GE Energy

Industrial Solutions

EntelliGuard® E

Circuit Breaker

Installation, Operation, and Maintenance Manual

Retain for Future Use.

imagination at work

HAZARD CATEGORIES

The following important highlighted information appears throughout this document to warn of potential hazards or to call attention to information that clarifies a procedure.

Carefully read all instructions and become familiar with the devices before trying to install, operate, service or maintain this equipment.

⚠ DANGER

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

⚠ WARNING

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

CAUTION

Failure to comply with these instructions may result in product damage.

NOTICE

Indicates important information that must be remembered and aids in job performance

TRADEMARKS

EntelliGuard™ E

EntelliGuard Messenger™

EntelliGuard™ TU

Entellisys™

WARRANTY

This document is based on information available at the time of its publication. While efforts have been made to ensure accuracy, the information contained herein does not cover all details or variations in hardware and software, nor does it provide for every possible contingency in connection with installation, operation, and maintenance. Features may be described herein that are not present in all hardware and software systems. GE Industrial Solutions assumes no obligation of notice to holders of this document with respect to changes subsequently made. GE Industrial Solutions makes no representation or warranty, expressed, implied, or statutory, with respect to, and assumes no responsibility for the accuracy, completeness, sufficiency, or usefulness of the information contained herein. No warrantees of merchantability or fitness for purpose shall apply.

Contact your local sales office if further information is required concerning any aspect of EntelliGuard E circuit breaker operation or maintenance.

Table of Contents

SECTION 1 – GENERAL INFORMATION

STORAGE

CAUTION

PRODUCT DAMAGE

- Do not store circuit breaker in corrosive environments above LC1 (sea salt mist) and G1 as per ANSI/ISA-S71.04-1985.
- Ensure circuit breakers are stored in a clean, dry location in their original packaging.

Failure to comply with these instructions may result in product damage.

Introduction

Quality Assurance

All EntelliGuard E circuit breakers have been designed and manufactured to the highest technical standards. Strict procedures ensure first class product quality.

Product Serial Number

Please have the serial number available when communicating about the circuit breaker. Each circuit breaker has a unique serial number located on the bottom right side (viewed from front) of the front fascia, see figure 1.2.

Measurement Units

- All data in this document is specified in conventional metric/SI units.
- All internal/external accessory and external cable/bus bar connections are metric.

PRODUCT DESCRIPTION

The EntelliGuard E power circuit breaker is designed to protect low voltage power circuits when used with Entellisys™ Low-Voltage Switchgear only. The EntelliGuard E circuit breaker must be used in concert with the EntelliGuard Messenger and current transformers mounted within the switchgear cubicle. All EntelliGuard E circuit breakers are designed for draw-out mounting. See Section 2 and the Entellisys Low-Voltage Switchgear application guide, DET-838 for complete product specifications.

Figure 1.1 shows a front view of the EntelliGuard E. The indicated features are referenced in this document.

HAND TOOLS NEEDED FOR INSTALLATION

Table 1.1 provides a list of the hand tools required to install, operate and maintain the EntelliGuard E Circuit Breaker.

Table 1.1. Required Hand Tools

Tool Name	Function
Cluster pliers (two pairs, each with a different gap, are supplied under Cat. No. GUNI)	To remove primary disconnect finger clusters for inspection and maintenance.
Screwdriver (8 mm)	• To operate racking drive shutter.
Allen wrench (5 mm)	• To remove arc chutes for inspection and maintenance. • To remove or adjust fixed and moving arcing contacts. • To remove mechanism.
Allen wrench key (4 mm)	To remove motor and gearbox mounting screws.
Metric feeler gauges	To check and adjust arcing contact gaps.
Pozidrive terminal screwdriver	• To remove mechanical and electronic component mounting screws. • To connect wiring to secondary disconnect terminals.
Pozidrive screwdriver (#1 and #3)	• To remove front cover mounting screws. • To remove Rogowski coil and Power current transformer cover plate at the rear of the circuit breaker moving portion.
Full Set of Metric Hex Allen Wrenches and Socket Set	• To remove PMU base, auxiliary switch assembly, etc.

FIGURE 1.1. ENTELLIGUARD E POWER CIRCUIT BREAKER FEATURES AND CHARACTERISTICS

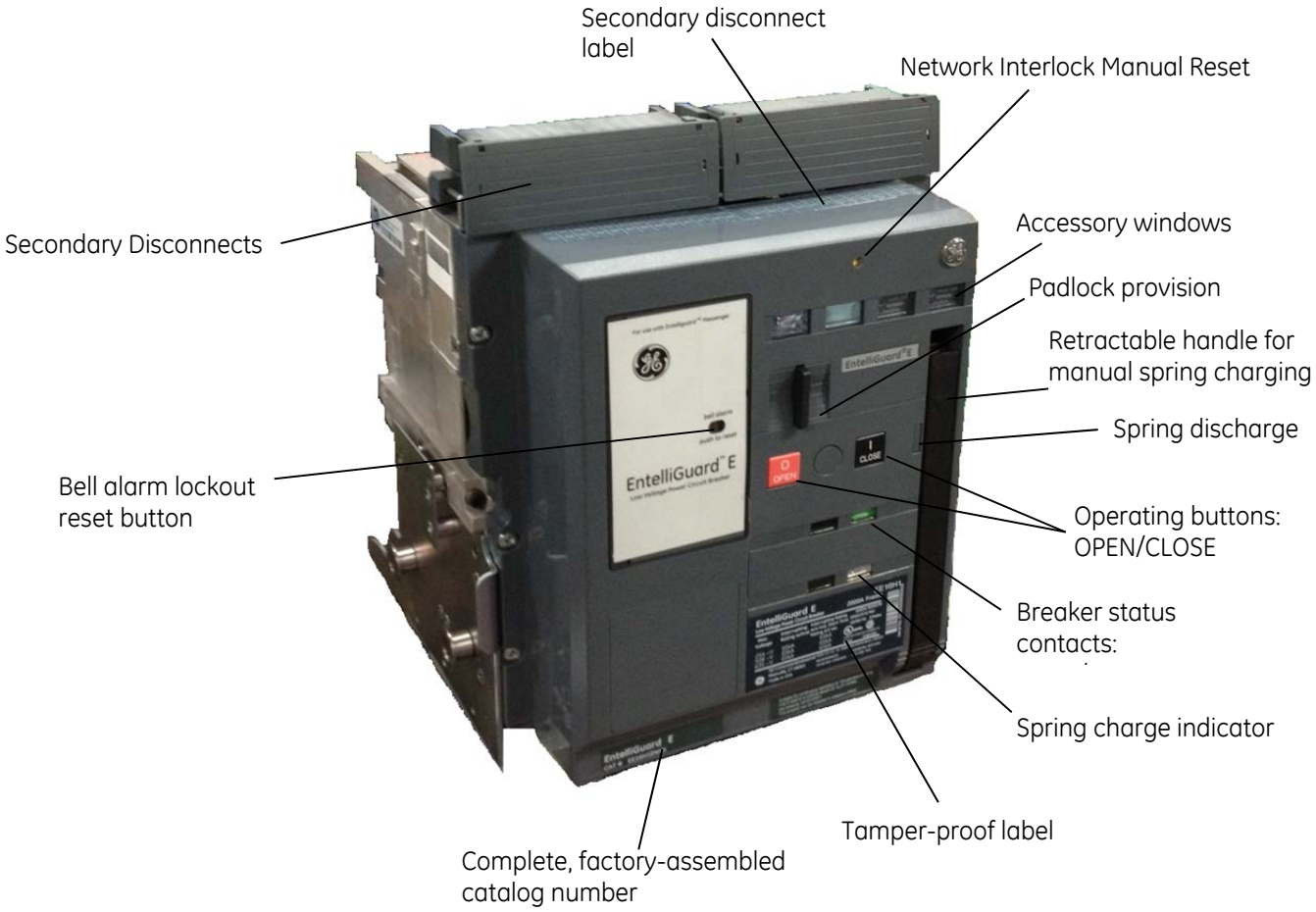
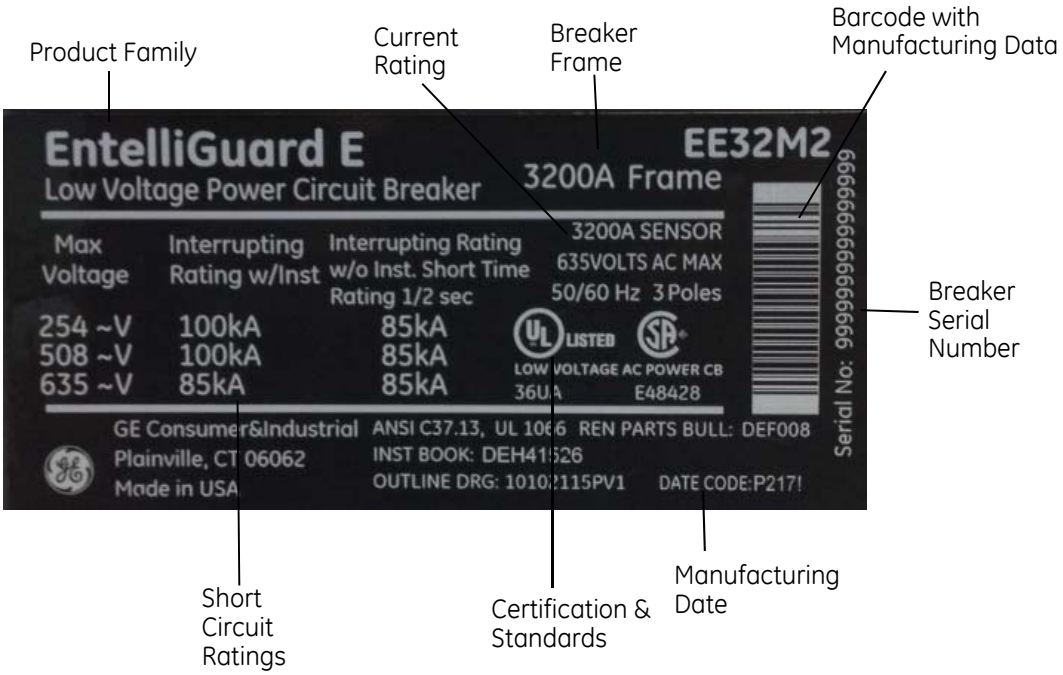


FIGURE 1.2. ENTELLIGUARD E POWER CIRCUIT BREAKER LABEL



SECTION 2 – PRODUCT SPECIFICATIONS

⚠ WARNING

IMPROPER INSTALLATION, OPERATION AND MAINTENANCE

Ensure only qualified personnel install, operate, service and maintain all electrical equipment.

Failure to comply with these instructions could result in death or serious injury.

TABLE 2.1. ENVIRONMENTAL CONDITIONS

Characteristic	Parameter
Temperature:	
Ambient for Normal Operation	-5 ºC to 70 ºC, 40 ºC max without derating
Ambient at 10% of listed endurance operations inside panel	-20 ºC to -5 ºC
Storage	-40 ºC to 70 ºC
Humidity	20% RH to 95% RH
Salt fog	per ASTM-B117
Vibration (random and sinusoidal)	1 G max., 50 Hz to 500 Hz in X, Y, Z directions
Fungus resistance	per ASTM G21
Voltage and current de-rating at altitude above sea level	per ANSI C37.20.1, Tables 2 and 3
Noise level	<30 dB
Endurance:	
closing coil, Shunt trip	20,000 operations
motor operator	12,500 operations

TABLE 2.2. ENTELLIGUARD E SHORT CIRCUIT AND INTERRUPTING RATINGS: ANSI/UL1066

Interrupting Rating Tier ANSI/UL1066 Devices, LVPCB					Envelope 1		Envelope 2	
Type	240 V	480 V	600 V	1/2S Withstand	400, 800, 1200	400, 800, 1600, 2000	3200	400-3200
S	65,000	65,000	50,000	50,000	X			
N	65,000	65,000	65,000	65,000		X	X	
H	85,000	85,000	65,000	85,000		X		
P	100,000	100,000	65,000	65,000		X		
E	85,000	85,000	85,000	85,000				X
M	100,000	100,000	85,000	85,000				X

TABLE 2.3. AGENCY CERTIFICATION

(All industry standards referenced in this table are the latest version at the time the product is sold.)

Standard Number	Title
ANSI C37.13,16,17, 20, 50	Low-voltage AC Power Circuit Breakers
UL 1066	Low voltage AC and DC Power Circuit Breakers Used in Enclosures
CSA 22.2, No 5.1	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

TABLE 2.4. PRODUCT DIMENSIONS AND WEIGHTS

Type	Width		Depth		Height		Weight	
	in.	mm	in.	mm	in.	mm	lbs.	kg
Envelope 1	13.07	332	16.34	415	17.24	438	149.9	68
Envelope 2, Up to 2000A	17.01	432	16.34	415	17.24	438	176.4	80
Envelope 2, Up to 3200A	17.01	432	16.34	415	17.24	438	209.4	95

SECTION 3 – LIFTING, MOUNTING AND INSTALLATION

⚠ WARNING

IMPROPER INSTALLATION, OPERATION AND MAINTENANCE

Ensure only qualified personnel install, operate, service and maintain all electrical equipment.

Failure to comply with these instructions could result in death or serious injury.

⚠ WARNING

FALLING OBJECT

- Ensure lifting equipment has capability for device being lifted.
- Wear hard hat, gloves and safety shoes.

Failure to comply with these instructions could result in death or serious injury.

CAUTION

PRODUCT DAMAGE

- Ensure circuit breaker and its accessories are always used within their designated ratings.
- Do not allow the circuit breaker to hit a hard surface while handling.
- Do not drag or slide the circuit breaker across a hard or rough surface.

Failure to comply with these instructions may result in product damage.

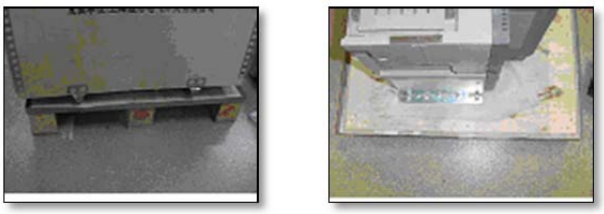
NOTICE

A factory-installed rejection feature prevents mismatching circuit breakers and cassettes/substructures, preventing the insertion of a circuit breaker with a lower rating into a higher rated cassette/substructure, or the insertion of a higher rated circuit breaker into a lower rated cassette/substructure.

CIRCUIT BREAKER UNPACKING (FIG. 3.1)

1. Inspect the shipping container for obvious signs of rough handling and/or external damage incurred during transportation.
2. Record any observed damage for reporting to the carrier. Ensure all recorded reports and claims include the order number and nameplate information.
3. Remove the banding straps and lift off the top cover.
4. Remove all packaging material.
5. Remove all product documentation and store properly.
6. Unscrew the mounting screws that fasten the circuit breaker to the bottom of the shipping pallet and remove the circuit breaker.

Figure 3.1. Unpacking the Circuit Breaker



BASIC CIRCUIT BREAKER CONSTRUCTION

Figure 3.2. Circuit Breaker Construction

EntelliGuard E circuit breakers consist of rigid front and rear housings made of thermoset composite resins which provide high structural strength and excellent dielectric properties. These housings enclose a contact system consisting of a moving portion and a fixed portion:

- Moving portion: comprised of multiple finger assemblies connected to a conductor through flexible copper connections. The number of finger assemblies depends on the circuit breaker's continuous and short circuit ratings. Each finger assembly has an arcing contact and a main contact.
- Fixed portion: consists of a main fixed contact which is brazed to a conductive pad, and arc runner which is fastened to the conductive pad which guides the arc to the arc chamber.

Each pole has an arc chamber comprised of arc chamber molds which houses the de-ion plates and filtering system. The pole configuration depends upon the breaker frame size.

The operating mechanism is mounted on the front housing. The energy stored in the mechanism is used to close the contact system. The mechanism is coupled to each pole by a common layshaft/drive shaft.

The trip unit measures current and protects the breaker by providing instantaneous over current override protection.

The fascia has interface buttons and features for safety locks.

The cassette consists of a mechanism which enables the circuit breaker to be racked in and out, and houses the interlocks.

The front panel on the cassette has three markings which indicate whether the breaker is in the CONNECTED, TEST or DISCONNECTED position.

Drawout Circuit Breaker Installation into the Cassette

1. Pull the lifting handles on both side walls of the circuit breaker.
2. Attach the lifting bar between the two holes of the lifting eyes as shown in Fig. 3.3.

Figure 3.3. Circuit Breaker Lifting

3. Remove any padlocks and keep the key in place for key locks if applied from the racking panel of the cassette.
4. Ensure the cassette position indicator shows DISCONNECTED and the racking handle is disengaged.
5. Ensure the cassette racking cams on both side walls of the cassette are in the completely racked out position as shown in Fig. 3.4.

Figure 3.4. Racking Drive in the DISCONNECTED Position

6. Pull out the cassette rails fully.
7. Lower the circuit breaker gradually so that the rollers drop over the rails. Ensure the grooves in all rollers straddle the rails as shown in Fig. 3.5.

Figure 3.5. Circuit Breaker Rollers Straddled on the Loading Rails

8. Remove the lifting bar and push the circuit breaker into the cassette until it reaches a positive stop (the racking pins on the circuit breaker are engaged with the racking cams of the cassette on both sides). The circuit breaker is now in the DISCONNECTED position (Fig. 3.6).

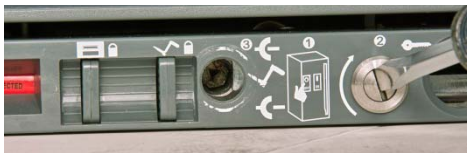
Figure 3.6. Circuit Breaker in DISCONNECTED Position

9. Push back both the extended rails of the cassette to the stowed position.
10. Close the circuit breaker cubicle door.
11. If the circuit breaker is CLOSED and the springs are charged, press the OPEN button on the circuit breaker fascia and ensure the circuit breaker contacts are open (Fig. 3.7).

Figure 3.7. Setting the Circuit Breaker to OFF

12. With a screwdriver, turn the racking handle shutter drive A clockwise (Fig. 3.8).

Figure 3.8. Racking Handle Shutter Drive Location



13. Insert the racking handle in the handle insertion hole on the cassette front panel.
14. Rotate clockwise to rack the circuit breaker into the cassette.

Figure 3.9. Turning the Racking Handle

15. Continue rotating the racking handle clockwise until the position indicator first shows TEST, then CONNECTED. When approaching the CONNECTED position, effort to turn the racking handle will increase as the clusters engage with the cassette-mounted contacts. If a motor spring charge is installed, it may operate when approaching the TEST position.
16. Remove and store the racking handle.
    The circuit breaker is now ready for normal operation.
17.

Circuit Breaker Removal from the Cassette

⚠ DANGER

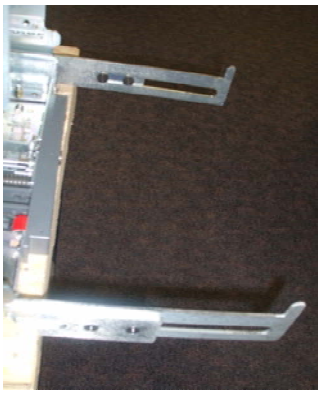
ELECTROCUTION

- Ensure the circuit breaker has been tripped, indicating OPEN, and the main springs are fully discharged.
- Do not touch the circuit breaker's isolating contacts during lifting.

Failure to comply with these instructions will result in death or serious injury.

1. Repeat Steps 11 through 13 as explained in the previous section. Insert the racking handle in the handle insertion hole on the cassette front panel
2. Rotate counter clockwise to rack the circuit breaker out of the cassette.
3. Continue rotating the racking handle counter clockwise until the position indicator first shows TEST, then DISCONNECTED.
4. Open the breaker cubicle door.
5. Pull out the cassette rails (Fig. 3.10).

Figure 3.10. Cassette Rails Pulled Out for Circuit Breaker Unloading



6. Using the hand grips on either side, pull the circuit breaker out of the cassette until it reaches a positive stop (rollers on the circuit breaker will stop against the extended rail projection as shown in Fig. 3.1.

7.

Figure 3.11. Circuit breaker Pulled Out of the Cassette for Unloading

8. Attach the lifting bar to remove the circuit breaker.

TRIP UNIT

General Information

All EntelliGuard E power circuit breakers are equipped with an electronic trip unit that provides an analog override instantaneous over current trip function.

Figure 3.12. Trip Unit

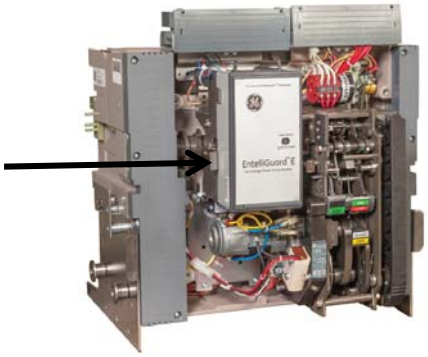
Trip Unit Installation

1. Remove breaker front cover (fascia).
2. The trip unit is mounted on the PMU base. Press the lever and align the trip unit as shown in Fig. 3.13.

Figure 3.13. Trip Unit Being Mounted on the PMU Base.

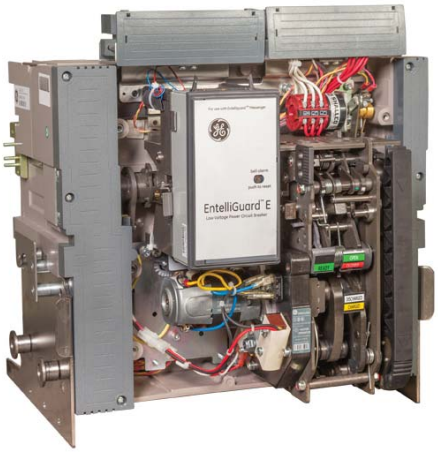
3. Insert the trip unit knob on the PMU base shown in Fig. 3.14.

Figure 3.14. Trip Unit Release Lever



4. Release the lever once the trip unit is inserted. This action will lock the trip unit to the PMU base as shown in Fig. 3.15.

Figure 3.15. Trip Unit Alignment



5. Install the front cover as shown in Fig. 3.16.

Figure 3.16. Front Cover Installation

WIRING

Tables 3.1 through 3.2 show the wiring schematic for Block A

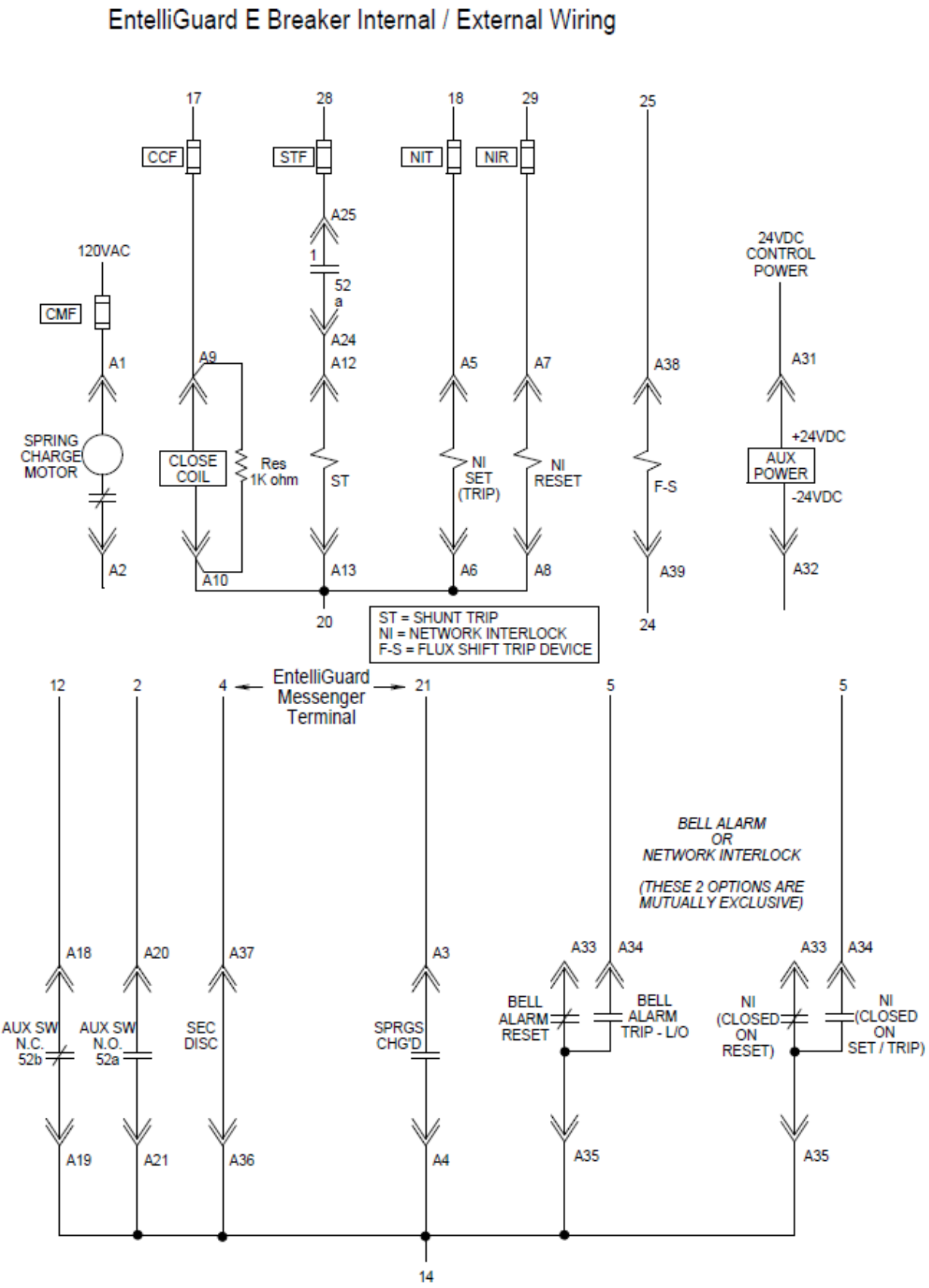
Table 3.1. Wiring Schematic for Block-A

	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13
	Motor	Motor	Spr NO	Spr NO	NI SET	NI SET	NI RESET	NI RESET	CC IMM	CC COM		ST	ST
Max. Current (I)	14.8 A	14.8 A	10 A	10 A	1.9 A	1.9 A	1.9 A	1.9 A	1.9 A	1.9 A		1.9 A	1.9 A
Max. Voltage (V)	120 V	120 V	240 V	240 V	120 V	120 V	120 V	120 V	120 V	120 V		120 V	120 V
	A14	**A15**	**A16**	**A17**	**A18**	**A19**	**A20**	**A21**	**A22**	**A23**	**A24**	**A25**	**A26**
					NC1	NC1	NO3	NO3			NO1	NO1	-
Max. Current (I)	15 A	15 A	15 A	15 A	15 A	15 A	15 A	15 A	15 A	15 A	1 A	15 A	-
Max. Voltage (V)	120 V	120 V	120 V	120 V	120 V	120 V	120 V	120 V	120 V	120 V	120 V	120 V	-
	A27	**A28**	**A29**	**A30**	**A31**	**A32**	**A33**	**A34**	**A35**	**A36**	**A37**	**A38**	**A39**
					24 V+	24 V-		BA/NI NO	BA/NI COM	DISC I/O COM	SEC CONN	FLUX SHIFTER+	FLUX SHIFTER -
Max. Current (I)					<500 mA	<500 mA				<500 mA	<500 mA	1A	1A
Max. Voltage (V)					30 V	30 V				480 mV	480 mV	16 V	16 V

Table 3.2. Wiring Schematic Nomenclature Definitions

Pin	Nomenclature	Description
A1	Motor	power input to motor operator
A2	Motor	
A3	SPR NO/RTC NO	spring charge status contact
A4	SPR NO/RTC NO	
A5	NI SET	power input to network interlock set
A6	NI SET	
A7	NI RESET	network interlock reset
A8	NI RESET	
A9	CC IMM	closing coil
A10	CC COM	closing coil neutral wire-common
A11		
A12	ST	power input to shunt trip
A13	ST	
A14		
A15		
A16		
A17		
A18	NC1	normally closed contact 1
A19	NC1	
A20	NO3	normally open contact 3
A21	NO3	
A22		
A23		
A24	NO1	normally open contact 1
A25	NO1	
A26	-	-
A27		
A28		
A29		
A30		
A31	24 V+	auxiliary power supply to trip unit
A32	24 V-	
A33		bell alarm/network interlock status switch
A34	BA/NI NO	
A35	BA/NI COM	
A36	DISC I/O COM	messenger I/O common
A37	SEC CONN	secondary disconnect connected
A38	Flux shifter +	flux shifter +
A39	flux shifter -	flux shifter -

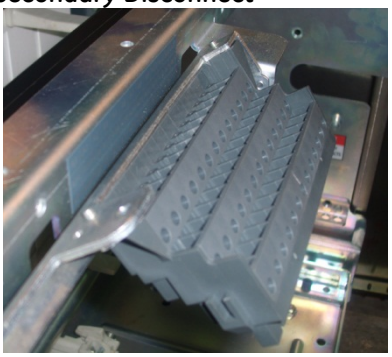
Figure 3.17. Circuit Breaker Wiring Diagram



SECONDARY DISCONNECT BLOCKS

- Located for wiring to the accessories :
  - Top-mounted for all envelopes.
- By removing one screw, the cassette-mounted secondary disconnect block can be tilted in the mounted state and can be removed for easy control circuit wiring (Fig. 3.18).

Figure 3.18. Secondary Disconnect



- Block-A contains a set of 39 self-aligning secondary circuit isolating contacts. Each contact is clearly labeled with the connection point.
- Block-B used for internal wiring in the cassette.

SECTION 4 – OPERATION

⚠ WARNING

IMPROPER INSTALLATION, OPERATION AND MAINTENANCE

Ensure only qualified personnel install, operate, service and maintain all electrical equipment.

Failure to comply with these instructions will result in death or serious injury.

⚠ WARNING

PERSONAL INJURY

- Avoid risk of injury from moving parts while handling the breaker.

Failure to comply with these instructions could result in death or serious injury.

CAUTION

PRODUCT DAMAGE

- Ensure circuit breaker and its accessories are always used within their designated ratings.
- Use the specially designed circuit breaker handling truck (optional accessory) when removing the circuit breaker from its cassette.

Failure to comply with these instructions may result in product damage.

STORED ENERGY MECHANISM KEY FEATURES

(Table 4.1)

NOTICE

- Each charging action provides sufficient charge for an O-C-O (Open-Close-Open) operation without requiring additional charging.

Circuit Breaker Charging

The circuit breaker can be charged in one of two ways:

- Manually, using a charging handle.
  - The charging handle lies flush within the circuit breaker front cover. It is easily retracted without special tools.
  - Full spring charging is accomplished with 10 full pumps or less of the handle. Handle movement includes suitable stops so that it cannot be over extended and cause operator injury.
  - The handle engages the charging ratchet during motion away from the circuit breaker front cover and rotates freely on the return stroke.
- Electrically, via a motor operator that is automatically activated after the closing operation.

Two Step Mechanism Design

- The first step charges the closing spring through the manual charging handle or through the spring charging motor.
- The second step closes the circuit breaker via the CLOSE pushbutton on the front cover or closes the breaker through energizing the closing coil.
- The mechanism is trip free and incorporates an anti-pumping system:
  - The circuit breaker may be closed only after the mechanism is fully charged and there is no active open command.
  - The closing coil has an electrical anti-pumping feature. The coil supply, if maintained continuously, will attempt to close the circuit breaker only one time. To achieve a second closing attempt, the closing coil must be de-energized and energized a second time.

Table 4.1. Stored Energy Mechanism Sequences of Operation

OPEN/CLOSED Indicator	Main Breaker Contacts	Charging Spring Indicator	Condition of Charging Springs	Next Permissible Operating Function
OPEN	open	discharged	discharged	closing springs may be charged
OPEN	open	charged	fully charged	contacts may be closed, then opened
CLOSE	closed	discharged	discharged	contacts may be opened or closing springs may be charged
CLOSE	closed	charged	fully charged	open-closed-open sequence may be carried out and the closing springs can be charged after the close operation opened
OPEN	open	charged	fully charged	closing spring may be discharged without closing contacts
CLOSE	closed	charging	partially charged	complete charging
OPEN	open	charging	partially charged	complete charging

CLOSING SPRING DISCHARGE PROCEDURE

The main spring may be discharged (also known as "crashing the mechanism") without closing the breaker by using a special tool operated through a small window on the front cover.

The mechanism closing springs are automatically discharged (crashed) when the circuit breaker is moved from the DISCONNECT position to the WITHDRAWN fully disconnected position and vice versa.

The closing springs must be discharged prior to removal of the arc-chute cover.

CLOSING PROCEDURE

- Pull the charging handle out and down to charge the closing springs (requires approximately 10 pumps of the handle to fully charge).
- If a motorized spring charging unit is installed, the springs will be automatically charged as soon as the motor is energized.
- Pressing the CLOSE pushbutton or energizing the closing coil (if installed) will close the circuit breaker.

CONDITIONS WHEN CLOSING CANNOT OCCUR

- The OPEN button is in a depressed position.
- The trip unit is not installed.
- If racking handle is inserted, remove it.
- The breaker is positioned anywhere between CONNECTED, TEST and DISCONNECTED positions.
- Trip unit reset button is protruding from the front cover. Press the reset button.
- A network interlockis installed and the SET coil is activated.
- A key interlock is operating on the breaker.

CIRCUIT BREAKER OPENING PROCEDURE

- Press the OPEN pushbutton or energize the shunt trip coil (if installed).
- Tripping under fault conditions will be automatic from the EntelliGuard Messenger.

Table 4.2. Cassette Operating Positions

Circuit Breaker Position in the Cassette	Primary Disconnects	Secondary Disconnects	Circuit Breaker Functionality	Circuit Breaker Door Position
CONNECTED	engaged	engaged	• circuit breaker may be operated both mechanically or electrically • ready for service	closed
TEST	disengaged	engaged	• circuit breaker may be operated both mechanically or electrically • circuit breaker and control circuit operations may be tested and verified	closed
DISCONNECTED	disengaged	disengaged	• circuit breaker may be operated only mechanically • circuit breaker may not be removed from the circuit breaker compartment	closed
WITHDRAWN	disengaged	disengaged	• circuit breaker may be operated only mechanically • circuit breaker may be removed from the circuit breaker compartment	open

SECTION 5 – LOCKS AND INTERLOCKS

⚠ DANGER

ELECTROCUTION

Ensure the circuit breaker has been tripped, indicating OFF, and the main springs are fully discharged before installing locks and interlocks.

Failure to comply with these instructions will result in death or serious injury.

⚠ WARNING

IMPROPER INSTALLATION, OPERATION AND MAINTENANCE

Ensure only qualified personnel install, operate, service and maintain all electrical equipment.

Failure to comply with these instructions could result in death or serious injury.

⚠ WARNING

PERSONAL INJURY

- Avoid risk of injury from moving parts while handling the circuit breaker.

Failure to comply with these instructions could result in death or serious injury.

CAUTION

PRODUCT DAMAGE

- Ensure the circuit breaker and its accessories are always used within their designated ratings.

Failure to comply with these instructions may result in product damage.

GENERAL INFORMATION

NOTICE

Ensure all padlocks are scissor compatible.

A variety of locks and interlock accessories are available. The operation of most of these accessories is described in this section.

CIRCUIT BREAKER FRONT PANEL LOCKING

Padlock or Scissor Lock for Breaker Trip Free Condition

1. While pressing the OFF pushbutton, pull out the padlock lever.
2. Ensure padlock shaft diameter is 3 mm to 9.5 mm.
3. Insert padlock hasp (Fig. 5.1).

Figure 5.1. Padlock for Breaker Trip Free Condition

DRAWOUT CASSETTE FRONT PANEL LOCKING

Security Locking

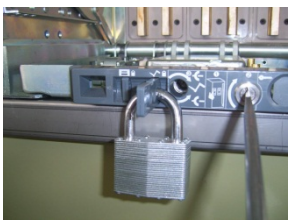
This function locks the entry of the racking handle in the crank insertion hole of the cassette front panel when the padlock is installed when circuit breaker in the DISCONNECTED/ CONNECTED position. Up to three padlocks (shaft diameter of 3 mm to 9.5 mm) may be installed for additional security (Fig. 5.2).

Figure 5.2. Circuit Breaker Security Padlocking Location

A Security Locking Bar

1. Ensure the position indicator shows the DISCONNECTED/CONNECTED position.
2. Remove the racking handle from the operating position.
3. Pull the locking bar until the locking eye is exposed and hold while inserting the padlock shaft (Fig. 5.3).

Figure 5.3. Padlock Insertion and Lock-Out on the Security Locking Bar



Isolation Shutters Locking (If Installed)

This function locks the operation of the safety shutters when the padlock is installed on the security locking

bar A (Fig 5.6) only when the cassette is in the DISCONNECTED position. Only one padlock (shaft diameter of 3 mm to 9.5 mm) may be installed.

1. Ensure the position indicator shows the DISCONNECTED position.
2. Remove the racking handle from the operating position.
3. Pull the locking bar until the locking eye is exposed and hold while inserting the padlock hasp (Fig. 5.4).

Figure 5.4. Padlock Insertion

Figure 5.5. Safety Shutter in Closed Position

Figure 5.6. Shutter Padlocking

A Shutter locking bar

Table 5.1. Drawout Circuit Breaker Locking

Function	Number and Type of Padlocks/Locking Devices	Padlock Shaft Diameter
Racking mechanism screw access blocking padlock in DISCONNECTED/TEST/CONNECTED positions.	three locks may be mounted	3 mm to 9.5 mm
Racking mechanism screw access blocking and breaker trip free position key lock in DISCONNECTED/TEST/CONNECTED positions (Kirk lock).	maximum of two locks	3 mm to 9.5 mm
Padlocking provisions on the drawout rails prevent unauthorized installation of a breaker that has been removed from the cassette for equipment or load maintenance.	maximum of three padlocks on each drawout rail	3 mm to 9.5 mm

SECTION 6 – ACCESSORIES DESCRIPTION

⚠ WARNING

IMPROPER INSTALLATION, OPERATION AND MAINTENANCE

Ensure only qualified personnel install, operate, service and maintain all electrical equipment.

Failure to comply with these instructions could result in death or serious injury.

GENERAL INFORMATION

Optional accessories are interchangeable across all EntelliGuard E power circuit breakers, regardless of nominal rating or envelope/frame size. Each accessory incorporates easy-fit design features for quick installation, either at the factory or in the field (Fig. 6.1).

NOTE: Replacement accessories have an "R" at the end of the catalog number as shown.

Figure 6.1. Accessory Mounting

INDIVIDUAL ACCESSORIES

Motorized Spring Charging Unit

The unique motor/gearbox unit is specially designed to operate with the full range of EntelliGuard E. It is easily fitted with three heavy-duty bolts. After a breaker close operation, the unit automatically recharges the spring and makes it ready for immediate open and re-close should the need arise. High speed recharging ensures that the springs are fully charged within approximately three seconds following a release. All electrically operated (EO) ANSI/UL breakers are equipped with "Spring Charged" contacts (GSCC1R) for status indication (Table 6.1).

Table 6.1. Motor Operators

Envelope	Power Consumption	Nominal Control Voltage	ANSI Range	Cat No.
1	AC – 350 VA	120 Vac	102 V to 132 V	GM01120AR
2 and 3	AC – 560 VA	120 Vac	102 V to 132V	GM02120AR

- Spring charge time = 3 sec max.
- Recommended fuse amps: contact factory.
- Duty cycle = 2/min.
- Envelope 1 motors: running VA ~ 350 VA; inrush = 2 to 3 times.
- Envelope 2 motors: running VA ~ 560 VA; inrush = 2 to 3 times.

Circuit Breaker Closing Coil

Easy-to-fit, clip-on closing coil with simple, plug-in connections is available. The closing coil offers electrical remote release of the spring charged closing mechanism. A standard anti-pump safety feature ensures that the remote signal must be released before further close commands are allowed.

Table 6.2. Closing Coil Characteristics

Type	Power Consumption	Nominal Control Voltage	Catalog Number
Closing Coil	AC: 350 W (inrush), 20 W (sealed)	110/130/120 Vac	GCCN120R

- Duty cycle = 2/min.
- Closing coil inrush = 350 VA.

Shunt Trip (ST)

Energizing the shunt trip, via local or remote input, will instantaneously activate the circuit breaker mechanism, ensuring a rapid open operation. The standard auxiliary switch ensures automatic isolation whenever the circuit breaker is open. The shunt trip release is a straightforward, field installable accessory.

Table 6.3. Extended Range Shunt Trip Rating

Nominal Control Voltage	Catalog Number
110 Vdc/120 Vac	GSTG120R

- Pickup range = 55%-110%.
- Duty cycle = 2/min.
- Inrush = 480 A (ac).
- Holding = 60 VA (ac).

Remote Operation Coil Combination

Each breaker accepts a maximum of three coils shown in Table 6.4. All coils are mounted from the front and snap onto the mechanism after the fascia is removed.

Table 6.4. Remote Operation Coil Combination

Combination	Coil Position on Fascia (from left)			
	1		2	3
1	NI SET	NI RESET	CC	ST

Auxiliary Switches

Auxiliary switches indicate breaker main contact position. They change their state in the same time sequence as the breaker main contacts. See Table 6.6 for rating.

Table 6.5. Auxiliary Switches

Contact Configuration	Cat. No.
Power rated (3NO+3NC)	GAUX3R

Table 6.6. Auxiliary Switch Ratings and Secondary Disconnect Points

Contact Configuration	Power Rated	Cat. No.
Power rated(3NO+3NC)	A14 - A25	GAUX3R

Circuit Breaker - Key Interlock Facility

This option provides factory-installed interlocking devices for installation between separate circuit breakers (baseplates and mechanism). This safeguard ensures that a circuit breaker cannot be closed unless the dedicated key has been inserted and secured within the lock. Circuit breakers accept ready-to-fit interlocking device kits such as Kirk for installation between related, separate circuit breakers (Table 6.7).

NOTE: Locks and keys are not supplied by GE. Please order separately from your local supplier.

Table 6.7. Key Interlocks and Door Interlocks

Description	Catalog Number
Baseplate and mechanism for Kirk Key locks (breaker mounted)	GBKRKR
Mechanism for Kirk key cassette interlock (cassette mounted)	GCKRKR
Door interlock (left side)	GLHD
Door interlock (right side)	GRHD

Carriage Position Switch (TOC)

Available as an option for mounting within the base of the cassette/substructure, the carriage position switch provides changeover contacts for electrical indication of the circuit breaker status: CONNECTED & TEST. This option is in addition to the mechanical indicators, which are fitted as standard. When installed, the carriage switch is IP2X protected and includes wiring to a terminal block located on the left side of the cassette (Table 6.8).

Table 6.8. Carriage Position Switches

Switch Configuration	Catalog Number
1 NO/NC switch per position	GCPS4R

Bell Alarm with Lockout

The bell alarm provides remote indication that the circuit breaker has opened because of an electrical fault. The Lockout feature is integral to the trip unit. When a Bell Alarm is supplied with the breaker, the trip unit dial is set and locked to the manual position. In order to re-close the breaker, the Lockout button must be pushed in/reset on the trip unit 1-Form C contact (Table 6.9).

Table 6.9. Bell Alarm Switches

Switch Configuration	Cat. No.
One single pole, double throw switch (1-Form C contact)	GBAT1R

Charging Spring Status Indicator

Factory-installed on the motor, this auxiliary switch indicates that the circuit breaker is charged and is standard with the spring-charging motor.

Secondary Disconnects (Factory-installed/Field Installable)

Inputs and outputs to the circuit breaker are wired through secondary disconnects located on the top of the breaker. The plug-style secondary disconnects engage mating disconnects in the breaker cubicle when the breaker is in the TEST or CONNECT position. Up to 39 points are available so that all breaker accessories can be wired to dedicated disconnect points. See Table 6.10 for block location and Table 6.11 for secondary disconnect parts.

Table 6.10. Block Location

Top Disconnect	
Block B	Block A
circuit breaker/cradle viewed from the front	

Table 6.11. Secondary Disconnect Parts

Breaker Type	Mounting	Number of Poles	Cat. No.
Drawout	Top	39 pole set	GSDWSR

- Set contains both the male and female sides of the secondary disconnect.
- Drawout kits include the metal bracket for connections to the cassette.

Cassette/Substructure
The drawout mechanism allows the breaker to be racked in four distinct positions:

- CONNECTED
- TEST
- DISCONNECTED
- WITHDRAWN

Position Indicators
Position indicators provide a positive mechanical indication of CONNECTED, TEST and DISCONNECTED positions of the breaker.

Rejection Device
A factory-installed rejection feature prevents mis-matching breakers and cassettes/substructures. This prevents:

- Inserting a breaker with a lower interruption rating into a higher rated cassette/substructure.
- Inserting a lower rated breaker into a higher rated cassette/substructure.

SECTION 7 – ACCESSORIES INSTALLATION

⚠ DANGER

ELECTROCUTION

Ensure the circuit breaker has been tripped, indicating OFF, and the main springs are fully discharged before installing accessories.

Failure to comply with these instructions will result in death or serious injury.

⚠ WARNING

IMPROPER INSTALLATION, OPERATION AND MAINTENANCE

Ensure only qualified personnel install, operate, service and maintain all electrical equipment.

Failure to comply with these instructions could result in death or serious injury.

⚠ WARNING

PERSONAL INJURY

- Avoid risk of injury from moving parts while handling the breaker.

Failure to comply with these instructions could result in death or serious injury.

CAUTION

PRODUCT DAMAGE

- Ensure circuit breaker and its accessories are always used within their designated ratings.

Failure to comply with these instructions may result in product damage.

CIRCUIT BREAKER FRONT COVER REMOVAL

Required for most accessory installation.

1. Remove the six mounting screws (Fig. 7.1).

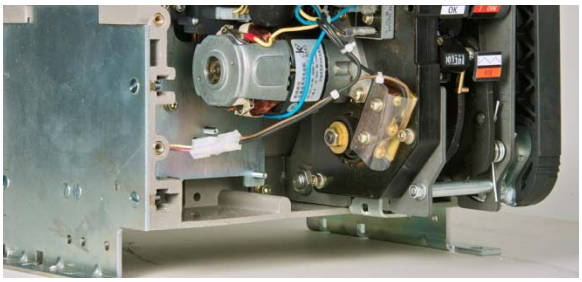
Figure 7.1. Front Cover

2. Pull the charging handle while easing the cover upwards .

MOTOR OPERATOR - SPRING CHARGING UNIT INSTALLATION

1. Slide the coupling bushing onto the camshaft.
2. Place the gearbox bearing onto the protruding motor drive shaft, pushing it home until flush with the mechanism sideplate. If it does not move easily to the flush position, pull the charging handle gently down to ease movement.
3. Mount the device using three M5 bolts through the holes provided in the gearbox endplate, torque to 7 N m.
4. Manually charge the closing springs and carefully locate the plastic switch actuator over the protruding drive shaft (Fig. 7.2), ensuring the switch operating arm is correctly positioned (switch arm should be in the 'cut out' portion of the motor switch actuator.

Figure 7.2. Motor Switch Actuator



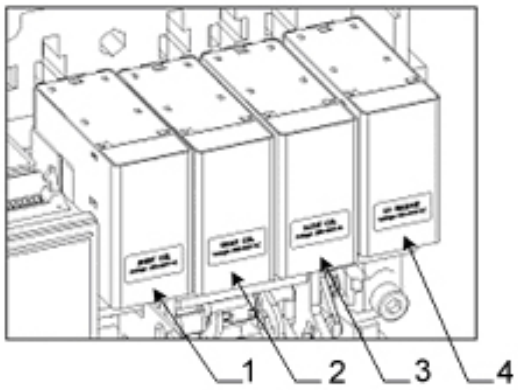
5. Use a M8 nylock nut to mount the motor switch actuator onto the shaft end, torque to 14.5 N m.
6. Connect the motor connector on to the motor harness.
7. Connect the remaining ground wire from the filter to the grounding point on the rear of the motor body.

Reverse the above procedure to remove the motorized spring charging unit

NETWORK INTERLOCK, SHUNT TRIP AND CLOSING COIL DEVICE INSTALLATION

NOTICE
The mounting positions of the three devices can be arranged in the locations as specified in Figure 7.3.

Figure 7.3. Device Location



Coil Position on Fascia		
1&2	3	4
Network Interlock	closing coil	shunt

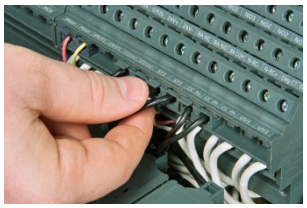
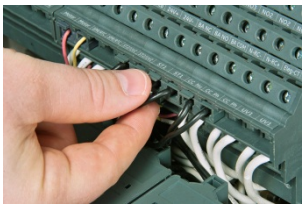
Shunt Trip & Closing Coil Installation (Fig. 7.4)

1. Tilt the device forward and engage the front hooks into the top support plate.
2. Tilt the device backwards until the rear hooks engage in the slots
3. Press down into position.

Figure 7.4. Closing Coil Installation


Connect the wire plugs (Fig. 7.5) according to the wiring schematic in Section 3.

Figure 7.5. Wiring

Closing Coil Removal

1. Disconnect the device and pull it forward until the rear hooks disengage.
2. Lift to release the front hooks.

NETWORK INTERLOCK INSTALLATION

When the network interlock is used with the EntelliGuard E, it will use the 1 and 2 positions of the coils as shown in Fig. 7.3. The mounting procedure is same as the shunt trip and closing coil.

BELL ALARM SWITCH INSTALLATION

1. Remove the trip unit from the PMU base.
2. Assemble the bell alarm assembly using four screws.
3. Reassemble the trip unit back onto the PMU base
4. Install the connector from the bell alarm in the specified location of the SD.

SHUTTER PROP OPEN FEATURE

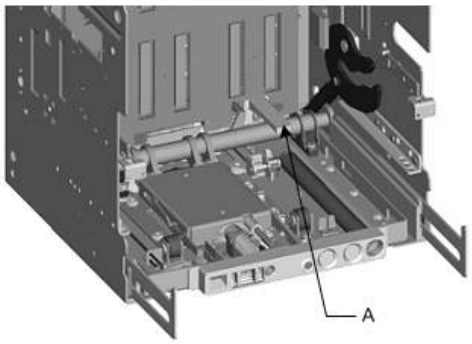
This feature allows the main primary contacts to be inspected.

⚠ DANGER

ELECTROCUTION
Ensure the primary contacts on the swictchgear are de-engergized prior to propping open the shutter.
Failure to comply with these instructions will result in death or serious injury.

1. Remove the circuit breaker from its cassette.
2. Rotate the shutter operating lever to open the shutter (Fig. 7.5).
3. Release the shutter operating lever to close the shutters.

Figure 7.5. Shutter Operating Lever Location



A Shutter Operating Lever

CARRIAGE POSITION SWITCH INSTALLATION

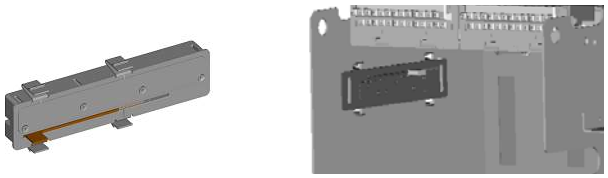
One configuration is available:

Mounted on the left-hand side of the cassette for all frames.

No fasteners are required. To insert, feed the wires through the large opening on the side of the cassette. Seat the carriage position switch in the front side of the hole first.

Then use this as a pivot and ensure that all four tabs lock in place (Fig. 7.6).

Figure 7.6. Carriage Position Switch Location



CLUSTERS (PRIMARY DISCONNECT FINGERS)

Clusters are the main isolating contacts which are installed on the rear terminals on the withdrawable circuit breaker. Cluster contacts may be easily and quickly removed and replaced using cluster pliers (Figs. 7.7 and 7.8).

Figure 7.7. Clusters

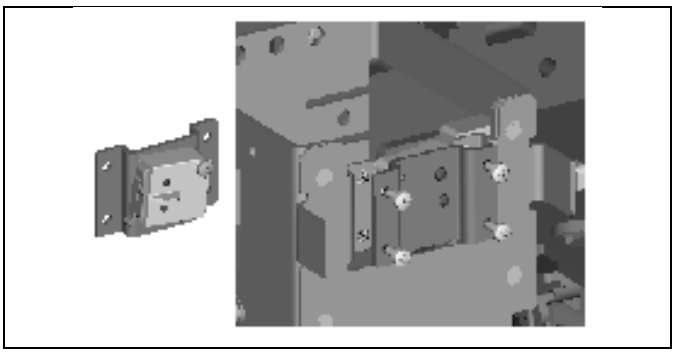
Figure 7.8. Cluster Pliers

Clusters are mounted vertically through cluster pads for different frame sizes. The slot is provided on the terminals for locking the clusters. For higher current and short circuit ratings, the clusters are assembled in parallel.

MECHANICAL BELL ALARM CONTACT INSTALLATION

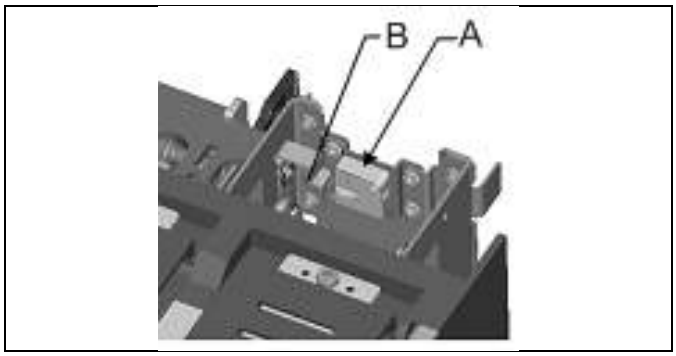
1. Remove the front cover.
2. Remove the trip unit.
3. Install the mechanical trip alarm as shown in Fig. 7.9.

Figure 7.9. Mechanical Trip Alarm



4. Connect the wires via the plug connectors to the respective locations of the secondary isolating contacts A33, A34 and A35 (Fig. 7.10).

Figure 7.10. Plug Connector Location



5. Replace the front cover.
6. Connect the wires via the plug connectors to the respective locations of the secondary disconnect contacts A33, A34 and A35.
7. Replace the front cover.

REJECTION FEATURE

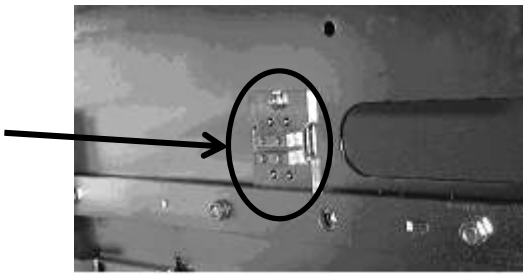
This factory-installed, pin and gate device prevents the insertion of a circuit breaker into a cassette if the nominal rating of the breaker is incompatible with that of the cassette and its ancillary equipment.

Figure 7.11. Rejection Feature

A Pin block assembly

Fig. 7.12 shows the corresponding restrainer assembly mounted on the cassette. There are two of these assemblies, one on each side of the cassette and the breaker.

Figure 7.12 Corresponding Restrainer



SECTION 8 – MAINTENANCE, TESTING AND TROUBLESHOOTING

⚠ WARNING

IMPROPER INSTALLATION, OPERATION, SERVICE AND MAINTENANCE

Ensure only qualified personnel install, operate, service and maintain all electrical equipment.

Failure to comply with these instructions could result in death or serious injury.

MAINTENANCE

⚠ DANGER

ELECTROCUTION

Ensure the circuit breaker has been tripped, indicating OFF, and the main springs are fully discharged when performing circuit breaker maintenance.

Failure to comply with these instructions will result in death or serious injury.

⚠ WARNING

PERSONAL INJURY

- Avoid risk of injury from moving parts while handling the circuit breaker.

Failure to comply with these instructions could result in death or serious injury.

Inspection Schedule

- Normal working conditions:
  - Annually, or
  - Following interruption of a short circuit, or
  - After repeated high value overload faults.
- Dusty/polluted environments:
  - Every six months, or
  - Following interruption of a short circuit, or
  - After repeated high value overload faults.

Cleaning Procedure

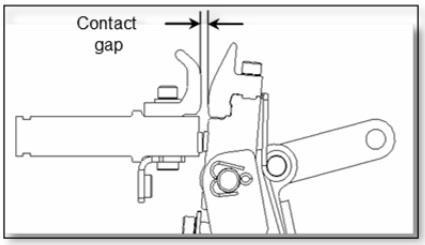
1. Inspect external surfaces for dust/dirt.
2. Clean with compressed air and dry cloth.

Contact Wear Indicator Inspection (GCNTW)

The contact wear indicator indicates the condition of the contact tip when the circuit breaker is viewed in the closed condition from the top side. It indicates the relative position of the back edge of each contact tip with the area marked on the wear indicator.

The back edge of each contact tip should line up with the outer edge of the marked area on the wear indicator. As the contacts erode, the gap between the back of the contact tip and the rear housing becomes smaller. If the back edge of the contact tip crosses into the marked area, the tip is heavily eroded, and it needs to be replaced (Fig. 8.1).

Figure 8.1. Contact Gap



1. Remove the arc chamber assemblies as shown in Fig. 8.2.

Figure 8.2. Arc Chamber Assembly Removal

2. Insert the wear indicator in each pole as shown in Fig 8.3.

Figure 8.3. Wear Indicator Insertion

3. View the back end of finger with the arcing contact edge with respect to the marked area on the wear indicator. The marked area indicates the allowable erosion for main tips (Fig. 8.4).

Figure 8.4. Wear Indicator in Place

1. Inspect the arc splitter plates and sides of the moldings for signs of wear or damage. Replace as necessary.
2. With the circuit breaker in the ON position, check the size of the gaps between the fixed and moving arcing contacts.
   - If the gap is greater than 2.5 mm:
     - No evidence of contact damage: loosen the fixed contact screw and adjust the gap to 2.5 mm. Retighten the screw (12 N m torque).
     - Evidence of excessive contact wear or damage: Replace the fixed arcing contacts and set the gap set to 2.5 mm.
   - Even if gaps are within operating tolerance (1 mm to 2.5 mm), always check contact screws for tightness to 12 N m torque.
3. Assemble the arc chamber. Torque to 2 N m.

Circuit Breaker Main Mechanism Inspection

- Check the circuit breaker CLOSE and OPEN action both manually and by remote means, if appropriate.
- Check all indicators for correct function.
- Check number of operations to the circuit breaker's specification.

Cassette Inspection

- Ensure the base of the cassette is clear of debris.
- Prop open the shutters and inspect the cassette's installed contacts for excessive wear or damage.
- Check the carriage switch operation (if installed) while racking the circuit breaker into and out of the CONNECTED position.

Isolating Contacts Inspection

1. Remove the circuit breaker from the cassette housing and place it on a suitable working surface.
2. Inspect the rear cluster contacts for signs of overheating and wear.
3. Remove the cluster contacts using the special cluster pliers.
4. Clean the isolating contacts and terminals with a soft, clean cloth to remove any old grease or dirt.
5. Apply a thin film of red lube grease D50HD38.

Lubrication

CAUTION
PRODUCT DAMAGE Do not lubricate Auxiliary Switch, Signaling Switches, Coils, Motor and Secondary Disconnects. **Failure to comply with these instructions may result in product damage.**

Ensure all metal-to-metal friction surfaces are kept lubricated:

1. Remove old lubrication and dirt.
2. Apply Molecote 4700.
3. Wipe off excess lubrication.

TROUBLESHOOTING

Table 8.1 reviews common problems, their possible cause(s) and solution(s). If problems persist please contact our Post Sales Service Department at 1-888-GERESOLVE (1-888-437-3765).

Table 8.1. Troubleshooting

Problem	Possible Cause	Solution
Breaker won't close.	• Breaker is between CONNECTED, TEST and DISCONNECTED positions. • Bell alarm has not been reset. • Interlocks installed. • Racking handle inserted.	• Rack circuit breaker to CONNECTED, TEST or DISCONNECTED remove racking handle and close circuit breaker. • Push BELL ALARM button on trip unit and close circuit breaker. • Remove interlocks. • Remove handle and close circuit breaker. • Check operational diagram and trip the relevant circuit breaker.
Breaker closes then opens instantaneously.	• Breaker information module connector is not inserted.	• Insert breaker information module connector to breaker information module.
Circuit breaker won't rack into cassette.	• Ensure breaker is pushed fully from the maintenance position to DISCONNECTED. • Racking drive not in DISCONNECTED position.	• Push breaker into DISCONNECTED position. • Ensure racking drive is in DISCONNECTED position.
Cannot insert racking handle.	• Shutter padlocks are installed. • Key locks are installed.	Remove padlocks and/or operate key locks.
Circuit breaker will not go into the DISCONNECTED position.	• Circuit breaker is incorrect for given cassette.	• Ensure circuit breaker and cassette go together.

ENTELLIGUARD® E PUBLICATIONS

To download publications like those shown below, visit www.geelectrical.com.

Publications	Pub #
Entellisys 5.0 Application Guide	DET-838
Entellisys 5.0 User Guide	DEH-501
Bell Alarm w/ Lockout	DEH-41409
Shunt Trip	DEH-41411
Remote Close Accessory Close Coil	DEH-41412
Motor Operator	DEH-41413
Aux Switch	DEH-41415
Network Interlock	DEH-41461*
Remote Racking Operator	DEH-41467
Clusters (Primary Disconnect Fingers)	DEH-41460
Key Interlock (cassette)	DEH-41500
Contact Wear Indicator	DEH-41382

** Secondary disconnect status switch location is different for EntelliGuard E breaker. Status switch position is A33,A34 & A35.*

NOTES:

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