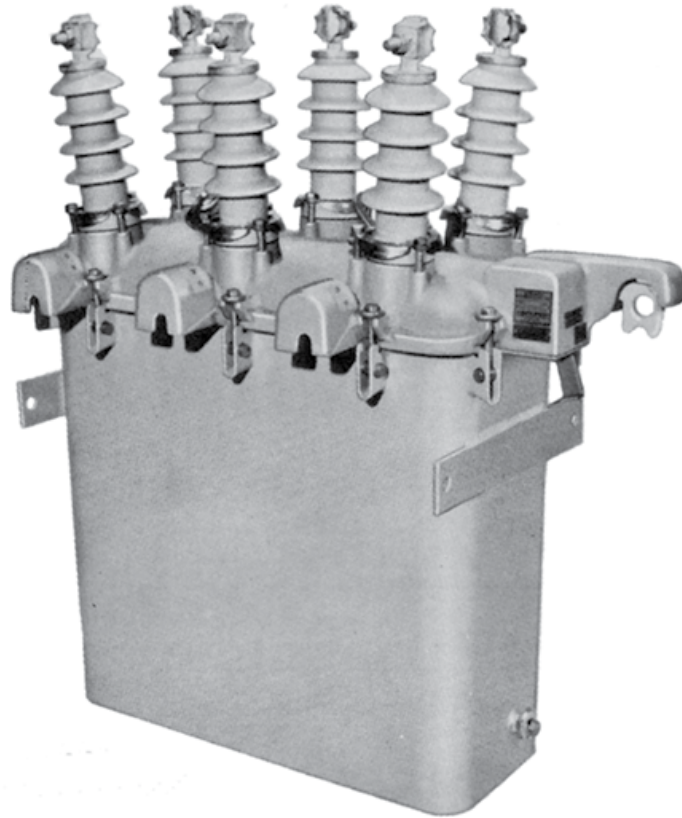


Types 6H and V6H three-phase reclosers installation and operation instructions



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Contents

SAFETY INFORMATION

| | |
|-------------------------------|----|
| Safety instructions | iv |
|-------------------------------|----|

PRODUCT INFORMATION

| | |
|---|---|
| Introduction | 1 |
| Acceptance and initial inspection | 1 |
| Handling and storage | 1 |
| ANSI standards | 1 |
| Quality standards | 1 |
| Description | 1 |
| Series trip solenoid | 2 |
| Hydraulic control mechanism | 2 |
| Fast and delayed timing characteristics | 2 |
| Data plates | 2 |
| Manual operating levers and indicators | 2 |
| Non-reclosing lever | 2 |
| Operations counters | 3 |
| Manual operating handle | 3 |

RATINGS AND SPECIFICATIONS

| | |
|--------------------------|---|
| Ratings tables | 4 |
|--------------------------|---|

DIMENSIONS AND WEIGHTS

| | |
|--|---|
| Dimensions and weights drawing and table | 5 |
|--|---|

INSTALLATION PROCEDURE

| | |
|-----------------------------|---|
| Line Installation | 6 |
|-----------------------------|---|

OPERATION

| | |
|-----------------------------------|---|
| Initial operation | 7 |
| Manual operation | 7 |
| Non-reclosing operation | 7 |

MAINTENANCE INFORMATION

| | |
|--|---|
| Maintenance requirements | 8 |
| Maintenance manuals | 8 |
| Frequency of maintenance | 8 |
| Maximum recloser maintenance intervals | 8 |
| Replacement parts | 8 |
| Factory-authorized service centers | 8 |
| Factory maintenance classes | 8 |
| Instructional video programs | 8 |
| Kits and product enhancements | 8 |



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 MN280023EN provides installation instructions, operation information and testing procedures for Eaton's Cooper Power™ series 6H and V6H three-phase reclosers. Before installing and operating one of these reclosers, carefully read and understand the contents of this manual.

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, contact your Eaton representative.

Acceptance and initial inspection

Each recloser 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 recloser:

1. Inspect the recloser thoroughly for damage and/or 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 recloser is to be stored for an appreciable period of time before installation, provide a clean, dry storage area. Locate the recloser so as to minimize the possibility of mechanical damage, particularly to the bushings.

ANSI® standards

Eaton reclosers are designed and tested in accordance with the following ANSI® standards: C37.60 and C37.85 and ANSI Guide C37.61.

Quality standards

ISO 9001 certified quality management system

Description

Types 6H and V6H three-phase reclosers are self-contained, hydraulically controlled devices that sense and interrupt fault currents on three-phasing or on a per phase basis of a electrical-power distribution circuit.

Independent operation of the three interrupting mechanisms allows single-phase tripping should a line fault occur. If a single phase sequences to lockout, the remaining two phases automatically trip open to lockout. If the fault is temporary, the device automatically recloses to restore service and then resets for another series of operations. If the fault is permanent, all three interrupting mechanisms are locked out simultaneously after the first, second, third or fourth trip operation, depending upon the setting. Once locked out, the recloser must be reset manually to restore service.

Operating sequences of a recloser can be all fast, all delayed, or a combination of fast operations followed by delayed operations.

Any one of up to three delay curves may be used to assure coordination with other reclosers or protection devices, allowing outages caused by permanent faults to be confined to shorter sections of line.

A series-connected coil initiates tripping. Current carrying and operating capacities vary with the operating coil's rating, which is selected to meet circuit requirements.

Fast operations (no intentional delay in interrupting the circuit) are used to clear temporary faults before branchline fuses are damaged.

Delayed operations (delay inversely proportional to the magnitude of the fault) are used to allow fault currents to be cleared by branch-line fuses.

A non-reclosing feature, standard on all Eaton reclosers, is set with a hotstick-operated lever. When set, the feature provides one operation to lockout without removing the recloser from service.

In a Type 6H recloser, current interruption takes place in oil, while the Type V6H recloser uses a vacuum interrupter.

Series trip solenoid

Fault-current sensing is provided by a series-connected solenoid coil that carries line current. When a fault occurs, tripping is initiated by the solenoid plunger.

The plunger, normally held at rest by the closing springs, is drawn into the coil by the magnetic force generated by the fault current. Downward travel of the plunger overtoggles springs in the contact assembly that open the recloser contacts. The same motion charges the closing springs in preparation for a reclosing operation.

When the circuit is opened, the solenoid coil is de-energized, allowing the closing springs to close the contacts and simultaneously return the plunger to its original position.

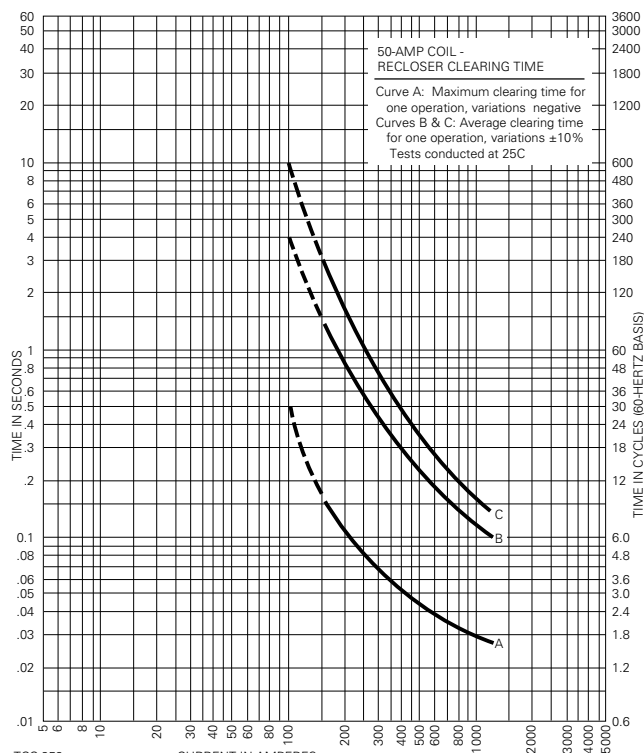


Figure 1. Type 6H time-current characteristics, 50 amp coil.

Hydraulic control mechanism

The hydraulic control mechanism provides selectivity in timing, enabling flexibility in application and coordination with other equipment. All timing is governed by the hydraulic mechanism that:

1. Controls the timing before contact opening.
2. Establishes the time delay before the contacts reclose.
3. Counts the number of operations.
4. Causes the recloser to lock out when the preset number of trip operations has been completed.

Fast and delayed timing characteristics

Variations of timing characteristics and sequences can be programmed for a maximum of four operations. When a recloser is programmed for both fast and delayed operations, the fast operations, involving no intentional time-delay, occur first in the sequence, according to the recloser's "A" curve time-current characteristic. Delayed operations are according to the recloser's "B" or "C" time-current curve. See Figure 1.

Refer to publication *R280-91-15, Time Current Curves Type 6H and V6H*, for more information.

Data plates

The recloser data plates, located near the operating-lever sleethood, provide ratings information including: product type and serial number, nominal operating voltage, maximum interrupting current, trip coil rating, operating sequence and number of operations to lockout. See Figure 2. Be sure all ratings and settings are correct for the planned installation.

Manual operating levers and indicators

The operating levers and indicators for the recloser are located under a sleethood on the recloser's source side. See Figure 2.

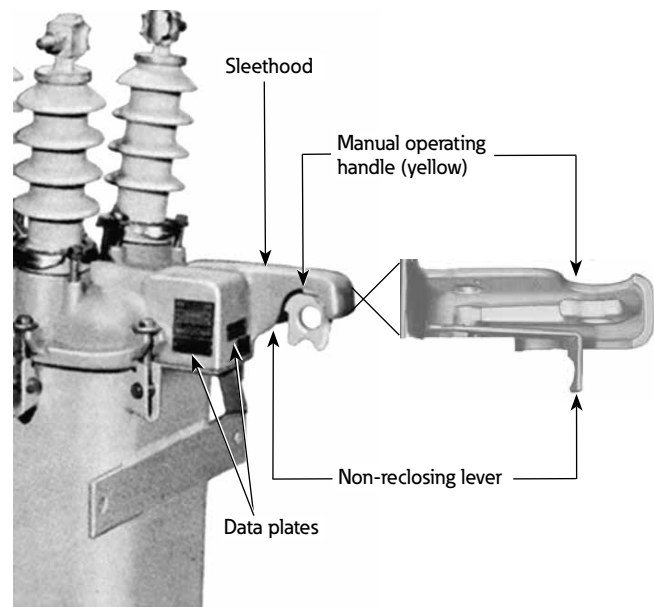


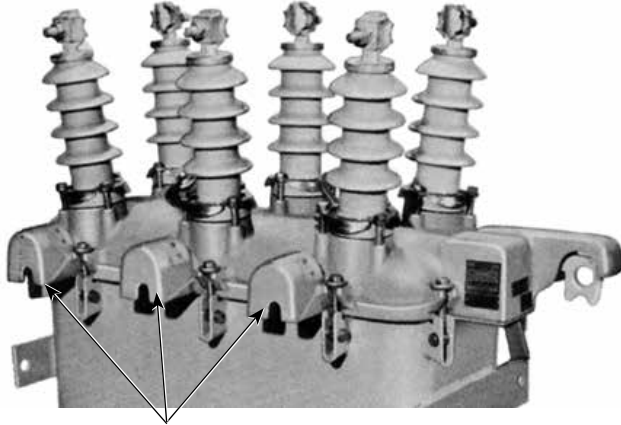
Figure 2. Recloser operating lever, handle and data plates.

Non-reclosing lever

The non-reclosing lever (Figure 2) provides the recloser with the capability of locking out on the first trip operation for downtime, hot-line work. This lever is also hotstick operated.

Operations counters

A four-digit mechanical phase-operations counter, which records all trip operations, is located under each of three sleethoods on load side of recloser. See Figure 3.



Individual phase operations counters

Figure 3. A phase operations counter is located under each sleethood.

Manual operating handle

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

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

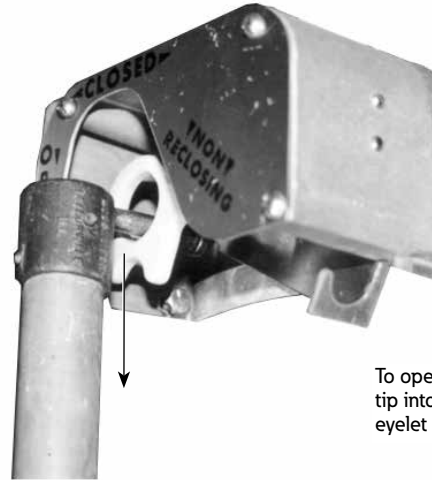
The manual operating handle (yellow handle) permits manual opening and closing of an energized recloser. It is not to be used as a substitute for a visible disconnect during line work. Pulling the handle down trips and locks open the main contacts of the recloser. Lifting up the handle closes the main contacts. The handle is operated with a hotstick.

The correct placement of the hotstick for opening the recloser is shown in Figure 4. To open, insert hotstick tip into eyelet of manual operating handle and pull down.

The correct placement of the hotstick for closing the recloser is shown in Figure 5. Place the hotstick tip in groove under manual operating handle eyelet and push up.

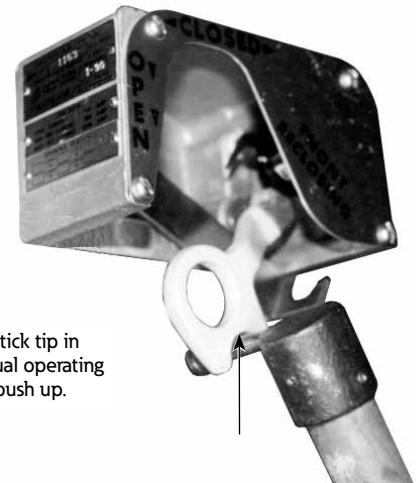
IMPORTANT

The manual operating handle is tripfree. If the recloser is closed against a fault, it will continue to trip and reclose until the handle is allowed to drop to the open position.



To open, insert hotstick tip into operating lever eyelet and pull down.

Figure 4. Correct placement of hotstick to open recloser.



To close, place hotstick tip in groove under manual operating handle eyelet and push up.

Figure 5. Correct placement of hotstick to close recloser.

Ratings and specifications

Table 1. Load and Interrupting Ratings

| Recloser Type | Trip-Coil Continuous Current (amps) | Minimum Trip (amps) | Interrupting Current (rms symmetrical amps) | | |
|----------------------------------|-------------------------------------|---------------------|---|-------|-------|
| | | | @4.8 | @8.32 | @14.4 |
| Type 6H 100 Amps Maximum | | | | | |
| 6H | 5 | 10 | 200 | 200 | 200 |
| | 10 | 20 | 400 | 400 | 400 |
| | 15 | 30 | 600 | 600 | 600 |
| | 25 | 50 | 1000 | 1000 | 1000 |
| | 35 | 70 | 1400 | 1400 | 1400 |
| | 50 | 100 | 2000 | 2000 | 2000 |
| | 70 | 140 | 2800 | 2500 | 2000 |
| | 100 | 200 | 3000 | 2500 | 2000 |
| Type V6H 200 Amps Maximum | | | | | |
| V6H | 5 | 10 | 200 | 200 | 200 |
| | 10 | 20 | 400 | 400 | 400 |
| | 15 | 30 | 600 | 600 | 600 |
| | 25 | 50 | 1000 | 1000 | 1000 |
| | 35 | 70 | 1400 | 1400 | 1400 |
| | 50 | 100 | 2000 | 2000 | 2000 |
| | 70 | 140 | 2800 | 2500 | 2000 |
| | 100 | 200 | 3000 | 2500 | 2000 |
| | 140 | 280 | 3000 | 2500 | 2000 |
| | 200 | 400 | 3000 | 2500 | 2000 |

Table 2. Ratings and Specifications

| Recloser type | Rated System Nominal Voltage (kV) | Rated System Max Voltage (kV) | Rated System Withstand Voltage (BIL) (kV) | 60 Hz Insulation Level Withstand Rating | | Continuous Rating (amps) |
|---------------|-----------------------------------|-------------------------------|---|---|-----------------|--------------------------|
| | | | | Dry 1-Min (kV) | Wet-10 Sec (kV) | |
| 6H | 14.4 | 15.5 | 110 | 50 | 45 | 100 |
| V6H | 14.4 | 15.5 | 110 | 50 | 45 | 200 |

Table 3. Duty Cycle

| Recloser Type | % of Interrupting Rating | Maximum Circuit X/R Ratio | Number of Unit Operations | Total Unit Operations |
|---------------|--------------------------|---------------------------|---------------------------|-----------------------|
| 6H | 15-20 | 2 | 32 | 68 |
| | 45-55 | 5 | 24 | |
| | 90-100 | 10 | 12 | |
| V6H | 15-20 | 2 | 128 | 272 |
| | 45-55 | 5 | 96 | |
| | 90-100 | 10 | 48 | |

Dimensions and weights

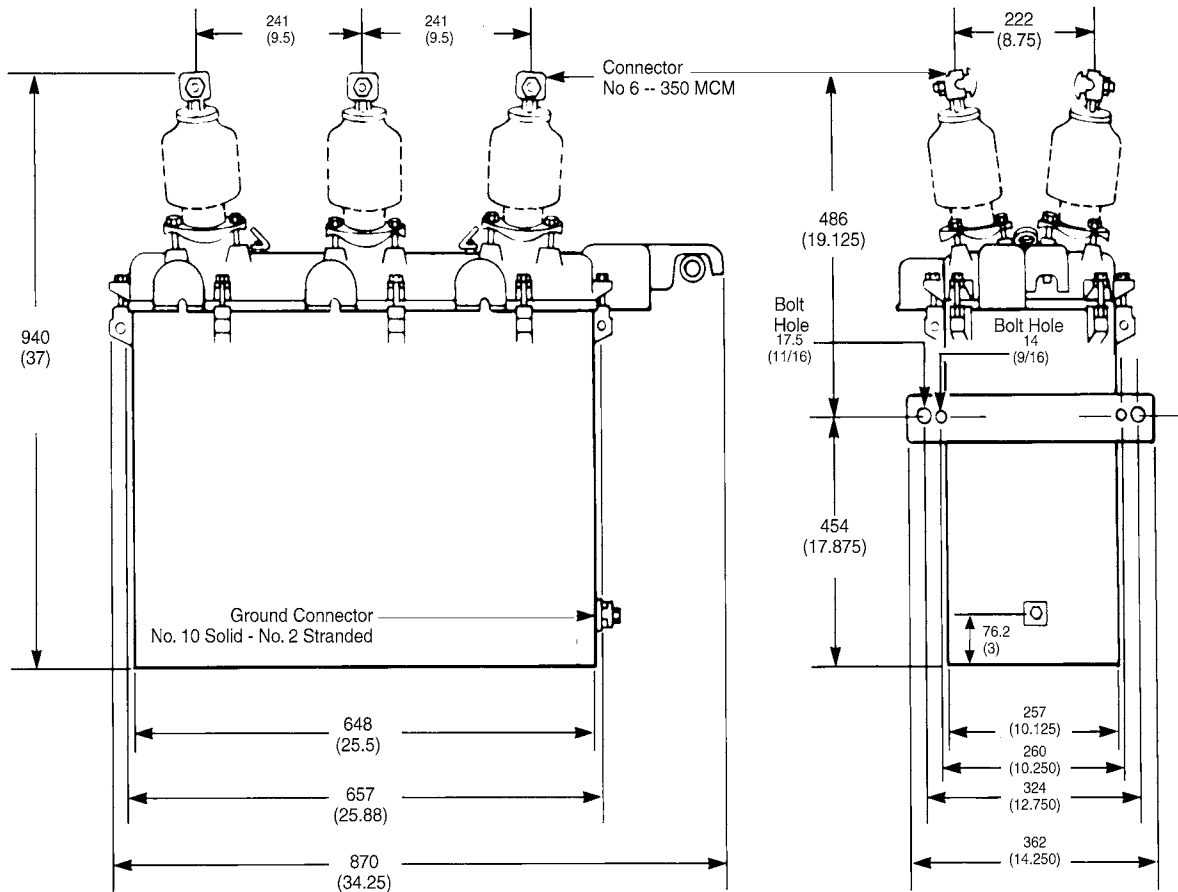


Figure 6. Dimensions of Type 6H and Type V6H reclosers.

Note: Unless otherwise specified, dimensions are stated in millimeters (inches).

Table 4. Weight, kG (lb.); Oil Capacity, Liter (U.S. Gallons.)

| Description | 6H, V6H |
|---------------------------------|--------------|
| Weight Without Oil, kG (lb) | 107.05 (236) |
| Weight With Oil, kG (lb) | 178.72 (394) |
| Oil Capacity, Liter (U.S. gal.) | 74.49 (21) |

Installation procedure

CAUTION

Equipment damage. Recloser must be open (yellow operating handle, under sleethood, down) before un tanking. Tripping the mechanism out of oil will cause excessive mechanical shock to the operating mechanism, which will cause accelerated wear and/or damage to the mechanism.

T202.0

When un tanking the recloser for inspection prior to installation, remove the bolts that secure the tank and head casting. Trip the recloser and carefully lift the mechanism out of the tank.

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

1. Check oil level. Before installing the recloser, check for proper oil level. With the mechanism removed from the tank, the oil level should be up to the fill line marked on the tank liner.
2. Test oil dielectric strength. If the recloser has been stored for some time or is being relocated, perform a dielectric test on the oil in accordance with ASTM-approved testing procedures.
 - A. On new equipment, the oil must have a minimum dielectric strength of 26 kV.
 - B. If the dielectric strength of the oil is less than 26 kV, filter the oil to restore its dielectric strength to an acceptable minimum level.
3. Replace head casting and mechanism in tank.
 - A. Wipe clean the O-ring type gasket, the gasket recess in the recloser head, and the tank gasket.
 - B. Position and tighten the head bolts alternately. Torque each head bolt to 11-16 ft-lbs.
 - C. Operate the unit manually eight times to ensure that no air remains in the hydraulic mechanism.
4. Test mechanical operation. An effective test can be performed as follows:
 - A. Move the yellow manual operating handle to the CLOSED position and wait at least 4 minutes.
 - B. Move the manual operating handle to the OPEN position and listen for opening of the main contacts. (A dull "clunk" will be audible.) Then quickly move the lever back to the CLOSED position. (A metallic "click" can be heard.)

- C. Continue opening and closing the recloser manually until lock-out is achieved. Lockout can be determined by listening for unlatching of the lockout mechanism and also by noting that the recloser mechanism will not latch when the operating handle is moved to the CLOSED position. This test also can be used to determine the number of operations to lock-out.
 - D. The number of fast and delayed operations can also be identified through this test. With fast operations, the main contacts will open almost instantaneously when the operating handle is moved to the OPEN position. With delayed operations, a short time elapses between placement of the operating handle in the OPEN position and opening of contacts.
5. Check data plates. Make sure the ratings and settings on the recloser data plates are correct for the planned installation.

CAUTION

Falling equipment. Use the lifting lugs provided and follow all locally approved safety practices when lifting and mounting the equipment. Lift the unit smoothly and do not allow the unit to shift. Improper lifting can result in severe personal injury, death, and/or equipment damage.

G106.3

6. Mount the recloser.

WARNING

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

T223.2

7. Ground the recloser. Use two #10 solid wires or a #2 stranded wire to make the ground connection. The ground connector is on the lower portion of the recloser tank. See Figure 6.

Line installation

Provide the recloser with bypass switches and surge protection as shown in Figure 7. Surge protection on both sides of the recloser is advisable. However, if surge protection is provided on only one side, locate it on the source side for line installations and on the load side for substation installations.

Connect the primary leads to the recloser. The sourceside bushings are on the lever-sleethood side of recloser and load-side bushings are on the counter sleethood side. The universal clamp-type terminals accept No.6 through 350 MCM conductors.

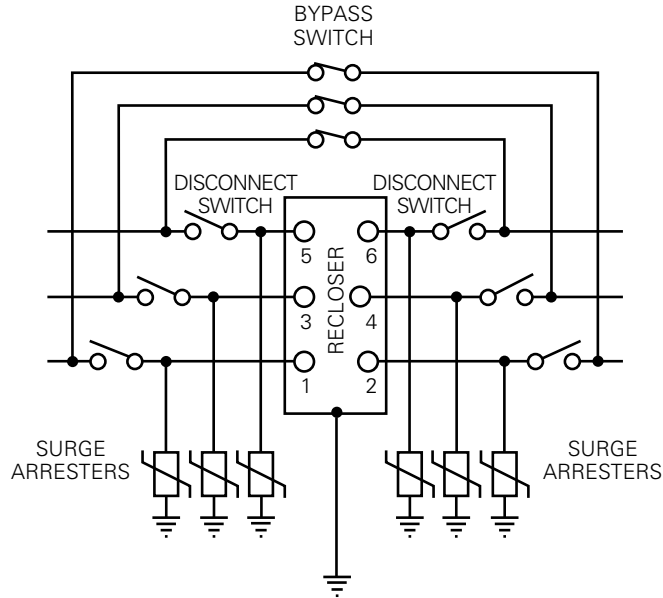


Figure 7. Connection diagram, with bypass switches shown closed, illustrates complete surge protection and disconnect switches to facilitate maintenance.

Operation

Initial operation

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

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

With the recloser connected as shown in Figure 7, close the source-side disconnect switches. Move the yellow manual operating handle under the sleethood to the CLOSE position as indicated on the sleethood housing. The recloser should immediately close. Close the loadside disconnect switches and open the bypass switches. The recloser is now in service. To remove from service, close the bypass switches and open the disconnect switches.

Manual operation

Manual operation of an energized Type 6H or Type V6H recloser requires a hotstick engagement of the yellow operating handle located under the sleethood. When the handle is pulled down, the mechanism is tripped to open the main contacts. When the handle is pushed up, the main contacts close.

Non-reclosing operation

When the non-reclosing lever (Figure 2) has been manually pulled down to the non-reclosing position, the recloser will not cycle through the normal operating sequence. Instead, any current over minimum trip rating will automatically lock the recloser open on the first trip operation. This immediate lockout protection is especially desirable for hot-line work. However, the non-reclosing lever does not interfere with manual recloser operation. The recloser can be opened or closed manually regardless of the position of the non-reclosing lever.

Maintenance information

Maintenance requirements

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

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

Maintenance manuals

Maintenance instructions for 6H and V6H reclosers are found in *Service Information S280-10-5, Type 6H and V6H Maintenance Instructions*.

Frequency of maintenance

To assure proper and trouble-free operation, reclosers must be maintained when they have operated the equivalent of a rated duty cycle (see Table 3).

Note: ANSI® C37.61, "Guide for the Application, Operation and Maintenance of Automatic Circuit Reclosers", gives a procedure for converting the rated standard duty cycle into an equivalent duty cycle based on the actual operating duty of the recloser.

Maximum recloser maintenance intervals

In the absence of specific operation experience, use the following guideline to establish maintenance intervals:

- Oil interrupting reclosers should be maintained at least every three years.
- Vacuum interrupting reclosers should be maintained at least every six years.

For additional information and specific maintenance requirements, including periodic maintenance inspection procedures, refer to *Service Information S280-10-5, Type 6H and V6H Maintenance Instructions*.

Replacement parts

Replacement parts for Eaton reclosers are available through the factory service department. To order replacement parts, refer to the applicable maintenance manual and the current replacement parts price list for catalog numbers and pricing. Contact your Eaton representative for additional information and ordering procedures.

Factory-authorized service centers

Factory-authorized service centers are located throughout the continental United States. They provide maintenance, repair and testing services for Eaton reclosers. For further information, contact your Eaton representative.

Factory maintenance classes

The factory service department offers recloser maintenance training classes. These classes, taught by experienced service technicians, are held at the factory in-house training facility.

The courses provide hands-on instruction and factory recommended procedures for the routine maintenance, troubleshooting, repair, and testing of Eaton switchgear. It is strongly recommended that all personnel who service and maintain Eaton switchgear attend the appropriate classes. For additional information about training classes, contact your Eaton representative.

Instructional video programs

Video cassette maintenance training program, *KSPV1A, General Maintenance and Inspection Procedures For Eaton Reclosers* is available as a supplemental training aid for maintenance personnel.

The video program, developed for use in the factory maintenance classes, is to be used in conjunction with existing service literature. For additional information about video programs, contact your Eaton representative.

Kits and product enhancements

Field service kits or other product enhancements may be available to improve / update the performance of 6H and V6H reclosers. Contact your Eaton representative for more information.

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