

Reclosers

Electronically Controlled
Types KFME and KVVME; Three-Phase

Service Information

KFE10008-E



Figure 1.
Kyle Type KFME recloser.

87899KM

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SAFETY FOR LIFE



Kyle Distribution Switchgear 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 Kyle 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

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 contains two types of hazard statements:


 **WARNING: Refers to hazards or unsafe practices which can result in death, severe personal injury, and equipment damage.**


 **CAUTION: Refers to hazards or unsafe practices which can result in damage to equipment or in personal injury.**


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.


 **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:** Hazardous voltage. Contact with high voltage will cause death or severe personal injury. Follow all locally approved safety procedures when working around high voltage lines and equipment.- G103.2

 **WARNING:** Do not operate this equipment out of oil. Oil is the electrical insulating medium within this equipment; operation out of oil will result in flashovers that will damage the equipment and can cause death or severe personal injury. G104.2

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

 **CAUTION:** Follow all locally approved safety practices when lifting and mounting the equipment. Use the lifting lugs provided. Lift the load smoothly and do not allow the load to shift. Improper lifting can result in equipment damage. G106.1

 **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. G109.2



PRODUCT INFORMATION

Introduction

Service Information KFE10008-E provides installation instructions, operation information and testing procedures for Kyle® reclosers.

The information contained in this manual is organized into the following major categories; *Safety Information, Product Information, Ratings and Specifications, Dimensions and Weights, Installation Procedure, Operation, and Maintenance Information*. Refer to 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 to 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 Cooper Power Systems Division sales engineer.

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 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 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

Kyle reclosers are designed and tested in accordance with the following ANSI standards : C37.60, C37.61 and C37.85

ISO Standards

The Quality System at the Cooper Power Systems Kyle Distribution Switchgear plant is ISO 9001 certified.

Description

A recloser (Figure 1) is a self-controlled device which senses distribution system overcurrents and interrupts the circuit to clear faults. It automatically recloses to restore service if a fault is temporary. Several attempts may be made to clear and re-energize the circuit and, if the fault still exists, the recloser locks out.

The opening recloser sequences can be all fast, all delayed, or any combination of fast followed by delayed up to a total of four. Fast operations clear temporary faults before branch line fuses are damaged. Delayed operations allow time for down-line protective devices to clear so that permanent faults can be confined to smaller sections of the system.

A complete electronic recloser package consists of the recloser which interrupts the circuit, an electronic control which senses overcurrents and actuates the recloser, and an interconnecting control cable.

The Type KFME and KFMVME reclosers are self-contained, three-phase current interrupting devices. The KFME recloser protects systems rated 2.4 through 14.4 kV, 400 amps maximum continuous and 8000 amps symmetrical interrupting. The KFME, with Low Voltage Closing, has an accessory that extends the interruption current to 12,000 Amps, symmetrical. The KFMVME recloser protects systems rated 2.4 through 24.9 Kv, 400 amps maximum continuous and 8000 amps symmetrical interrupting.

Recloser Operation

Recloser tripping and closing are initiated by signals from the electronic control. When fault currents in excess of the programmed minimum-trip value are detected in one or more phases, a signal from the control actuates a low energy tripper in the operating mechanism of the recloser to trip the opening springs and open the interrupter contacts.

Closing energy and the force required to charge the opening springs is supplied by a high-voltage closing solenoid momentarily connected phase-to-phase through a high-voltage contactor. At the programmed reclosing time, the control energizes a rotary solenoid in the operating mechanism which mechanically closes the closing solenoid contactor to connect the closing coil to its power source. The energized closing coil pulls a plunger down, charging the opening springs.

A number of high voltage coils are available for the closing solenoid to cover the range of the rated nominal system voltage of the recloser. Also available are low voltage coils to energize the closing solenoid from either a 120-240Vac or 125-250Vdc source.

A yellow trip-and-reset handle, located under the sleet-hood, is linked to the trip mechanism. It can be used to manually trip the recloser and override the control to keep the recloser open. It cannot manually close the recloser, but must be in the closed position (up) before the rotary solenoid can be energized. A contact-position indicator, located on the outboard side of the sleet hood, indicates the position of

the recloser contacts. “OPEN” is displayed when the contacts are open and “CLOSED” when contacts are closed.

Vacuum Interruption

Arc interruption takes place within three sealed vacuum interrupters. Oil is used for electrical insulation, but is not involved in arc interruption.

The moving contacts in the vacuum interrupters are driven by the release of opening springs. A low energy tripper, actuated by the recloser control, releases the opening spring. Closing energy, as well as energy to charge the opening spring, is supplied by a high-voltage closing solenoid momentarily connected phase-to-phase through a high-voltage contactor.

Recloser Controls

Kyle Type KFME and KFMVE reclosers are electronically controlled by a Kyle recloser control. Kyle offers a choice of three controls that can be used to operate these reclosers.

The Form 4C microprocessor-based recloser control, shown in Figure 2, incorporates computer technology to provide enhanced application versatility and ease of operation.

All standard control operating parameters, including phase and ground-fault minimum trip levels, time-current curve selection, and sequences of recloser operation, are keyboard programmable. Simple keyboard sequences, and dedicated function keys, provide convenient programming and interrogation of the control's various operating parameters. A large LCD display provides control feedback during programming and interrogation, and front panel LCD indicators provide control and recloser status, at a glance.

The control is equipped with keyboard-selectable time-current curves which are interchangeable for use as either phase or ground. Each of the curves can be custom modified to provide almost unlimited coordination flexibility.

The control provides a wide range of standard features, which include: supervisory operation, remote status indication, fault indication via LCD targets and counters, event recorder, recloser duty monitor, demand metering, and load profile monitoring.

The Form 4C control can also be equipped with an accessory supervisory input/output board to extend the supervisory operation capabilities of the control.

All operating parameters and databases may be accessed digitally either temporarily via the front data port or by SCADA when the optional digital communications accessory is installed.

Complete descriptive, installation and operation information for the Form 4C microprocessor-based recloser control, and accessories, can be found in *Service Information S280-77-1 and Programming Guide S280-77-4*.

The Kyle FX and FXA microprocessor-based recloser controls provide the operational intelligence for three-phase electronically-controlled reclosers. Both controls are equipped with features that provide application flexibility, current metering, and event recording.

The FX control is designed to operate without an external power source. Current transformers, located within the recloser, provide energy to operate the control and maintain charge on the control battery.

The FXA primary source of power is 120 or 240Vac (customer supplied). A battery provides backup power to the control.

The FX and FXA controls make use of a unique Microsoft® Windows-based application to program and interrogate the controls. The FX control connection is made via a fiber-optic interface, located on the control printed circuit board. The FXA connection is made via a front panel EIA232D port.



Figure 2.
Kyle Form 4C microprocessor-based electronic control.

911064KM



Figure 3.
Kyle FX microprocessor-based electronic control.

The control interface software application makes it possible to upload operating parameters to the control as well as download present operating parameters from the control and collected data from the control data bases. Operating parameters and collected data can be saved on disk for future reference or to provide system documentation.

The FXA control may also be equipped with an optional SCADA accessory that provides numerous discrete input/output points for customer use.

Complete installation and operation information can be found in Service Information FX10001-E (FX) and S280-78-1 (FXA).



Figure 4.
Kyle FXA microprocessor-based electronic control.

Operating Levers and Indicators

The operating lever and indicators for the Type KFME and KFVME reclosers are located under the sleethood.

Manual Operating Handle

The yellow manual-operating handle permits manual opening of the recloser. Pulling the handle down trips and locks open the main contacts and opens the low voltage closing circuit of the recloser. The recloser cannot be manually closed with the yellow handle; however, the handle must be in the "CLOSED", or up, position for the closing circuit to be operational. The handle is operated with a hookstick.

Contact-Position Indicator

A contact position indicator, linked to the recloser mechanism but independent of the operating handle, is located under the sleethood.

Operations Counter

A four-digit mechanical counter, located under the sleethood, cumulatively records each time the recloser opens.

RATINGS AND SPECIFICATIONS

Check Recloser Ratings Prior To Installation

The recloser will operate effectively to interrupt fault currents only when applied within its specified ratings. Prior to installation, check data plate ratings and compare with

the system characteristics at the point of application. Consult the following ratings and specifications for the KFME and KFVME three-phase reclosers. Ratings and specifications are in accordance to ANSI/IEEE standard C37.60-1981 or latest revision.

TABLE 1
Voltage Ratings

	KFME	KFVME
Nominal Operating (kV).....	2.4-14.4	2.4-24.9
Maximum rated voltage (kv).....	15.5	27.0
Rated impulse withstand voltage (BIL) (kV crest)	110	125
60Hz withstand voltage (kV rms)		
Dry, 1 min	50	60
Wet, 10 sec	45	50
RIV at 1000 kHz, at 9.41kV (microvolts max)	100	100
Operating frequency Hz	50-60	50-60

TABLE 4
Closing Coil Impedance Ratings

Nominal ac Voltage (kV)	Impedance Z (ohms)	ac Resistance (ohms)	Reactance X (ohms)	Power Factor (percent)	dc Resistance (ohms)
2.4	41.83	16.01	38.65	38.3	8.22
4.16					
4.8	149.43	62.09	135.92	41.5	31.52
6.0	--	--	--	--	--
7.2					
7.62	408.49	145.86	381.56	35.7	84.12
8.0					
8.32	504.02	172.05	473.74	34.1	95.99
11.5	978.14	316.03	925.68	32.3	211.4
12.0					
12.47	1163.5	384.6	1098.1	33.1	226.9
13.2					
14.4	1551.89	511.64	1465.12	33.0	350.8
20.0	3034.32	967.32	2875.0	31.9	647.8
22.0	--	--	--	--	--
23.0					
24.9	--	--	--	--	--
125 (Vdc)	--	--	--	--	1.289
250 (Vdc)	--	--	--	--	4.77

TABLE 2
Current Ratings

	KFME	KFVME
Maximum continuous current (Amps)	400	400
Overload capability (4hr) (Amps)	500*	500*
(2hr) (Amps)	600*	600*
Interrupting current (rms sym Amps)	8000	8000
Magnetizing interrupting current (Amps)	14	14
Cable changing current (Amps)	2	5
Three-second current (rms sym Amps) ..	8000	8000
Momentary current (rms asym Amps) ...	12800	12800
Make current (peak asym Amps)	21500	21500

TABLE 5
Mechanical Specifications

Operating temperature (°C):	
Minimum	-30
Maximum	+50*
Close mechanism	Solenoid close
Open mechanism	Spring operated
Contact close time (cycles)	0.75
Contact gap (cm) [in.]	0.95 [0.375]
Contact open time (milliseconds)	8.3
Interrupting time (maximum, cycles)	1.50
Allowable contact erosion (cm) [in.]	0,15 [0.060]
Resistance, Nominal (micro-ohms):	
Bushings, terminal-to-terminal	400
Across the interrupter	70
Mechanical life (minimum operations)	2500

* A 560A continuous current rating option is available. No overload capability.

** After level-off at rated continuous current.

*** 12kA available as an option with Low Voltage Closing.

TABLE 3
Duty Cycle*

Number of Operations	% of Interrupting Rating	Max Circuit X/R Ratio	
		KFME	KFVME
88	15-20	3	4
112	45-55	7	8
32	90-100	14	15
232 Total Operations			

* In accordance with ANSI standard C37.60--1981

*150 percent overload rating not applicable at ambients exceeding +40°C.

DIMENSIONS AND WEIGHTS

Recloser weights, oil capacity and bushing creepage.

	KFME	KFVME
Recloser weight with oil, kg (lb.)	172 (380)	177 (390)
Recloser weight with pole-top frame, kg (lb.)	181 (400)	182 (410)
Recloser weight and substation frame, kg (lb.)	240 (530)	245 (540)
Recloser oil capacity, liters (gal.)	71,9 (19)	71,9 (19)
Standard bushing creepage, cm (in.)	29,53 (11 ⁵ / ₈)	67,31 (26 ¹ / ₂)

Recloser dimensions

Dim.	KFME	KFVME
A	20,3cm (8")	23,2cm (9 ¹ / ₈ ")
B	27,3cm (10 ³ / ₄ ")	31,4cm (12 ³ / ₈ ")
C	27,9cm (11")	24,4cm (9 ⁵ / ₈ ")
D	54,8cm (21 ⁹ / ₁₆ ")	69,8cm (27 ¹ / ₂ ")
E	28,5cm (11 ¹ / ₈ ")	44,5cm (17 ¹ / ₂ ")
F	93,7cm (36 ⁷ / ₈ ")	109,8cm (43 ¹ / ₄ ")

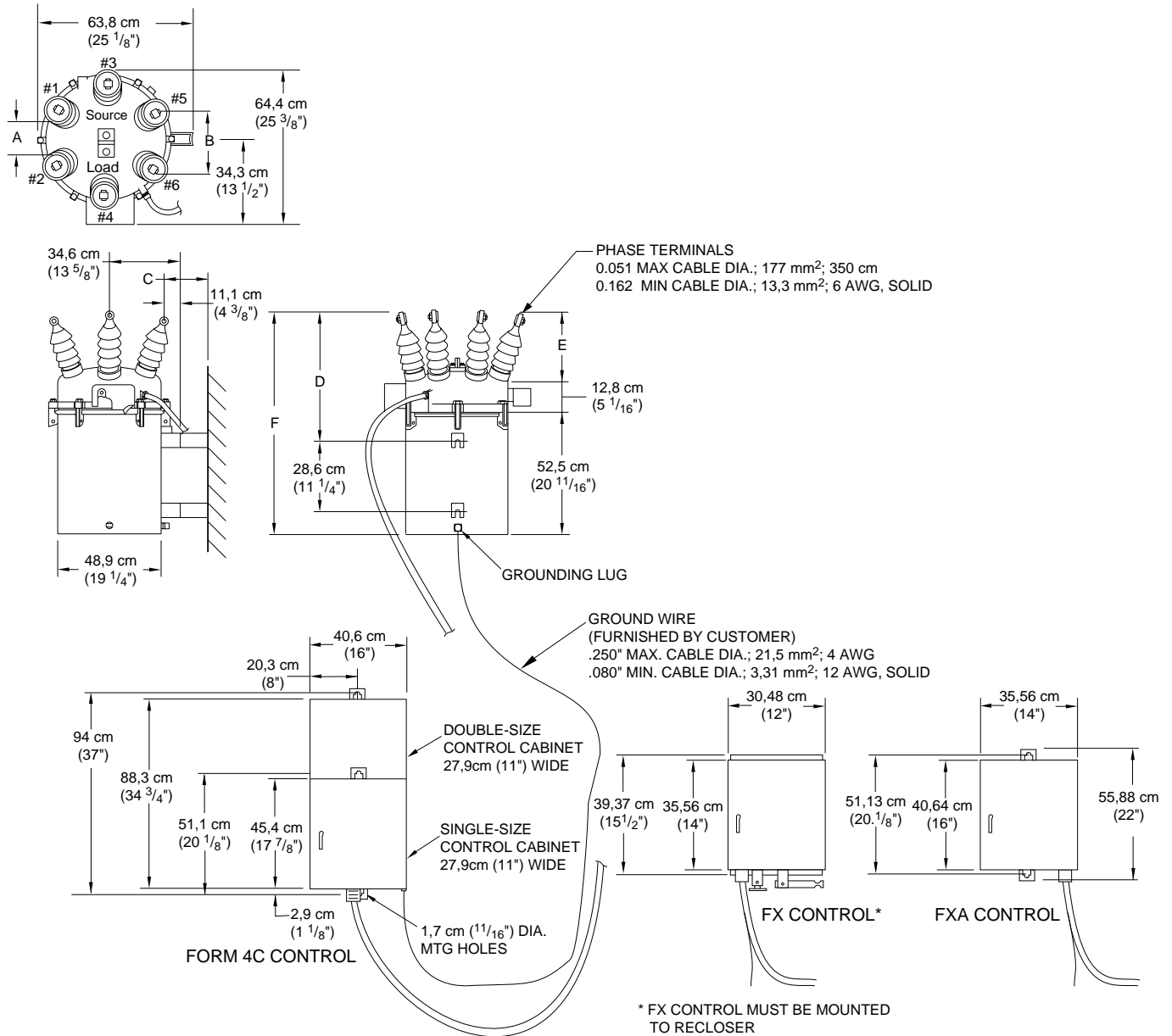




Figure 5.
KFME and KFVME dimensions.

INSTALLATION PROCEDURE


The KFME and KVVME reclosers are used in conjunction with Kyle electronic recloser controls. If used with a Form 3A ME control, refer to *Service Information S280-75-1*. If used with a Form 4C control, refer to *Service Information S280-77-1 and S280-77-4 Programming Guide*.


 **WARNING:** Follow all locally approved procedures and safety practices when installing, operating, or testing this equipment. Failure to comply can result in death, severe personal injury, and equipment damage. G111.2

 **CAUTION:** This equipment relies on oil to provide electrical insulation between components. The dielectric strength of the oil 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 insulating oil that does not meet minimum requirements can result in internal flashovers that will damage the equipment and can cause personal injury. G107.2

1. **Check the oil level.** Using the dipstick located on the recloser head, make sure the oil in the recloser tank is at the proper level.
2. **Test the oil dielectric strength.** Perform a dielectric test on the oil in accordance with ASTM-approved testing procedures.
 - A. 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 the dielectric strength to the acceptable minimum level.
3. **Check the data plate ratings.** Make sure the ratings on the recloser data plates are correct for the planned installation.

Closing coil voltage rating of the recloser must equal system voltage for high voltage closing.

 **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

 **CAUTION:** Follow all locally approved safety practices when lifting and mounting the equipment. Use the lifting lugs provided. Lift the load smoothly and do not allow the load to shift. Improper lifting can result in equipment damage. G106.1

Lifting The Recloser

The KFME and KVVME reclosers are equipped with a single lifting lug intended for vertical lifting. When lifting the recloser for mounting or any other purpose, follow approved safety practices, lift the load smoothly and do not allow it to shift.

Mounting The Recloser

Direct Mounting

Type KFME and KVVME reclosers can be mounted directly to a substation structure or frame. The recloser should be mounted using 1,59 cm (5/8 in.) diameter mounting hardware which must be furnished by the customer. When mounting the recloser on a flat surface, be sure to use adapter plates (shipped with recloser) between the tank lugs and the flat surface.

Pole Mounting

KFME and KVVME reclosers can be pole mounted by using a pole-mounting extension hanger shown in Figure 6. Hardware to attach the extension hanger to the recloser is included with the hanger. Be sure to use flat-surface adapter plates between recloser tank lugs and extension hanger lugs. The extension hanger is mounted to the pole with 1,90 cm (3/4 in) bolts and washers furnished by the customer.

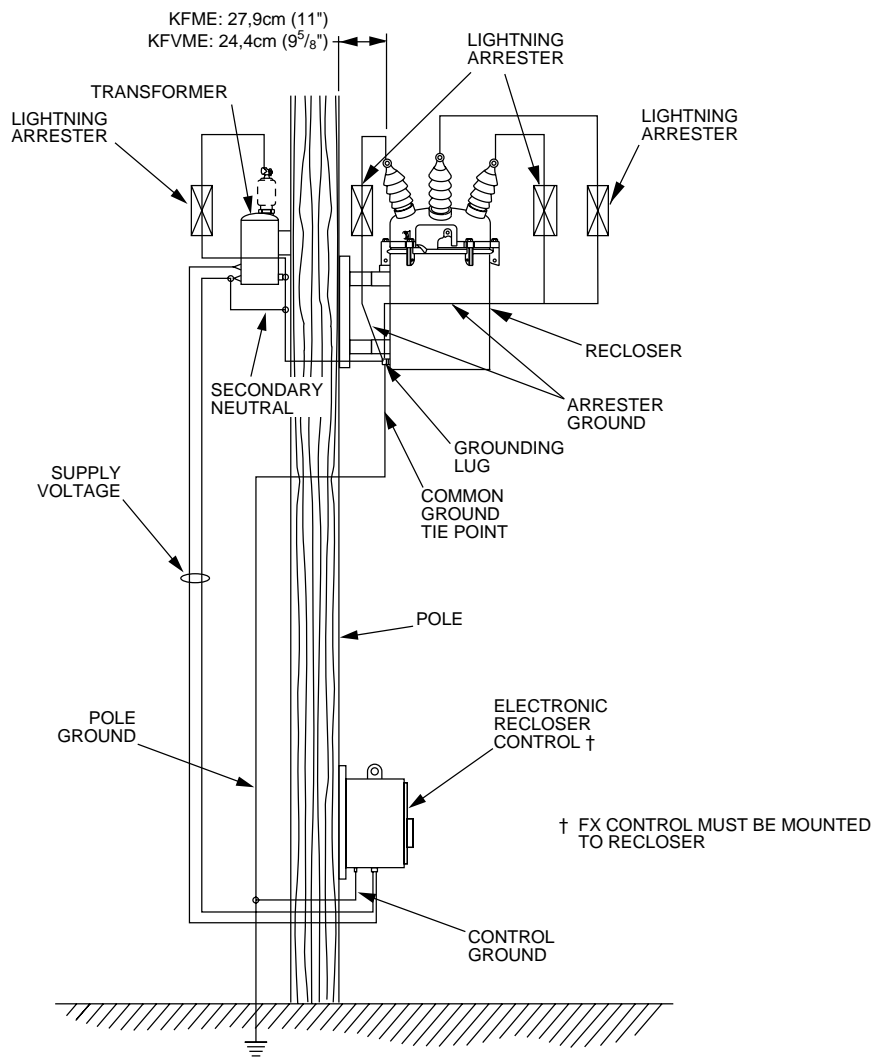
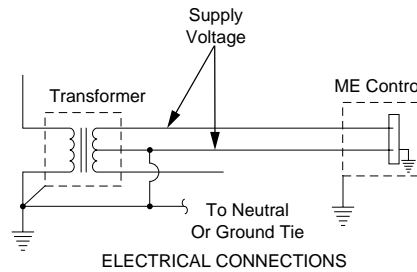


Figure 6. Mounting and clearance dimensions for pole mounting extension hanger.

Substation Elevating Structure

KFME and KVVME reclosers can be substation mounted using the KRK942 Substation Elevating Structure shown in Figure 7. Hardware to attach the recloser to the elevating structure is furnished with the structure. Hardware to anchor the structure must be furnished by the customer.

A series of mounting holes, spaced 7,62 cm (3 in.) apart permits varying the recloser height. The range of terminal top heights obtainable for a recloser with standard 29,53 cm (11⁵/₈ in.) creepage bushing is from 271,2cm (106 ³/₄in.) to a maximum of 324,6 cm (127 ¹³/₁₆ in.).

	Dimensions	A	B
KFME	Without BCT's	271,3 (106 ¹³ / ₁₆) to 324,6 (127 ¹³ / ₁₆)	42,0 (16 ⁹ / ₁₆)
	With BCT's	283,4 (111 ⁹ / ₁₆) to 336,7 (132 ⁹ / ₁₆)	54,1 (21 ⁵ / ₁₆)
KVVME	Without BCT's	286,5 (112 ¹³ / ₁₆) to 339,9 (133 ¹³ / ₁₆)	57,3 (22 ⁹ / ₁₆)
	With BCT's	296,6 (117 ⁹ / ₁₆) to 352,6 (138 ¹³ / ₁₆)	71,0 (27 ⁵ / ₁₆)

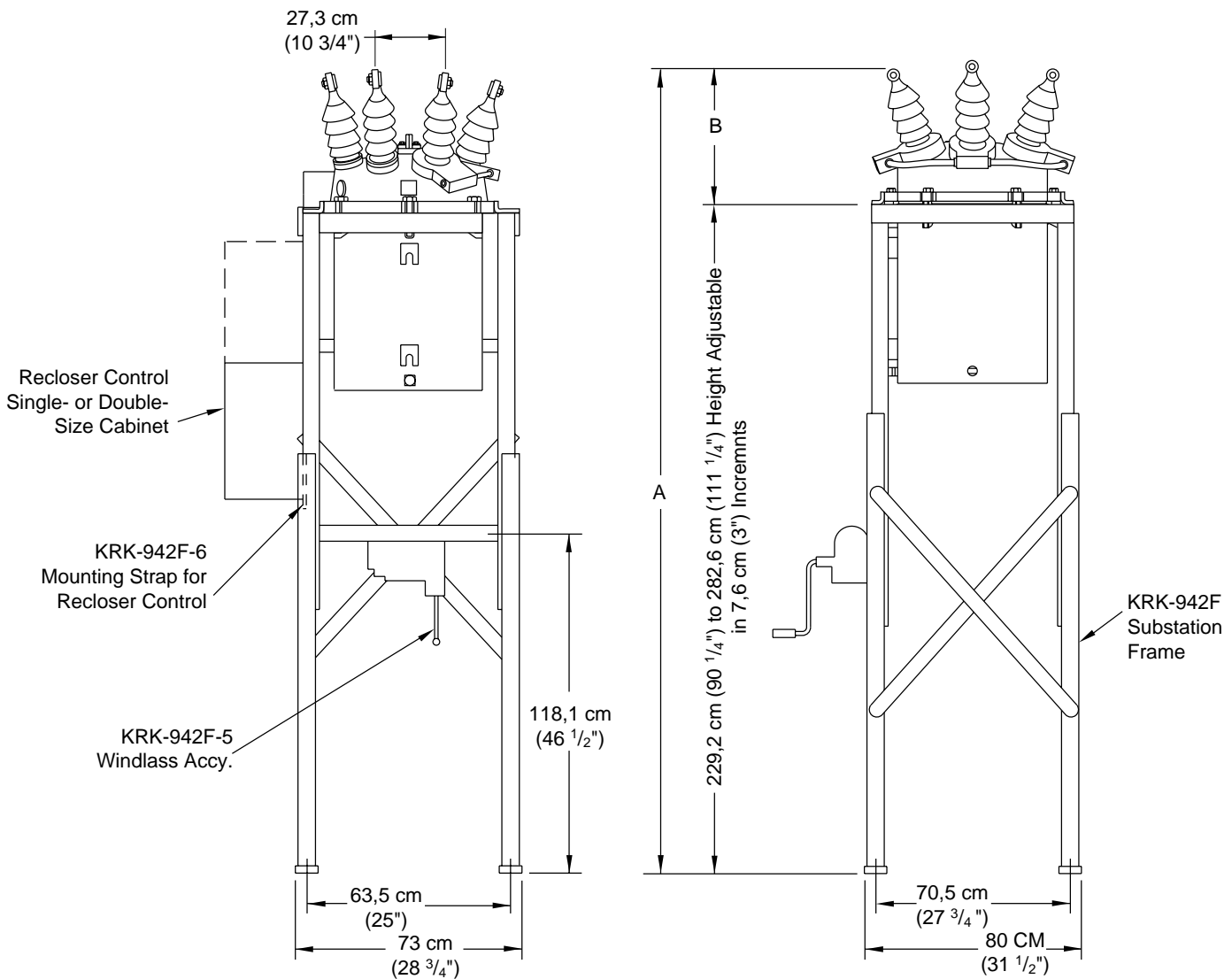


Figure 7. Mounting and clearance dimensions for KFME/KVVME recloser with KRK942F Substation Elevating Structure.

MAIN WIRING CONNECTIONS FOR INSTALLATION

Bypass Switches

For maintenance ease, it is suggested that KFME and KFVME recloser installations include bypass and disconnect switches. Figure 8 illustrates a typical installation with crossarm mounted bypass switches and Figure 9 illustrates an installation with inline bypass switches.

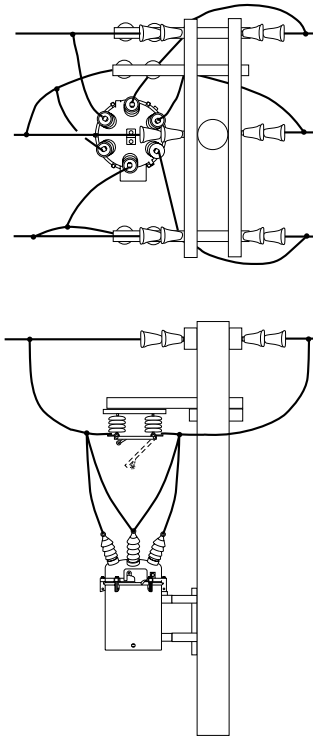


Figure 8.
Typical KFME/KFVME recloser installation with crossarm mounted bypass switches.

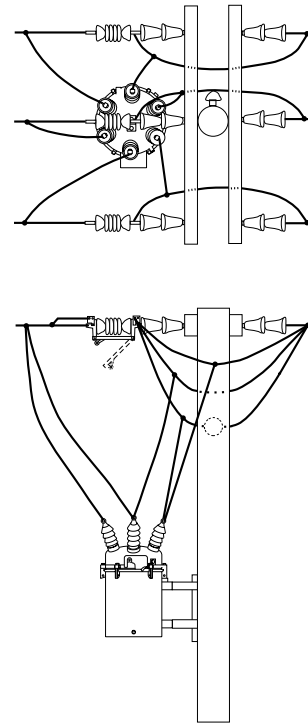


Figure 9.
Typical KFME/KFVME recloser installation with inline bypass switches.

Surge Protection

Reclosers operate best when protected with surge arresters. On line applications, surge protection is recommended on both sides of the recloser. If protection is to be provided on one side only, install the arresters on the source side. In substations, arresters are located on the load side. Figure 10 illustrates a protection scheme for KFME or KFVME reclosers, including surge arresters.

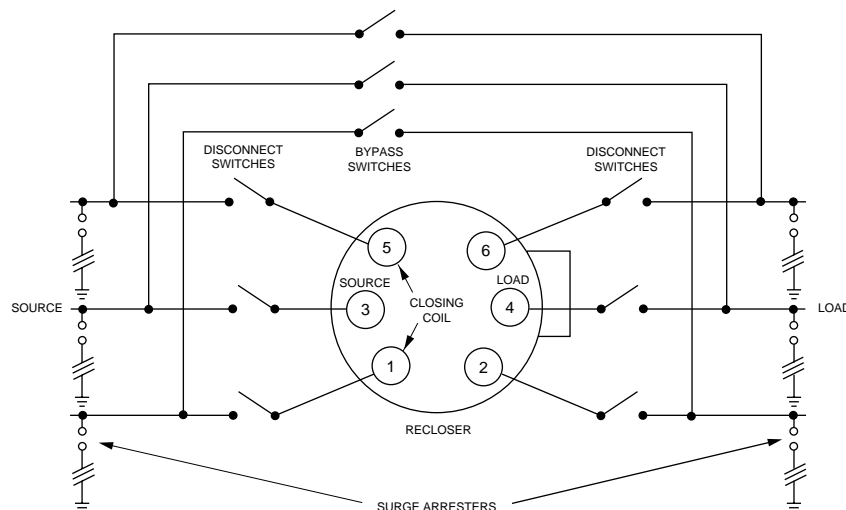


Figure 10.
Typical KFME/KFVME recloser connections with bypass and disconnect switches and surge protection on source and load sides.

Grounding

WARNING: Hazardous voltage. Recloser and control must be solidly grounded. Improper grounding can result in contact with high voltage, which will cause death or severe personal injury. G115.0

The recloser ground connector, located on the recloser tank near the bottom (Figure 5) will accommodate two No. 10 solid through No. 2 stranded conductors.

Another ground connector is provided at the bottom of the electronic control cabinet for connecting a No. 14 through No. 4 stranded grounding cable to the substation elevating structure or to other suitable ground.

Connect the ground in accordance with utility standards.

High Voltage

Bushing terminals are universal clamp type connectors which accept No. 6 through 350 MCM conductors. High voltage line connections must be made to recloser bushing terminals in accordance with "SOURCE" and "LOAD" markings in the head casting.

CAUTION: Source leads MUST be connected to terminals 1, 3, and 5 marked "SOURCE" on the head casting to provide operating energy for the high voltage closing solenoid. The closing solenoid is connected between terminals 1 and 5 during a closing operation. T247.0

OPERATION

Manual Operation

From the Control Panel of Form 4C and FXA Controls

To close recloser:

1. Move manual control switch to TRIP position.
2. Move yellow trip-reset handle on recloser up to its CLOSED position.
3. Make sure high-voltage source lines are energized, providing power to the closing solenoid.
4. Move manual control switch to CLOSE. Recloser should close immediately.

To open recloser and lockout control:

Move the manual control switch to the TRIP position. The recloser will open and control will lockout.

From The FX Control

To close recloser:

Push the Close Button, located on the bottom of the control, to initiate a closing signal to the recloser.

At The Recloser

To open recloser (connected to Form 4C or FXA controls):

Pull down the yellow manual-operating handle located under the recloser sleethood. Then operate manual control switch of the control to TRIP position.

To open recloser and lockout control (connected to FX control):

The recloser can not be opened manually from the FX control. Pull down the yellow manual-operating handle, located under the sleethood of the recloser.

To close the recloser (connected to Form 4C or FXA controls):

Manual closing is normally accomplished from the operator panel on the electronic control.

NOTE: The yellow trip-reset handle must be returned to the CLOSED position to permit recloser closing. If the control is in a closed condition when the yellow handle is moved up, the recloser will close.

Initial Operation

With Form 4C and FXA Controls

With the electronic control connected and energized and with the source lines energized, perform the following steps to place the recloser in service:

1. Check that the control is:
 - A. Tripped: Move manual control switch, on the operator panel, to TRIP.
 - B. Set for normal operation: set switches to NORMAL (unless altered operation is desired).
2. Move the yellow trip-reset handle, under the recloser sleethood, to its CLOSED position.
3. Move the manual control switch, on operator control panel, to CLOSE.
4. Open the bypass switches or perform the equivalent operation with jumper switches if these are used instead of disconnect and bypass switches.

Automatic Operation

Once closed and in service, the electronic control will automatically cause trip and reclosing operations as programmed by the control. If the control sequences to lock-out, the recloser will remain open (the red indicator blade under the sleethood in the down position) until the control is manually operated to close.

Form 4C and FXA Controls

The Form 4C and FXA controls can be set for non-reclosing operation at any time by moving a toggle switch on the control panel from NORMAL RECLOSING to NON-RECLOSING. If a fault occurs the control will cause the lockout after the first tripping operation.

Ground-trip operation can be blocked by moving a toggle switch on the control panel from NORMAL to GROUND TRIP BLOCK.

Both controls are equipped with switches to enable or disable supervisory operation and for switching to alternate minimum trip settings. Refer to *Service Information S280-77-1* and *S280-77-4* for additional information on the Form 4C control and *S280-78-1* for FXA control information.

FX control

The FX control interface software application provides the ability to enable or disable non-reclose or ground trip block via a personal computer.

The FX control can be set for non-reclosing operation by pulling down on the non-reclose lever. Once activated, the control will provide one operation to lockout.

NOTE: It is advisable to only use the levers to enable or disable non-reclose and ground trip block to provide a positive visual indication to the lineman.

By pulling down on the The Ground Trip Block lever, ground trip sensing is deactivated and the control will only respond to a phase fault condition.

Control Lockout

Form 4C and FXA Control

The Form 4C and FXA controls each are equipped with a front panel display that provides continuous indication of recloser status.

To place recloser back in service after the control has locked out: Move the manual control switch on the control panel to CLOSE. The recloser will close immediately and, if a fault still exists, the recloser will perform the programmed number of operations to lockout.

NOTE: The yellow trip-reset handle must be returned to the CLOSED position to permit recloser closing. If the control is in a closed condition when the yellow handle is moved up, the recloser will close.

FX Control

The FX control interface application provides the ability to program control lockout via a personal computer.

Cold-Load Pickup

Form 4C Controls

When closing in after an extended outage, the cold-load inrush current or magnetizing inrush current may be great enough to trip the recloser. Provisions for cold-load pickup are built into the electronic control. Tripping on cold-load pickup generally can be prevented by the following procedure:

1. Set the ground-trip and recloser operating mode switches on the control according to local standard startup practices.
2. Move the manual control switch to CLOSE and hold. With the switch held on CLOSE, the recloser will close in and the control will operate on the programmed delayed phase-trip timing characteristics.
Should a fault be present on the line during the cold-load pickup procedure, the control will operate the recloser on the delayed timing characteristics once and lock out (if set in the NON-RECLOSING operating mode) or for a sequence of all delayed operations to lockout (if set in the NORMAL RECLOSING operating mode).
3. Release the manual control switch, letting it return to the center position.

FX and FXA Controls

Cold Load Pickup on the FX and FXA controls is engaged or disabled via a windows-based programming software. Refer to *Service Information FX10001E* for the FX control and *S280-78-1* for the FXA control.

TESTING

All reclosers are carefully tested and adjusted at the factory to operate according to published data. Well-equipped test facilities, a detailed testing procedure, and thoroughly trained personnel assure accurately calibrated equipment. Each recloser leaves the factory ready for installation.

Pre-installation testing is not necessary. However, should verification of recloser operation prior to installation be required, refer to *Service information, S280-77-1* for the Form 4C control, *FX10001E* for the FX control, and *S280-78-1* for the FXA Control.

Safety Requirements

To prevent accidental contact with high-voltage parts, the recloser and high voltage transformer must be placed in a test cage and all proper grounding procedures must be observed.

WARNING: Hazardous voltage. The switchgear and high voltage transformer must be in a test cage or similar protective device 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. T221.3

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

Untanking the Recloser

CAUTION: Equipment damage. Recloser must be open (yellow operating handle, under sleet hood, down) before untanking. 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 untanking the recloser for inspection or repair, use care to keep from catching corona shields on inside lip of tank. This is particularly likely on units that are heavily unbalanced, such as those equipped with accessory BCT's on one side.

Testing Vacuum Interrupters

Check the vacuum integrity of the interrupter assemblies, using the following procedure:

With the recloser in the open position and the yellow trip-reset handle down, perform a high-pot test for one minute across each open vacuum interrupter assembly at the following test voltage:

KFME: 37.5 kVrms or 53 kVdc

KVVME: 45 kVrms or 63.5 kVdc

IMPORTANT: To prevent possible damage to the vacuum interrupters, the dc test sources should be limited to a maximum of 5 milliamps. The interrupter should withstand the test voltage and should not load down the source.

ACCESSORIES

The Type KFME and KVVME reclosers can be equipped with a number of factory-installed accessories which are described below. Power requirements, connection instructions and adjustments where needed are also described.

Extra Creepage Bushings

When KFME reclosers are to be installed where extensive salt spray, smog, smoke or other atmospheric contaminants reduce the effectiveness of porcelain insulation, Extra Creepage Bushings (KRK288FC) can be supplied. Standard Type KFME recloser bushings provide 29,6 cm (115/8 in.) of creepage; extra creepage accessory bushings provide 43,2 cm (17 in.).



Figure 11. Bushing Current Transformer accessory mounted on recloser bushings. 82083KMA

Bushing-Type Multi-Ratio Current Transformers, Factory Installed

A set of three 600:5 multi-ratio current transformers for operating relays or load meters can be factory installed externally on the source side bushings (Figure 11). The accessory includes three current transformers, conduit, fittings and factory wiring to a terminal block mounted in a weatherproof junction box. Taps on the secondary winding provide the different ratios. The available ratios and their corresponding terminal connections are shown in Table 6. The terminal arrangement for the tapped secondary (Figure 12) is accessible when the cover plate on the transformer housing is removed.

CAUTION: Hazardous Voltage. The recloser is shipped with each BCT secondary shorted with a jumper wire between terminals X1 and X5. Do not remove the jumper wire until external connections to the CT's have been completed. Energizing the recloser with the jumper wire removed and the CT's not connected can generate dangerous voltages in the CT secondaries. T248.0

TABLE 6
Bushing-Type Current Transformer Accuracy. (Does not apply to BCT accessory KA712L2).

Ratio	Terminal Connection	Relay Accuracy Class	Metering Accuracy Class		
			.3B-0.5	.6B-1.0	1.2B-2.0
600:5	X1-X5	C-100	.3B-0.5	.6B-1.0	1.2B-2.0
500:5	X2-X5	--	.3B-0.5	.6B-1.0	1.2B-2.0
450:5	X3-X5	--	.3B-0.5	.6B-1.0	1.2B-2.0
400:5	X1-X4	--	.3B-0.2	.6B-0.5	1.2B-2.0
300:5	X2-X4	--	.3B-0.2	.6B-0.5	1.2B-1.0
250:5	X3-X4	--	--	.6B-0.2	1.2B-0.5
200:5	X4-X5	--	--	.6B-0.2	1.2B-0.5
150:5	X1-X3	--	--	--	1.2B-0.2
100:5	X1-X2	--	--	--	--
50:1	X2-X3	--	--	--	--

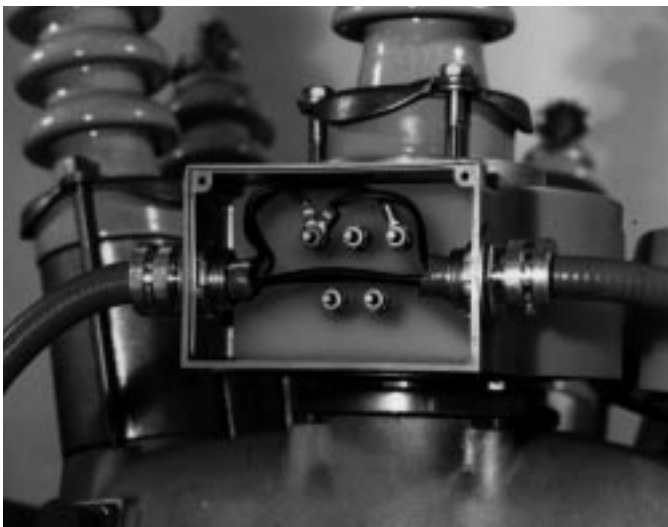


Figure 12.
Bushing Current Transformer secondary winding taps are located in the transformer housing.

82084KMA



Figure 13.
Bushing Current Transformer accessory KA712L2 mounted on recloser bushings. Factory or Field installation.

82083KMA

The KA712L2, slip-on type Bushing Current Transformer accessory (Figure 13) is specifically designed for load metering at the equipment location. This accessory can be conveniently installed at the site without removing the recloser bushings.

NOTE: If the recloser is equipped with extra-creepage bushings, it may be necessary to remove the bushings when installing the “slip-on” bushing CT. This requires the tank to be dropped.

The BCT's have accuracies of $\pm 5\%$ for conventional metering, and four taps to provide the current ratios in Table 7.

For more information on BCT accessory KA712L2, see *Service Information S280-90-5*.

TABLE 7
Current Ratios of BCT accessory KA712L2, Multi-Ratio 600:5

DC RESISTANCE	Current Ratio	Connection Terminals
		100:5
	200:5	A-B
	300:5	B-C
	400:5	B-D
	500:5	A-C
	600:5	A-D

CT's can carry 150% of rated secondary current continuously

Auxiliary Switch

Remote indication of recloser contact position can be accomplished with the Auxiliary Switch accessory KRK1020FA. The contacts of the Auxiliary Switch can also be used to switch other circuits in accordance with the opening and closing of the recloser contacts. The auxiliary switches are mounted on the side of the recloser mechanism frame. The Auxiliary Switches are wired to a receptacle on the side of the head casting.

The switches are single pole double throw—"a" and "b". When the recloser contacts are open, the "a" contacts are also open and the "b" contacts are closed. The relationship between the auxiliary switch and recloser contacts is shown in Table 9. The contacts cannot be changed. Auxiliary switch interrupting ratings are shown in Table 8.

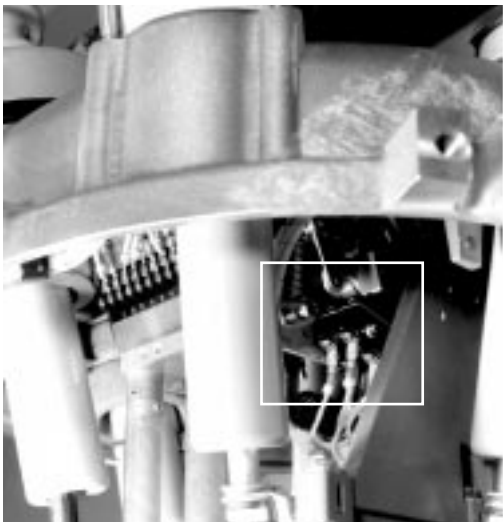


Figure 14.
Auxiliary Switch accessory mounted on side of the recloser mechanism.

82083KMA

TABLE 8
Interrupting Ratings of Auxiliary Switch

Volts	Current (amps)
120ac	15
240ac	15
24dc	2
48dc	$\frac{3}{4}$
125dc	$\frac{1}{2}$
250dc	$\frac{1}{4}$

TABLE 9
Auxiliary Switch Contact Positions


Recloser Contacts	Open	Closed
Auxiliary "a" contacts are	Open	Closed
Auxiliary "b" contacts are	Closed	Open

Junction Box

The Junction Box accessory provides a convenient single location for customer wiring to the Auxiliary Switch accessory, or to a Low Voltage Closing coil. An accessory interconnection cable is available for connection between the auxiliary switch receptacle and the junction box assembly.

Manual Closing Tool


A T-handled closing tool is available for closing a de-energized recloser when high-voltage closing power is not available.

 **WARNING:** Hazardous voltage. Never use a manual closing tool to close an energized recloser. Manually closing an energized recloser can result in contact with high voltage which will cause death or severe personal injury.

T231.1

To close a de-energized recloser with the closing tool.

1. Remove the closing tool port plug from the side of the recloser head casting.
2. Insert the closing tool into the port and engage the pin on the closing shaft (Figure 15).

 **CAUTION:** Equipment damage. Do not turn the manual closing tool more than one-quarter turn clockwise. Forcing the tool beyond the mechanism stop may shear the pin on the closing shaft of the recloser.

T222.0

3. To close the recloser, place the yellow operating handle (under the sleethood) in the up (CLOSED) position and turn the tool one-quarter turn clockwise.
4. Replace the plug before returning the recloser to service.




82059KMA-1

Figure 15.
Using the manual closing tool to operate the recloser.

To Trip The Recloser

Pull down on the yellow operating handle or operate the manual control switch, on the operator control cabinet, to trip and release.

 **CAUTION:** Equipment damage. Do not attempt to trip a recloser by operating the manual closing tool from CLOSED to OPEN. This will result in damage to the recloser operating mechanism.

T228.0

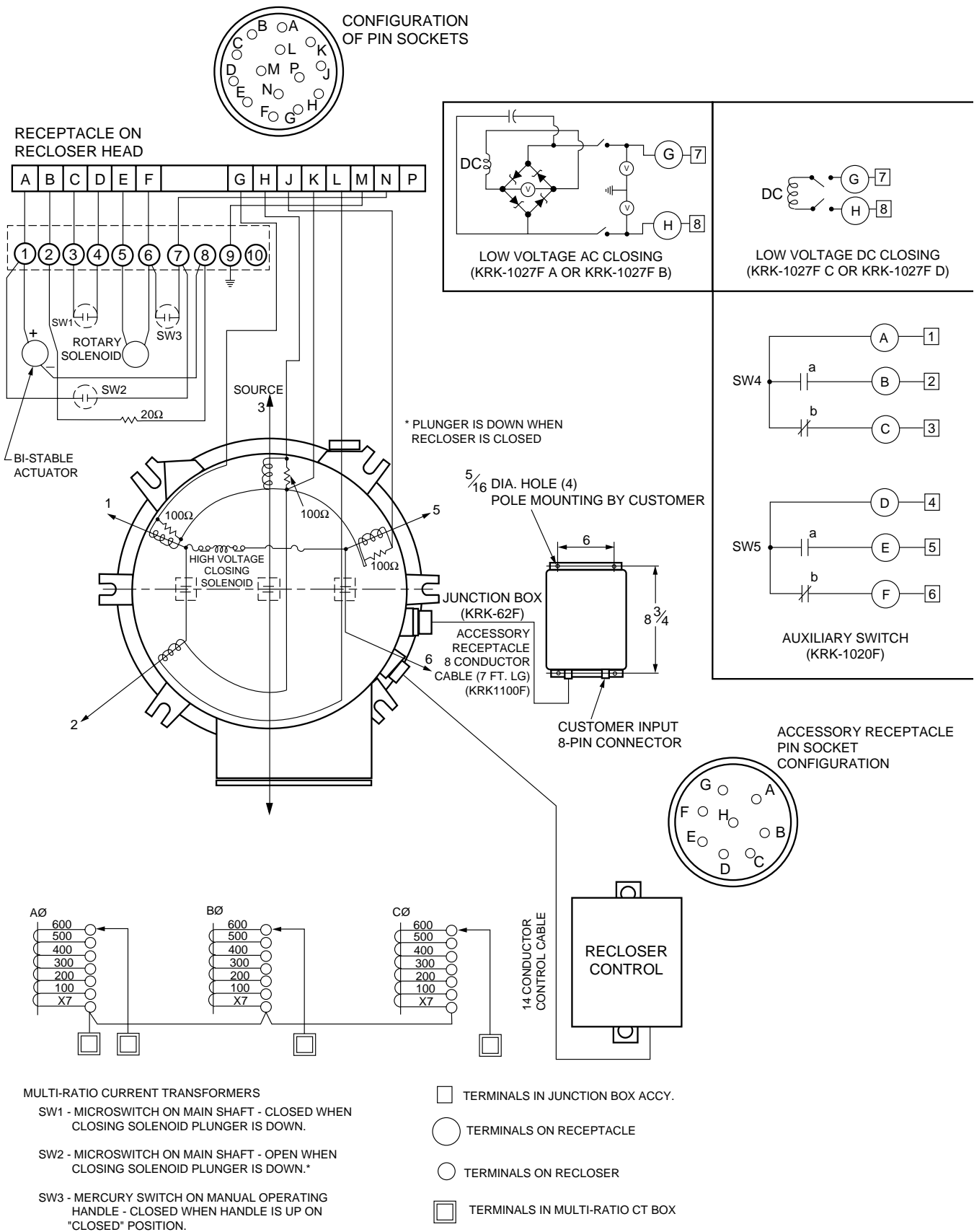



Figure 16.
Recloser Schematic Diagram.


MAINTENANCE INFORMATION

Maintenance Requirements

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

 **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 oil to provide electrical insulation between components. The dielectric strength of the oil 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 insulating oil that does not meet minimum requirements can result in internal flashovers that will damage the equipment and can cause personal injury.

G107.2

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, page 6).

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 operating experience, use the following guideline to establish maintenance intervals:

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

Replacement Parts

Replacement parts for Kyle 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 Cooper Power Systems Sales 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 Kyle reclosers. For further information, contact your Cooper Power Systems sales 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's in-house training facility. These courses provide training and factory recommended procedures for the routine maintenance, troubleshooting, repair and testing of Kyle reclosers and controls. It is recommended that all personnel who service and maintain Kyle switchgear, attend the appropriate classes. For additional information, contact your Cooper Power Systems sales representative.



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