

TriSync™ Three-Phase Vacuum Capacitor Switch Installation and Operation Instructions



Powering Business Worldwide

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Safety for life



Eaton meets or exceeds all applicable industry standards relating to product safety in its Cooper Power™ series products. We actively promote safe practices in the use and maintenance of our products through our service literature, instructional training programs, and the continuous efforts of all Eaton employees involved in product design, manufacture, marketing, and service.

We strongly urge that you always follow all locally approved safety procedures and safety instructions when working around high voltage lines and equipment, and support our “Safety For Life” mission.

Safety information

The instructions in this manual are not intended as a substitute for proper training or adequate experience in the safe operation of the equipment described. Only competent technicians who are familiar with this equipment should install, operate, and service it.

A competent technician has these qualifications:

- Is thoroughly familiar with these instructions.
- Is trained in industry-accepted high and low-voltage safe operating practices and procedures.
- Is trained and authorized to energize, de-energize, clear, and ground power distribution equipment.
- Is trained in the care and use of protective equipment such as arc flash clothing, safety glasses, face shield, hard hat, rubber gloves, clampstick, hotstick, etc.

Following is important safety information. For safe installation and operation of this equipment, be sure to read and understand all cautions and warnings.

Hazard Statement Definitions

This manual may contain four types of hazard statements:

DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

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

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in equipment damage only.

Safety instructions

Following are general caution and warning statements that apply to this equipment. Additional statements, related to specific tasks and procedures, are located throughout the manual.

DANGER

Hazardous voltage. Contact with hazardous voltage will cause death or severe personal injury. Follow all locally approved safety procedures when working around high- and low-voltage lines and equipment.

G103.3

WARNING

Before installing, operating, maintaining, or testing this equipment, carefully read and understand the contents of this manual. Improper operation, handling or maintenance can result in death, severe personal injury, and equipment damage.

G101.0

WARNING

This equipment is not intended to protect human life. Follow all locally approved procedures and safety practices when installing or operating this equipment. Failure to comply can result in death, severe personal injury and equipment damage.

G102.1

WARNING

Power distribution and transmission equipment must be properly selected for the intended application. It must be installed and serviced by competent personnel who have been trained and understand proper safety procedures. These instructions are written for such personnel and are not a substitute for adequate training and experience in safety procedures. Failure to properly select, install or maintain power distribution and transmission equipment can result in death, severe personal injury, and equipment damage.

G122.2

Product information

Introduction

Service Information MN230011EN provides installation instructions, operation information, and maintenance information for Eaton's Cooper Power series TriSync™ capacitor switches.

The information contained in this manual is organized into the following major categories: Safety information, Product information, Ratings and specifications, Installation procedure, Switch operation, Dimensions, and Service information. Refer to the table of contents for page numbers.

Read this manual first

Read and understand the contents of this manual and follow all locally approved procedures and safety practices before installing or operating this equipment.

Additional information

These instructions cannot cover all details or variations in the equipment, procedures, or process described nor provide directions for meeting every possible contingency during installation, operation, or maintenance. When additional information is desired to satisfy a problem not covered sufficiently for the user's purpose, please contact your Eaton Cooper Power series product representative.

Acceptance and initial inspection

Each capacitor switch is completely assembled, inspected, tested, and adjusted at the factory. It is in good condition when accepted by the carrier for shipment. Upon receipt of a capacitor switch, inspect the capacitor switch thoroughly for damage and loss of parts incurred during shipment. If damage or loss is discovered, file a claim with the carrier immediately.

Handling and storage

If the capacitor switch is to be stored for an appreciable time before installation, provide a clean, dry storage area. Locate the capacitor switch so as to minimize the possibility of mechanical damage.

When transporting or storing the switch, the contacts should be kept in the closed position to avoid damage to the vacuum bottle contacts.

Standards

TriSync capacitor switches are designed and tested in accordance with IEEE Std C37.66™ standard.

Quality standards

ISO 9001 Certified Quality Management System

Description of operation

The TriSync vacuum capacitor switch is a Three phase, Solenoid-operated vacuum switch. The solid polymer insulation system does not rely on gas, foam, or liquid dielectrics. Highly resistant to ozone, oxygen, moisture, contamination, and ultraviolet light, it is an environmentally safe capacitor switch. The TriSync capacitor switch has polymer bushings and is suitable for operation through a temperature range as shown in Table 1.

Ratings and specifications

Check switch ratings before installation

The TriSync capacitor switch must be applied within its specified ratings. Check data plate ratings and compare with the system characteristics at the point of application prior to installation. Table 1 list the ratings and specifications for the TriSync capacitor switch.

Ratings

All ratings meet or exceed values in IEEE Std C37.66™ standard for a distribution-class switch, where applicable.

Table 1. Ratings and specifications

Voltage Class	15 kV	25 kV	38 kV
Switch Type	110 BIL	150 BIL	200 BIL
Rated Maximum Voltage, 50/60 Hz			
Ungrounded capacitor banks, L-L (kV)	15.6	25	38
Solidly grounded capacitor banks, L-L (kV)	27	38	66
Impulse Withstand Voltage			
Open contact kV (BIL)	95	125	200
Line to ground (kV BIL)	110	150	200
Withstand Voltage, 50/60 Hz			
Power Frequency Dry Withstand (kV)	50	70	70
Power Frequency Wet Withstand (kV)	45	60	60
Continuous current 50/60 Hz (A)	200,400	200	400
Capacitive switching current 50/60 Hz (A)	200,400	200	400
Fault making peak current (A)	15,000	15,000	32,500
Symmetrical fault making current (A)	6,000	6,000	12,500
Withstand peak current (A)	15,000	15,000	32,500
Short-time symmetrical withstand current (A)	4,500	4,500	6,250
High frequency transient making peak current (A)	9,000/12,000*	9,000	10,000
Rated transient inrush frequency (Hz)	6,000	6,000	6,000
Creepage Distance			
Terminal to terminal (mm)	600	813	1,628
Terminal to ground (mm)	610	813	1,696
Operating Voltage Range, 50/60 Hz**			
110/120 Vac (V)	75-130	75-130	95-130
240 Vac (V)	150-260	150-260	N/A
Nominal Control Current			
110/120 Vac	27	27	36 open, 24 close
240 Vac	18	18	N/A
Open and close cycle time (msec)	100/100	100/100	125/100
Assembly weight, excluding control box (lb/kg)	225/102	225/102	475/215
Operating temperature range	-40 °C to +60 °C	-40 °C to +60 °C	-40 °C to +55 °C, -50 °C consult product line
Mechanical operations	50,000	50,000	50,000
Aux. Contact Rating			
110/120 Vac (A)	15	15	15
240 Vac (A)	15	15	N/A
110/120 Vdc (A)	0.20	0.20	0.20

* The 15.6 kV rated TriSync capacitor switch is available with an optional high frequency transient making peak current of 12 kA. Contact factory for additional information.

** Contact factory for more information regarding dc control voltages.

Note: The durability of the TriSync capacitor switch was demonstrated by completing a minimum of 50,000 mechanical operations after performing the Mechanical Life Test in accordance with IEEE Std C37.66™ standard. One operation is defined as 1 close and 1 open operation.

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Installation procedure

⚠ CAUTION

Personal injury. Sheds on epoxy encapsulation have sharp edges. Wear protective gloves when handling the unit. Failure to do so can result in cuts and abrasions.

T258.1

Check-out procedure

1. **Check data plate.** Make sure that ratings on the data plate are correct for the planned installation.
2. **Visually inspect the switch.** Visually inspect the switch for any damage to bushing sheds, terminals, tank, mounting frame or cables of trip handle.
3. **Install the switch.** Follow locally approved installation procedures.

High-voltage connections

For 15 & 25 kV designs – TCSA, TCSB, TCSF

1. **Ground the switch.** Make the ground connection to the ground connector located on the located on the switch frame.
2. **Make line connections.** Connect the primary leads to the switch terminals. The universal clamp-type terminals accommodate AWG No. 8 solid through 2/0 stranded conductor.
3. Recommended torque levels for line and load terminal hardware are 20–22 ft-lbs (27.1–29.8 N-m) not to exceed 30 ft-lbs (40.7 N-m).

For 38 kV designs – TCSE

1. **Ground the switch.** Make the ground connection to the ground connector located on the switch located on the switch frame.
2. **Make line connections.** Connect the primary leads to the switch terminals. The switch terminal utilizes the Standard NEMA 2 Hole termination, compatible lugs, following recommended lug hardware and torque, should be selected for customer wiring.

⚠ WARNING

Hazardous voltage. Solidly ground all equipment. Failure to comply can result in death, severe personal injury, and equipment damage.

T223.2

⚠ WARNING

This equipment is not intended to protect human life. Follow all locally approved procedures and safety practices when installing or operating this equipment. Failure to comply can result in death, severe personal injury and equipment damage.

G102.1

Control Wiring

Connections for control of the capacitor switch and auxiliary functions are made through the receptacles located on the bottom of the junction box. There are two different receptacles. The 12-pin receptacle is used for power and functional operation, and the 10-pin receptacle is use for switching auxiliary equipment.

Cable lengths and control boxes which house controller modules, are optional. If supplied the control box will be provided with wiring to junction box receptacles.

See additional details for control and auxiliary cables below;

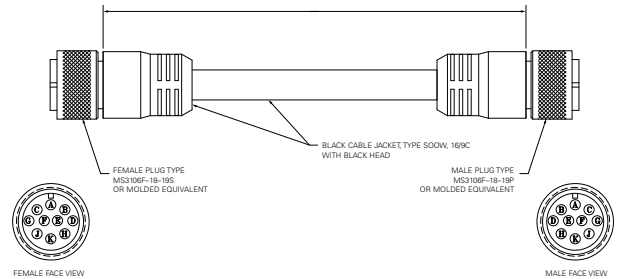


Figure 1. 10-pin auxiliary cable (CCR088P)

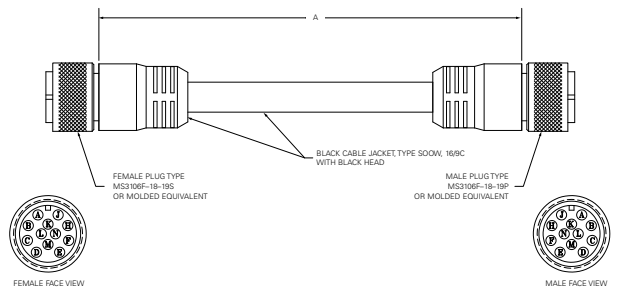


Figure 2. 12-pin control cable (CCR090P)

Three-wire control

Remote control of the TriSync capacitor switch is supplied by a single-pole, double-throw switch (three-wire control). Any manual switch, relay contact, time switch, voltage-, current- or photo-electric-controlled switch, or similar device can be used, provided the control circuit is energized per table 1 open and close cycle time (ms) this time is a little different for 38kV. it is given in the ratings table for each operation. **Eaton requires a 10-second cool-down period between open and close operations to ensure the switch coil does not overheat or become damaged.**

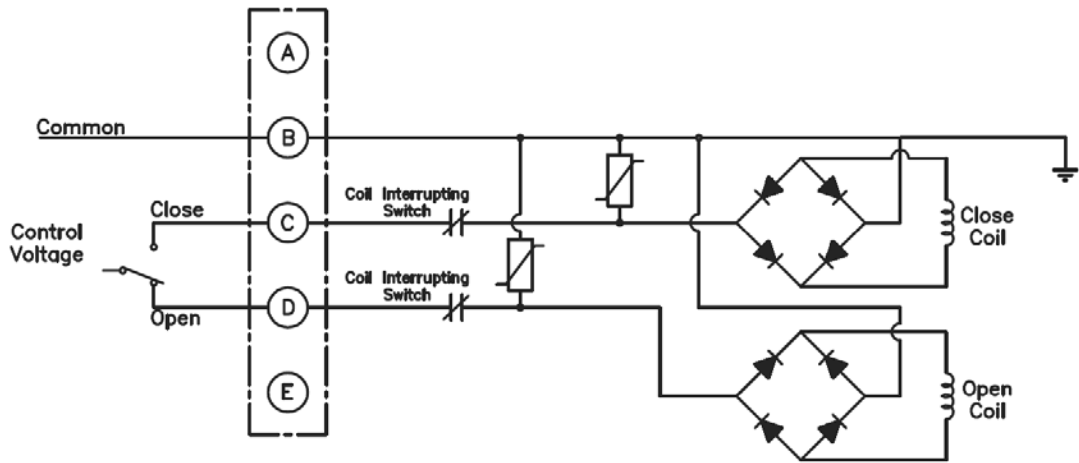
A connection diagram for a standard three-wire control is shown in Figure 3.

TriSync Three-Phase Vacuum Capacitor Switch

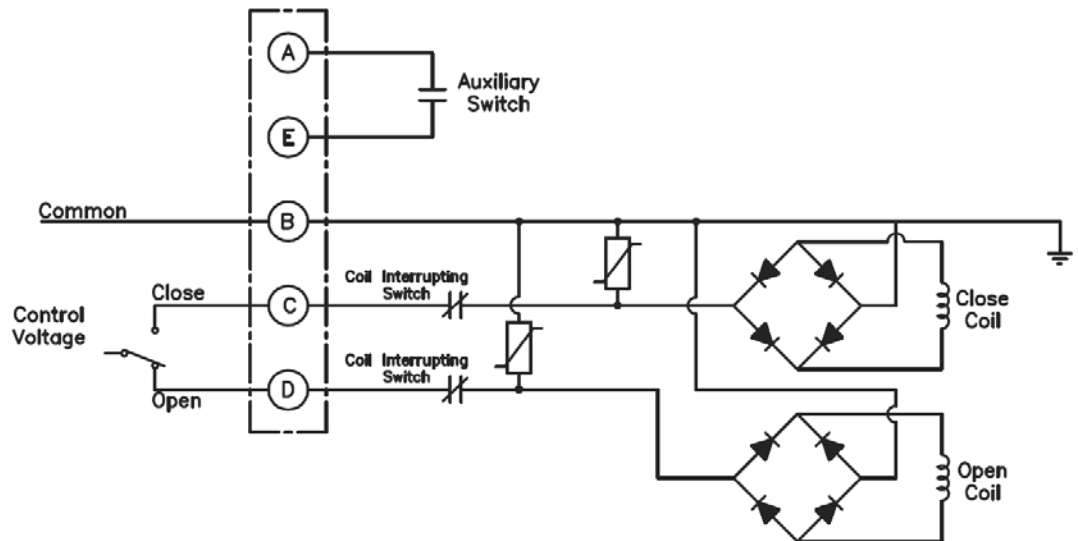
Wiring diagrams

Schematic diagrams of switch actuators wired for two- and three-wire controls are shown in Figure 3. Accessories are shown with dashed lines. These diagrams apply only for alternating current (ac) control voltage. For direct current (dc) control voltage please contact your Eaton's Cooper Power series product representative.

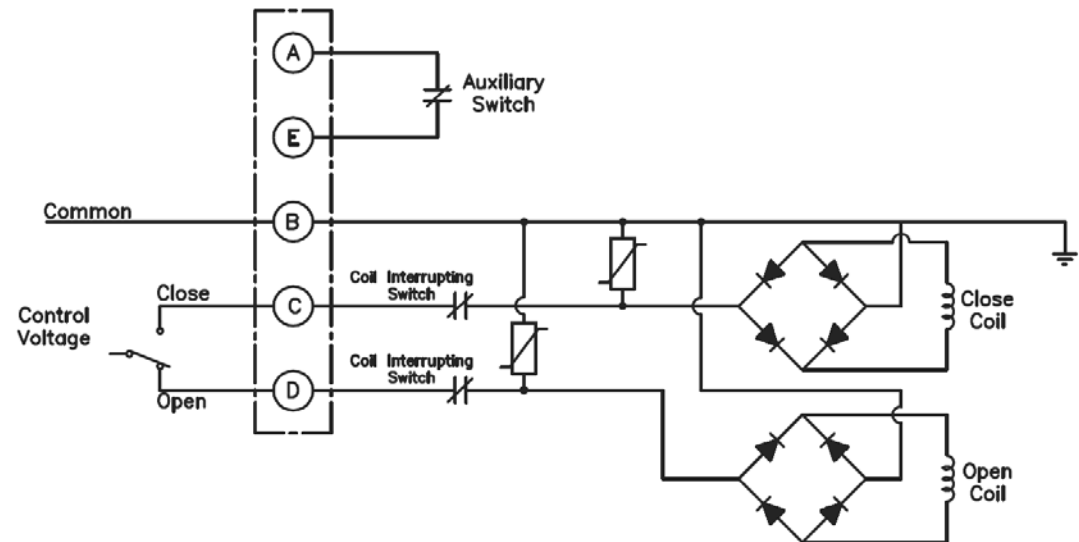
**A. 5-Pin
Three-Wire
Control**



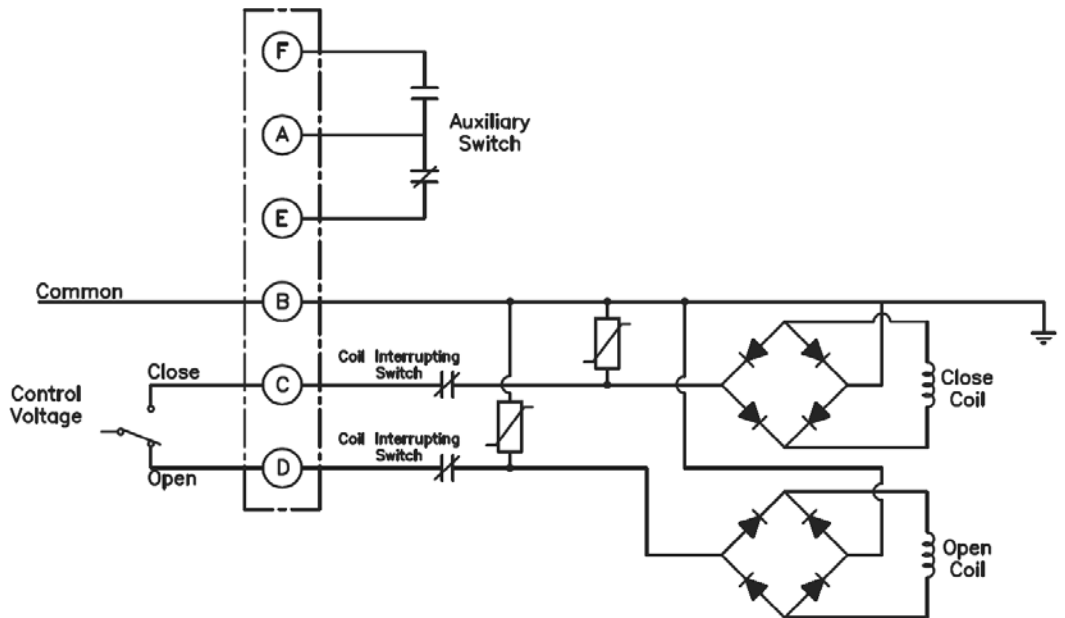
**B. 5-Pin
Three-Wire Control
with Form A Auxillary
Switch Accessory**



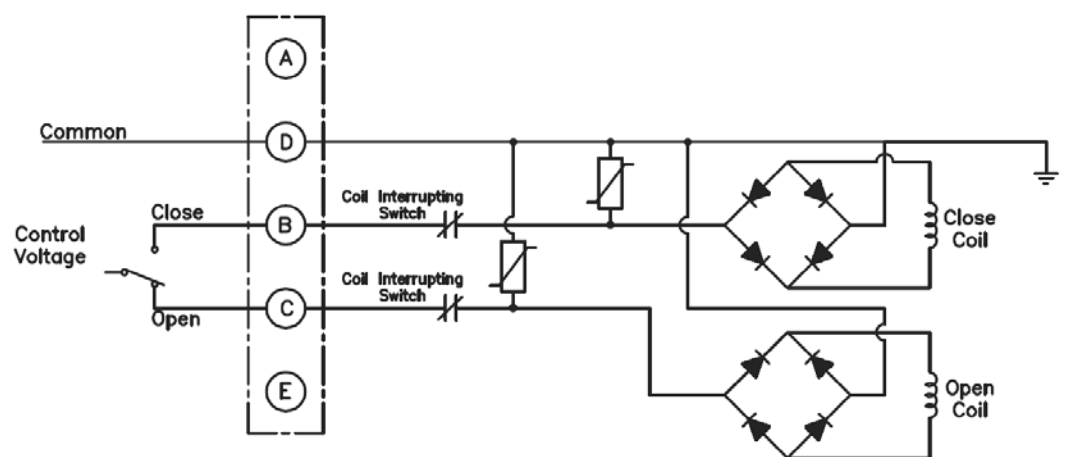
**C. 5-Pin
Three-Wire Control
with Form B Auxillary
Switch Accessory**



**D. 6-Pin
Three-Wire Control
with Form C Auxillary
Switch Accessory**



**E. 5-Pin
Three-Wire Control
Non-Standard**



**H. 10-Pin
Three-Wire Control with Direct Form
A + Direct Form B + Indirect Form A
Auxillary Switch Accessory**

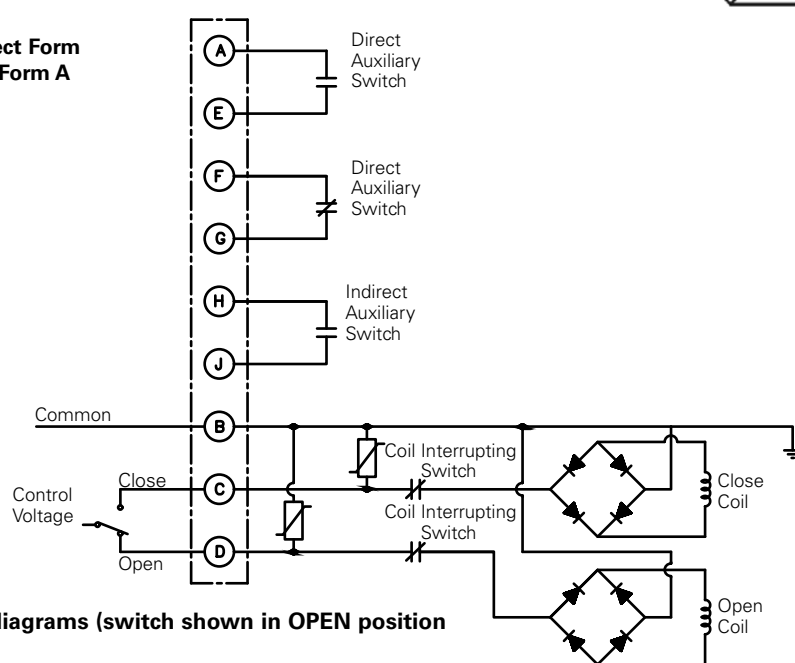


Figure 3. Typical connection diagrams (switch shown in OPEN position)

TriSync Three-Phase Vacuum Capacitor Switch

Switch operation

Electrical operation

The switch may be opened and closed electrically by applying rated control voltage to the proper terminals of the actuator receptacle. See “Installation procedure” on page 3 for electrical connections and operating time.

Manual hotstick operation



Hazardous voltage. This device is not a substitute for a visible disconnect. Follow all locally approved safety practices. Failure to follow proper safety practices can result in contact with high voltage, which will cause death or severe personal injury.

G112.1

The TriSync switch features a manual gang open operation, operating all three phases simultaneously.

The manual trip works with or without supply power. Each phase of the switch includes a switch position indicator.

This manual gang can be operated by engaging the yellow manual operating handle shown in Figure 4 and Figure 5, with a hotstick. This yellow handle extends beyond the frame for easy access, and includes a notch for hotstick engagement.

Control power is required to close the switch.

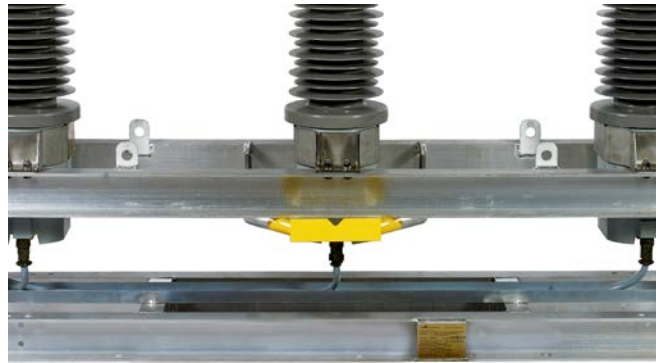


Figure 4. Front view of yellow manual operating handle



Figure 5. Side view of yellow manual operating handle

Dimensions

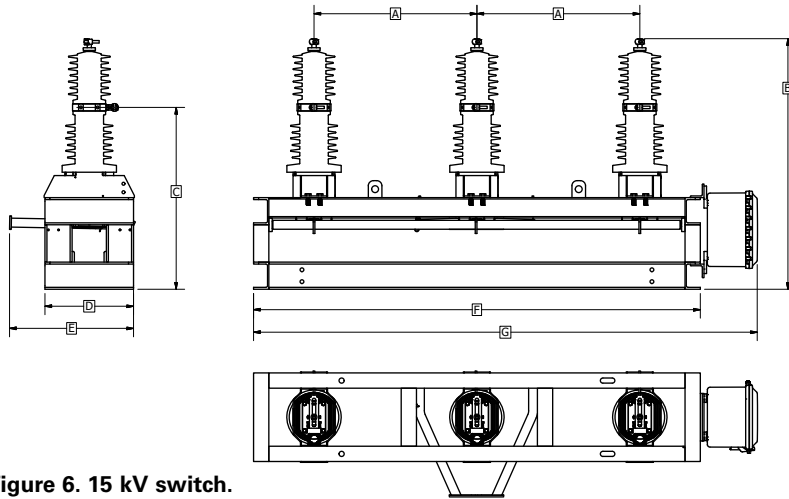


Figure 6. 15 kV switch.

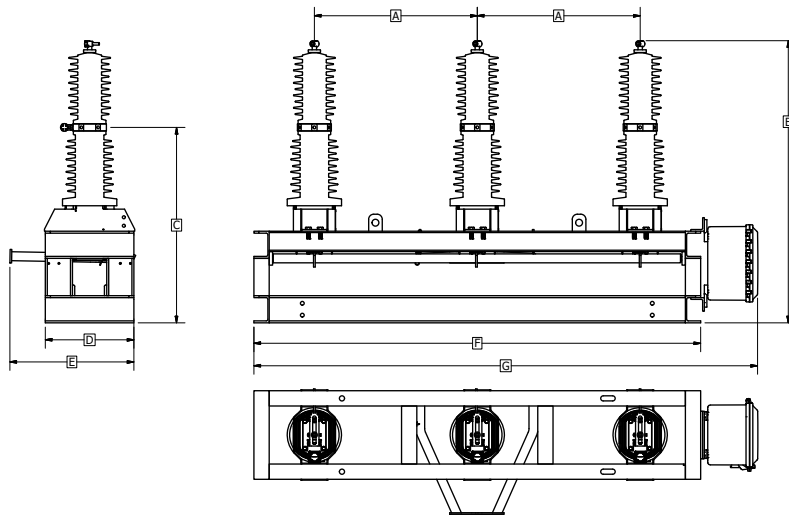


Figure 7. 25 kV switch.

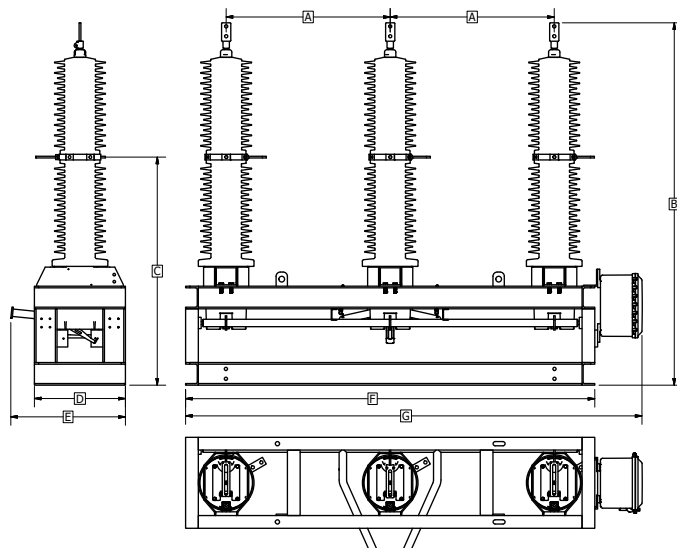


Figure 8. 38 kV switch.

Table 3. Dimensions

15 kV	
"A"	24.00" (610 mm)
"B"	36.92" (938 mm)
"C"	26.79" (680 mm)
"D"	13.05" (331 mm)
"E"	18.27" (464 mm)
"F"	65.81" (1672 mm)
"G"	74.20" (1885 mm)
25 kV	
"A"	24.00" (610 mm)
"B"	41.56" (1056 mm)
"C"	28.79" (731 mm)
"D"	13.05" (331 mm)
"E"	18.27" (464 mm)
"F"	65.81" (1672 mm)
"G"	74.20" (1885 mm)
38 kV	
"A"	29.00" (737 mm)
"B"	64.07" (1627 mm)
"C"	40.33" (1024 mm)
"D"	16.09" (409 mm)
"E"	20.20" (513 mm)
"F"	72.34" (1837 mm)
"G"	80.68" (2049 mm)

Figure 6, 7, 8. Dimensions of TriSync capacitor switch All dimensions are inches (mm). Dimensions shown are approximate. See Table 3.

Service information

Service requirements

The mechanical durability of the TriSync capacitor switch was demonstrated by completing a minimum of 50,000 operations after performing the Mechanical Life Test in accordance with IEEE Std C37.66™ standard. The switch requires no routine maintenance; however, the switch should be inspected on a regular basis to check for physical damage and to verify operation.

Frequency of inspection

Because these switches are applied under widely varying operation and climatic conditions, maintenance intervals are best determined by the user based upon actual operating experience.

WARNING

Hazardous voltage. The switchgear (apparatus and control) and high-voltage transformer must be in a test cage or similar protected area to prevent accidental contact with the high-voltage parts.

Solidly ground all equipment. Failure to comply can result in death, severe personal injury, and equipment damage.

T221.5

CAUTION

Radiation. At voltages up to the specified test voltages, the radiation emitted by the vacuum interrupter is negligible. However, above these voltages, radiation injurious to personnel can be emitted. See Service Information S280-90-1, *Vacuum Interrupter Withstand Test Voltage Ratings Information*, for further information.

G109.2



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

Eaton's Power Systems Division
2300 Badger Drive
Waukesha, WI 53188
United States
Eaton.com/cooperpowerseries