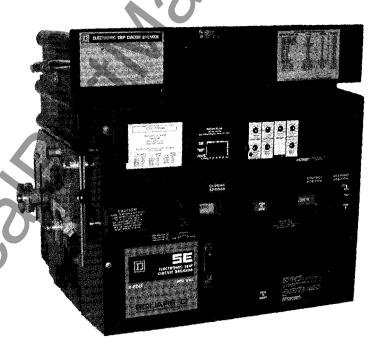
Instruction Bulletin

48040-495-07 09/2002 Cedar Rapids, IA, USA ECN 720A

SE Electronic Trip Circuit Breaker with MICROLOGIC® Trip System

Retain for future use.





HAZARD CATEGORIES AND SPECIAL SYMBOLS







Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a "Danger" or "Warning" safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

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

A WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, can result in death or serious injury.

ACAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, can result in minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, can result in property damage.



Provides additional information to clarify or simplify a procedure.

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. This Class A digital apparatus complies with Canadian ICES-003.

PLEASE NOTE

FCC NOTICE



TABLE OF CONTENTS

SECTION 1:	GENERAL INFORMATION		
		SEF Circuit Breakers	4
		SED Circuit Breaker	
		Trip Unit	
		Ampere Rating	
		Sensor Size	
		Frame Size	
		Current Rating	
		Interrupting Ratings	
SECTION 2:	DECEIVING AND LIETING CIDCL	JIT BREAKER	
SECTION 2.	RECEIVING AND LIFTING CIRC		
		Receiving Circuit Breaker	8
		Lifting Circuit Breaker	8
SECTION 3:	SEF CIRCUIT BREAKER		
		Factory-installed SEF Circuit Breaker	
		Field-installed SEF Circuit Breaker	
		Enclosure Door/Cover	
		Enclosure Size	
		Ventilation	
		Bussing	
		Install SEF Circuit Breaker	
		Install Arc Barriers	
		Inspect SEF Circuit Breaker	
		Check SEF Circuit Breaker Operation	1
		Charge Closing Springs	
	•	Close Circuit Breaker	
		Open Circuit Breaker	
		Remove SEF Circuit Breaker	
	(
SECTION 4:	SED CIRCUIT BREAKER	<u>U</u>	17
		Install CED Circuit Presiden	
		Install SED Circuit Breaker	
		Check SED Circuit Breaker Operation	
		Manually Charge Closing Springs Close Circuit Breaker	
		Open Circuit Breaker Check Drawout Operation	
		Remove SED Circuit Breaker	
		TIOTHOVE GED GIFOUR DICERCO	22
SECTION 5:	TRIP UNIT OPERATION		24
		Current Rating	24
		Rating Plug	
		Ammeter/Trip Indicator	25
	X /	Memory Feature	
		Ground-fault Detection	
		Trip Characteristics	26
		Trip Unit Functions	
A	▼	Long-time Trip Function	
		Short-time Trip Function	
12		Instantaneous Trip Function	
		Ground-fault Trip Function	
		Ground-fault Alarm Function	28

Equipment Required	SECTION 6:	TRIP UNIT ADJUSTMENTS AND	CONTROL WIRING	29
Trip Unit Settings			Trin Unit Adjustments	29
Adjust Trip Unit				
Control Wiring				
Circuit Breaker Accessories 33				
Communicating with a POWERLOGIC® System				
Zone-selective Interlocking (ZSI)				
Ground-fault Protection 33				
Test Ground-fault Feature 33			Ground-fault Protection	33
Check Installation				
SED Circuit Breaker in Service 33				
Place Circuit Breaker in Service 33			SED Circuit Breaker	34
Seal Trip Unit 33 SECTION 7: MAINTENANCE Routine Maintenance 36 SEF Circuit Breaker 36 SEF Circuit Breaker 36 SED Circuit Breaker 36 Primary Injection Testing 37 SECTION 8: ACCESSORIES 36 General 36 Shunt Trip 36 Shunt Trip 36 Shunt Trip 36 Auxiliary Swirtch 35 Undervoltage Trip 35 Alarm Switch 44 Spring Charging Motor 44 SEF Circuit Breaker Cell Switch 44 Close Button Cover 44 SEF Circuit Breaker Padlock Attachment 41 SEF Circuit Breaker Padlock Attachment 41 SEF Circuit Breaker Rey Interlock 42 SED Circuit Breaker Key Interlock 44 SEF Circuit Breaker Key Interlock 44 SED Circuit Breaker Cell Keying Kit 44 Restraint Interface Module 43 Universal Test Set 44 Communications Adapter 44 SECTION 9: REPACKING CIRCUIT BREAKER 45 Repacking 45 Repacking 45 Repacking 45 Repacking 45 Repacking 45 Repacking 45 Refore Working on Circuit Breaker 44 Retrial Required 45 Repacking 45 Refore Working on Circuit Breaker 44 Retrial Required 45 Repacking 45 Repacking 46 Refore Working on Circuit Breaker 48 Retrially-mounted Accessories 49 Interlocks 49 Interlocks 50 Auxiliary Cover Interlock 50 Key Interlock (Optional) 50				
SECTION 7: MAINTENANCE Souther Maintenance 36			Seal Trip Unit	35
Routine Maintenance				
SEF Circuit Breaker	SECTION 7:	MAINTENANCE		
SED Circuit Breaker				
Primary Injection Testing				
SECTION 8: ACCESSORIES 36 36 36 37 38 38 38 38 38 38 38				
General			Primary Injection Testing	37
General	SECTION 8:	ACCESSORIES		38
Shunt Trip 38	OLO HONO.	ACCESCOMES		
Shunt Close (Remote Close) 38				
Auxiliary Switch				
Undervoltage Trip				
Alarm Switch				
Spring Charging Motor			4 1	
SED Gircuit Breaker Cell Switch				
Close Button Cover SEF Circuit Breaker Padlock Attachment 41				
SEF Circuit Breaker Padlock Attachment				
SED Circuit Breaker Padlock Attachment				
Circuit Breaker Key Interlock				
SEF Circuit Breaker Key Interlock				
SED Circuit Breaker Key Interlock				
SED Circuit Breaker Cell Keying Kit				
Restraint Interface Module		* .		
Universal Test Set				
Communications Adapter				
SECTION 9: REPACKING CIRCUIT BREAKER 45 Equipment Required 45 Materials Required 45 Repacking 45 SECTION 10: TROUBLESHOOTING SED Circuit Breaker Troubleshooting 47 SEF Circuit Breaker Troubleshooting 48 Before Working on Circuit Breaker 48 Internally-mounted Accessories 49 Interlocks 50 Auxiliary Cover Interlock 50 Key Interlock (Optional) 50				
Equipment Required			Communications Adapter	44
Materials Required 45	SECTION 9:	REPACKING CIRCUIT BREAKER		45
Materials Required 45			Equipment Dequired	45
Repacking			• • • •	
SECTION 10: TROUBLESHOOTING SED Circuit Breaker Troubleshooting 47 SEF Circuit Breaker Troubleshooting 48 Before Working on Circuit Breaker 48 Internally-mounted Accessories 49 Interlocks 50 Auxiliary Cover Interlock 50 Key Interlock (Optional) 50			·	
SED Circuit Breaker Troubleshooting			Tiopasting	
SEF Circuit Breaker Troubleshooting	SECTION 10:	TROUBLESHOOTING		47
Before Working on Circuit Breaker				
Internally-mounted Accessories 49 Interlocks 50 Auxiliary Cover Interlock 50 Key Interlock (Optional) 50				
Interlocks				
Auxiliary Cover Interlock		•	·	
Key Interlock (Optional)50		▼		
			The state of the s	
Cell Door Interlock 51	13			
			Cell Door Interlock	
Push-to-open Padlock Attachment (Optional)53			Push-to-open Padlock Attachment (Optional)	53

		Drawout Access Cover Interlock	53
		Drawout Mechanism Lockout	
		Drawout Carriage Padlock Hasp	53
		SED 4000 A Circuit Breaker Interlock	53
ADDENIDIY 1.	DIMENSIONS		5.4
APPENDIX I:	DIMENSIONS		
		SED (Drawout) Circuit Breaker	54
		SEF (Fixed-Mounted) Circuit Breaker	55
		Neutral Current Transformer	
		SEFM40CK Terminal Connector Kit	58
ADDENINY 2.	WIRING DIAGRAMS		60
AFFENDIA 2.	WINING DIAGNAMS		
		Terminal Connectors for SE Circuit Breaker	60
		AC Auxiliary Switches	61
		AC/DC Auxiliary Switches	62
		Alarm Switches	63
		Shunt Trip	63
		Undervoltage Trip	64
		Shunt Close	64
		Spring Charging Motor	65
		Ground-Fault Systems	
		Ground-fault Test Circuit	66
		3Ø3W (Three-phase, Three-wire) Residual Ground-fault	
		Sensing System	66
		3Ø4W (Three-phase, Four-wire) Residual Ground-fault	
		Sensing System	67
		3Ø4W (Three-phase, Four-wire) Source Ground-sensing	
		System	
		Zone-Selective Interlocking	
		Ground-fault Zone-selective Interlocking	
		Short-time Zone-selective Interlocking	
		CIM3F Communications Adapter Connections	
		SED4000 A Circuit Breaker Cooling Fan	71
A DDENIBLY C	0474100 111110555	•//	
APPENDIX 3:	CATALOG NUMBERS		72
NDEX:	\		73
			13

MAN CORE

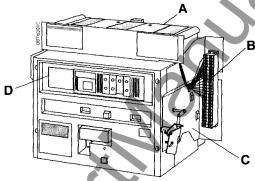
SECTION 1— GENERAL INFORMATION

SE electronic trip circuit breakers with MICROLOGIC[®] trip systems are available in either fixed-mounted (SEF) or drawout (SED) construction. For both constructions, the circuit breaker case is factory sealed and must not be opened for any reason. **Opening the case voids UL Listing and all warranties**. No user-serviceable parts are located inside the molded case.

SEF CIRCUIT BREAKERS

- A. Rear-mounted power terminals permit cable connections or bolted bus connections
- B. Terminal blocks for connection to control wiring
- Side plates bolt to the switchboard frame to support the circuit breaker
- D. Electronic trip unit provides adjustable tripping functions

Figure 1: SEF Circuit Breaker



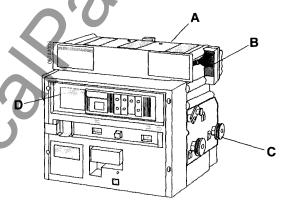
SED CIRCUIT BREAKER

The SED circuit breaker is designed to mount in a drawout carriage inside an enclosure.

The drawout carriage includes rails to install and withdraw the circuit breaker, copper bussing to provide the main electrical connections to the circuit breaker, and interlocks to ensure safe operation.

- Plug-on pressure connection to make the line and load connections
- B. Plug-on pressure connection for control wiring
- Circuit breaker installs in drawout carriage using drawout rails
- D. Electronic trip unit provides adjustable tripping functions

Figure 2: SED Circuit Breaker



TRIP UNIT

The trip unit includes all the trip function adjustments and a receptacle for the rating plug. Indicators will show if a trip was due to an overload, shortcircuit or ground-fault condition. The trip unit can be sealed to prevent tampering by unauthorized personnel.

AMPERE RATING

The maximum current that a circuit breaker can carry is called the ampere rating. It is determined by the mathematical equation:

Ampere Rating

(P)

Sensor Size

(S)

Rating Plug %

SENSOR SIZE

The circuit breaker sensor size is the maximum ampere rating possible for a *specific* circuit breaker. It is based on the size of the current sensor inside the circuit breaker. (Current sensors are integral to the circuit breaker and cannot be removed or replaced.)

SE circuit breakers are available in eight sensor sizes: 400, 800, 1200, 1600, 2000, 2500, 3000 and 4000 amperes. The sensor size is indicated on the faceplate on the front of the circuit breaker.

FRAME SIZE

The maximum ampere rating a circuit breaker *family* can carry is called the frame size. All SE circuit breakers have a 4000 A frame size and are the same physical size.

The rating plug applies a multiplier (ranging from 0.4 to 1.0) to the sensor size. The rating plug multiplier value is printed on the face of the rating plug along with the mathematical equation used to obtain the ampere rating. (The rating plug catalog number is ARPXXX, with XXX being the multiplier value stated as a percentage.)

CURRENT RATING

Continuous current carrying capacity of the circuit breaker is determined by multiplying the circuit breaker sensor size by the rating plug multiplier and the trip unit long-time pickup switch setting. All SE circuit breakers are rated for 100% continuous loading.

Sensor X Rating Plug Size Multiplier	X	Long-time Pickup Switch Setting	=	Current Rating
1200 X 100%	X	1.0	=	1200

INTERRUPTING RATINGS

The maximum amount of current the circuit breaker is designed to safely interrupt is called the ampere interrupting rating (AIR).

Table 1: Interrupting Ratings

Circuit	UL Listed	Interrupting	30-cycle Short-time	
Breaker	240 Vac	480 Vac	600 Vac	Rating
SEF, SED	150 000	100 000	85 000	50 000
SEHF, SEHD	200 000	150 000	100 000	65 000

¹ Interruption rating is value shown or interruption rating of switchboard, whichever is lower.

SECTION 2— RECEIVING AND LIFTING CIRCUIT BREAKER

RECEIVING CIRCUIT BREAKER

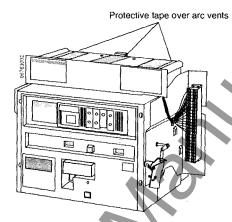
Immediately inspect all equipment for shipping damage. If damage is found or suspected, file a claim as soon as possible with carrier and notify nearest Square D representative.

Also inspect circuit breakers and equipment after installation BEFORE energizing switchboard.

NOTE: Protective tape is placed over arc vents to keep debris out of circuit breaker. Do not remove tape prior to installation.

If equipment must be stored before installation, store in a clean dry place, protected from dirt and water. Provide ample air circulation and heat, if necessary, to prevent condensation.

Figure 3: SEF Circuit Breaker



LIFTING CIRCUIT BREAKER

A DANGER

HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION

Circuit breaker weighs over 280 lbs. (127 kg) and must be lifted using lifting adapter and hoist capable of lifting 300 lbs. (136 kg).

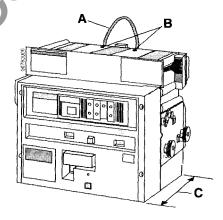
Failure to follow this instruction will result in death or serious injury.

Lift circuit breaker using supplied lifting adapter (A). Insert lifting adapter hooks into two holes at upper rear of circuit breaker and position adapter so hooks extend out through two holes (B) on top of circuit breaker.

Lifting must be done using a hoist capable of lifting 300 lbs. (136kg) or more. Connect hoist to lifting adapter and lift circuit breaker slowly.

Although not recommended, the circuit breaker can be lifted from below using a platform, supporting weight of circuit breaker in area (C). The auxiliary cover and current transformers can be damaged if used to support the weight of the circuit breaker.





SECTION 3— SEF CIRCUIT BREAKER

A DANGER

HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION

- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this
 equipment.

Failure to follow this instruction will result in death or serious injury.

FACTORY-INSTALLED SEF CIRCUIT BREAKER

SEF circuit breakers are normally factory installed in switchboards. For factory-installed circuit breakers:

- 1. Disconnect all power to enclosure.
- 2. Inspect circuit breaker as instructed on page 14.

FIELD-INSTALLED SEF CIRCUIT BREAKER

- 1. Disconnect all power to enclosure.
- 2. Check enclosure design. Conduct tests per UL 891 if:
 - More than one device is mounted in a single enclosure.
 - The enclosure does not meet the minimum enclosure requirements listed in this section.

Enclosure Door/Cover

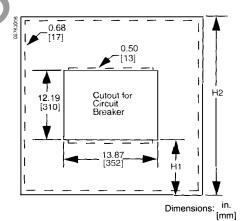
An SE circuit breaker cover must have:

 at least three 1/4-20 securing screws on each side

or

 at least three 1/4-20 securing screws on one side and a minimum of three hinges on opposite side

Figure 5: SE Enclosure Door Dimensions



Minimum Door Dimensions

Frame Size	H1	H2	
400-3000 A		26.45 in. [672 mm]	
4000 A	10.13 in. [257 mm]	32.45 in. [824 mm]	

Enclosure Size

Shaded area is minimum SE mounting area. DO NOT locate additional equipment or structural members in this area.

Figure 6: SE Mounting Area

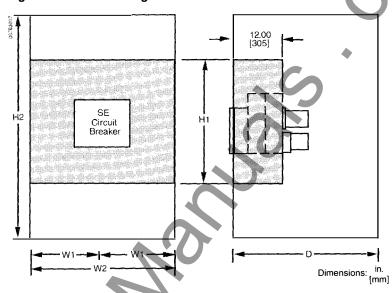


Table 2: Enclosure Dimensions

Minimum Mounting				Minimum Enclosure		
Frame	Half Width	Width	Height	Height	Depth	Volume V
Size	W1	W2	H1	H2	D	in.
400 A, 800 A, 1200 A, 1600 A	15 in. [381 mm]	30 in. [762 mm]	29.5 in. [749 mm]		-	31 860 in. [809 244 mm]
2000 A, 2500 A, 3000 A	18 in. [457 mm]	36 in. [914 mm]	29.5 in. [749 mm]	-	-	38 232 in. [971 093 mm]
4000 A in	21 in.	42 in.	34.5 in.	90 in.	48 in.	-
3Ø3W system	[533 mm]	[1067 mm]	[876 mm]	[2286 mm]	[1219 mm]	
4000 A in	24 in.	48 in.	34.5 in.	90 in.	48 in.	_
3Ø4W system	[608 mm]	[1219 mm]	[876 mm]	[2286 mm]	[1219 mm]	

Refer to UL 891 and the National Electrical Code (NEC) for wire bending requirements. Adequate conduit entry area must be available.

NOTE: Terminal connector kit SEFM40CK is required for all 4000 A SEF circuit breaker mounting. Enclosure design must allow for installation of terminal connector kit. THE UL LISTING IS VOID UNLESS TERMINAL CONNECTOR KIT IS USED. See Appendix A for dimensions of terminal connector kit.

Wire Bending Space

MAN CORE

Ventilation

The SE circuit breaker requires unrestricted ventilation openings in the enclosure. See Table 3 for amount of ventilation required. These values are based on one SE circuit breaker per enclosure.

Table 3: Enclosure Ventilation

Frame Size	Ventilation Required		
400 A, 800 A, 1200 A, 1600 A	NONE		
2000 A	154 in. ² (99 355 mm ²) on front of enclosure, place equal amounts at top and bottom of enclosure front.		
2500 A	308 in. ² (198 710 mm ²) in back of enclosure, place equal amounts at top and bottom of enclosure back.*		
3000 A	308 in. 2 (198 710 mm 2) in back of enclosure, place equal amounts at top and bottom of enclosure back, with 6 in. (152 mm) of clearance behind enclosure.*		
3000 A	If there is less than 6 in. (152 mm) of clearance behind enclosure, add an additional 308 in. (198 710 mm²) of ventilation to enclosure front.		
4000 A	388 in. ² (250 323 mm ²) in back of enclosure, place equal amounts at top and bottom of enclosure back.		

^{*}Ventilation can be located on front. However, available circuit breaker mounting space will be reduced.

Bussing

- Size bussing per UL 891.
- Install cables using <u>75°C</u> insulated wire per NEC Table 310-16

CAUTION

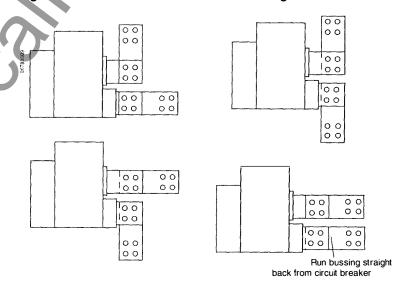
HAZARD OF CIRCUIT BREAKER DAMAGE

The SEF circuit breaker is not designed to support bussing or terminal extensions. All bussing and terminal extensions MUST be supported by means other than circuit breaker tangs.

Failure to follow this instruction can result in equipment damage.

A. 400-2000 A Circuit Breaker

Figure 7: 400-2000 A Circuit Breaker Bussing Method



INTA COR

B. 2500-3000 A Circuit Breaker

- 1. Add terminal extensions.
- 2. Mount extensions as shown in Figure 8.

Table 4: Extension Sizes

Frame	Copper Terminal Extensions		
Size	No.	Size	
2500 A	3	0.25 X 4.00 X 10.70 in. [6 X 102 X 272 mm] long	
3000A	4	0.25X 4.00 X 10.70 in. [6 X 102 X 272 mm] long	

NOTE: The supply terminal extensions must have 1/4 in. (6.4 mm) minimum spacing between bus bars. See Figure 9.

 Cable the 2500 A SEF circuit breaker using 75°C insulated wire per NEC Table 310-16. Cable the 3000 A SEF circuit breaker using 90°C insulated wire based on ampacity of 75°C wire per NEC Table 310-16.

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2500-3000 A Circuit Breaker Bussing Methods

Figure 9: Minimum Bus Bar Spacing

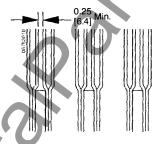


Figure 8:

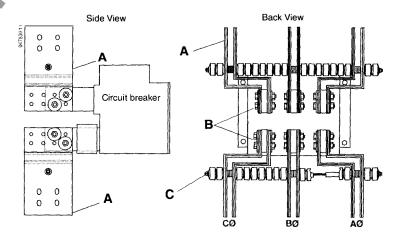
Dimensions: in. [mm]

C. 4000 A Circuit Breaker

NOTE: The UL Listing is void unless terminal connector kit SEFM40CK is used. See Appendix A for dimensional drawings of SEFM40CK kit.

- Mount four terminal connectors (A) per phase (from SEFM40CK kit) to circuit breaker.
- Install hex head bolts, Belleville washers and hex nuts (provided) (B). Torque to 70 lb-ft (95 N•m).
- 3. Torque KEPS nuts (C) to 225 lb-in (25 Nom).
- Bus with four 1/4 x 6 in. (6 x 152 mm) copper bus bars per phase or copper bus of equivalent cross-sectional area. If aluminum bus is desired, perform tests per UL 891 for acceptability.
- If cabling, use 90°C insulated wire based on ampacity of 75°C wire per NEC Table 310-16.

Figure 10: 4000 A Circuit Breaker With SEFM40CK Terminal Connector Kit



INSTALL SEF CIRCUIT BREAKER

A DANGER

HAZARD OF PERSONAL INJURY OR EQUIPMENT DAMAGE

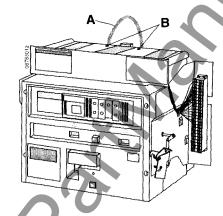
- Install circuit breaker ONLY when switchboard section is secured to avoid tipping.
- Circuit breaker weighs over 280 lbs. (127 kg) and must be lifted using lifting adapter and hoist capable of lifting 300 lbs. (136 kg).

Failure to follow this instruction will result in death, serious injury or equipment damage.

- Insert hooks of the supplied lifting adapter

 (A) into the two holes at upper rear of circuit breaker and position adapter so hooks extend out through two holes (B) on top of circuit breaker. Connect hoist capable of lifting 300 lbs. (136 kg) or more to lifting adapter and lift circuit breaker slowly.
- Install circuit breaker into enclosure. Make sure circuit breaker is secure.

Figure 11: SE Circuit Breaker Lifting Adapter



3. Remove hoist and lifting adapter. Store lifting adapter outside of the switchboard.

A DANGER

HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION

Energizing the circuit breaker with lifting adapter installed could result in a cross-phase condition. The lifting adapter must be removed from the circuit breaker before proceeding with installation.

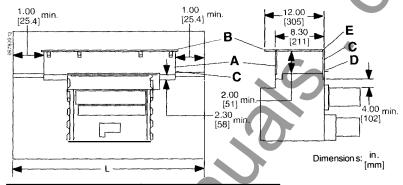
Failure to follow this instruction will result in death or serious injury.

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INSTALL ARC BARRIERS

- Install front (A), top (B) and rear (C) arc barriers around circuit breaker. Make arc barriers from 0.188 in. (5 mm) thick insulating material with a UL 94V-0 Flammability Rating.
- Support rear arc barrier (C) with a nonmagnetic barrier support angle (D) at least 0.125 in. (3 mm) thick with 2 in. (51 mm) flanges and length L. Rigidly mount support to enclosure frame members.
- Mount top arc barrier (B) to rear arc barrier with four angle brackets (E). The top arc barrier must extend to front of enclosure.
- Mount front arc barrier behind circuit breaker behind the gas shield. Mount front arc barrier to top arc barrier with four angle brackets.

Figure 12: Arc Barrier Clearances



Sensor Size	Minimum Barrier Length L
400 A, 800 A, 1200 A, 1600 A	30 in. [762 mm]
2000 A, 2500 A, 3000 A	36 in. [14 mm]
4000 A	42 in. [1067 mm]

INSPECT SEF CIRCUIT BREAKER

Inspect circuit breaker when equipment is first installed and again before placing circuit breaker in service. If damage such as loose power terminals, distorted connectors or any loose parts in switchboard section is found, contact Square D.

Make sure all bus and circuit breaker connections are properly torqued. Refer to Switchboard Installation/Maintenance Manual for torque values.

A DANGER

HAZARD OF PERSONAL INJURY OR EQUIPMENT DAMAGE

Install circuit breaker ONLY when switchboard section is secured to avoid tipping.

Failure to follow this instruction will result in death, serious injury or equipment damage.

CHECK SEF CIRCUIT BREAKER OPERATION

Charge Closing Springs

Electrically Charge Closing Springs

SE circuit breakers have a two-step stored energy mechanism: closing spring charging and contact closing are two distinct operations. Closing springs must be fully charged to close circuit breaker.

SE circuit breakers can be provided with an electrical operation system to automatically charge closing springs and permit remote circuit breaker operation. Refer to Section 8 for more information

INTA CORE

Manually Charge Closing Springs

CAUTION

HAZARD OF HANDLE DAMAGE

Do not apply excessive force to handle.

Failure to follow this instruction can result in equipment damage.

NOTE: The circuit breaker is shipped with springs discharged. (Closing spring indicator reads DISCHARGED.

- 1. Rotate closing spring charging handle (A) out to operating position.
- Move handle up and down 25 full strokes (B) until handle disengages and moves freely in both directions. (Closing spring indicator reads CHARGED.)
- 3. Return handle to stored position.

DISCHARGED

CHARGED

Close Circuit Breaker

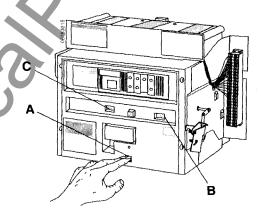
NOTE: Safety interlocks prevent closing of circuit breaker if certain conditions are not met. Refer to Section 10—Troubleshooting for information about these interlocks.

- Close circuit breaker by depressing Push-to-Close button (A). Closing circuit breaker automatically charges contact opening springs.
- When circuit breaker closes, contact position indicator (B) reads CLOSED and closing springs indicator (C) reads DISCHARGED.

The circuit breaker can be manually recharged when circuit breaker is closed. If an electrical operation system is provided and connected to a power source, closing springs start charging automatically when circuit breaker is closed.

Figure 14: Close Circuit Breaker

Figure 13: Charging Closing Spring



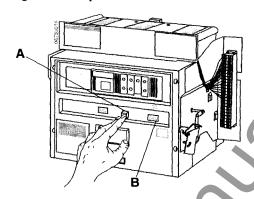
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Open Circuit Breaker

Open circuit breaker by pushing Push-to-Open button (A).

The contact position indicator (B) will read OPEN.

Figure 15: Open Circuit Breaker



REMOVE SEF CIRCUIT BREAKER

- Disconnect all power supplying this equipment before working on or inside equipment.
- Remove the circuit breaker in reverse order of installation.

A DANGER

HAZARD OF PERSONAL INJURY OR EQUIPMENT DAMAGE

- Remove circuit breaker ONLY when switchboard section is secured to avoid tipping.
- Circuit breaker weighs over 280 lbs. (127 kg) and must be lifted using lifting adapter and hoist capable of lifting 300 lbs. (136 kg).

Failure to follow this instruction will result in death, serious injury or equipment damage.

CAUTION

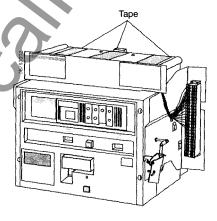
HAZARD OF CIRCUIT BREAKER DAMAGE

Arc vents must be covered with tape before moving or servicing circuit breaker. If any object drops into arc vents, return circuit breaker to Square D.

Failure to follow this instruction can result in equipment damage.

If arc vents are not already covered with tape, cover them with tape at this time.

Figure 16: Cover Arc Vents



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SECTION 4— SED CIRCUIT BREAKER

SED circuit breakers mount in carriage assemblies equipped with drawout rails and bussing specifically designed for them. Square D equipment has the carriage assembly already in the equipment. If installing SED circuit breaker in other than Square D equipment, a carriage assembly is required. Install carriage assembly according to the instructions shipped with it.

A DANGER

HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION

- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is
 off
- Replace all devices, doors and covers before turning on power to this
 equipment.

HAZARD OF PERSONAL INJURY OR EQUIPMENT DAMAGE

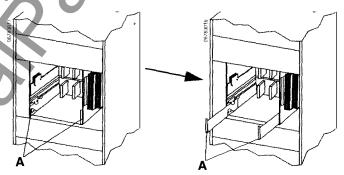
Install circuit breaker ONLY when switchboard section is secured to avoid tipping.

Failure to follow this instruction will result in death, serious injury or equipment damage.

INSTALL SED CIRCUIT BREAKER

- 1. Disconnect all power to enclosure.
- Inspect power connectors and main power terminals of the circuit breaker. With a lintfree cloth, remove any foreign material which can be stuck to the joint compound on the power connector. If joint compound has been removed, replace only with Square D joint compound PJC8311.
- Pull out drawout rails (A) until they drop into the horizontal position.

Figure 17: Drawout Rails



MAN COR STANDARD CORE

A DANGER

HAZARD OF PERSONAL INJURY OR EQUIPMENT DAMAGE

Circuit breaker weighs over 280 lbs. (127 kg) and must be lifted using lifting adapter and hoist capable of lifting 300 lbs. (136 kg).

Failure to follow this instruction will result in death, serious injury or equipment damage.

- 4. Insert hooks of the supplied lifting adapter (A) into the two holes at upper rear of circuit breaker and position adapter so hooks extend out through two holes (B) on top of circuit breaker. Connect hoist capable of lifting 300 lbs. (136 kg) or more to lifting adapter and lift circuit breaker slowly.
- Lower circuit breaker until all four drawout wheels (A) are on the extended rails, positioning the front wheels as shown.

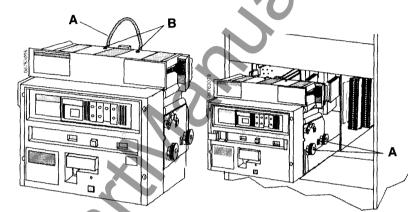


Figure 18: Install SE Circuit Breaker

- 6. Remove hoist and lifting adapter. Store lifting adapter outside of the switchboard.
- 7. Inspect circuit breaker when equipment is first installed and again before placing circuit breaker in service. If damage such as loose power terminals, distorted connectors or any loose parts in switchboard section is found, contact Square D. Make sure all bus and circuit breaker connections are properly torqued. Refer to Switchboard Installation/Maintenance Manual.
- 8. Push circuit breaker toward carriage. Make sure the secondary terminal connector (A) is in alignment with the terminal in the carriage (B).

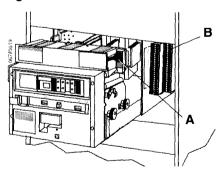
A DANGER

HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION

Energizing the circuit breaker with lifting adapter installed could result in a cross—phase condition. The lifting adapter must be removed from the circuit breaker before proceeding with installation.

Failure to follow this instruction will result in death or serious injury.

Figure 19: SED Circuit Breaker on Drawout Rails



MAN CORE

CHECK SED CIRCUIT BREAKER OPERATION

SE circuit breakers have a two-step stored energy mechanism: closing spring charging and contact closing are two distinct operations. Closing springs must be fully charged to close circuit breaker.

SE circuit breakers can be provided with an electrical operation system to automatically charge closing springs and permit remote circuit breaker operation. Refer to Section 8 for more information.

Manually Charge Closing Springs

A CAUTION

HAZARD OF HANDLE DAMAGE

Do not apply excessive force to handle.

Failure to follow this instruction can result in equipment damage.

NOTE: The circuit breaker is shipped with springs discharged. (Closing spring indicator reads DISCHARGED.)

- Rotate closing spring charging handle (A) out to operating position.
- Move handle up and down 25 full strokes (B) until handle disengages and moves freely in both directions. (Closing spring indicator reads CHARGED.)
- 3. Return handle to stored position.

Close Circuit Breaker

NOTE: Safety interlocks prevent closing of circuit breaker if certain conditions are not met. Refer to Section 10—Troubleshooting for information about these interlocks.

- Close circuit breaker by depressing Push-to Close button (A). Closing circuit breaker automatically charges contact opening springs.
- When circuit breaker closes, contact position indicator (B) reads CLOSED and closing springs indicator (C) reads DISCHARGED.

The circuit breaker can be manually recharged when circuit breaker is closed. If an electrical operation system is provided and connected to a power source, closing springs start charging automatically when circuit breaker is closed.

Figure 20: Charging Closing Spring

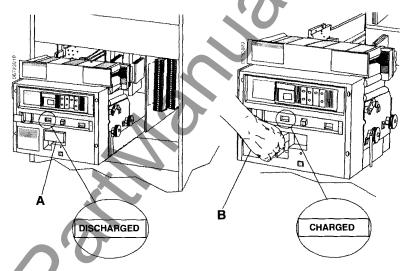
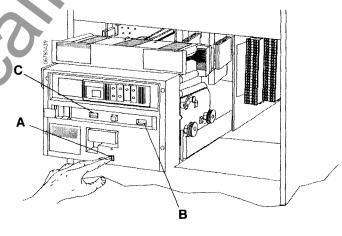


Figure 21: Close Circuit Breaker



MAN CORE CORE

REMOVE SED CIRCUIT BREAKER

A DANGER

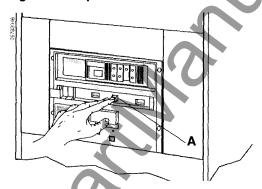
HAZARD OF PERSONAL INJURY OR EQUIPMENT DAMAGE

- Remove circuit breaker ONLY when switchboard section is secured to avoid tipping.
- Circuit breaker weighs over 280 lbs.(127 kg) and must be lifted using lifting adapter and hoist capable of lifting 300 lbs.(136 kg).

Failure to follow this instruction will result in death, serious injury or equipment damage.

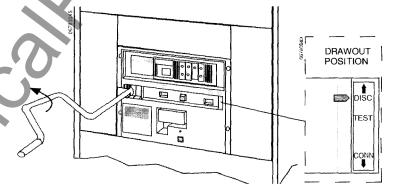
- 1. Turn off all power supplying this equipment before working on or inside equipment.
- 2. Open the circuit breaker by pushing the Push-to-Open button (A).

Figure 28: Open Circuit Breaker



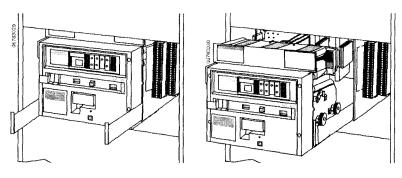
- 3. Place circuit breaker in disconnected position:
 - a. Lift access cover
 - b. Insert drawout crank.
 - c. Rotate the crank clockwise until stop is reached.
 - d. Drawout position indicator must point to DISC.
- Lift drawout access cover and remove crank. Allow drawout access cover to close.
- Remove switchboard door retaining screws and open the door.

Figure 29: Place Circuit Breaker in Disconnect Position



- 6. Pull out circuit breaker.
 - a. Extend drawout rails until they drop into a horizontal position.
 - b. Roll circuit breaker out onto the drawout rails until drawout wheels are in the first rail stop at the front of the rails.

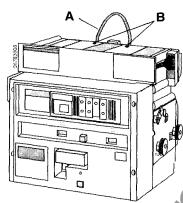
Figure 30: Pull Out Circuit Breaker



MAN CORE CORE

- 7. Insert hooks of the supplied lifting adapter (A) into the two holes at upper rear of circuit breaker and position adapter so hooks extend out through two holes (B) on top of circuit breaker. Connect hoist capable of lifting 300 lbs. (136 kg) or more to lifting adapter and lift circuit breaker slowly.
- 8. Lower circuit breaker onto flat surface capable of supporting its weight.

Figure 31: SE Circuit Breaker Lifting Adapter



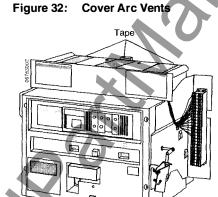
CAUTION

HAZARD OF CIRCUIT BREAKER DAMAGE

Arc vents must be covered with tape before moving or servicing circuit breaker. If any object drops into arc vents, return circuit breaker to Square D.

Failure to follow this instruction can result in equipment damage.

Cover arc vents with tape if not already covered.



MAN CORE CORE

SECTION 5— TRIP UNIT OPERATION

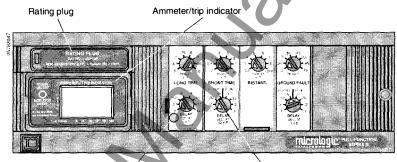
NOTE: Settings and descriptions in this section are general descriptions of the trip unit functions and are not representative of all options. For detailed information, refer to the published trip curve for that specific circuit breaker rating and functions.

SE circuit breakers are equipped with the MICROLOGIC Full-function Trip System (Figure 33), which provides adjustable tripping functions and characteristics using true rootmean-square (RMS) current sensing.

Adjustable rotary switches allow the user to set the proper overcurrent or ground current protection required in the electrical system. If trip currents and time delays exceed set values, the trip system trips the circuit breaker.

The trip unit indicator will flash at 90% of the long-time pickup level and will be lit continuously above 100% of the pickup level.

Figure 33: Full-function Trip System



Trip unit indicator

Adjustable rotary switches

CURRENT RATING

Determine current rating by multiplying the circuit breaker sensor size by the rating plug multiplier and the trip unit long-time pickup switch setting. For example:

Sensor Size	x	Rating Plug Multiplier	x	Long-time Pickup Switch Setting	=	Current Rating	
3000	x	0.75	Х	0.5	=	1125	

The label on the circuit breaker marked "Configuration as Shipped" gives the circuit breaker configuration as it left the factory. See Appendix C for available field-installable rating plug kits.

RATING PLUG

CAUTION

HAZARD OF CIRCUIT BREAKER DAMAGE

Rating plug and ammeter/trip indicator are subject to damage from static charge. Do not handle these devices by their contacts. If either is removed, hold it against the metal circuit breaker enclosure at least two seconds before reinstalling.

Failure to follow this instruction can result in equipment damage.

Rating plugs are available with multipliers ranging from 0.40 to 1.00. If the rating plug is not installed, the circuit breaker will operate safely, but the rating plug multiplier will default to 0.40.

NOTE: Ground-fault values are based on the sensor size of the circuit breaker and are not affected by changing the rating plug.

Figure 34: Rating Plug



INTA CORE

AMMETER/TRIP INDICATOR

The ammeter/trip indicator monitors current in phases A, B and C, and ground-fault current. Each value can be viewed one at a time using the phase select/indicator reset button. (Phase values are displayed in true RMS. Ground-fault current values are displayed in calculated RMS based on measured peak current.)

The bar graph at the base of the window indicates the level of operating current as a function of the programmed ampere rating of the circuit breaker.

The window displays "OVERLOAD," "SHORT CIRCUIT," or "GROUND FAULT" when the circuit breaker trips. Reset indicator by pushing the phase select/indicator reset button.

The phase select/indicator reset button can be pressed at any time to test that the ammeter/trip indicator is functioning. The window will display a battery symbol. If this does not occur, contact Square D for a replacement ammeter/trip indicator. Ammeter/trip indicator must be installed in trip unit for test function to work.

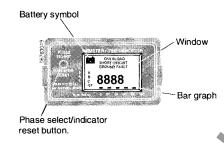
MEMORY FEATURE

NOTE: If checking trip times, wait 15 minutes after circuit breaker trips before resetting to allow memory to reset completely to zero.

GROUND-FAULT DETECTION

NOTE: Circuit breakers with ground-fault alarm will not trip if a ground fault occurs.

Figure 35: Ammeter/Trip Indicator



MICROLOGIC trip systems feature a memory circuit for intermittent overload or ground-fault conditions. This allows the circuit breaker to respond to a series of on (I) and off (O) overload conditions which could cause conductor overheating, but go undetected in a conventional electronic trip device.

If the circuit breaker trips due to an overload condition, wait at least one minute before resetting the circuit breaker. This allows the memory to clear itself sufficiently for the circuit breaker to be turned on (I).

Circuit breakers with integral ground-fault detection provide ground-fault tripping or alarm on grounded neutral systems. They can be applied on three-phase, four-wire circuits, on three-phase, three-wire circuits where the neutral is grounded but not carried throughout the system, or on grounded delta systems. These circuit breakers utilize a residual sensing scheme for ground-fault detection.

Circuit breakers with integral ground-fault <u>tripping</u> provide ground-fault protection for equipment.

Circuit breakers with integral ground-fault <u>alarm</u> provide ground-fault monitoring and alarm through the POWERLOGIC® system. This feature meets NEC Sections 700-7(d) and 700-26 for emergency systems.

Circuit breakers with either ground-fault feature are equipped with an internal ground-fault test feature. The ground-fault test system is built into the circuit breaker and eliminates the need for any additional test equipment, such as monitor panels. See Appendix B for wiring diagrams.

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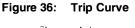
TRIP CHARACTERISTICS

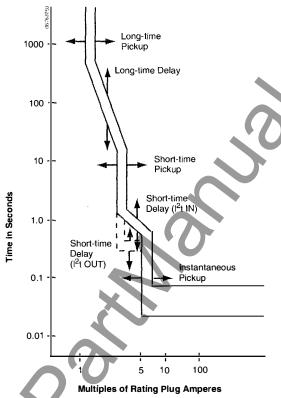
Trip settings are used to obtain a coordinated system in which a downstream circuit breaker will trip before an upstream circuit breaker. Figure 36 shows the various parts of the trip curve affected by the trip settings.

NOTE: Settings and descriptions in this section are general descriptions of the the trip unit functions and are not representative of all options. For detailed information, refer to the published trip curve for that specific circuit breaker rating and functions.

Properly adjusting the MICROLOGIC trip settings will result in a characteristic trip curve that falls above and to the right of the branch circuit breaker characteristic curve. Under overload or short-circuit conditions, the branch circuit breaker will trip first.

For more information on a system coordination study, contact the local field office.





TRIP UNIT FUNCTIONS

Long-time Trip Function

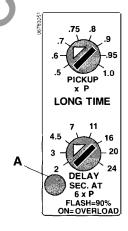
Long-time Pickup Switch — sets maximum current level (based on circuit breaker ampere rating) which circuit breaker will carry continuously. If current exceeds this value, circuit breaker will trip after the preset delay time.

Long-time Delay Switch — sets length of time that circuit breaker will carry a sustained overcurrent below the short-time pickup current level before tripping. Delay bands are labeled in seconds of overcurrent at six times the ampere rating. For maximum coordination, there are eight delay bands.

Indicator— the trip unit indicator (A) will flash at 90% of the long-time pickup level and will be lit continuously above 100% of the pickup level.

NOTE: Turn circuit breaker off (O) before adjusting trip unit switches.

Figure 37: Long-timeTrip Switches



INTA CORE

Short-time Trip Function

Short-time Pickup Switch — sets current level (based on circuit breaker ampere rating) between the long-time pickup level and the instant. pickup level at which circuit breaker will trip after the preset short-time delay.

Short-time Delay Switch—sets length of time circuit breaker will carry an overcurrent which exceeds the short-time pickup level but is less than the instant. pickup level. The delay can be set to four positions of I² t ramp function (I² t IN) or four positions of fixed time delays (I² t OUT).

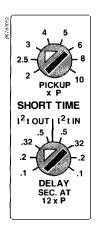
Instantaneous Trip Function

Instant. Pickup Switch— sets current level (based on circuit breaker ampere rating) at which circuit breaker will trip with no intentional time delay.

In circuit breakers with both short-time and instantaneous trip, the instantaneous trip will override the short-time function if the instant. pickup is adjusted at the same or lower setting than the short-time pickup.

In circuit breakers with both short-time and instantaneous trip, the adjustable instantaneous trip can be disabled by setting instant, pickup to OFF. A high-level instantaneous override remains in effect.

Figure 38: Short-time Trip Switches



A DANGER

HAZARD OF ELECTRIC SHOCK OR BURN

- High voltages can cause the electrical system to carry overcurrent for longer than design capabilities allow when turning instantaneous trip to OFF.
- Turning instantaneous trip to OFF must be done only by qualified electrical personnel.

Failure to follow this instruction will result in death, serious injury or equipment damage.

Figure 1: Instantaneous Trip Switch



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Ground-fault Trip Function

Ground-fault Pickup Switch — sets current level (based on circuit breaker ampere rating) at which circuit breaker will trip after the preset ground-fault delay.

Ground-fault Delay Switch — sets length of time circuit breaker will carry ground–fault current which exceeds ground-fault pickup level before tripping. Delay can be adjusted with four positions of I²t ramp function (I²t IN) or four positions of fixed time delays (I²t OUT).

NOTE: Ground-fault values are based on circuit breaker sensor size only, not rating plug multiplier. Changing the rating plug multiplier has no effect on ground-fault values.

Ground-fault Alarm Function

Ground-fault Alarm Switch — sets current level (based on circuit breaker sensor size) at which circuit breaker will signal the POWERLOGIC system that a ground fault is present.

NOTE: Ground-fault values are based on circuit breaker sensor size only, not rating plug multiplier. Changing the rating plug multiplier has no effect on ground-fault values.

Figure 39: Ground-fault Trip Switches



Figure 40: Ground-fault Alarm Switch



MAN CORE

SECTION 6— TRIP UNIT ADJUSTMENTS AND CONTROL WIRING

TRIP UNIT ADJUSTMENTS

Circuit breakers are shipped with trip unit adjustments set at their lowest settings, except for the long-time pickup switch, which is set at 1.0.

NOTE: Turn circuit breaker off (O) before adjusting switches.

Trip Unit Settings

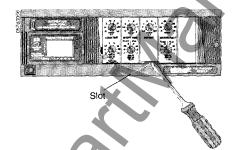
Actual settings for a specific application must be determined by a qualified consultant or plant engineer to provide proper coordination with other circuit breakers in the distribution system. For a detailed description of trip unit operation and available trip functions, refer to Section 5 — Trip Unit Operation.

Adjust Trip Unit

Remove plastic cover.

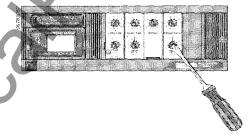
- a. Place a small straight-blade screwdriver in slot in cover.
- b. Exert pressure upward and outward.

Figure 41: Remove Plastic Cover



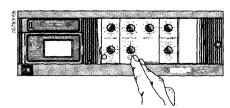
2. Set switches to desired level using a small straight-blade screwdriver.

Figure 42: Set Switches



3. Replace plastic cover. DO NOT seal trip unit cover at this time.

Figure 43: Replace Plastic Cover



MAN CORE CORE

CONTROL WIRING

Control power wiring must be connected to provide power for proper operation of any internal electrical accessories. Use a control power transformer of sufficient size for the circuit breaker configuration (see Table 5).

Table 5: Control Power Transformer

Configuration	Minimum Size	
Circuit breakers with ground-fault option but without accessories.	150 VA	
Circuit breakers with accessories, with or without ground-fault option.	500 VA	
Two or three circuit breaker throwover systems.	1000 VA	

Wiring diagrams for individual accessories can be found in Appendix B- Wiring Diagrams.

Terminal connectors are supplied on SE circuit breakers to permit connection of control wiring

Control wiring for circuit breakers which have been factory installed in switchboard is prewired. Any additional customer wiring must be made to the terminal connectors.

NOTE: Ground the circuit breaker side plates whenever control power wiring such as test power is connected to a circuit breaker which is not mounted in the switchboard.

A DANGER

HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION

- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn OFF all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is OFF.
- Replace all devices, doors and covers before turning on power to this
 equipment.
- Ground the circuit breaker side plates whenever control power wiring such as test power is connected to a circuit breaker which is not mounted in the switchboard.

Failure to follow this instruction will result in death or serious injury.

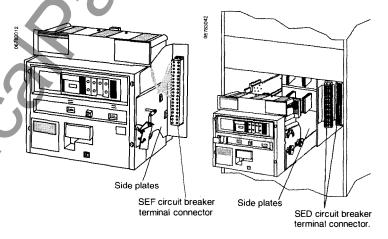
CAUTION

HAZARD OF EQUIPMENT DAMAGE FROM OVERVOLTAGE

Do not hi-pot test control wiring.

Failure to follow this instruction can result in equipment damage.

Figure 44: Terminal Connectors



Circuit Breaker Accessories

Communicating with a POWERLOGIC® System

Wire factory-installed accessories according to wiring diagrams in Appendix B.

To network a circuit breaker to a POWERLOGIC® system, use a MICROLOGIC® Communication Adapter, Cat. No. CIM3F. Install the communications adapter according to the installation instructions that come with the adapter kit.

INTA COR

Zone-selective Interlocking (ZSI)

Zone-selective interlocking (ZSI) allows electronic trip circuit breakers to communicate fault information with each other. This permits faster tripping and reduces switchboard or panelboard stresses without a loss of circuit breaker coordination.

Circuit breakers **must** be coordinated using a system coordination study for ZSI to work effectively. For more information on a system coordination study, contact the local field office.

Coordination is done by adjusting the MICROLOGIC trip settings to obtain a system in which a downstream circuit breaker will trip before an upstream circuit breaker under overload, short-circuit or ground-fault conditions.

During a short-circuit or ground-fault condition on a ZSI system, the circuit breaker directly ahead of the fault sends a signal upstream via control wiring to restrain upstream devices from tripping and then trips with no intentional time delay to clear the fault. Upstream devices which receive a restraint signal obey their short-time and/or ground-fault delay settings to maintain coordination in other areas of the system. Upstream devices which do not receive a restraint signal trip with no intentional time delay.

Allowable ZSI combinations are shown in Table 6. For double-ended or larger systems, systems containing devices not shown in the table, or if more inputs or outputs are needed than the number indicated in the table, contact the local field office.

Short-time delay and ground-fault delay can be interlocked either simultaneously or independently. Refer to Appendix B for an example of a zone-selective interlocking wiring diagram.

The circuit breaker may be self-restrained by connecting its input terminal to its own output terminal. This allows devices downstream to trip and clear the fault. Self-restrain the circuit breaker if:

- the circuit breaker is feeding another panel and
- there are no electronic trip circuit breakers or type GC Ground-fault Sensing Systems downstream from the circuit breaker being installed.

Table 6: ZSI Combinations

Upstream Device (receives input from RIM) Downstream Device (sends output to RIM)	MICROLOGIC #.0x Trip Units	Square D MICROLOGIC Series & Trip Units	Square D GC-100 Ground-fault Relay for Equipment Protection	Square D GC-200 Ground-fault Relay for Equipment Protection	Merlin Gerin STR58 Trip Units	Federal Pioneer USRC and USRCM Trip Units
MICROLOGIC #.0x Trip Units	15	R	R	15	15	R
Square D MICROLOGIC Series B Trip Units	R	26	R	R	R	15
Square D GC-100 Ground-fault Relay for Equipment Protection	R	R	7	R	R	R
Square D GC-200 Ground-fault Relay for Equipment Protection	15	R	R	15	15	R
Merlin Gerin STR58 Trip Units		R	R	15	15	R
Merlin Gerin STR53 Trip Units		R	R	15	15	R
Federal Pioneer USRC and USRCM Trip Units		15	R	R	R	15
Square D Add-on Ground Fault Module for Equipment Protection		5	R	R	R	R
P PIM module is required to restrain any device						_

R-RIM module is required to restrain any devices.

Numerical References—Maximum number of upstream circuit breakers which can be restrained without requiring a RIM Module.

MAN COR STANDARD CORE

The circuit breaker may be unrestrained by not connecting its input terminal to any output terminal. This results in the circuit breaker ignoring its programmed delay values and tripping with no intentional delay to clear the fault. An electronic trip circuit breaker is left unrestrained only if:

- there are no other overcurrent protection devices between it and the load that it is feeding and
- the load requires no intentional delay time before the circuit breaker trips.

To activate short-time zone-selective interlocking:

- If system design requires circuit breaker to be self-restrained, self-restrain it by leaving factory-installed jumper between terminals 23 and 24. Otherwise, remove factoryinstalled jumper from short-time terminals 23 and 24.
- To restrain other circuit breakers, connect short-time output (terminal 24) and equipment ground (common) (terminal 22) of circuit breaker to short-time inputs and equipment grounds (commons) of circuit breakers to be restrained.
- To restrain this circuit breaker, connect short-time input (terminal 23) and common (terminal 22) of circuit breaker to short-time outputs and equipment grounds (commons) from circuit breakers doing restraining.

To activate ground-fault zone-selective interlocking repeat steps 1–3 above, using ground-fault terminals 20 and 21 and equipment ground (common) terminal 22.

If the distance between any two circuit breakers exceeds 1000 ft. (305 m), a restraint interface module will be required. See Section 8—Accessories for more information.

NOTE: Jumpers to self-restrain circuit breakers must be in place unless zone-selective interlocking is activated. If jumpers are removed and zone-selective interlocking is not activated, circuit breaker will ignore its programmed delay and trip with no intentional delay.



Ground-fault Protection

If circuit breaker does not have integral groundfault tripping or alarm, skip this subsection.

Three-phase, four-wire circuits require a neutral current transformer (CT). Connect neutral CT to circuit breaker control wiring terminals according to wiring diagrams in Appendix B, depending on type of ground-fault sensing required. All ground-fault circuit breakers include an integral ground-fault test feature which requires external 120 Vac (100 VA) power.

- For ground-fault alarm, link circuit breaker into a POWERLOGIC system, using a MICROLOGIC Communications Adapter, Cat.No. CIM3F. Install communications adapter per the installation instructions which come with the adapter kit.
- 2. Connect neutral CT, if needed:

A. Primary

If load is connected to bottom end of circuit breaker, connect load neutral to H1 terminal of neutral CT.

If supply power is connected to bottom end of circuit breaker, connect supply neutral to H1 terminal of neutral CT.

NOTE: The equipment grounding connection must be upstream (line side) of the neutral CT and a neutral connection must exist from the supply transformer to the equipment.

B. Secondary

Connect terminal X1 of the neutral CT to terminal 16 of the circuit breaker and terminal X2 of the neutral CT to terminal 17 of the circuit breaker, using no more than 25 ft. (7.6 m) of No. 14 AWG wire.

 Connect ground-fault test power by connecting a 120 Vac power source to terminals 13 and 14.

Test Ground-fault Feature

A DANGER

HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION

Disconnect all power supplying the neutral CT primary circuit before working on neutral CT terminals.

Failure to follow this instruction will result in death or serious injury.

CAUTION

HAZARD OF DAMAGE TO TRIP UNIT

- Connect 120 Vac only to ground-fault test circuit terminals. See Appendix B for wiring diagram.
- Do not apply 120 Vac to terminals other than ground-fault test circuit.

Failure to follow this instruction can result in equipment damage.

Test ground-fault feature as described in the Ground-fault Field Test Procedure supplied with circuit breaker.

MAN CORE

CHECK INSTALLATION

SED Circuit Breaker

- Push circuit breaker into carriage until levering device arms (A) come into contact with the carriage assembly.
- Make sure the secondary terminal connector (B) is in alignment with the terminal in the carriage.
- 3. Push drawout rails into switchboard to their stored position.
- 4. Close and secure door using previously removed screws.

Place circuit breaker in test position.

- 1. Open the drawout access cover (A).
- 2. Insert drawout crank (B) over the drawout mechanism operating shaft.
- 3. Rotate crank clockwise until test position is reached.
- Lift drawout access cover and remove drawout crank, allowing drawout access cover to close.

NOTE: Drawout position indicator must be at midpoint in the test position before access cover will close.

- Turn on control power. If circuit breaker is equipped with a spring charging motor and the closing springs are discharged, they will be charged automatically at this time.
- Check operation of any accessories. Refer to Section 9 — Accessories for details. Correct any improper operation before proceeding.

- 1. Inspect circuit breaker mounting, connections and accessories.
- 2. Inspect any downstream equipment.

Circuit breaker MUST be on drawout rails and in the disconnected (DISC) position. Refer to Section 4 — SED Circuit Breaker.

Figure 45: Levering Device Arms

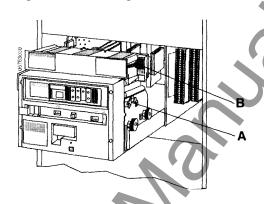
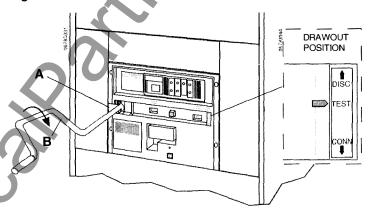


Figure 46: Place in Test Position



MAN CORE

DRAWOUT

CAUTION

HAZARD OF EQUIPMENT DAMAGE

Figure 47:

Do not drive drawout mechanism beyond the connected position.

Failure to follow this instruction can result in equipment damage.

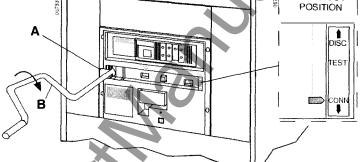
Place in connected position.

- 7. Open the drawout access cover (A).
- 8. Insert drawout crank (B) over the drawout mechanism operating shaft.
- 9. Rotate crank clockwise until stop is reached.

NOTE: To open the SEF circuit breaker cell door:

- 1. Open circuit breaker by pressing the Push-to-Open button.
- 2. Remove screws securing door.
- 3. Press Push-to-Open button while opening cell door.

Place in Connected Position



PLACE CIRCUIT BREAKER IN **SERVICE**

Place circuit breaker in service as described in the Switchboard Installation/Maintenance Manual.

HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION

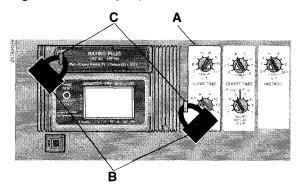
Faults can result from damage or incorrect installation practices that were undetected during pre-energizing inspection. Allow only qualified electrical personnel to be present during initial energizing of equipment.

Failure to follow this instruction will result in death or serious injury.

SEAL TRIP UNIT

- 1. Put the clear plastic cover (A) in place.
- 2. Insert seals (B) through sealing posts (C).

Figure 48: **Sealing Trip Unit**



MAN CORE CORE

SECTION 7— MAINTENANCE

ROUTINE MAINTENANCE

Perform routine maintenance periodically and following any severe electrical fault.

A DANGER

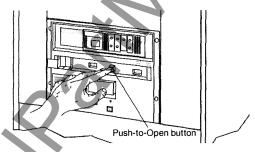
HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION

- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is
 off.
- Replace all devices, doors and covers before turning on power to this
 equipment.

Failure to follow this instruction will result in death or serious injury.

- Disconnect all power to circuit breaker and accessories.
- 2. Open the circuit breaker by pushing the Push-to-Open button.

Figure 49: Opening the Circuit Breaker



SEF Circuit Breaker

Inspect the circuit breaker. If damage such as loose power terminals, distorted connectors or any loose parts in the switchboard section is found, contact Square D.

SED Circuit Breaker

NOTE: If shipping circuit breaker to another location, repack as instructed in Section 9—Repacking Circuit Breaker

- Remove circuit breaker from enclosure, see circuit breaker removal instructions in Section 4, page 22.
- 2. Mount filler plate to the cell door to cover the circuit breaker opening.
- 3. Cover arc vents with tape
- Inspect the circuit breaker. If damage such as loose power terminals, distorted connectors or any loose parts in the switchboard section is found, contact Square D.

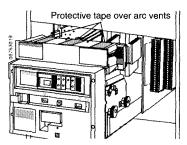
CAUTION

HAZARD OF CIRCUIT BREAKER DAMAGE

Cover arc vents with tape before moving or servicing circuit breaker. If any object drops into arc vents, return circuit breaker to Square D.

Failure to follow this instruction can result in equipment damage.

Figure 50: Cover Arc Vents with Tape



MAN CORE CORE

- 5. Inspect line and load power connectors:
 - Check power connectors. They must be clean, with their joint compound of a soft consistency with no caking or residue and white to tan in color. If compound no longer has a soft uniform consistency, but is discolored with oil separation or a caked residue, overheating may have occurred. Consult the local field office.
- Use joint compound, Cat. No. PJC8311, available from Square D, to relubricate the connectors following inspection.

SED 4000 A Circuit Breaker Only

Check cooling fan:

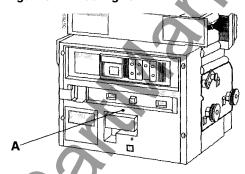
The fan cooling system of the SED 4000 A drawout circuit breaker produces air flow around the circuit breaker carriage connections as the circuit breaker nears full load.

The fan cooling system contains an integral selftest feature. Test fan by means of a PUSH-TO-TEST button (A) on the front of the circuit breaker

Primary Injection Testing

NOTE: Use only Square D joint compound, Cat. No. PJC8311, for proper operation and longevity of drawout connectors.

Figure 51: Cooling Fan Test



Before conducting any tests refer to the National Electrical Manufacturers Association Guidelines for Inspection and Preventive Maintenance of Molded Case Circuit Breakers Used in Commercial and Industrial Applications (NEMA Standards Publication AB-4). This testing is to be done by qualified personnel only.

Primary injection test involves utilizing a high-current, low-voltage source to pass current through each pole of the circuit breaker. In order to properly perform primary injection testing, all of the secondary sensing wiring must be properly connected:

Jumper terminal 16 to terminal 19 Jumper terminal 17 to terminal 18 Jumper terminal 20 to terminal 21

For ground-fault breakers.

Jumper terminal 23 to terminal 24

Short-time delay self restraint.

SEF circuit breakers are jumpered at the terminal blocks on the side of the circuit breaker. SED circuit breakers require an adapter plug kit (Cat. No. SEPITK2) to perform testing safely.

To defeat ground-fault on SEF circuit breakers, place an additional jumper from terminal 16 to terminal 17.

To defeat ground-fault on SED circuit breakers, follow instructions with SEPITK2 to achieve the same jumper configurations.

MAN CORE

SECTION 8— ACCESSORIES

GENERAL

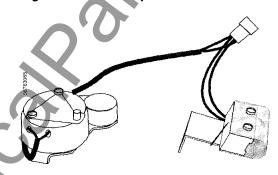
UL Listed accessories described in this section are available for factory installation and field replacement. Labels on the circuit breaker indicate which accessories are installed in a particular circuit breaker.

Customer wiring to internal electrical accessories is connected to the terminal blocks either on the SEF circuit breaker or in the switchboard cell for SED circuit breakers. Wiring diagrams can be found in Appendix B. Table 7 lists the minimum size control power transformer necessary for accessory operation.

If checking operation of internally-operated accessories, refer to Section 10— Troubleshooting. To replace an accessory, follow the instructions in the field-replaceable accessory kit.

SHUNT TRIP

The shunt trip opens the circuit breaker electrically from a remote location using an external voltage source. The shunt trip includes a coil clearing contact which opens the shunt trip coil circuit when the circuit breaker opens. The shunt trip mounts behind the auxiliary cover in the right side of the accessory section and is field installable.



Circuit breakers with ground-fault option but without

Circuit breakers with accessories, with or without

Two or three circuit breaker throwover systems

Shunt Trip

SHUNT CLOSE (REMOTE CLOSE)

NOTE: For circuit breakers with spring-charging motor only)

The shunt close closes the circuit breaker electrically from a remote location, using an external power source. If control voltage is continuously applied to the shunt close circuit, an integral anti-pump feature prevents automatic reclosing after opening. The shunt close contains a fuse for overcurrent protection. The shunt close mounts behind the auxiliary cover in the right side accessory section and is factory installed and field replaceable.

NOTE: Attempting to electrically close a circuit breaker with an undervoltage trip without energizing the undervoltage trip first will cause the shunt close fuse to open.

Control Power Transformer Requirements

Minimum Size

150 VA

500 VA

1000 VA

Figure 53: Shunt Close

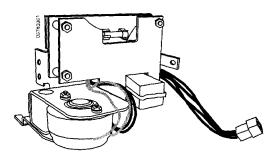
Table 7:

accessories

Figure 52:

Configuration

ground-fault option



MAN CORE CORE

UNDERVOLTAGE TRIP

The undervoltage trip accessory (UVR) opens the circuit breaker when voltage in the monitored circuit drops below 35%–70% of nominal voltage. Reclosure of the circuit breaker can occur only when the UVR supply voltage is above 80%–90% of nominal voltage. The monitored circuit can be wired in series with an externally-mounted normally-closed contact to open the circuit breaker from a remote location.

An integral adjustable delay feature provides the time delay necessary to avoid nuisance circuit breaker opening from momentary fluctuations in the monitored voltage source. The time delay is adjustable from 0.1 second to 1.5 seconds and is set by using a small screwdriver to rotate the adjusting screw (A) on the time delay unit. An interlock prevents mechanical closing of the circuit breaker under a low-voltage condition. The undervoltage trip mounts behind the auxiliary cover in the right side accessory section and is field installable.

NOTE: An undervoltage trip accessory in a circuit breaker must be energized prior to closing the circuit breaker either electrically or mechanically.

AUXILIARY SWITCH

The auxiliary switch is generally used for control circuits and indicator lights associated with circuit breaker operation. The auxiliary switch indicates the position of the circuit breaker main contacts as follows

A contacts – open when circuit breaker is open and closed when circuit breaker is closed.

B contacts – closed when circuit breaker is open and open when circuit breaker is closed.

An auxiliary switch can be converted from type A to type B (and vice versa) in the field. Two kinds of auxiliary switches are available. The ac-rated switch (Fig. 61) is rated for ac use only. The dc-rated switch (Fig. 62) has an ac/dc rating and is primarily for use in dc control systems.

The auxiliary switch is mounted behind the auxiliary cover in the right side accessory section and is field installable.

Figure 54: Undervoltage Trip

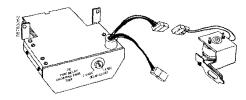


Figure 55: Time Delay Adjusting Screw

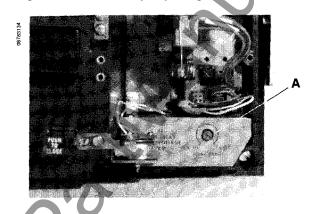
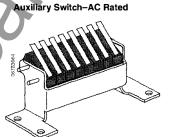
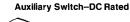
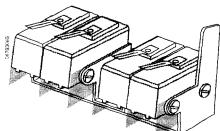


Figure 56: Auxiliary Switches







MAN CORE

ALARM SWITCH

The alarm switch indicates any automatic circuit breaker opening, whether due to an overload, short-circuit, ground-fault or undervoltage condition. It does not actuate when the circuit breaker opens due to a manual operation or a shunt trip. The alarm switch is reset by depressing the Push-to-Open button. The alarm switch has two switches, which can be wired as two normally-open contacts, two normally-closed contacts or one normally-open and one normally-closed contact. Switches can be converted in the field. The alarm switch mounts behind the auxiliary cover in the right side of the accessory section and is field installable

SPRING CHARGING MOTOR

The spring charging motor automatically charges the circuit breaker closing springs. A complete electrical operation system must include a spring charging motor and shunt close to close the circuit breaker and either a shunt trip or an undervoltage trip to electrically open the circuit breaker.

Spring charging is initiated automatically whenever the closing springs are discharged and power is supplied to the charging motor. When the springs are completely charged, the motor circuit is disconnected and the closing spring indicator reads CHARGED. The spring charged contacts (terminals 47 and 48) close at this time. If control power is not available, spring charging can be done manually. The spring charging motor is mounted behind the auxiliary cover in the left accessory section, behind the transformer mounting plate. The spring charging motor is factory installed and field replaceable.

SED CIRCUIT BREAKER CELL SWITCH

The cell switch is employed when SE circuit breakers are used in transfer schemes. The switch mechanically detects circuit breaker movement from the connected position to the test position and only permits operation of the transfer scheme when the circuit breaker is in the connected position. The cell switch is mounted on the left side of the drawout carriage and is available with up to eight convertible contacts with ratings equal to Class 8501 Type X relays (10 amperes continuous at 120 Vac, 60 Hz).

Figure 57: Alarm Switch

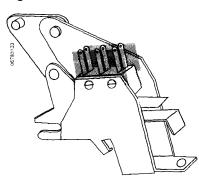


Figure 58: Spring Charging Motor

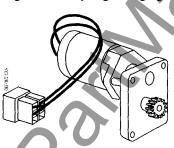
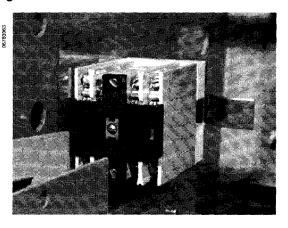


Figure 59: SED Circuit Breaker Cell Switch



MAN COR STANDARD CORE

CLOSE BUTTON COVER

The close button cover, Cat. No. SE1CBC, restricts manual closing of the circuit breaker. The circuit breaker can be closed in an emergency by inserting a small screwdriver through the hole in the cover (A) and pushing the Push-to-Close button

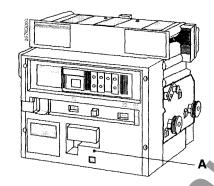
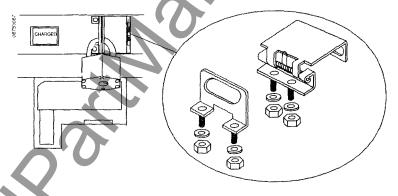


Figure 60: Close Button Cover

Figure 61: SEF Circuit Breaker Padlock Attachment

SEF CIRCUIT BREAKER PADLOCK ATTACHMENT

The padlock attachment, Cat. No. SE2PA, locks the SEF circuit breaker main contacts open. This field-installable accessory will accept up to three padlocks. Maximum shackle diameter is 3/8 in. (9.5 mm). The padlock attachment is mounted to the face of the circuit breaker as shown. When in use, it depresses the Push-to-Open button



SED CIRCUIT BREAKER PADLOCK ATTACHMENT

Drawout circuit breakers can be padlocked open using the drawout mechanism lockout.

To lock circuit breaker open, first move circuit breaker to the test position. (Circuit breaker cannot be padlocked in the disc position.) Then, with access cover still open, move lockout over to hold the access cover open. The lockout will accept up to three padlocks with a maximum shackle diameter of 3/8 in. (9.5 mm).

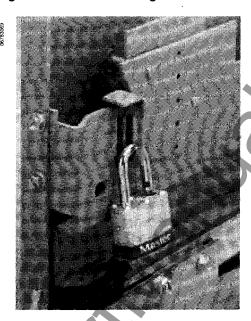
Figure 62: SED Circuit Breaker Padlock Attachment



MAN COR

In addition, a drawout carriage padlock hasp is provided on all drawout carriage assemblies and can be padlocked to prevent the installation of a circuit breaker.

Figure 63: Drawout Carriage Padlocked



CIRCUIT BREAKER KEY INTERLOCK

The key interlock is used for coordinating circuit breaker operation with other keyed devices. The key interlock must be purchased separately. When the interlock bolt is extended, the circuit breaker is held open.

SEF Circuit Breaker Key Interlock

The SEF circuit breaker key interlock bracket with mounting hardware is supplied in a field-installable kit, Cat. No. SE1 KI, and is designed for mounting on the right side plate above the cell door interlock.

Single bolt key interlocks with up to three cylinder locks (not provided) can be used. The Push-to-Open button must be depressed before the interlock bolt can be extended.

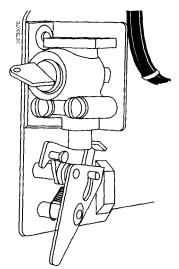
A WARNING

HAZARD OF UNINTENDED EQUIPMENT ACTION

- · The circuit breaker key interlock can be defeated.
- Do NOT attempt to use the key interlock as a circuit breaker lockout.
- · Read and understand this bulletin before using the key interlock.

Failure to follow this instruction can result in death, serious injury or equipment damage.

Figure 64: SEF Circuit Breaker Key Interlock

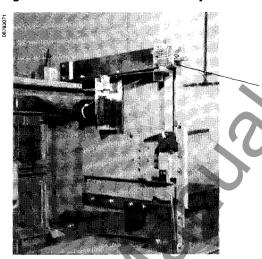


MAN CORE

SED Circuit Breaker Key Interlock

The SED circuit breaker key interlock mechanism (A) mounts on the upper right side of the drawout carriage. The key interlock mounting bracket is factory installed and field replaceable

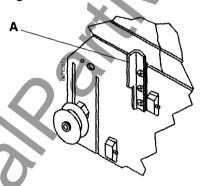
Figure 65: SED Circuit Breaker Key Interlock



SED CIRCUIT BREAKER CELL KEYING KIT

The SED circuit breaker cell keying kit (A) is installed on the SED circuit breaker and drawout carriage. It allows only a circuit breaker of a particular sensor size to be installed in the drawout carriage

Figure 66: SED Circuit Breaker Cell Keying Kit

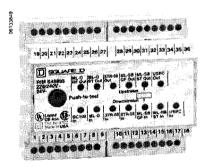


RESTRAINT INTERFACE MODULE

The restraint interface module, Cat. No. RIM32, is required on ZSI systems when

- Distance between any two circuit breakers in the restraint system exceeds 1000 ft. (305 m).
- Interlocking circuit breakers and/or groundfault modules need assistance to communicate. See page 31 for ZSI combinations requiring RIM32

Figure 67: Restraint Interface Module



MAN CORE

UNIVERSAL TEST SET

The universal test set is available to test all Square D circuit breakers with MICROLOGIC trip units. It has the ability to run trip unit tests automatically with prompts to the user for initial information. Test modules for each circuit breaker series are used to store data necessary for automatic tests for that type and sensor.

Testing can be done with a circuit breaker installed in the switchboard, but the zone-selective interlocking wires (restraint OUT) must be disconnected. If circuit breaker is connected to a POWERLOGIC system, the CIM3F Communications Adapter must be disconnected also. No other circuit breaker disassembly is required

COMMUNICATIONS ADAPTER

The field-installable communications adapter, Cat. No. CIM3F, is used to allow the circuit breaker trip unit to communicate with a Square D POWERLOGIC communications network. This allows an SE circuit breaker to be networked in a PowerLogic system. See Appendix B for CIM3F wiring instructions

Figure 68: Universal Test Set

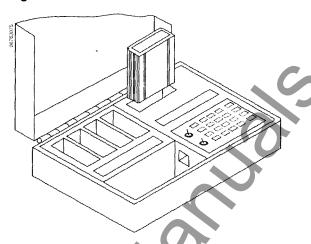
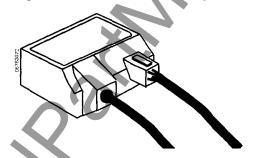


Figure 69: Communications Adapter



MAN CORE

SECTION 9— REPACKING CIRCUIT BREAKER

EQUIPMENT REQUIREDHoist, lifting capacity 300 lbs. (136 kg)

Banding or Strapping Equipment

Lifting Adapter, supplied with circuit breaker

MATERIALS REQUIRED

Tape, masking, duct, etc.

Pallet

Padding

Large Plastic Sheet or Bag

Packing Carton, 1300 lb. (590 kg) Class 2

Bands or Straps

Original packing materials or equivalent. (Original packing materials are available from Square D. Cat. No. SERETPKG.)

REPACKING

A DANGER

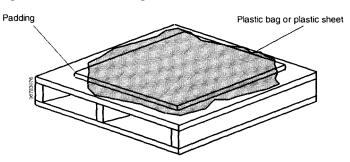
HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION

- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is
 off.
- Replace all devices, doors, and covers before turning on power to this
 equipment.

Failure to follow this instruction will result in death or serious injury.

- Disconnect all power to circuit breaker and accessories.
- 2. Remove circuit breaker from switchboard. Instructions for removing the circuit breakers are in Sections 3 and 4.
- Place padding and plastic bag or sheet on pallet.

Figure 70: Place Padding and Sheet on Pallet



INTA CORE

A DANGER

HAZARD OF PERSONAL INJURY OR EQUIPMENT DAMAGE

Circuit breaker weighs over 289 lbs. (127 kg) and must be lifted using lifting adapter and hoist capable of lifting 300 lbs. (136 kg).

Failure to follow this instruction will result in death or serious injury.

4. Insert hooks of lifting adapter (A) into the two holes at upper rear of circuit breaker and position adapter so hooks extend out through two holes (B) on top of circuit breaker. Connect hoist capable of lifting 300 lbs. (136 kg) or more to the lifting adapter and lift circuit breaker slowly.

Figure 71: Lift Circuit Breaker

A

B

B

Colored A

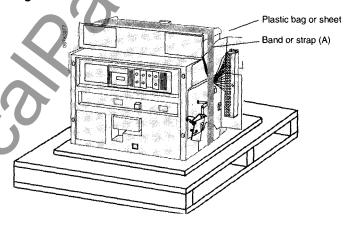
Co

Place circuit breaker on pallet so tangs are

over wide retaining board and circuit breaker

- rests inside plastic bag.
 6. Remove lifting adapter.
- 7. Pull plastic bag or sheet over circuit breaker and tape securely.
- 8. Secure circuit breaker to pallet using band or strap (A) to prevent shifting.

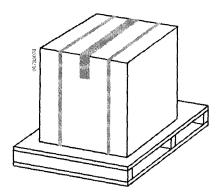
Figure 72: Secure Circuit Breaker



9. Enclose circuit breaker in packing carton.

10. Secure unit for shipping using bands or straps.

Figure 73: Secure Unit for Shipping



MAN COR STANDARD CORE

SECTION 10—TROUBLESHOOTING

If problems occur during installation, refer to the following guide. If trouble persists, contact the local field office.

A DANGER

HAZARD OF ELECTRIC SHOCK, BURN, OR EXPLOSION

- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors, and covers before turning on power to this
 equipment.

Failure to follow this instruction will result in death or serious injury.

SED CIRCUIT BREAKER TROUBLESHOOTING

Table 8: SED Circuit Breaker Troubleshooting

Condition	Possible Causes	Solution		
Circuit breaker will not close.	Closing springs are not fully charged. Drawout access cover is not closed. Auxiliary cover is not installed properly. Trip unit is not properly mounted. Undervoltage trip is not energized. Shunt close fuse is open. Key interlock is engaged. Circuit breaker is already closed.	Charge closing springs. Close drawout access cover. Check auxiliary cover installation. Check trip unit mounting. Energize undervoltage trip. Check shunt close fuse. Check key interlock. Check if circuit breaker is closed.		
Cell door will not open.	Circuit breaker is installed in cradle with drawout mechanism past disconnected position.	Check circuit breaker position in cradle. Drawout mechanism must be in disconnected position.		
Drawout mechanism will not operate.	Circuit breaker is closed.	Open circuit breaker.		
Drawout access cover will not operate.	Circuit breaker is closed.	Open circuit breaker.		
Drawout access cover will not close.	Circuit breaker is between connected and test position. Access cover is locked open by the drawout mechanism lockout.	Check circuit breaker position. Circuit breaker mus be either fully connected or withdrawn at least to the test position. Check position of drawout mechanism lockout.		
Drawout access cover cannot be padlocked open.	Circuit breaker is in the disconnected position.	Check circuit breaker position.		
Circuit breaker cannot be pushed into carriage.	Drawout assembly is not completely in disconnected position. Padlock installed in padlock hasp.	Check circuit breaker position. Remove padlock from padlock hasp.		
Auxiliary cover cannot be removed.	Circuit breaker is closed. Drawout assembly is not completely in disconnected position.	Open circuit breaker. Place drawout assembly completely in disconnected position.		

MAN COR STANDARD CORE

SEF CIRCUIT BREAKER TROUBLESHOOTING

Table 9: SEF Circuit Breaker Troubleshooting

Condition	Possible Causes	Solution		
Circuit breaker will not close	 Closing springs are not fully charged. Cell door is not closed. Auxiliary cover is not installed properly. Trip unit is not properly mounted. Undervoltage trip is not energized. Shunt close fuse is open. Push-to-Open button is depressed. Key interlock is engaged. Circuit breaker is already closed. 	 Charge closing springs. Close cell door. Check auxiliary cover installation. Check trip unit mounting. Energize undervoltage trip. Check shunt close fuse. Check Push-to-Open button. Check key interlock. Check if circuit breaker is closed. 		
Cell door will not open. 1. Circuit breaker is closed. 2. Push-to-Open button is not depressed.		 Open circuit breaker. Depress Push-to-Open button. 		
Auxiliary cover cannot be removed.	Circuit breaker is closed.	Open circuit breaker.		

BEFORE WORKING ON CIRCUIT BREAKER

- 1. Disconnect all power to circuit breaker and accessories.
- 2. Open the circuit breaker by pushing the Push-to-Open button (A).

Figure 74: Open Circuit Breaker

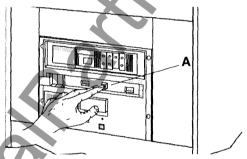


Figure 75: Place in Disconnect Position

- 3. SED circuit breaker only: Place SED circuit breaker in disconnected position before doing any work on circuit breaker:
 - a. Lift access cover (A).
 - b. Insert drawout crank (B).
 - c. Rotate drawout crank clockwise until stop is reached.
 - d. Drawout position indicator (C) must point to DISC.
 - e. Lift drawout access cover and remove crank. Allow drawout access cover to close.

A DRAWOUT POSITION

DRAWOUT POSITION

TEST

CONN

INTA CORE

INTERNALLY-MOUNTED ACCESSORIES

internally-mounted accessories are located behind the circuit breaker auxiliary cover.

- If circuit breaker is not mounted in a switchboard, connect a temporary ground wire to circuit breaker side plate (A).
- To gain access to internally-mounted accessories remove the auxiliary cover:
 - a. Loosen the four cover retaining screws
 (B).
 - b. Remove auxiliary cover.

NOTE: An interlock prevents removal of the auxiliary cover when circuit breaker is closed or when drawout mechanism is in any position other than disconnected.

 Connect control wiring. Control wiring to internal electrical accessories is connected to the terminal connectors either on the SEF circuit breaker or in the switchboard cell for SED circuit breakers. Refer to Section 3— SEF Circuit Breaker for information regarding control wiring for the SEF circuit breaker and Section 4—SED Circuit Breaker for information regarding control wiring for the SED circuit breaker.

Table 10 lists the minimum size control power transformer necessary for operation. See Appendix B for wiring diagrams.

- Replace auxiliary cover (circuit breaker must be open).
 - a. Firmly seat auxiliary cover (A) and align mounting holes.
 - b. Hold auxiliary cover down against the spring tension of the auxiliary cover interlock and tighten mounting screws (B).

NOTE: If auxiliary cover is not properly installed, the circuit breaker may not close or will not indicate OPEN condition.

A DANGER

HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION

When connecting control power wiring to a circuit breaker which is not mounted in a switchboard, connect a temporary ground wire to circuit breaker side plate.

Failure to follow this instruction will result in death or serious injury.

Figure 76: Remove Auxiliary Cover

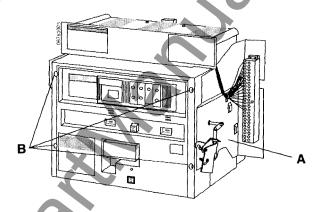
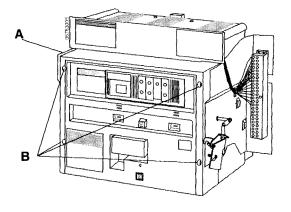


Table 10: Control Power Transformer Requirements

Configuration	Minimum Size
Circuit breakers with ground-fault option but without accessories	150 VA
Circuit breakers with accessories, with or without ground-fault option	500 VA
Two or three circuit breaker throwover systems	1000 VA

Figure 77: Replace Auxiliary Cover



INTERLOCKS

The SE circuit breaker includes safety interlocks to prevent unsafe or incorrect operation. Interlocks are provided to minimize the possibility of contact with energized parts or exposure to hazardous conditions. Some interlocks can be bypassed for the convenience of qualified maintenance personnel.

Interlocks which are noted as being optional are available as accessories. For more information on those interlocks, refer to Section 8—Accessories.

Auxiliary Cover Interlock

The auxiliary cover interlock

- prevents circuit breaker from being closed when auxiliary cover is removed
- and
- prevents removal of the auxiliary cover when the circuit breaker is closed.

A DANGER

HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION

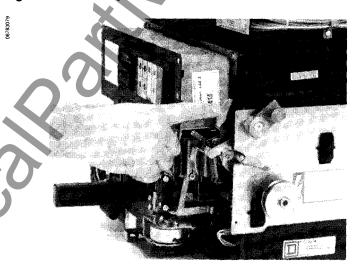
- Bypassing interlocks can result in exposure to energized parts and/or exhaust gas resulting from circuit breaker interruption. Do not bypass interlocks on an energized system.
- Turn off all power supplying this equipment before bypassing any interlock.

Failure to follow this instruction will result in death or serious injury.

Bypassing Auxiliary Cover Interlock

- 1. Turn off all power to system.
- To close circuit breaker with auxiliary cover removed, depress interlock arm while closing circuit breaker.

Figure 78: Auxiliary Cover Interlock



Key Interlock (Optional)

The key interlock

- coordinates circuit breaker operation with other keyed devices, or
- ensures circuit breaker is off (O) when maintaining downstream equipment.

NOTE: Push-to-Open button must be depressed before the interlock bolt can be extended.

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Cell Door Interlock

 prevents cell door from being opened when circuit breaker is closed

and

 prevents circuit breaker from being closed when cell door is open.

The cell door interlock minimizes the possibility of contact with energized parts or exposure to exhaust gases from interruption.

The cell door interlock is located on the side of the circuit breaker (A) and can be bypassed for the convenience of qualified personnel. If circuit breaker cell has arc barriers in place, the interlock can be disabled. (See Section 3 for a description of arc barriers.)

Bypassing Cell Door Interlock

When circuit breaker is closed, the door can be opened by

· removing screws securing the door,

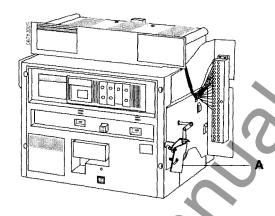
or

 inserting a screwdriver into the slot in the front of the door and applying an upward force with screwdriver to release the cell door latch.

When the door is open, the circuit breaker can be closed by bypassing the interlock.

Depress the interlock lever while closing the circuit breaker to defeat the interlock

Figure 79: Cell Door Interlock



A DANGER

HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION

- Turn off all power supplying this equipment before bypassing interlock.
- Before energizing system close door and secure it using all previously removed screws.

Failure to follow this instruction will result in death or serious injury,

CAUTION

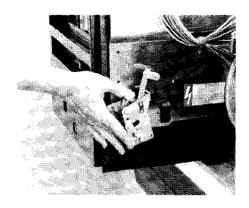
HAZARD OF EQUIPMENT DAMAGE

The interlock lever must remain depressed the entire time the door is open.

Failure to follow this instruction can result in equipment damage.

Figure 80: Bypassing the Cell Door Interlock





MAN COR STANDARD CORE

Disabling Cell Door Interlock

A DANGER

HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION

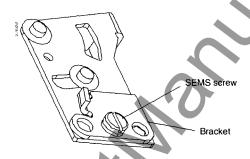
Do not disable cell door interlock on SEF circuit breakers unless circuit breaker cell has arc barriers in place. (See Section 3 for description of arc barriers.)

Failure to follow this instruction will result in death or serious injury.

To disable the cell door interlock:

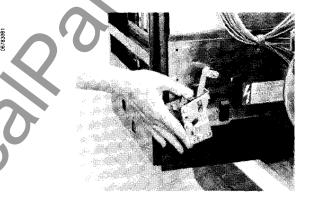
- 1. Remove interlock restraint bracket.
 - a. Loosen 12-24 X 7/16 in. SEMS screw.
 - b. Lift bracket off cell door interlock assembly.

Figure 81: Remove Interlock Restraint Bracket



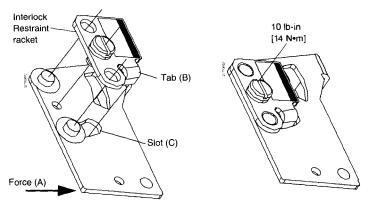
2. Push interlock lever in.

Figure 82: Push in Interlock Lever



- 3. While maintaining force (A) to hold interlock lever in, install interlock restraint bracket:
 - a. Install interlock restraint bracket so tab
 (B) is toward bracket and screw is aligned with screw hole
 - b. With tab (B) securely seated in slot (C), tighten screw.

Figure 83: Install Interlock Restraint Bracket



MAN CORE CORE

Push-to-open Padlock Attachment (Optional)

NOTE: For SEF circuit breaker only.

Drawout Access Cover Interlock

NOTE: For SED circuit breaker only.

The drawout access cover interlock (A)

 prevents closing of circuit breaker while drawout access cover is open

and

 prevents opening of drawout access cover while circuit breaker is closed

The drawout access cover is held open if circuit breaker drawout mechanism is between the connected and test positions.

Drawout Mechanism Lockout

NOTE: For SED circuit breaker only.

Drawout Carriage Padlock Hasp

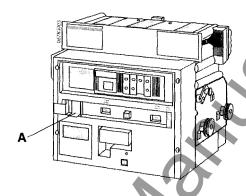
NOTE: For SED circuit breaker only.

The drawout carriage padlock hasp prevents a circuit breaker from being inserted into a drawout carriage.

A padlock installed on the padlock hasp interferes with circuit breaker movement, keeping the circuit breaker on the drawout rails.

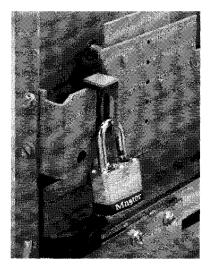
The push-to-open padlock attachment prevents closing of the circuit breaker. This is accomplished by using the padlock attachment to depress the Push-to-Open button thus maintaining the circuit breaker in the open position.

Figure 84: Drawout Access Cover



The drawout mechanism lockout prevents access to the drawout mechanism, preventing movement of circuit breaker on the drawout rails. It can be used to lock the circuit breaker in either the connected or test position. It can also be used to hold the drawout access cover open, preventing closing of circuit breaker.

Figure 85: Drawout Carriage Padlock Hasp



SED 4000 A Circuit Breaker Interlock

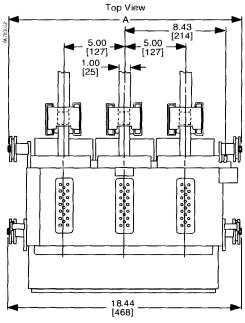
NOTE: For SED circuit breaker only.

The SED 4000 A circuit breaker interlock prohibits installation of the SED 4000 A fan-cooled circuit breaker into any cell other than the cell designed for it.

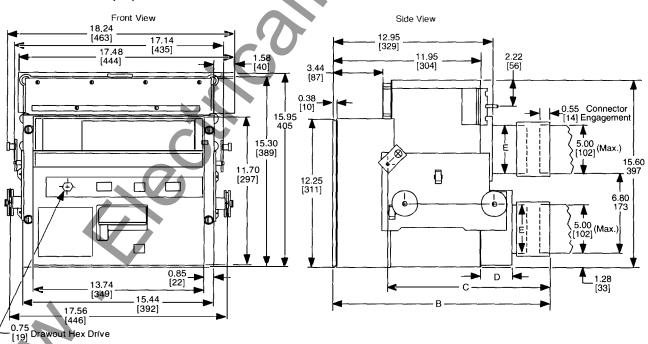
APPENDIX 1—DIMENSIONS

SED (DRAWOUT) CIRCUIT BREAKER

Figure 86: SED Circuit Breaker



Circuit Breaker Type	Frame Size	Dim. A	Dim. B	Dim. C	Dim. D	Dim. E
SED	400–1200A	18.44 in. [468 mm]	17.32 in. [440 mm]	12.96 in. [329 mm]	3.00 in. [76 mm]	2.75 in. [70 mm]
SED SEHD	1600–3000A 400–3000A	18,44 in. [468 mm]	17.32 in. [440 mm]	12.96 in. [329 mm]	3.00 in. [76 mm])	4.00 in. [102 mm]
SED SEHD	4000A	19.44 in. [479 mm]	18.32 in. [465 mm]	13.96 in. [355 mm]	3.50 in. [89 mm]	4.00 in. [102 mm]

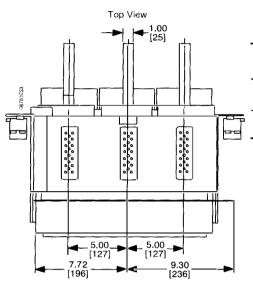


Dimensions: in.

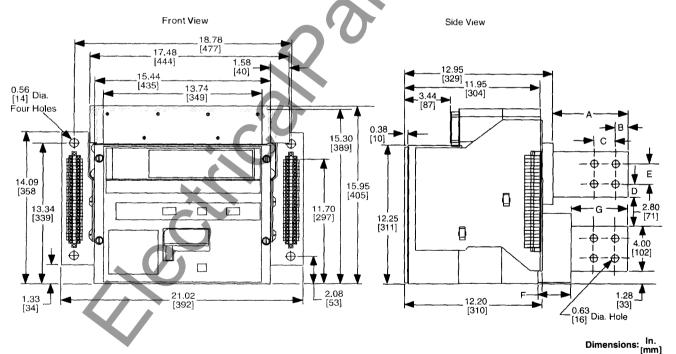
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SEF (FIXED-MOUNTED) CIRCUIT BREAKER

Figure 87: Type SEF with 1600–4000 A Sensors Type SEHF with 400–4000 A Sensors

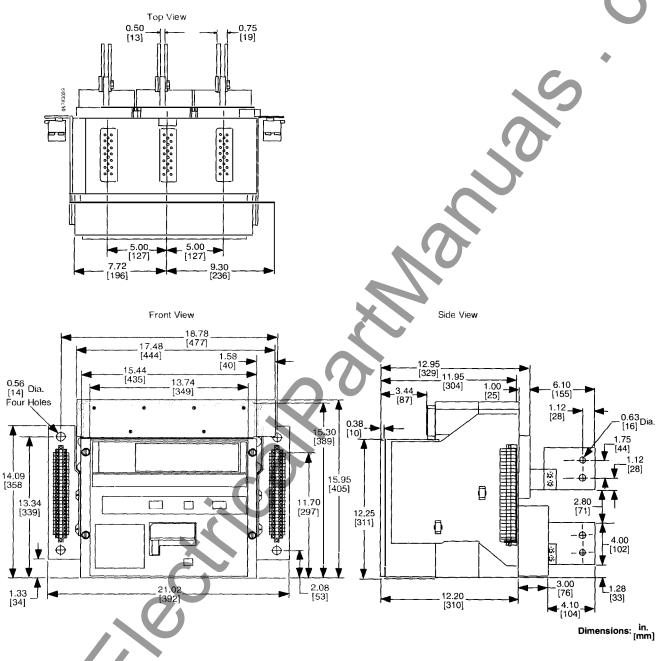


Sensor Size	Dim. A	Dim. B	Dim. C	Dim. D	Dim. E	Dim. F	Dim. G
400 A-	6.10 in.	1,12 in.	1.75 in.	1.12 in.		3.00 in.	4.10 in.
3000 A	[155 mm]	[29 mm]	[45 mm]	[29 mm]		[76 mm]	[104 mm]
4000 A	8.10 in.	1.50 in.	2.00 in.	1.20 in.	1.60 in.	3.75 in.	5.35 in.
	[206 mm]	[38 mm]	[51 mm]	[31 mm]	[41 m])	[89 m]	[136 m]



MAN COR STANDARD CORE

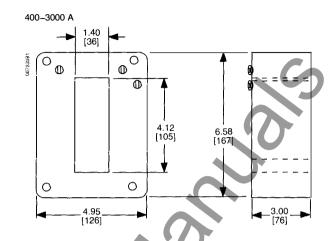
Figure 88: Type SEF with 400-1200 A Sensors



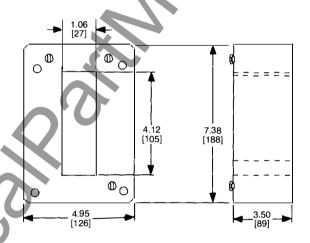
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NEUTRAL CURRENT TRANSFORMER

Figure 89: Neutral Current Transformer



4000 A



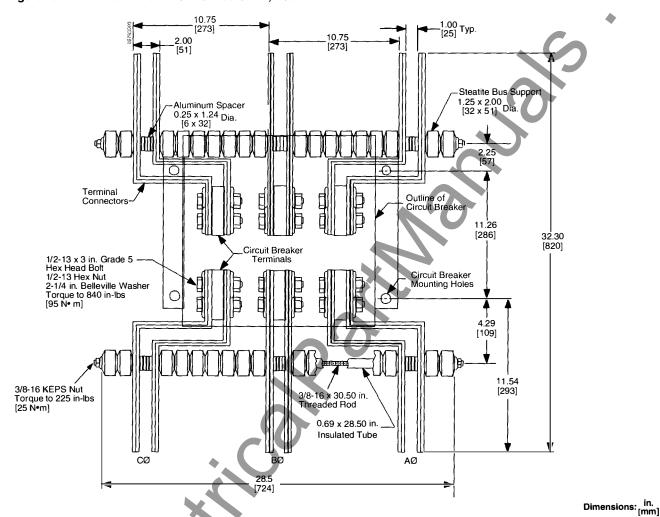
Dimensions: in. [mm]

MAN CORE

SEFM40CK TERMINAL CONNECTOR KIT

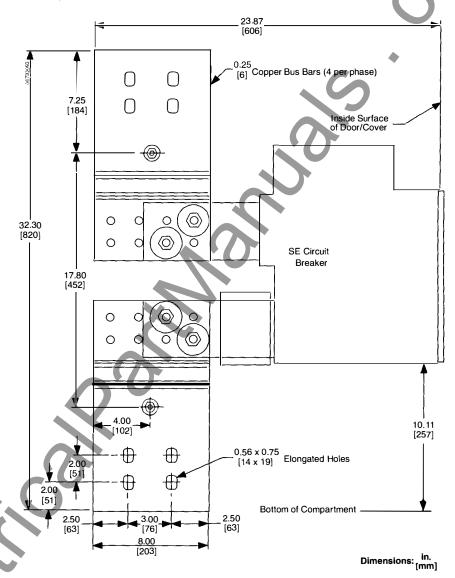
For Use with Type SEF Circuit Breakers with 4000 A Sensors

Figure 90: SEFM40CK Terminal Connector Kit, Back View



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Figure 91: SEFM 40 CK Terminal Connector Kit, Side View



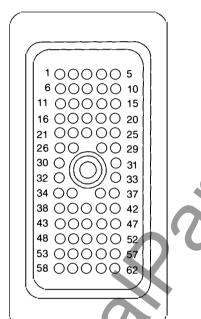
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APPENDIX 2—WIRING DIAGRAMS

TERMINAL CONNECTORS FOR SE CIRCUIT BREAKER

Figure 92: Terminal Connector Layout

SED Circuit Breaker Control Terminal as Viewed from Back of Circuit Breaker



SEF Circuit Breaker Terminal Blocks as Viewed from Front of Circuit Breaker

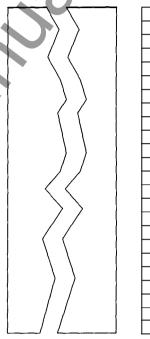


Table 11: Terminal Connection

Terminal No.	Connection	Terminal No.	Connection
1, 2	Alarm Switch 1	27, 28	Auxiliary Switch 2
3, 4	Alarm Switch 2	29, 30	Auxiliary Switch 3
5, 6	Undervoltage Trip	31, 32	Auxiliary Switch 4
7, 8	Shunt Close	33, 34	Auxiliary Switch 5
9, 10	Shunt Trip	35, 36	Auxiliary Switch 6
11, 12	Spring Charging Motor	37, 38	Auxiliary Switch 7
13, 14	Ground-fault Test	39, 40	Auxiliary Switch 8
15	Reserved	41	CIM3F—Red
16, 17	Ground-fault Sensing	42	CIM3F—Black
18, 19	Ground-fault Sensing	43	CIM3FBlue
20, 21	Ground-fault Zone Interlock	44	CIM3F—Orange
22	Equipment Ground (Common)	45, 46	Fan Cooling (SED 4000 A only)
23, 24	Short-time Zone Interlock	47, 48 Spring Charged Contact ¹	
25, 26	Auxiliary Switch 1	49, 50	Jumpered Internally in Control Plug

<u>15</u>

<u>21</u>

¹Circuit breakers with spring charging motors only.

MAN COR STANDARD CORE

AC AUXILIARY SWITCHES

Switch Ratings:

- (0.04 ampere minimum)
- 10 A 120 Vac 50/60 Hz
- 1/4 HP 120 Vac 50/60 Hz

Wiring notes:

- 1. Connect yellow leads to common terminal.
- 2. Switch type A is OPEN when circuit breaker is open (wire normally-closed contact using blue leads).
- 3. Switch type B is CLOSED when circuit breaker is open (wire normally-open contact using blue leads).
- Due to the limited number of available control terminals, switches can be wired as either A or B.

Figure 93: AC Auxiliary Switches as Viewed from Front of Circuit Breaker

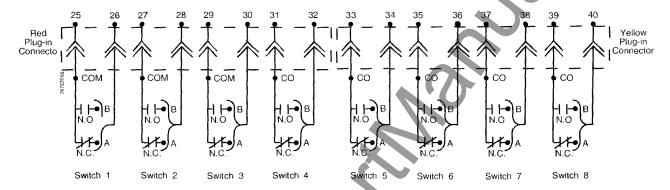


Table 12: AC Auxiliary Switch Configuration

Accessory	Swit	ch 1	Swit	ch 2	Swit	tch 3	Swit	ch 4	Swit	tch 5	Swit	ch 6	Swit	ch 7	Swit	ch 8
Suffix	Α	В	A	В	A	В	A	В	A	В	A	В	A	В	A	В
A4	Х		Х			Х		×								
B4	Х		Х			Х		×								
C4	Х		Х			X		Х								
AB	Х		Х		Х		X			Х		Х		Х		Х
B8	Х		Х		Х	1	Х			Х		Х		Х		Х
C8	Х		Х		X		Х			Х		Х		Х		Х

MAN COR STANDARD CORE

AC/DC AUXILIARY SWITCHES

Switch Ratings:

- (1 ampere minimum)
- 10 A 120 Vac 50/60 Hz
- 10 A 125 Vdc
- 1/4 HP 120 Vac 50/60 Hz
- 1/4 HP 125 Vdc

Wiring notes:

- 1. Connect yellow leads to common terminal.
- Switch type A is open when circuit breaker is open (wire normally-closed contact using blue leads).
- Switch type B is closed when circuit breaker is open (wire normally-open contact using blue leads).
- 4. Due to the limited number of available control terminals, switches can be wired as either A or B.

Figure 94: AC/DC Auxiliary Switches

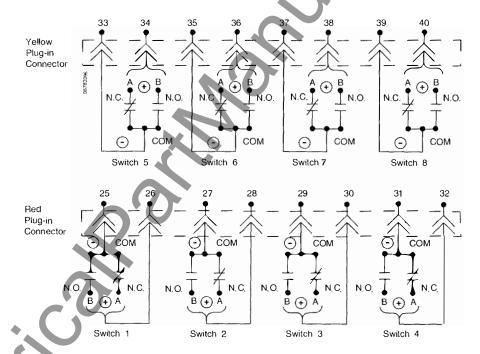


Table 13: AC/DC Auxiliary Switch Configuration

Accessory Suffix	Swit	ch 1	Swit	ch 2	Swit	ch 3	Swit	ch 4	Swit	ch 5	Swit	ch 6	Swit	ch 7	Swit	ch 8
Accessory Suma	A	В	A	В	A	В	A	В	A	В	A	В	A	В	A	В
D4	Х		X			Х		Х								
E4	Х		×			Х		Х								
F4	X		Х			Х		Х								
D8	×		Х		Х		Х			Х		Х		Х		Х
E8	Х		Х		Х		Х			Х		Х		Х		Х
F8	X		Х		Х		×			Х		×		Х		Х

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ALARM SWITCHES

Switch Ratings:

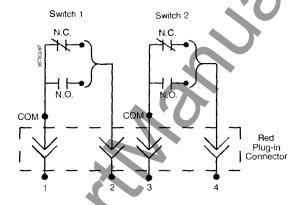
- (0.04 ampere minimum)
- 10 A 120/240 Vac 50/60 Hz
- 1/4 HP 120 Vac 50/60 Hz

NOTE: Alarm switches are actuated if the circuit breaker is opened as the result of an overload, short-circuit, ground-fault, or undervoltage condition. Alarm switches are not actuated if the circuit breaker is opened by the manual Push-to-Trip or shunt trip operations.

Table 14: Alarm Switch Configurations

Accessory	Swi	tch 1	Switch 2		
Suffix	N.O.	N.C.	N.O.	N.C.	
B4, E4, B8, E8	Х		Х		
A4, D4, A8, D8		Х	Х		
C4, F4, C8, F8		Х		Х	

Figure 95: Alarm Switches as Viewed from Front of Circuit Breaker



SHUNT TRIP

The minimum size control power transformer to be supplied is as follows:

- Circuit breakers without accessories, with ground-fault option = 150 VA
- Circuit breakers with accessories, with or without ground-fault option = 500 VA
- Two or three circuit breaker throwover systems = 1000 VA

Figure 96: Alarm Switches as Viewed from Front of Circuit Breaker

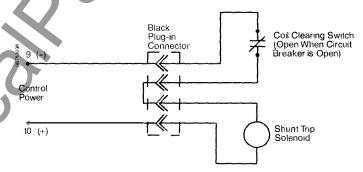


Table 15: Shunt Trip Information

Catalog Number	Series 2 Catalog	Accessory Kit	Rating		
Suffix ¹	Number Suffix	Number	Voltage	Amperage	
T1, S1, ES1	S1	S3ST120AC2	120 Vac	10 A	
T2, S2, ES2, ES5, ET5	T1	S3ST024DC2	24 Vdc	12 A	
T3, S3, ES3, ES6, ET6	T2	S3ST048DC2	48 Vdc	24 A	
T4,S4,ES4,ES7, ET7	T4	S3ST125DC2	125 Vdc	10 A	

¹ Suffix numbers T1 through T4 are UVR/shunt trip combination Series 3 and newer.

INTA COR.

UNDERVOLTAGE TRIP

The minimum size control power transformer to be supplied is as follows:

- Circuit breakers without accessories, with ground-fault option = 150 VA
- Circuit breakers with accessories, with or without ground-fault option = 500 VA
- Two or three circuit breaker throwover systems = 1000 VA

NOTE: Energize the undervoltage trip accessory prior to closing the circuit breaker either electrically or mechanically. An attempt to close the circuit breaker electrically without energizing the undervoltage trip accessory will cause the fuse on the shunt close to open.

Figure 97: Undervoltage Trip Wiring Diagram

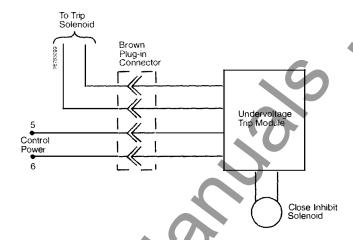


Table 16: Undervoltage Trip Information

Catalog Number	Accessory Kit	Rating	
Suffix	Number	Voltage	Amperage
V1, T1-T4, ET1-ET7	SEUVR120AC2	120 Vac	100 mA

SHUNT CLOSE

The minimum size control power transformer to be supplied is as follows:

- Circuit breakers without accessories, with ground-fault option = 150 VA
- Circuit breakers with accessories, with or without ground-fault option = 500 VA
- Two or three circuit breaker throwover systems = 1000 VA

NOTE: Energize the undervoltage trip accessory, if installed, prior to closing the circuit breaker either electrically or mechanically. An attempt to close the circuit breaker electrically without energizing the undervoltage trip accessory will cause the fuse on the shunt close to open.

Table 17: LETTELFUSE® Information

Shunt Close Catalog No.	LITTELFUSE ^{®1} BAG Type Catalog No.	Ampere Rating
S3SC120AC2	361005	5
S3SC024DC2	361005	5
S3SC048DC2	362010	10
S3SC125DC2	361005	5

LITTLEFUSE is a registered trademark of Littelfuse Inc.

Figure 98: Shunt Close Wiring Diagram

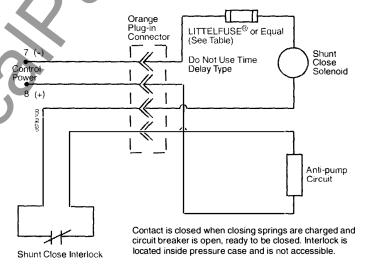


Table 18: Shunt Close Information

Catalog Number	Catalog Number	Accessory	Rating			
Suffix	Suffix-Series 2	Kit Number	Voltage	Amperage		
ES1, EV1, ES5, ES6, ES7, ET5, ET6, ET7	C1	S3SC120AC2	120 Vac	10 A		
ES2	D1	S3SC024DC2	24 Vdc	12 A		
ES3	D2	S3SC048DC2	48 Vdc	24 A		
ES4	D4	S3SC125DC2	125 Vdc	10 A		

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SPRING CHARGING MOTOR

Figure 99: Spring Charging Motor Wiring Diagram

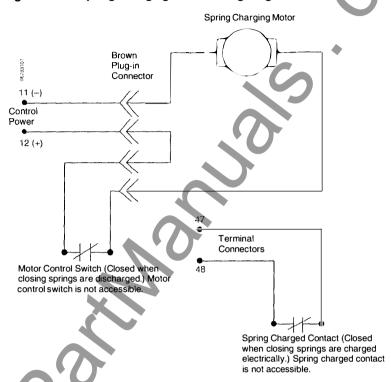


Table 19: Spring Charging Motor Information

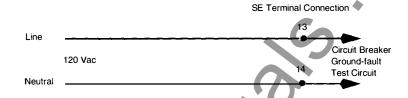
Catalog No.	Accessory Kit	Rating				
Suffix	Number	Voltage	Amperage			
ES1, EV1, ET1	S3MOT120AC2	120 Vac	1.00 A			
ES2	S3MOT024DC2	24 Vdc	2.75 A			
ES3	S3MOT048DC2	48 Vdc	2.75 A			
ES4	S3MOT125DC2	125 Vdc	2.75 A			

MAN CORE

GROUND-FAULT SYSTEMS

Ground-fault Test Circuit

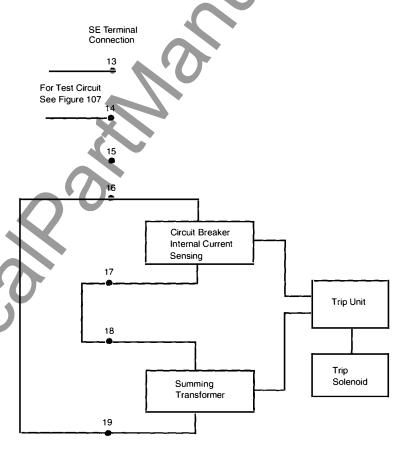
Figure 100: Ground-fault Test Circuit



3Ø3W (Three-phase, Three-wire) Residual Ground-fault Sensing System

- SE circuit breakers furnished with the ground-fault protection for equipment feature must be wired as shown for use on threephase, three-wire systems. SEF circuit breakers have factory-installed jumper wires on the terminal blocks. SED circuit breakers must have jumper wires installed on the switchboard carriage terminal blocks.
- 2. Before doing any primary injection testing, refer to Section 7–Maintenance.
- 3. For location of terminal connections, see Terminal Connector for SE Circuit Breaker at beginning of this appendix.

Figure 101: 3Ø3W Residual Ground-fault Sensing System



MAN CORE CORE

3Ø4W (Three-phase, Four-wire) Residual Ground-fault Sensing System

- Connect neutral current transformer into neutral of power system:
 - For forward fed systems, the <u>load</u> neutral must be connected to the "H1" end of the neutral current transformer.
 - For reverse fed systems, the <u>supply</u> neutral must be connected to the "H1" end of the neutral current transformer.
- Connect neutral current transformer terminals to circuit breaker terminals:
 - If neutral current transformer is labeled Series 3, connect terminal X1 of neutral current transformer to circuit breaker terminal 16 and connect terminal X2 of neutral current transformer to circuit breaker terminal 17.
 - If neutral current transformer is not labeled Series 3, connect terminal X1 of neutral current transformer to circuit breaker terminal 17 and connect terminal X2 of neutral current transformer to circuit breaker terminal 16.

Do not use more than 14 feet (4.27 m) of No. 14 wire for this connection.

- Ground terminal 1 of neutral current transformer only if no other ground exists in control system. (Check NEC requirements and connect to equipment ground bars.)
- 4. SE circuit breakers furnished with the ground-fault protection for equipment feature must be wired as shown for use on threephase, four-wire systems. SEF circuit breakers have factory-installed jumper wires on the terminal blocks. SED circuit breakers must have jumper wires installed on the switchboard carriage terminal blocks.
- 5. Before doing any primary injection testing, refer to Section 7—Maintenance.

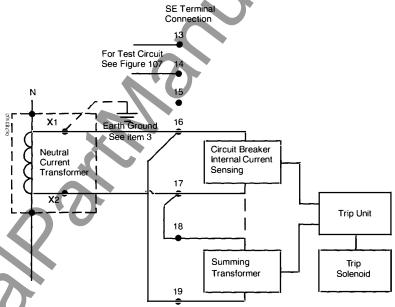
CAUTION

HAZARD OF EQUIPMENT DAMAGE.

Conductors attached to circuit breaker bottom terminations must have their associated neutral conductor(s) connected to end of neutral current transformer identified as **H1**.

Failure to follow this instruction can result in equipment damage.

Figure 102: 3Ø4W Residual Ground-fault Sensing System Wiring Diagram



NOTE: For test circuit and location of terminal connections, see Terminal Connector for SE Circuit Breaker at beginning of this appendix.

Table 20: Neutral Current Transformer Connections

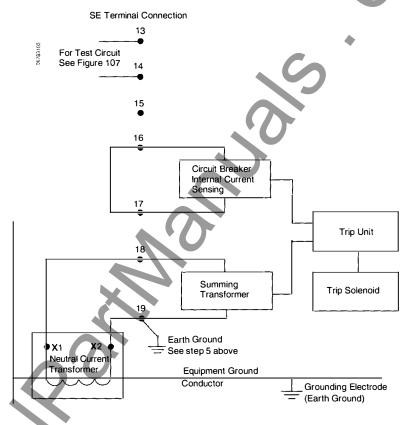
Neutral Current Transformer	Connections
Series 3	
48162-151-52	Connect terminal X1 of neutral current
48162-144-51	transformer to circuit breaker terminal 16.
48162-142-51	Connect terminal X2 of neutral current transformer to circuit breaker terminal 17
48040-104-51	transferred to the curt breaker terminar 17.
48162-151-51	Connect terminal X1 of neutral current
48162-144-50	transformer to circuit breaker terminal 17.
48162-142-50	Connect terminal X2 of neutral current
48162-104-50	transformer to circuit breaker terminal 16.

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3Ø4W (Three-phase, Four-wire) Source Ground-sensing System.

- 1. Remove jumper wires connecting terminals 16 to 19 and terminals 17 to 18 (if installed).
- 2. Install jumper wire (No. 18 wire or larger) between terminals 16 and 17.
- Connect a neutral current transformer (CT) into conductor connecting power system neutral-to-ground (equipment ground conductor). Polarity of CT is not important to source ground sensing.
- Connect terminals X1 and X2 of current transformer to circuit breaker terminals 18 and 19. DO NOT use more than 14 feet (4.27 m) of No. 14 wire for this connection.
- Ground circuit breaker terminal 19 only if no other ground exists in control system. (Check NEC requirements and connect to equipment ground bars.)
- 6. Before doing any primary injection testing, refer to Section 7—Maintenance.

Figure 103: 3Ø4W Source Ground-sensing System



MAN CORE CORE

ZONE-SELECTIVE INTERLOCKING

Ground-fault Zone-selective Interlocking

- Ground-fault time-delay tripping will be based on trip unit setting if circuit breaker is restrained by a self-restraint jumper wire between terminals 20 and 21. If jumper wire is removed, circuit breaker will trip approximately 0.07 seconds after groundfault pickup point is exceeded.
- Ground-fault time-delay tripping based on trip unit setting will also occur if circuit breaker is restrained by a restraint signal from a downstream circuit breaker. Use No.14 or No.16 cable, twisted in pairs, and run separately from power cables. Connect one cable from downstream circuit breaker output terminal to input terminal 20 and other cable from downstream circuit breaker equipment ground (common) terminal 22. If cable length exceeds 1000 ft. (305 m) between circuit breakers, a restraint interface module (Cat. No. RIM32) will be required.
- Output from one circuit breaker can restrain tripping of multiple circuit breakers. See Section 6, Table 8.
- Some ZSI installations require a restraint interface module, Cat. No. RIM32. See Section 6. Table 8.

CAUTION

HAZARD OF EQUIPMENT DAMAGE.

Do not apply more than 12 volts to terminals 20 and 21.

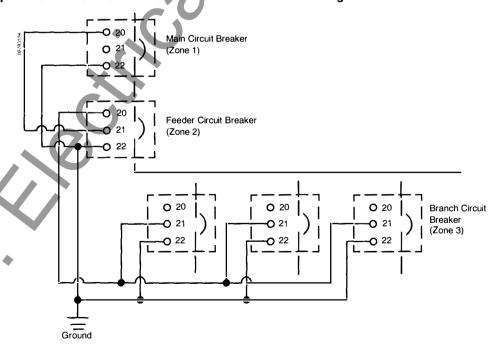
Failure to follow this instruction can result in trip unit damage from excessive voltage.

Figure 104: Connections for ground-fault delay coordination.

20 Input from ground-fault restraint21 Output from ground-fault restraint

22 Equipment ground (common)





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Short-time Zone-selective Interlocking

- Short-time time-delay tripping will be based on trip unit setting if circuit breaker is restrained by a self-restraint jumper wire between terminals 23 and 24. If jumper wire is removed, circuit breaker will trip approximately 0.07 seconds after short-time pickup point is exceeded.
- 2. Short-time time-delay tripping based on trip unit setting will also occur if circuit breaker is restrained by a restraint signal from a downstream circuit breaker. Use No.14 or No.16 cable, twisted in pairs, and run separately from power cables. Connect one cable from downstream circuit breaker output terminal to input terminal 23 and other cable from downstream circuit breaker equipment ground (common) to equipment ground (common) terminal 22. If cable length exceeds 1000 ft. (305 m) between circuit breakers, a restraint interface module (Cat. No. RIM32) will be required.
- Output from one circuit breaker can restrain tripping of multiple circuit breakers. See Section 6, Table 8.
- Some ZSI installations require a restraint interface module, Cat. No. RIM32. See Section 6, Table 8.

CAUTION

HAZARD OF EQUIPMENT DAMAGE.

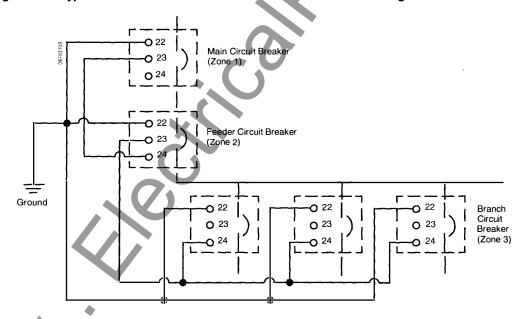
Do not apply more than 12 volts to terminals 23 and 24.

Failure to follow this instruction can result in trip unit damage from excessive voltage.

Figure 106: Connections for short-time delay coordination.

- 22 Equipment ground (common)
- 23 Input to short-time restraint
- 24 Output from short-time restraint

Figure 107: Typical Connections for Short-time Zone-selective Interlocking



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CIM3F COMMUNICATIONS ADAPTER CONNECTIONS

Figure 108: CIM3F Communications Adapter Connections

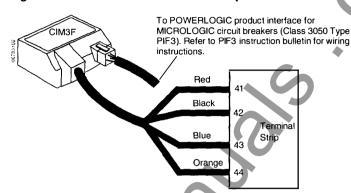
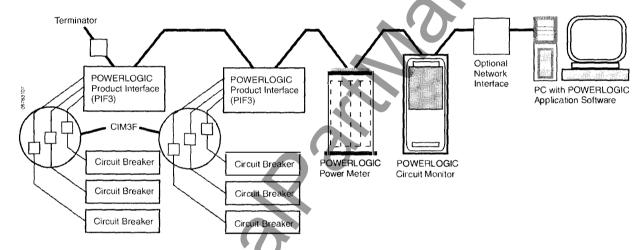


Figure 109: SE Circuit Breakers (CB) in a Typical POWERLOGIC system

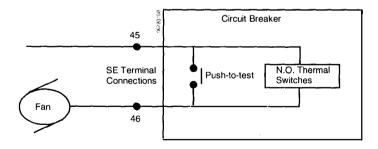


SED4000 A CIRCUIT BREAKER COOLING FAN

- 1. Switch ratings: 10 ampere, 120 Vac.
- 2. Fan rating: 120 Vac.
- 3. Thermal switch contacts close when current through circuit breaker nears 4000 amperes.
- 4. Fan push-to-test button will operate cooling fan.

For location of terminal connections, see Terminal Connector for SE Circuit Breaker at beginning of this appendix

Figure 110: SED4000 A Circuit Breaker Cooling Fan Wiring Diagram



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APPENDIX 3—CATALOG NUMBERS

Table 21: Neutral Current Transformers

Circuit Breaker Sensor Size	Neutral Current Transformer Catalog Number
400 A	SE04NCT
800–1200 A	SE12NCT
1600-3000 A	SE30NCT
4000 A	SE40NC5

Table 22: Field-installable Accessory Kits

Description	Catalog Number
Padlock Attachment	SE2PA
Close Button Cover	SE1CBC
Key Interlock Bracket	SE1K1
Drawout Crank	SEDC

Table 23: Field-installable Rating Plug Kits

Catalog Number	Multiplier
ARP040	0.400
ARP050	0.500
ARP056	0.563
ARP058	0.583
ARP060	0.600
ARP063	0.625
ARP067	0.667
ARP070	0.700
ARP075	0.750
ARP080	0.800
ARP083	0.833
ARP088	0.875
ARP090	0.900
ARP100	1.000

Table 24: Field-replaceable Accessory Kits

Description	Rating	Catalog Number
Spring Charging Motor Replacement Kit	120 Vac 24 Vdc 48 Vdc 125 Vdc	\$3MOT120AC2 \$3MOT024DC2 \$3MOT048DC2 \$3MOT125DC2
Shunt Close Replacement Kit	120 Vac 24 Vdc 48 Vdc 125 Vdc 120Vac	\$3SC120AC2 \$3SC024DC2 \$3SC048DC2 \$3SC125DC2 \$3ST120AC2
Shunt Trip Replacement Kit	24 Vdc 48 Vdc 125 Vdc	S3ST024DC2 S3ST048DC2 S3ST125DC2
Undervoltage Trip Replacement Kit	120 Vac	S3UVR120AC2
Auxiliary Switch Replacement Kit	4 ac/dc 4 ac/dc add on 4 ac only 8 ac only	S34DCB2 S3DCT2 S34AC2 S38AC2
Alarm Switch Replacement Kit	2 ac only	S3AS2

MAN CORE CORE

INDEX

Α	operation 39	close button 41
Accessories	wiring	enclosure 9
alarm switch	ac auxiliary switch 61	interlock 53
operation 40	ac/dc auxiliary switch 62	Crank, drawout 20, 34
wiring 63	В	Current rating 7
ammeter/trip indicator 25	_	Current sensor 7
auxiliary switch	Bussing SEF circuit breaker 11	Current transformer, neutral 33, 57,
operation 39	Bypassing interlock 51	68, 72
wiring 61, 62	auxiliary cover 50	D
catalog numbers 72	C	
cell keying kit 43	_	Dimensions
cell switch 40	Carriage assembly 17	neutral current transformer 57
close button cover 41	Catalog numbers accessory kits 72	SED circuit breaker 54 SEF circuit breaker
communications adapter	accessory kits 72 neutral current transformer 72	with 1600-4000 A sensors 55
operation 30, 44	rating plugs 72	with 400-1200 A sensors 56
wiring 71	cell door 51	SEFM40CK terminal connector 58
control power transformer 30, 49	Cell door interlock 51	SEHF circuit breaker
general information 38	bypassing 51	with 400-4000 A sensors 55
internally-mounted 49	disabling 51	dimensions 58
key interlock 42	Cell keying kit 43	Disabling cell door interlock 52
lifting adapter 8, 13, 18, 23 padlock attachment	Cell switch accessory 40	Drawout access cover
SED circuit breaker 41	Charge closing springs	interlock 53
SEF circuit breaker 41	SED circuit breaker 19	operation 20, 34
replacing 38	SEF circuit breaker 14	Drawout carriage
restraint interface module 43	Charging motor 40, 65	description 6
shunt close	CIM3F. See Communications adapter	padlock 41
operation 38	Circuit breaker	padlock hasp 53
wiring 64	lifting 8	requirement 17
shunt trip	receiving 8	Drawout circuit breaker. See SED circuit
operation 38	Circuit breaker. See SED circuit breaker,SEF	breaker
wiring 63	circuit breaker Close button cover 41	Drawout crank 20, 34 Drawout mechanism
spring charging motor		check operation 20
operation 40	Closing springs charging SED circuit breaker 19	lockout 53
wiring 65	charging SEF circuit breaker 14	Drawout rails 17
trip indicator. See Ammeter/trip indicator	Communications adapter	
troubleshooting 47	operation 44	E
undervoltage trip	wiring 71	Electronic trip unit. See Trip unit
operation 39	with ground-fault alarm 33	Enclosure
wiring 64 universal test set 44	with POWERLOGIC 30	arc barrier clearances 14
wiring 30	Connector kit, terminal. See Terminal	door/cover dimensions 9
AIR. See Interrupting rating	connector kit	size 10
Alarm switch	Continuous current rating. See Current rating	ventilation 11
operation 40	Control wiring	wire bending requirements 10
wiring 63	accessories 30	F
Ammeter/trip indicator 25	control power transformer 30, 38,	
Ampere interrupting rating. See Interrupting	49	Fan, cooling
rating	general information 30	operation 37
Ampere rating 6	ground-fault protection 33	wiring 71
Arc barriers 14	POWERLOGIC system 30	Filler plate 36
Arc vent tape 23	zone-selective interlocking 31 Cooling fan	Fixed-mounted circuit breaker. See SEF
Auxiliary cover	operation 37	circuit breaker
installation 49	wiring 71	Frame size 7
interlock 50	Coordination, study 26, 31	G
Dypassing 30	Coordination, system 26, 31	<u> </u>
Temoval 49	Cover	Ground-fault alarm
Auxiliary switch	auxiliary 49	description 25
_	•	accomplian 20

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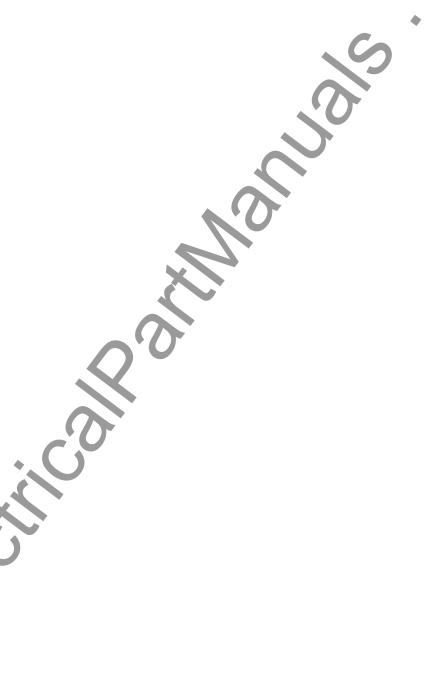
	_	
switch 28	N	wiring 71
detection 25	Neutral current transformer 33, 68	dimensions 54
test 33	catalog numbers 72	drawout operation 20
test circuit 66	dimensions 57	drawout rails 17
tripping		installation 17
delay switch 28	0	interlocks 50
description 25	Open circuit breaker	key interlock 41
pickup switch 27	SED circuit breaker 20	lifting 8, 23
wiring 33	SEF circuit breaker 16	mounting 17
with POWERLOGIC system 33		opening 20
zone-selective interlocking 31	Р	placing in service 34
wiring	Packing circuit breaker 45	push-to-close button 19
3Ø3W residual 66 3Ø4W residual 66	Padlock attachment	push-to-open button 20
	push-to-open 53	receiving inspection 8
3Ø4W source 68	SED Circuit Breaker 41	removal 22
zone-selective interlocking 69	SEF circuit breaker 41	storage 8 troubleshooting 47
1	Padlock hasp 53	
languat ainsuit bus along 0	POWERLOGIC system 25, 30, 71	SEF (fixed-mounted) circuit breaker 4000 A terminal kit 12
Inspect circuit breaker 8	wiring 71	accessories 38
Installation	Primary injection testing. See Testing	
arc barriers 14	Push-to-close button	bussing 11 charging the closing springs 14, 15
SED circuit breaker 34 SEF circuit breaker 9	SED circuit breaker 19	charging the closing springs 14, 15 check installation 34
	SEF circuit breaker 15	check operation 14
Instantaneous trip	Push-to-open button	closing 15
function 27	SED circuit breaker 20	description 6
pickup switch 27	SEF circuit breaker 16	dimensions 55
Integral ground fault See Ground-fault Interlock	Push-to-open padlock attachment 53	enclosure
		door/cover 11
auxiliary cover 50 bypassing 50	R	size 10
cell door	Rails, drawout 6, 17	ventilation 11
bypassing 51	Rating	wire bending space 10
disabling 52	ampere 7	factory-installed 9
drawout access cover 53	current 7	field-installed 9
drawout access cover 55 drawout carriage padlock 41	interrupting 7	inspect installation 14
drawout carriage padlock hasp 53	Rating plug 7	installation 13
drawout mechanism lockout 53	catalog numbers 7, 72	interlocks 50
key 53	multiplier 7	key interlock 42
push-to-open padlock attachment 53	operation 24	lifting 13, 18
SED 4000 A circuit breaker 53	Receiving	opening 16
trip unit 41	inspection 8	push-to-close button 15
Internally-mounted accessories 49	storage 8	push-to-open button 16
Interrupting rating 7	Remote close. See Shunt close	receiving inspection 8
	Removal	removal 16
J	SED circuit breaker 22	storage 8
Joint compound 37	SEF circuit breaker 16	troubleshooting 48
	Repacking 45	ventilation 11
K	Restraint interface module 32, 43,	wire bending requirements 10
Key interlock 42, 50	69, 70	SEFM40CK terminal connector. See
. (/1	RIM32. See Restraint interface module	Terminal connector kit
L	S	Sensor size 7
Lifting adapter 8, 13, 23		Short-time trip
Lifting circuit breaker 13, 23	Safety interlocks. See Interlocks	delay switch 27
Long-time trip	Sealing the trip unit. See Trip unit	function 27
delay switch 26	SED (drawout) circuit breaker	pickup switch 27
function 26	4000 A circuit breaker 53	zone-selective interlocking 31
pickup switch 27	accessories 38	wiring 70
· · ·	carriage assembly 17	Shunt close
M •	charging the closing springs 19	operation 38
Maintenance 36	check drawout operation 20	wiring 64
Memory feature, trip unit 25	check installation 34	Shunt trip
MICROLOGIC trip unit See Trip unit	check operation 19, 20	operation 38
Motor, spring charging 40	closing 19	wiring 64
3 3 3	cooling fan	Spring charging motor
	check 37	

MAN CORPORTINAS CORP.

```
operation
    wiring
                                              Warranty 6
Switch
                                              Wire bending requirements
    alarm
          40
                                              Wiring
    auxiliary
              39
                                                 cooling fan 71
    cell 40
                                                  SED 4000 A cooling fan 71
System coordination
                      26
                                              Wiring diagrams
T
                                                 alarm switch 63
                                                 auxiliary switch 61,
                                                                        62
Tape, arc vent 16
                                                 communication module
Terminal connections 58
                                                  ground-fault
Terminal connector kit (SEFM40CK)
                                                     3Ø3W residual ground-fault sensing
    connections 60
    description 12
                                                     3Ø4W residual ground-fault sensing
    requirements for
                     10
Terminal connectors 30,
                            49,
                                  60
                                                     3Ø4W source ground-sensing
Test set, universal 44
                                                 shunt close 64
Testing
                                                  shunt trip 63
    ground fault 33
                                                  spring charging motor
                                                                        65
    primary injection 37
                                                 terminal connections
   trip unit 44
                                                 undervoltage trip 64
Transformer
                                                 zone-selective interlocking
                               49
   control power
                                                     ground-fault 69
    neutral current
                    33.
                          72
                                                     short-time 70
       dimensions
                    57
                                              Wiring, control power. See Control wiring
Trip characteristics
                    26
Trip curve 26
                                              Z
Trip indicator. See Ammeter/trip indicator
                                              Zone-selective interlocking
Trip system 6
                                                 activating 32
Trip unit
                                                 allowable combinations
   adjustable switches
                                                 wiring
   adjustments 29
                                                     ground-fault
   ammeter/trip indicator 25
                                                     short-time 70
   control wiring 30
                                              ZSI. See Zone-selective interlocking
   description 6
   functions 26
       ground-fault alarm
       ground-fault trip 28
       instantaneous trip
                          27
       integral ground-fault detection
       long-time trip 27
       short-time trip 27
   memory feature 25
   operation 24
   rating plug 24
    setting current rating
   testing 26
   trip characteristics
    trip curve 26
Troubleshooting
                 48
    accessories
                 47,
    SED circuit breaker
    SEF circuit breaker
                       42
U
Undervoltage trip
   adjustable delay
   operation 39
          64
   wiring
Universal test set
Ventilation
```

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