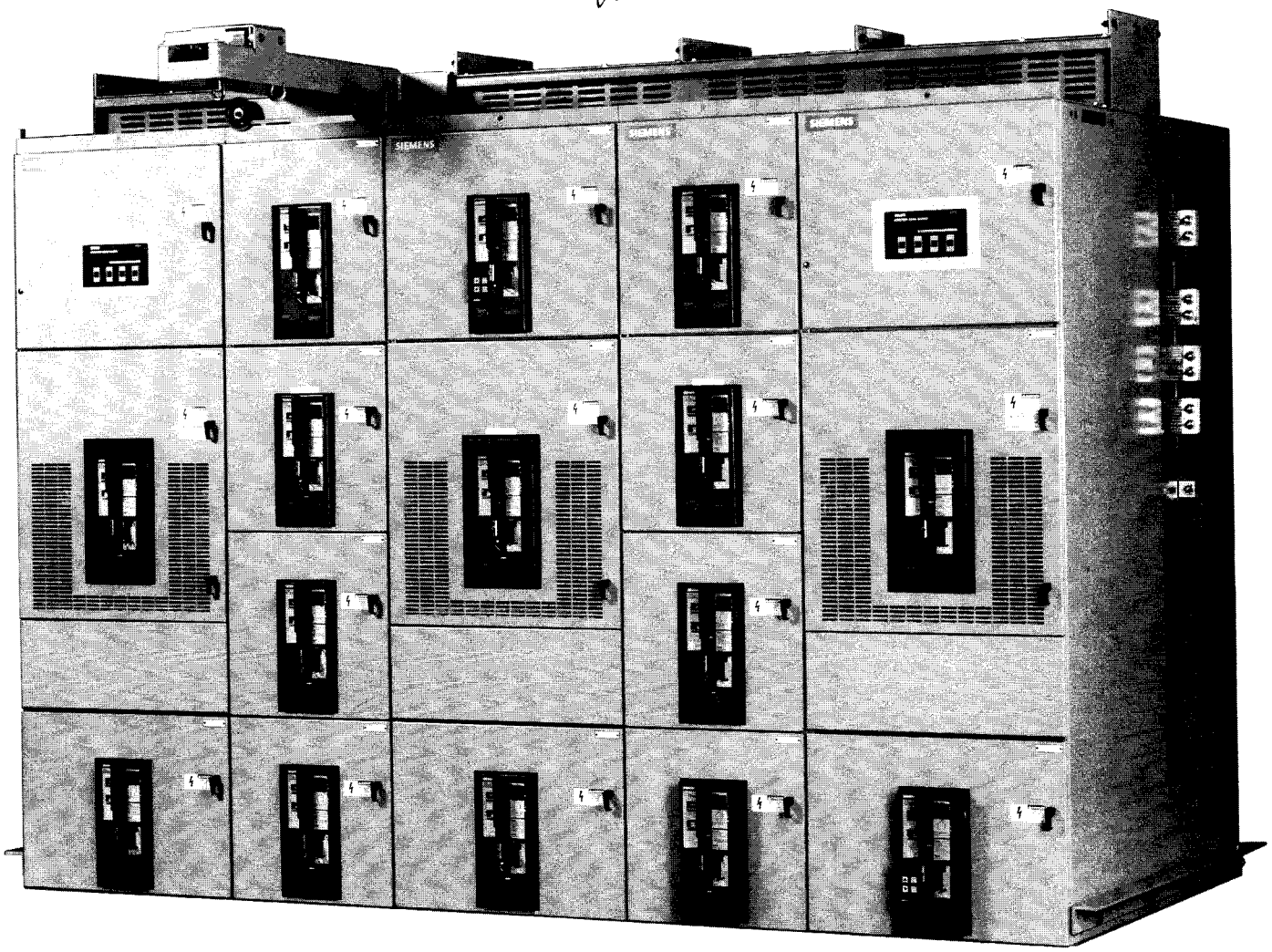
SIEMENS

Low Voltage
Metal-Enclosed Switchgear

moc TOC



SG3061

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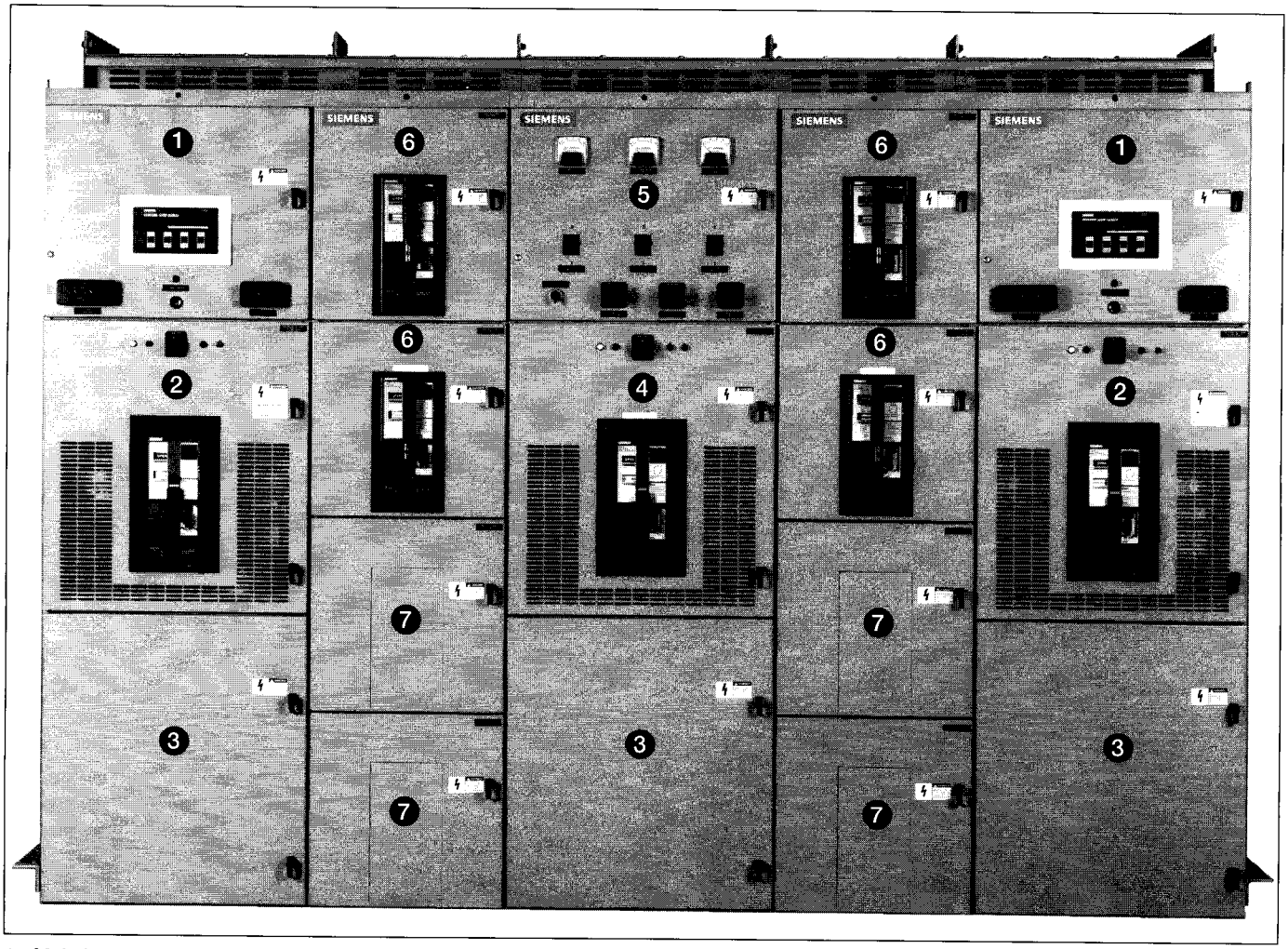
General Description

Typical Double-Ended Substation with Provision for Future Feeders



1. Main incoming service metering
2. Main breaker RL-3200
3. Blank cell (could also be used for a feeder breaker)
4. Tie breaker RL-3200
5. Auxiliary metering
6. Feeder breaker, fused or unfused, up to 2000A
7. Provision for future feeder

General Description

Low voltage metal-enclosed switchgear is used in electric power distribution systems for the control and protection of circuits and equipment. The switchgear employs draw-out-type low voltage power circuit breakers.

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:

Siemens switchgear is available in two 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 60 Hertz
- Voltages of 208, 240, 480, or 600 volts
- Currents up to 4000 amperes

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

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

Static Trip III trip units are provided on all low voltage power circuit breakers. All circuit breakers are UL listed. Tables 1 and 2 show the maximum nominal ratings for circuit breakers.

Industry Standards

Type R and SR switchgear with power circuit breakers is designed, tested and constructed to be 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 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 & DC Power Circuit Breakers Used in Enclosures.

Features and modifications required by NEC are incorporated when the assembly is used 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.

Features & Benefits

Circuit Protection and Reliability

Siemens switchgear provides efficient and safe power distribution and control. All applicable ANSI, NEMA, IEEE, and UL standards are met.

Closed-door racking is standard. Mechanical interlocks prevent racking a closed circuit breaker or mismatching a breaker and a compartment. Each compartment is also enclosed with grounded steel barriers.

Harmonics-induced trips are avoided with the Static Trip III trip unit, standard on all circuit breakers. By using **RMS current sensing** instead of peak sensing, accurate load protection is provided without causing unnecessary shutdowns or jeopardizing system integrity due to high trip settings.

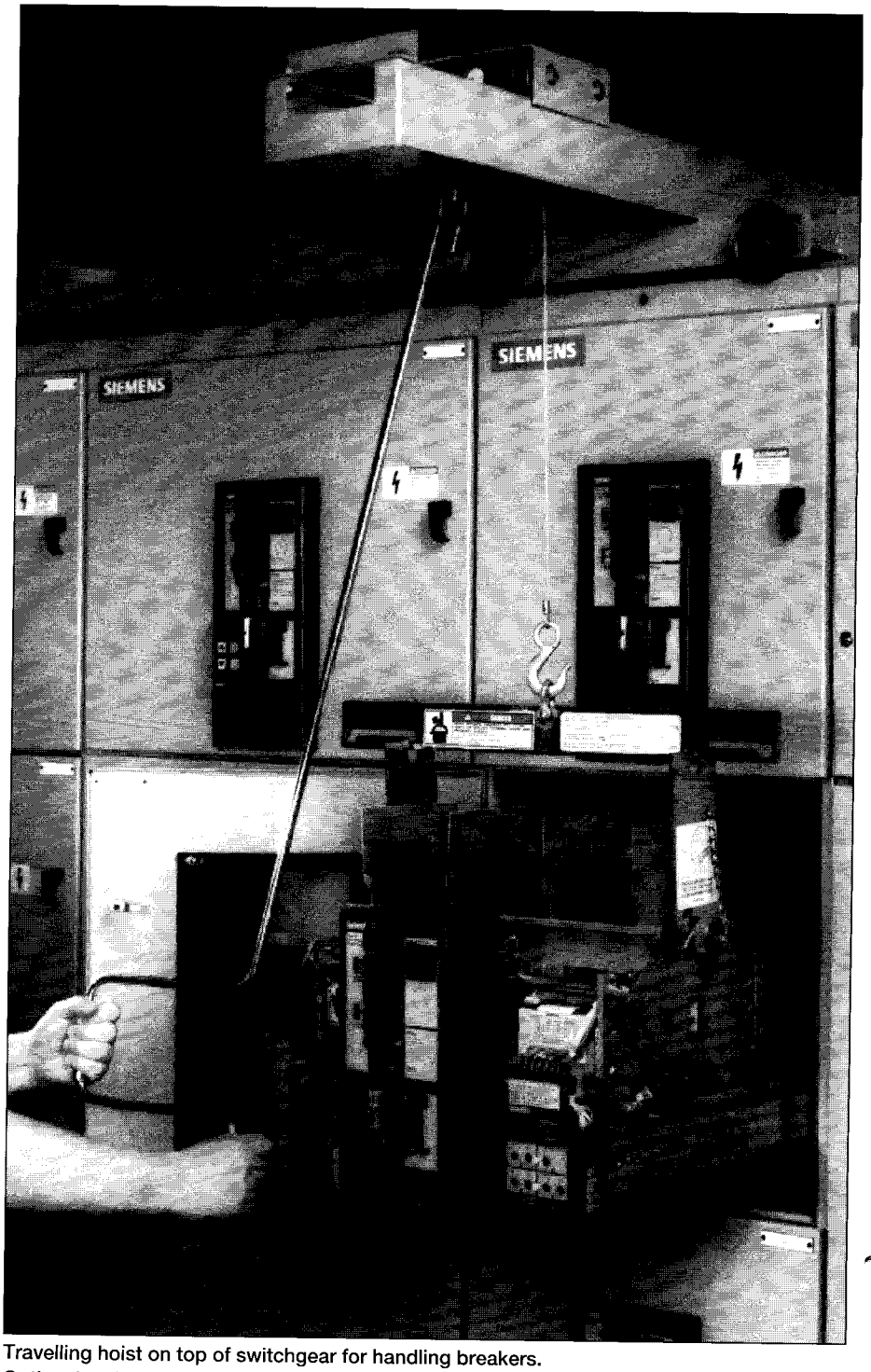
All switchgear equipment, including circuit breakers, is **manufactured, assembled and tested in one location**. This assures an integrated fit and high quality . The overall effect is guaranteed reliability.

Application Flexibility

Five circuit breaker sizes are available with ratings from 800 to 4000A. Extended interruption ratings are optional with up to 130kA without fuses and 200kA with fuses. All circuit breakers are **UL listed**. UL listing is also available for cubicles.

Frames rated up to 2000A can be stacked four high and can include integrally-mounted fuses. A single vertical section can accommodate a fused 3200A or 4000A circuit breaker.

Two widths of vertical sections are available to simplify planning and design: 22 and 30 inches. Each section has a **uniform depth of 60 inches.** Rear extensions are available as needed for additional cabling area. All breaker sizes can be housed in a combination of these sections.



Travelling hoist on top of switchgear for handling breakers. Optional on indoor; standard on outdoor.

Features & Benefits

Each section has cable compartment barriers between adjacent sections and secondary **wire troughs** with optional covers. Metal barriers are available for incoming line, bus and cable compartments. An insulated main bus option is also available.

Maintenance Convenience

Not only has maintenance convenience been built into the switchgear design, but also a reduced need for maintenance.

For example, **welded aluminum** main and vertical bus joints provide increased reliability and reduce maintenance. Bolted copper bus with silver-plated connections is optionally available.

Adequate workspace has been provided in the cable termination area for easy access. All factory **wiring is clearly labeled** to expedite troubleshooting and wiring connections. All connections are made on terminal blocks. Optional metal covers may be provided over terminal blocks located in the rear cable area.

Common circuit breaker design allows **standardization of parts**. This simplifies maintenance and provides for interchangeable parts. Thus, inventory requirements are reduced as well as overall maintenance costs. Routine circuit breaker maintenance normally can be performed in less than 30 minutes.

The breaker position is clearly visible with the door closed. **Closed door racking** of circuit breakers to all positions (connected, test, and disconnected) is standard.

Each compartment has **telescoping**, self-contained, ball-bearing **drawout rails** that allow a breaker to be fully withdrawn without additional support. This allows for convenient inspection of key components and quick changeout if necessary. An optional top-mounted hoist allows quick removal and installation of circuit breakers.

The Static Trip III trip unit is located on the front of the breaker so that a PTS4 port-able test set can easily be plugged in for testing purposes.

Another maintenance feature is the location of current sensors, which are mounted on the circuit breakers where they can be easily inspected, tested, or replaced.

Maximum Safety

Safety concerns apply to both personnel and equipment. Many safety features are designed into the switchgear assembly.

A top mounted hoist is standard in outdoor and optional on indoor switchgear to provide safe installation and removal of circuit breakers.

Closed door racking is standard.

Mechanical interlocks assure that only an open breaker can be racked from one position to another. Additional interlocks assure that only a properly rated circuit breaker (ampere and interrupting capacity) can be inserted into a compartment. Any attempt to withdraw a circuit breaker with charged springs to the disconnected position will automatically discharge the springs.

Optional shutters provide isolation for primary contacts when circuit breaker is withdrawn.

When the closing springs are charged, the circuit breaker does not automatically close. A separate closing lever is operated to release the stored energy.

Pyro-Shield™, a fiberglass-reinforced polyester insulation system, is used for high strength, track-resistance, and flame retardance. The bus supports and moldings provide high momentary short circuit strength.

Most **bus bars** are arranged with edges **vertically oriented** to incorporate high creepage distances that resist dust buildup and the effects of contaminants. **Copper run-back buses** that pass through the main bus area are insulated. Purchaser wiring compartments can be isolated by optional grounded metal barriers from the main bus area.

Reduced Capital Costs

The flexibility of the compartment assembly and breaker design allows the number of compartments to be maximized in a vertical section and thus reduces the overall cost. The compartment doors can accommodate control switches, indicating lights, test blocks and an ammeter.

The ground bus is centrally located to accommodate either top or bottom entry, thus reducing cabling requirements.

Many circuit breaker parts are interchangeable among frame ratings, which simplifies maintenance and reduces inventory costs. The Static Trip III trip unit can be **interchanged on any frame rating.**

The switchgear assembly is **shipped with circuit breakers installed**, to reduce shipping damage, storage requirements, and handling. Installation cost and time is also reduced.

Power Circuit Breakers

Table 1. Type RL Low Voltage Power Circuit Breaker Ratings At 50/60 Hertz

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

*With the addition of fan cooling and 5000A copper main bus, a 4200A continuous rating is available.

Table 2. Type RLF Fused Circuit Breaker Ratings At 50/60 Hertz

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

Power Circuit Breakers

Description

The RL series circuit breakers are designed for up to 600V service with current carrying capacities up to 4000A and interrupting capacities up to 130,000A unfused and 200,000A 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.

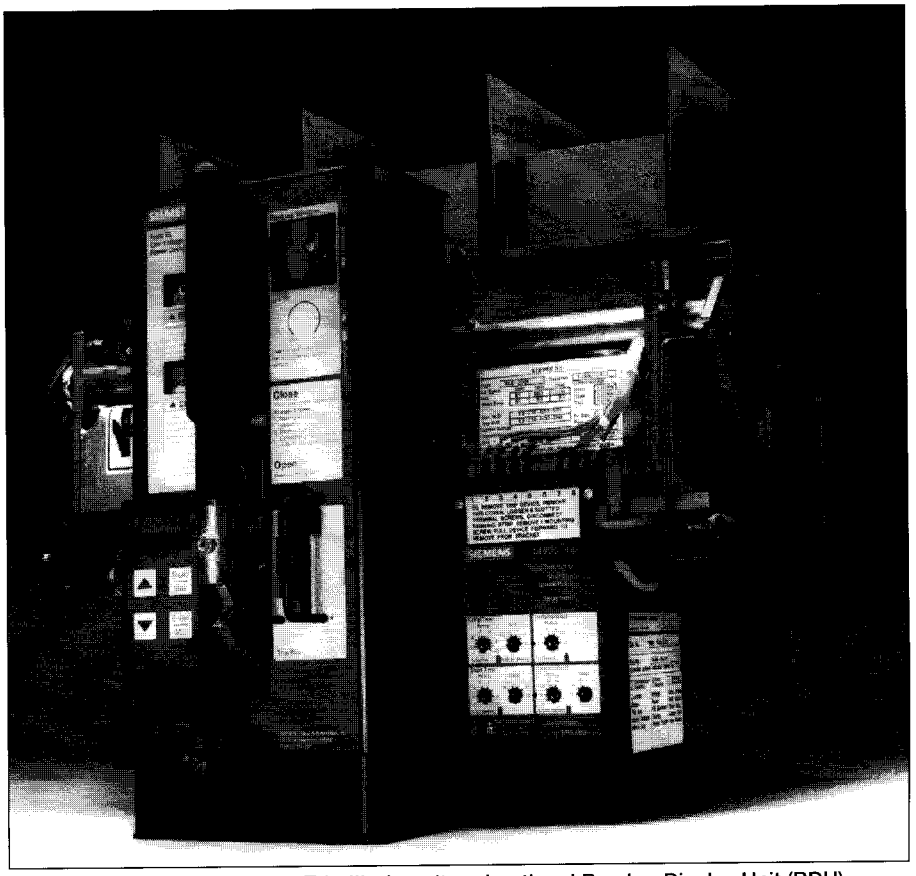
Typical breaker features are arc quenchers, main and arcing contact structures, inductive tripping sensors, control wiring, auxiliary switches, interlocks, and position indicators. Other features include interpole barriers, and a mechanical trip bar. Each circuit breaker is a complete 3-pole, single-throw element that is mechanically and electrically trip-free, with a Static Trip III overcurrent trip unit.

Tables 3 and 4 show circuit breaker operating time and control data.

Circuit Breaker Racking

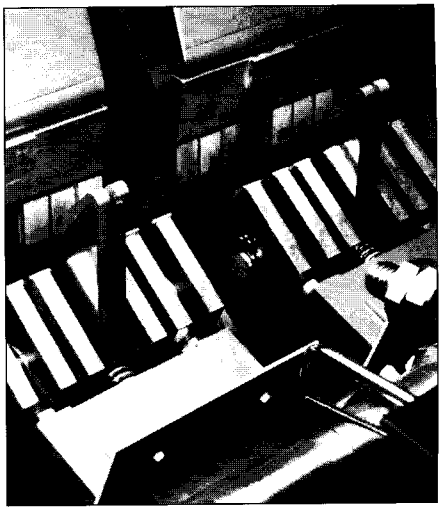
Racking can be done with the compartment **door open or closed**. Racking is accomplished by turning a racking screw on the front of the breaker with a crank.

The racking screw turns U-shaped brackets on each side of the breaker. The movement of the brackets rack the breaker frame in or out of the compartment.



RL Circuit Breaker with Static Trip III trip unit and optional Breaker Display Unit (BDU)

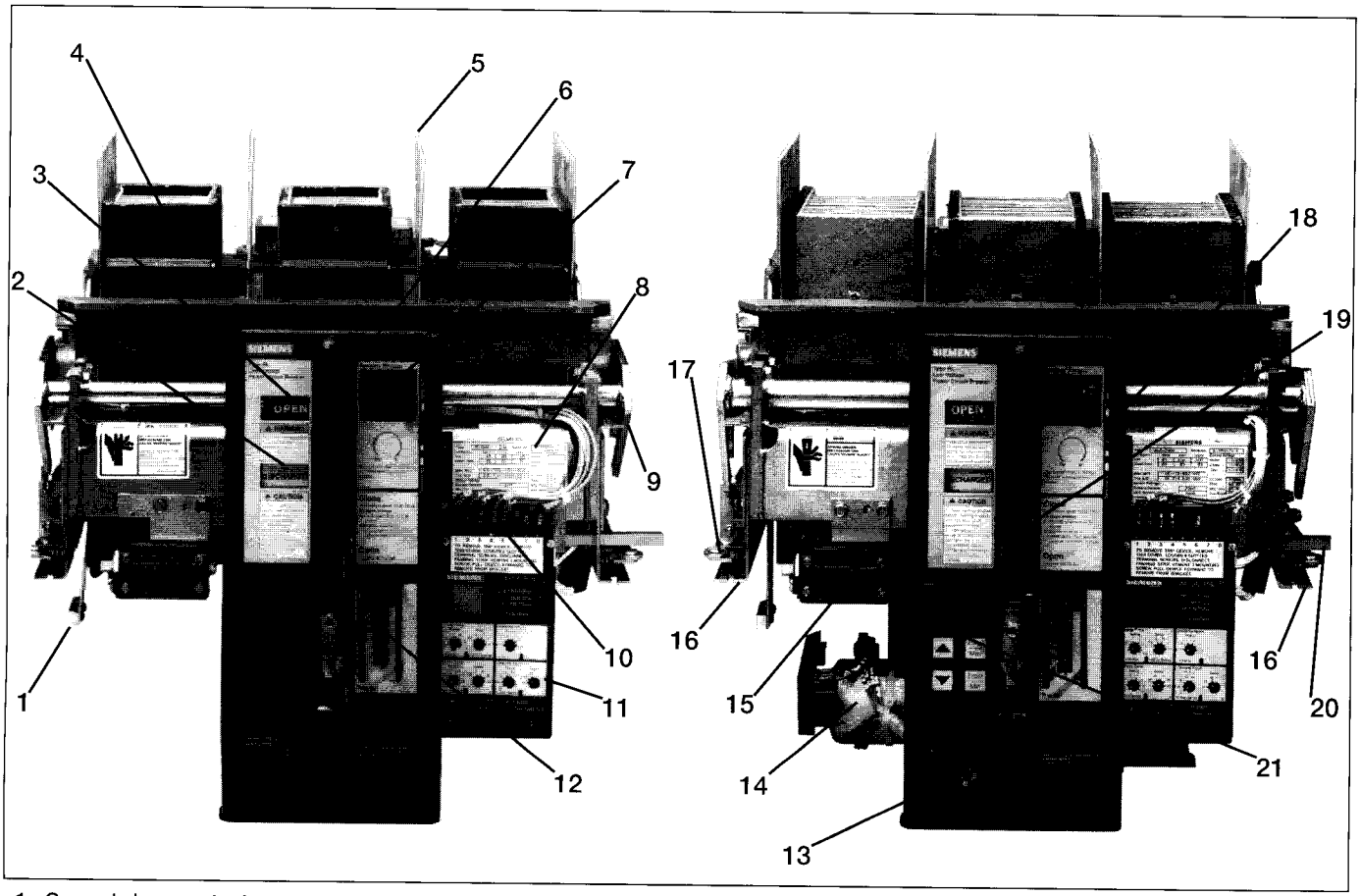
As the racking screw is turned counterclockwise, the breaker frame moves out of the compartment and disconnects the primary contacts followed by the secondary contacts. With only the secondary contacts connected (test position), the breaker may be closed and opened for testing without energizing the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



Main and Arcing Contacts, similar design for all ratings

Power Circuit Breakers

Circuit Breaker Detail

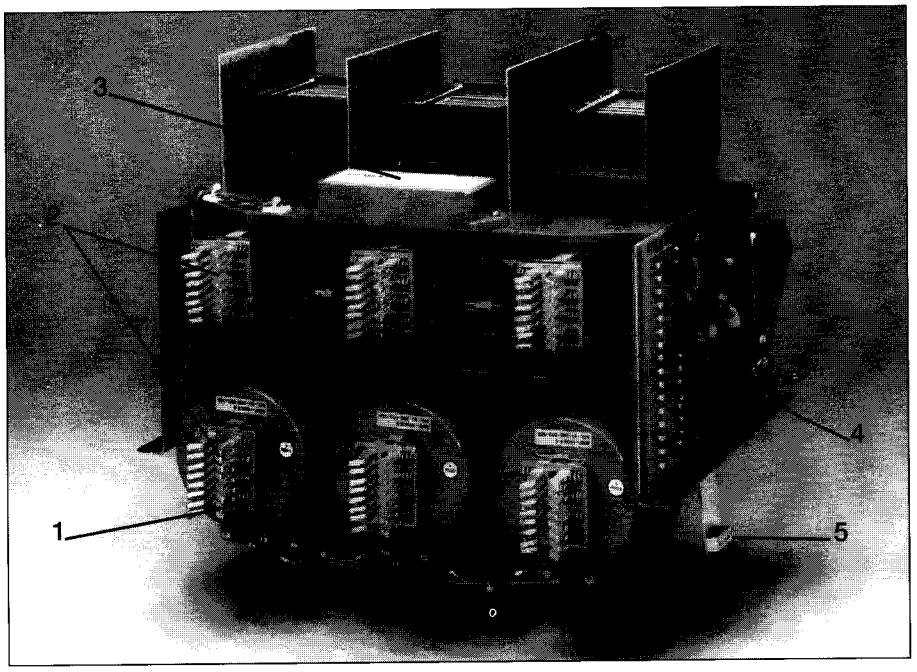


1. Ground shoe contact
2. Stored energy mechanism position indicator
3. Contact position indicator
4. Arc chutes
5. Inter-phase barriers
6. Handle for manually charging stored energy closing springs*
7. Racking mechanism shutter (with padlocking provisions)
8. Circuit breaker rating nameplate
9. Clevis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

*Optional on electrical breakers
**Optional on manual breakers

Power Circuit Breakers

Circuit Breaker Detail (continued)



1. Current Sensors
2. Primary Disconnects
3. PT Module (Optional)
4. Secondary Disconnects
5. Ground Shoe Contact

Table 3. Circuit Breaker Operating Time And Data (60 Hertz Basis)

	RL-800 RLE-800 RLI-800 RLE-800	RL-1600 & 2000 RLE-2000 RLF-1600 & 2000	RL-3200 RLF-3200	RL-4000 RLE-4000 RLF-4000
Time from Energizing Shunt Trip Coil Unit (Cycles):				
Contacts Part	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):				
Between Main Contacts	1.0	1.0	1.0	1.0
Between Arcing Contacts	1.1	1.1	1.1	1.1

Table 4. Circuit Breaker Control Data

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

Power Circuit Breakers

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 moveable contacts are mounted on the back of the breaker.

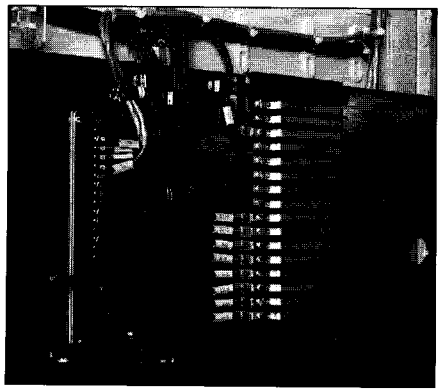
Stainless steel springs provide pressure to the finger contacts in the connected position. Low contact resistance is maintained by these self-aligning contacts.

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. The secondary contacts 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

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 circuit breaker
- prevent closing a circuit breaker until it is fully racked to the Connected position, or in the test position
- prevent inserting or withdrawing a circuit breaker from the compartment while the closing springs are charged

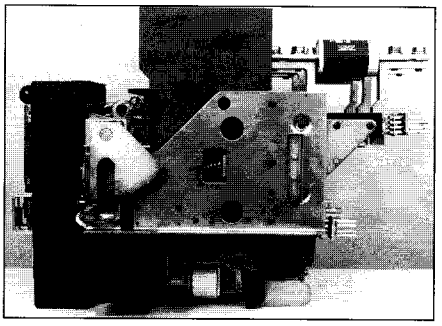
Arc Interruption

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 limit short circuit 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 and 4000 ampere, are available with current limiting fuses mounted on a separate drawout carriage. This carriage is key interlocked with the circuit breaker to allow racking of the fuse carriage with the associated circuit breaker in the open position. The fuse carriage mounts in the same vertical section as the circuit breaker element.

Current Sensors

The tripping system of the circuit 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. The trip device then operates the actuator to trip the breaker based on a pre-set time delay versus current magnitude relationship.

Table 5. Available Sensor Ratings

Frame Size and Max Amp Rating	Sensor Rating
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]

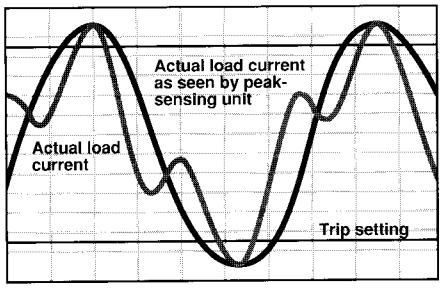
[1] Optionally available with integral 2000A ground sensor winding to meet NEC 230-95 requirements.

Power Circuit Breakers

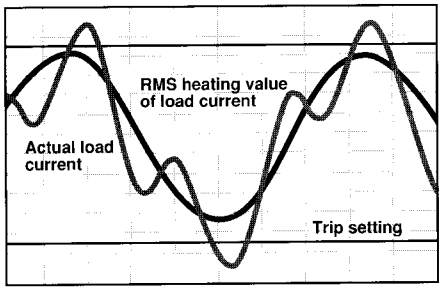
Static Trip III Trip Unit

Static overcurrent tripping devices have been standard on Siemens circuit breakers for thirty years. The **Static Trip III** trip unit represents a new generation of 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. For complete information refer to SG 3169-1.

The time-current characteristics of the Static Trip III trip unit are shown in figure 2, page 15.



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



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.

Static Trip III trip unit and Breaker Display Unit (BDU)

Figure 1. Static Trip III Catalog Number Designations

RMS TSIG T Z C NPX R

Basic Product Designations:
- T = Long Time setting with switchable thermal memory
- S = Short Time
- I = Instantaneous
- G = Ground Fault

LCD Targets/Watchdog Circuit

Zone Interlocking Capability (Automatically supplied with Short Time and/or Ground Fault)

Communications Capability

Options Available With Communications:
- N = Neutral Current Metering
- P = Power Metering
- X = Protective Relaying

Retrofit Package for Universal Mounting

Power Circuit Breakers

The Static Trip III trip unit comes in four models for maximum flexibility. Table 7 shows the functions of the various models.

The parameters metered by the Static Trip IIIC/CP trip units are shown in Table 8.

For protective relay functions, Table 9 shows how the Static Trip IIICPX trip unit can be used.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 set-point data can be read on the BDU in straightforward engineering units. Alarm and relay setpoint can be configured using the BDU keypad.

Table 6. Static Trip III Trip Unit Settings

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	.08, .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.

Table 8. Static Trip III Metering Functions

Measured Parameters	Model IIIC	Model IIICP
Phase Currents	•	•
Avg Phase Currents	•	•
Ground Current[1]	•	•
Neutral Current[2]	opt	opt
Phase Voltage[3]		•
Avg Phase Voltage[3]		•
Line Voltages		•
Avg Line Voltages		•
kW		•
kW Demand		•
kW Hours		•
kW Hours Reverse		•
kVA		•
kVAR		•
kVAR Hours		•
Power Factor		•
Frequency		•

[1] Included when ground fault protection specified.
[2] Requires "N" option and neutral current sensor.
[3] Only displayed for four wire systems.

Table 7. Static Trip III Trip Unit Functions

Functions/Static Trip III 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]	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[1,5]		opt	opt	opt
Event Log		•	•	•
Phase Current Metering		•	•	•
Ground Current Metering[3]		•	•	•
Neutral Current Metering[4]		opt	opt	opt
Min/Max Current Log		•	•	•
Power Metering Functions			•	•
Min/Max Power Log			•	•
Extended Protective Relaying				•
Extended Trip Log				•

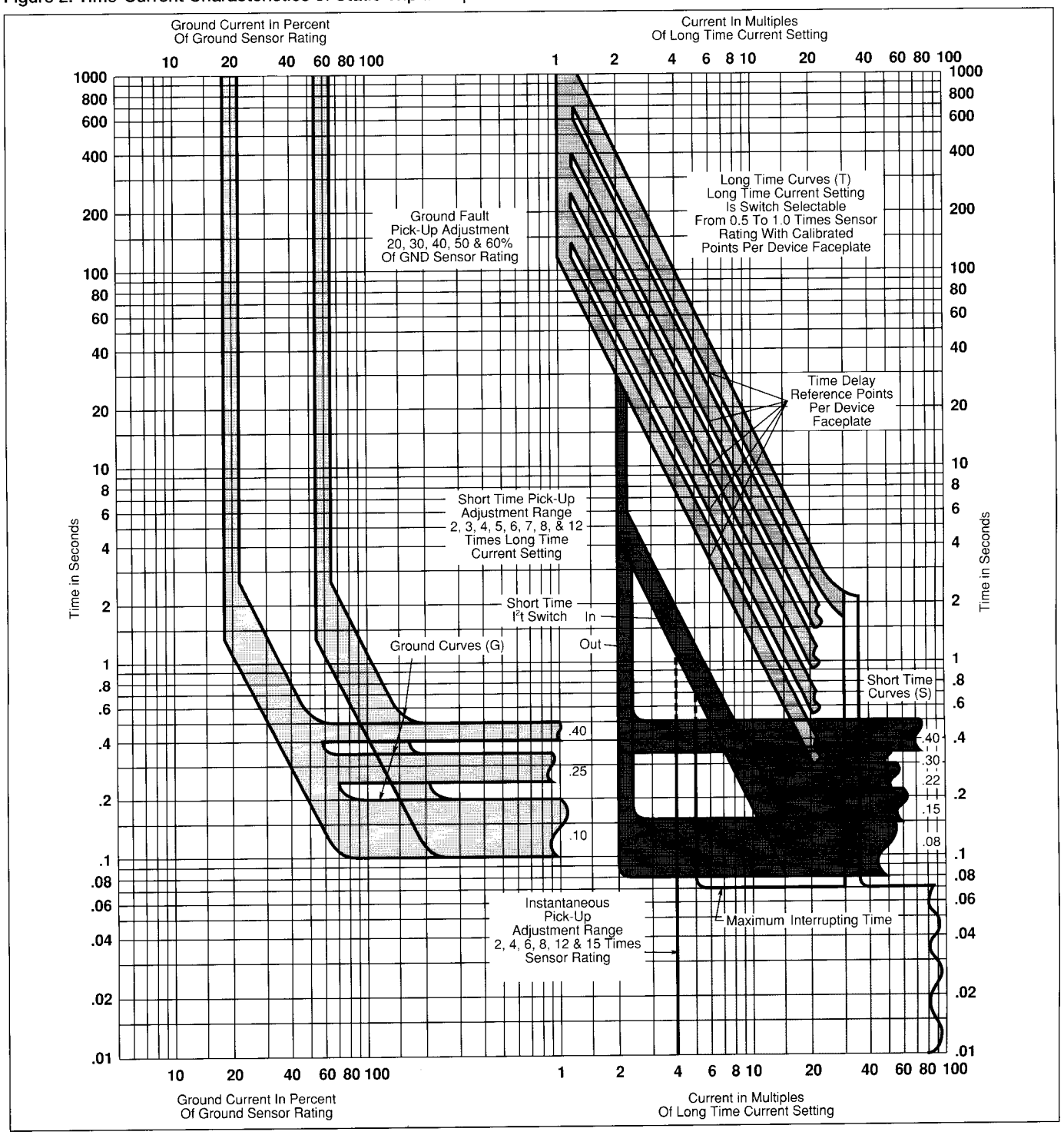
[1] Requires additional wiring to meet specific application.
[2] Supports optional Breaker Display Unit accessory.
[3] Included when ground fault protection specified.
[4] Requires "N" option and neutral current sensor.
[5] Open command uses alarm relay output and restricts use for other alarm functions. Close command requires electrically operated breaker.

Table 9. 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	50.0-70.0Hz		•	
Underfrequency	45.0-60.0Hz		•	

Power Circuit Breakers

Figure 2: Time-Current Characteristics of Static Trip III Trip Units



Power Circuit Breakers

Tripping Actuator

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

Options

Type RL circuit breakers have several options. Some of these include:

- Shunt Trip (for MO breakers)
- Operation Counter
- Undervoltage Trip Device
- Electrically Operated Interlock
- Automatic Trip Alarm Contact with Lockout (Bell Alarm)

• 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 and optional on manually operated breakers.

Table 10. Shunt Trip Coil Ratings

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

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. 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.

• Operation Counter - A mechanically operated, 5-digit nonresetable counter can be mounted beneath the breaker auxiliary switch. The counter will record the number of operations that take place. 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.

Table 11. Undervoltage Trip Ratings

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

*Not available. Use 120 VAC undervoltage device with appropriate 240-120 or 480-120 voltage transformer in cubicle.

The static timing unit is adjustable from 0.04 to 4 seconds for time delay. This delay allows the system to distinguish between undervoltage conditions and momentary voltage dips.

• Electrically Operated Interlock - An interlock can be added to electrically interlock two breakers to prevent 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.

Table 12. Interlock Coil Ratings

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

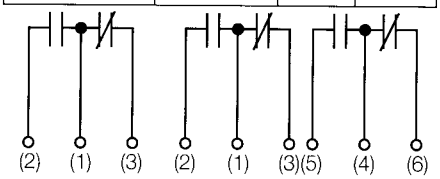
The interlock has a mechanical link that goes to the main shaft of the breaker. The interlock is held in the picked-up position when the breaker is closed. Once closed, the interlock can be de-energized without tripping the breaker. There are no adjustments for pickup or dropout voltages. The interlocks are continuously energized.

• Automatic Trip Alarm Contact with Lockout (Bell Alarm) - The trip bell alarm is initiated by the Static Trip III trip unit through an optional contact circuit. The circuit can control an auxiliary alarm contact locally or remotely for indication of an automatic trip. The alarm contact circuit must be reset manually or electrically before reclosing.

Two types of contacts are available: a single-pole, double-throw (SPDT) or a double-pole, double-throw (DPDT). A lockout feature can be added to prevent reclosing after a fault occurs. This is accomplished by connecting the contact in series with the breaker closing coil.

Table 13. Bell Alarm Contact Ratings

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



Switchgear Assembly

Description

The switchgear assembly consists of multiple 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. Compartments are sized to provide uniform height of each switchgear assembly.

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 prepared for painting by a five-stage wash system consisting of:

- Alkaline Cleaner
- Fresh Water Rinse
- Iron Phosphate Treatment
- Fresh Water Rinse
- Non-Chromate Sealer.

After cleaning and stabilization, the steel parts are coated with a thermosetting polyester power applied with electrostatic equipment at a nominal 2 mils dry film thickness, and then cured at 425°F for 20 minutes. Standard finish color is light gray ANSI 61.

If a different finish color is required, it is applied after assembly is complete. The outer surfaces are cleaned and prepared for the final top coat of Alkyd Enamel. This finish is applied with conventional spray equipment and is allowed to air cure. The completed finish has a nominal 2 to 3 mils dry film thickness.

Assembly Construction

The 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.

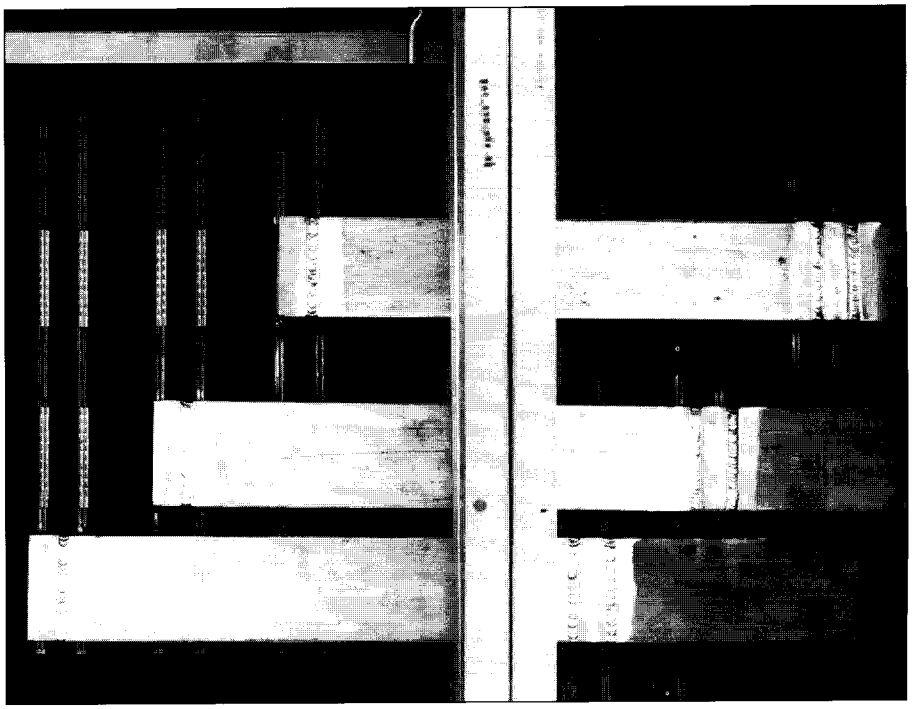
Bolted steel/glass polyester compartments housing each power circuit breaker are mounted in the vertical section to form the switchgear assembly. This assembly isolates the circuit breakers from the bus/cable section and from adjacent circuit breaker compartments.

The bus/cable section includes the main horizontal bus, riser bus, connections from the main bus to each set of primary disconnects, and load side copper runback bus. The cable lugs are accessible without reaching over the main bus.

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

Main and Ground Bus

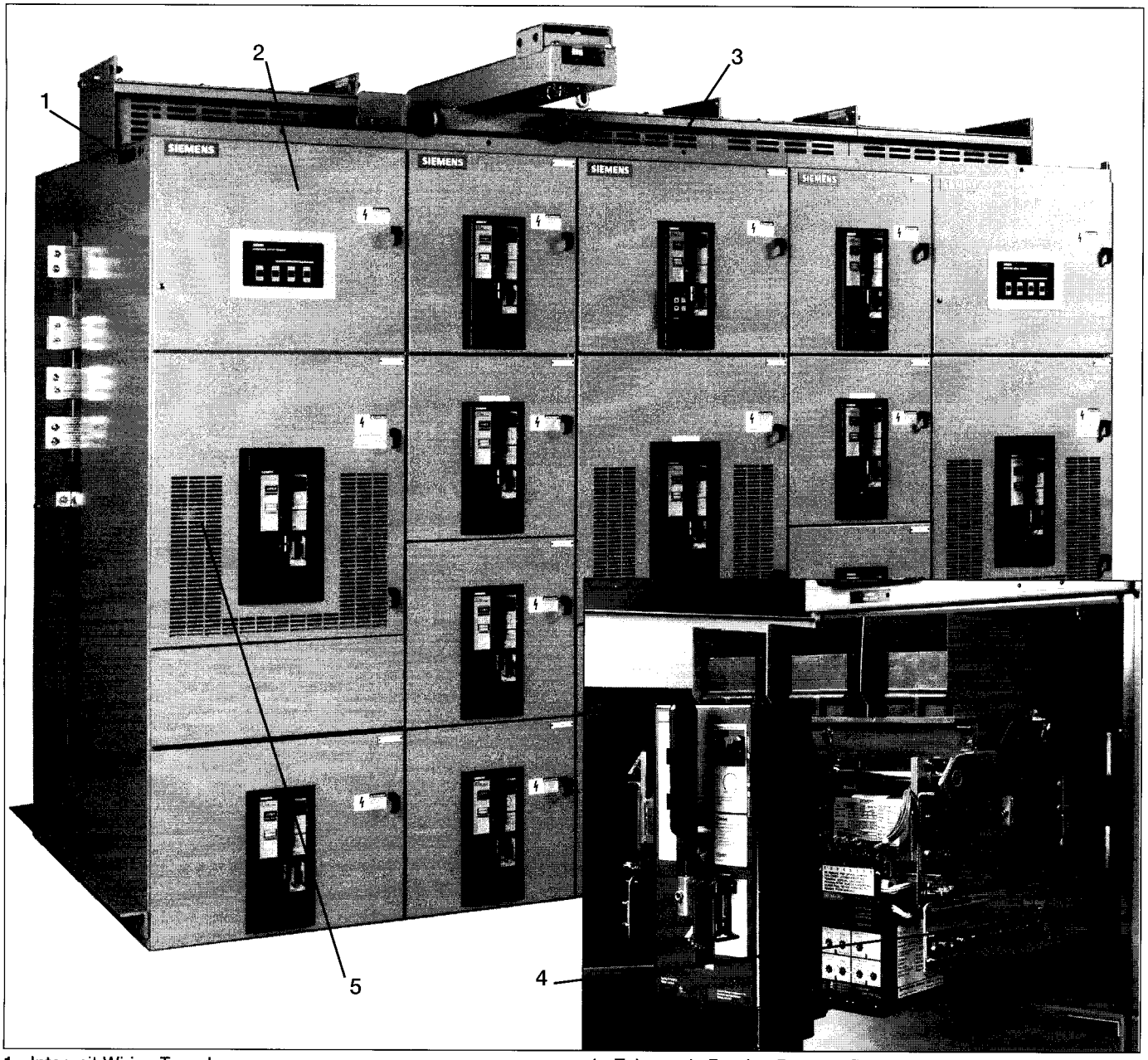
The standard main bus is **welded aluminum**. Provisions for future extension of main bus conductors include tin-plated joints with high tensile strength steel hardware and conical (Belleville) washers. This allows for bolted connections that eliminates field welding of the bus. Optionally available are silver-plated or tin-plated copper bus.



Welded aluminum main bus and risers

Switchgear Assembly

Switchgear Assembly Detail



1. Interunit Wiring Trough
2. Meter and Auxiliary Compartment
3. Ventilation and Lifting Structure
4. Telescopic Breaker Drawout Rails
5. Ventilation Openings (RL-2000, RL-3200 and RL-4000)

Switchgear Assembly

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. An insulated main and vertical bus are optionally available.

The 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 or 4000 amperes continuous current.

A standard 1/4 x 2 inch copper ground bus extends through all sections and is securely bolted. 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 run-backs for feeder circuits are **one-piece copper** construction. Run-backs are **insulated** with sleeve tubing in the main bus area and 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. Sleeve-type **wire markers** are provided as standard on each end of all control wires.

Insulation

The insulation used in the switchgear is Pyro-Shield, a fiberglass-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.

Pyro-Shield moldings are used for the circuit breaker base plate to mount the contact structure. The moldings include contoured surfaces to increase creepage distances and to avoid continuous surfaces for dust build-up.

Primary disconnects are insulated by Pyro-Shield sheets in the compartment. Compartments reserved for future circuit breakers have a Pyro-Shield sheet barrier to cover the primary disconnects.

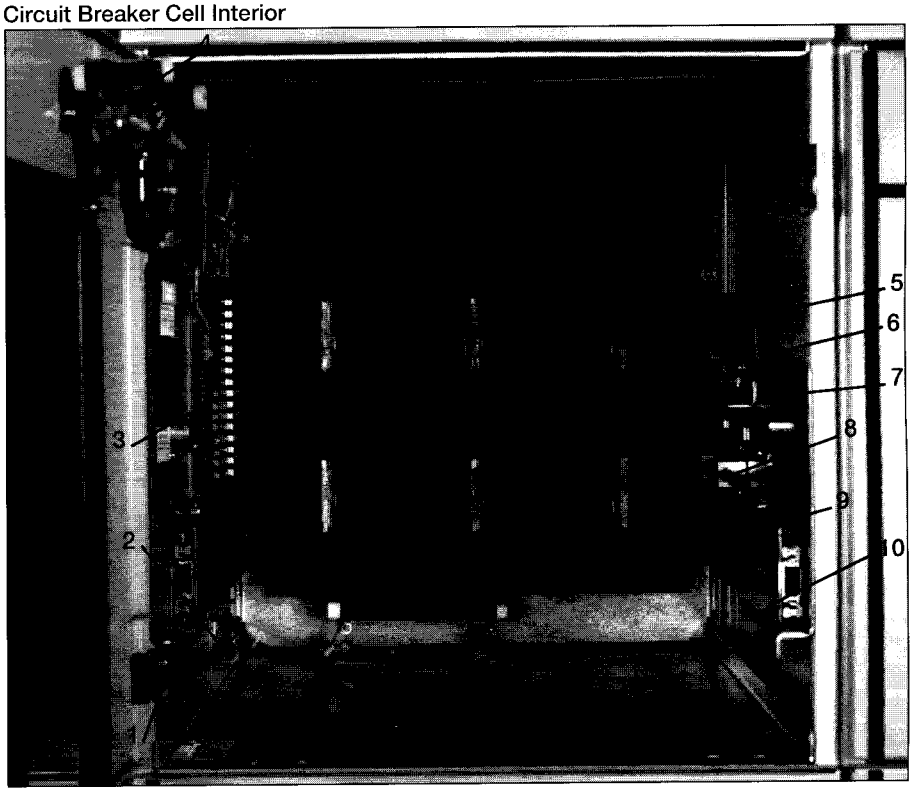
Circuit Breaker Compartments

Typical circuit breaker compartments include primary disconnects, ground disconnect, drawout rails, and associated safety interlocks and secondary disconnects, if appropriate. The drawout rails have ball-bearings to reduce friction. The rails telescope, allowing 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. The pull-out fuse holder has a set of clips to store the holder in the fuse block when the circuit is disconnected.

Up to three current transformers for metering or relaying can be mounted in each compartment.

Circuit Breaker Cell Interior



1. Control Circuit Fuses
2. Ground Disconnect
3. Secondary Disconnect
4. Front Panel Devices
5. Primary Disconnect
6. TOC Switch Operator
7. Interference Interlock
8. MOC Switch Operator
9. Space Heater
10. Drawout Rails

Switchgear Assembly

Circuit breaker compartment front panels can be used to hold a variety of auxiliary devices. A typical compliment of devices includes a breaker control switch with red & green light, ammeter with switch, and PK-2 test block.

Metering and Auxiliary Compartments

Metering and auxiliary compartments are available to house devices such as voltage transformers, metering, control power transformers, and supervisory devices that do not fit on a normal breaker door.

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. Tables 14 and 15 show the ratings available.

Current transformers are normally mounted on the compartment primary disconnect studs where they are readily accessible. Tables 16 and 17 show the ratings available.

Table 14. Voltage Transformers

Ratio	Accuracy Class @ 60 Hz Burden W	X	Y	Volt-Amp Rating	Thermal Rating VA	Cycles
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 15. Control Power Transformers - 115°C Rise

KYA	Phase	Primary Voltage	Secondary Voltage
3 5 10 * 15 *	Single	240/480	120/240

* Requires complete compartment.

Table 16. Current Transformers for RL-800, RLE-800, RLI-800, RL-1600, RL-2000 or RLE-2000, Applications[1]

Ratio	Accuracy @ 60 HZ Metering Burden (ohms) B-0.1	B-0.2	B-0.5	B-1.0	B-2.0	Relay Class
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

[1]Breaker compartment will accept 3 CT's in-line on lower disconnects

Table 17. Current Transformers for RL-3200[1] or RL-4000[2] or RLE-4000[2] Applications

Ratio	Accuracy @ 60 HZ Metering Burden (ohms) B-0.1	B-0.2	B-0.5	B-1.0	B-2.0	Relay Class
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	0.6	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

[1] Breaker compartment will accept a total of 6 CT's, 3 on lower and 3 on upper disconnects.
[2] Breaker compartment will accept 3 CT's in staggered arrangement, 2 on lower and 1 on upper disconnects.

Switchgear Assembly

4700 Power Meter

The Siemens 4700 electronic metering package can be used in place of traditional meters. As many as 12 functions performed by analog devices can be measured by the 4700 power meter with accuracy, flexibility, and features the older technology doesn't offer.

Table 18. 4700 Measured Parameters

Measured Parameters	Accuracy	
	Standard	High (optional)
Phase currents Avg phase current Ampere demand Phase voltages Avg phase voltage Line voltages Avg line voltage	1.0%	.25%
kW kVA kVAR kW Demand kW Hours kVAR Hours	2.0%	.50%
Power Factor	4.0%	1.0%
Frequency	.5Hz	.2Hz

The 4700 power meter records out-of-limit events and minimum and maximum values for each measured parameter. The hardened electronics can withstand surges and transients in accordance with ANSI C37.90.1. The display used is a 20-character high-visibility readout LCD that automatically scales values.

Up to three relay contacts can be added to output channels to activate alarms, shed loads, or trip breakers as desired. An output can be tied to any measured parameter to replace a transducer and provide an analog output to SCADA, control systems, or programmable logic controllers.

The 4700 meter can also serve as a data collection point. Up to four discrete dry-contact type inputs are optionally available to provide data such as on/off status of a fan or pump, indication of overtemperature of a transformer or other on/off-type indications. Such data may be transmitted to supervisory computers via the ACCESS network.

4700 Power Meter with easy to understand display

For complete information, refer to Bulletin SG3089.

Feeder Metering

Traditional instrumentation and control devices are normally located on feeder circuit breaker compartment doors. These include:

- Circuit breaker control switch, rotary type (or pushbutton)
- Indicating lights, 1-red and 1-green
- Ammeter, 3 1/2" scale, 2% accuracy
- Ammeter transfer switch, rotary type
- Current test block, 6 pole, type PK-2

Switchgear Assembly

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
- Container of touch-up paint

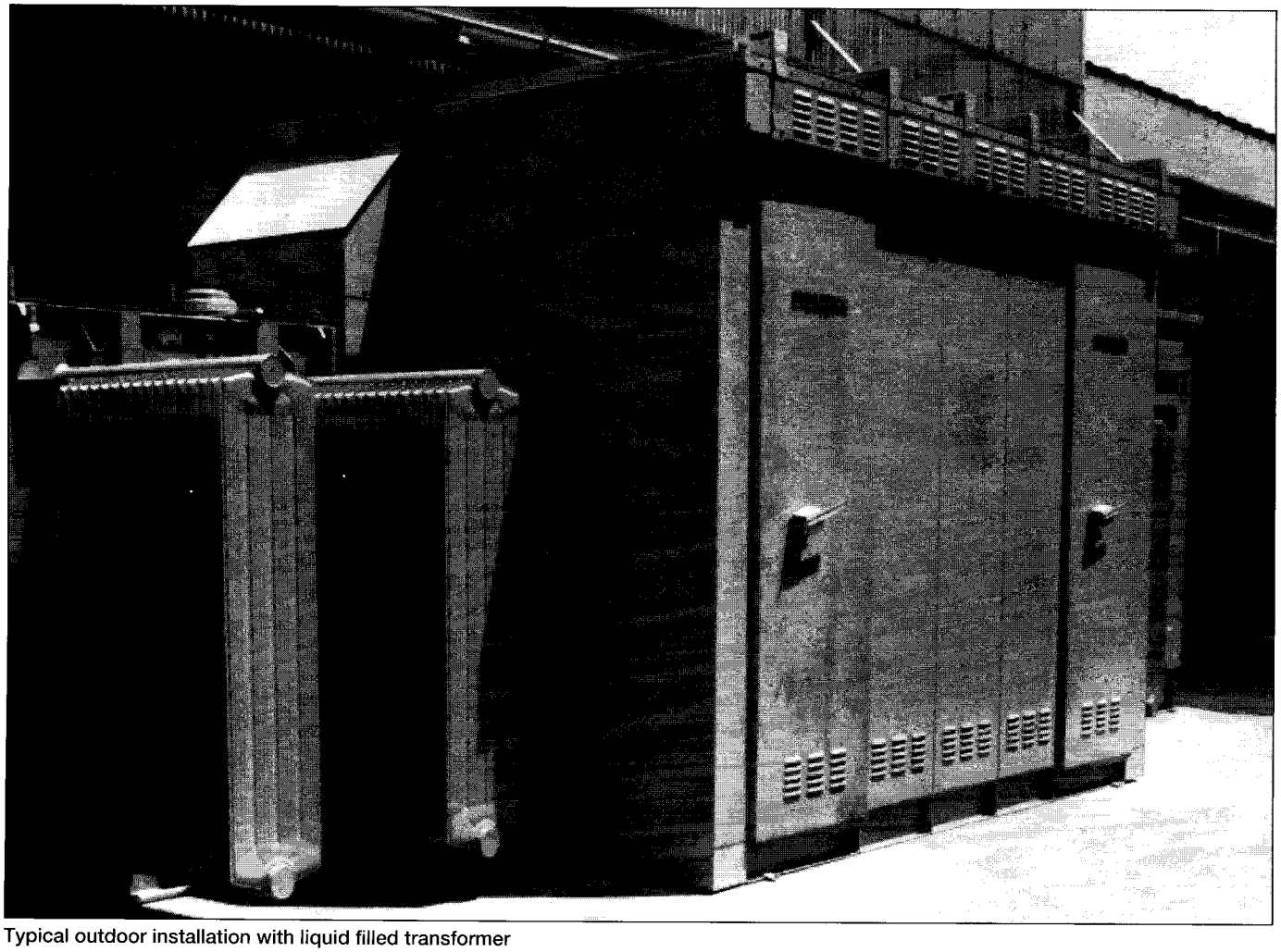
As an optional accessory, a test cabinet is available for indoor use that is wall mounted with necessary equipment for testing electrically operated breakers that have been removed from the breaker compartment.

Outdoor Switchgear

Type SR outdoor switchgear is enclosed in a weather resistant (NEMA 3R) steel housing. All exterior doors extend below the floor line and are sealed with synthetic rubber gaskets.

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 1/32 inch thick 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. The full length front doors are hinged and may be padlocked. Rear doors are hinged and secured with captive bolts.

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 at each end of the aisle. A GFI convenience outlet is included.



Typical outdoor installation with liquid filled transformer

Switchgear Assembly

Space heaters are provided in the compartment areas to eliminate excessive condensation. One optional thermostat in the bus compartment can control the operation of the space heaters. The rear of each vertical section has a door for access to the primary cable entrance area and secondary terminal blocks.

Options

Type R switchgear has several options. Some of these include:

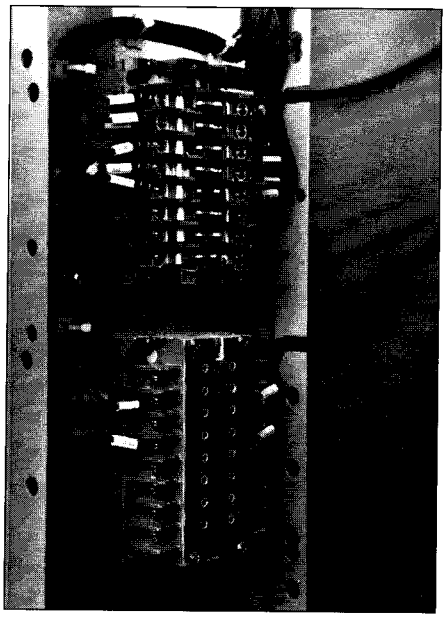
- Switchgear Mounted Hoist
- Breaker Compartment Shutters
- Wire Trough Covers
- Hinged Rear Doors
- Key Interlocks
- TOC and MOC Switches
- PTS4 Static Trip Test Set

• **Switchgear Mounted Hoist-** A hoist that travels along rails can be mounted on top of the switchgear to ease breaker handling. This hoist is standard on outdoor switchgear and optional on indoor switchgear.

The hoist connects to the breaker in the withdrawn position via a lifting bar. A handcrank lifts and holds the breaker while it is guided to the desired location.

• **TOC and MOC Switches** - The Truck Operated Cell (TOC) Switch is used to provide interlocking control or remote indication of the breaker racking position.

The Cubicle Mounted Auxiliary switch or Mechanism Operated Cell (MOC) switch is used to provide interlocking control or remote indication based on the main contact position (open or closed).



MOC and TOC Switches. TOC shown with cover removed

The switches contain 4 (or 8) contacts and are mounted in the rear of the vertical section. The switch is actuated by a push-pull mechanism at the circuit breaker.

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.

• **Shutters -** Shutters are available to provide protection against accidental contact with primary disconnects in a compartment when the breaker is removed. The shutter assembly is driven by the movement of the breaker.

• **Wire Trough Covers -** Removable metal wire trough covers are available for enclosing secondary wiring within each vertical section in the primary bus and outgoing cable areas.

• **Hinged Rear Door** - A full-height, hinged, formed rear door is available in place of standard two-piece, bolted backplates on indoor switchgear. Hinged doors are standard on outdoor switchgear.

• **Key Interlock -** Key interlocks can be provided in the breaker compartment that hold the key when the circuit breaker is closed, thus preventing operation of a remote device unless the breaker is open. The main and tie breakers can be interlocked as well as the main breakers and disconnects or interrupter switches.

• **PTS4 Test Set** - PTS4 Test Set allows testing of the full range of protective settings of Static Trip III trip units. Testing may be done with trip unit mounted on the circuit breaker or standing alone on the workbench.

Portable PTS4 Test Set provides convenient testing of protective features

Table 19. Auxiliary Switch[1] and MOC and TOC Switch Ratings.

		DC			AC	
Volts	24	48	125	250	120	240
Make and interrupting capacity, amps	30	20	10	2	25	20
Continuous current [1]	30	30	30	30	30	30

[1] For breaker mounted switches, limited to 20A. continuous rating.

Remote Monitoring Capability

Siemens switchgear equipment can be monitored remotely through the Power Monitor™ display and monitoring unit and the ACCESS™ PC-based electrical distribution communication system.

Power Monitor Panel

The Power Monitor display and monitoring unit displays data from the Static Trip IIIC trip units, 4700 power meters, SAMMS™ motor protective relays, and other Siemens devices with built-in communications capability. The Power Monitor display and monitoring unit eliminates the need for door-mounted meters, indicators and switches.

The Power Monitor display and monitoring unit delivers data for facility planning, daily operations, and utility cost control and allocation. Real-time and historical data is collected, recorded and displayed to assist with evaluating the electrical distribution system performance.

An early warning system provides alarm capability to avoid costly shutdowns. Data is available for tripped unit conditions and diagnostic checking.

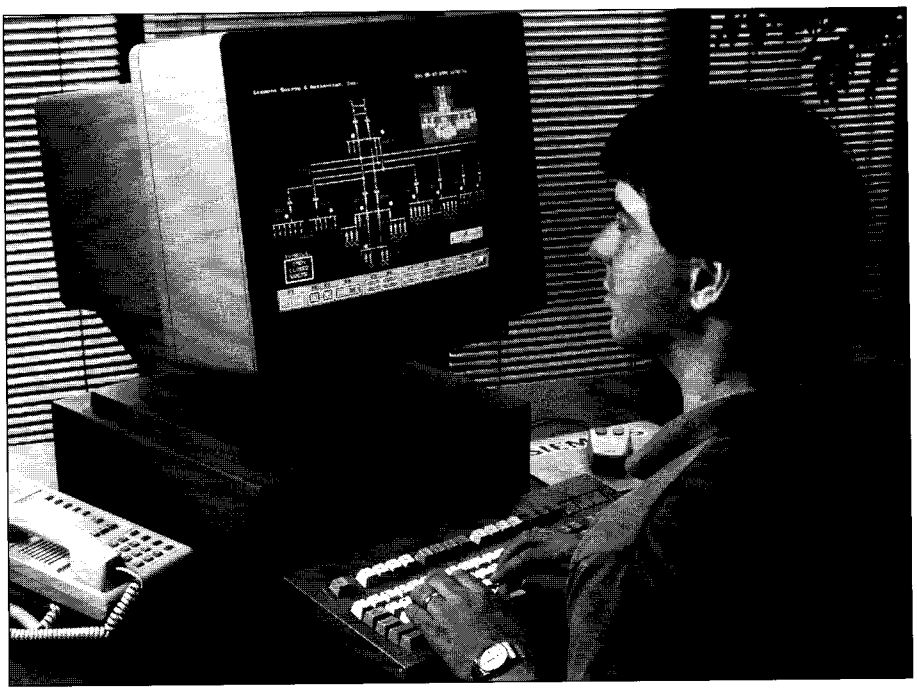
ACCESS Electrical Distribution Communication System

The ACCESS system is a facility-wide power management data system that collects and displays significant power data. The data can be used to maximize process efficiencies, allocate utility costs, and better manage total power consumption and demand.

Information can be collected by substation, assembly, business unit, or other possible grouping.

The system can interface with up to 32 Power Monitors to allow communication with more than 2000 devices. Communication with distributed control or SCADA systems is also possible.

Power Monitor display and monitoring unit with sealed input panel



ACCESS system host computer with system one line

Selection Criteria

This section provides recommended circuit breaker usage for secondary unit substation applications at typical low voltage ratings, on three-phase systems. The circuit breakers recommended match standard transformer capacities and system parameters to meet the electrical, thermal, and mechanical requirements.

This information serves as a guideline. Other factors that will affect the breaker operation need to be considered. Such factors include voltage, power factor, temperature, altitude, circuit configurations, large motor loads, high inertia (WK^2) motor loads, unusual or cyclic load characteristics.

Short circuit currents are determined using assumptions and approximations that have been proven to be valid. These will not apply in all cases and the short circuit calculations for the specific application should be made. (Refer to IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems, IEEE Standard No. 242-1986.)

Recommendations are given for standard unfused circuit breakers used in selective and fully rated systems. If continuous current requirements allow a lower circuit breaker rating or configurations requiring higher interrupting capacity, use high interrupting type (RLI), extended interrupting type (RLE) or fused type (RLF) circuit breakers.

Main breakers are normally provided without an instantaneous trip element to provide selective coordination with downstream feeder breakers. Feeder breakers in fully rated systems are normally supplied with an instantaneous trip element.

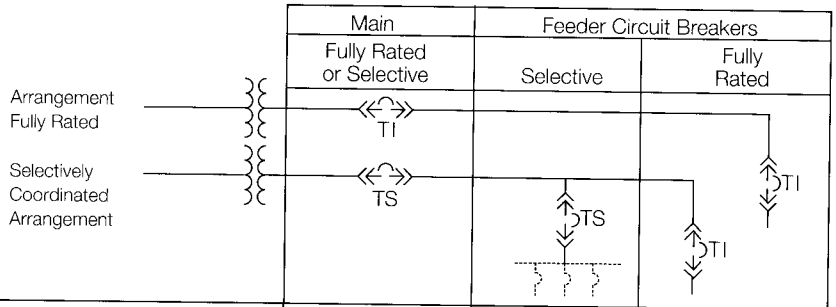
Assumptions

The short circuit currents are calculated based on the following assumptions:

- Source of power to the secondary switchgear is the substation transformer.
- Different transformer impedance values are shown. For impedances not shown, short circuit currents are inversely proportional.
- Transformer kVA ratings are based on 65°C liquid filled type, or 150°C dry type. For liquid type with 55/65°C dual temperature rise, continuous capacities increase by 12 percent. For open ventilated dry type with 115/150°C dual temperature rise, continuous capacities increase by 15 percent; with 80/150°C dual temperature rise, increase by 135 percent. For fan cooled ratings, increase liquid type by 15 percent, (except 2500 kVA units which increase 25 percent); dry type by 33 1/3 percent.
- The short circuit current contribution from connected motor load is based on standard motors. The assumed contribution is 2 times transformer full-load current for 208Y systems, and 4 times transformer full load current for 240, 480 and 600V systems.
- Total connected motor kVA does not exceed 50 percent of transformer base kVA for 208Y systems and 100 percent for 240, 480, or 600 volt systems. For other percentages, the motor contribution will be in direct proportion.
- All short circuit current values are RMS symmetrical.
- A three-phase bolted fault occurs at the outgoing terminals of the feeder breaker.

Selection Criteria

Table 20.
Application Table 208 Volts, Three-Phase

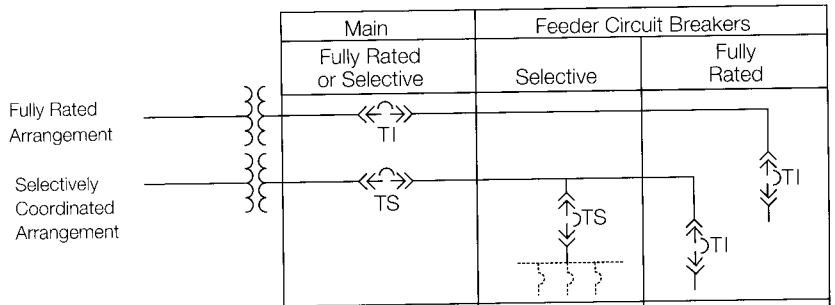


Transformer Rating 3-Phase kVA and Impedance Percent	Maximum Short-Circuit MVA Available From Primary System	Full Load Continuous Current (amperes)[1]	Short-Circuit Rating Symmetrical Current (amperes)			Main	Feeder Circuit Breakers	
			Trans-former Alone	50% Motor Load	Combined	Long-Time Instantaneous or Long-Time Short-Time	Long-Time Short-Time	Long-Time Instantaneous
						Minimum Rating Breaker		
						Breaker	Breaker	Breaker
300 5%	50 100 150 250 500 750 Unlimited	834	14900 15700 16000 16300 16500 16600 16700	1700	16600 17400 17700 18000 18200 18300 18400	RL-1600	RL-800	RL-800
500 5%	50 100 150 250 500 750 Unlimited	1388	23100 25200 26000 26700 27200 27400 27800	2800	25900 28000 28800 29500 30000 30200 30600	RL-1600	RL-800 RLE-800	RL-800
750 5.75%	50 100 150 250 500 750 Unlimited	2080	28700 32000 33300 34400 35200 35600 36200	4200	33900 36200 37500 38600 39400 39800 40400	RL-3200	RLE-800	RL-800
1000 5.75%	50 100 150 250 500 750 Unlimited	2780[2]	35900 41200 43300 45200 46700 47300 48300	5600	41500 46800 48900 50800 52300 52900 53900	RL-3200[2]	RLE-800 RL-1600 RL-2000	RL-800 RLE-800

[1] With transformer operating on base temperature rise.
[2] The main circuit breaker shown does not have sufficient continuous current carrying capacity for full capacity application if the transformer is dual temperature rise and/or if ever fan cooled.

Selection Criteria

Table 21
Application Table 240 Volts, Three-Phase

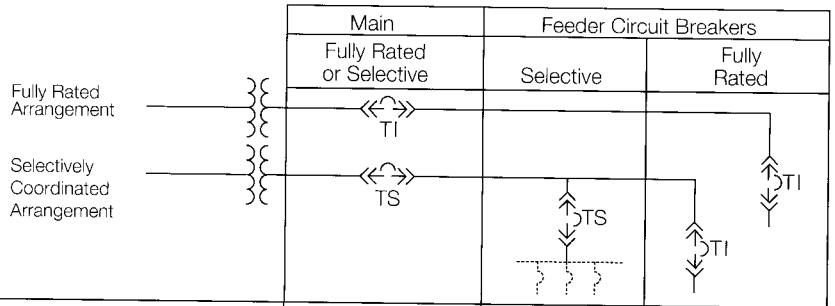


Transformer Rating 3-Phase kVA and Impedance Percent	Maximum Short-Circuit MVA Available From Primary System	Full Load Continuous Current (amperes)[1]	Short-Circuit Rating Symmetrical Current (amperes)			Main	Feeder Circuit Breakers	
						Fully Rated or Selective	Selective	Fully Rated
			Trans-former Alone	100% Motor Load	Combined	Long-Time Instantaneous or Long-Time Short-Time	Long-Time Short-Time	Long-Time Instantaneous
						Minimum Rating Breaker		
						Breaker	Breaker	Breaker
300 5%	50 100 150 250 500 750 Unlimited	722[2]	12900 13600 13900 14100 14300 14325 14400	2900	15800 16500 16800 17000 17200 17225 17300	RL-800[2]	RL-800	RL-800
500 5%	50 100 150 250 500 750 Unlimited	1203	20000 21900 22500 23100 23600 23700 24100	4800	24800 26700 27300 27900 28400 28500 28900	RL-1600	RL-800	RL-800
750 5.75%	50 100 150 250 500 750 Unlimited	1804[2]	24900 27800 28900 29800 30600 30800 31400	7200	32100 35000 36100 37000 37800 38000 38600	RL-2000[2]	RLE-800	RL-800
1000 5.75%	50 100 150 250 500 750 Unlimited	2406	31000 35600 37500 39100 40400 40900 41800	9600	40600 45200 47100 48700 50000 50500 51400	RL-3200	RLE-800 RL-1600 RL-2000	RL-800 RLE-800
1500 5.75%	50 100 150 250 500 750 Unlimited	3609[2]	41200 49800 53500 56800 59600 60600 62800	14400	55600 63200 67900 71200 74000 75000 77200	RL-4000[2]	RL-2000 RLE-2000	RLE-800 RLI-800

[1] With transformer operating on base temperature rise.
[2] The main circuit breaker shown does not have sufficient continuous current carrying capacity for full capacity application if the transformer is dual temperature rise and/or if ever fan cooled.

Selection Criteria

Table 22
Application Table 480 Volts, Three-Phase

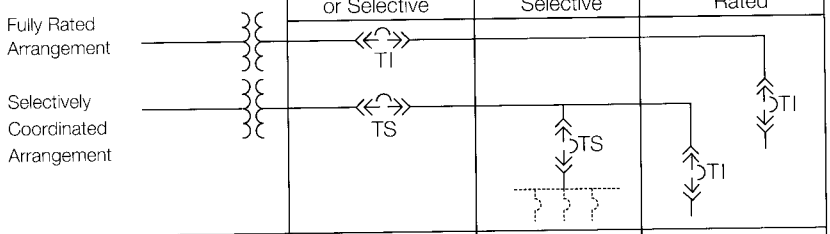


Transformer Rating 3-Phase kVA and Impedance Percent	Maximum Short-Circuit MVA Available From Primary System	Full Load Continuous Current (amperes)[1]	Short-Circuit Rating Symmetrical Current (amperes)			Main	Feeder Circuit Breakers	
						Fully Rated or Selective	Selective	Fully Rated
			Trans-former Alone	100% Motor Load	Combined	Long-Time Instantaneous or Long-Time Short-Time	Long-Time Short-Time	Long-Time Instantaneous
						Minimum Rating Breaker		
						Breaker	Breaker	Breaker
300 5%	50 100 150 250 500 750 Unlimited	361	6400 6800 6900 7000 7100 7150 7200	1400	7800 8200 8300 8400 8500 8550 8600	RL-800	RL-800	RL-800
500 5%	50 100 150 250 500 750 Unlimited	601	10000 10900 11300 11600 11800 11900 12000	2400	12400 13300 13700 14000 14200 14300 14400	RL-800	RL-800	RL-800
750 5.75%	50 100 150 250 500 750 Unlimited	902	12400 13900 14400 14900 15300 15400 15700	3600	16000 17500 18000 18500 18900 19000 19300	RL-1600[2]	RL-800	RL-800
1000 5.75%	50 100 150 250 500 750 Unlimited	1203	15500 17800 18700 19600 20200 20400 20900	4800	20300 22600 23500 24400 25000 25200 25700	RL-1600	RL-800	RL-800
1000 8.0%	50 100 150 250 500 750 Unlimited	1203	12000 13300 13800 14300 14600 14800 15000	4800	16800 18100 18600 19100 19400 19600 19800	RL-1600	RL-800	RL-800

[1] With transformer operating on base temperature rise.
[2] The main circuit breaker shown does not have sufficient continuous current carrying capacity for full capacity application if the transformer is dual temperature rise and/or if ever fan cooled.

Selection Criteria

Table 22
Application Table 480 Volts, Three-Phase
(Continued)

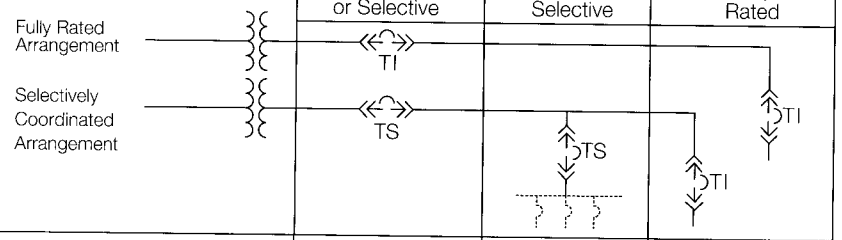


Transformer Rating 3-Phase kVA and Impedance Percent	Maximum Short-Circuit MVA Available From Primary System	Full Load Continuous Current (amperes)[1]	Short-Circuit Rating Symmetrical Current (amperes)			Main	Feeder Circuit Breakers	
						Fully Rated or Selective	Selective	Fully Rated
			Trans-former Alone	100% Motor Load	Combined	Long-Time Instantaneous or Long-Time Short-Time	Long-Time Short-Time	Long-Time Instantaneous
						Minimum Rating Breaker		
						Breaker	Breaker	Breaker
1500 5.75%	50 100 150 250 500 750 Unlimited	1804[2]	20600 24900 26700 28400 29800 30300 31400	7200	27800 32100 33900 35600 37000 37500 38600	RL-2000[2,3]	RL-800 RLE-800	RL-800 RLE-800
1500 8.0%	50 100 150 250 500 750 Unlimited	1804[2]	16400 18900 20000 20900 21700 22000 22500	7200	23600 26100 27200 28100 28900 29200 29700	RL-2000[2,3]	RL-800	RL-800
2000 5.75%	50 100 150 250 500 750 Unlimited	2405	24700 31000 34000 36700 39100 40000 41800	9600	34300 40600 43600 46300 48700 49600 51400	RL-3200[4]	RLE-800 RL-1600 RL-2000	RLE-800
2500 5.75%	50 100 150 250 500 750 Unlimited	3008[2]	28000 36500 40500 44600 48100 49400 52300	12000	40000 48500 52500 56600 60100 61400 64300	RL-3200[2]	RLE-800 RL-1600 RL-2000	RLE-800
3000 5.75%	50 100 150 250 500 750 Unlimited	3607[2]	30700 41200 46500 51900 56800 58700 62700	14400	45100 55600 60900 66300 71200 73100 77100	RL-4000[2]	RL-1600 RL-2000 RLE-2000	RLE-800 RLI-800

[1] With transformer operating on base temperature rise.
[2] The main circuit breaker shown does not have sufficient continuous current carrying capacity for full capacity application if the transformer is dual temperature rise and/or if ever fan cooled.
[3] If transformer is dual temperature rise and/or fan cooled, use RL-3200.
[4] If transformer is dual temperature rise and/or fan cooled, use use RL-4000.

Selection Criteria

Table 23
Application Table 600 Volts, Three-Phase

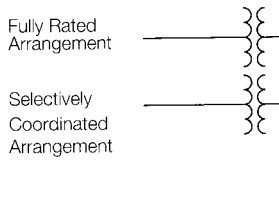


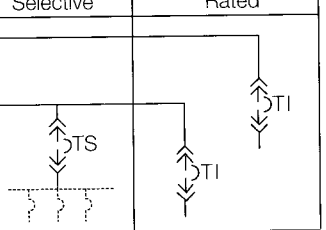
Long-Time Transformer Rating 3-Phase kVA and Impedance Percent	Maximum Short-Circuit MVA Available From Primary System	Full Load Continuous Current (amperes)[1]	Short-Circuit Rating Symmetrical Current (amperes)			Main	Feeder Circuit Breakers	
						Fully Rated or Selective	Selective	Fully Rated
			Trans-former Alone	100% Motor Load	Combined	Long-Time Instantaneous or Long-Time Short-Time	Long-Time Short-Time	Long-Time Instantaneous
						Minimum Rating Breaker		
						Breaker	Breaker	Breaker
300 5%	50 100 150 250 500 750 Unlimited	289	5200 5500 5600 5600 5700 5750 5800	1200	6300 6700 6800 6800 6900 6950 7000	RL-800	RL-800	RL-800
500 5%	50 100 150 250 500 750 Unlimited	481	8000 8700 9000 9300 9400 9500 9600	1900	9900 10600 10900 11200 11300 11400 11500	RL-800	RL-800	RL-800
750 5.75%	50 100 150 250 500 750 Unlimited	722[2]	10000 11100 11600 11900 12200 12300 12600	2900	12900 14000 14500 14800 15100 15200 15500	RL-800[2]	RL-800	RL-800
1000 5.75%	50 100 150 250 500 750 Unlimited	962	12400 14300 15000 15600 16200 16400 16700	3900	16300 18200 18900 19500 20100 20300 20600	RL-1600	RL-800	RL-800

[1] With transformer operating on base temperature rise.
[2] The main circuit breaker shown does not have sufficient continuous current carrying capacity for full capacity application if the transformer is dual temperature rise and/or if ever fan cooled.

Selection Criteria

Table 23
Application Table 600 Volts, Three-Phase
(Continued)





Transformer Rating 3-Phase kVA and Impedance Percent	Maximum Short-Circuit MVA Available From Primary System	Full Load Continuous Current (amperes)[1]	Short-Circuit Rating Symmetrical Current (amperes)			Main	Feeder Circuit Breakers	
						Fully Rated or Selective	Selective	Fully Rated
			Trans-former Alone	100% Motor Load	Combined	Long-Time Instantaneous or Long-Time Short-Time	Long-Time Short-Time	Long-Time Instantaneous
						Minimum Rating Breaker		
						Breaker	Breaker	Breaker
1500 5.75%	50 100 150 250 500 750 Unlimited	1444[2]	16500 20000 21400 22700 23900 24200 25100	5800	22300 25800 27200 28500 29700 30000 30900	RL-1600[2,3]	RL-800	RL-800
							RLE-800	RLE-800
2000 5.75%	50 100 150 250 500 750 Unlimited	1924[2]	19700 24800 27200 29400 31300 32000 33500	7800	27500 32600 35000 37200 39100 39800 41300	RL-2000[2,3]	RL-800	RL-800
							RLE-800	RLE-800
2500 5.75%	50 100 150 250 500 750 Unlimited	2404	22400 29200 32400 35600 38500 39500 41800	9600	32000 38800 42000 45200 48100 49100 51400	RL-3200	RLE-800	RLE-800
							RL-1600	
							RL-2000	

[1] With transformer operating on base temperature rise.
[2] The main circuit breaker shown does not have sufficient continuous current carrying capacity for full capacity application if the transformer is dual temperature rise and/or if ever fan cooled.
[3] If transformer is dual temperature rise and/or fan cooled, use RL-3200.

Selection Criteria

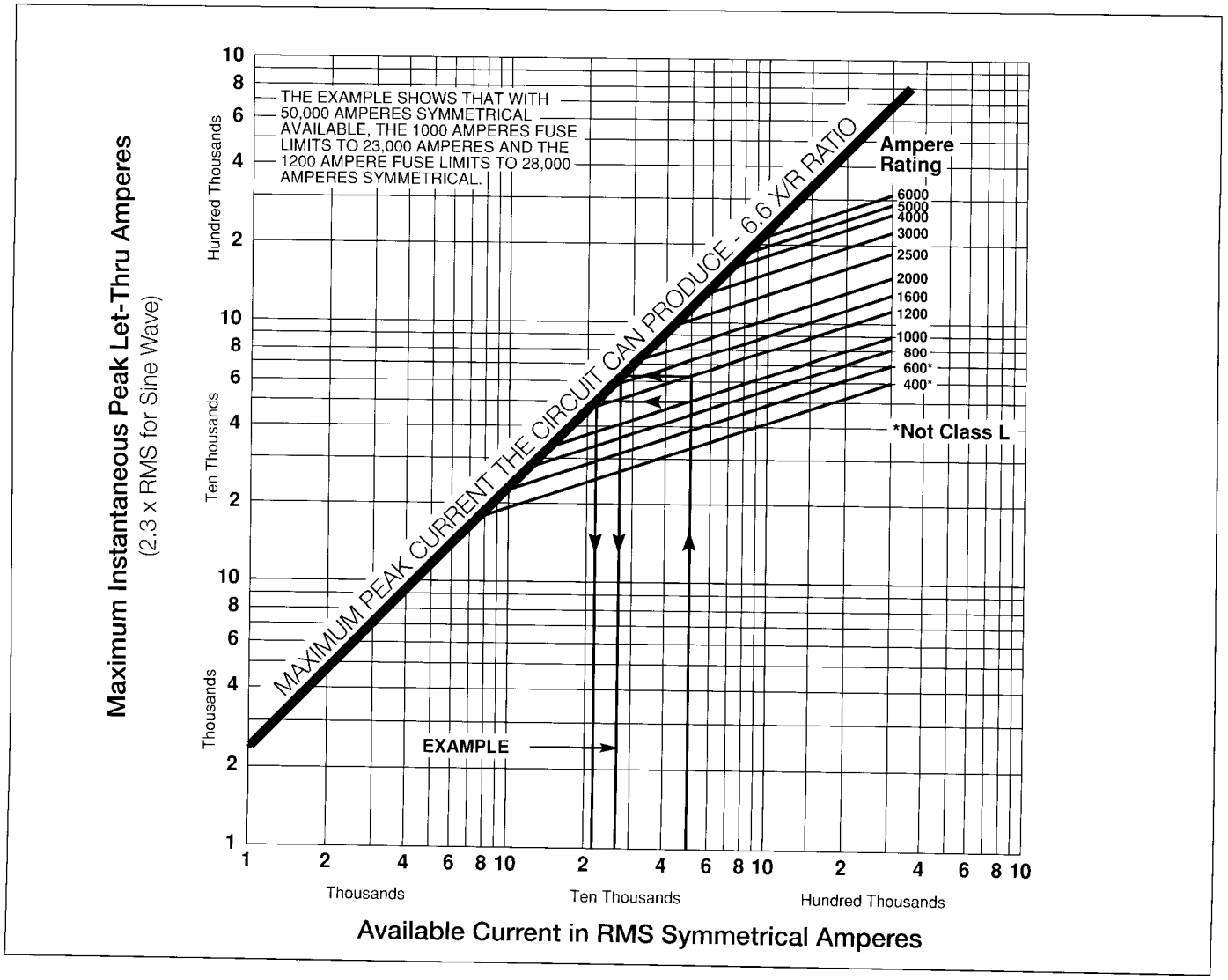
Type RLF fused circuit breakers are a combination of current limiting fuses and RL circuit breakers. Fused breakers clear short circuits rapidly and have high interrupting capacity. Various fuse sizes are available. Fused breakers are typically used to protect:

- Circuit breakers that experience short circuit currents exceeding the interrupting rating of the circuit breaker, particularly from feeders to small loads.
- Loads such as motor control centers, panelboards, and bus ducts that may have ratings below the available short circuit currents, or be damaged by faults that are not limited or cleared rapidly.

For protecting circuit breakers, use a high fuse rating such as 1200A for the RLF-800. This will minimize fuse blowing because most faults will be detected by the instantaneous element of the static trip device.

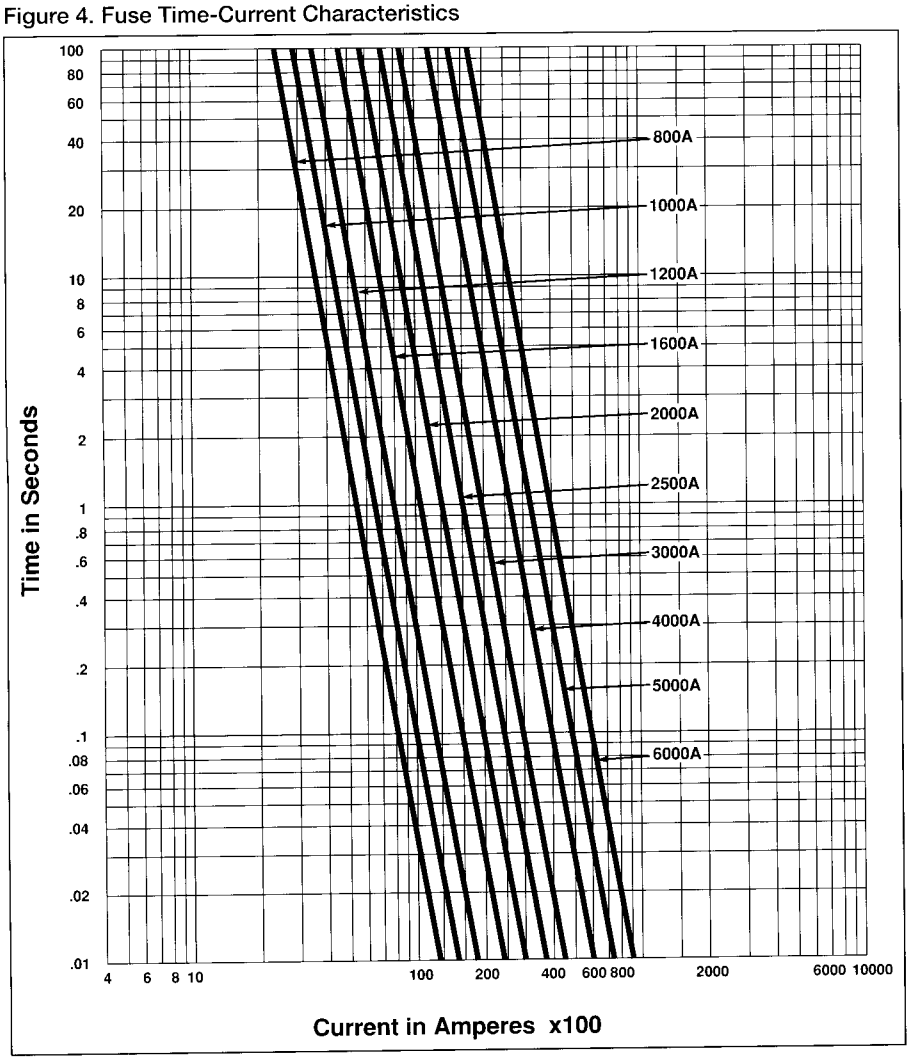
For protecting loads, use a fuse rating that limits the fault to less than the rating of the equipment. Check the limiting effect of the fuse with the following Let-Thru characteristic chart, Figure 2. When selecting fuse values, also consider thermal conditions, upstream devices, and melting time.

Figure 3. Peak Let-Thru Current



Selection Criteria

Figure 4. Fuse Time-Current Characteristics



For thermal coordination with the circuit breaker, the following rules typically apply:

1. Always use a fuse rated 125 percent or higher than the breaker longtime pickup setting.

2. For a continuous current of 80 to 90 percent of breaker rating, use a fuse rated 150 percent or higher than the breaker frame rating.

3. For a continuous current of 90 to 100 percent of breaker rating, use a fuse rated 200 percent or higher than the breaker frame rating.

Upstream devices such as circuit breakers, fuses, or relays need to be coordinated with the fuse value. Time-current curves should be prepared to verify proper operation.

The melting time of a fuse needs to be coordinated with the static trip device. The melting time of a fuse should be at least double the total clearing time of the breaker when the static trip device transfers to instantaneous pickup. Refer to the following Fuse Time-Current chart for fuse melting characteristics.

Dimensions & Configurations

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).

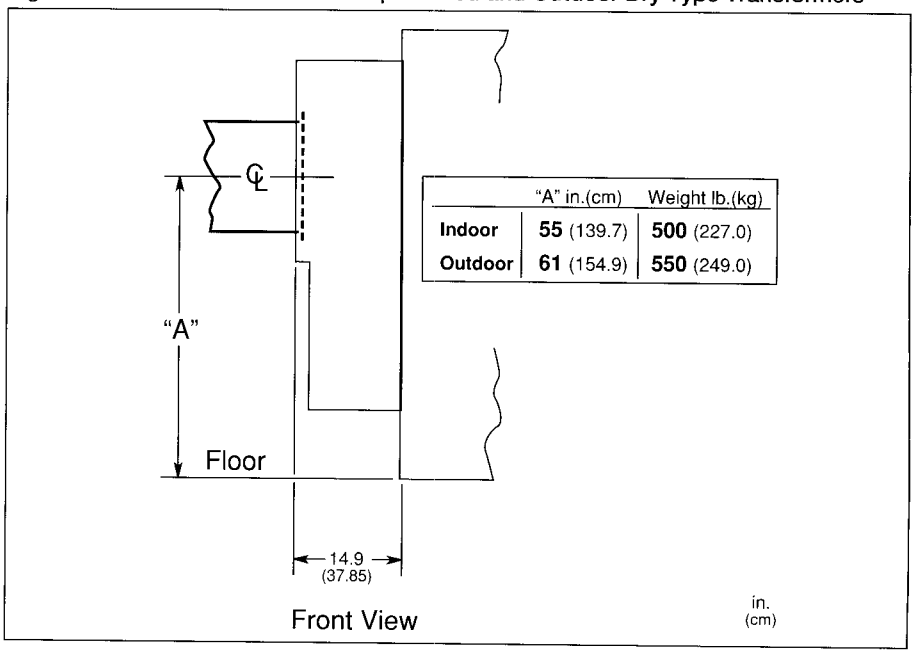
Normal indoor vertical sections are 101 inches (256.5 cm) high and 60 inches (152.4 cm) deep. A top mounted hoist, which is shipped as an accessory in a separate container, adds 2 inches (5.1 cm) for a total installed height of 103 inches (261.5 cm).

The outdoor switchgear assembly contains the indoor assembly in an outdoor housing. The overall height is 113.0 inches (287.0 cm) and the depth is 119.4 inches (303.3 cm).

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.

Figure 5. Transition Sections For Liquid Filled and Outdoor Dry Type Transformers



	"A" in.(cm)	Weight lb.(kg)
Indoor	**55** (139.7)	**500** (227.0)
Outdoor	**61** (154.9)	**550** (249.0)

Dimensions & Configurations

Table 24. Breaker Element Weight

	Element Type	RL-800	RLE-800	RLI-800	RL-1600	RL-2000	RLE-2000	RL-3200	RL-4000	RLE-4000
Operation	Manual	140 (64)	170 (77)	175 (79)	180 (82)	210 (96)	215 (98)	290 (132)	350 (159)	355 (161)
	Electrical	150 (68)	180 (82)	185 (84)	190 (86)	220 (100)	225 (102)	300 (136)	360 (164)	365 (166)
Additional Weight for Shipping		45 (21)	45 (21)	45 (21)	45 (21)	45 (21)	45 (21)	50 (23)	50 (23)	50 (23)

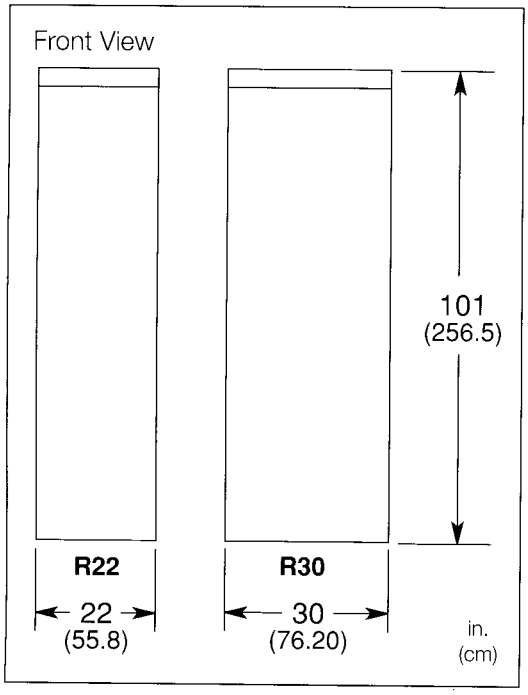
Fused Element Weight

	Element Type	RLF-800	RLF-1600	RLF-2000	RLF-3200	RFC-3200[1]	RLF-4000	RFC-4000[2]
Operation	Manual	195 (84)	310 (141)	325 (147)	290[4] (132)	390[3,4] (177)	350[4] (159)	450[3,4] (204)
	Electrical	205 (93)	320 (145)	335 (152)	330[4] (136)		360[4] (163)	
Additional Weight for Shipping		45 (21)	45 (21)	45 (21)	50 (23)	50 (23)	50 (23)	50 (23)

[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.
[4] For total weight, add weight of breaker element and separate fuse carriage.

Dimensions & Configurations

Figure 6. Auxiliary Sections



Weights for Figure 5.

	Weights lb. (kg)	
	R22	R 30
Indoor	1000 (454.0)	1200 (544.0)
Outdoor	2000 (907.0)	2400 (1088.0)

Weights for Figures 6*, 7* and 8*.

	Weights lb. (kg)	
	R22	R 30
Indoor	1400 (635.0)	1900 (862.0)
Outdoor	2400 (1088.0)	3100 (1406.0)

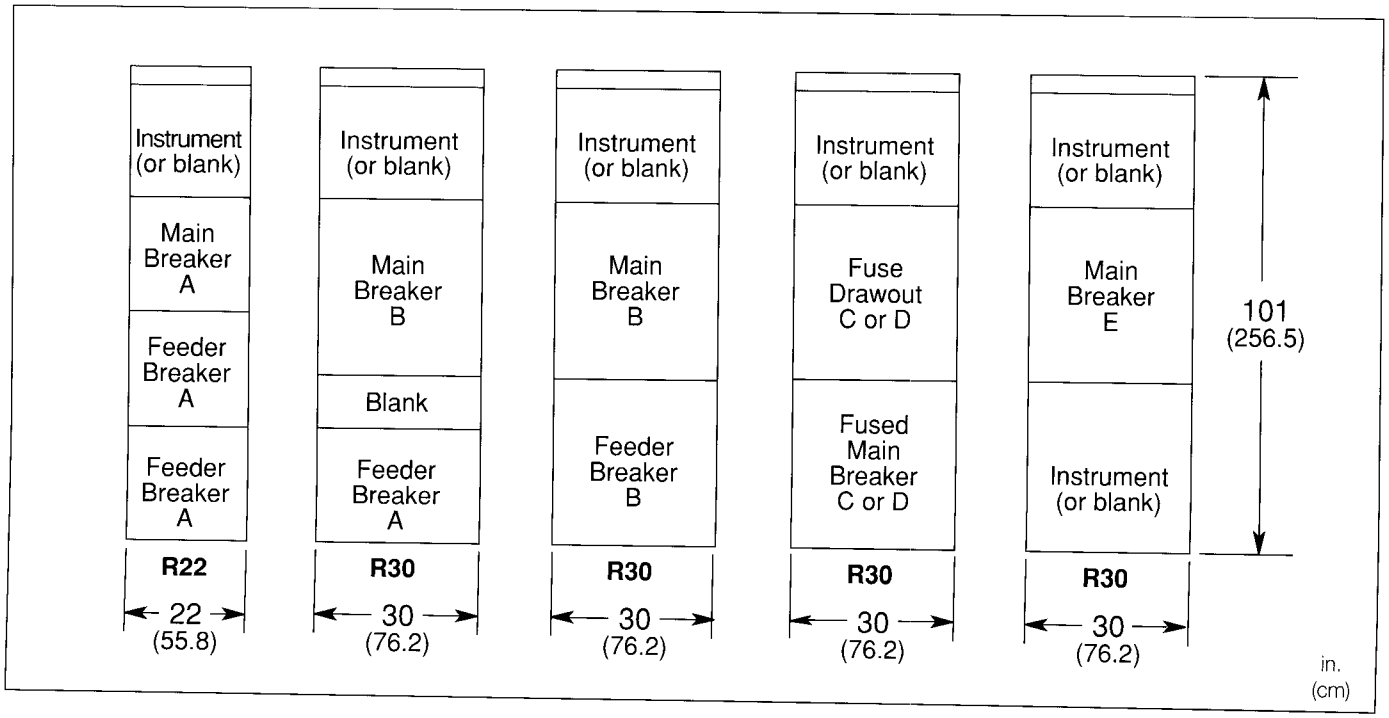
*Weights shown do not include weight of circuit breaker removable elements. All weights are approximate based on aluminum bus. For outdoor lineup, add 1200 lb. (544 kg) to total weight of individual sections for end walls and hoist.

Circuit breakers are coded on Figures 6, 7 and 8 as follows:**

A = RL- 800/1600/2000,
RLF- 800/1600/2000,
RLE 800/2000, RLI-800
B = RL- 3200
C = RLF- 3200 in one cell, with fuse drawout in other cell
D = RLF- 4000 in one cell with fuse drawout in other cell
E = RL- 4000, RLE-4000

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

Figure 7. Main Breaker Sections



Dimensions & Configurations

Figure 8. Feeder Breaker Sections and Combinations

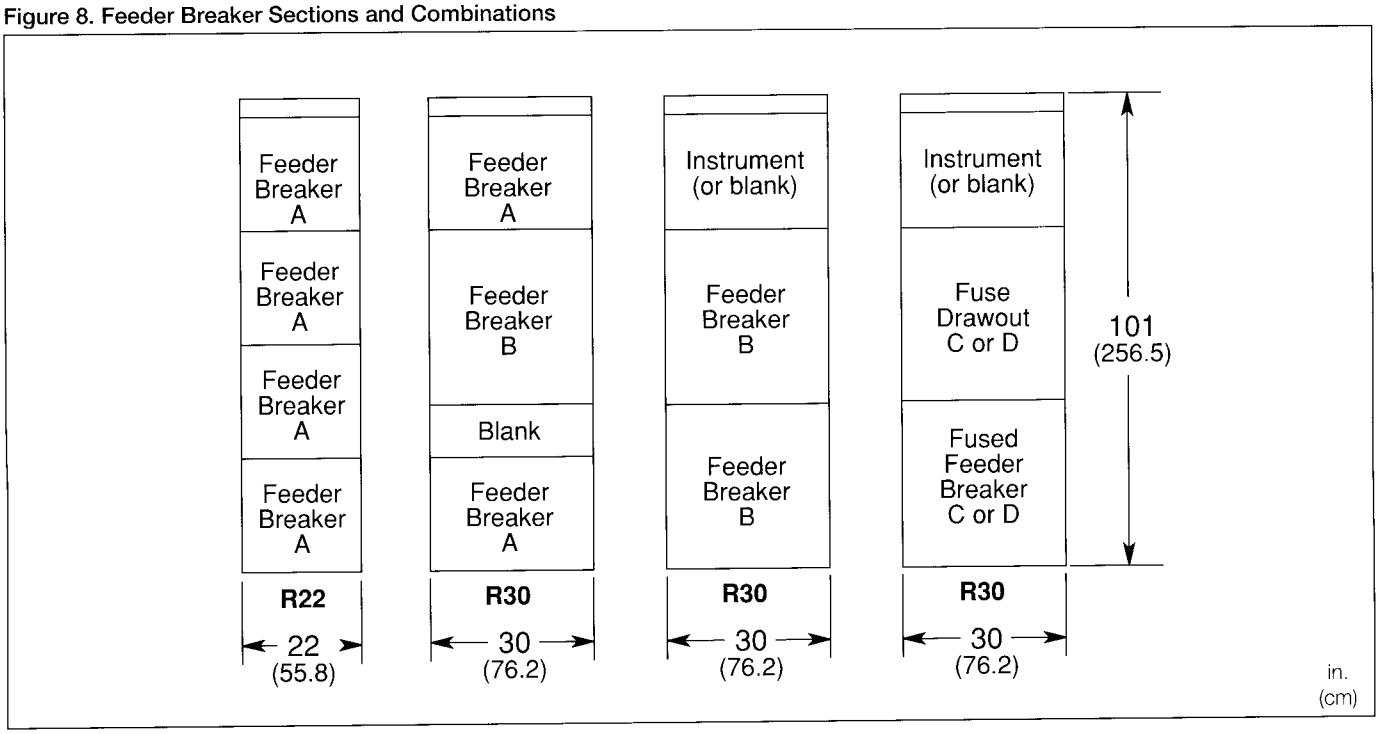
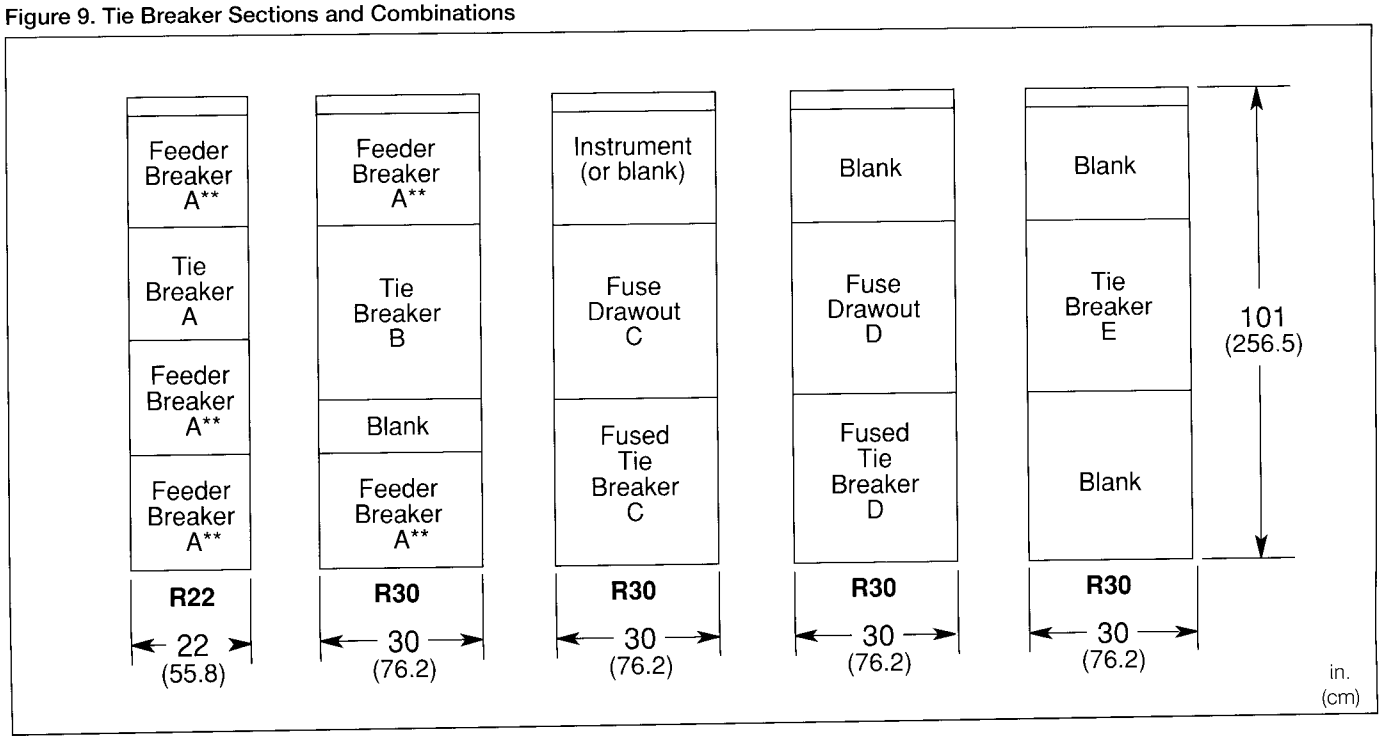
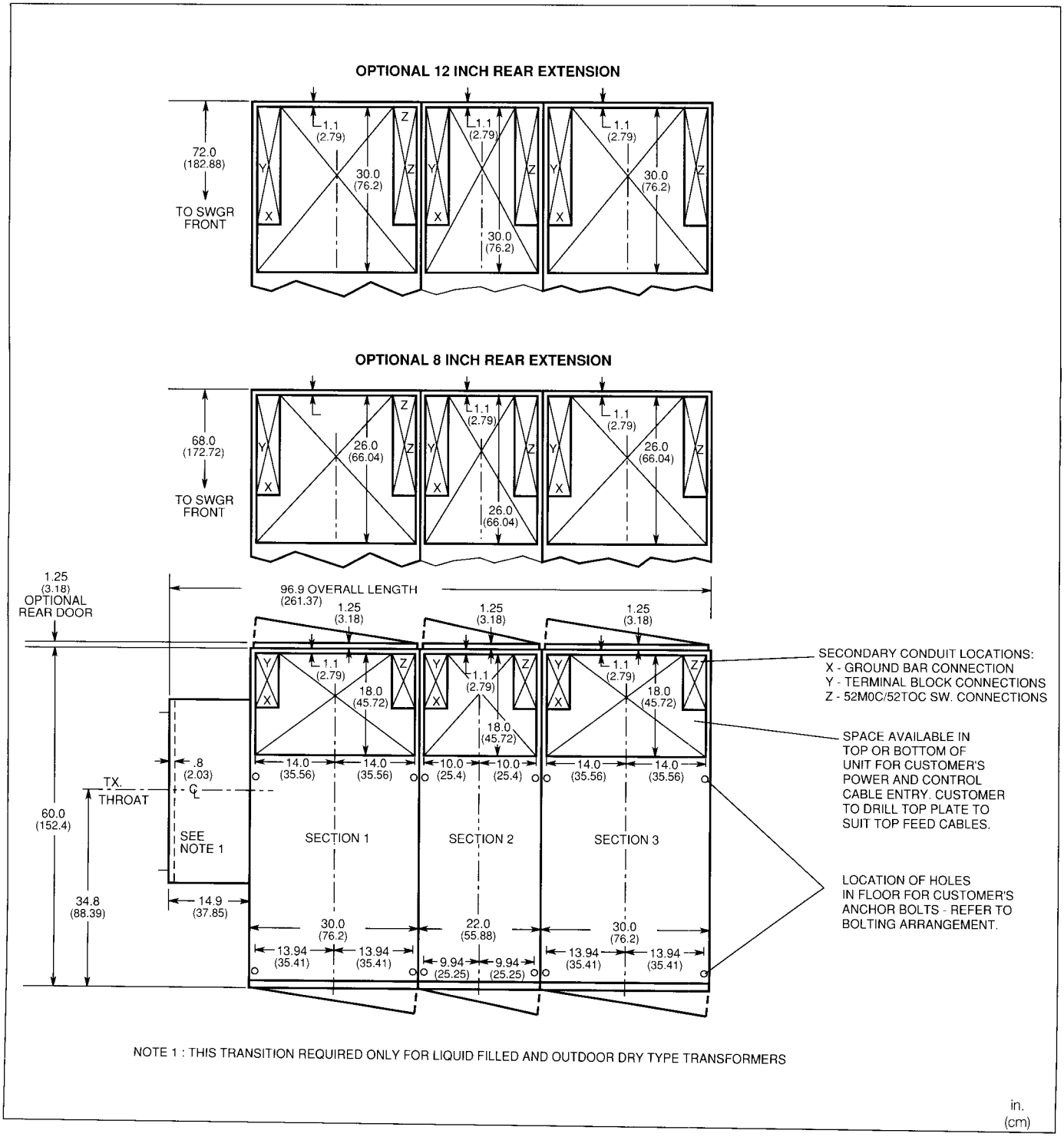


Figure 9. Tie Breaker Sections and Combinations



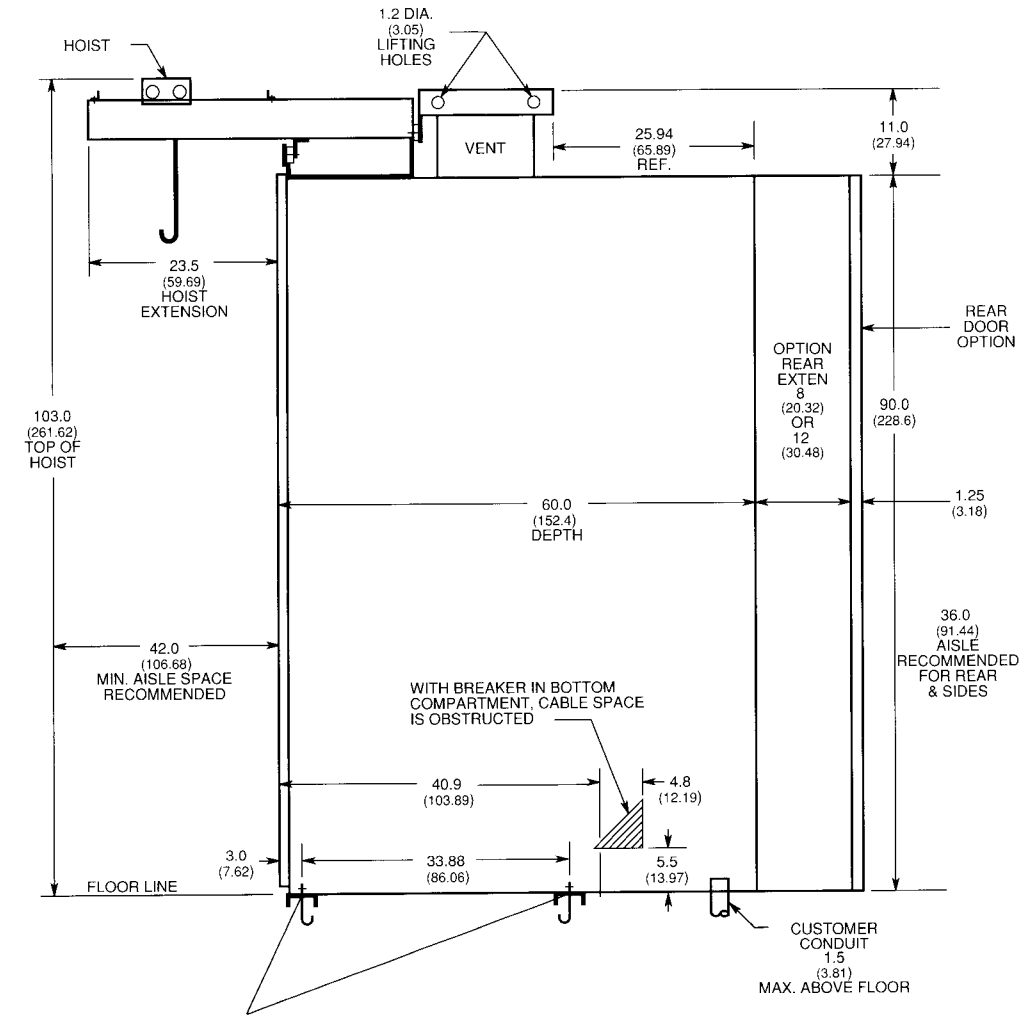
Dimensions & Configurations

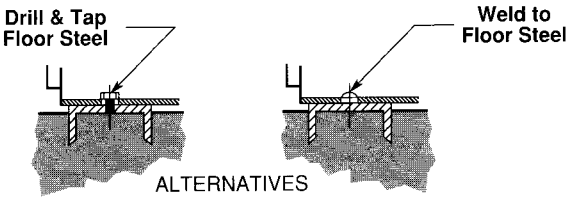
Figure 10. Indoor Floor Plan



Dimensions & Configurations

Figure 11. Indoor Side View



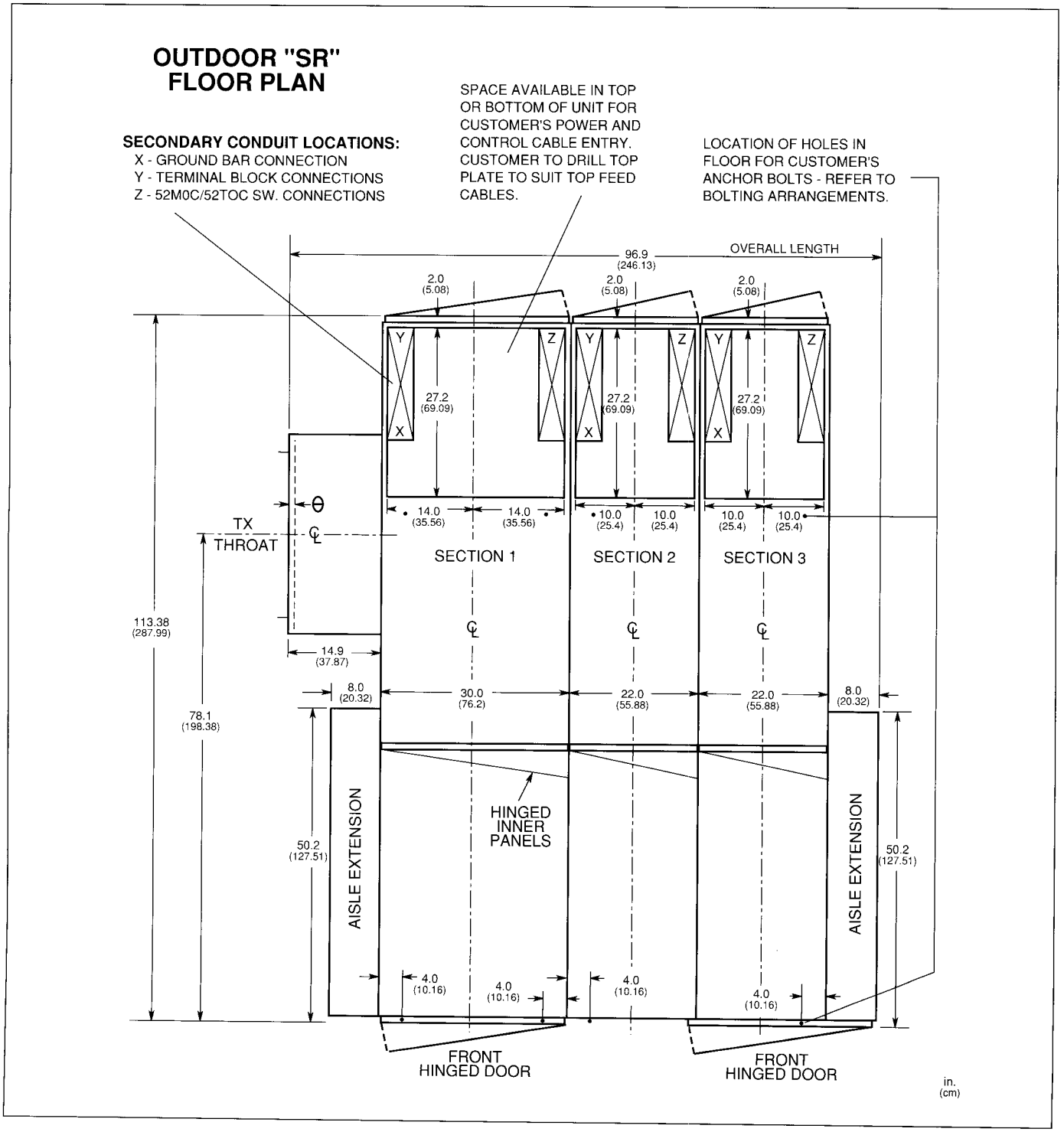


INDOOR BOLTING ARRANGEMENT
TYPE R LOW VOLTAGE SWITCHGEAR
(SIDE VIEW)

in.
(cm)

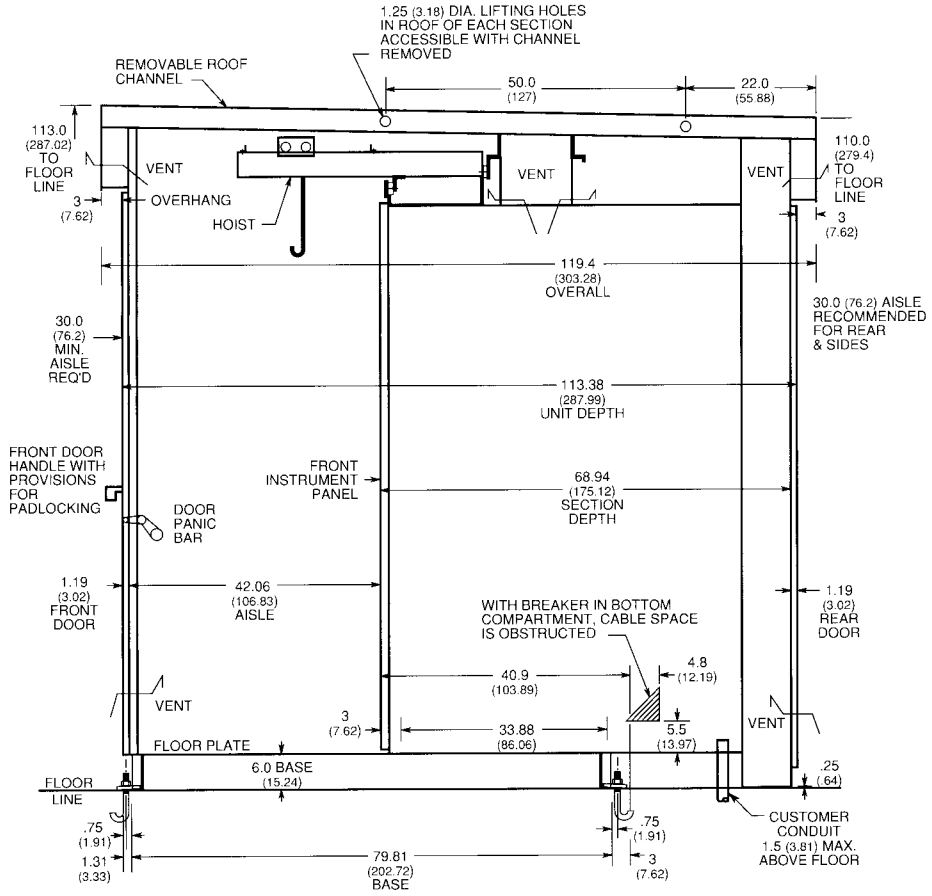
Dimensions & Configurations

Figure 12. Outdoor Floor Plan

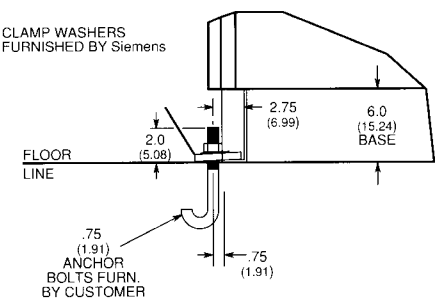


Dimensions & Configurations

Figure 13. Outdoor Side View



TYPE 'SR'
OUTDOOR SWITCHGEAR
(SIDE VIEW)



OUTDOOR BOLTING ARRANGEMENT
TYPE SR LOW VOLTAGE SWITCHGEAR
(SIDE VIEW)

in.
(cm)

Typical Equipment Specification

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 C37.13-1991** - Low-Voltage AC Power Circuit Breakers Used in Enclosures
- **ANSI C37.16-1988** - Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors - Preferred Ratings, Related Requirements, and Application Recommendations
- **ANSI C37.17-1979** - Trip Devices for AC and General Purpose DC Low™Voltage Power Circuit Breakers
- **ANSI/IEEE C37.20.1-1987** - Metal-Enclosed Low-Voltage Power Circuit-Breaker Switchgear
- **ANSI/IEEE C37.27-1987** - Application Guide for Low-Voltage AC Nonintegrally Fused Power Circuit Breakers (Using Separately Mounted Current Limiting Fuses)
- **ANSI C37.50-1989** - Standard Test Procedures for Low-Voltage AC Power Circuit Breakers Used in Enclosures.
- **ANSI C37.51-1989** - Standard Conformance Test Procedures for Metal Enclosed Low-Voltage AC Power Circuit-Breaker Switchgear Assemblies
- **ANSI/NEMA 250-1985** - 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
- **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 on the side of 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

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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 aluminum with welded connection joints (option) copper with silver plated 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 reaching over the main and vertical bus. Bus bracing shall be equal to the short circuit interrupting rating of the lowest rated circuit breaker applied in the assembly. A 1/4" by 2" copper ground bus will be provided. (Option) Barriers shall be provided which isolate the rear cable termination compartment in each vertical section. With these barriers installed, the rear cable area will be completely segregated between vertical sections. (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 and 4000 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 SG3169-1 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 4700 power meter, Siemens Static Trip III trip units, Siemens Power Monitor Display and Monitoring Unit and traditional analog devices. For more detailed specification information on Siemens devices refer to Bulletin SG3089 – 4700 Power Meter Electronic Metering Package; SG3169-1 – Static Trip III Microprocessing Based Tripping System; and SG3129-02 – Power Monitor Display and Monitoring Unit. 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

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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 length 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 inches 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 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
- (optional) overhead hoist for indoor switchgear
- (optional) test cabinet
- (optional) breaker dolly

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.

Related Publications

Brochures:

Type R Low Voltage Metal-Enclosed Switchgear (SG3069-2)
Static Trip III Microprocessor-based Tripping System (SG3169-1)
4700 Power Meter Electronic Metering Package (SG3089)
Power Monitor Display And Monitoring Unit (SG3129-02)
ACCESS Electrical Distribution Communication System (SG3099)

Video

Microprocessor-based Tripping System Static Trip III, 21:00, V#2000
Bench Testing Of Static Trip III Trip Units, 29:00, V#2001
Power Monitor Operation, 38:00, V#2004
ACCESS Electrical Distribution Communication System: An Engineering Overview, 9:15, V#2006
ACCESS Electrical Distribution Communication System, 10:00, V#2007
Bench Maintenance of Type RL Low Voltage Circuit Breakers, 22:00, V#2002

Notes

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