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Type NR oil switch installation and operation instructions

Powering Business Worldwide

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Safety for life

Eaton's Cooper Power series products meet or exceed all applicable industry standards relating to product safety. 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 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 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.

CAUTION

Indicates a hazardous situation which, if not avoided, could 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. G122.3

Product information

Introduction

Service Information MN230008EN provides installation instructions, operation information and testing procedures for the Type NR oil switch.

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 Weights, and Maintenance 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's Cooper Power series product representative.

Acceptance and initial inspection

Each switch is completely assembled, inspected, tested and adjusted at the factory and is filled to the correct level with insulating oil. It is in good condition when accepted by the carrier for shipment. Upon receipt of a switch:

1. Inspect the switch thoroughly for damage and loss of parts or oil incurred during shipment. If damage or loss is discovered, file a claim with the carrier immediately.
2. Check for oil leakage and tighten all bolts that may have loosened during shipment, especially the bolts attaching the head to the tank.

Handling and storage

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

Description of operation

The Type NR oil switch is a single-phase device for use on distribution circuits. Compact design makes this switch ideal for use on capacitor banks, especially pole-top installations. This switch is electrically operated and can be controlled by time switches, voltage- or current-sensitive control devices, or by single-pole, double-throw switches. An operating handle, which also serves as a contact position indicator, is provided for manually opening and closing the switch.

⚠ WARNING

Never manually close this switch into a faulted line. The make-and-latch rating of the switch applies only when it is electrically operated. Closing a switch manually on a faulted line can result in death, severe personal injury, and equipment damage. G127.0

Check switch ratings prior to installation

The 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. Tables 1 and 2 list the specifications and ratings for the Type NR oil switch.

Quality standards

ISO 9001 Certified Quality Management System

Ratings and specifications

Table 1. Electrical data (control)

Description	Rating	
Nominal operating voltage (50/60 Hz only) (Vac)	120	240
Operating voltage range (Vac)	95 – 130	190 – 260
Closing-motor current (amp)	1.9	.7
Switch response time, opening (sec)	4.0	4.0
Switch response time, closing (sec)	0.5	0.5

Table 2. Voltage and current ratings

Description	Standard	15 kV with 17" creepage	15 kV with 125 kV BIL	22 kV
Maximum Design Voltage, kV	15.0	15.0	15.0	22.0
Nominal Operating Voltage, kV	2.4-14.4	2.4-14.4	2.4-14.4	20.0
Basic Insulation Level (BIL), kV	95	95	125	125
60 Hertz withstand voltage, kV				
Dry, one minute	35	35	42	60
Wet, ten seconds	30	30	36	50
Continuous current rating, Amps	200	200	200	60
Load interrupting ability (inductive), symmetric Amps				
75-100% power factor	200	200	200	60
50-75% power factor	100	100	100	60
< 50% power factor	50A	100A	50A	60
Maximum capacitive current, amps (parallel bank-max)	200	200	200*	60*
High frequency transient current, Amps	12000	12000	12000	12000
Transient frequency, Hz	6000	6000	6000	6000
High frequency damping factor	.40 -.55	.40 -.55	.40 -.55	.40 -.55
Momentary rating, Amps asym.	9000	9000	9000	9000
Short time current Amps				
1/2 second,sym.	6000	6000	6000	6000
1 second, sym.	4500	4500	4500	4500
Close and latch rating, Amps asym.	9000	9000	9000	9000

*The 125 kV BIL switch and the 22.0 kV switch are rated for single bank switching only.

Installation procedure

⚠ WARNING

Do not operate this equipment if energized parts are not immersed in dielectric fluid. Operation when parts are not properly immersed in dielectric fluid may result in internal flashovers that will damage the equipment and can cause death or severe personal injury. G104.4

⚠ CAUTION

This equipment relies on dielectric fluid to provide electrical insulation between components. The dielectric strength of the fluid must be checked on a regular basis, as part of the routine maintenance inspection, to ensure that it is at or above minimum dielectric requirements. Use of this equipment with dielectric fluid that does not meet minimum requirements can result in internal flashovers that will damage the equipment and can cause personal injury. G107.3

Check-out procedure

1. **Untank the switch.** When untanking the switch for inspection, remove the four bolts that secure the tank and head casting. Trip the switch and carefully lift the mechanism.
2. **Check oil level.** Before installing the switch, check for proper oil level. With the mechanism removed from the tank, the oil level should be even with the top of the tank liner.
3. **Test oil dielectric strength.** If the switch has been stored for some time or is being relocated, perform a dielectric test on the oil. Refer to *Reference Data TD280022EN, Oil Specifications and Tests* for test procedures and test values. Oil that does not meet specifications should be replaced. Approximately 1-1/2 gallons are required.
4. **Replace head casting and mechanism in tank.**
   A. Wipe clean the O-ring type gasket and the tank gasket seat.
   B. Place head and mechanism assembly into the tank. The head can be rotated to any position except where the actuator housing or manual operating handle interfere with the tank mounting bracket.
   C. Position the four head bolts, with fasteners under the tank lip, and tighten alternately (torque to 10 - 14 ft lbs).
5. **Test mechanical operation.** CLOSE and OPEN the switch contacts manually using the yellow operating handle. Confirm that the contacts have closed and opened by listening for the sound of operation or by a continuity check between the switch bushings. Leave the contacts in the open position.
6. **Check data plate.** Make sure that ratings on the data plate are correct for the planned installation.

⚠ 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

7. **Mount the switch.** The switch can be direct pole mounted with a through-bolt. Mounting hardware is also available for substation and cross-arm pole mounting. Dimensions to determine mounting position and clearances are shown in Figures 5, 6 and 7.

Main wiring

⚠ WARNING

Hazardous voltage. Solidly ground all equipment. Failure to comply can result in death, severe personal injury, and equipment damage. T223.2

1. **Ground the switch.** Make the ground connection to the ground connector (located 3" from the bottom of the tank).
2. **Make line connections.** Connect the primary leads to the switch bushing terminals. The universal clamp type terminals accommodate No. 8 solid through 2/0 stranded conductor.

Control wiring

Connections

Connections to the actuating mechanism are made at a terminal strip located in the actuator housing. Wiring access is through a 1-1/16" diameter opening in the bottom of the housing. Receptacles are supplied with 5-pin, 3-conductor or 6-pin, 6-conductor configurations as standard from the factory.

The terminal strip is factory wired to an accessory receptacle mounted in the bottom of the housing. Wiring and receptacle combinations are available to accommodate various combinations of accessories. Mating plugs for the accessory receptacles must be ordered separately. Maximum cable and wire sizes accommodated by the plugs are tabulated in Table 3.

Pin orientation diagrams for the accessory receptacles are shown in Figure 1.

Table 3. Control wiring specifications

Accessory plug catalog number	Number of pins	Cable range O.D. (in.)	Maximum wire size AWG
CCR010P1	5	0.437-0.562	12
CCR009P1	6	0.500-0.625	16

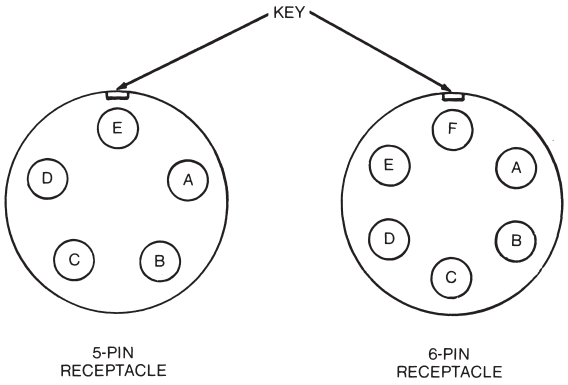

Figure 1. Nuts to loosen or remove

Three-wire control

The basic device for remote control of the Type NR oil switch is a single-pole, double-throw switch (three-wire control) supplied by the customer. Any manual switch, time switch, voltage-, current- or photo-electric controlled switch, or similar device can be used provided the control circuit is energized for a minimum of 4.5 seconds for each operation. A connection diagram for a standard three-wire control is shown in Figure 2.

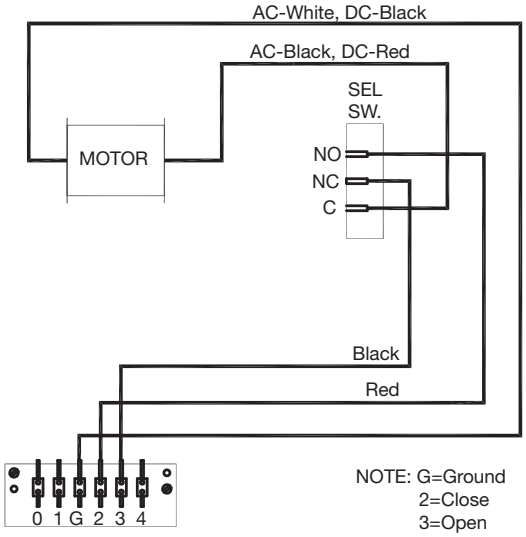

Figure 2. Typical connection diagrams

Wiring diagram

Connection diagrams of switch actuators with various accessories wired for two- and three-wire control are shown in Figure 3.

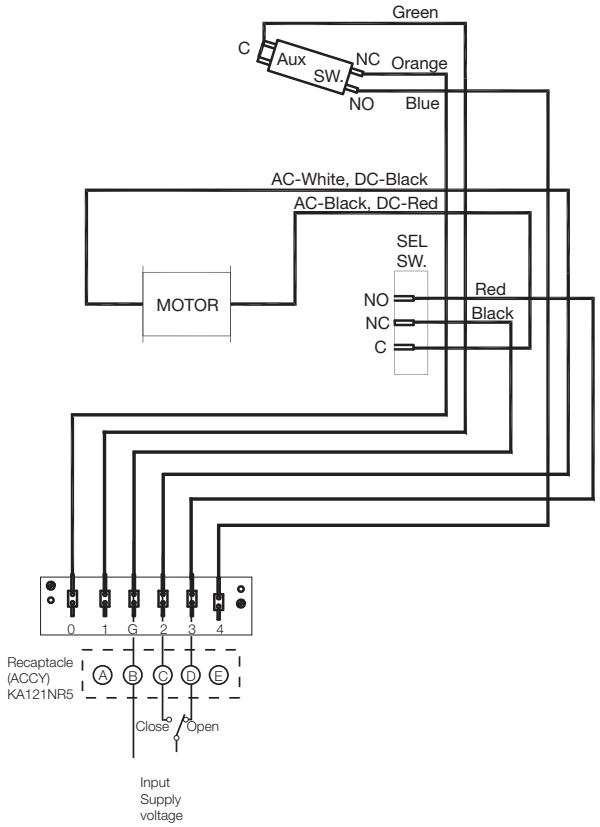

Figure 3. Actuator wiring with various accessories connected

Three-wire control with holding switch

If the controlling switch is energized for less than the required 4.5 seconds, a factory-installed holding switch accessory is required. However, the control circuit must be energized for at least one second for each operation to insure operation of the holding switch. A connection diagram for a three-wire control with a holding switch is shown in Figure 4.

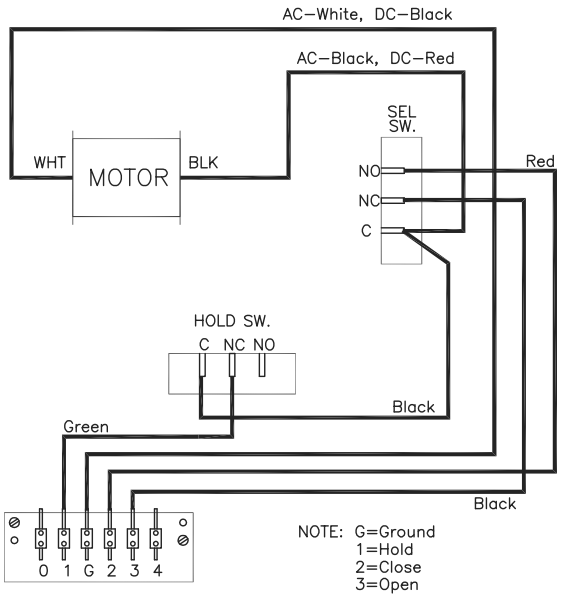

Figure 4. Three-wire control with holding switch

Switch operation

Electrical operation

The switch may be opened and closed electrically by applying rated control voltage to the proper terminals of the actuator terminal block.

If the switch actuator does not respond to an electrical operating signal, it may be that the main switch contacts are not in synch with the electrical control. For example, if the switch is manually opened, an electrical OPEN signal must be transmitted to bring the control into synch with the switch contacts before an electrical CLOSE signal will close the switch. The converse is also true.

Manual operation

⚠ WARNING

Never manually close this switch into a faulted line. The make-and-latch rating of the switch applies only when it is electrically operated. Closing a switch manually on a faulted line can result in death, severe personal injury, and equipment damage. G127.0

The switch may be manually opened by operating the yellow handle under the sleet hood.

Dimensions and weights

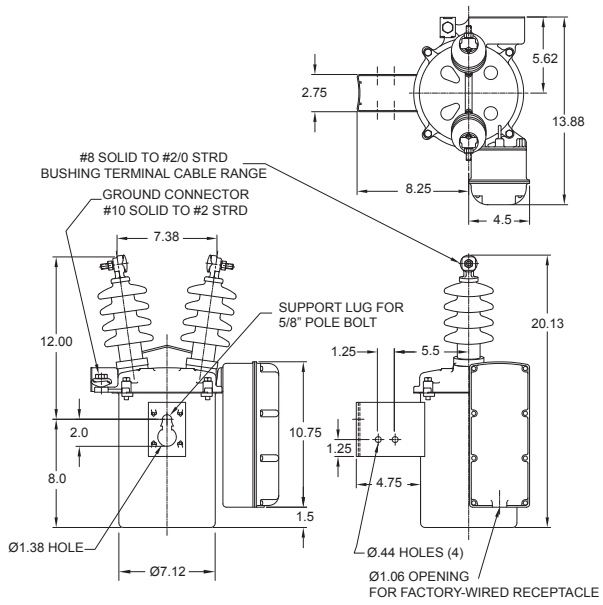

Figure 5. Outline dimensions of 95 kV BIL Type NR oil switch with standard bushings, (15.0 kV Rating only).

Table 4. Weight and Oil Capacity of Type NR Switch

Net weight with oil	37 lbs.
Oil capacity	1-1/2 gal.

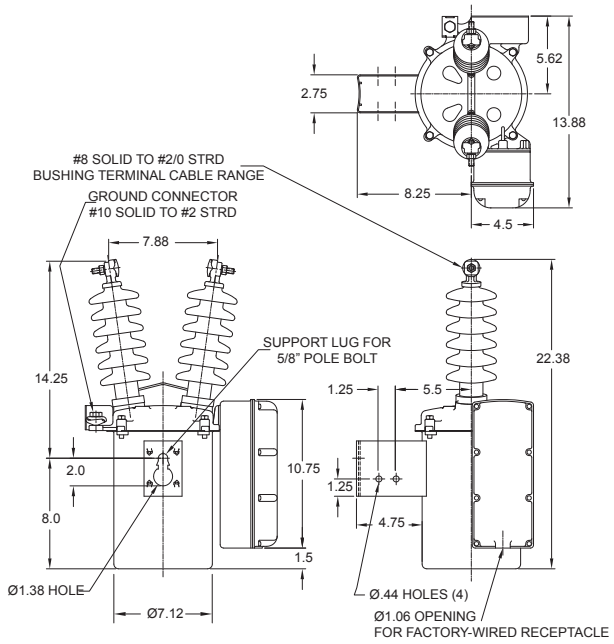

Figure 6. Outline dimensions of 95 kV BIL type NR oil switch with 17" creepage bushings, (15.0 kV rating only).

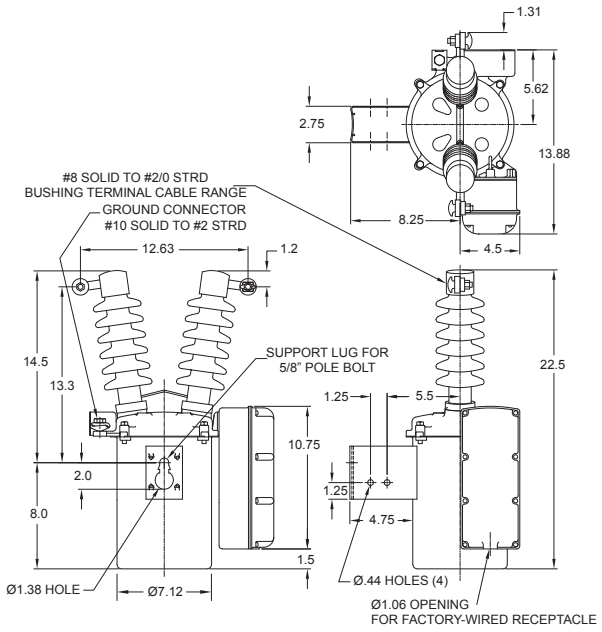

Figure 7. Outline dimensions of 125 kV BIL Type NR oil switch (22.0 kV Rating standard bushings and 15.0 kV Rating optional bushings).

Maintenance information

⚠ CAUTION

This equipment requires routine inspection and maintenance to ensure proper operation If it is not maintained, it can fail to operate properly. Improper operation can cause equipment damage and possible personal injury. G105.1

⚠ CAUTION

This equipment relies on dielectric fluid to provide electrical insulation between components. The dielectric strength of the fluid must be checked on a regular basis, as part of the routine maintenance inspection, to ensure that it is at or above minimum dielectric requirements. Use of this equipment with dielectric fluid that does not meet minimum requirements can result in internal flashovers that will damage the equipment and can cause personal injury. G107.3

Maintenance requirements

All Type NR oil switches require routine inspection and maintenance to ensure proper operation. If the equipment is not adequately maintained, it may fail to operate properly.

Maintenance manual

Maintenance instructions for Type NR oil switch is provided in *Service Information MN230001EN. Reference TD280022EN* provides information on oil specifications and tests.

Frequency of maintenance

Because this switch is applied under widely varying operating and climatic conditions, maintenance intervals are best determined by the user based on actual operating experience. Eaton recommends that the switch be inspected yearly and serviced as needed. In no case should the service interval, between periodic maintenance and inspection extend beyond 1200 operations.

Replacement parts

Replacement parts for the Type NR oil switch are available through the factory Service Department. To order replacement parts, refer to the applicable maintenance manual. Contact your Eaton's Cooper Power series product representative for additional information and ordering procedures.

Factory authorized service centers

Factory authorized service centers are located throughout the continental United States to provide maintenance, repair, and testing services for Type NR oil switches. For further information, contact your Eaton's Cooper Power series product representative.

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