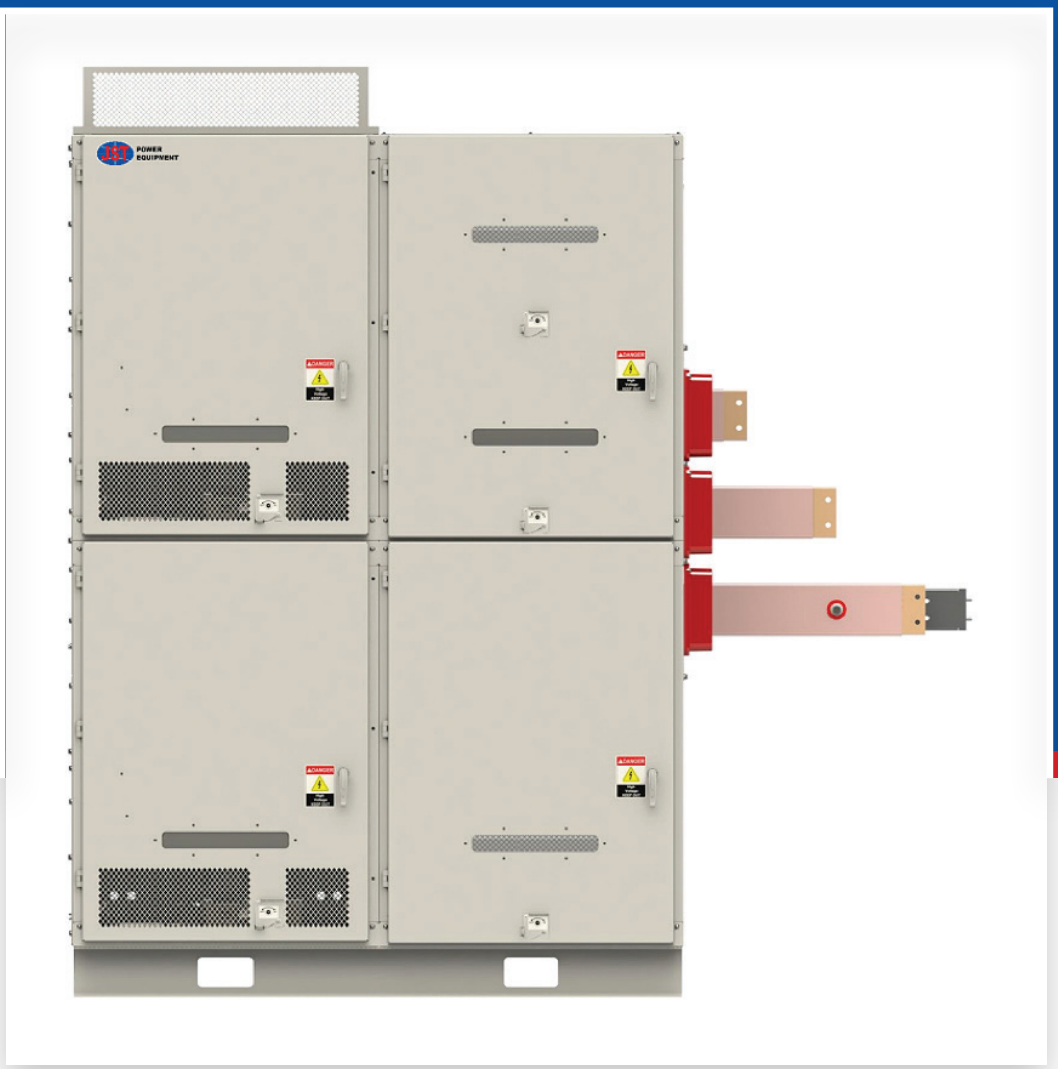
JST POWER EQUIPMENT



INSTALLATION, OPERATION and MAINTENANCE MANUAL

J100CLAD™ Standard Switchgear

J3Mag™ Vacuum Circuit Breaker

J100CLAD / J3Mag – *Contents*

J100CLAD / J3Mag – *Introduction*

GENERAL

This manual is intended to be used solely for information purposes on the handling, installation, operation, and maintenance of the J100CLAD switchgear. These instructions are intended solely for use by fully qualified personnel and are not to be substituted for proper training, experience, or supervision. Please read this manual carefully and store it with other documents that are provided along with the switchgear. JST Power Equipment provides solutions for different installation configurations. For this reason, some details and variations may not be in this manual. As needed, consult the latest technical documents, or contact a JST Power Equipment representative. To the extent permitted by law and not otherwise prohibited by contract, JST Power Equipment will not be responsible for any special, indirect, incidental, or consequential loss or damage of equipment, loss of power, cost of capital, or any other claims for damages or injury resulting from the use of the information in this manual.

⚠WARNING

TESTING AND OPERATION OF THE BREAKER MUST BE WITHIN THE NAMEPLATE RATINGS. OPERATION OF A BREAKER BEYOND ITS RATING MAY CAUSE AN EQUIPMENT FAILURE LEADING TO PROPERTY DAMAGE, PERSONAL INJURY AND/OR DEATH.

SAFETY NOTES & WARNINGS

The operation of this equipment relies on the correct handling, installation, and maintenance of the breaker. Prior to taking any steps set forth in this manual, please make sure of the following precautions:

- Ensure that all procedures and standards required by relevant law as well as safe practices are followed during all actions mentioned in this manual.
- Make sure not to exceed the ratings of the circuit breaker.
- Make sure that the operator has **this manual and other relevant documents** on hand while following any of these instructions.

In order to protect the personnel following the instructions in this manual, he following practices should be followed:

- **DO NOT** work on a closed circuit or energized circuit breaker.
- **DO NOT** attempt to change the functionality of the interlocks.
- **DO NOT** work on a breaker before ensuring all components are disconnected and grounded.
- **DO NOT** work on a breaker with power supplied to the secondary control circuit.
- **DO NOT** leave the breaker in an intermediate position between the Disconnect, Test or Connect positions.

Important Safety Alerts

These important safety alerts are intended to notify personnel to situations where death, personal injury, or property damage may occur:

The personnel responsible for following any of these instructions must be knowledgeable of all levels of OSHA safety procedures and other safety precautions. This manual is to be followed by qualified personnel and is to be used for assistance and shall not be deemed a substitute for proper training or experience. In case additional information is needed, refer to the nearest JST Sales office. Be sure to quote the order number assigned by JST.

⚠WARNING

ENSURE THAT POLYESTER, ACETATE, NYLON, OR RAYON CLOTHING ARE NOT WORN BY PERSONNEL WHILE WORKING UNDER POSSIBLE EXPOSURE TO ELECTRIC ARCS OR FLAMES. THE OSHA STANDARD 1910.269 STATES THAT NOT FOLLOWING THESE INSTRUCTIONS CAN CAUSE DEATH OR SEVERE BURNS AND DISFIGUREMENT, FR RATED CLOTHING IS STRONGLY RECOMMENDED.

⚠DANGER

USED TO INDICATE A SITUATION THAT WILL CAUSE SERIOUS INJURY OR DEATH IF INSTRUCTIONS ARE NOT FOLLOWED PROPERLY.

⚠WARNING

USED TO INDICATE A SITUATION THAT COULD POSSIBLY CAUSE SERIOUS INJURY OR DEATH IF INSTRUCTIONS ARE NOT FOLLOWED PROPERLY.

⚠CAUTION

USED TO INDICATE A SITUATION THAT COULD POSSIBLY CAUSE MINOR OR MODERATE INJURY IF INSTRUCTIONS ARE NOT FOLLOWED PROPERLY.

NOTICE

USED TO INDICATE IMPORTANT INSTRUCTIONS, SAFETY INSTRUCTIONS, AND OTHERS.

J100CLAD / J3Mag – *Introduction*

SWITCHGEAR AND BREAKER DESCRIPTIONS

J100CLAD is a medium-voltage, metal-clad, air insulated switchgear of modular construction. This equipment is designed for indoor applications up to 15kV system voltage and is equipped with vacuum circuit breakers. After its delivery, external power and auxiliary connections may be required. J3MAG is a magnetically actuated breaker with independent pole actuators. The fewer moving parts of the design compared to mechanical stored energy type mechanisms eliminates lubrication and most maintenance requirements. Normal operations are conducted with doors closed, except for maintenance and part replacements.

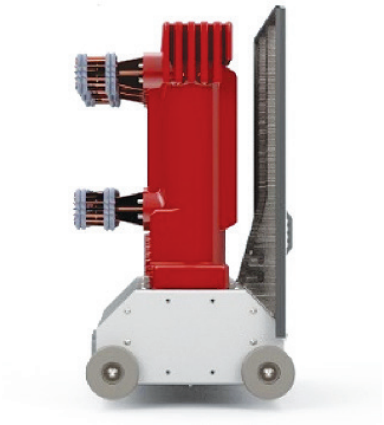


Fig. 1.1. 50kA Breaker Poles

SWITCHGEAR AND BREAKER COMPONENT DESCRIPTIONS

Breaker poles (VI)

The breaker poles are mounted on top of monobloc actuator housing. Cast resin is used to enclose the live parts of the breaker to protect the poles from external interferences. The poles can be rated for 25kA, 31.5kA, 40kA, 50kA.

Racking Mechanism

J100CLAD utilizes a chain and socket mechanism to rack the J3Mag Circuit Breaker into the Connect, Test, and Disconnect position.

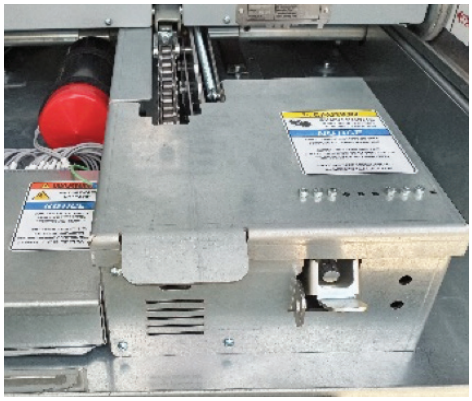
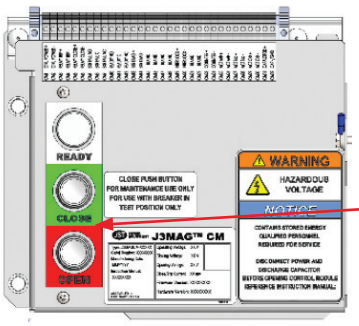


Fig. 1.2. Racking Mechanism

Control Module

The control module is composed of a single circuit board that is not user serviceable. This component is hard wired to a terminal block which allows for safe operation. Some of the components on the board are output relays, control and signals, AC/DC supply power, power electronics to control the actuator coils, and logic circuit/power electronics. The OPEN/CLOSE pushbuttons are located on the control module and serve to open and close the circuit breakers. Refer to the LM-RDI-001 J3MAG Control Module Manual for more information.



OPEN/CLOSE Push Buttons

Fig. 1.3. Control Module

Storage Capacitors

The capacitor stores the energy needed for the operation of the breaker. With a single charge, the capacitor can provide enough energy for an O-C-O (Open-Close-Open). This component can be found on the floor of the breaker compartment. A **blue "READY" light illuminates** to indicate that the circuit breaker is functional and ready to operate.

Figure 1.4. Storage Capacitor

J100CLAD / J3Mag – *Introduction*

Primary Contacts

The circuit breaker has self-aligning, fully automatic primary and secondary contacts allowing the operators to keep the front door closed throughout the racking operation. The moving primary contacts of the circuit breaker, also called tulips are a set of copper fingers held together with garter springs. They are connected when the breaker is in the CONNECT position and disconnected when the breaker is in the test or DISCONNECT position.

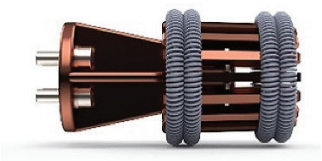


Fig. 1.5. Contacts

Secondary Disconnect

This component is responsible for connecting the auxiliary switches and actuator dive connections. The secondary disconnect is connected to the breaker during the CONNECT and TEST positions but disconnected at the DISCONNECT position.

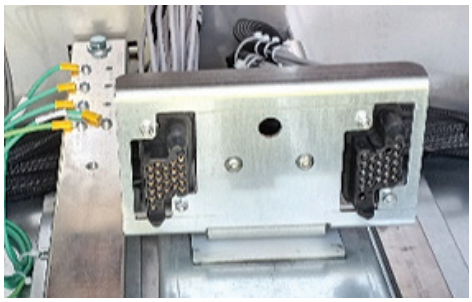


Fig. 1.6. Secondary Disconnect

Operation Counter

The main function of this component is to display the number of open operations that the breaker has performed over the life of the circuit breaker. The operation counter can be found on the front panel of the breaker.

Fig. 1.7. Operation Counter

Status Flags

Status flags are the indicators on every actuator that displays whether the breaker is in OPEN position (green), or CLOSED position (red) (ANSI).

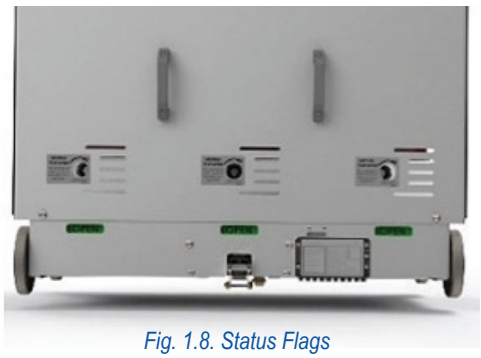


Fig. 1.8. Status Flags

Nameplate/Interference Plate

The nameplate provides information such as the ratings and serial number. This component can be found on the front of the breaker below the front panel and prevents accidental insertion of incorrect breaker.

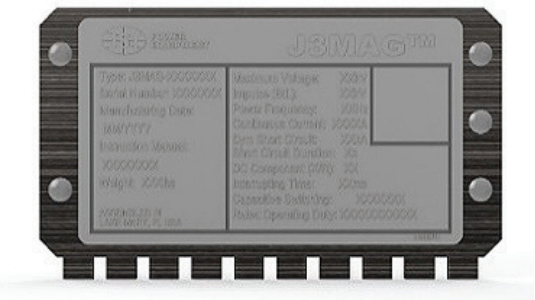


Fig. 1.9. Nameplate

Magnetic Actuator

J3Mag uses three independent actuators for interrupter operations, one actuator per pole. This design reduces moving parts making the actuator maintenance-free for the lifetime of the product.

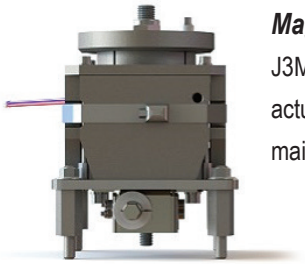


Figure 1.10. Magnetic Actuator

J100CLAD / J3Mag – *Introduction*

SWITCHGEAR COMPARTMENTS

The J100CLAD is divided into the following compartments:

Main Bus Compartment

Comprised of metal clad construction. Contains the main bus and connections to load side of primary bushings.

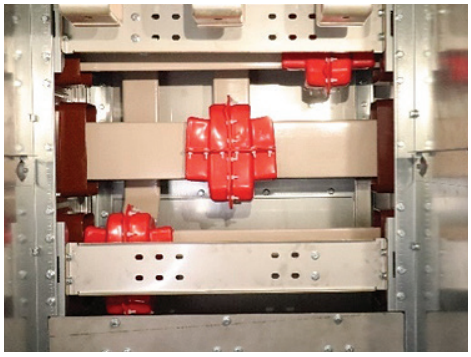


Fig. 1.11. Busbar Compartment

Cable Compartment

The cable compartment omprises the rear portion of the cubicle. It contains bus runbacks, zero sequence CT's, surge arrestors, etc.

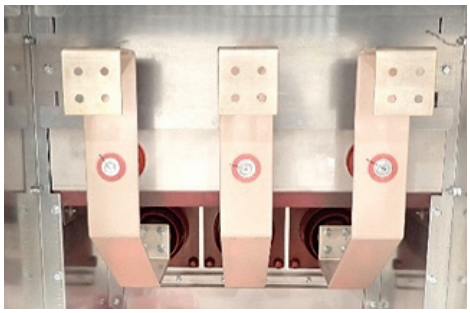


Fig. 1.12. Cable Compartment

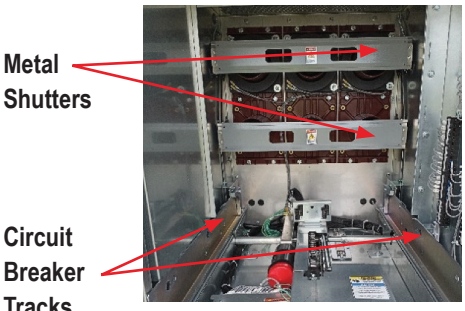


Fig. 1.13. Circuit Breaker Compartment

Circuit Breaker Compartment

The J100CLAD circuit breaker compartment houses/contains the racking mechanism, shutters, control module, current transformers, and other equipment necessary for breaker operation. A viewing window allows verification of the J3Mag OPEN/CLOSE status position with the compartment door closed.

Low Voltage Compartment

Used to house control components such as fuse holders, terminal blocks, and auxiliary relays. The breaker door usually holds relays, indicating lights and control switches. To tilt down the low voltage compartment, pull the spring-loaded slide-bolt latch from each of the sides of the compartment so the panel will be released and tilted down. To place the panel back in the straight position, simply raise the tray upward until latched in place.

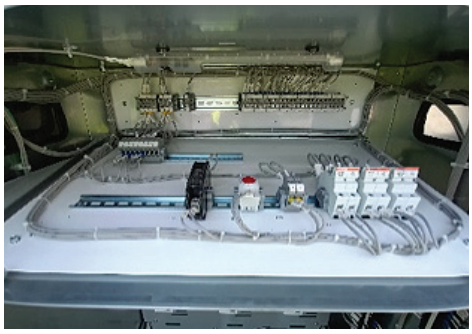


Fig. 1.14. Low Voltage Compartment

Auxiliary Compartments

Auxiliary compartments are the portion of the switchgear that encloses voltage transformers, control power transformers, or other miscellaneous.

Fig. 1.16. CPT Compartment

Potential Transformer Compartment

Main function is to provide housing for PTs and PT primary fuses.

Control Power Transformer

Main function is to provide housing for CPT rated up to 15kVA.

Draw Out Fuse Compartment

Houses removable truck for externally fixed CPT for ratings above 15 kVA.

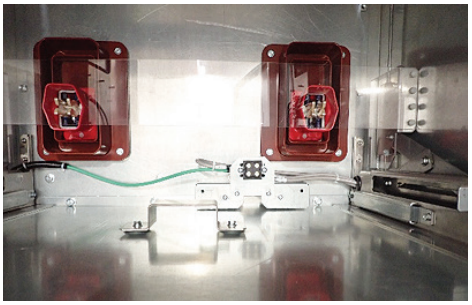


Fig. 1.15. PT Compartment

J100CLAD / J3Mag – *Introduction*

INTERLOCKS

The J100CLAD and J3Mag include the following interlocks designed according to IEEE standards to ensure the safety of the personnel while operating the equipment:

⚠WARNING

DO NOT ATTEMPT TO MODIFY, BY-PASS, OVER-RIDE OR ADJUST INTERLOCKS. INTERLOCKS MUST WORK AS INTENDED IN ORDER TO PROTECT PERSONNEL AND EQUIPMENT.

Racking Interlocks

The racking interlock lever must be depressed in order to begin racking the circuit breaker in any direction from any positive position (Disconnect, Test, and Connect). The racking lever is blocked from actuation when the circuit breaker is CLOSED, therefore only actuates when the breaker is OPEN. The ability to close the circuit breaker is mechanically and electrically blocked unless it is in one of the two positive positions (TEST and CONNECT) and the racking lever is in the up position. If the circuit breaker is in between positions, the circuit breaker cannot be closed.

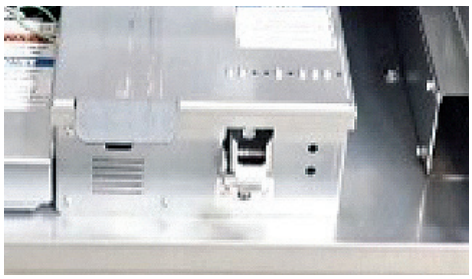


Fig. 1.17. Racking Interlocks

Interchangeability Interlock

The nameplate tabs are cut according to the breakers rating and corresponds to features in the switchgear. This mechanism allows for compatible ratings and construction of the breaker to be inserted into the breaker compartment.

Figure 1.18. Interchangeability Interlock

CPT Secondary Interlock

Interlock to prevent racking out CPT before opening secondary circuit breaker.

J100CLAD / J3Mag – *Receiving, Handling and Storage*

Before receiving the equipment, make sure that the area follows the service conditions described on Appendix C – J100CLAD and J3MAG Service Conditions.

RECEIVING THE PRODUCT

After receiving the equipment, check that it is still properly packed, and that the nameplate information matches the order confirmation data. Make sure that all the items in the packing list were delivered. If any damage is encountered, photograph it. Contact your JST Power Equipment representative within the first five days of receiving the switchgear. JST's standard shipping method is "FOB Factory" unless the contract documents say differently. JST Power Equipment is not responsible for damage after delivery of the equipment to the carrier.

There are two options for the shipping of the J3Mag breaker. It can be shipped in the CONNECTED position inside the switchgear or separately. If separately, the J3Mag is shipped with proper protection and a plastic cover to avoid water infiltrations during the shipping process. To keep the circuit breaker clean, keep the plastic covers on during loading and unloading of the breaker.

HANDLING THE PRODUCT

NOTICE

ENSURE ALL DOORS AND FRAMES ARE CLOSED AND LATCHED BEFORE REMOVING THE CIRCUIT BREAKER. DO NOT REMOVE SHIPPING BASE UNTIL SWITCHGEAR IS AT THEIR FINAL DESTINATION TO AVOID DAMAGE TO THE EQUIPMENT. DO NOT USE FORKLIFT FOR JACKING AS IT MAY CAUSE DISTORTIONS AND DAMAGE TO THE EQUIPMENT.

The J100CLAD switchgear and J3Mag circuit breaker should not be lifted without proper lifting equipment. To place the circuit breaker in proper height for installation, a lift truck is recommended.

- Always transport frames upright.
- Do not put stress on any insulating parts or terminal of the breaker.
- Do not use front handles to pull circuit breaker unless it is in the full disconnect position.
- Do not use embedded pole assembles or primary leads of embedded poles for moving the circuit breaker. This may damage and alter the alignment of the pole assemblies.

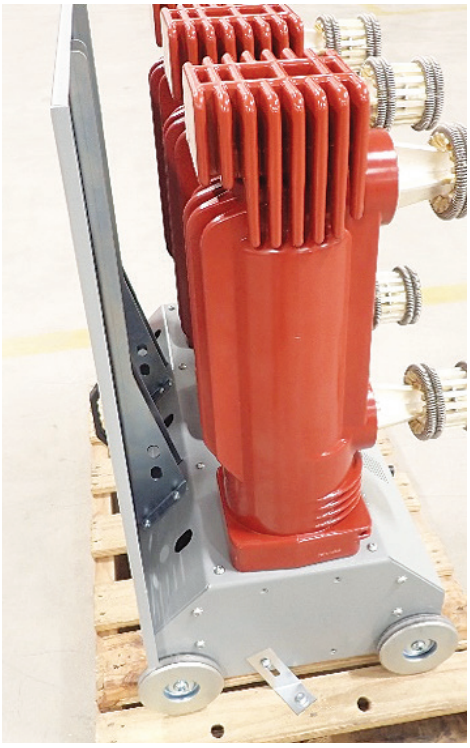


Fig. 2.1. Breaker on Pallet

STORING THE PRODUCT

Keep the equipment in dry and clean indoor ventilated areas. The floor should be well-drained and paved so that the equipment is not damaged over time.

For long term storage, turn on heaters, if equipped. Remove the plastic wrap used for protecting during shipment and cover with a moisture barrier such as a tarp until the switchgear is put into service. Do not store equipment outdoors. Leave a minimum 4' (four feet) gap on the back of the equipment for maintenance purposes.

Circuit breakers are made to be installed permanently as soon as they are delivered. In case that does not happen, the packaging of the circuit breaker must be replaced with the original material supplied.

J100CLAD / J3Mag – *Installation*

ON SITE TRANSPORTATION

The installation of the J100CLAD switchgear should be carried out by personnel with special qualification and experience. To move the switchgear to its desired destination, use one of the following methods: Towing, Crane, Forklift or Jacks and Rollers.

NOTICE

THE USE OF EQUIPMENT OTHER THAN SPECIFIED BELOW MAY RESULT IN PHYSICAL DAMAGE TO THE EQUIPMENT.

Towing

- Ensure the chains used to move the switchgear are of the proper rating, have been inspected and meet all required safety margins and standards.
- Secure chain to the holes on each end of the base as well as to the towing equipment.
- Use protection of the lower edges of the switchgear as needed to protect from damage.
- Make sure that the floor is consistent enough to handle the weight of the equipment.

Crane

- Attach slings or chains to the shipping channel extensions (if requested) by using a spreader bar and slowly lift the switchgear.
- Use the crane to move it close to its final destination.
- Use a forklift to position each unit. If using chains or wire rope slings, use a squared four-inch block of wood to protect the equipment from damage.

Figure 3.1. Crane

Forklift

- Insert forks through shipping base according to the yellow “LIFT HERE” label so that it is under the entire bottom of the equipment (from front to rear).
- Slightly tilt forks rearward and carefully lift switchgear.
- Move frame to desired location and carefully lower equipment into position.

Jacks and Rollers

- Use jacks on each corner of the shipping base to raise the switchgear and move steel pipe rollers to relocate switchgear to desired destination.

SHIPPING BASE

After the switchgear is moved to its final destination, the shipping base should be removed by following these instructions:

Figure 3.2. Shipping Base

- Open switchgear doors. If breakers were installed for shipment, remove the lower position breakers.
- Remove bolts securing the base to the equipment.
- Close and latch all doors. Use jacks on corner of the shipping split to raise the switchgear enough to be able to remove the shipping base. Keep all corners leveled to avoid distortion to the base of the equipment.
- Place a piece of wood in each of the four corners of the base and slowly lower one side until the equipment’s weight is shifted to the corresponding wood piece. Repeat this on the other three sides.
- To remove the pieces of wood, use a pry-bar to lift each of the corners.
- Secure the switchgear units by bolting to the floor. (Refer to JST factory drawings)

J100CLAD / J3Mag – *Installation*

CONNECTIONS

Connection to Ground Bus

The switchgear comes with the ground bus bars bolted to each frame. After installation, connect ground bus bars between shipping sections, and to the station ground with a cable or bus of equal or larger gauge than the housing ground bus. Make sure NOT to run cable or bus in conduit.

Installation of Bus Bar Connections between Shipping Splits

The factory assembles the main bus bar in each section. At shipping splits, the main bus bar and splice plates are shipped loose for field installation. Refer to the General Assembly Drawings. The contact surfaces of the bus at bolted joints are plated. Clean contact surfaces with a clean cloth. Be careful not to remove or tarnish plating.

Remove necessary barriers and boots to gain access to main bus compartment and bolt the main bus. Refer to Target Torque Values on Page 22 for more information on the torque of the bolt. Ensure all barriers and boots are reinstalled.

Secondary and Control Connections

In the Low Voltage Compartment, use the inner connect wire opening to access the connections between shipping splits. The interconnection between sections should be disconnected and with a tag on each end. Reconnect those two ends referring to the connection diagram specific to the project.

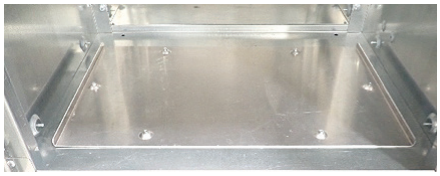


Figure 3.8. Bottom entry plate

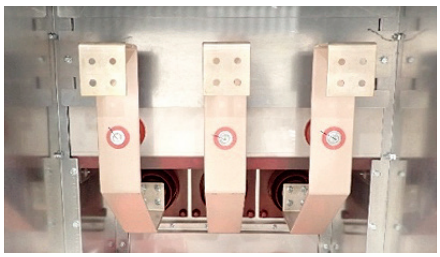


Figure 3.9. Bottom Entry Primary Busbar Connection

Primary Cable Connections

In the General Arrangement drawings, identify if the access to the primary cables is provided through the roof or floor. In the final assembly, use grand plates of 1/8" (one-eighth of an inch) aluminum. Unbolt roof plate or floor plate, cutting holes for power cable conducts, reinstall roof plate or floor plate. Pull power cables with enough length for connection to lug pad. (Refer to Fig. 3.9)

⚠WARNING

ALL POWER CABLE ENTRIES MUST BE PROPERLY SEALED TO PREVENT ENTRANCE OF MOISTURE OR DUST.

Connection to Control Source

Refer to the connection diagrams to connect the control source leads to their respective terminal blocks. Top entries use rubber grommets which need to be cut with appropriate size center hole. Bottom entries use the 11"x2" opening to run wires from below.

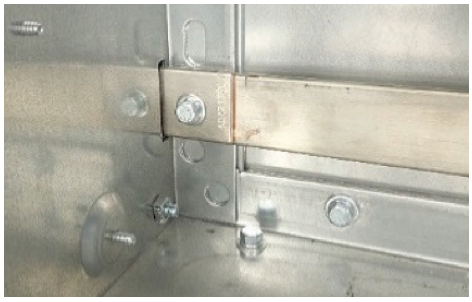


Figure 3.3. Ground Bus

Figure 3.4. Main Bus

Figure 3.5. Main Bus Connection

Figure 3.6. Boots

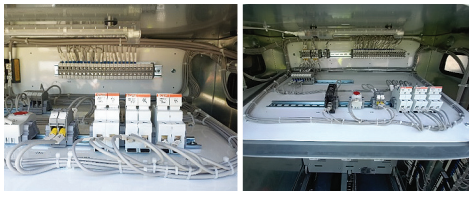


Figure 3.7. Secondary and Control Connections

J100CLAD / J3Mag – *Installation*

INSERTION AND WITHDRAWAL OF AUXILIARY MODULES

The J100CLAD switchgear may be equipped with Potential Transformers (PT) and Control Power Transformers (CPT) modules. The fuses can be replaced when the draw-out element is in Tilt-Out or Withdrawn position. Both assemblies have four positions: Connect, Disconnect, Tilt-Out, and Withdrawn.

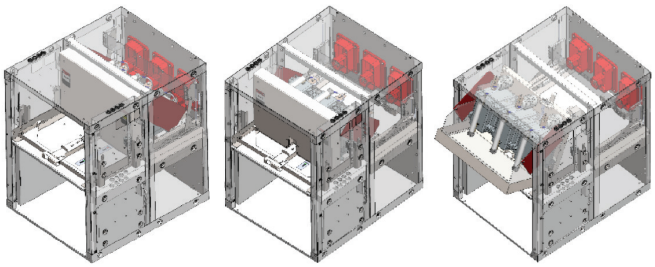


Fig. 3.10. WYE-WYE PT Connect, Disconnect, and Tilt-Out

"Connect" – PT or CPT is fully racked in with primary and secondary connected.

"Disconnect" – PT or CPT is racked out until the end of its linear motion. Primary and secondary are disconnected. Shutter assembly will block access to primary stabs.

"Tilt-Out" – PT or CPT continues to be racked out and starts rotating via a scissor-jack mechanism. During rotation, the tray assembly is discharged to ground and ready for service.

"Withdrawn" – PT or CPT is rotated back to Disconnect ready to be removed from compartment.

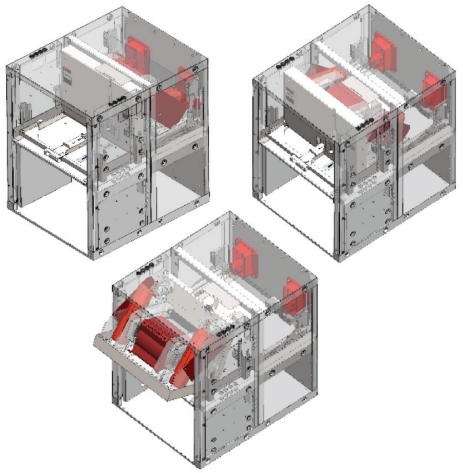


Fig. 3.11. Single-Phase CPT Connect, Disconnect, and Tilt-Out

Insertion of Auxiliary Modules

- Remove padlock from the PT or CPT module door (if included).
- Uncover the PT or CPT module racking port.
- In case component is withdrawn, use handles to push it into disconnected position. Each auxiliary unit is bolted to rails with 3/8" hardware. (See Figure 3.12 for reference)
- For the CPT only, open the module door and turn off the secondary breaker and padlock interlock to ensure secondary breaker cannot be closed. Then, close the module door.
- Insert racking handle into the racking port and rack in.
- Open the component door, switch the secondary breaker to the "ON" position, and padlock slide interlock in position.

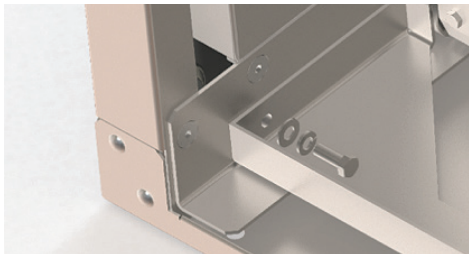


Fig. 3.12. Bolt to Rails

Fig. 3.14. Insertion of Auxillary Modules

Disconnect and Withdrawal of Auxiliary Modules

- Remove padlock from the PT or CPT module door (if included).
- Uncover the PT or CPT module racking port.
- For the CPT only, open the module door and turn off the secondary breaker and padlock the interlock to ensure secondary breaker cannot be closed. Then, close the module door.
- Insert racking handle into the racking port and rack until Disconnected.
- To withdraw the PT or CPT draw-out element, unfasten hardware and withdraw unit onto lifting truck.

Fig. 3.13. Insertion of Auxiliary Modules

J100CLAD / J3Mag – *Installation*

TESTING AND FINAL INSPECTION

After all previous steps are completed, follow these instructions to conduct a DC hipot voltage test.

1. Remove packaging, shipping materials, and shipping blocks from relays.
2. Make sure that the internal parts of the equipment are dry
3. Conduct potential tests phase-to-phase and phase-to-ground according to the table values below to make sure there is no damaged insulation.
4. De-energize and ground the main circuit and check the continuity of all circuits.

60HZ, RMS, Withstand Voltages *(Table 3.1)*

Rated Max Voltage (kV rms)	Factory Test (kV rms)	DC Field Test (kV)
4.76	19	20
15.0	36.0	37.5

CONTROL CIRCUIT CHECKOUT

NOTICE

VERIFY THE PROPER PHASING OF ALL MAIN CIRCUITS ACCORDING TO CONNECTION DIAGRAMS.

1. Rack and place all breakers in the DISCONNECT position.
2. Open all normal control power source to disconnect.
3. Check that each breaker is in the OPEN position.
4. Connect a temporary control power source to the circuit load terminals. Energize the control circuit from the temporary control power according to the electrical drawings provided for the specific project.
5. Rack all breakers to the TEST position, one by one. Make sure that each is connected to the control power by checking that the status flags indicate OPEN. (Refer to Figure 1.6)
6. Test all breakers for closing and tripping. Refer to Operation of Breaker, Page 15.
7. De-energize the control circuit. If the AC control is from transformers in the switchgear, remove the temporary separate source of control power and reinstall all fuses in the transformer circuit.
8. Set and verify all relays, regulators, and other devices for the proper operation of loads.
9. Remove shorting screws from the terminal blocks in the current trans former circuits and store screws in the corners of the blocks.

PLACING SWITCHGEAR INTO SERVICE

General

- When working on the equipment, make sure the main bus is de-energized and grounded.
- Ensure the breakers are all in the TEST position.
- Before energizing any part of the switchgear, ensure all mechanical devices are operating correctly.
- Operate the circuit breaker. Refer to Operation of Breaker on Page 15.
- Verify incoming and outgoing power connections are secure.
- Verify the phase sequence of the incoming power source before making connections. The connection diagram indicates which components are phase sensitive.
- Bolt the bus together and ensure bolted joints are still in accordance with Target Torque Values on Page 22.

NOTICE

BEFORE FOLLOWING THESE INSTRUCTIONS, BE SURE TO COMPLETE THE CONTROL CIRCUIT CHECKOUT

Energizing the Main Bus

1. Make sure all doors and panels are latched.
2. Energize the control equipment bus.
3. Verify all relays, regulators, and other devices are in working order.
4. Rack breakers to the CONNECTED position.
5. Energize the separate control power source.
6. Energize the incoming bus to the main breaker of the frame configuration.
7. Close the main circuit breaker energizing the switchgear main bus.
8. Close the desired feeder and tie circuit breakers.

J100CLAD / J3Mag – *Operation*

PRE-OPERATIONAL CHECKS

⚠WARNING

EVERY STEP FOR PRE-OPERATIONAL CHECKS SHOULD BE DONE BY PERSONNEL WITH QUALIFICATIONS AND EXPERIENCE WITH THE CIRCUIT BREAKER AND ITS INSTALLATION PROCEDURES.

The instructions below should be followed before operating the circuit breaker:

- Make a visual inspection of the breaker, ensuring no external parts interfering with moving parts of the breaker or switchgear.
- Check that there is enough air flow in the installation environment by ensuring that the air vents on the switchgear panels are not blocked.
- Check that the power supply voltage is between 85% and 100% of the rated auxiliary voltage.
- Establish the setting of the primary overcurrent protection.

BREAKER RACKING POSITIONS

The J3Mag circuit breakers are designed to have three positive stop racking positions:

"Disconnect" – Both primary and secondary contacts are disengaged.

"Test" – Primary contact are disengaged. Secondary (control) contacts are engaged for in cell breaker testing.

"Connected" – Primary and secondary (control) contacts are engaged.

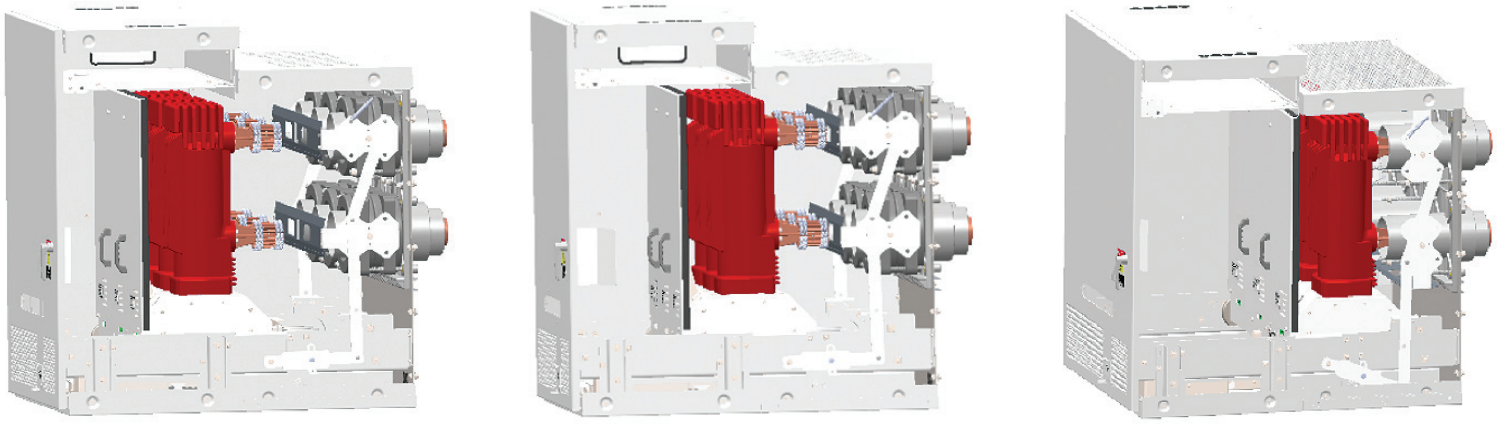


Fig. 4.1. Breaker in Disconnect, Test, and Connected positions

J100CLAD / J3Mag – *Operation*

INSERTION AND REMOVAL OF BREAKER

Before inserting a circuit breaker into the switch-gear compartment, please review the following:

- Make sure that the breaker and switchgear rating nameplates match.
- Make sure that the control module and switchgear control voltage ratings match.
- Ensure that breaker is in OPEN position.
- DO NOT force a closed-circuit breaker into or out of the compartment.
- DO NOT remove rating plate on circuit breaker. The rating plate prevents an improperly rated circuit breaker from being inserted into a switchgear compartment.

Insertion of Breaker

This section provides instructions for the insertion of the J3Mag Circuit Breaker into a J100Clad Switchgear compartment.

1. Verify through the window that there is no circuit breaker currently in the switchgear compartment.
2. OPEN switchgear breaker compartment door to fully open position.
3. Align lift truck on both sides with the switchgear compartment rails.
4. Lock the rear wheels of the lift truck. (Refer to Figure 4.4 and Figure 4.5)
5. Verify that the breaker is OPEN.
6. Push breaker into compartment until breaker disconnect lever lines up with the racking mechanism chain shuttle.

⚠WARNING

DO NOT ATTEMPT TO USE ANY OTHER ACCESSORIES OTHER THAN THE REQUIRED LIFT TRUCK TO REMOVE BREAKER FROM COMPARTMENT.

This section provides instructions for the removal of the J3Mag circuit breaker from a J100Clad Switchgear compartment.

1. Verify through the window that the circuit breaker has been opened and racked to the "Disconnect" position.
2. OPEN switchgear breaker compartment door to fully open position.
3. Align lift truck on both sides with the switchgear compartment rails.
4. Lock the rear wheels of the lift truck.
5. Push down on breaker disconnect lever to disconnect from racking mechanism chain shuttle.
6. Pull breaker from compartment onto lift platform.

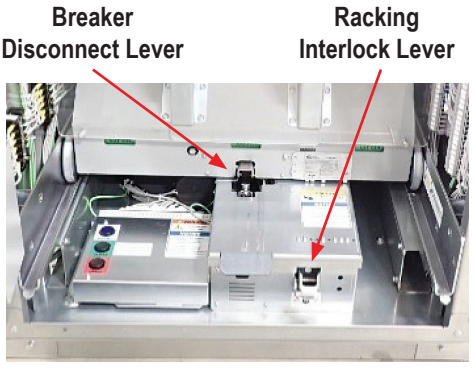


Fig. 4.2. Breaker disconnect lever and racking interlock lever

Fig. 4.4. Locked Rear Wheels of Lift Truck

Fig. 4.4. Locked Rear Wheels of Lift Truck

Fig. 4.5. Unlocked Rear Wheels of Lift Truck

J100CLAD / J3Mag – *Operation*

RACKING THE BREAKER

This section describes the procedures to operate the breaker between positive stop positions.

Before any operation:

1. Check that the circuit breaker is in the open position and the compartment door is closed and latched.
2. Insert racking handle into the appropriate breaker door opening.
3. Hold racking handle and depress racking interlock lever.
4. Turn racking handle clockwise (disconnect to test or test to connect) or counter-clockwise (connect to test or disconnect) for a half turn before releasing the racking interlock lever.

Disconnect to Test or Test to Disconnect:

1. Continue racking until desired position is reached (about 4 turns).
2. A positive stop will be felt, and the racking interlock lever will snap into the up position.

Connect to Test or Test to Connect:

1. Continue racking until desired position is reached (about 18 turns).
2. A positive stop will be felt, and the racking interlock lever will snap into the up position.

OPERATION OF BREAKER

Control Switch

Use the control switch on the front door of the switchgear to conduct electrical OPEN and CLOSE operations of the circuit breaker. The flag will be green when OPEN and red when CLOSED. (ANSI)

Control Module

Use the OPEN/CLOSE pushbutton to conduct electrical OPEN and CLOSE operations of the breaker. Refer to LM-RDI-001 J3Mag Control Module Manual for instructions on this operation.

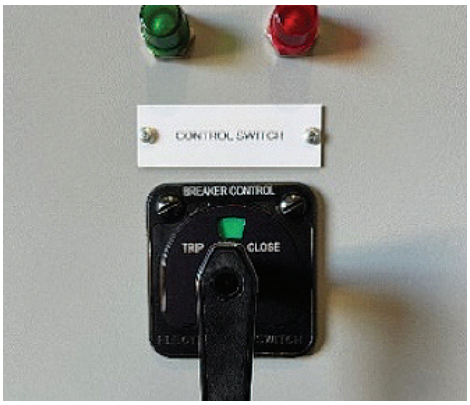


Fig. 4.6. Control Switch

MANUAL TRIP

This operation is not recommended if the breaker is in the CONNECT position and should be used for maintenance operation only. The J3Mag circuit breaker can be manually opened (not closed) through the Manual Trip Port. Before conducting this operation, check that the status flag states CLOSED and that the Stored Energy “Ready” Indicator is off.

Fig. 4.7. Manual Trip

J100CLAD / J3Mag – *Technical Data*

J100CLAD SWTICHGEAR RATINGS *(Table 4.1)*

Rated Max Voltage (at 60Hz)	Rated Volt. Range Factor	Power Frequency Withstand Voltage 60Hz, 1 Minute	Lightning Impulse Withstand Voltage (BIL)	Rated Main Bus Continuous Current	Rated Short-Circuit and Short-Time Current Withstand (2 Seconds)	Rated Momentary Short-Circuit Current Withstand (10 Cycles)
kV rms	K	kV rms	kV Peak	Amperes	kA rms, Sym.	kA rms, Asym.
4.76	1	19	60	1200, 2000 3000, 4000	25	65
					31.5	82
					40	104
					50	130
8.25	1	36	95	1200, 2000 3000, 4000	40	104
15	1	36	95	1200, 2000 3000, 4000	25	65
					31.5	82
					40	104
					50	130

• The switchgear assembly is designed for use with type J3Mag circuit breakers. • Switchgear assemblies can be supplied with UL-label.

J3MAG CIRCUIT BREAKER RATINGS *(Table 4.2)*

Rated Max Voltage	Nominal Voltages	Power Frequency Withstand (Hi-Pot)	Rated Lightning Impulse Withstand (BIL)	Continuous Current	Rated Short-Circuit and Short-Time Current	Rated Close and Latch Current
kV rms	K	kV rms	kV Crest	Amperes	kA rms	kA Peak
4.76	2.4, 4.16	19	60	1200, 2000 3000	25	65
					31.5	82
					40	104
					50	130
8.25	4.8, 6.9, 7.2	36	95	1200, 2000 3000	40	104
15	6.9, 7.2, 8.4, 12, 12.47, 13.2, 13.8, 14.4	36	95	1200, 2000 3000	25	65
					31.5	82
					40	104
					50	130

• Rated Voltage Range factor is K = 1.0 for all circuit breakers. • Maximum Permissible Tripping Time Delay (Y) is 2-seconds for all circuit breakers.

AUXILIARY CONTACT & TOC SWITCH SETTINGS *(Table 4.5)*

Rated Voltage	600 VAC, 250 VDC
Switching Capacity	Up to 16A
Dielectric Withstanding Voltage	2500 VRMS
Contact Resistance	Up to 10mΩ (Average 4mΩ)
Insulation Resistance	1000MΩ min. initial
Number of Poles	9(52A) - 9(52B)
Indexing	90°
Contacts	Break Before Make
Terminal Type	Screw
Construction	Closed

CAPACITOR RATINGS *(Table 4.4)* (for circuit breaker magnetic actuation)

Rated Maximum Voltage	Continuous Current	Interruption	Capacitor Rating
kV, rms	Amperes	kA, rms	VDC, µF
4.76-15	1200	25	250, 16000
		31.5	
	2000-3000	25	250, 30000
		31.5	
	1200-3000	50	250, 30000

J100CLAD / J3Mag – *Technical Data*

STANDARDS AND SPECIFICATIONS

J100CLAD switchgear and J3Mag circuit breaker has been tested in accordance with:

- IEEE Std C37.04-2018
- IEEE Std C37.09-2018
- IEEE Std C37.20.2-2015
- IEEE Std C37.54-2002
- IEEE Std C37.55-2020

WEIGHT

J100CLAD Switchgear Weights *(Table 4.6)*

Continuous Current	Approximate Weight	
Amperes	Pounds	Kilograms
1200	3550	1610
2000	5200	2359
3000	5200	2359

- This is an approximation of the switchgear weight without a breaker. The true weight of the frame will depend on the configuration and components of each project.
- For the weight of a frame with a circuit breaker, add the weight of the respective switchgear and breaker per frame

Auxilliary Module Weights *(Table 4.8)*

Auxiliary Module	Approximate Weight	
	Pounds	Kilograms
PT	361	163
CPT	218	99

- 5kV potential transformers unit with 3 PTs. Subtract 35 lbs for each PT not required.
- 15kV potential transformers unit with 3 PTs. Subtract 90 lbs for each PT not required.
- Weight for CPT is for 15 kVA.

J3Mag Circuit Breaker Weights *(Table 4.7)*

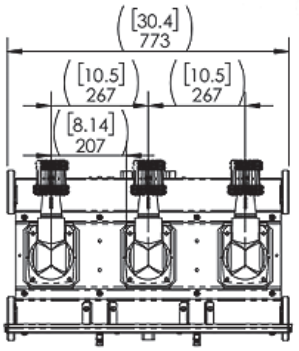
Rated Short-Circuit and Short-Time Current	Continuous Current	Approximate Weight	
kA rms	Amperes	Pounds	Kilograms
31.5	1200	321	146
	2000	321	146
	3000	546	248
50	1200	531	241
	2000	546	248
	3000	546	248

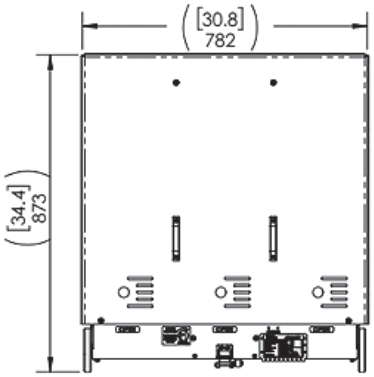
CONTROL MODULE TROUBLESHOOTING

For instructions on troubleshooting the control module, refer to the LM-RDI-001 J3Mag Control Module Manual.

J100CLAD / J3Mag – *Technical Data*

DIMENSIONS





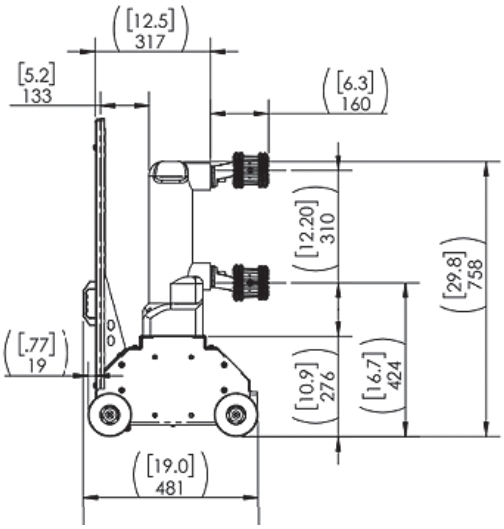
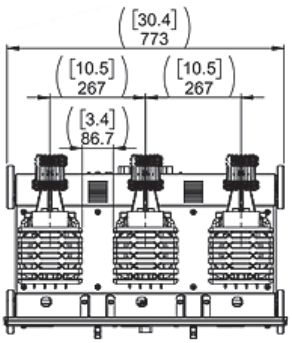
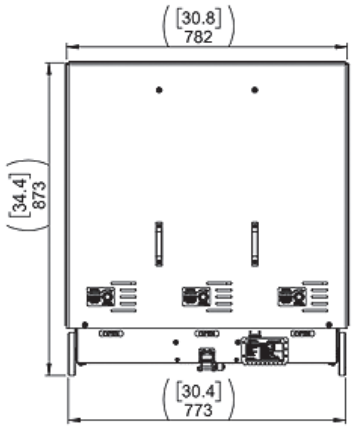


Fig. 4.8. Dimensions for 25kA and 31.5kA circuit breaker





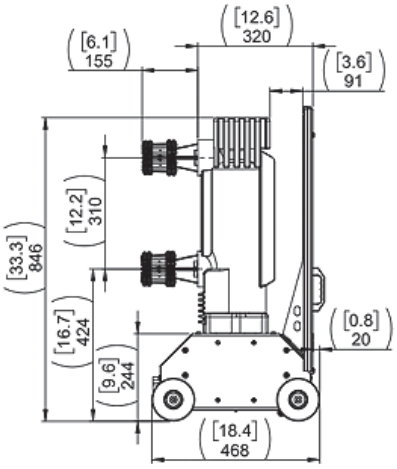
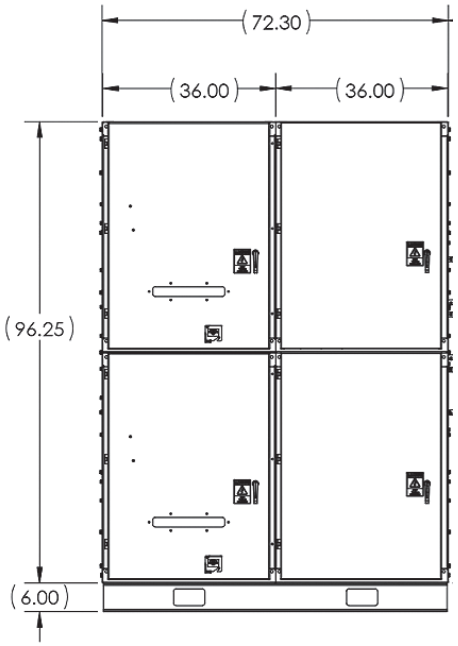


Fig. 4.9. Dimensions for 40kA and 50kA circuit breaker



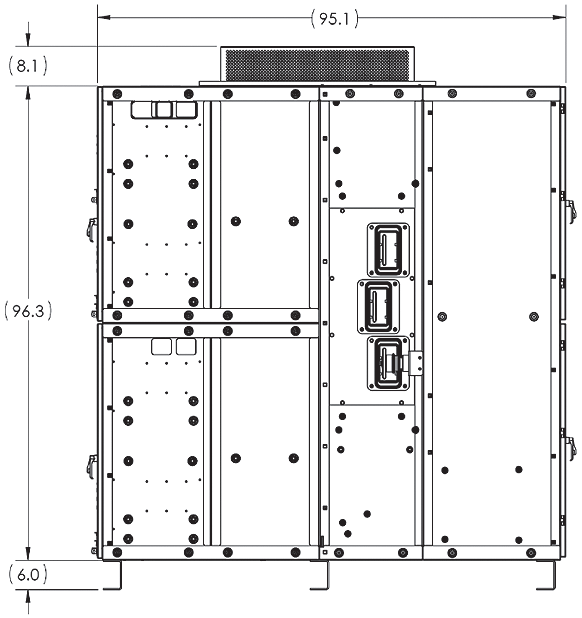


Fig. 4.10. Dimensions for 31.5 kA Switchgear

J100CLAD / J3Mag – *Maintenance*

SWITCHGEAR AND BREAKER INSPECTION

IEEE recommends conducting frequent checks on switchgear and breaker equipment. Be sure to apply most frequent checks along with the least frequent ones. For example, after one year, apply the frequent checks along with the yearly checks.

NOTICE

MAKE SURE TO CONDUCT ALL INSPECTIONS AFTER A FAULT INTERRUPTION EVENT.

Frequent checks (every six months) recommended for the switchgear maintenance:

- Check that there are no loose parts, warping, unusual noise, or atypical vibrations in the front and back of the equipment. Do not block any of the ventilation openings.
- A clean dry cloth should be enough for any accumulation of dust/dirt over time.
- If blown, PT and CPT fuses should be replaced with those specified in the project Bill of Materials.
- Open and close each circuit breaker, one at a time, and verify proper operation.
- Open circuit breaker, rack the breaker from Connected to Test to Disconnect. Verify racking mechanism is operating properly.

SWITCHGEAR MAINTENANCE

Every year, perform the following operations:

⚠ DANGER

TURN OFF THE POWER SOURCE OF THE SWITCHGEAR BEFORE ANY INSPECTION OR MAINTENANCE PROCEDURE. MAKE SURE THAT THE EQUIPMENT IS DE-ENERGIZED AND GROUNDED. CHECK OUTGOING TERMINALS TO ENSURE THERE IS NO BACKFEED VOLTAGE CONDITION.

SWITCHGEAR INSPECTIONS

- Check all indicators and meters.
- If any heaters or thermostats are used, check that those are operating as expected.
- Make sure wires have no wear or damage.
- Clean insulation such as phase bus insulation, surge arresters, standoff insulations, and through wall bushings with a dry cloth or OSHA approved cleaner.
- Make sure bolts are properly secured. Refer to Target Torque Values on Page 22.
- Withdraw and clean draw-out components. After, clean contacts.
- Remove air filters (if equipped). Clean with water or replace as necessary.

Every two years, perform the following operations:

- Inspect secondary wiring bundles for discoloration. Replace wires as needed.
- Inspect primary insulation system for accumulated dust. If necessary, clean with a dry cloth or an OSHA approved cleaner.
- Check the calibration of protection relays.

Every ten years, perform the following operations:

- Tighten all secondary control wire connections.
- Torque all primary conductor connection bolts according to Appendix B – Target Torque Values.

J100CLAD / J3Mag – *Maintenance*

BREAKER MAINTENANCE

Although the magnetically actuated operating mechanism of the J3Mag circuit breaker is maintenance free, visual inspection and maintenance on other components is required. The goal of the maintenance operations described in this manual is to keep the circuit breaker in good condition for as long as possible.

The vacuum interrupters require no maintenance. The operating mechanism of the breaker requires inspections and proper maintenance to reach its expected life.

Before any maintenance operation on the circuit breaker:

- Make sure breaker is OPENED and in the DISCONNECT position.
- Open breaker compartment door.
- Remove the control power and allow 10 minutes to confirm the discharge of the capacitors in the compartment.
- Breaker should now be ready for maintenance.

After any maintenance that requires untightening screws:

- Retighten the bolts according to Target Torque Values on Page 22.

A J3Mag circuit breaker is expected to need a visual inspection every five years unless it exceeds 10,000 normal load operations. If the breaker is stored in harsh, dusty, or humid environments, or is applied to unusual service conditions, or is operated 2,000 times or more per year, the breaker may need annual inspection and maintenance. After each interrupted fault, the breaker must be inspected, and the primary circuit must be field tested. Refer to Breaker Inspections and Functionality Tests below.

If cleaning of surfaces such as the breaker contact bushings is necessary, use dry cloth. Make sure to clean any discolored surfaces due to overheating on the contact areas.

BREAKER INSPECTIONS AND FUNCTIONALITY TESTS

- Make a visual inspection of the circuit breaker to ensure there is no contamination, electrical discharge, or corrosion.
- When the breaker is not connected to the load, conduct a few opening and closing operations.
- Make a visual inspection to ensure isolating contacts are clean and components are not damaged.
- Rotate the contact clusters to ensure smooth movement.
- Retighten all screws and nuts.
- Make sure the lubrication on the tulip contacts is in good condition.
- Make a visual inspection on the racking mechanism to ensure that the chain is properly lubricated, and components are not damaged.
- Make sure to rack the circuit breaker in and out to all 3 positions to ensure the functionality of the circuit breaker racking mechanism.

SPARE PARTS

JST recommends having spare parts in stock so that production downtime is minimized. The parts and quantity will change depending on customer and usage of the equipment. This choice should be made by the customer based on their own experience and knowledge.

REPAIRS

Repairs and replacement of spare parts and accessories should be done only by JST Power Equipment or qualified and trained personnel.

Spare Parts *(Table 5.1)*

Part Name	Description	Part Number	Qty.
Control fuses	Spare Fuses, Breaker Control, up to 6A, 250V, box of (10)	ATQR6	1
Capacitor	250VDC, 16000 µF	ALS70A163NP250	1
	250VDC, 30000 µF	ALS80A303QT250	1
Control Module	Spare Breaker Control Module, rated from 48 VDC to 125 VDC and 120 VAC	J3MAGCM-1	1
Touch Up Paint	ANSI 61, 12oz can	2RE51	1
Lubricant	Tulip Lubricant, NO-OX-ID (1-pint)	10203	1
	Racking Mechanism Lubricant, Isoflex Topas NB 52, 50g	0041310221	1

J100CLAD / J3Mag – *Electric Circuit Diagrams*

SAMPLE CONTROL MODULE SCHEMATIC

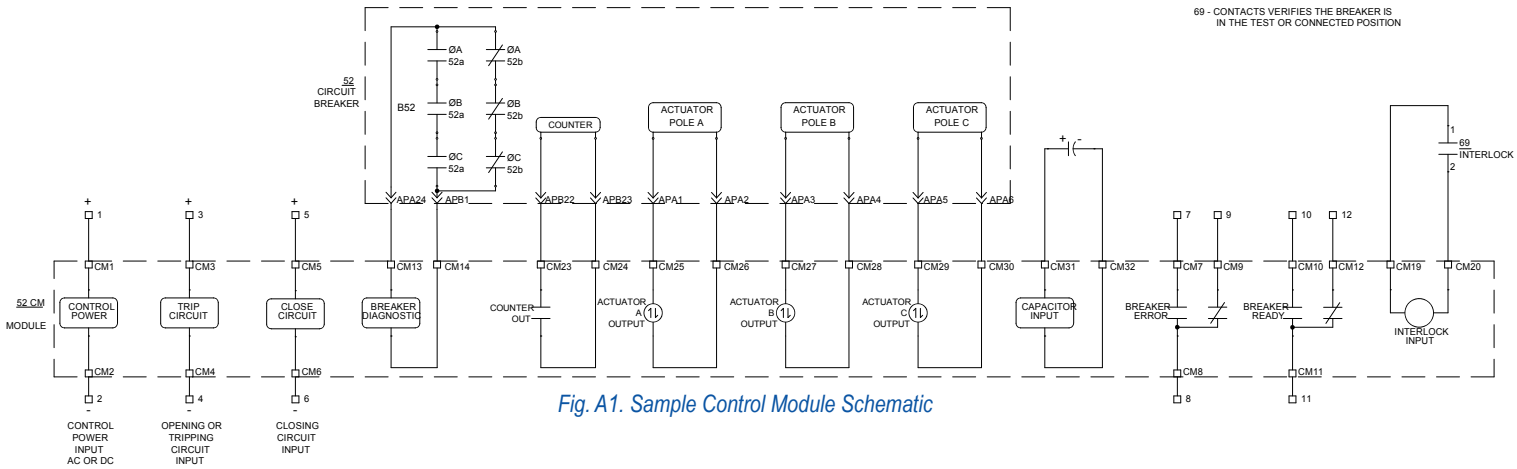


Fig. A1. Sample Control Module Schematic

For additional information on the control module such as connections and troubleshooting, refer to the LM-RDI-001 J3Mag Control Module Manual.

SAMPLE BREAKER CONTACT SCHEMATIC

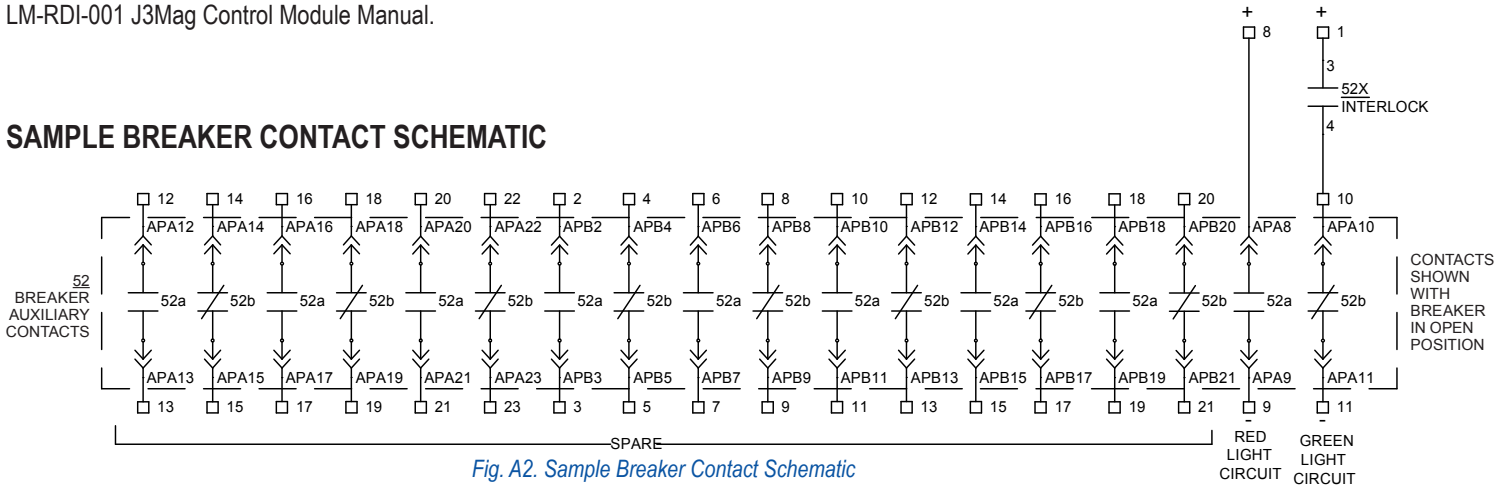
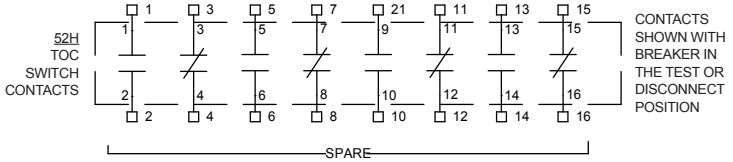


Fig. A2. Sample Breaker Contact Schematic

AUXILIARY CONTACT RATINGS *(Table A1)*

Rated Voltage	600 VAC, 250 VDC
Switching Capacity	Up to 16A
Dielectric Withstanding Voltage	2500 VRMS
Contact Resistance	Up to 10mΩ (Average 4mΩ)
Insulation Resistance	1000MΩ min. initial
Number of Poles	8
Indexing	90°
Contacts	Break Before Make
Terminal Type	Screw
Construction	Closed

TOC Switch Contact



*16-POLE TOC OPTION AVAILABLE

Fig. A3. Sample TOC Switch Contact Schematic

52H/TOC Switch,
8-Pole (4)a (4)b
16-Pole (8)a (8)b

J100CLAD / J3Mag – *Target Torque Values*

APPLICATION TORQUE CHART* *(Table B1)*

Application	Base Material	Hardware Material	Hardware Size	FT - LBS	Nm
Main Bus	Copper	Grade 5 Steel	1/2-13	60	81
Ground Bus To Frame	Copper-Steel	Grade 5 Steel	3/8-16	35	47
Insulator Standoffs	Steel	Grade 5 Steel	3/8-16 1/2-13	35 35	47 47
Primary Bushing	Brass	Grade 5 Steel	3/8-16	35	47
Primary Bushing To Backsheet	Epoxy	Grade 5 Steel	3/8-16	35	47

***NOTE:** Use These Values Unless Stated Otherwise

Reference Imperial Torque Chart *(Table B2)*

Diameter	Grade 5 Steel	
	Ft - Lbs (max load)	Nm (max load)
1/4 - 20	8	10
5/16 - 18	17	23
3/8 - 16	30	40
7/16 - 14	50	67
1/2 - 13	75	100
9/16 - 12	110	148
5/8 - 11	150	203
3/4 - 10	267	362
7/8 - 9	429	580
1 - 8	644	870

Reference Metric Torque Chart* *(Table B3)*

Diameter	Bolt Class 8.8 Steel	
	Ft - Lbs (max load)	Nm (max load)
M4	2	3
M5	4	5
M6	7	10
M8	18	25
M10	37	50
M12	64	88
M14	103	140
M16	161	218
M18	222	301

***NOTE:** For reference only. Use torque values unless stated otherwise. Torque values apply toward steel-to-steel. Dry bolting applications refer to manufacturers recommended torque requirements.

J100CLAD / J3Mag – *Service Conditions*

Altitude

- ≤ 1000m (3300ft.) above sea level. For application above 1000m derating according to C37.20.2 is applicable.

Climate

- If in high humidity and/or rapid temperature change environments, use proper protection equipment such as heaters.

Environment temperature

- Appropriate temperature is between - 5° C and + 40° C. The average should be less or equal to + 25° C.

Humidity

- 20-90% RH non-condensing.

J100CLAD / J3Mag – *Accessories*

⚠CAUTION

ALWAYS FOLLOW SAFETY AND PRECAUTION PRACTICES WHILE LIFTING CIRCUIT BREAKERS.
ALWAYS REFER TO THE PROPER INSTRUCTIONS FOR THE INSTALLATION OF THE LIFTING HOOK.
VERIFY THAT THE LIFTING HOOK IS NOT DAMAGED OR WORN BEFORE ITS USE.
USE OTHER FORMS OF SUPPORT ALONG WITH THE LIFTING YOKE WHEN THE CIRCUIT BREAKER IS UNDER SERVICE.
VERIFY THAT THE LIFTING DEVICE IS DESIGNED TO HANDLE THE WEIGHT OF THE BREAKER (REFER TO TABLE 4.7 CIRCUIT BREAKER WEIGHTS)

The following are available accessories that can be used with the J3Mag circuit breaker:

LIFT TRUCK

The lift truck is used to withdraw circuit breakers from the switchgear compartment. For instructions on how to operate and maintain the lift truck, refer to Lift Truck Manual.

BREAKER TEST BOX

The test box is mounted securely to the wall in the designated testing station. Once the breaker is racked out and taken to the testing station, open the door of the test box and it should look like the image below. The connection harness is then connected to the rear of the breaker. After successful connection, flip the power switch to “ON” and allow the capacitor(hidden) to charge. Once charged, the “READY” light will fully illuminate (this may take a few minutes) and the breaker is ready for testing. Hold the “OPEN” button down for one second and release. There will be an audible response from the breaker and the labels will flip to read “OPEN” across the bottom at all three poles. Wait a few seconds then hold the “CLOSE” button for one second and release. Again, there will be an audible response from the breaker and all three labels will flip to read “CLOSE”. If all operations happened as described the test was successful and no further action is required. If not, then the test was not successful and further testing is needed. At that point, please contact your JST representative.

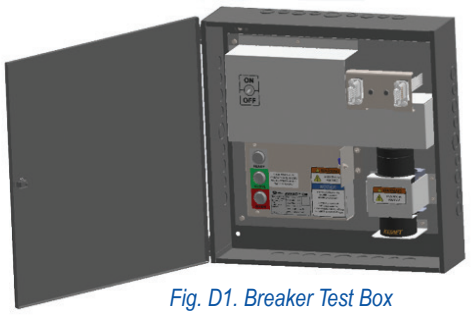


Fig. D1. Breaker Test Box

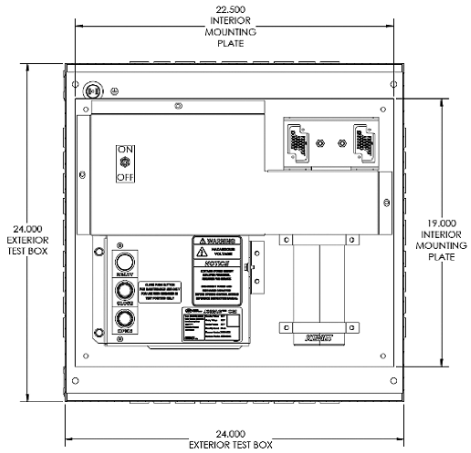


Fig. D2. Breaker Test Box with Dimensions

RACKING HANDLE

The racking handle is used to move the circuit breaker between the Disconnect, Test, and Connect positions. For the proper use of the racking handle, press down the racking interlock lever and rotate racking handle clockwise to rack in and counterclockwise to rack out.

J100CLAD / J3Mag – *End of Life of Product*

END OF LIFE OF PRODUCT

JST Power Equipment is dedicated to following the ISO 14 001 standards for environment protection from possible harm. Make sure to act in accordance with the proper requirements in the local, state, and national level. The equipment should be disposed according to the raw material of the product:

- Metal: Separation and recycling
- Thermoplastics: Recycling or disposal
- Epoxy resin: Separation of metal and disposal of remains
- Rubber: Disposal
- Oil: Draining and recycling or proper disposal
- Packing material: Recycling or disposal
- Rare earth metals: Recycling

JST POWER EQUIPMENT

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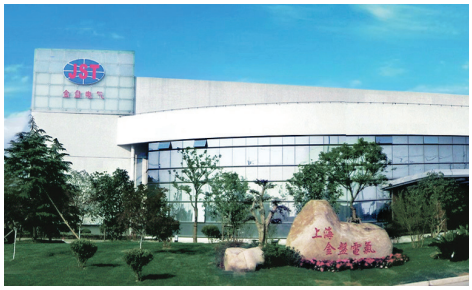
Nogales, Mexico

Haikou, Hainan

Wuhan, Hubei



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