Both yellow FAN ON indicating lights are illuminated

If, when applying control power, the fans are running while the green ON/AUTO switch is in AUTO, the circuit breaker overcurrent output relay is not programmed correctly. Follow the circuit breaker configure

If the green ON/AUTO switch light is not illuminated, check to see if there is a problem with the fan control switch or with the EKIP signaling module.

If any of the yellow Fan On Indicating Lamps are not illuminated, check to see if the fan itself has failed. Refer to 1VAL106902-MB for instructions on how to replace a cooling fan.

NOTICE

NOTICE: Each cooling fan has a built-in alarm that indicates if the fan's speed has dropped to 40% of its maximum speed. The yellow Fan On Indicating Light will turn off if the fan's speed drops below this value.

Load shedding event

For a fan failure event, the load shedding contact will close. Two possible causes include:

- Fan Speed Failure (Ex: Rotor is stuck, debris on blades hindering fan operation, etc.)
- DC Power Supply Failure

If load shedding had not occurred but either a fan speed failure or DC power supply failure has occurred, check to see if the load shed relays are properly engaging.

Maintenance

Cooling fans have a lifetime of ~40,000 hours. It is recommended to inspect and test the fans once per year. To test the fans refer to the Test Procedure section above.

Switchboard maintenance

General maintenance procedures

To obtain the best service from the switchboard, establish a periodic maintenance schedule. At a minimum, perform an annual check and overall maintenance procedure for the switchboard devices and all connections. Equipment subject to highly repetitive operation may require more frequent maintenance.

Keep a permanent record of all maintenance work. Include a list of periodic checks and tests, the date they were made, the condition of the equipment, and any repairs or adjustments performed. Maintenance employees should follow all recognized safety practices, such as those in the National Electrical Code (NEC), the Canadian Electrical Code (CEC), and in company and other safety regulations.

For specific information about the maintenance of devices, such as circuit breakers, relays, and meters, refer to the separate manuals provided with each device.

Observe the following important points:

- Periodically inspect the switchboard while under load to determine if there is any indication of overheating. If overheating or any other unsatisfactory condition is found, completely de-energize the switchboard and investigate. Look particularly for loose bolts and connections or overloading. Remove any accumulation of dirt or other foreign matter in the enclosure. Do not touch live parts while the switchboard is energized
- Plated parts may become dark over time due to oxidation. Do not remove this discoloration, as this will reduce the thickness of the plating

- Retorque terminal connections and hardware to the values specified in Table 1 to eliminate possible heating points. Transmission of vibrations through the building structure and conduits to the switchboard may loosen hardware. Turning the load off and on causes expansion and contraction between lugs and cables, which tends to loosen the lug hardware
- Do not open sealed circuit breakers or trip units, as this may disturb the calibration
- Switchboard enclosures equipped with filters are recommended to be inspected at least once a year
- Be sure to return all barriers to their original locations before re-energizing

Ambient temperatures and circuit loading

Switchboards are designed for installation where the average ambient temperature does not exceed 40°C (104°F). For higher temperatures, derating is required. The conductor temperatures within the enclosure may be as high as 90°C (194°F). Some parts of the circuit breakers, switches, and fuses may run hotter. Make sure to follow the load requirements for each device in the switchboard.

Short circuits

Generally, the overcurrent protective device on the circuit will prevent any electrical damage except at the point of the short circuit. Make a thorough inspection of the entire system after any large fault current to ensure that there has been no mechanical damage to conductors, insulation, or equipment.

In addition, the individual overcurrent protective device or devices that performed the short-circuit interruption must be inspected for possible arcing damage. Do not open sealed devices such as circuit breaker trip units. Replace any device that may have been damaged by the short circuit. For additional details on a device, refer to the applicable instruction manual provided with the device.

Arcing damage to insulation

Some organic insulating materials carbonize when subjected to the heat of an electrical arc and lose their insulating properties. Any insulation found to be carbon-tracked must be replaced before re-energizing.

Water-soaked equipment

Electrical equipment exposed to water can be extremely hazardous if reenergized without performing a proper evaluation and taking necessary actions. Reductions in the integrity of electrical equipment due to moisture can affect the ability of the equipment to perform its intended function.

Damage to electrical equipment can also result from flood waters contaminated with chemicals, sewage, oil, and other debris, which will affect the integrity and performance of the equipment. Ocean water and salt spray can be particularly damaging due to the corrosive and conductive nature of the saltwater residue.

Do not energize equipment that is exposed to flood or other contaminated water. Consult ABB Field Services for guidance.

When equipment has become exposed to non-contaminated water observe the following points during maintenance: Completely de-energize the switchboard. Carefully clean and dry all parts of the switchboard. When using heaters, make sure the temperature does not exceed 180° F. Replace all fuses. Inspect all individual devices for the entrance of water, dirt, or foreign matter. Replace all sealed devices and circuit breakers.

Before re-energizing the switchboard, perform a megohm resistance test, as described in the Testing and Inspection section on page 23. If assistance or guidance is required, contact your local service engineer. Your supplier's service shop may have facilities for reconditioning equipment and devices. Water soaked equipment will void the factory warranty.

Spare parts

Spare parts stock for the components of the switchboard, such as bus and insulators, is not recommended. When components must be ordered, please refer to the nameplate marking and shop drawing number and order by description. Replacement parts and devices, such as circuit breakers, meters, and switches, will vary due to the variety of installations.

Reference document numbers

Installation manuals

Additional technical information, instructions and installation manuals can be found in the following documents:

- Power panelboard
 - 1SQC900003M0201 – ReliaGear neXT Panelboard – Low Voltage Power Panel – Bulk pack/ Unassembled Version
 - 1SQC900004M0201 – ReliaGear neXT Panelboard – Low Voltage Power Panel – Assembled Interior Version
 - 1SQC900003M0202 - ReliaGear neXT Panelboard – Circuit Breaker Installation Guide
 - 1SQC900005M0201 – ReliaGear neXT – Reduced Energy Let-through Unit (RELT)
 - 1SQC900006M0201 – ReliaGear neXT – Surge Protection Device Unit (SPD)
 - 1SQC900010M0201 – ReliaGear neXT - Service Entrance Barrier
 - 1SDH000722R0001 – SACE® Tmax XT – Installation Instructions XT4
 - 1SDH002011A1002 – SACE® Tmax XT – Installation Instructions XT5
 - 1SDH002012A1002 – SACE® Tmax XT – Installation Instructions XT6
 - 1SDH002013A1001 – SACE® Tmax XT7 – XT7M – Installation Instructions XT7-XT7M
 - 1SDH001821A1002 – SACE® Tmax XT7 - User manual for use and maintenance of Ekip Touch Trip units for SACE® Tmax XT7 low-voltage molded-case circuit breakers
 - 1SDH002039A1002 – SACE® Tmax XT - Operation and maintenance manual for Ekip Touch Trip Units
 - 1SDH002031A1002 – SACE® Tmax XT2 - XT4 - User manual for use and maintenance of Ekip Touch Trip units for SACE® Tmax XT2 - XT4 low-voltage molded-case circuit breakers
 - 1SDH000722R0003 – SACE® Tmax XT UL – Installation instructions XT4 UL
 - 1SDH002013A1606 – SACE® Tmax XT – KLC-A STI, RONIS 1104, Kirk – XT7
 - 1SDH000719R0610 – SACE® Tmax XT – PLL XT1-XT3 Padlocks Device OP/CL
 - 1SDA066592R1 – SACE® Tmax XT – PLL XT2-XT4 Padlocks Device OP/CL
 - 1SDH002013A1604 – SACE® Tmax XT – PLL – Padlock device XT7 in open position
 - 1SDC007114G0201 – Arc flash energy reduction using ABB SACE® Emax 2 with second I Protection (2I) and Dual Settings
 - 1SXU210248C0201 – SACE® Tmax XT UL/CSA – Low voltage molded case circuit breakers UL489 and CSA CS22.2 Standards for the NEMA market
 - 1SDH001000R0524 – Ekip Signalling 2K - E1.2-E2.2-E4.2-E6.2-XT2-XT4-XT5-XT7-XT7M
 - 1SXU200040C0201 - SACE® Emax 2 low voltage power circuit breakers ANSI C37/UL1066/CSA standards
 - GEH6270 - Power Break II circuit breakers 800-4000 A frames, 240-600 Vac
 - 1SDH001000R0002 - Installation, operation and maintenance instructions for the installer and the user
 - SACE® Emax 2 E2.2-E4.2-E6.2
 - 1SDH000999R0002 - Installation, operation and maintenance instructions for the installer and the user
 - SACE® Emax 2 E1.2

Reference standards

All ABB switchboards meet the following standards:

- UL 50 Thirteenth Edition - Enclosures for Electrical Equipment, Non-Environmental Considerations
- UL 50E Second Edition - Enclosures for Electrical Equipment, Environmental Considerations
- UL 67 Thirteenth Edition - Standard for Panelboards
- UL 98 Fourteenth Edition - Enclosed and Dead Front Switches
- UL 489 - Thirteenth Edition - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
- UL 891 Twelfth Edition - Switchboards
- UL 969 Fifth Edition - Standard for Marking and Labeling Systems
- National Electric Code 2020 Edition
- NEMA PB1 2011 Edition - Panelboards
- NEMA PB2 2011 Edition - Deadfront Distribution Switchboards
- CSA C22.2 No. 244:19 Second Edition - Switchboards
- IBC 2018 - International Building Code
- CBC 2019 - California Building Code
- UL 1066 Fourth Edition – Standard for Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures



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