

480V Metal-Enclosed Switchgear Selection and Application Guide



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Siemens low-voltage metal-enclosed switchgear is used in electric power distribution systems for the control and protection of circuits and equipment. The switchgear employs drawout type low voltage power circuit breakers described on pages 5-13.

LV switchgear is typically installed in:

- **Industrial Plants** — for power and lighting networks and feeders, power generation and other auxiliaries, and to provide power for machine tools and material handling equipment drivers.
- **Utility and Co-generation Facilities** — for motor control centers to protect and distribute power to electrical devices such as blowers, compressors, fans, pumps, and motors.
- **Commercial and Residential Buildings** — for protection and distribution of power for lighting, elevators, air conditioning, blowers, fans, motors, and pumps.

Available Types:

- **Type R** — indoor (NEMA 1)
- **Type SR** — outdoor walk-in (NEMA 3R)

Low-voltage switchgear can be applied on distribution systems with:

- 3-phase, 3- or 4-wire feeders
- 50 or 60Hz
- Voltages of 208, 240, 480, or 600 volts
- Currents up to 5000 amperes

Circuit breakers may be either manually or electrically operated, fused or unfused. The following designations are used:

- RL — Standard Interrupting
- RLE — Extended Interrupting
- RLI — High Interrupting
- RLF — Fused Type

Siemens Static Trip III trip units are provided on all low voltage power circuit breakers, except non-automatic circuit breakers. All circuit breakers are UL Listed. See Tables 4.10 and 4.11 for circuit breaker ratings.



480 Volt Metal-Enclosed Switchgear

Industry Standards

Types R and SR switchgear with power circuit breakers are designed, tested and constructed in accordance with:

- ANSI C37.20.1 — Metal-Enclosed Low Voltage Power Circuit Breaker Switchgear
- ANSI C37.50 — Test Procedure for Low Voltage AC Power Circuit Breakers Used in Enclosures
- ANSI C37.51 — Conformance Testing of Metal-Enclosed Low Voltage AC Power Circuit Breaker Switchgear Assemblies
- Applicable standards of IEEE and NEMA
- Applicable requirements of the National Electric Code (NEC)
- UL 1558 — Metal-Enclosed Low Voltage Power Circuit Breaker Switchgear

Type RL drawout circuit breakers are in accordance with:

- ANSI C37.13 — Low Voltage AC Power Circuit Breakers Used in Enclosures
- ANSI C37.16 — Preferred Ratings, Related Requirements, and Application for Low Voltage Power Circuit Breakers and AC Power Circuit Protectors.

- ANSI C37.17 — Trip Devices for AC and General Purpose DC Low-Voltage Power Circuit Breakers.
- UL 1066 — Low Voltage AC and DC Power Circuit Breakers Used in Enclosures.

Features and modifications required by NEC are incorporated when the assembly is designated as "Service (Entrance) Equipment."

UL Listing (Optional)

An Underwriters' Laboratories listing mark (UL label) can be optionally supplied for each vertical section. The specific section must contain only devices which are UL Listed or are UL recognized components found suitable for the intended use. All circuit breaker drawout elements are UL Listed.

480V Metal-Enclosed Switchgear

Construction Details

General

General

The Siemens 480 volt switchgear assembly consists of one or more metal-enclosed, vertical sections. Normally the end sections are designed to allow for installation of future sections.

Each vertical section consists of up to four individually enclosed breaker or auxiliary compartments which are sized to provide uniform height.

Included in each assembly are various components such as circuit breakers, instrumentation and control equipment, transformers, relays, three-phase bus work, and all internal wiring, connectors, and other supporting equipment.

In accordance with ANSI C37.20.1, the maximum temperature for parts that are handled is 50°C. The main bus maximum temperature rise is 65°C above 40°C ambient. The temperature rise of the air surrounding the cable connection points is limited to 45°C above 40°C ambient.

Finish

During construction, the structural steel parts, panels, and compartments are all prepared for painting by a five-stage wash system. Standard finish color is light gray ANSI 61. If a different finish color is required, it is applied over the standard finish with conventional spray equipment and is allowed to air cure. The completed finish has a nominal 2 mils dry film thickness.

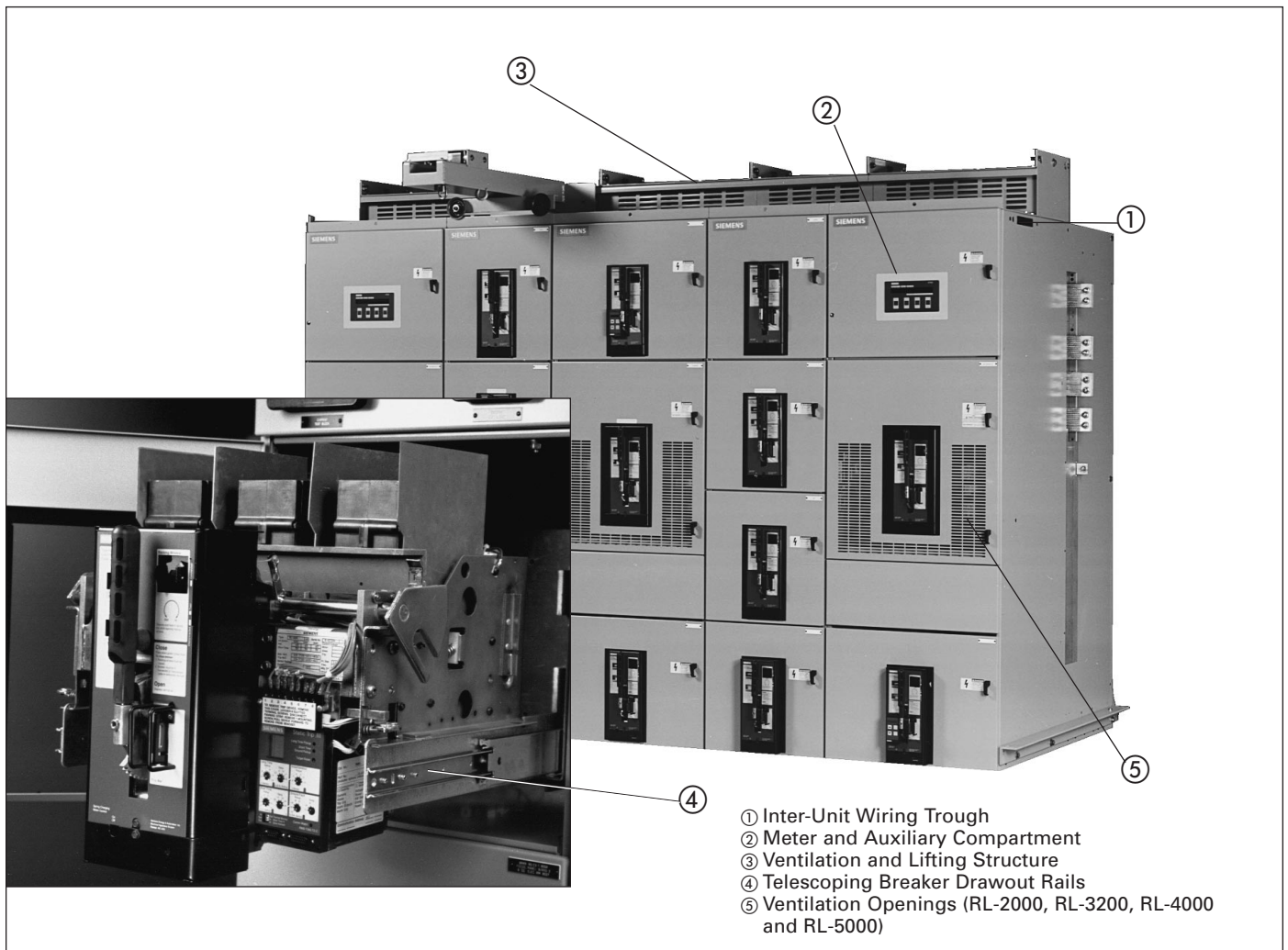
Assembly Construction

Siemens metal-enclosed power switchgear is constructed of preformed, full-depth, 14-gauge steel sheets bolted together and reinforced with cross-member braces to form a rigid, self-supporting compact assembly. The top and rear plates, and side sheets are all 14-gauge steel. When two vertical sections are mounted together, two sheets of 14-gauge steel separate adjacent circuit breaker compartments.

Bolted steel / glass polyester compartments housing each power circuit breaker are mounted in the vertical section to form the switchgear assembly. This isolates the circuit breakers from the bus / cable section and from adjacent circuit breaker compartments.

The bus / cable section includes main horizontal bus, riser bus, connections from the main bus to each set of primary disconnects, and load side copper run-back bus.

Grounded metal barriers can be provided to isolate the main bus from cable connections. Barriers are also available to isolate the incoming line to the main circuit breakers from the main load bus of the switchgear.



480V Metal-Enclosed Switchgear

Construction Details

General

Main and Ground Bus

The standard main bus is silver-plated copper. Welded aluminum is also available. Provisions for future extension of aluminum main bus conductors include tin plated joints with high tensile strength steel hardware. Tin-plated copper bus is optionally available.

The main three-phase horizontal bus is arranged vertically one phase above the other with edge-to-edge alignment to provide high, short circuit strength. Insulated main and vertical bus are optional.

Main bus ratings available are 1600, 2000, 3200, 4000, or 5000 amperes continuous current. A neutral bus is furnished when specified, and can be rated 1600, 2000, 3200, 4000 or 5000 amperes continuous current.

A standard copper ground bus extends through all sections. A cable lug can be mounted to the ground bus in each section.

Minimum bus bracing is 65,000 amperes RMS symmetrical. Higher symmetrical bracings are available based on the lowest breaker short circuit rating in the group.

Load side runbacks for feeder circuits are one-piece copper construction, are insulated with sleeve tubing in the main bus area, and are supported by high-strength, glass polyester moldings.

Control Wiring

Standard secondary and control wiring is #14 AWG extra-flexible, stranded copper type SIS. Terminations are made with compression-type, insulated terminals.

For devices not having screw-type terminals, tab-type disconnects are used.

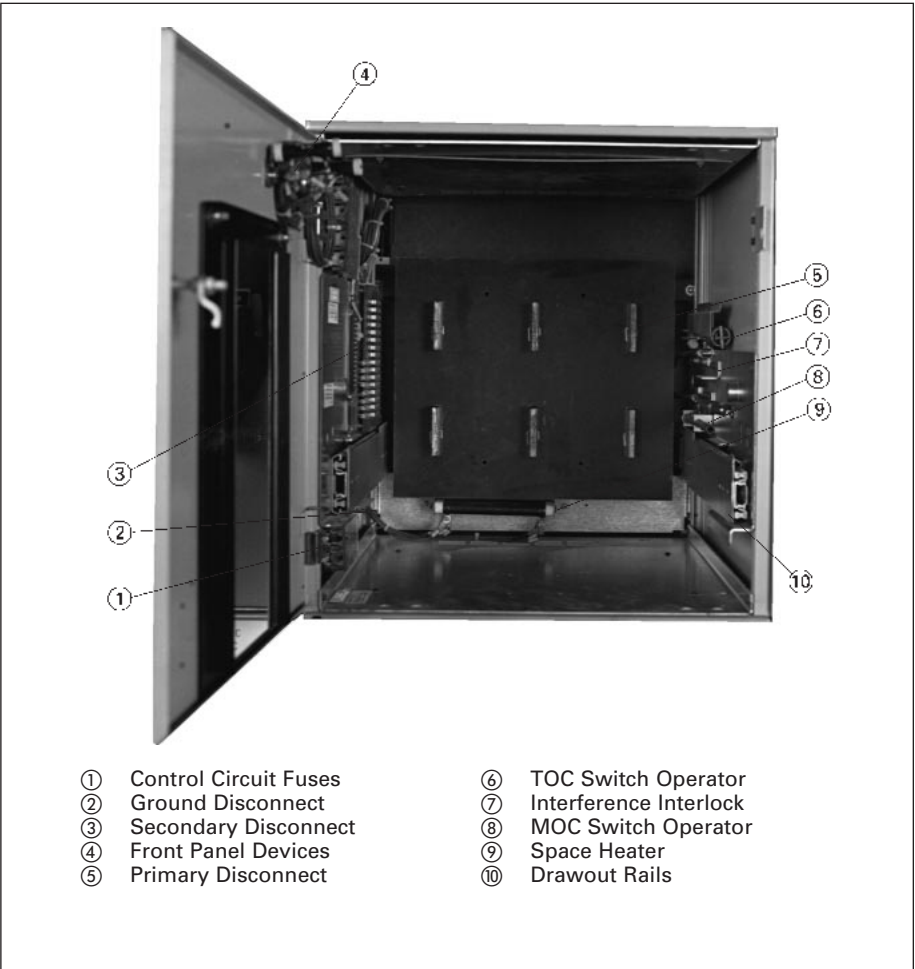
Insulation

The insulation used is Pyro-Shield, a fiber-glass-reinforced polyester material that has high impact strength and low moisture absorption. Other features include high flame retardance, high resistance to chemical fumes, and long life at high temperatures.

Circuit Breaker Compartments

Typical circuit breaker compartments include primary disconnects, ground disconnect, drawout rails, and associated interlocks, and secondary disconnects, if appropriate. Telescoping drawout rails allow the breaker to be withdrawn from the compartment without additional extensions or adapters. Compartments for electrically-operated circuit breakers include secondary disconnects and control circuit fuses. Up to three current transformers for metering or relaying can be mounted in each compartment.

Circuit breaker compartment front panels can be used to hold a variety of auxiliary devices such as breaker control switches, ammeters, and test blocks.



Circuit Breaker Cell Interior

480V Metal-Enclosed Switchgear

Construction Details

General

Options

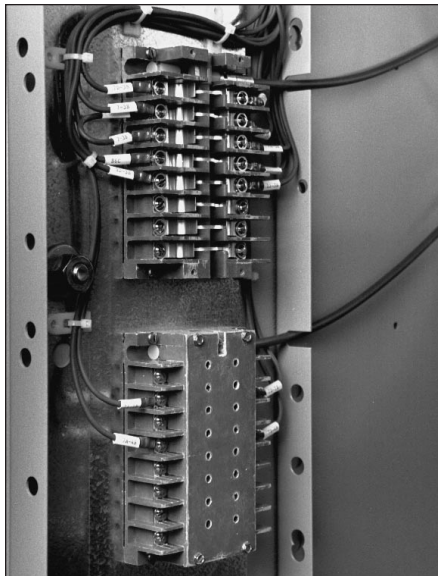
Switchgear Mounted Hoist

The hoist, optional on type R indoor switchgear, and standard on type SR outdoor switchgear, travels along rails on top of the switchgear to ease breaker handling.

TOC and MOC Switches

The Truck Operated Cell (TOC) Switch provides interlocking control or remote indication of the breaker racking position. The cubicle mounted auxiliary switch or Mechanism Operated Cell (MOC) switch provides interlocking control or remote indication based on the main contact position (open or closed).

The switches have field adjustable contacts for simple conversion of contacts from normally open ("a" type) to normally closed ("b" type). Each contact may be adjusted individually without disassembly or removal of wiring.



MOC and TOC Switches. TOC Shown with Cover Removed.

Shutters

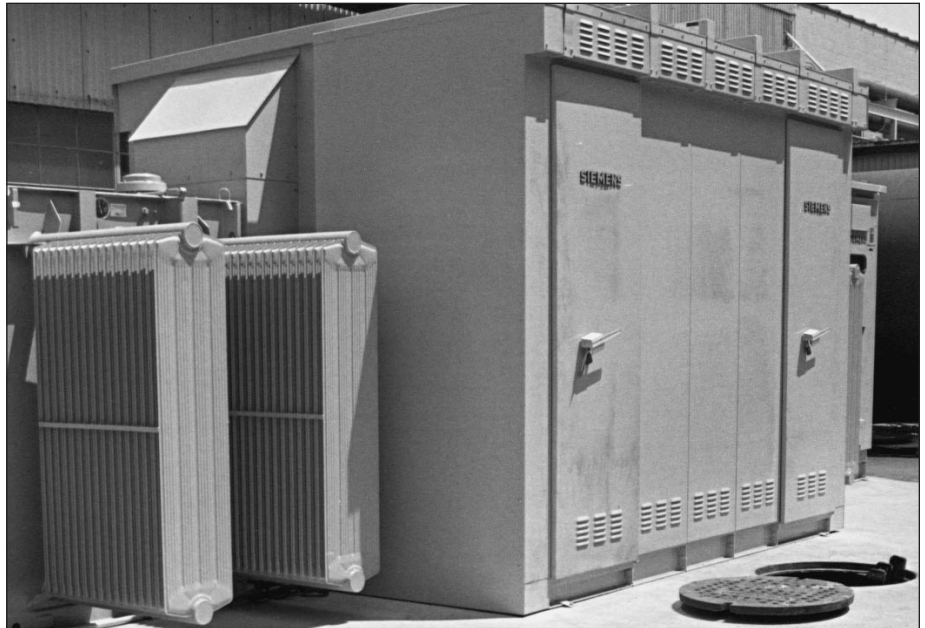
These provide protection against accidental contact with primary disconnects in a compartment when the breaker is removed.

Wire Trough Covers

Secondary wiring is enclosed within each vertical section in the primary bus and outgoing cable areas.

Key Interlock

This provides a mechanical means for operating circuit breakers and other devices only when prescribed conditions are met.



Typical Outdoor Installation with Liquid Filled Transformer

PTS4 Test Set

Set allows testing of the full range of protective settings of Static Trip III trip units.

Metering and Auxiliary Compartments

Compartments are available to house devices such as voltage transformers, metering, control power transformers, and supervisory devices.

Instrument and Control Transformers

Voltage transformers and control power transformers are mounted in auxiliary compartments. These transformers are protected by primary pull-out type current-limiting fuses and secondary fuses. Current transformers are normally mounted on the compartment primary disconnect studs where they are readily accessible. See Tables 4.10, 4.11, 4.12, and 4.13 for available ratings.

Outdoor Switchgear

Type SR outdoor switchgear, available up to 5000 amp, is enclosed in a weather resistant (NEMA 3R) steel housing. All exterior doors extend below the floor line and are gasket sealed.

For protection from snow, rain, and dust, the switchgear rests on a six-inch, formed steel base which provides rigid support and a tight bottom seal. A heavy duty, coal tar emulsion protective undercoating is applied to the underside for protection against moisture and corrosion. Shielded ventilation housings permit proper air circulation while excluding dust, dirt, and foreign matter.

A lighted, unobstructed service aisle is provided at the front of the switchgear allowing inspection and maintenance without exposure to the elements. An access door equipped with an emergency bar release is located at each end of the aisle. A GFI convenience outlet is included.

Accessories

Each switchgear assembly includes the following standard accessories:

- Crank for circuit breaker racking
- Lifting bar assembly for all circuit breaker types
- Spring charging handle for electrically operated circuit breakers

As an optional accessory, a test cabinet is available for indoor use that is wall mounted with necessary equipment for testing electrically-operated breakers that have been removed from the breaker compartments.



Portable PTS4 Test Set

480V Metal-Enclosed Switchgear

LV Power Circuit Breakers

General

The Siemens RL series circuit breakers are designed for up to 600 volt service with current carrying capacities of up to 5000 amperes and interrupting capacities of up to 130,000 amperes unfused or 200,000 amperes fused.

These compact, fast operating circuit breakers incorporate a stored energy closing mechanism, either manually or electrically charged, for fast, positive closing.

A quick-make closing mechanism releases the stored energy for high speed closing of the primary contacts. This positive, controlled closing prevents unnecessary arcing between the movable and stationary breaker contacts and thus lengthens contact and breaker life.

Manual tripping is performed with the push lever on the front of the breaker. Up to three padlocks can be used to lock the breaker contacts in the open position.

Typical Breaker Features

- Arc Quenchers
- Main and Arcing Contact Structures
- Inductive Tripping Sensors
- Control Wiring
- Interlocks
- Position Indicators
- Interpole Barriers
- Mechanical Trip Bar
- Auxiliary Switches (option)

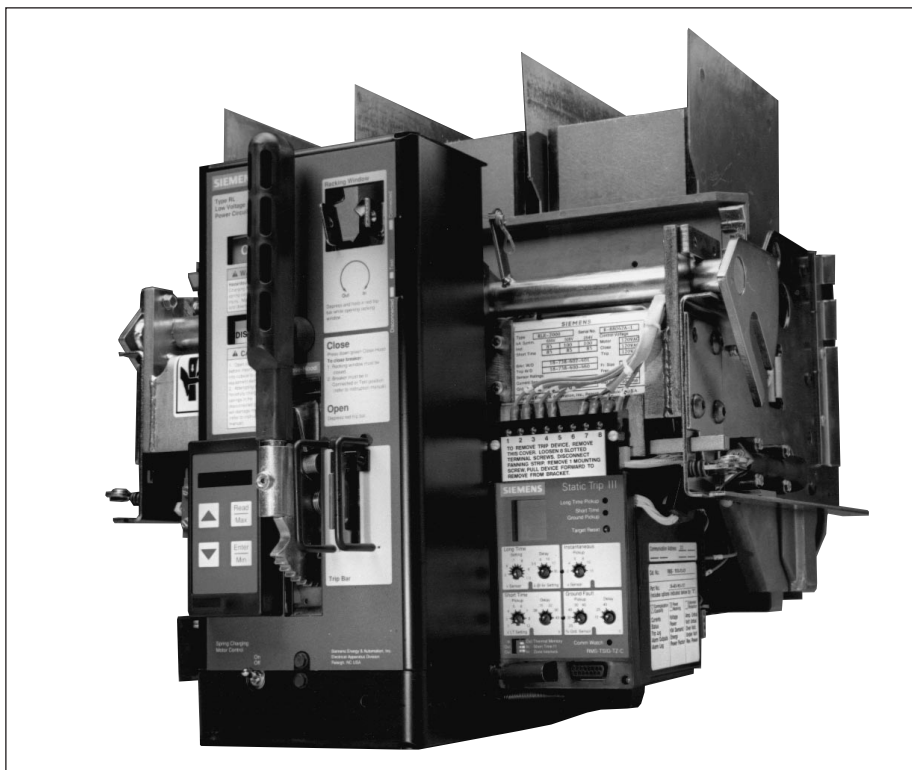
Each circuit breaker is a complete 3-pole, single-throw element that is mechanically and electrically trip-free, with a Static Trip III overcurrent trip unit.

Tables 4.16 and 4.17 show circuit breaker operating and control data.

Circuit Breaker Racking

Racking is accomplished by turning a racking screw on the front of the breaker and may be done with the compartment door open or closed. The racking screw turns U-shaped brackets on each side of the breaker which rack the breaker frame in or out of the compartment.

As the racking screw is turned counter-clockwise, the breaker frame moves out of the compartment and disconnects the primary contacts, followed by the secondary contacts. With only the secondary contacts connected (test position), the breaker may be closed and opened for testing without energizing the load. An indicator located on the front of the breaker identifies the position of the breaker in the compartment.



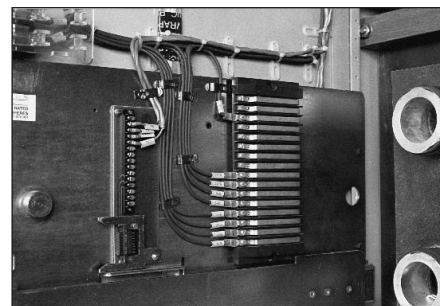
Type RL Circuit Breaker With Static Trip III Trip Unit And Optional Breaker Display Unit (BDU)

Primary Disconnects

Primary current is applied to the circuit breaker through silver plated disconnects. The stationary contacts are mounted through solid Pyro-Shield insulation sheets in the back of the compartments. The movable contacts are mounted on the back of the breaker. Stainless steel springs provide pressure to the finger contacts in the connected position. Low contact resistance is maintained by these self-aligning contacts. The primary contacts are positioned so that current can flow only in the connected position. In the test position the contacts are separated a safe distance.

Secondary Disconnects

Secondary circuits are connected to the circuit breaker through silver-plated, slide-type contacts which are located below the arc quenching area to avoid contamination from arc product gases. The position of these contacts is visible with the panel door open. The stationary contacts are silver-plated copper strips mounted on a Pyro-Shield molded base. The contacts are recessed to guide the movable, self-aligning contacts and to prevent accidental short circuiting. Secondary connections are made automatically in both the connected and test positions.



Secondary Disconnects in Cell
Left = Communications
Right = Breaker Control



Main and Arcing Contacts — Similar Design for all Ratings

480V Metal-Enclosed Switchgear

LV Power Circuit Breakers

General

Ground Connection

A ground contact is located on the circuit breaker to connect with the ground circuit. The breaker is grounded in both the connected and test positions.

Drawout Interlocks

All circuit breakers have drawout interlocks to:

- prevent racking a closed breaker
- prevent closing breaker until racked to connected or test position
- prevent inserting or withdrawing breaker from compartment while closing springs are charged

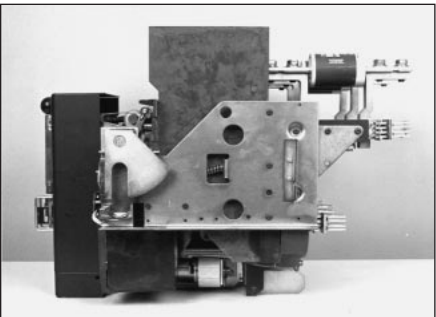
Arc Interruption

When a fault occurs, the main contacts open first, transferring the fault current to the arcing contacts. As the arcing contacts open, the thermal and electromagnetic characteristics force the arc into the arc chute, where the metal plates lengthen, constrict, and cool the arc.

Current Limiting Fuses

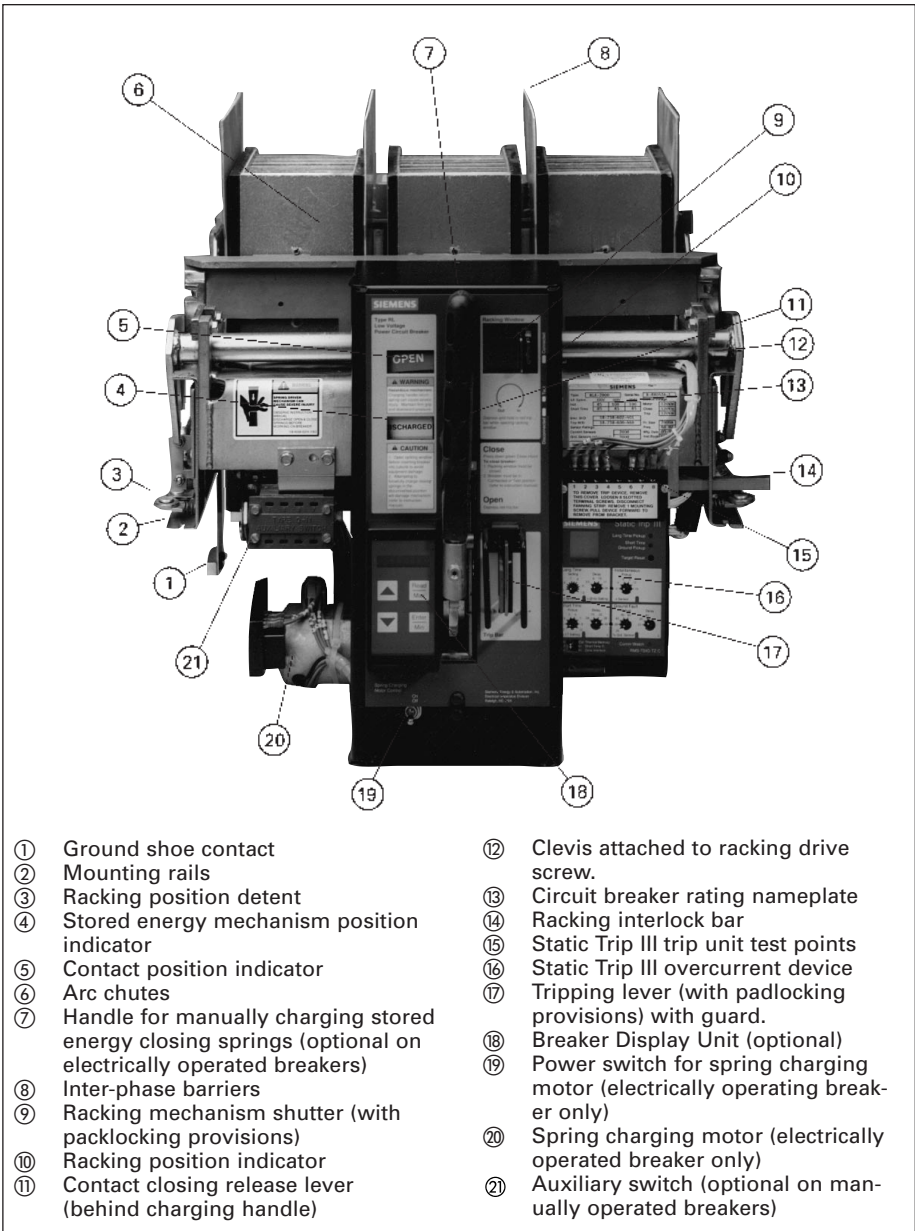
The 800, 1600 and 2000 ampere circuit breakers are available with integrally mounted current limiting fuses to increase interrupting rating and / or to limit short circuit (let-through) current. The fuses are bolted in series with the upper set of primary disconnects. The breakers meet all required standards and are UL Listed based on current limiting fuses.

An open fuse tripping device is wired in parallel with the main fuses to insure that the circuit breaker opens if a main fuse interrupts, thus preventing single phasing. This device holds the circuit breaker trip-free until it is reset and also indicates which main fuse has interrupted.



Integrally Fused RLF-800 Circuit Breaker

The higher rated circuit breakers, 3200, 4000 and 5000 ampere, are available with current limiting fuses mounted on a separate drawout carriage, which is key interlocked with the circuit breaker. This allows racking of the fuse carriage only with the associated circuit breaker in the



- ① Ground shoe contact
- ② Mounting rails
- ③ Racking position detent
- ④ Stored energy mechanism position indicator
- ⑤ Contact position indicator
- ⑥ Arc chutes
- ⑦ Handle for manually charging stored energy closing springs (optional on electrically operated breakers)
- ⑧ Inter-phase barriers
- ⑨ Racking mechanism shutter (with packlocking provisions)
- ⑩ Racking position indicator
- ⑪ Contact closing release lever (behind charging handle)
- ⑫ Clevis attached to racking drive screw.
- ⑬ Circuit breaker rating nameplate
- ⑭ Racking interlock bar
- ⑮ Static Trip III trip unit test points
- ⑯ Static Trip III overcurrent device
- ⑰ Tripping lever (with padlocking provisions) with guard.
- ⑱ Breaker Display Unit (optional)
- ⑲ Power switch for spring charging motor (electrically operating breaker only)
- ⑳ Spring charging motor (electrically operated breaker only)
- ㉑ Auxiliary switch (optional on manually operated breakers)

RL Circuit Breaker Features (Electrically Operated Breaker Shown)

open position. The carriage mounts in the same vertical section as the circuit breaker element.

Current Sensors

The tripping system of the RL breaker is self-powered from the current sensors mounted on the primary contacts of the breaker element (four-wire ground applications include a fourth sensor mounted in the cable compartment). A signal from the current sensors, proportional to primary current, is applied to the trip device which then operates the actuator to trip the breaker based on a pre-set time delay versus current magnitude relationship.

Table 4.1 Available Sensor Ratings ①

Frame Size and Max Amp Rating	Sensor Ratings
800	150, 200, 300, 400, 600, 800
1600	150, 200, 300, 400, 600, 800, 1200, 1600
2000	150, 200, 300, 400, 600, 800, 1200, 1600, 2000
3200	1200, 1600, 2000, 3200 ①
4000	1600, 2000, 3200 ①, 4000 ①
5000	5000 ①

① Optionally available with integral 2000A ground sensor winding to meet NEC 239-95 requirements.

480V Metal-Enclosed Switchgear

LV Power Circuit Breaker Trip Unit

General

Static Trip® III Trip Unit

Static overcurrent tripping devices have been standard on Siemens circuit breakers for over thirty years. The Static Trip III trip unit features microprocessor-controlled tripping, while providing RMS sensing for standard overcurrent protection, and optional metering and communications functions. Located in the lower right side of the breaker, the trip unit is readily accessible for simple reading and adjustment of all settings and indicators. Static Trip III trip units are interchangeable on all ratings of low voltage circuit breakers.

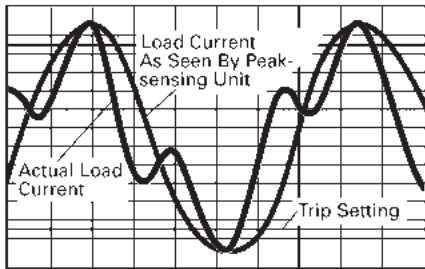
The time / current characteristics of the Static Trip III trip unit are shown on page 13.



All communicating Static Trip III trip units include a local communication port that supports the breaker-mounted display unit or BDU. The BDU features a high-visibility

alpha-numeric display. Real-time metered values, min/max values, event log data and setpoint data can be read on the BDU in straightforward engineering units. Alarm and relay setpoint can be configured using the BDU keypad.

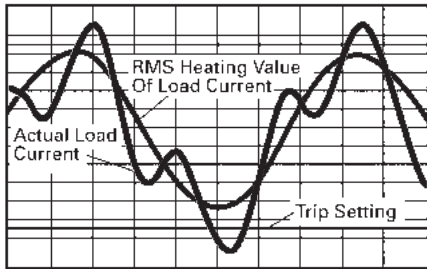
This data can also be communicated to other devices or computers for control monitoring via Siemens' ACCESS system. See Section 1 of this guide for a thorough description of ACCESS.



Harmonics distort the current wave shape and can increase its peak value. Normal peak-sensing units may trip, causing nuisance shutdowns.



Static Trip® III Trip Unit (right) and Breaker Display Unit (left)



Siemens RMS sensing samples the entire current wave shape and calculates the effective heating value of the current. Static Trip III trip units provide accurate protection and avoid unnecessary trips.

T: Long Time	
Setting ^① (X Sensor Rating)	Delay (Seconds @ 6X Setting)
.5, .55, .6, .65, .7, .75, .8, .85, .9, .95, 1.0	3.5, 6, 10 17, 30
S: Short Time	
Pickup (X LT Setting)	Delay (Seconds)
2, 3, 4, 5, 6, 7, 8, 12	0.8, .15, .22 .30, .40
I: Instantaneous	
Pickup (X Sensor Rating)	Delay (Seconds)
2, 4, 6, 8, 12, 15	No Intentional Delay
G: Ground Fault	
Pickup (% Ground Sensor)	Delay (Seconds)
20, 30, 40, 50, 60	.10, .25, .40

^① Pickup is fixed at 1.1 times long time setting.

480V Metal-Enclosed Switchgear

LV Power Circuit Breaker Trip Unit

General

Table 4.3 Static Trip III Trip Unit Functions

Function	Model			
	III	IIIC	IIICP	IIICPX
Self-Powered Overcurrent Protection	✓	✓	✓	✓
RMS Sensing	✓	✓	✓	✓
Switchable Thermal Memory	✓	✓	✓	✓
Ground Fault Protection	opt	opt	opt	opt
LCD Target	✓	✓	✓	✓
Protective Microprocessor Watchdog	✓	✓	✓	✓
Pickup LEDs	✓	✓	✓	✓
Zone Interlocking ^① (For Short Time and Ground Fault)	opt	opt	opt	opt
Retrofit Universal Mounting Package	opt	opt	opt	opt
RS-485 Communications Port	—	✓	✓	✓
Breaker Display Unit Port ^②	—	✓	✓	✓
Communications Microprocessor Watchdog	—	✓	✓	✓
Comm Watch LED	—	✓	✓	✓
Backup Shadow Protection	—	✓	✓	✓
Trip Log	—	✓	✓	✓
Alarm Relay Output ^①	—	opt	opt	opt
Trip Unit Status Indication	—	✓	✓	✓
Breaker Position Indication	—	✓	✓	✓
Breaker Operation Counter	—	✓	✓	✓
Communication Open/Close/Trip ^{①③}	—	opt	opt	opt
Event Log	—	✓	✓	✓
Phase Current Metering	—	✓	✓	✓
Ground Current Metering ^④	—	✓	✓	✓
Neutral Current Metering ^⑤	—	opt	opt	opt
Min/Max Current Log	—	✓	✓	✓
Power Metering Functions	—	—	✓	✓
Min/Max Power Log	—	—	✓	✓
Extended Protective Relaying	—	—	—	✓
Extended Trip Log	—	—	—	✓

Table 4.4 Static Trip IIICPX Protective Relay Functions

Protective Function	Setting Range	Typical Applications		
		Motors	Generators	Mains
Current Unbalance	5–50%	✓	✓	—
Voltage Unbalance	5–50%	✓	—	✓
Overvoltage	60–660V	—	✓	—
Undervoltage	60–660V	✓	✓	—
Reverse Power	10–2000kW	—	✓	✓
Overfrequency	50.0–70.0 Hz	—	✓	—
Underfrequency	45.0–60.0 Hz	—	✓	—

RL Breaker Accessories/Modifications

Type RL circuit breakers feature several options, including:

- Shunt Trip, (for MO breakers)
- Operation Counter
- Undervoltage Trip Device
- Electrically Operated Interlock
- Automatic Trip Alarm Contact (with or without Lockout Bell Alarm)

Tripping Actuator

The tripping actuator is a low energy, flux-shifting device that allows fast action tripping of the breaker.

Shunt Trip

The shunt trip is used to electrically trip the circuit breaker from a remote device, such as pushbutton, switch, or relay. The shunt trip is standard on all electrically operated breakers, optional on manually operated breakers. The shunt trip coil is designed for a momentary duty cycle. Thus, an “a” type auxiliary contact switch is used to interrupt the shunt trip circuit immediately after the breaker is tripped.

Table 4.5 Static Trip III Metering Functions

Function	Model	
	IIIC	IIICP
Phase Currents	✓	✓
Avg Phase Currents	✓	✓
Ground Current ^④	✓	✓
Neutral Current ^⑤	opt	opt
Phase Voltage ^④	—	✓
Avg Phase Voltage ^④	—	✓
Line Voltages	—	✓
Avg Line Voltages	—	✓
kW	—	✓
kW Demand	—	✓
kW Hours	—	✓
kW Hours Reverse	—	✓
kVA	—	✓
kVAR	—	✓
kVAR Hours	—	✓
Power Factor	—	✓
Frequency	—	✓

^① Requires additional compartment mounted devices and wiring to meet specific application.

^② Supports optional Breaker Display Unit accessory.

^③ Open command uses alarm relay output and restricts use for other alarm functions. Close command requires electrically operated breaker.

^④ Included when ground fault protection specified.

^⑤ Requires “N” option and neutral current sensor.

^⑥ Only displayed for four wire systems.

Table 4.6 Shunt Trip Coil Ratings

Nominal Control Voltage		Operating Voltage Range	Shunt Trip (Amperes) Seal-In/Inrush
60 Hz AC	120	104–127	1.65/7.7
	240	208–254	0.71/3.4
DC	48	28–56	5.45
	125	70–140	2.76
	250	140–280	1.85

When the coil is energized, the armature picks up and rotates the trip latch, thereby tripping the breaker. A compression spring returns the armature to the normal position.

480V Metal-Enclosed Switchgear

LV Power Circuit Breakers

General

RL Breaker Accessories / Modifications (cont'd)

Operation Counter

A mechanically-operated, 5-digit non-resettable counter can be mounted beneath the breaker auxiliary switch. The counter is incremented by the action of the auxiliary switch operating mechanism.

Undervoltage Trip Device

The undervoltage trip device protects against a drop in normal bus voltage and functions to directly trip the breaker. Pickup occurs at 85 percent or less of rated value and dropout between 30 and 60 percent of rated value. Pickup and dropout are individually adjustable. Instantaneous or time-delayed operation can be provided. The static timing unit is adjustable from 0.04 to 4 seconds for time delay. This allows the system to distinguish between undervoltage conditions and momentary voltage dips.

Table 4.7 Undervoltage Trip Ratings

Nominal Control Voltage		Pickup Voltage	Dropout Voltage
60 Hz AC	120	100	60
	240 or 480 ^①	—	—
DC	48	40	24
	125	105	62

^① Not available. Use 120 VAC undervoltage device with appropriate 240/120V or voltage transformer in cubicle.

Electrically Operated Interlock

This can be added to interlock two breakers, preventing both from being closed at the same time. These electromechanical devices add an additional solenoid that must be energized before the breaker can be closed. When the interlock is de-energized, the breaker is held trip-free and cannot be closed electrically or manually. The interlock has a mechanical link that goes to the main shaft of the breaker. The interlock is held in the picked-up position when the breaker is closed. Once closed the interlock can be de-energized without tripping the breaker. There are no adjustments for pickup or dropout voltages. The interlocks are continuously energized.

Table 4.8 Interlock Coil Ratings

Nominal Control Voltage		Voltage Range	
		Pickup Voltage	Dropout Voltage
60 Hz AC	120	104	36
	240	208	72
DC	48	38	15
	125	100	38
	250	200	75

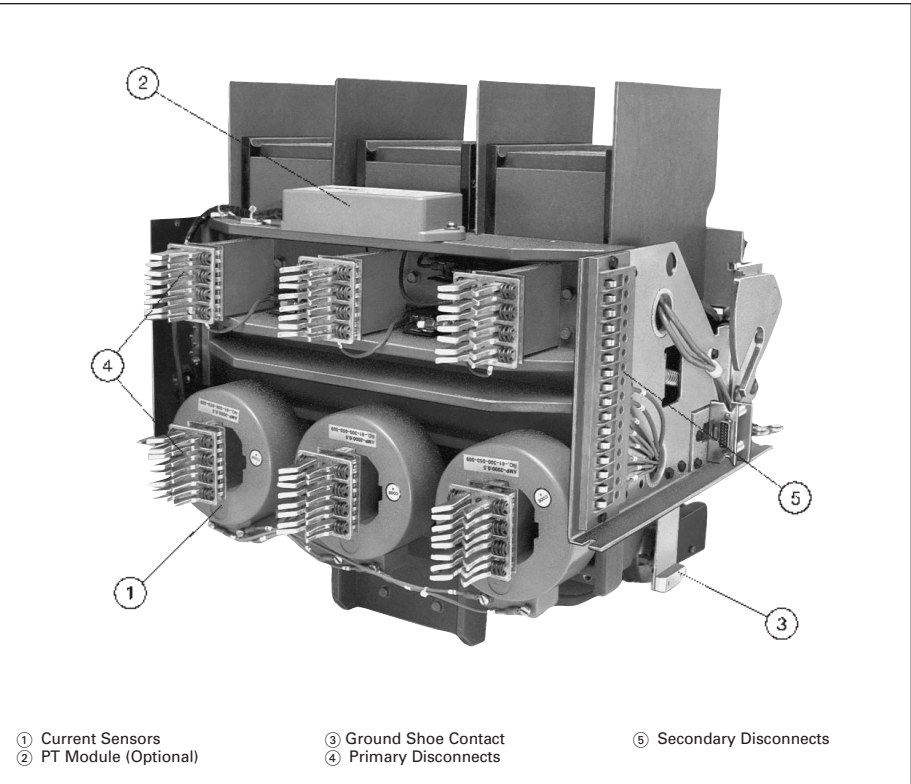
Automatic Trip Alarm Contact (with or without Lockout) (Bell Alarm)

The bell alarm contact is operated when the trip actuator operates in response to the Static Trip III trip unit. It indicates when the circuit breaker has tripped as a result of the static trip unit. The contact can control a local or remote auxiliary alarm for indication of an automatic trip or, by wiring in series with a breaker closing coil, for interlocking to prevent circuit breaker closure until the circuit is reset. The contact must be reset manually or electrically (optional). The manually reset switch is available with a single-pole double-throw contact, or two single-pole single-throw contacts. The electrically reset switch is available with a single-pole single-throw contact.

If desired, a mechanical lockout option may be provided. This substitutes a manual reset for the automatically reset tripping actuator. In this case the breaker is held trip free until the lockout is manually reset.

Table 4.9 Bell Alarm Contact Ratings

Nominal Control Voltage		Bell Alarm Contact Ratings (Amperes)		
		Continuous	Make	Break
60 Hz AC	120	10.0	10.0	10.0
	240	10.0	10.0	10.0
DC	48	0.5	10.0	0.5
	125	0.5	10.0	0.5
	250	0.25	10.0	0.25



RL Circuit Breaker – Rear View

480V Metal-Enclosed Switchgear

VT, CPT, CT Data

Technical

Table 4.10 Voltage Transformers

Ratio	Accuracy Class at 60 Hz			Volt-Amp Rating	Thermal Rating VA	Hertz
	Burden					
	W	X	Y			
600:120	0.6	0.6	1.2	100	150	50/60
480:120	0.6	0.6	1.2	100	150	50/60
288:120	0.6	0.6	1.2	100	150	50/60

Table 4.11 Control Power Transformers—115°C Rise

kVA	Phase	Primary Voltage	Secondary Voltage
3 5 10 ① 15 ①	Single	240/480	120/240

① Requires complete compartment.

Table 4.12 Current Transformers for RL-800, RLE-800, RLI-800, RL-1600, RLE-1600, RL-2000, or RLE-2000 Applications②

Ratio	Accuracy at 60 Hz Metering Burden (ohms)					Relay Class
	B-0.1	B-0.2	B-0.5	B-1.0	B-2.0	
100:5	1.2	2.4	—	—	—	C5
150:5	1.2	2.4	—	—	—	C5
200:5	1.2	1.2	—	—	—	C10
250:5	0.6	1.2	—	—	—	C10
300:5	0.6	0.6	1.2	—	—	C10
400:5	0.6	0.6	1.2	—	—	C5
500:5	0.6	0.6	0.6	—	—	C10
600:5	0.3	0.6	0.6	1.2	—	C10
800:5	0.3	0.3	0.6	0.6	—	C15
1000:5	0.3	0.3	0.3	0.6	1.2	C20
1200:5	0.3	0.3	0.3	0.6	1.2	C20
1500:5	0.3	0.3	0.3	0.3	0.6	C30
1600:5	0.3	0.3	0.3	0.3	0.6	C30
2000:5	0.3	0.3	0.3	0.3	0.6	C5
2500:5	0.3	0.3	0.3	0.3	0.3	C10

② Breaker compartment will accept 3 CT's in-line on lower disconnects.

Table 4.13 Current Transformers for RL-3200③, RLE-3200③, RL-4000④, RLE-4000④, or RL-5000② Applications

Ratio	Accuracy at 60 Hz Metering Burden (ohms)					Relay Class
	B-0.1	B-0.2	B-0.5	B-1.0	B-2.0	
1000:5	0.3	0.3	0.6	0.6	1.2	C20
1200:5	0.3	0.3	0.3	0.6	1.2	C25
1500:5	0.3	0.3	0.3	0.3	0.6	C35
2000:5	0.3	0.3	0.3	0.3	0.3	C25
2500:5	0.3	0.3	0.3	0.3	0.3	C30
3000:5	0.3	0.3	0.3	0.3	0.3	C15
3200:5	0.3	0.3	0.3	0.3	0.3	C20
4000:5	0.3	0.3	0.3	0.3	0.3	C10
5000:5	0.3	0.3	0.3	0.3	0.3	C10

② Breaker compartment will accept 3 CT's in line on lower disconnects.

③ Breaker compartment will accept 6 CT's, 3 on lower and 3 on upper disconnects.

④ Breaker compartment will accept 3 CT's in staggered arrangement, 2 on lower and 1 on upper disconnects.

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LV Power Circuit Breakers Ratings

Technical

Table 4.14 Type RL Low-Voltage Power Circuit Breaker Ratings At 50 / 60 Hertz

Frame Size Amperes	Breaker Type	Voltage Ratings		Insulation Level Dielectric Withstand Volts	Short Time Rating Symmetrical Amperes	Short Circuit Rating Symmetrical Current		Continuous Current Rating Amperes
		Rated Volts	Rated Max. Volts			With Instantaneous Trip Amperes	Without Instantaneous Trip Amperes	
800	RL-800	600	635	2200	30,000	30,000	30,000	75–800
	RLE-800				42,000	65,000	42,000	75–800
	RLI-800				22,000	42,000	22,000	75–800
1600	RL-1600				50,000	65,000	50,000	75–1600
	RLE-1600				65,000	65,000	65,000	75–1600
2000	RL-2000				65,000	65,000	65,000	75–2000
	RLE-2000				85,000	85,000	85,000	75–2000
3200	RL-3200				65,000	85,000	65,000	600–3200
	RLE-3200				85,000	85,000	85,000	600–3200
4000	RL-4000				85,000	100,000	85,000	800–4000
	RLE-4000				100,000	100,000	100,000	800–4000
5000	RL-5000				85,000	100,000	85,000	2500–5000
800	RL-800	480	508	2200	30,000	30,000	30,000	75–800
	RLE-800				42,000	65,000	42,000	75–800
	RLI-800				22,000	100,000	22,000	75–800
1600	RL-1600				50,000	65,000	50,000	75–1600
	RLE-1600				65,000	65,000	65,000	75–1600
2000	RL-2000				65,000	65,000	65,000	75–2000
	RLE-2000				85,000	100,000	85,000	75–2000
3200	RL-3200				65,000	85,000	65,000	600–3200
	RLE-3200				85,000	85,000	85,000	600–3200
4000	RL-4000				85,000	100,000	85,000	800–4000
	RLE-4000				100,000	100,000	100,000	800–4000
5000	RL-5000				85,000	100,000	85,000	2500–5000
800	RL-800	240 and 208	254	2200	30,000	42,000	30,000	75–800
	RLE-800				42,000	65,000	42,000	75–800
	RLI-800				22,000	100,000	22,000	75–800
1600	RL-1600				50,000	65,000	50,000	75–1600
	RLE-1600				65,000	65,000	65,000	75–1600
2000	RL-2000				65,000	65,000	65,000	75–2000
	RLE-2000				85,000	100,000	85,000	75–2000
3200	RL-3200				65,000	85,000	65,000	600–3200
	RLE-3200				85,000	85,000	85,000	600–3200
4000	RL-4000				85,000	130,000	85,000	800–4000
	RLE-4000				100,000	130,000	100,000	800–4000
5000	RL-5000				85,000	100,000	85,000	2500–5000

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LV Power Circuit Breakers Ratings

Technical

Table 4.15 Type RLF Fused Circuit Breaker Ratings At 50/60 Hertz

Frame Size Amperes	Type	Voltage Ratings		Insulation Level Dielectric Withstand Volts	Short Circuit Ratings Symmetrical Amps	Range of Fuse Rating Amperes	Continuous Current Rating Amperes
		Rated Volts	Rated Max. Volts				
800	RLF-800	208 to 600	600	2200	200,000	250–1600	75–800
1600	RLF-1600					800–3000	75–1600
2000	RLF-2000					4000	75–2000
3200	RLF-3200 & RFC-3200 Fuse Carriage			2200	200,000	2000–5000	600–3200
4000	RLF-4000 & RFC-4000 Fuse Carriage			2200	200,000	4000–6000	800–4000
5000	RLF-5000 & RFC-5000 Fuse Carriage			2200	200,000	5000–6000	2500–5000

Table 4.16 Type RL Circuit Breaker Operating Data (60 Hertz Basis)

Description		Type			
		RL-800 RLE-800 RLI-800 RLF-800	RL-1600 & 2000 RLE-1600 & 2000 RLF-1600 & 2000	RL-3200 RLE-3200 RLF-3200	RL-4000 & 5000 RLE-4000 RLF-4000 & 5000
Time from Energizing Shunt Trip Coil Unit (Cycles):	Contacts Part Open	1.5–3.0	1.25–3.0	1.0–3.0	2.0–3.0
	Contacts Fully Open	2.2–3.7	2.2–3.5	2.2–3.5	3.0–4.0
Time from Energizing Closing Control Relay Until (Cycles):	Contacts Touch	2.5–5.0	2.0–5.0	2.2–5.0	2.5–5.5
	Contacts Fully Close	2.8–5.3	2.3–5.3	2.5–5.7	2.5–5.7
Average Spring Charging Time (Seconds):	Minimum Voltage	15	17	19	22
	Nominal Voltage	10	12	13	15
	Maximum Voltage	8	8	8	10
Length of Break, Inches (mm)	Between Main Contacts	1.00 (25 mm)	1.00 (25 mm)	1.00 (25 mm)	1.00 (25 mm)
	Between Arcing Contacts	1.10 (28 mm)	1.10 (28 mm)	1.10 (28 mm)	1.10 (28 mm)

Table 4.17 Type RL Circuit Breaker Control Data

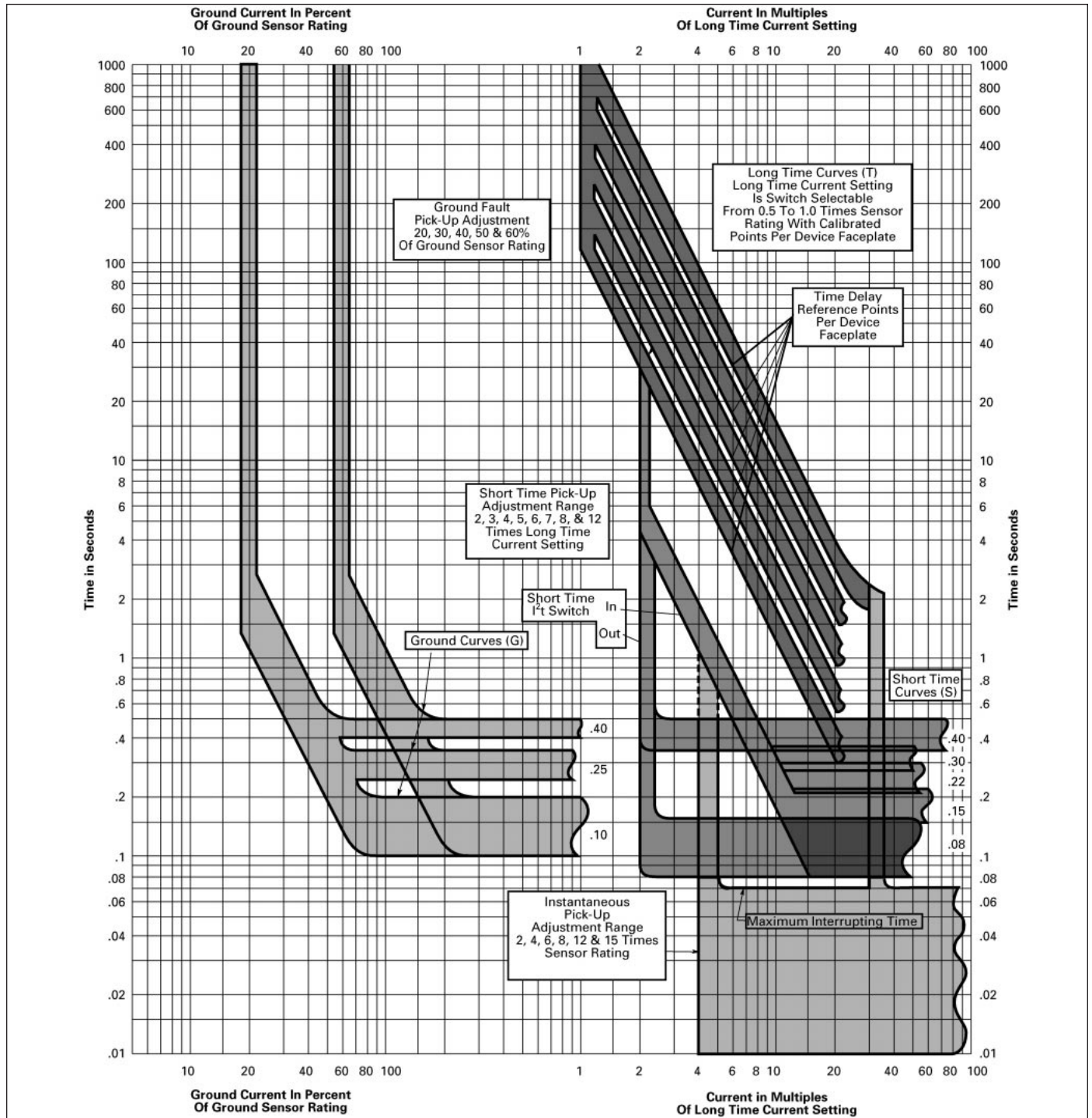
Description		Voltage Rating				
Nominal Control Voltage		120 VAC	240 VAC	48 VDC	125 VDC	250 VDC
Spring Charge Motor Voltage Range		104–127	208–254	38–56	100–140	200–280
Current of Spring Charge Motor:	Cutoff Value — Amperes	0.48	0.36	1.16	0.45	0.21
	Inrush Value — Amperes	3.3	1.75	7.5	3.97	1.92
Shunt Trip and Closing Coil Voltage Range (at Coil)		104–127	208–254	28–56	70–140	140–280
Tripping Coil Current (Seal-in / Inrush) — Amperes		1.65/7.7	0.71/3.4	5.45	2.76	1.85
Closing Coil Current (Seal-in / Inrush) — Amperes		1.65/7.7	0.71/3.4	5.45	2.76	1.85
Y-Relay Current (Max. Value — Amperes)		0.026	0.015	0.15	0.02	0.01

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LV Power Circuit Breakers

Technical

Time/Current Characteristics of Static Trip® III Trip Unit



480V Metal-Enclosed Switchgear

Weights and Dimensions

Dimensions

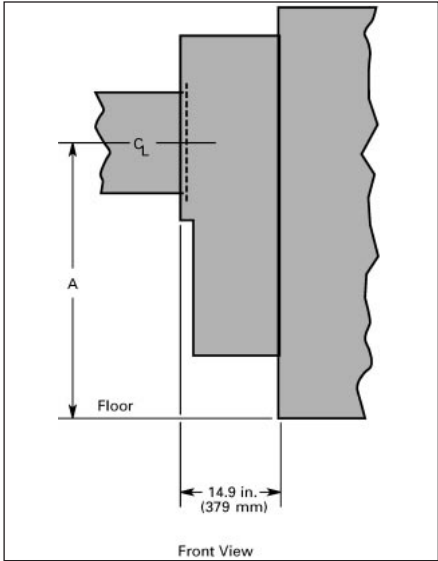
Siemens 480 volt switchgear can be configured in many ways by combining different section types. Up to five vertical sections plus a transition section can be shipped together as a unit. If all vertical sections are not to be shipped as a unit, specifications need to be provided that describe the limiting factors (e.g., low door or narrow hallway).

Normal indoor vertical sections are 101 in. (2565 mm) high and 60 in. (1524 mm) deep. A top-mounted hoist, which is shipped as an accessory in a separate container, adds 2 in. (51 mm) for a total installed height of 103 in. (2616 mm).

The outdoor switchgear assembly contains the indoor assembly in an outdoor housing. The overall height is 113 in. (2870 mm) and the depth is 119.40 in. (3033 mm).

The major assembly sections include:

- **Transition Sections** — used as transition to liquid filled transformer or to outdoor dry type transformers.
- **Auxiliary Sections** — used as incoming bus duct or cable entrance when a main breaker is not used.
- **Main Sections** — used to contain main breaker and may house metering and feeder breakers.
- **Feeder Sections** — used to contain feeder breakers and other equipment such as instrumentation.
- **Tie Sections** — used to contain tie breaker and other equipment such as feeder breakers.



Transition Section For Liquid Filled and Outdoor Dry Type Transformers

Table 4.18

	Dimension A in Inches (mm)	Weight in lbs. (kg)
Outdoor	55 (1397)	500 (227)
Indoor	61 (1549)	550 (250)

Table 4.19 Breaker Element Weight in lbs. (kg)

Operation	Element Type											
	RL-800	RLE-800	RLI-800	RL-1600	RLE-1600	RL-2000	RLE-2000	RL-3200	RLE-3200	RL-4000	RLE-4000	RL-5000
Manual	140 (64)	170 (64)	175 (80)	180 (82)	185 (84)	210 (95)	215 (98)	290 (132)	295 (134)	350 (159)	355 (161)	425 (193)
Electrical	150 (68)	180 (82)	185 (84)	190 (86)	195 (89)	220 (100)	225 (102)	300 (136)	305 (139)	360 (164)	365 (166)	445 (202)
Additional Weight for Shipping	45 (20)	45 (20)	45 (20)	45 (20)	45 (20)	45 (20)	45 (20)	50 (23)	50 (23)	50 (23)	50 (23)	55 (25)

Table 4.20 Fused Element Weight in lbs. (kg)

Operation	Element Type								
	RLF-800	RLF-1600	RLF-2000	RLF-3200	RFC-3200 ^①	RLF-4000	RFC-4000 ^②	RLF-5000	RFC-5000 ^④
Manual	195 (89)	310 (141)	325 (148)	290 ^③ (132)	390 ^③	350 ^③ (95)	450 ^③	425 ^③ (193)	475 (217) ^③
Electrical	205 (93)	320 (145)	335 (152)	330 ^③ (150)	(177)	360 ^③ (100)	(205)	445 ^③ (202)	
Additional Weight for Shipping	45 (20)	45 (20)	45 (20)	50 (23)	50 (23)	45 (20)	50 (23)	55 (25)	55 (25)

① For use with RLF-3200 breaker.
② For use with RLF-4000 breaker.
③ Fuses mounted on separate drawout carriage and located in separate compartment. For total weight, add weight of breaker element and separate fuse carriage.
④ For use with RLF-5000 breaker.

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Auxiliary / Breaker Section Dimensions

Dimensions

Auxiliary Sections — Front Views

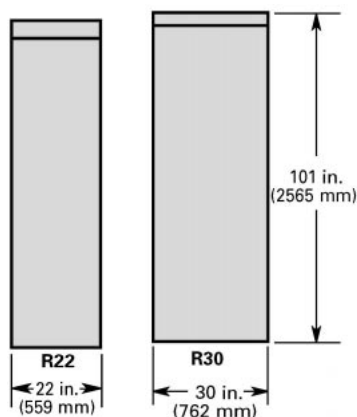


Table 4.21 Auxiliary Section Weight in lbs. (kg)

	R22	R30
Indoor	1000 (455)	1200 (545)
Outdoor	2000 (909)	2400 (1091)

Dimensions in Inches (mm)

Table 4.22 Breaker Section and Connection Weights in lbs. (kg) ①

	R22	R30	R36
Indoor	1400 (636)	1900 (864)	2210 (1005)
Outdoor	2400 (1091)	3100 (1409)	—

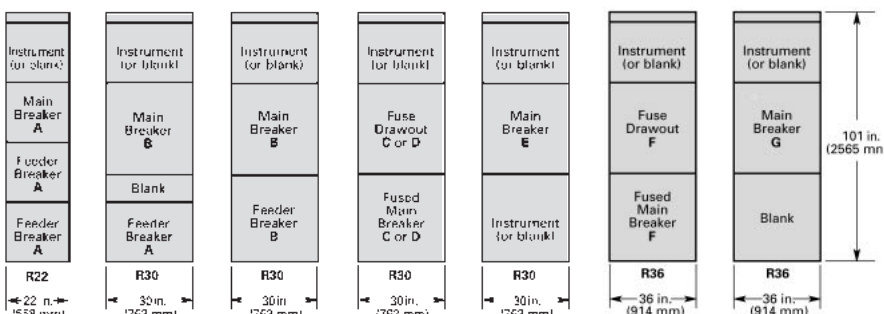
① Weights shown do not include weight of circuit breaker removable elements. All weights are approximate based on aluminum bus. For outdoor lineup, add 1200 lb (545 kg) to total weight of individual sections for end walls and hoist.

Breaker Designations

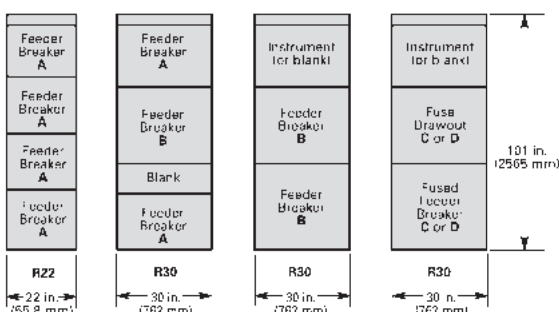
- A** = RL- 800 / 1600 / 2000,
RLF- 800 / 1600 / 2000,
RLE- 800 / 2000^②, RLI-800^②
- B** = RL- 3200
- C** = RLF- 3200 in one cell, with
fuse drawout (RFC-3200)
in other cell
- D** = RLF- 4000 in one cell, with
fuse drawout (RFC-4000)
in other cell
- E** = RL- 4000, RLE-4000
- F** = RLF- 5000 in one cell with
fuse drawout (RFC-5000)
in other cell
- G** = RL- 5000

② 22 in. (559 mm) compartment only.

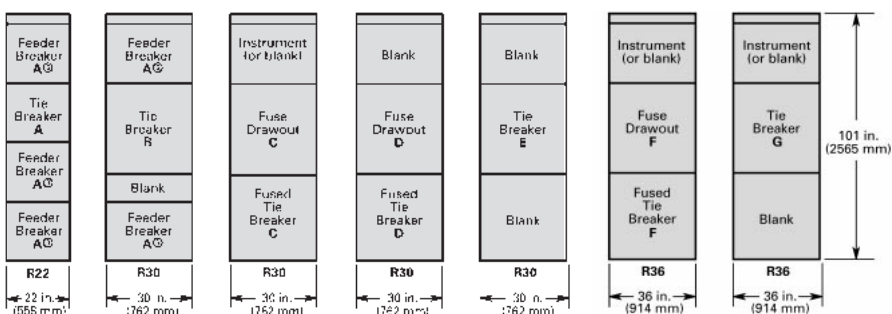
Main Breaker Sections — Front Views



Feeder Breaker Sections and Combinations — Front Views



Tie Breaker Sections and Combinations — Front Views

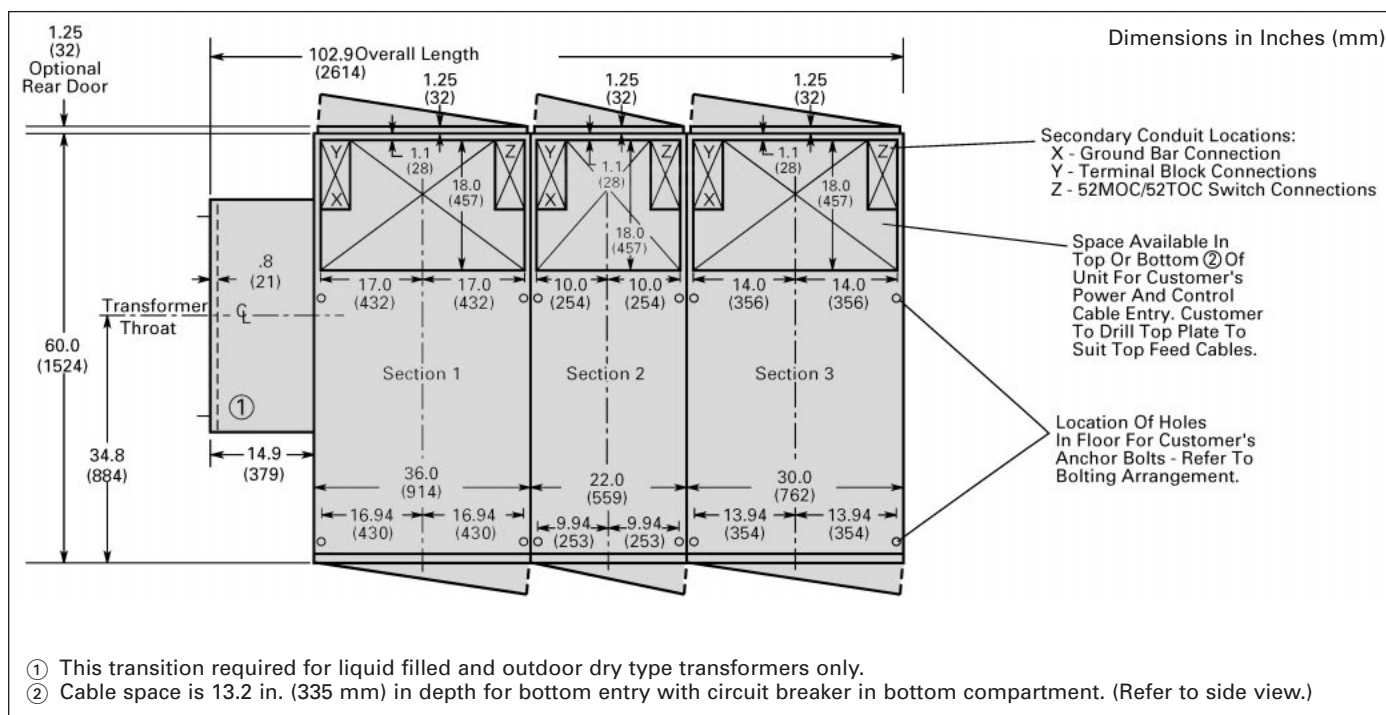


③ Feeder breakers located above tie breaker must be electrically on opposite side of tie breaker from feeder breaker which is located below the breaker.

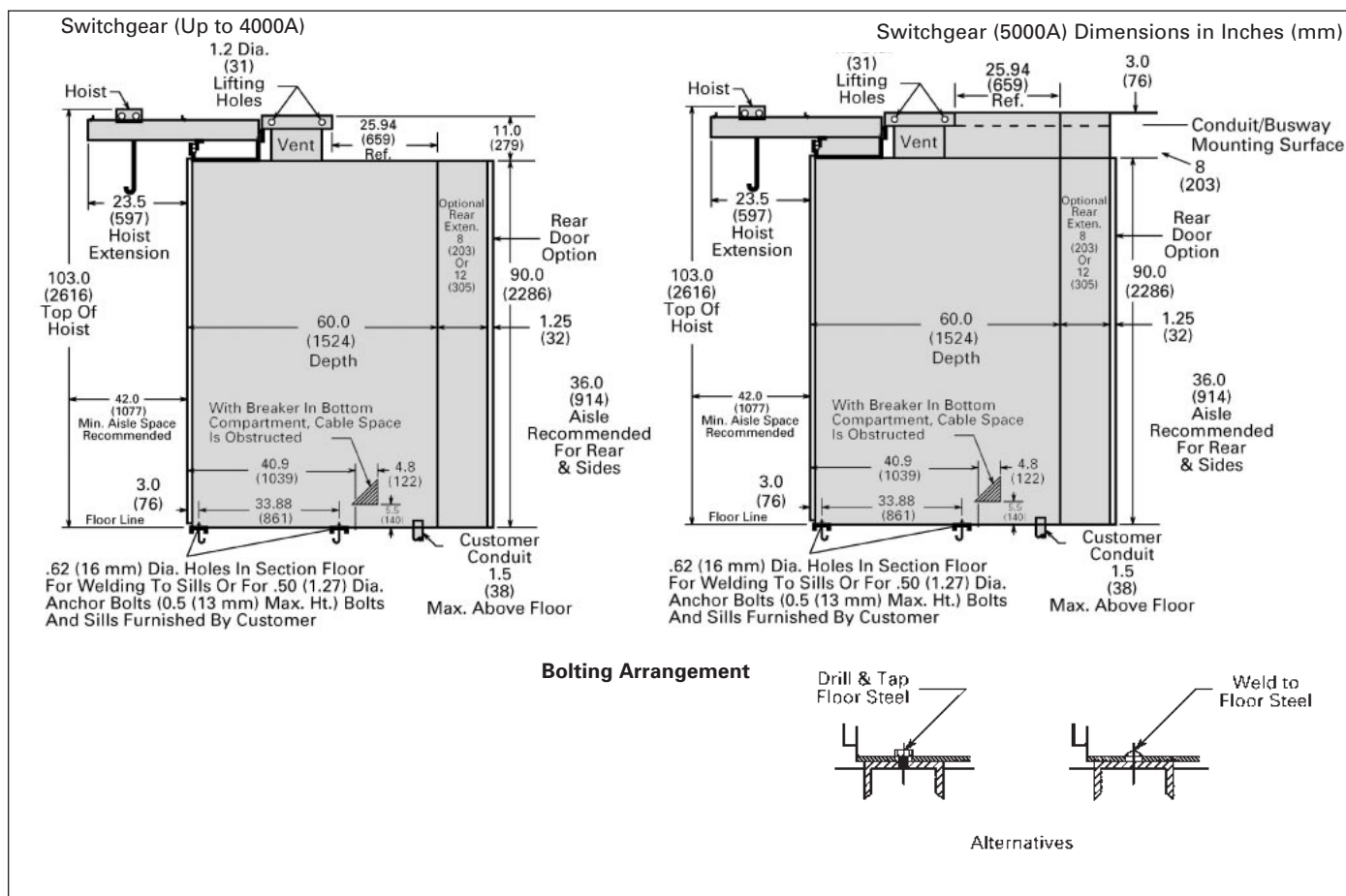
Indoor Floor Plan, Side View

Dimensions

Indoor Floor Plan



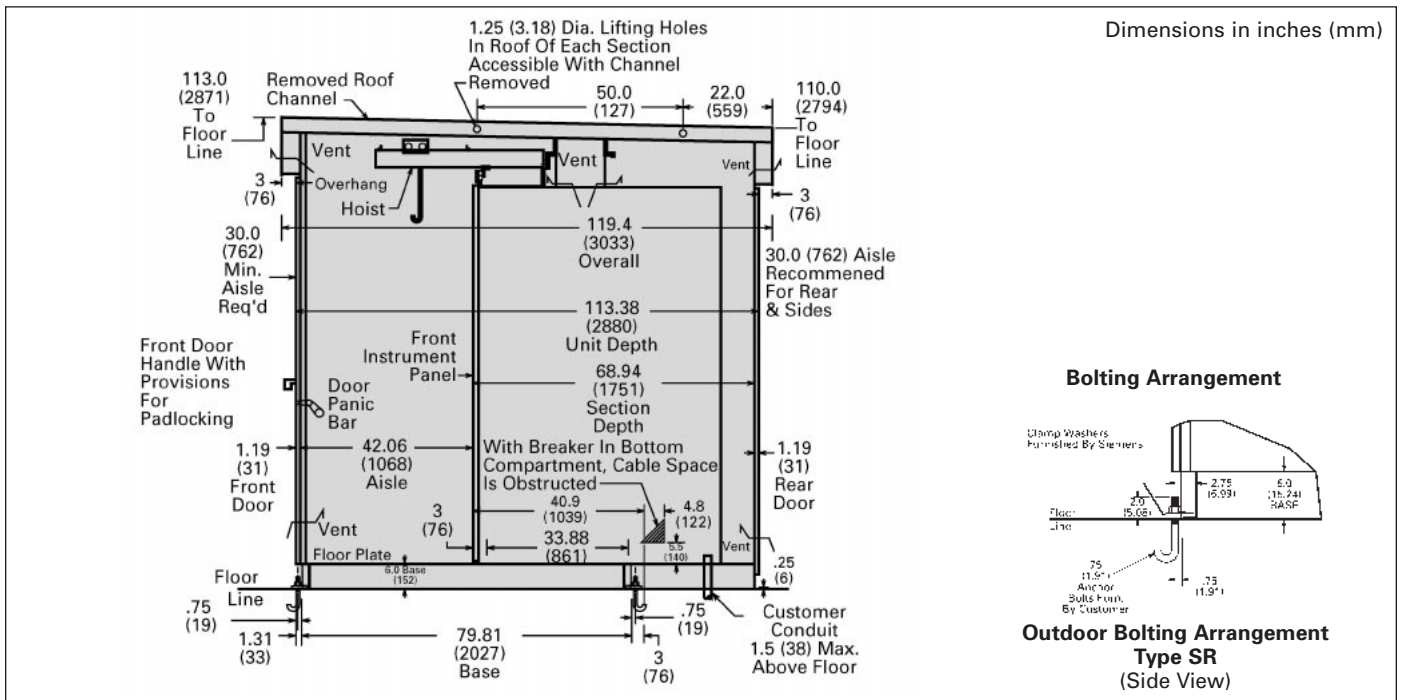
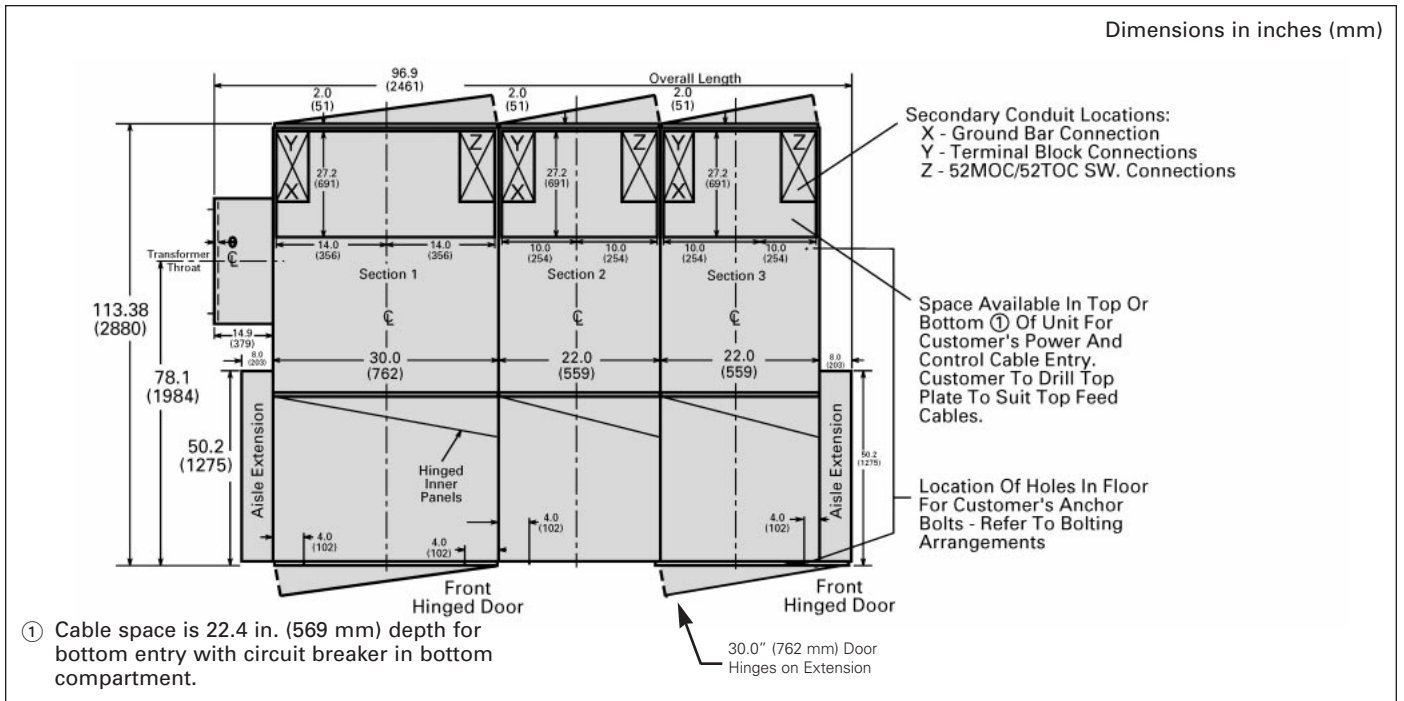
Indoor Side View



Outdoor Floor Plan, Side View

Dimensions

Outdoor Floor Plan



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Guide Form Specifications

Specifications

This equipment specification guide provides information for describing a typical metal enclosed low voltage power circuit breaker switchgear assembly. Items or features that are non-standard but required for a specific application are preceded by (option). Items preceded or followed by a blank () require that additional data be provided in order to complete the specification.

General

The equipment to be supplied shall be metal enclosed low-voltage power circuit breaker switchgear with drawout circuit breaker elements. All power circuit breakers and assemblies shall be produced by a single manufacturer and shall be designed, tested and manufactured in accordance with the standards referenced in this specification.

Codes and Standards

The switchgear assemblies and power circuit breakers shall comply with the codes and standards as indicated. Copies of certified design tests shall be furnished if requested to confirm compliance.

- **ANSI / IEEE C37.13** — Low-Voltage AC Power Circuit Breakers Used in Enclosures
- **ANSI C37.16** — Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors — Preferred Ratings, Related Requirements, and Application Recommendations
- **ANSI C37.17** — Trip Devices for AC and General Purpose DC Low-Voltage Power Circuit Breakers
- **ANSI / IEEE C37.20.1** — Metal-Enclosed Low-Voltage Power Circuit-Breaker Switchgear
- **ANSI / IEEE C37.27** — Application Guide for Low-Voltage AC Nonintegrally Fused Power Circuit Breakers (Using Separately Mounted Current Limiting Fuses)
- **ANSI C37.50** — Standard Test Procedures for Low-Voltage AC Power Circuit Breakers Used in Enclosures.
- **ANSI C37.51** — Standard Conformance Test Procedures for Metal Enclosed Low-Voltage AC Power Circuit-Breaker Switchgear Assemblies
- **ANSI / NEMA 250** — Enclosures for Electrical Equipment (1000 Volts Maximum)
- **NEMA SG 3** — Low-Voltage Power Circuit Breakers

- **NEMA SG 5** — Power Switchgear Assemblies
- **(option) NEMA 210** — Secondary Unit Substations
- **UL 1066** — Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures
- **(Option) UL 1558** — Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear

Assembly

The switchgear assembly shall be Siemens Type R and is to be located indoors, with a NEMA 1 enclosure, (option) outdoor, NEMA 3R per specifications below and constructed of multiple, metal-enclosed, ventilated sections. The front of each vertical section is to contain three or four compartments with 14 gauge steel side sheets and compartment barriers of 11 gauge steel. A double thickness of 14 gauge steel is to be provided between vertical sections. The side sheets shall be full height and depth to provide a full metal barrier separating the rear cable compartments between sections. End sections shall include provisions for main bus extension and installation of future vertical sections. The design shall incorporate preformed steel channels, angles, and side sheets bolted together and reinforced to form a rigid, self-supporting, compact assembly.

Horizontal barriers are to be provided to form individual circuit breaker or metering compartments. Circuit breaker compartments are to be barriered from the bus compartment through a primary disconnect assembly. Each circuit breaker or metering compartment shall be provided with a hinged front door secured with rotary latches requiring no tools to operate.

Circuit breaker compartments shall include stationary primary contact disconnects. The primary disconnects shall be copper, silver-plated at connection points and shall be of one piece construction. The upper set of disconnects shall bolt directly to the main bus and, for feeder circuit breakers, the lower set shall extend to the rear cable area and shall be insulated where they pass through the main bus compartment. Primary disconnects shall be sized for the maximum continuous current of the circuit breaker which will be located in the compartment. Interlocks shall be provided which will prevent a circuit breaker element of the incorrect frame size or interrupting rating from being inserted into the compartment. A stationary circuit breaker frame grounding contact shall be provided which shall be visible with the circuit breaker installed in any position.

Secondary control contacts, when required, shall be located in the circuit breaker compartment and shall be of the sliding contact, silver-plated copper design. Barriers shall be provided between terminal points. The secondary control contacts shall engage the drawout circuit breaker element in the connected and test positions.

Control circuit fuses for electrically operated circuit breakers shall be located on the side of the circuit breaker compartment and shall be contained in a dead-front, pull-out fuse block with a clear cover. Withdrawing the cover from the fuse block shall automatically remove the control circuit fuses and hold them captive. The fuse block cover shall include provisions for being installed in the reverse position in order to maintain the open control circuit for testing or maintenance purposes while continuing to hold the fuses captive.

All control wiring within the assembly shall be continuous and shall terminate on each end at a suitable terminal block. Control wiring shall be 14 gauge, stranded, type SIS, and shall be labeled at each end with sleeve type wire markers. Wire markers shall be machine imprinted with the wire name as indicated on the wiring diagrams. Wrap on wire markers will not be accepted. Terminals shall be insulated locking fork or ring tongue type except where connecting to components that do not accept these terminations. Control wiring for external connections shall be terminated in the rear cable area for ease of access. (Option) Metal covers shall be provided over control wiring troughs where they pass through the power cable termination area. (Option) Metal covers shall be provided over terminal blocks located in the power cable termination area.

Bus

Main bus shall be three-phase, ___ wire ___ ampere copper with silver-plated connection joints (option) aluminum with welded connection points (option) copper with tin-plated connection points. (Option) Neutral bus rating shall be ___ % of the main bus current rating and shall be located centrally in the structure for ease of terminating cables whether entering from above or below. 600 volt clearances shall be maintained in all horizontal and vertical buses such that insulation is not required. The main horizontal bus shall be run in a vertical, edge-to-edge arrangement for high short circuit strength. Access to the rear cable termination area shall be possible without

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Guide Form Specifications

Specifications

reaching over the main and vertical bus. Bus bracing shall be equal to the short circuit interrupting rating of the lowest rated non-fused circuit breaker applied in the assembly. A 0.25 in. (6 mm) by 2.00 in. (51 mm) copper ground bus will be provided. Barriers shall be provided which isolate the rear cable termination compartment from the adjacent vertical section. (Option) Barriers shall be provided to isolate the rear cable area from the main bus area. (Option) Barriers shall be provided to separate the incoming line connections from the main horizontal and vertical bus.

Circuit Breakers

Circuit breakers shall be Siemens Type RL and shall be either electrically or manually operated as indicated on the data sheets (or drawings). Minimum interrupting ratings will be as defined on the data sheets (or drawings) and shall meet or exceed the interrupting ratings as defined by ANSI standards. (Option) Fused circuit breakers are to be the integrally fused type through the 2000 ampere frame size. 3200 through 5000 ampere frame sizes are to be supplied with separate drawout fuse carriages which are mounted in the same vertical section as the circuit breaker element and are to be key interlocked with the circuit breaker element such that the fuse carriage cannot be withdrawn unless the circuit breaker is locked in the open position. All fused circuit breakers are to be equipped with blown fuse lockout devices to prevent single phasing. The application of fused circuit breakers shall not reduce the amount of rear cable termination space which would have been provided with non-fused circuit breakers.

Circuit breakers are to be 600 volt class with nominal ratings as dictated by the system voltage. Circuit breakers shall be three-pole, single-throw, operated by a stored energy mechanism, with arc quenchers, main and arcing contact structure, a three-phase solid state trip overcurrent trip unit, trip actuator, three single ratio tripping sensors, and primary disconnecting devices. In addition, the circuit breaker element shall have connected, test, and disconnected position indicators, spring charged/discharged indicators, and circuit breaker open or closed indicators all of which shall be visible to the operator with the compartment door closed. It shall be possible to rack the circuit breaker element from the disconnect to the connected position with the compartment door closed. Interlocks will be provided that prevent racking a circuit breaker unless the circuit breaker is open and that prevent closing a circuit breaker unless it is in the connected or test position.

Solid State Trip Units

Solid state trip units shall be Siemens

- Static Trip III (basic device)
- (Option) Static Trip IIIC (adds communications capability)
- (Option) Static Trip IIICP (adds communications and power metering)
- (Option) Static Trip IIICPX (adds communications, power metering, and relaying functions)

Trip units shall be interchangeable so that any trip unit can be used with any frame size circuit breaker. The basic trip unit shall be a self powered, micro-processor based device that measures true RMS currents. Long time, short circuit or ground fault trip indication shall be maintained for a minimum of 48 hours without the need for a separate battery or relay. Peak sensing devices will not be accepted. All adjustment setting switches shall be digitally encoded type with gold contacts. (Note: Refer to catalog section SGBR-3169B for specifications on the Siemens Static Trip III trip unit family and all associated options).

Instrumentation and Metering

A wide variety of user defined metering and instrumentation options are available. They include Siemens 4720, 4700 & 4300 power meters, Siemens Static Trip III trip units, and traditional analog devices. For more detailed specification information on Siemens devices refer to bulletins SGFL 3181B, 3161A, and 3151B for 4720, 4700, and 4300 power meters, respectively; and SGBR-3169B Static Trip III Micro-processor Based Tripping System. If one of the options selected requires separate voltage and current transformers, such as the Siemens 4700 power meter, the following may be used to define these devices.

Current transformers shall have standard accuracy class ratings as defined by ANSI C37.20.1 and shall be mounted directly on the stationary primary disconnects in the circuit breaker compartment. Voltage transformers shall have a minimum 150VA thermal rating and shall be located in a metal enclosed metering compartment and shall be protected on the primary side with current limiting fuses.

Outdoor

(Option) Outdoor, NEMA 3R, walk-in, weatherproof construction is to be provided. The complete assembly is to rest on a formed steel base provided under each vertical section and running perpendicular to the depth of the switchgear. The underside of the enclosure and base structure is to be undercoated with coal tar emulsion material.

Front and rear doors are to be gasketed and hinged. Front doors, located at each end, are to include panic release door hardware, three point latches, and provision for padlocking. Rear doors shall be bolted. All exterior hardware shall be stainless steel.

An indoor access aisle approximately 42 in. (1067 mm) deep and accessible from either door is to be provided at the front of the switchgear line-up for inspection and testing of the circuit breakers and associated equipment. A hand-operated traveling hoist, mounted above the switchgear is to be provided for changeout of circuit breakers. The aisle is to have an extension on each end to accommodate end unit doors that have instrumentation and metering, and to provide additional space for circuit breaker handling.

The switchgear is to include space heaters to prevent condensation of moisture. The aisle shall be provided with incandescent lights, convenience receptacle, and an ON / OFF switch at each end to control the lights.

Finish

During construction, the structural steel parts, panels, and compartments shall be prepared for painting by a five-stage wash system consisting of an alkaline cleaner, fresh water rinse, iron phosphate treatment, fresh water rinse, and non-chromate sealer. After cleaning and stabilization, the steel parts shall be coated with a thermosetting polyester powder applied with electrostatic equipment at a nominal 2 mils dry film thickness and then cured at 425 degrees Fahrenheit for 20 minutes. Paint color shall be ANSI 61 light gray. The paint finish shall have a pencil hardness of 2H, a gloss as defined by ANSI D523-78 of 45-55%, a salt spray rating per ASTM B-117-73 of 600 hours, and shall be outdoor rated per UL1332.

Accessories

The following accessories are to be provided:

- crank for racking circuit breakers
- lifting yoke for circuit breakers
- container of touch-up paint
- (optional) portable test set, type PTS4
- overhead hoist for indoor switchgear
- (optional) test cabinet

Testing

Production tests in accordance with ANSI C37.20.1, ANSI C37.50, ANSI C37.51 and NEMA SG 5 shall be performed on the completed assembly. Certified copies of these tests shall be furnished upon request.

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