SIEMENS

RLX SPECS

Low Voltage Metal-Enclosed Switchgear

Type R 600 Volts.

SIEMENS

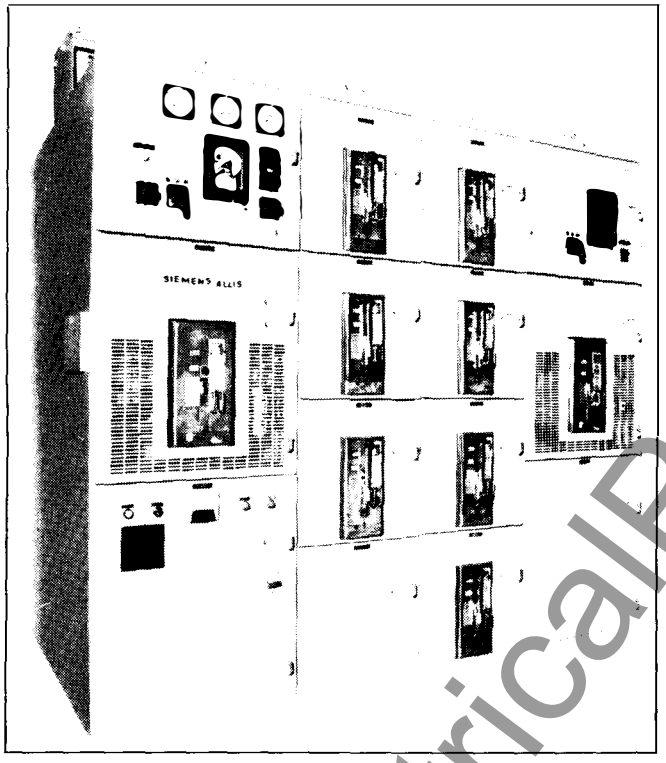
Low Voltage Metal-Enclosed Switchgear

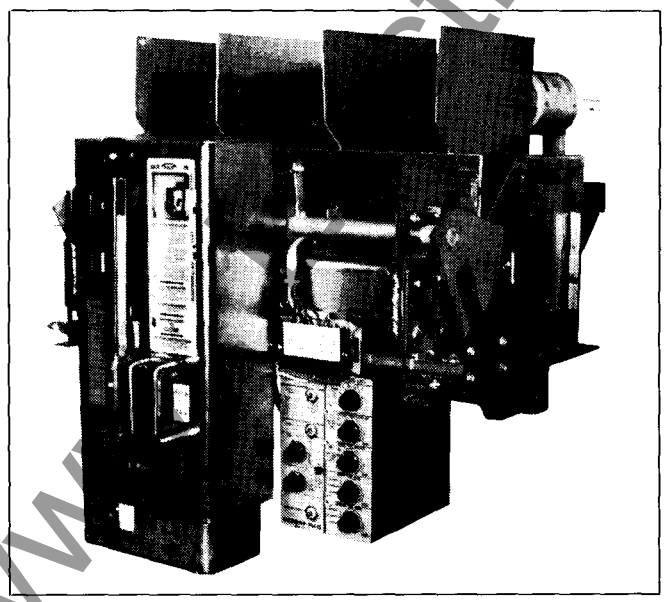
SG 3061

Switchgear Division

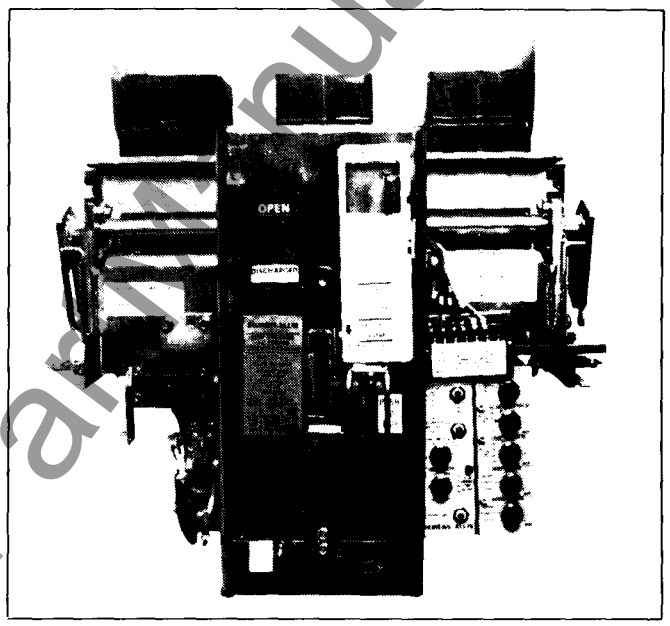
Type R
600 Volts

Description





RLF-800 M.O.



RL-1600 E.O.

Low voltage metal-enclosed switchgear with drawout type low voltage power circuit breakers is used in electric power distribution systems for the control and protection of circuit conductors and equipment.

It is installed in industrial power distribution systems, generating station auxiliary substations and in commercial buildings as the service equipment for such typical applications as:

- **Industrial Plants**—For power and lighting networks, power and lighting feeders, plus power generation and auxiliaries. Also to provide power for machine tools and material handling equipment drives.
- **Central Stations**—Protect and distribute power to station auxiliaries—blowers, compressors, fans, pumps, motors.
- **Commercial and Residential Buildings**—For protection and distribution of power for lighting, elevators, air conditioning, plus blowers, fans, motors and pumps.

Available in indoor "R" and outdoor walk-in "SR" construction, it is applied at system voltages of 600, 480, 240 and 208 volts. The circuit breakers may be either manually or electrically operated, unfused or fused and are designated:

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Description

Standard Interrupting Rating Type	Extended Interrupting Rating Type	Fused Type
RL-800	RLX-800	RLF-800 integrally fused
RL-1600	RLX-1600	RLF-1600 integrally fused
RL-2000		RLF-2000 integrally fused
RL-3200		RLF-3200
RL-4000		RLF-4000

Fuses for use with the RLF-3200 and RLF-4000 fused circuit breakers are furnished mounted on a separate drawout carriage.

Static Trip II® solid state trip devices are provided on all low voltage power circuit breakers.

Features & Benefits

- Two design widths of units: 30 inch and 22 inch. All breaker sizes can be accommodated in a combination of units of the two widths.
- Flexibility of mounting arrangements: Four-high stacking of ratings from 800A through 2000A in 22 wide unit.
- Five circuit breaker frame sizes: 800, 1600, 2000, 3200 and 4000 amperes
- Extended interrupting capacities optionally available
- UL listing optionally available for cubicles (UL 1558)
- UL listing of circuit breakers is standard
- Increased cable termination area
- Uniform depth: All units are 60" deep for all breaker ratings.
- Welded aluminum main and vertical bus joints: increased reliability and reduced maintenance. Bolted copper bus with silver-plated connectons is optionally available.
- Cable compartment barriers between adjacent units.
- Insulated main bus optionally available
- Metal barriers for incoming line, bus and cable compartments—optionally available.
- Secondary wire troughs, with optional covers.
- Closed door drawout of circuit breakers with connected-test-disconnect positions.
- Primary disconnect shutters - optionally available.
- Convenient Inspection—With door open and the circuit breaker fully withdrawn, key components can be inspected without removal from the rails.
- Telescoping, full drawout, self contained, ball bearing breaker drawout rails.
- True Stored Energy Operator—Charging of the closing springs does not close the circuit breaker. A separate closing lever is operated to release the stored energy.
- "Pyro-Shield" Coordinated Insulation System—High strength, track-resistant, flame retardant, fiberglass-reinforced polyester insulation, bus supports and moldings provide high momentary short circuit strength. Edge-to-edge bus bar arrangements which incorporate high creepage allowances resist dust buildup and the effects of contaminants.
- Static Trip II® solid state overcurrent tripping systems first introduced in 1971 assures years of trouble free, reliable service and provides optimum distribution system protection. Any available type of device will fit all low voltage power circuit breakers.
- Trip Target Indicators—Aid in determining the cause of tripping—optionally available on Static Trip II® devices.
- Simple Breaker Rating Change—Changes in continuous current or pickup setting can be made without any special tools by merely adjusting the knob settings on the Static Trip II® system.
- Plug-in testing of Static Trip II® system. Portable test set is optionally available.
- Front Access Current Transformers—Mounted on the stationary disconnects in the breaker compartment where they can be easily replaced when a change in current rating is required.

General

Type "R" Low Voltage Switchgear Assembly includes a bolted steel framework, sheet steel enclosure, individual breaker compartments, hinged breaker and auxiliary compartment panels, drawout breaker guide rails, interlocks, three-phase buswork and supports, stationary primary and secondary disconnecting devices, ground bus, power cable termination connectors, control cable terminations, instruments and relays, control wiring, terminal blocks and instrument transformers.

1. Meter and Auxiliary Compartment (Page 9)
2. Control Wiring (Page 9)
3. Control Circuit Fuses (Page 6)

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4. Telescopic Breaker Drawout Rails (Page 6)
5. Stationary Secondary Disconnects (Page 6)
6. Breaker Escutcheon Opening
7. Indicating Instruments
8. RL-3200 Electrically Operated Breaker in Connected Position
9. RL-3200 Electrically Operated Breaker in Test Position
10. RL-1600 Manually Operated Breaker in Connected Position
11. RL-800 Manually Operated Breaker in Connected Position
12. Future Breaker Compartment (Page 6)
13. Auxiliary Compartment
14. Blank Compartment
15. Ventilation Opening (RL-2000, RL-3200 and RL-4000)
16. Ventilation and Lifting Structure
17. Interunit Wiring Trough

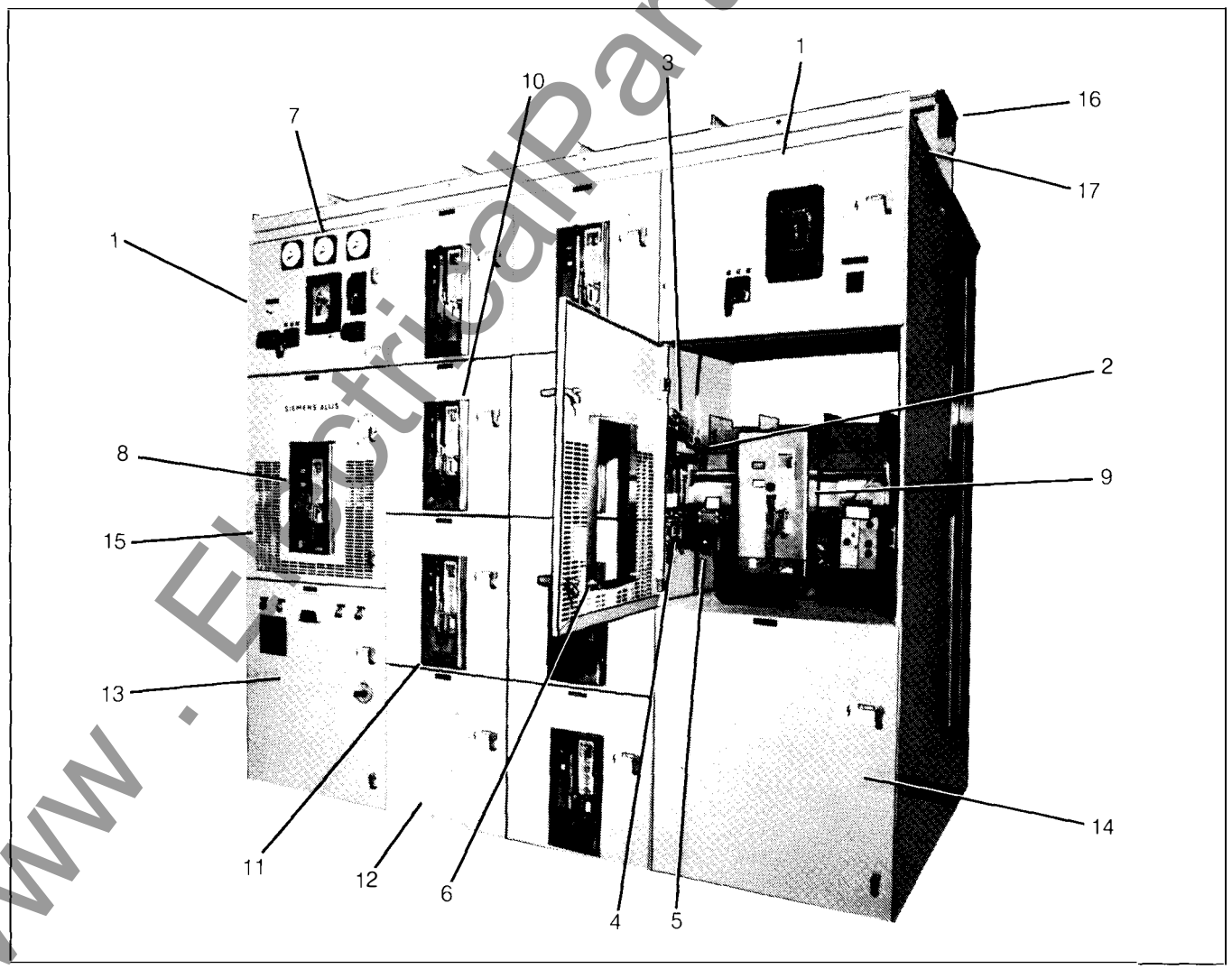

Figure 1. Typical Group Indoor Switchgear.

Description

Standards & Ratings

SiemensType "R" and "SR" metal-enclosed low voltage switchgear with drawout power air circuit breakers is designed, tested and constructed to be in accordance with ANSI C37.20, "Switchgear Assemblies", and other related ANSI standards, as well as the applicable standards of IEEE and NEMA, and meets the applicable requirements of the National Electric Code (NEC).

The Type "RL" drawout circuit breakers are in accordance with ANSI C37.13, C37.16 and C37.17 for the frame sizes from 800 to 4000A.

Optionally available, an Underwriters Laboratory (UL) listing mark (label) can be supplied for each vertical unit provided the specific unit contains only devices which are UL listed or are UL recognized components found suitable for intended use.

When the assembly is specified for application as "Service (Entrance) Equipment", the additional features and modifications as required by NEC are incorporated.

All circuit breaker drawout elements are UL list marked as standard.

The assembly is UL listed in accordance with UL 1558 entitled "Low Voltage Power Circuit Breaker Switchgear", conforming to ANSI C37.20, C37.50 and C37.51.

Specifications—Cubicles

Framework and Compartments

The switchgear is totally metal-enclosed ventilated multiple unit construction, wherein the switching structure basically is comprised of an assembly of individual standardized enclosed breaker compartments to form a single, compact switchgear unit. Each unit consists of three or four circuit breaker and/or metering compartments as determined by standard engineering practice to provide uniform height of the switchgear. Construction is of 11 gauge steel or equal, except doors, top plates and rear plates are 14 gauge. Side sheets are 14 gauge with 2 thicknesses between units.

The switchgear assembly is composed of as many vertical units as required. Normally the end units include provisions for the future installation of additional units.

Low voltage metal-enclosed switchgear has the accepted features of complete dead-front construction, with totally metal-enclosed circuit breakers; metal-enclosed top, rear and ends of the complete switchgear and including complete interlocking features, all in accordance with ANSI C37.20-1974.

The steel framework of Type R low voltage switchgear is constructed of performed, full depth, #14 gauge steel side sheets bolted together and reinforced with cross-member braces to form a rigid, self-supporting, compact assembly. Compartments housing each low voltage power circuit breaker are bolted steel sub-assemblies mounted within the framework to form the complete switchgear assembly. The top, side and rear sections are fitted with removable steel sheets securely bolted to the framework forming a rigid assembly. Where two vertical breaker sections are to be mounted together side by side, there are two thicknesses of #14 gauge steel between adjacent circuit breaker compartments.

The circuit breakers are barriered from the bus/cable compartment by the compartment housing the breaker.

The bus/cable compartment includes the main horizontal bus which can be provided at either of two levels, riser bus, connections from the main bus to one set of primary disconnects, and load side "run-back bus" so that cable lugs are accessible without reaching over main bus (see below).

Main and Ground Bus

Standard main bus construction incorporates aluminum bus with welded connection of main bus conductors to vertical riser buses and welded connection at main bus joints Figure 2. Shipping splits and provisions for future extension of main bus conductors using tin-plated joints with high tensile strength steel hardware and conical (Belleville) washers are designed for bolted connection and are incorporated as standard eliminating any need for field welding. The main three phase horizontal bus is vertically arranged one phase above the other with edge-to-edge alignment providing a high short circuit strength system. Bolted copper bus with silver-plated joints is optionally available. Insulated bus is also available as an option.

Main bus ratings are 1600, 2000, 3200, 4000 and 5000 amperes continuous. Bus bracing is based on smallest breaker short circuit rating. Minimum bracing is 65,000 amperes RMS symmetrical. Other symmetrical bracings are 85,000 and 130,000 amperes

A neutral bus is furnished when specified, and can be rated 1600, 2000, 2300, 3200 or 4000 amperes continuous.

A 1/4" x 2" copper ground bus is furnished as standard extending through all units and securely bolted to the structure. Provision is made within each unit for mounting of grounding cable lug.

Optional barriers as shown in Figure 3 can be provided between the bus and cable areas, to isolate the cable area. Barriers are also available to isolate the incoming bus of main circuit breakers from the main bus (not shown).

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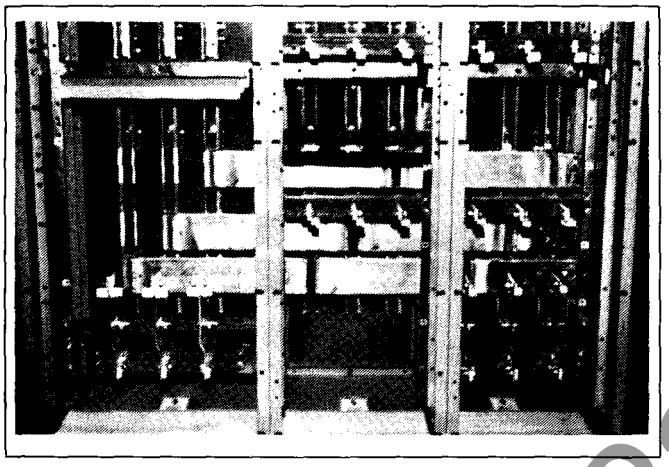

Figure 2. Rear View Showing Welded Aluminum Main Bus. Note Bolting Provisions for Shipping Split or Future Expansion.

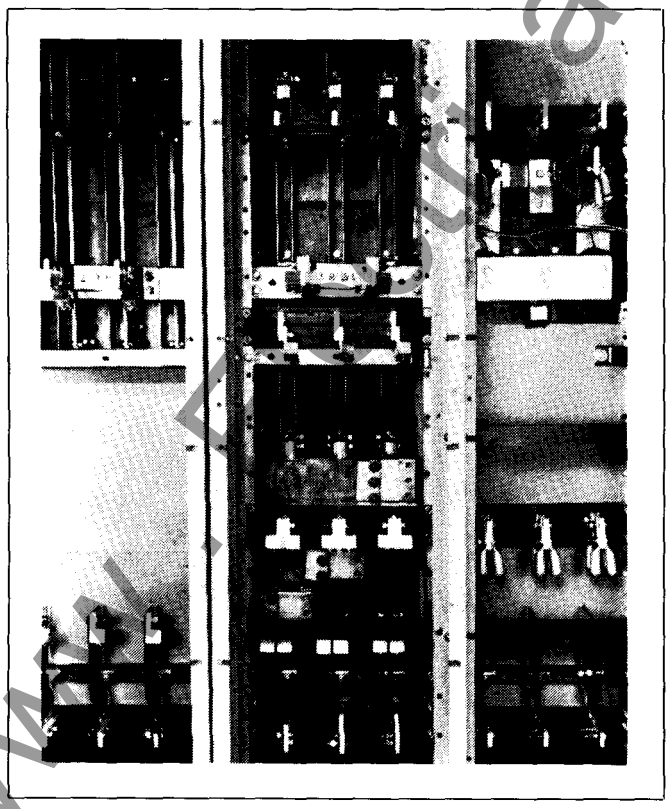

Figure 3. Rear View Showing Bolted Copper Main Bus and Bus-Cable Compartment Barriers.

The assembly is designed for temperature limitations as defined by ANSI C37.20, paragraph 4.4.

The units are designed for a 50°C maximum total temperature of parts handled by the operator. The bus is designed for 65°C maximum rise above 40°C ambient. Air surrounding the switchgear cable connection points is limited to 45°C rise above 40°C ambient. ANSI C37.20, paragraph 7 includes application requirements.

Load side (runback) conductors for feeder circuits are a single piece copper design through 1600 amperes, with no bolted joints from circuit breaker disconnect to the cable lug mounting surface Figure 4. Runbacks are insulated with sleeve tubing where passing through the main bus area, and are supported in a high strength glass polyester molding. Feeder circuit breaker cells are consistently arranged with top studs connected to the main bus, and lower studs to outgoing cable terminations.

Insulation System

Track-resistant Pyro-Shield insulation is used throughout in the coordinated insulation system and designed to provide liberal creepage allowances. Pyro-Shield insulation, a fiberglass-reinforced polyester material, has high impact strength which eliminates risk of damage due to short circuit stress and assures low moisture absorption. Other advantages are high flame retardance, long life—even at high temperatures1plus high resistance to chemical fumes.

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.

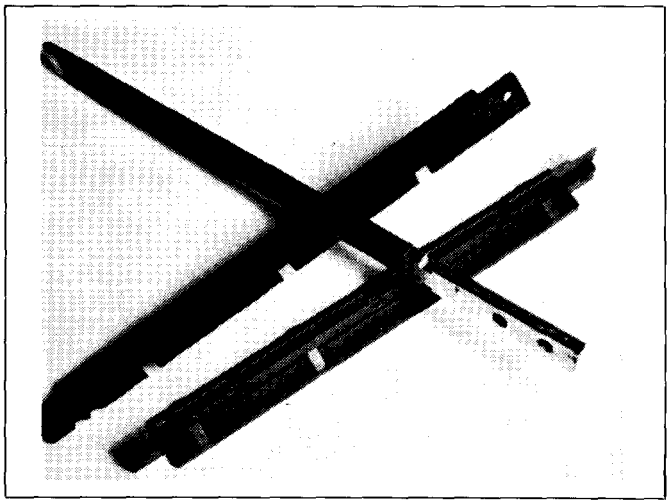

Figure 4.

Description

Primary disconnects are mounted on Pyro-Shield sheets in the cubicle. The high momentary strength provided by the edge-to-edge bus bar arrangement is coupled with high creepage distance Pyro-Shield insulation to provide the bus bar bracing.

A completely insulated bus bar insulation system is optionally available for the main and vertical bus within the breaker units.

Each circuit breaker cell includes provisions for mounting up to three "RD" current transformers for metering or relaying. Figure 6 shows three current transformers installed in an RL-800 cell, with the glass polyester barrier removed to show the transformers. Figure 8 shows an RL-3200 cell with glass polyester barrier installed over the current transformers.

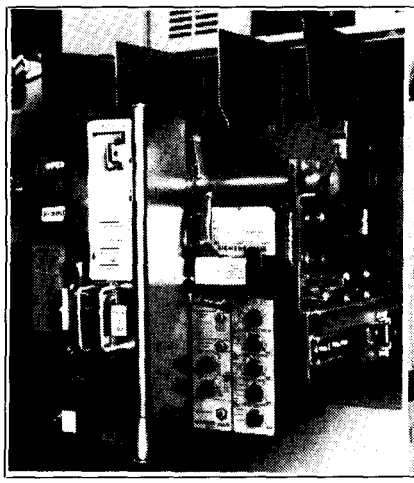

Figure 5. Fully Withdrawn RL-800 on Telescoping Rails.

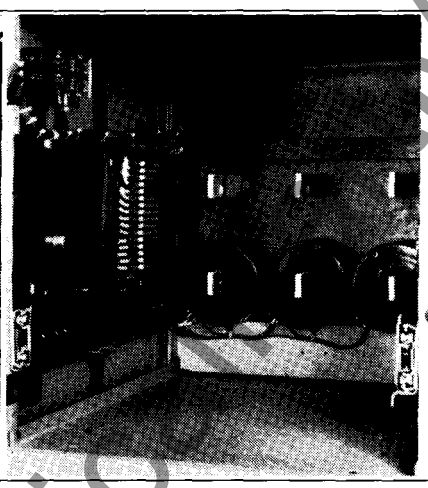

Figure 6. Typical Compartment for Electrically Operated Breaker with Secondary Disconnect and Fuse Holder. Note Barrier Removed from CT's.

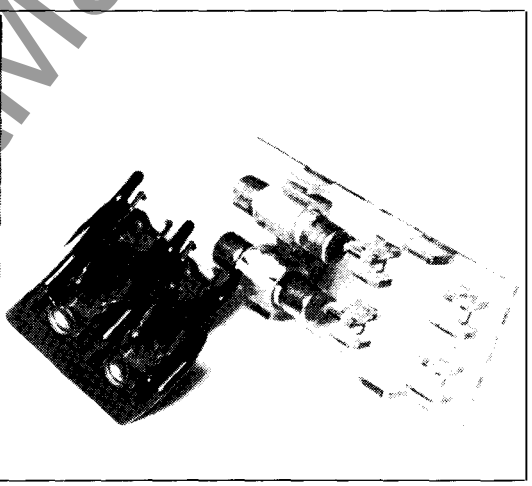

Figure 7. Control Circuit Dead Front Fuse Holder.

Circuit Breaker Compartments

Each circuit breaker compartment includes as standard the stationary primary disconnects, ground disconnect, and the telescoping drawout rails, plus the associated safety interlocks.

Circuit breakers can be fully withdrawn on compartment rails, which include ball bearings to reduce friction. The rails telescope to allow the breaker to extend fully out of the compartment without the need for additional extensions or adapters. Figure 5.

Cells for electrically operated circuit breakers also include the spring mounted secondary disconnect molding plus control circuit fusing with clear plastic dead front fuse holders. Refer Figure 6.

The pull-out fuse holder Figure 7 is designed with a set of clips to allow the storage of the holder in the fuse block when circuit is disconnected. This feature provides benefit of not misplacing or interchanging of fuses while performing maintenance on a breaker.

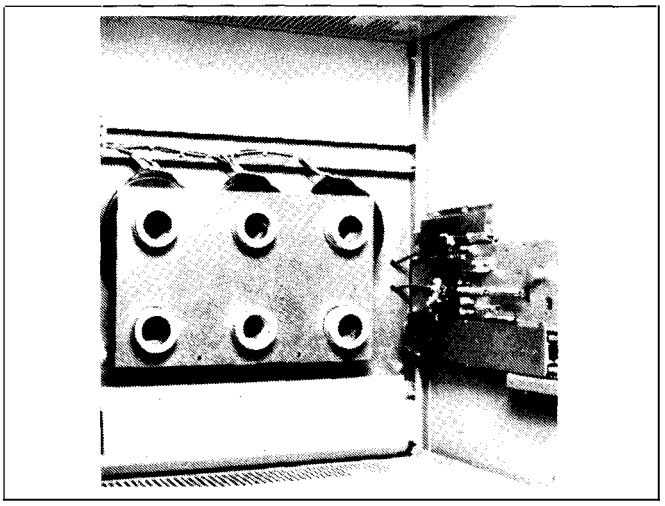

Figure 8. Typical Compartment for RL-3200 or RL-4000. Note MOC and TOC Switch Actuating Mechanisms.

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Future Circuit Breaker Compartments

To prevent accidental contact with live parts, a Pyro-Shield sheet barrier is used to cover the primary disconnect contacts of compartment arranged for future addition of breaker.

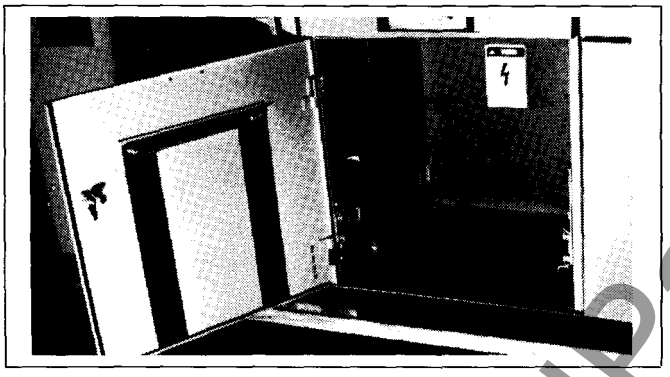

Figure 9.

Circuit Breaker Closed-Door Racking

Racking the breaker in or out is accomplished by operating a racking screw with a crank as shown in the illustrations. The screw operates a clevis on each side of the breaker that fits into pins mounted on the compartment wall. The motion of the clevis around the stationary pins moves the breaker into or out of the compartment and provides positive positioning of the breaker throughout its movement from disconnect to connected position.

When the breaker is completely racked in, it is said to be in the CONNECTED position. Figure 10. This is the normal operating position. As it is drawn out, it passes into a TEST position where the primary disconnects no longer make contact, but the secondary circuits remain connected. In this position the breaker may be opened and closed for testing without energizing the load.

Beyond the test location the breaker is in the DISCONNECTED position where all contacts are parted. Racking of the breaker can be done while the compartment door is open or closed. Figure 11.

A position indicator is located on the front of the breaker mechanism cover. The breaker movement relative to the Connect, Test and Disconnect positions may be observed while turning the racking crank.

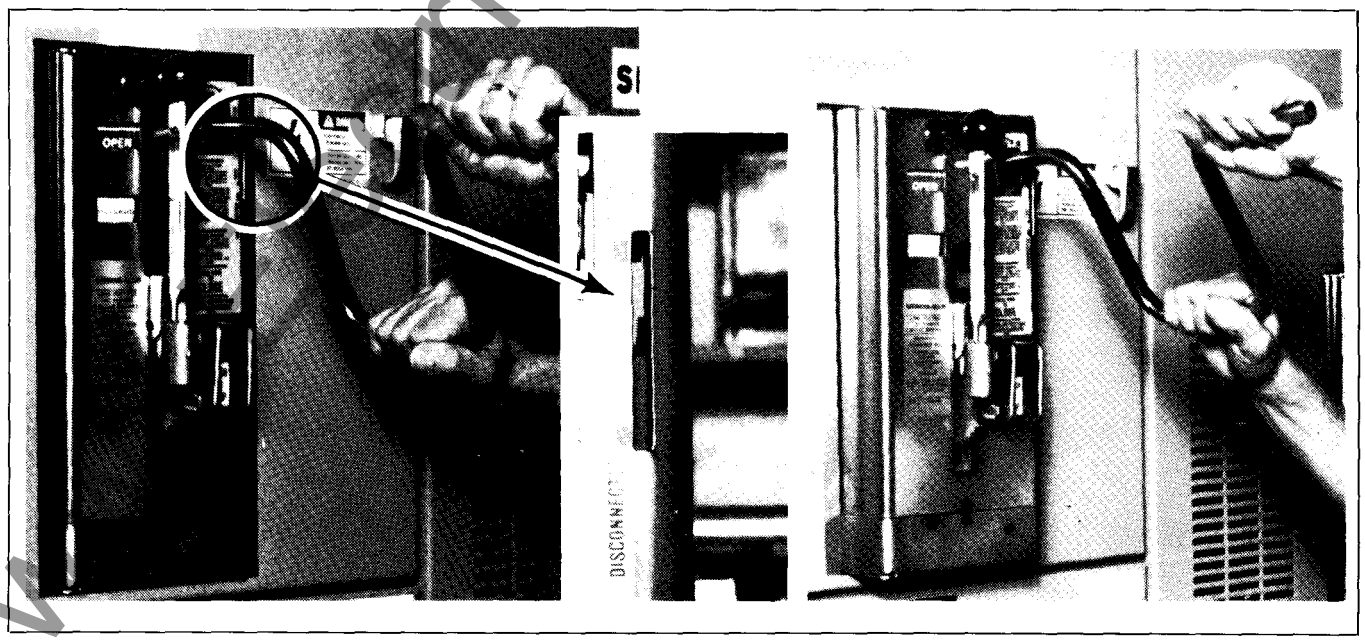

Figure 10. Breaker Racking Between Connected-to-Test Position.

Figure 11. Breaker Racking Between Test-to-Disconnect Position.

Instrument and Control Transformers

Potential Metering Transformers

These are mounted within metering compartments, and are protected by primary pull-out type current limiting fuses. Secondary fuses are also provided.

Table 1. Type BT Potential Transformers

Ratio	Accuracy Class @ 60 Hz Burden W	X	Y	Volt-Amp Rating	Thermal Rating VA	Cycles	Weight Lbs.
600/120	0.6	0.6	1.2	100	500	50/60	
480/120	0.6	0.6	1.2	100	500	50/60	16
288/120	0.6	0.6	1.2	100	500	50/60	

NOTE: Thermal rating based on 30°C rise above 55° ambient.

Control Power Transformers

These are normally mounted within metering compartments, and are protected by primary pull-out type current limiting fuses. Secondary fuses are also provided. Where size prevents location in metering compartment, they are located in a separate compartment.

Table 2. Type BT Control Power Transformers—115°C Rise

KVA	Phase	Primary Voltage	Secondary Voltage	Weight Lbs.
3				60
5				85
10 ①		240/480	120/240	135
15 ①				185

① Requires complete compartment.

Instrument Transformers

Current Transformers

Most arrangements have current transformers mounted on the stationary primary disconnect studs where they are readily accessible when a feeder circuit change requires replacement of CT's for those of a different rating. No need to enter bus or cable compartment and disturb primary buswork or disconnect cables when replacing CT's.

Table 1. "RD-100": For RL-800, RL-1600 or RL-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	4.8			C5
150/5	1.2	1.2	2.4	4.8		C10
200/5	0.6	1.2	2.4	2.4		C15
250/5	0.6	0.6	1.2	2.4	4.8	C20
300/5	0.3	0.6	1.2	1.2	2.4	C20
400/5	0.3	0.3	0.6	1.2	2.4	C30
500/5	0.3	0.3	0.6	0.6	1.2	C40
600/5	0.3	0.3	0.3	0.6	0.6	C50
800/5	0.3	0.3	0.3	0.6	0.6	C40
1000/5	0.3	0.3	0.3	0.3	0.6	C60
1200/5	0.3	0.3	0.3	0.3	0.3	C70
1500/5	0.3	0.3	0.3	0.3	0.3	C80
1600/5	0.3	0.3	0.3	0.3	0.3	C80
2000/5	0.3	0.3	0.3	0.3	0.3	C30
2500/5	0.3	0.3	0.3	0.3	0.3	C30

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

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Table 2. "RD-200": For RL-3200 ① or RL-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	0.3	0.3	0.6	C70
1200/5	0.3	0.3	0.3	0.3	0.3	C80
1500/5	0.3	0.3	0.3	0.3	0.3	C110
2000/5	0.3	0.3	0.3	0.3	0.3	C80
2500/5	0.3	0.3	0.3	0.3	0.3	C100
3000/5	0.3	0.3	0.3	0.3	0.3	C70
3200/5	0.3	0.3	0.3	0.3	0.3	C70
4000/5	0.3	0.3	0.3	0.3	0.3	C50

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.

Metering and Auxiliary Compartments

Instruments, meters and switches for main bus metering are normally grouped on a panel above the main breaker. This compartment also serves to enclose auxiliary devices, potential transformers, control power transformers, and the like.

Standard indicating instruments are rectangular panel type with 2 percent accuracy, semi-flush mounted. Standard instrument transfer and breaker control switches are miniature rotary type.

Optional switchboard indicating instruments are available, with one percent accuracy and 250° scales. Optional switches are Siemens Type 210. Watthour meters are switchboard type, and provided with drawout cases which include built-in test facilities.

Primary fuses for potential transformers and control power transformers are installed in pull-out range type fuse holders. The secondary fuses may be supplied in pull-out type fuse holders as an option.

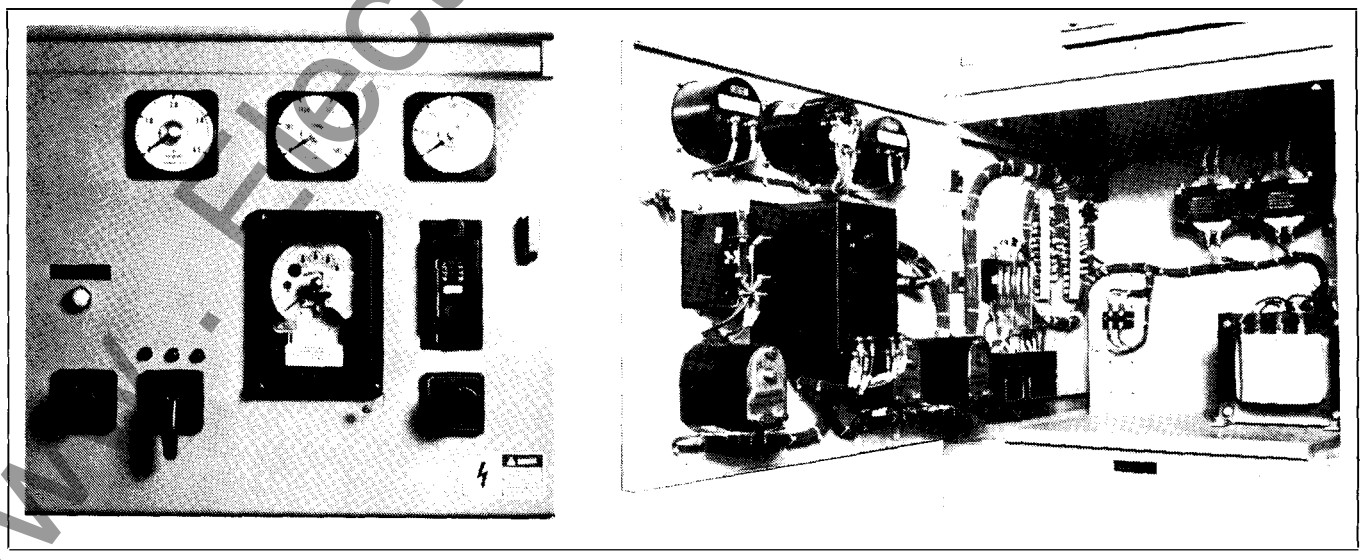


Figure 12. Typical Front Panel of Main Metering Compartment.

Figure 13. Interior View of Typical Main Metering Compartment with Potential and Control Power Transformers and Optional Wire-End Identification Markers.

Feeder Metering

Common instrumentation and control devices can be accommodated on feeder circuit breaker cell doors, including any or all of the following:

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

Control Wiring

All secondary and control wiring is No. 14 (minimum) extra flexible stranded copper type SIS. Termination is by compression type, insulated ring terminals for connection to screw type terminal blocks and screw type device terminals. For termination to devices not having screw type terminals, sleeve connectors, locking fork terminals or tab type disconnects will be employed. Optional wire-end identification markers can be supplied as either adhesive backed vinyl wrap-around or vinyl sleeve type.

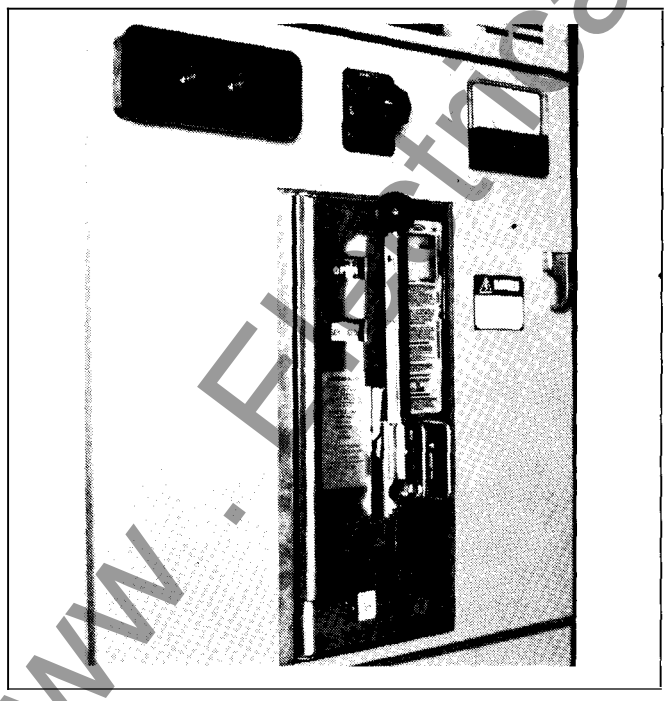


Figure 14.

Accessories

Standard Accessories

Each switchgear assembly will include as standard:

Crank for circuit breaker racking
Lifting bar assembly for all circuit breaker types
Manual spring charging handle if electrically operated circuit breakers are included
Quart of touch-up paint

Optional Accessories

Inspection and test cabinet, indoor wall mounted with necessary control for testing electrically operated breakers while breaker is outside of unit.

Traveling Crane—Optional on Indoor

A hoist for ease of breaker handling, which is mounted on top of each switchgear group, travels along rails to locate above any unit. To remove a breaker it must first be drawn completely out and the lifting bar attached forming a two point lift. Then the hook from the crane is connected to the bar and by turning a crank which reels up the cable attached to the hook, the breaker is raised or lowered. Figure 15.

This hoist is optional on indoor groups, but is standard with outdoor lineups.

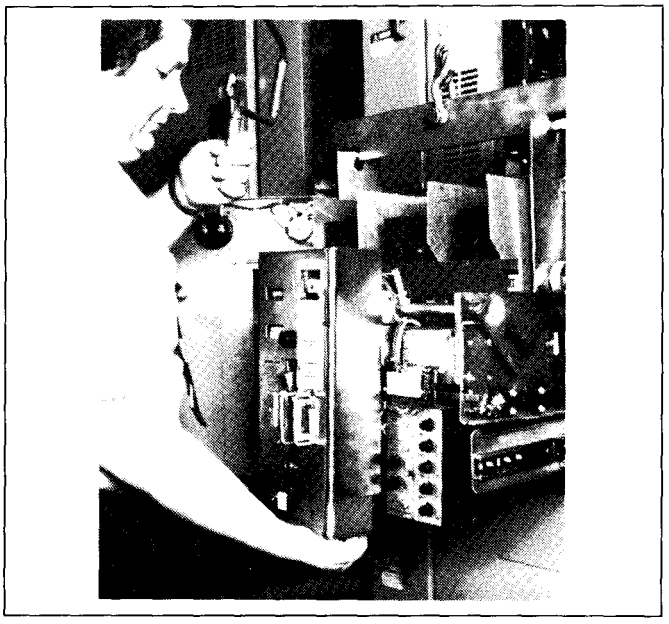


Figure 15. Overhead Hoist Utilizes Universal Lifting Bar for all Sizes of Breakers.

Switchgear Division

Type R
600 Volts

Description

Optional Features

Shutters

Grounded metal shutters are optionally available to provide protection against accidental contact with energized primary disconnects when the breaker is withdrawn from its cell. The shutter assembly drive mechanism positively drives the shutter in both opening and closing function.

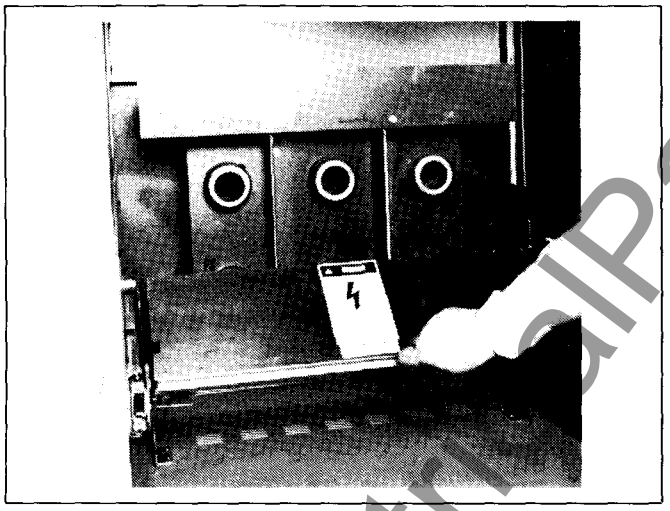


Figure 16.

Wire Trough Covers

Removable trough covers are available for enclosing secondary wiring within each vertical section in the primary bus and outgoing cable areas. Figure 17.

Hinged Rear Doors—Indoor

Full height formed rear door with removable pin hinges are available in place of standard split, bolted on plates. Doors are secured by hex head hardware. Figure 18.

Outdoor Switchgear

Outdoor switchgear, type "SR" is similar to indoor switchgear, except that it is enclosed in a weather resistant (NEMA 3R) steel housing. The equipment is designed so that weather conditions will not affect operation of the switchgear. An illuminated expanded service aisle is provided at the front of the switchgear allowing inspection and maintenance without exposure to the elements. An access door is provided at each end of the front aisle wall with panic bar latch release inside

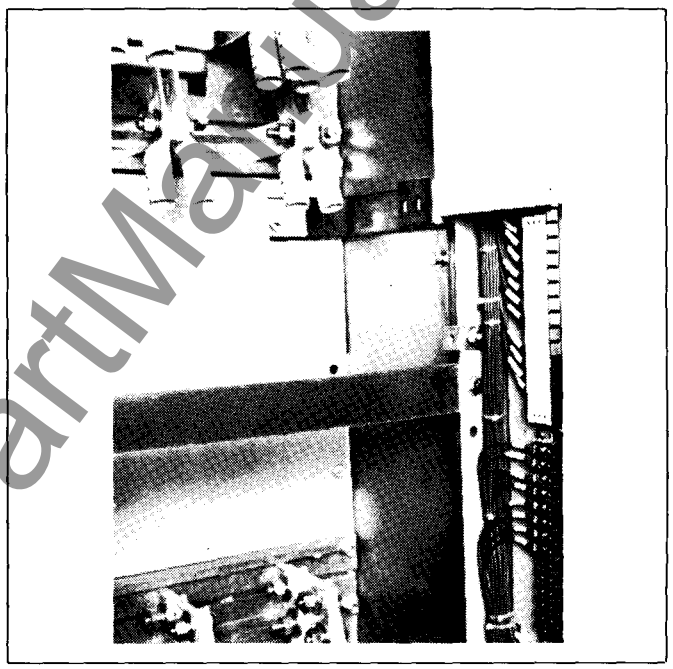


Figure 17. Cable Area Wire Trough with Lower Cover Removed.

Figure 18. Rear Hinged Doors Offer Ease of Access to Cable Compartments.

the aisle. The rear of each cubicle is equipped with a door for access to the primary cable entrance area and secondary terminal blocks. The full length front doors are hinged and may be padlocked. Rear doors are hinged and secured with tamper-resistant screws. They extend below the floor line to assure complete enclosure. Synthetic rubber gasketing around front and rear doors insures thorough sealing of the unit. Shielded ventilation housings are appropriately located to permit proper air circulation, but to exclude dust, dirt and insects.

For protection from snow, rain and dust, each group is mounted on an integral six inch formed sheet steel base assembly which provides a rigid support for switchgear units and a tight bottom seal. A bituminous undercoating is applied to all undersurfaces as protection against moisture and corrosion.

Hinged front doors provide easy access to wide, unobstructed service aisle.

Space heaters in the breaker, bus and auxiliary compartments eliminate excessive condensation. One thermostat, if specified, in the bus compartment of each unit controls operation of the space heaters.

Standard accessories for outdoor units include all those provided for indoor switchgear. In addition, a light is mounted inside the aisle opposite the front of each unit and are controlled by 3-way switches on each end wall. Each group of units contains a convenience outlet and wall mounted panelboard with four molded case circuit breakers for control and protection of switchgear auxiliary circuits.

A traveling hoist is standard for outdoor units.

Finish

The structural steel parts and cubicles are conveyed through a spray tunnel where they are degreased and exposed to a hot phosphate chemical treating mixture followed by a hot sealing solution and drying agent. The panels are treated similarly.

The hot phosphate bath effects a chemical conversion of the metallic surface to a nonmetallic phosphate coating. Insoluble in water, this coating is effective in retarding corrosion. It is an excellent undercoating for paint.

After cleaning and stabilization, the framework and panels receive a cost of rust-resisting paint. The framework, panels and other detail parts are conveyed through two zone baking ovens to insure adequate curing. All exterior surfaces of outdoor weather-resistant equipment are given an additional finish coat of paint. Standard indoor finish is light gray ANSI 61; outdoor, dark gray ANSI 24 or sky gray ANSI 70. Standard finish paints are air-dry alkyd enamel.

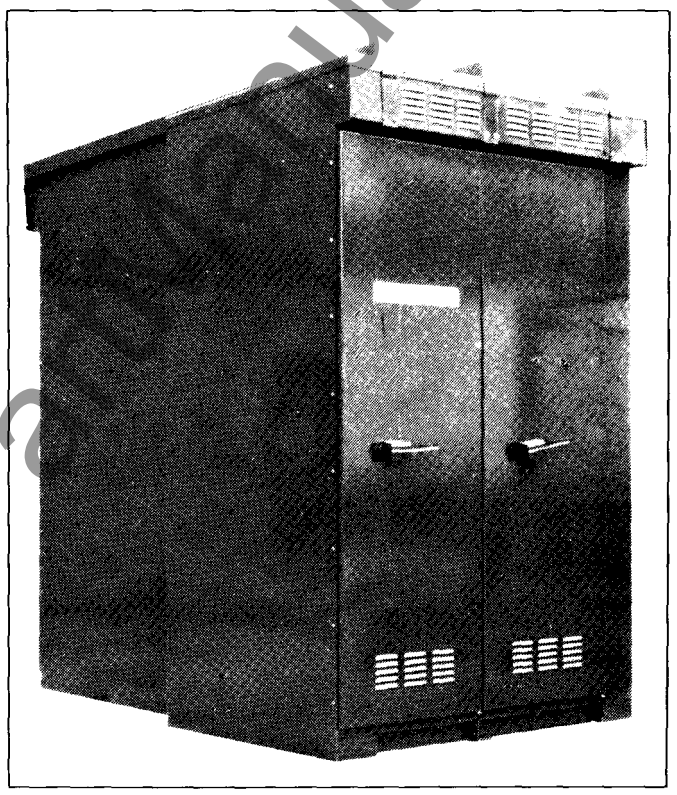


Figure 19. Typical Outdoor Construction. Note Front Aisle Extension on Each End.

Circuit breaker parts receive a protective zinc di-chromate plating which provides a contrasting gold color, eliminating any need for periodic repainting.

Specifications—Circuit Breakers

General Description and Operation

The RL series low voltage power circuit breakers are designed for 600-volt and below service with current carrying capacities up to 4000 amp and interrupting capacities up to 200,000 amperes. These compact, fast operating, dead-front circuit breakers incorporate a stored energy operating mechanism for fast, positive closing.

RL series low voltage power circuit breaker includes a stored energy operating mechanism (either manually or electrically operated), arc quenchers, main and arcing contact structure, inductive tripping sensors, static overcurrent trip device, control wiring, auxiliary switches, interlocks and position indicators.

Switchgear Division

Type R
600 Volts

Description

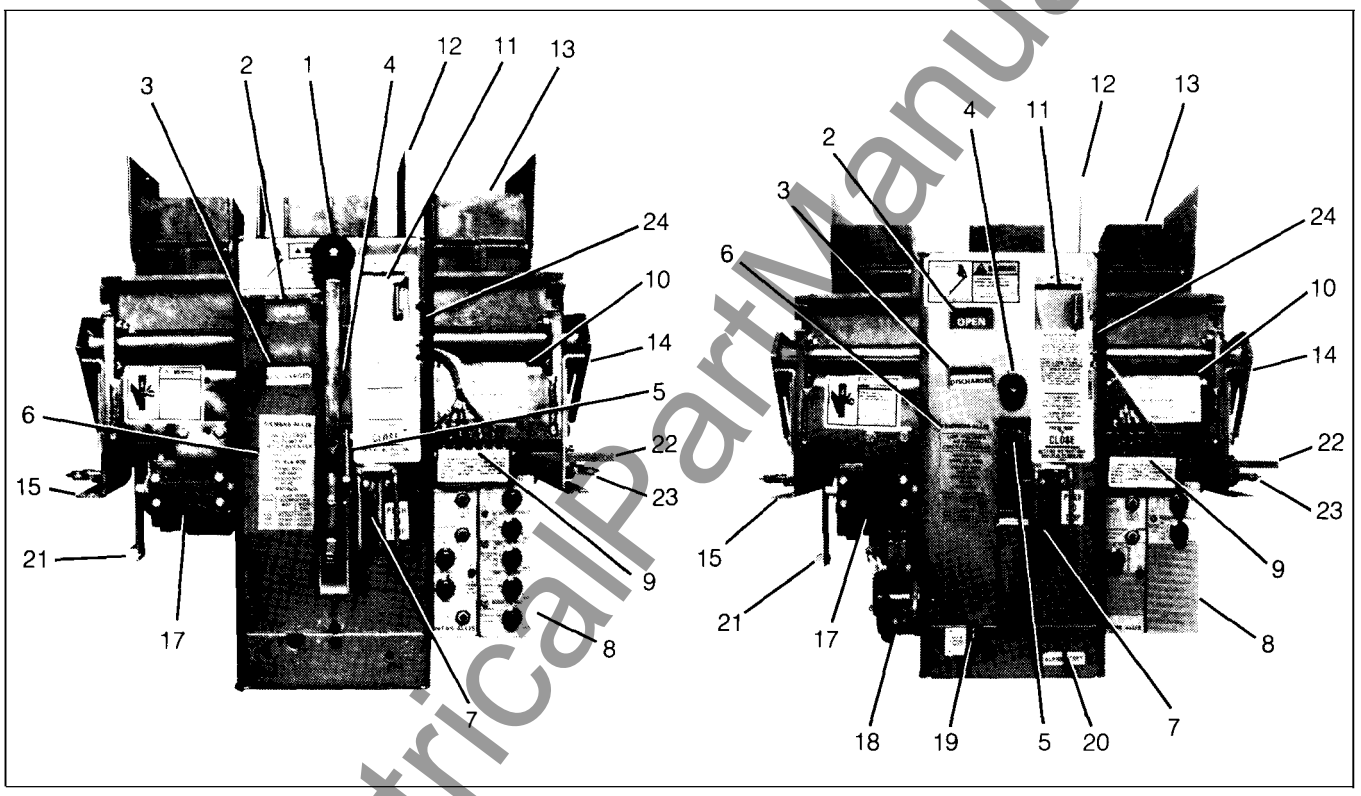


Figure 20. TL-800 Manually Operated Circuit Breaker.

Figure 21. RL-800 Electrically Operated Circuit Breaker.

1. Handle for manually charging stored energy closing springs**
2. Contact position indicator
3. Stored energy mechanism position indicator
4. Handle stop
5. Contact closing release lever
6. Circuit breaker rating nameplate
7. Tripping level (with padlocking provisions) with guard
8. Static Trip II® overcurrent device
9. Static Trip II® test points
10. Static Trip II® rating nameplate
11. Racking mechanism shutter (with padlocking provisions)
12. Inter-phase barriers
13. Arc chutes
14. Clevis attached to racking drive screw
15. Drawout rails
16. Secondary disconnects* (not illustrated)
17. Auxiliary switch*
18. Spring charging motor (electrically operated breaker only)
19. Power switch for spring charging motor (electrically operated breaker only)
20. Bell alarm manual reset lever
21. Ground shoe contact
22. Racking interlock bar
23. Racking position detent
24. Racking position indicator

* Optional on manual breakers.
** Optional on electrical breakers.

Description

Manually operated circuit breakers consist of 3 pole single throw element mechanically trip free, complete with static overcurrent trip device, manually charged stored energy closing mechanism, interpole barriers, arc quenchers, operating handle, push button mechanical trip, position indicator, all mounted to provide the drawout feature.

Electrically operated circuit breakers consist of 3 pole single throw element mechanically and electrically trip-free, complete with static overcurrent trip device, electrically charged stored energy closing mechanism, interpole barriers, arc quenchers, electrically operated spring release solenoid, shunt trip device, push button mechanical trip, position indicator, four auxiliary switches, all mounted to provide the drawout feature.

Stored energy provides a quick-make switching mechanism that assures high speed closing of breaker primary contacts, independent of the operator. Positive, controlled closing prevents unnecessary arcing between the movable and stationary breaker contacts as would be the case with slow or hesitant manual closing. This prevents the potentially dangerous result of improper closing, thereby lengthening contact and breaker life.

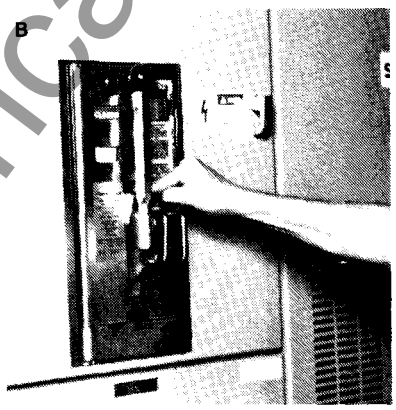
Manual operated stored energy breakers are charged by one downward stroke of the handle, Figure A; when handle is released it returns to the normal position. A closing lever, located on the front of the breaker behind the manual charging handle releases the stored energy to close the breaker, Figure B.

Electrically operated stored energy breakers are closed smoothly and positively by the action of springs that have been precharged by an electric motor. The springs remain charged indefinitely until the breaker is to be closed. When energy is released to close the breaker, the motor automatically recharges the springs for another closing operation.

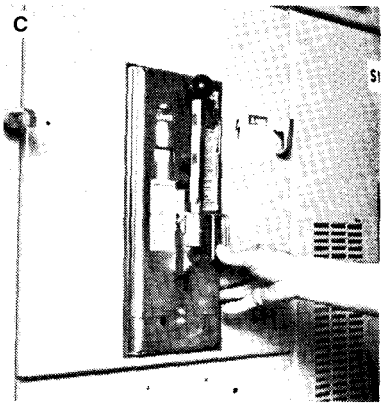
Manual tripping of manual and electrically operated breakers is accomplished by operation of the manual trip lever, Figure C.

As an option to electrically operated stored energy breakers, a manual spring charging handle as furnished on manually operated breakers can also be supplied, if specified.

A) A single, complete downward movement of the handle manually charges the circuit breaker closing springs. A ratchet insures a complete closing stroke.



B) With the manual handle returned to vertical position, the closing release lever is depressed, releasing the spring energy and closing the breaker contacts. This simultaneously charges the opening springs.



C) Depressing the manual trip level opens the circuit breaker contacts. Note the provision for padlocking.

Manual Operation

Switchgear Division

Type R
600 Volts

Description

Provision for Padlocking "Trip Free'

The push button mechanical trip level includes a slot with provision with 3 padlocks. When padlocked in the depressed position, the circuit breaker is trip free, and the contacts will not move even if the closing release or electric close coil operates. If charged, this closing spring will discharge, but the contacts will remain in the open position.

The racking mechanism shutter includes provisions for one padlock, to prevent unauthorized racking.

Primary Disconnects

Primary circuit connections between the removable circuit breaker and the switchgear assembly are made by sets of silver-plated contacts on the circuit breaker with silver-plated stationary contacts in breaker compartment. The finger contacts are mounted on the studs of the circuit breaker, facilitating inspection and maintenance. The stationary contacts are mounted on a solid Pyro-Shield insulation sheet which is bolted to the rear wall of the breaker cubicle.

Primary disconnecting devices are arranged so that contact is made only when the removable circuit breaker is in the operating or connected position. In the test position the primary contacts are separated by a safe distance.

Firm contact pressure is maintained by means of stainless steel back-up springs. As the circuit breaker is moved into the operating position, the wiping action of the self-aligning contacts assures low contact resistance.

Secondary Disconnects

Secondary circuit connections between the circuit breaker and stationary switchgear structure are made by means of automatic, self-aligning, multi-contact, silver-plated, slide-type connectors.

The contact surfaces on the stationary element are heavily silver-plated copper strips mounted on a molded base of Pyro-Shield insulation. The stationary contact surfaces are recessed to properly guide the movable fingers and to prevent accidental short-circuiting of the control circuits.

The movable secondary disconnect elements are located on the lower left side of the low voltage power circuit breaker, well below the arc quenching area to avoid contamination from rapidly rising arc product gases. With the panel door open, the engagement of the secondary disconnecting elements is clearly visible to the operator.

The secondary connections automatically make contact when the breaker is in both the test and connected positions.

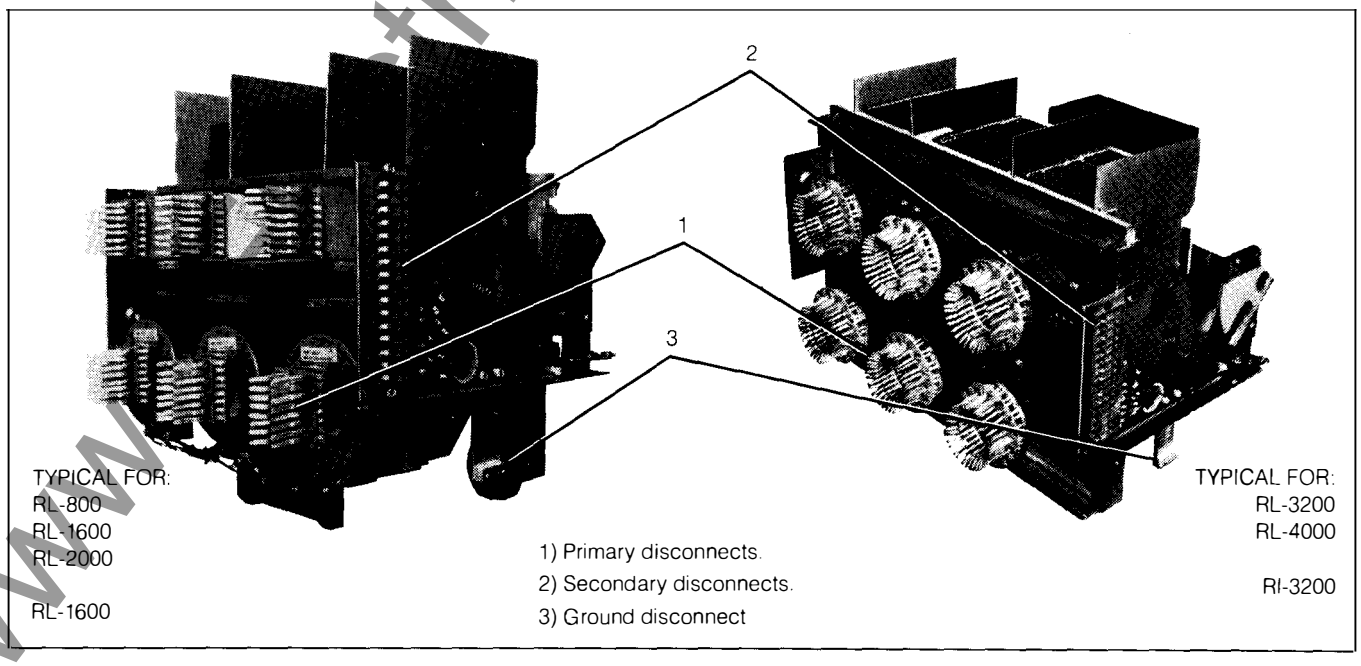


Figure 22. Disconnects Provide the Drawout Capability of:

Ground Connection

A ground contact on the removable low voltage power circuit breaker engages with the ground circuit through a contact in the breaker compartment in both the test and connected positions.

Draw-Out Interlocks

Integral parts of the circuit breaker mechanism include provisions to:

1. Rack the circuit breaker in or out of the cubicle compartment.
2. Interlocking to prevent racking a closed circuit breaker into or out of the connected position.
3. Interlocking to prevent closing a circuit breaker until it is fully racked to the connected position.
4. Interlocking to prevent withdrawing a circuit breaker from the cubicle while the closing springs are charged.

In order to rack the breaker into its compartment, the manual trip bar must be depressed and the racking mechanism shutter opened to gain access to the racking screw. Figure 23. As the trip bar is depressed, a shaft connected to it moves to permit opening the shutter, which holds the bar in. As long as the bar is pressed in and the shutter is open, the breaker is trip free, and cannot be closed. This interlock arrangement prevents racking the breaker in or out while it is closed.

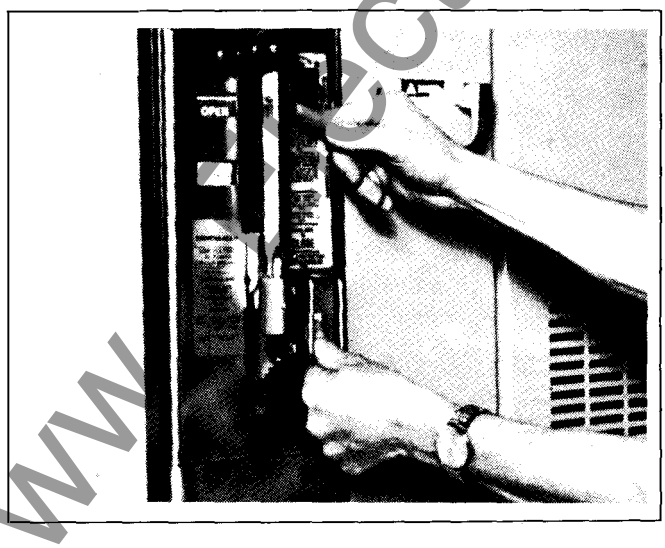


Figure 23.

The cubicle interlock rod is also directly actuated by the movement of the manual trip bar. With the manual trip bar in its normal position the interlock rod is extended; with trip bar pressed in, the rod is withdrawn. At positions corresponding to Test and Connected, the extended rod is engaged in a position hole on the side of the cubicle. This is aided by a detent on the breaker which engages the cubicle to assure proper alignment.

Rotation of the racking screw will rack the breaker into the TEST position. At the TEST position, the racking shutter can be closed, causing the trip bar to reset and the interlock rod to engage the cubicle position hole allowing the breaker to be closed. The breaker can then be operated for test if desired.

The same procedure is followed for movements into the connected position. In the CONNECTED position, the interlock will similarly engage the cubicle position hole and reset, allowing the circuit breaker to be closed. This prevents closing a circuit breaker which is not in the CONNECTED position.

With the circuit breaker between positions, the interlock bar will not engage the position holes of the cubicle. If the interlock bar is not in its reset position the breaker will be held TRIP-FREE and cannot be closed.

To withdraw the breaker from the CONNECTED position, the racking screw is rotated in the opposite direction.

When racking the circuit breaker out from TEST to the DISCONNECTED position, the closing springs will automatically discharge, at or before reaching the Disconnect position.

Arc Interruption

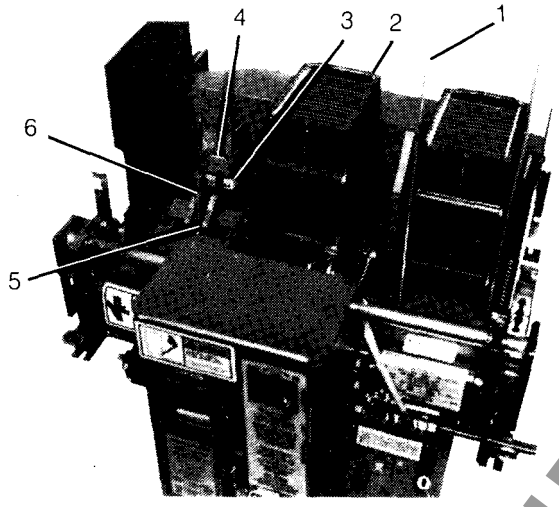
The RL series low voltage power circuit breakers interrupt in air, using arc chutes to elongate and cool the arc for high speed interruption. Circuit breakers equipped with instantaneous trip will interrupt a bolted three phase short circuit in 3 cycles or less.

A short circuit or overload will be detected by the solid state trip device, which will trip the circuit breaker via the tripping actuator. The opening springs will cause the movable contacts to open. The main contacts open first, to transfer the fault current to the arcing contacts. As these part, the thermal and electromotive characteristics of the arc cause it to be forced into the arc chute, where the metal plates elongate, constrict and cool it.

Switchgear Division

Type R
600 Volts

Description



1) Interpole barriers of glass polyester.
2) Arc chute.
3) Stationary main contacts.
4) Stationary arcing contacts.
5) Movable main contacts.
6) Movable arcing contacts.

Figure 24. Circuit Breaker Partly Disassembled to Show:

Fused Circuit Breakers

The 800, 1600 and 2000 ampere frame size circuit breakers are available with integrally mounted current limiting fuses, to increase their interrupting rating and/or limit the short circuit current to downstream equipment. The fuses are bolted in series with the upper set of primary disconnects. 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. It also indicates which main fuse has interrupted.

The larger frame size circuit breakers, 3200 and 4000 ampere, are available with current limiting fuses mounted on a separate drawout element, which is key interlocked with the circuit breaker to prevent racking the fuse element unless the circuit breaker is racked to the disconnect position.

The breakers have been qualified to all required standards and are UL list marked, based on use of either Gould-Shawmut or Reliance current limiting fuses, which are specially designed for use with Siemens Type RL circuit breakers.

Fuses rated 600 amperes and below are Class J, Chase-Shawmut Cat. No. A4J or Reliance Cat. No. LEF.

Fuses rated 800 amperes and above are Class L, Chase-Shawmut Cat. No. A4BY or Reliance Cat. No. LEF.

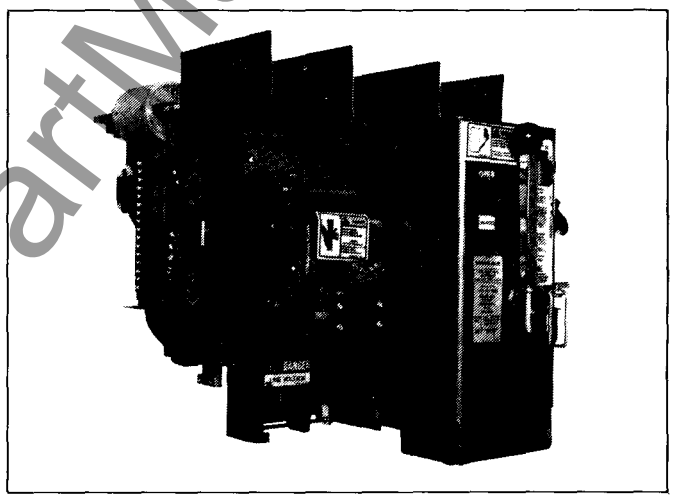


Figure 25. Integrally Fused RLF-1600 Circuit Breaker.

Key Interlocks (Optional)

Provision is included for mounting of key interlock assembly of the Superior or Kirk type within the breaker compartment. See Figure 27.

Key interlocks can be provided which will hold the key captive when the circuit breaker is closed, thus preventing operation of a remote device unless breaker is open. These are also used to interlock main and tie breakers and to interlock main breakers with disconnects or interrupter switches.

Truck Operated (TOC) Cell Switch

Used for providing control interlocking or remote indication based on breaker drawout position (Connected vs. Test Position).

The switches containing 4 or 8 contacts are mounted in the rear termination area. The switch is actuated by a reliable push-pull mechanism from 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. See Table 1 for ratings.

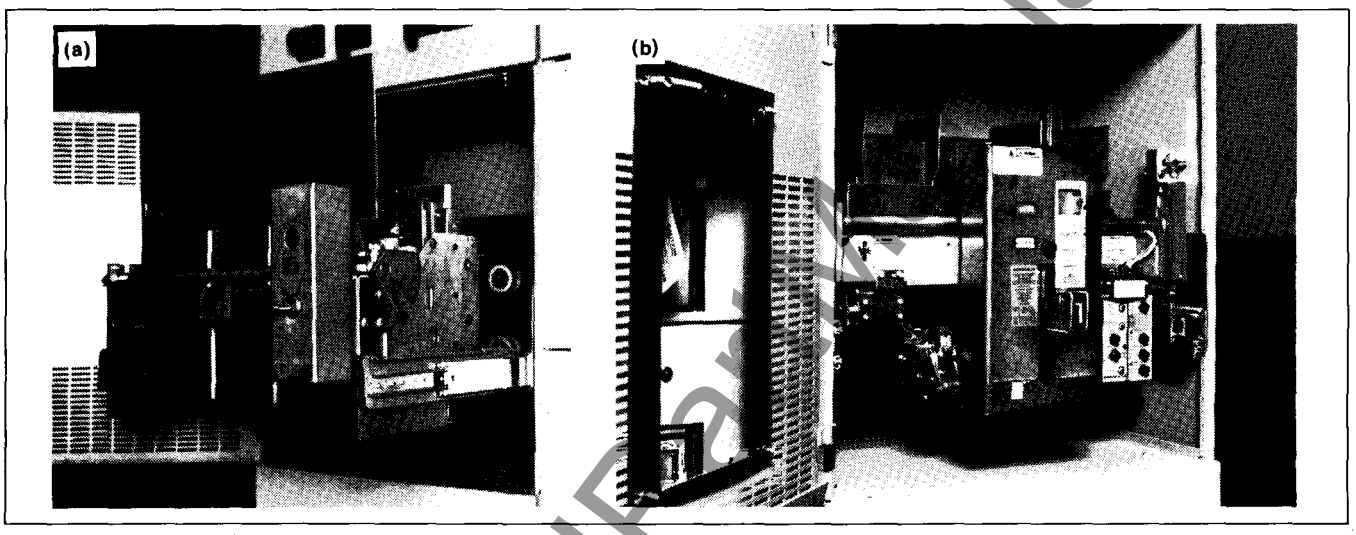


Figure 26. Separate RFC-3200 Fuse Carriage (a) for use with RLF-3200 Circuit Breaker (a).

Cubicle Mounted Auxiliary Switches (Mechanism Operated—MOC)

Used for providing indication (remote) or control interlocking based on main contact position (open vs. closed). When auxiliary switch contacts are required beyond the 4 contacts available on the circuit breaker, a Mechanism-Operated auxiliary switch (MOC), containing 4 or 8 contacts is mounted in the rear termination area. The switch is actuated by a reliable push-pull mechanism from 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. See Table 1 for ratings.

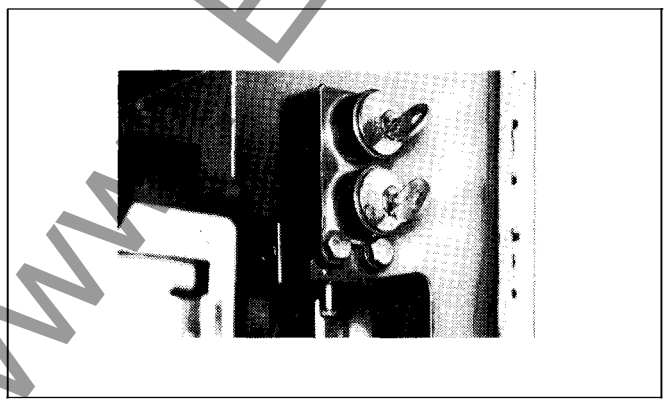


Figure 27. Key Interlock Provision.

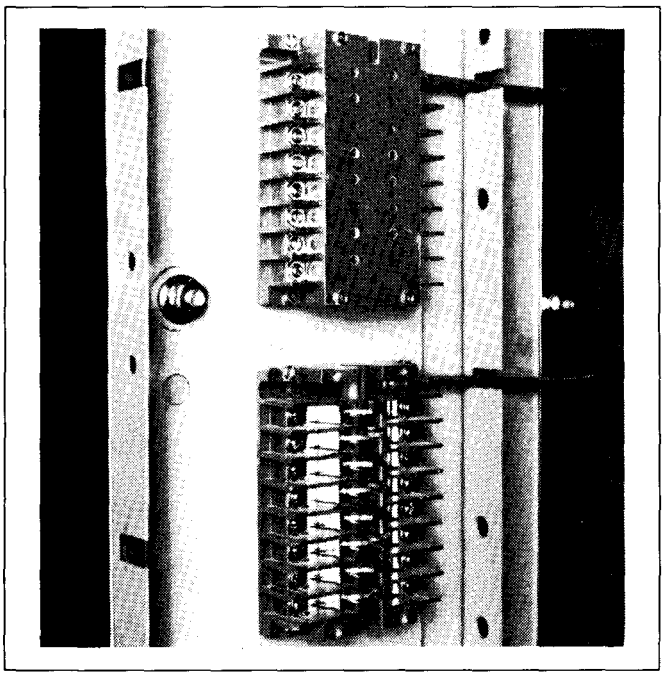


Figure 28. MOC and TOC Switches. Cover Removed to Show Field Convertible Contacts.

Switchgear Division

Type R
600 Volts

Description

Table 1. "Q-11" Breaker Mounted Auxiliary Switch① and MOC and TOC Switch Ratings.

Volts	DC				AC	
	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 20 A. continuous rating of standard No. 14 wire, unless otherwise specified.

Shunt Trip

Provides means to electrically trip from a remote device, such as pushbutton, switch or relay for automatic tripping. It is standard on all electrically operated breakers and optionally available on manually operated breakers.

Since the shunt trip coil is designed for a momentary duty cycle, an "a" auxiliary contact switch is used to interrupt its circuit immediately after the breaker is tripped. Energization of the coil causes the armature to pick up and rotate the trip latch to trip the breaker. A compression spring returns the armature to its normal position.

Operation Counter (Option)

Mounted beneath the breaker mounted auxiliary switch, the mechanically operated, 5 digit non-resettable counter is actuated from the auxiliary switch operating mechanism.

Undervoltage Trip Device (Option)

The undervoltage trip device provides protection against the effects of a drop in normal bus voltage and functions to directly trip the breaker. Pick-up is 85% or less of rated value, drop-out is between 30% and 60% of the rated value. Pick-up and drop-out are individually adjustable. Either instantaneous or time-delay operation can be supplied. The integral static timing unit is adjustable from 0.04 to 4 seconds for providing a time delay between the detection of the undervoltage condition and breaker trip to ride over system momentary voltage dips.

Automatic Trip Alarm Contact (Bell Alarm), with Lockout (Option)

The bell alarm switch is initiated by the operation of the Static Trip Device, and functions to operate a switch.

The contacts may be used for remote indication of an automatic trip.

A single pole double throw (SPDT) or a double pole throw (DPDT) switch is available. Table 3. The switch operator must be reset either manually, or optionally by electrical reset. The contacts of the bell alarm switch can be connected in series with the breaker closing coil, to provide a lockout feature to prevent reclosing after a fault.

Electrically Operated Interlock (Option)

This interlock provides a means to electrically interlock two breakers to prevent both being closed at the same time. These electro-mechanical devices amount to an additional solenoid that must be energized before the breaker can be closed. When the device is de-energized the breaker is held trip-free so that it cannot be closed either electrically or manually. The devices are available for 48, 125 and 250 volt D.C. as well as for 120 and 240 volt A.C. They are similar in construction and mount in the same location as the undervoltage trip device. The electrical interlock has a mechanical link from the device to the main shaft of the breaker to hold the device in the picked-up position when the breaker is closed. Once closed the device can be de-energized without tripping the breaker. There are no adjustments for pickup or drop-out voltages of the device. The devices are designed to be energized continuously.

Table 1. Shunt Trip Coil Rating

Control Voltage			Shunt Trip (Amperes)
Nominal		Operating Range	Inrush
DC	24	14-28	17.7
	32	18-38	15.0
	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

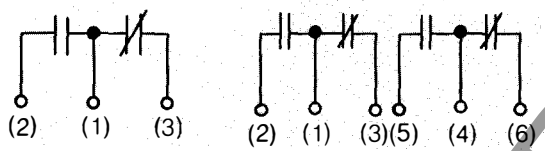
Table 2. Undervoltage Coil Rating

Nominal Control Voltage		Voltage	
		Pickup	Dropout
DC	48	40	24
	125	105	62
60 Hz AC	120	100	60
	240 or 480①	—	—

① Not available. Use 120 VAC undervoltage device with appropriate 240-120 or 480-120 voltage transformer in cubicle.

Table 3. Bell Alarm Contact Rating

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
60 Hz AC	120	10.0	10.0	10.0
	240	10.0	10.0	10.0



a. SPDT Contact b. DPDT Contact

Table 4. Interlock Coil Rating

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

Overcurrent Tripping Devices

Static overcurrent tripping systems have been standard on the Siemens LA line of circuit breakers since 1961. The tripping system was updated in 1971 to make use of the latest integrated circuit components and is called STATIC TRIP II®. Based on its time proven service record, it continues as the standard tripping system for the RL series breakers.

Static Trip II® Trip Device Features

- Ease and accuracy in making field adjustments
- Excellent repeatability.
- Negligible change in characteristics with normal temperature variation.
- Continuous pick-up adjustment over a wide range—no taps to change.
- Ground current tripping available without an external relay.
- Targets available to indicate the cause of tripping
- Simple field testing without need of a primary current source—portable test set available as an option.
- Minimum maintenance—only one moving part.
- Simple breaker rating change.
- Flexibility—many combinations available including long time delay, short time delay, instantaneous and ground fault elements in the same device.

Trip Device Accessibility

Located in the lower right side of the breaker compartment, the trip device is readily accessible to the operator for simple adjustment of all settings.

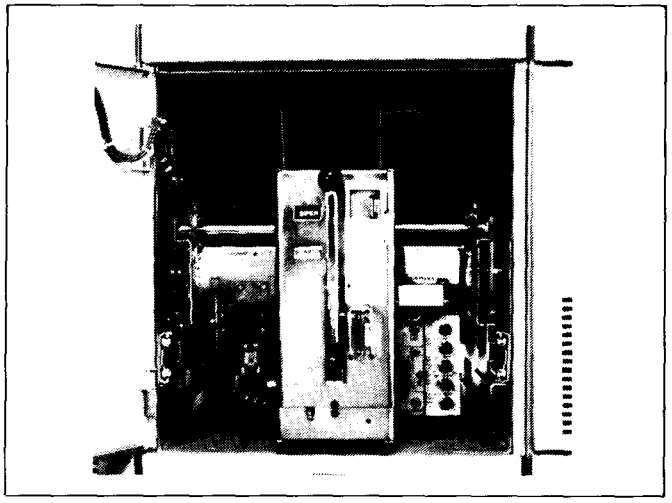


Figure 29.

Tripping Transformers

The tripping system is completely contained on the circuit breaker. The power for tripping the breaker and for operating the solid state circuitry in the static trip device is drawn from the primary current through tripping current transformers mounted on the breaker. Four-wire ground applications include a fourth transformer mounted in the cable compartment. A signal, proportional to primary current, is taken from these same tripping transformers. This signal is applied to the static trip device and causes it to operate the tripping actuator to trip the breaker in accordance with a pre-set time delay versus current magnitude relationship.

Switchgear Division

Type R
600 Volts

Description

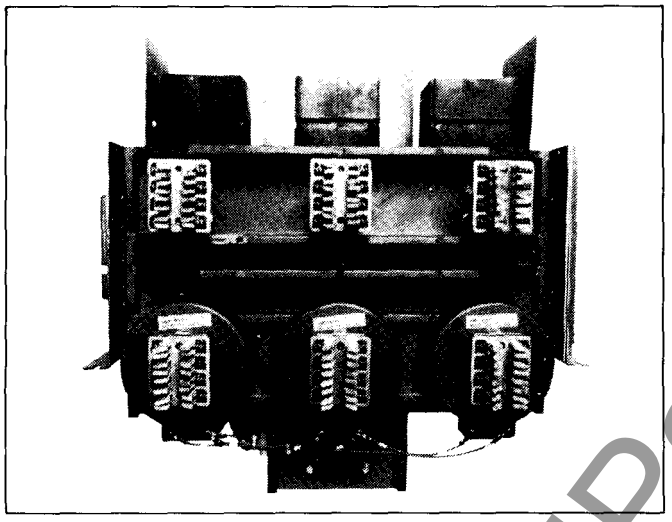


Figure 30. Tripping Transformers Furnish Input Signal to Trip Device in Proportion to Primary Current.

Tripping Actuator

Fast action tripping of the breaker is achieved with a low energy flux-shifting tripping actuator. When the breaker is in the closed position, the spring is reset mechanically and held in that position by a permanent magnet. Most of the flux from the magnet flows through the armature rather than through the higher reluctance path of the air gap inside the coil. The magnetic force holds the armature and spring firmly in position. When the flux-shifting coil is energized by the static trip device, the flux of the coil and air gap cancels the flux of the permanent magnet, releasing the armature which allows the spring to act to trip the breaker.

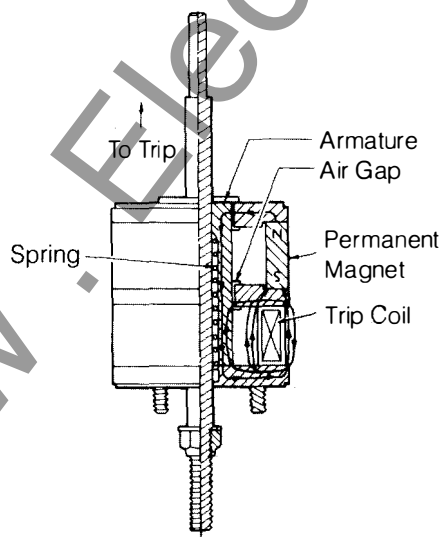


Figure 31. Tripping Actuator.

Description of Operation—Static Trip II® Overcurrent System

A block diagram of the static trip system is shown below, Figure 32. The power supply and signal transformers step the secondary current of the tripping transformers down to a level suitable for the solid state circuits. The power supply transformers, unlike the signal transformers, do not need to maintain a constant ratio and are therefore designed to saturate so as to limit maximum power input to the static trip device.

The desired time-current relationship of the long time delay circuit is accomplished as follows: a pulse generator and time shaping circuit in combination produce a train of pulses whose frequency is proportional to approximately the square of the primary current. Both the pulse generator and the counter are blocked when the signal is below the pickup level. If the signal reaches the pickup level, both the pulse generator and counter are released, the counting of pulses begins. The counter is a 7-stage binary counter which produces an output from the first stage after one count, from the second stage after two counts, from the third stage after four counts, and so on up to 64 counts for the last stage. The time band switch selects the counter stage which is connected to operate the tripping actuator through the static switch circuit. This scheme results in each time band having a delay precisely twice that of the next lower band.

The tripping transformer neutral (N) is wired to terminal 9 for systems without ground tripping and to terminal 4 for 3 wire systems with ground fault tripping. Ground fault protection is available for 4-wire circuits also with only the addition of an external tripping transformer.

Adjustment knobs are available on the front of the static trip unit for all the applicable adjustments shown in the block diagram, Figure 33.

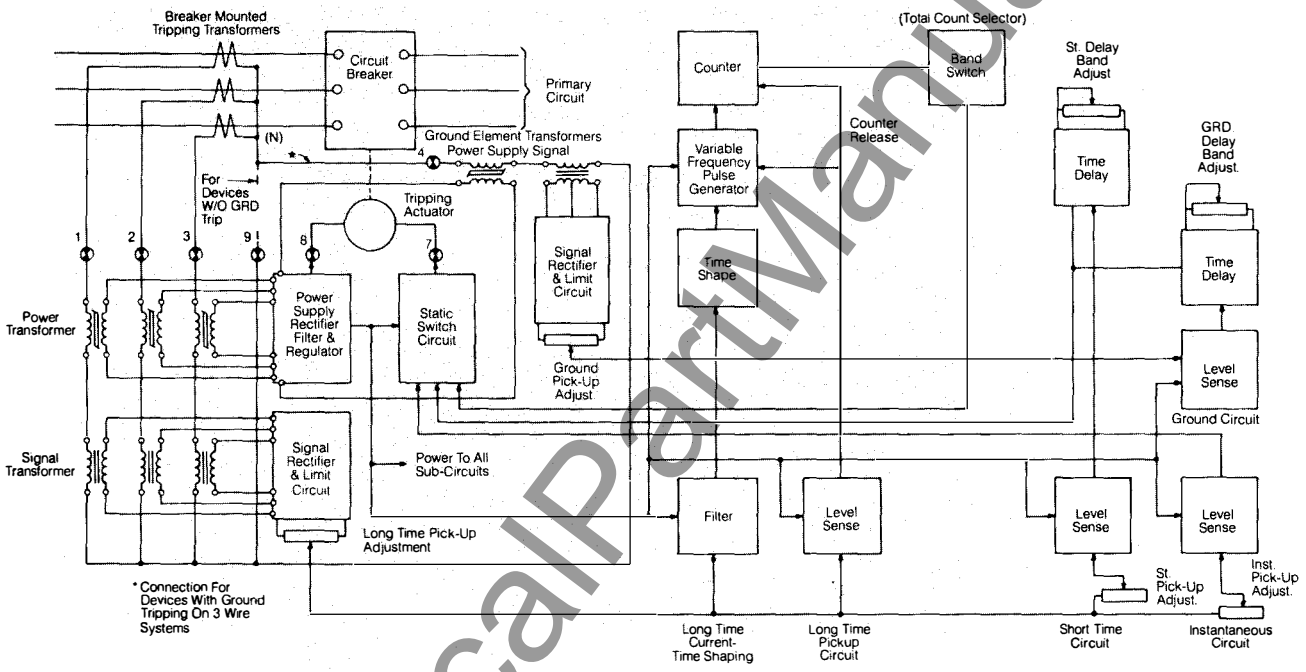


Figure 32. Block Diagram of Static Trip II®

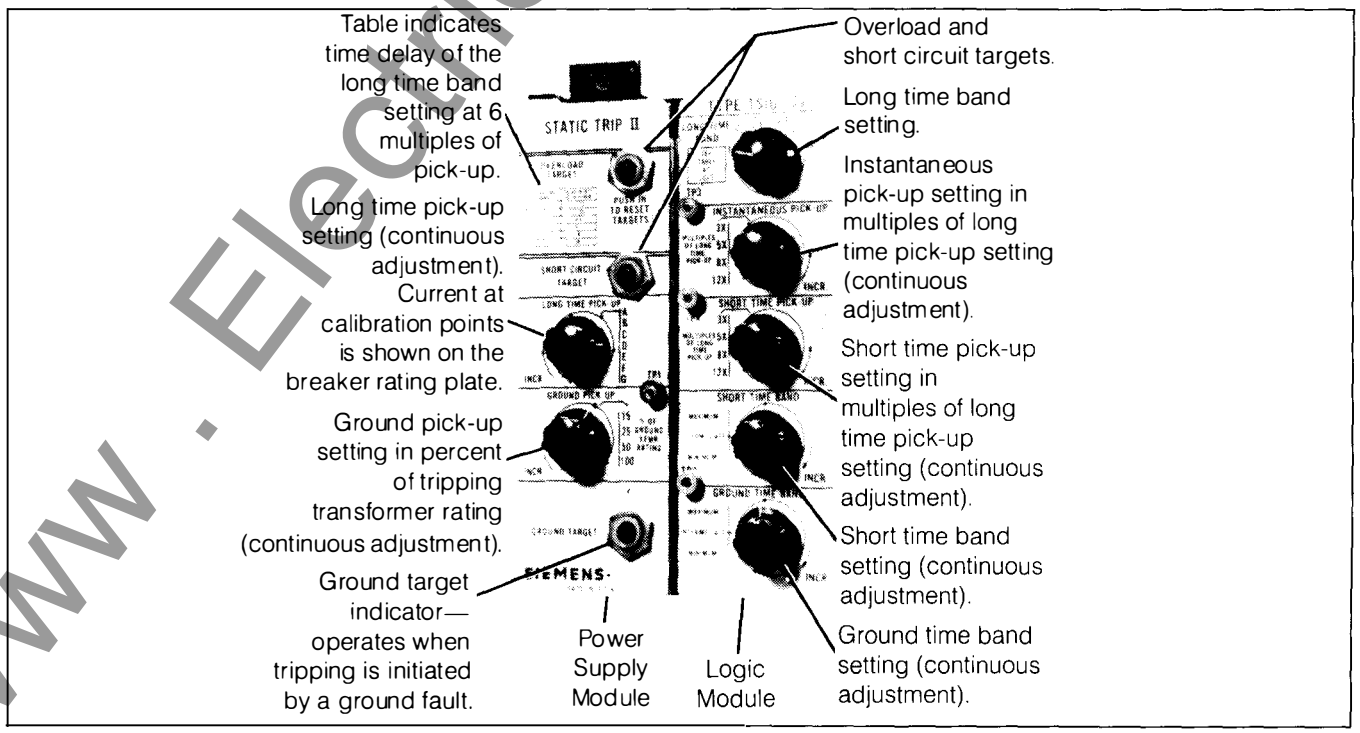


Figure 33.

Switchgear Division

Type R
600 Volts

Description

Types and Application of Static Trip II® Overcurrent System

Available Types

Nine types of Static Trip II devices are available. Similar in many respects, they differ only in their specific application. All use identical tripping transformer inputs and provide output signals to the tripping actuator. Several types are shown in the picture below, Figure 34.

The type designation is coded to indicate the functional elements: T = LONG-TIME delay elements, S = SHORT-TIME delay element, I = INSTANTANEOUS element, G = ground current element, (OT) indicates that the device does not have trip indication targets, (2T) two targets that indicate tripping on short circuit (short time or instantaneous) or overload (Long Time) current, and (3T) for three targets that indicate tripping on overload, short circuit or ground current. For each element except instantaneous there are two adjustment knobs on the front of the device, one for pick-up setting and one for delay setting. The instantaneous element has only one knob for pick-up setting. Targets are optional on all devices. Following are brief descriptions of the different types.

1. Type TI(OT) (Standard) and TI(2T) (Optional)—A dual trip device normally used for phase overcurrent protection. The long time pick-up range is selected from the trip rating table and is continuously adjustable from "A" thru "G" in the field. The instantaneous element is continuously field adjustable from 3 to 12 multiples of the long time pick-up setting selected. The long time delay is field adjustable with a choice of six bands.

2. Type TIG(3T) (optional)—A dual trip device which provides phase overcurrent protection same as Type TI plus sensitive ground fault protection for 3-wire and 4-wire circuits on systems with either phase-to-phase or phase-to-neutral loading. Ground current pick-up settings are independent of the phase pick-up settings, and continuously adjustable in the field from 15% through 100% of the tripping transformer rating. When used on 4-wire circuits, a fourth tripping transformer is required. It is mounted in the cubicle, and wired to the breaker through secondary disconnects.

3. Type TS(OT) and TS(2T) (optional)—A selective trip device used for phase overcurrent protection which provides time delay tripping only. It allows complete field adjustment of the long time band and pick-up plus the short time band and pick-up. The short time pick-up can be adjusted from 3 to 12 multiples of the long time pick-up setting. Any one of the three short time bands can be used with any of the six long time bands.

4. Type TSG(3T) (optional)—A selective trip device which provides phase overcurrent protection same as Type TS plus sensitive ground fault protection for 3-wire and 4-wire circuits on systems with either phase-to-phase or phase-to-neutral loading. Ground current pick-up settings are independent of the phase pick-up settings, and continuously adjustable in the field from 15% through 100% of the tripping transformer rating. When used on 4-wire circuits, a fourth tripping transformer is required. It is mounted in the cubicle and wired to the breaker through secondary disconnects.

5. Type TSI(OT) and TSI(2T) (optional)—A triple selective trip device used for phase overcurrent protection which provides long time delay, short time delay, and instantaneous elements. It allows complete field adjustment of the long time band and pick-up, the short time band and pick-up and the instantaneous pick-up. Both the short time and instantaneous elements can be adjusted to pick up at 3 to 12 multiples of the long time pick-up setting. Any one of the three short time bands can be chosen to be used with any of the six long time bands.

6. Type TSIG(3T) (optional)—A triple selective trip device which provides phase overcurrent protection same as Type TSI plus sensitive ground fault protection for 3-wire and 4-wire circuits on systems with either phase-to-phase or phase-to-neutral loading. Ground current pick-up settings are independent of the phase pick-up settings, and continuously adjustable in the field from 15% through 100% of the tripping transformer rating. When used on 4-wire circuits, a fourth tripping transformer is required. It is mounted in the cubicle, and wired to the breaker through secondary disconnects.

Ground Fault Trip (Optional)

Solidly grounded low voltage systems are prone to relatively low magnitude arcing ground faults which can go undetected by the phase overcurrent protecting elements. By including the sensitive ground trip element as an integral part of the Static Trip II® System, coordinated ground fault protection is provided.

Ground Fault Trip System is optionally available with the Static Trip II® device. The ground trip element characteristics are shown on the left side of the characteristic, Figure 38 on page 23. This element is connected in the neutral of the three tripping transformer secondaries so that it senses ground current only, and not load current. This arrangement permits more sensitive settings below normal load current values, thereby providing better protection against ground faults, which are often limited to low levels by ground return impedance and by arc resistance of arcing faults.

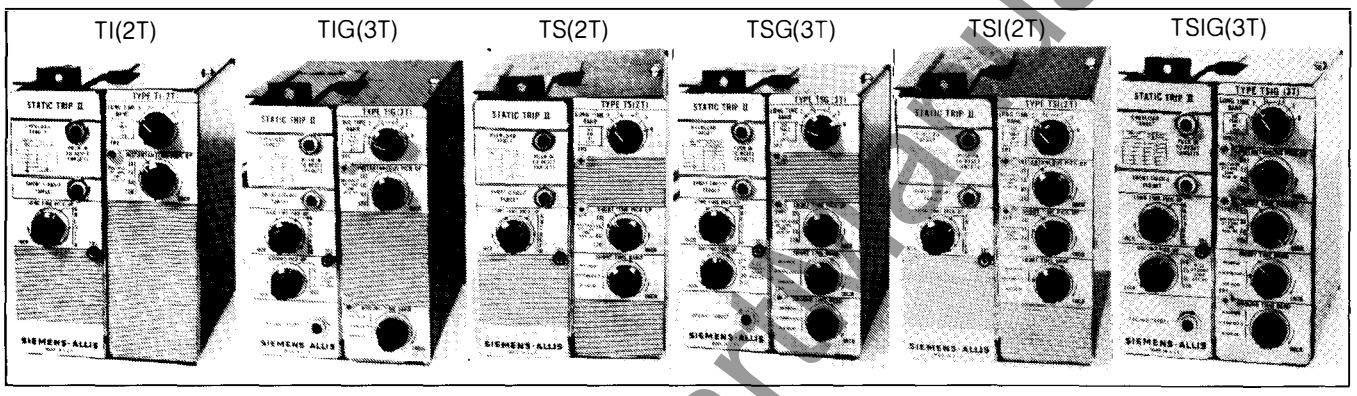


Figure 34. Typical Static Trip II® Trip Devices

Arcing ground faults can be very destructive, so it is desirable to clear them as quickly as possible. However, some adjustable delay is needed if coordination is to be provided between breakers at various levels in the system. Consequently ground trip elements are provided with the same fixed short delays as the short time element and with the same calibrated points. Minimum, Intermediate and Maximum, corresponding to nominal values of 0.1, 0.25 and 0.45 seconds. The ground pickup dial is calibrated in percent of breaker current rating with calibrated points at 15%, 25%, 50% and 100% (Figure 33). The ground element is designed for application to solidly grounded systems only.

Temperature Range of Operation

Operation of the static tripping system is extremely stable over a wide range of temperature. From -40°C to 55°C (-40°F to 131°F) the variation from performance at room temperature is less than 10 percent in pick-up value and timing. If they must be operated in environments beyond these limits, heating or ventilation is recommended. They will operate at 65°C (149°F) indefinitely without any permanent change in characteristics.

Simplified Breaker Rating Change

The continuous rating of the circuit breaker may be readily changed in the field by replacing the tripping transformers mounted on the circuit breaker studs. Refer Figure 35. The transformer rating listed in primary amperes will be found on the rating plate of each circuit breaker, Figure 36. Whenever a breaker rating is changed, a new rating plate is also furnished.

Field Testing

Static tripping enables simple and economical field testing of the static trip devices. An inexpensive portable test set using 115-volt power is available to make function and timing tests to indicate if the device is working properly. Operation of a circuit breaker may also be checked by whether or not it trips when supplied an appropriate signal. Figure 37.

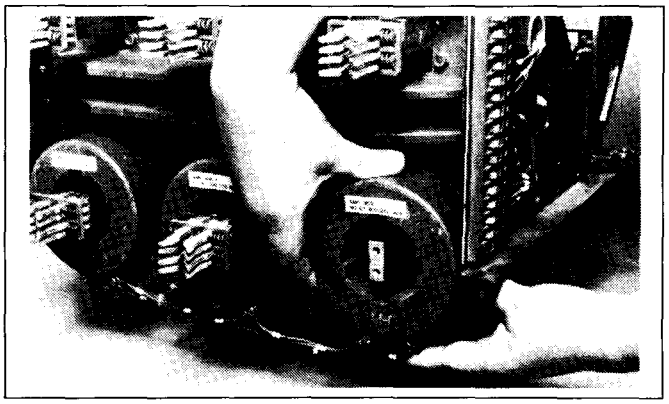


Figure 35.

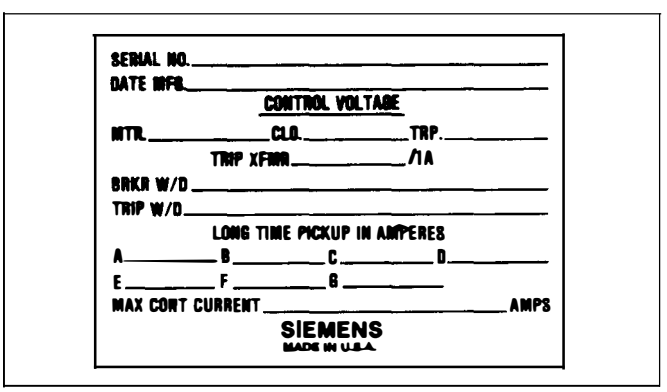


Figure 36. Breaker Rating Plate.

Switchgear Division

Type R
600 Volts

Description

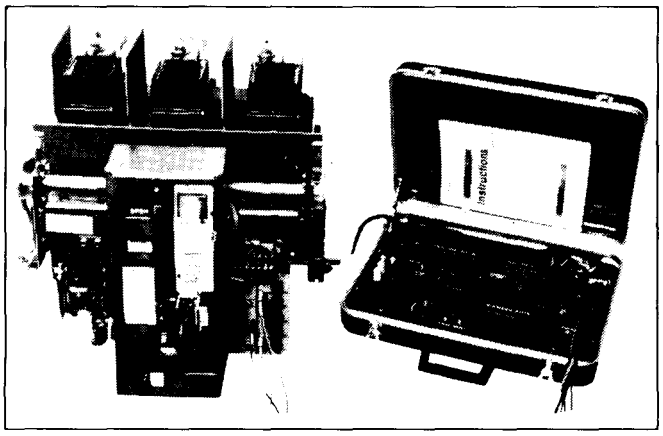


Figure 37. Portable Test Set is Shown Being Used on Breaker Removed from its Cubicle. The Test Set May Also Be Used with the Breaker in "TEST" or "DISCONNECTED" Positions in its Cubicle.

Target Indicators (Optional)

STATIC TRIP II® Overcurrent Trip Devices have target indicators available as an option. The type of fault which caused the circuit breaker to trip can be determined at a glance. A red button pops out indicating "Overload", (long time trip) "Short Circuit" (short time and/or instantaneous trip) or "Ground" (ground fault). Refer Figure 33, Page 19.

You save time and money while simplifying maintenance. All STATIC TRIP II® devices feature solid state circuitry and are continuously adjustable, permitting pinpoint settings. Choose from nine models to suit your particular application.

Table 1. Static Trip Rating Table—Amperes

Breaker Frame Size Type	Tripping XFMR Rating (Primary Amps)	Long Time Element Calibrated Pick-Up Settings†							Max. Const. Rating	Ground Element Calibrated Pick-Up Settings			
		A	B	C	D	E	F	G		15%	25%	50%	100%
800A Frame RL-800 RLF-800	80	40	50	60	70	80	90	100	100	ϴ	ϴ	40	80
800A Frame: RL-800 RLF-800 RLX-800	200 400 800	100 200 400	125 250 500	150 300 600	175 350 700	200 400 800	225 450 900*	250 500 1000*	250 500 800	ϴ 60 120	50 100 200	100 200 400	200 400 800
1600A Frame: RL-1600 RLX-1600 RLF-1600	200 400 800 1600	100 200 400 800	125 250 500 1000	150 300 600 1200	175 350 700 1400	200 400 800 1600	225 450 900 1800*	250 500 1000 2000*	250 500 1000 1600	ϴ 60 120 240	50 100 200 400	100 200 400 800	200 400 800 1600
2000A Frame: RL-2000 RLF-2000	200 400 800 1600 2000	100 200 400 800 1000	125 250 500 1000 1250	150 300 600 1200 1500	175 350 700 1400 1750	200 400 800 1600 2000	225 450 900 1800 2250*	250 500 1000 2000 2500*	250 500 1000 2000 2000	ϴ 60 120 240 300	50 100 200 400 500	100 200 400 800 1000	200 400 800 1600 2000
3200A Frame: RL-3200 RLF-3200	1600 2000 2400 3200	800 1000 1200 1600	1000 1250 1500 2000	1200 1500 1800 2400	1400 1750 2100 2800	1600 2000 2400 3200	1800 2250 2700 3600*	2000 2500 3000 4000*	2000 2500 3000 3200	240 300 360 480	400 500 600 800	800 1000 1200 1600	1600 2000 2400 3200
4000A Frame: RL-4000 RLF-4000	3200 4000	1600 2000	2000 2500	2400 3000	2800 3500	3200 4000	3600 4500*	4000 5000*	4000 4000	480 600	800 1000	1600 2000	3200 4000

* Exceeds maximum continuous current rating of frame—do not use these settings.
† Long time element continually adjustable from A through G.
ϴ Breaker may not trip with this ground fault setting.

Description

Types Available

TI(OT): Long Time and Instantaneous
TS(OT): Long Time and Short Time
TSI(OT): Long Time, Short Time, and Instantaneous
TI(2T): Long Time and Instantaneous
TS(2T): Long Time and Short Time
TSI(2T): Long Time, Short Time, and Instantaneous.
TIG(3T): Same as TI(2T), plus ground fault

TSG(3T): Same as TS(2T), plus ground fault
TSIG(3T): Same as TSI(2T), plus ground fault

Devices with (OT) designation
Devices with (2T) designation include targets to indicate overload trip and short circuit trip, while those with (3T) designation also include a ground trip target.

GENERAL NOTES
Static Trip II Overcurrent Device

1. The "Tripping XFMR Rating" values represent the primary value of the current transformer ratio in amperes. The secondary value is one ampere.
2. The pick-up settings of the long time element are continuously adjustable, and are calibrated at points "A" through "G" as shown in the rating table.
3. The pick-up settings of the instantaneous and short time delay elements are continuously adjustable, and are calibrated at 3, 5, 8 and 12 multiples of the long time pick-up setting.
4. The pick-up settings of the ground elements are continuously adjustable, and are calibrated in percent of the tripping transformer rating as shown in the rating table.
5. The long time element has 6 bands which are field selectable. The time delay at 6 multiples of pickup is as follows:

   Band 1 — 1.12 seconds Band 4 — 9 seconds
   Band 2 — 2.25 seconds Band 5 — 18 seconds
   Band 3 — 4.5 seconds Band 6 — 36 seconds
6. The short time element and ground element have 3 bands which are calibrated at minimum, intermediate and maximum, but are continuously adjustable.
7. The maximum interrupting time is the maximum length of time that fault current flows, including arcing time.
8. Instantaneous maximum interrupting time may be greater when breakers are closed in on a fault depending on actual fault conditions. The maximum potential increase for a 3-phase fault is 0.01 seconds and for a single-phase ground fault is 0.02 seconds.
9. The lower limit of ground fault recognition is 25 amperes for the RL-800 or RLF-800 and 40 amperes for the RLX-800, RL-1600, RLX-1600 and RLF-1600.

Switchgear Division

Type R
600 Volts

Description

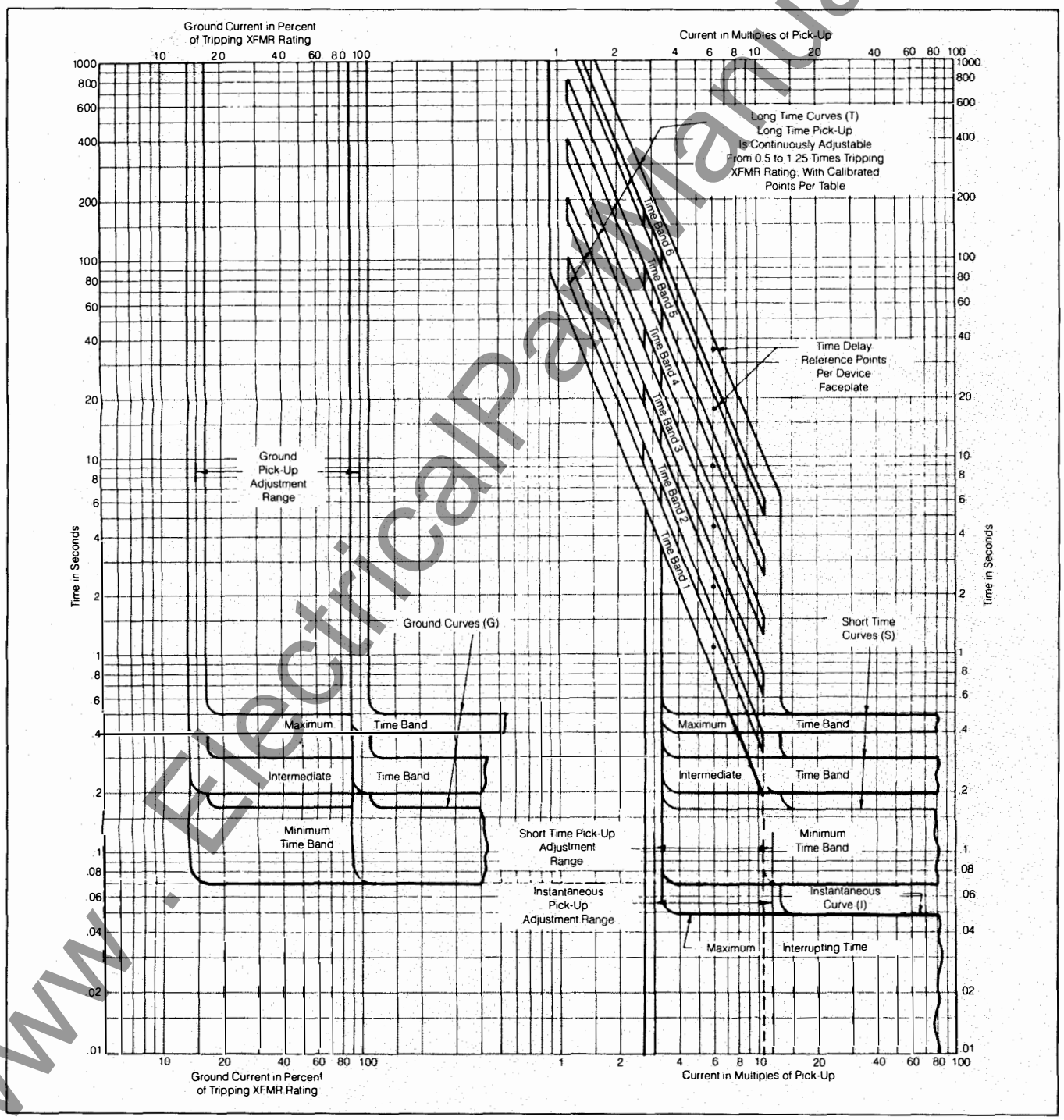


Figure 38. Static Trip II® Time-Current Characteristic.

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

Voltage Ratings		Type	Frame Size Amperes	Insulation Level Dielectric Withstand Volts	Short Time Rating Symmetrical Amps	Short Circuit Rating Symmetrical Current		Continuous Current Rating Amperes
Rated Volts	Rated Max. Volts					With Instantaneous Trip	Without Instantaneous Trip	
1	2	3	4	5	6	7	8	9
600	635	RL-800	800	2200	30,000	30,000	30,000	40-800
		RLX-800	800	2200	42,000	42,000	42,000	100-800
		RL-1600	1600	2200	50,000	50,000	50,000	100-1600
		RLX-1600	1600	2200	65,000	65,000	65,000	100-1600
		RL-2000	2000	2200	65,000	65,000	65,000	100-2000
		RL-3200	3200	2200	65,000	65,000	65,000	1000-3200
		RL-4000	4000	2200	85,000	85,000	85,000	2000-4000
480	508	RL-800	800	2200	30,000	30,000	30,000	40-800
		RLX-800	800	2200	42,000	42,000	42,000	100-800
		RL-1600	1600	2200	50,000	50,000	50,000	100-1600
		RLX-1600	1600	2200	65,000	65,000	65,000	100-1600
		RL-2000	2000	2200	65,000	65,000	65,000	100-2000
		RL-3200	3200	2200	65,000	65,000	65,000	1000-3200
		RL-4000	4000	2200	85,000	85,000	85,000	2000-4000
240 & 208	254	RL-800	800	2200	30,000	42,000	30,000	40-800
		RLX-800	800	2200	42,000	50,000	42,000	100-800
		RL-1600	1600	2200	50,000	65,000	50,000	100-1600
		RLX-1600	1600	2200	65,000	65,000	65,000	100-1600
		RL-2000	2000	2200	65,000	65,000	65,000	100-2000
		RL-3200	3200	2200	65,000	85,000	65,000	1000-3200
		RL-4000	4000	2200	85,000	130,000	85,000	2000-4000

All circuit breakers are UL listed.

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 Rating Symmetrical Amps	Range of Fuse Ratings Amperes	Continuous Current Rating Amperes
Rated Volts	Rated Max. Volts						
1	2	3	4	5	6	7	8
208 to 600	600	RLF-800	800	2200	200,000	250-1600	40-800
		RLF-1600	1600	2200	200,000	800-3000	100-1600
		RLF-2000	2000	2200	200,000	4000	100-2000
		RLF-3200 & RFC-3200 Fuse Carriage	3200	2200	200,000	2000-5000	1000-3200
		RLF-4000 & RFC-4000 Fuse Carriage	4000	2200	200,000	2000-6000	2000-4000

The fuse drawout carriage is located in a separate compartment and is interlocked with the associated circuit breaker. All circuit breaker (and drawout fuse carriage, if applicable) are UL listed.

Switchgear Division

Type R
600 Volts

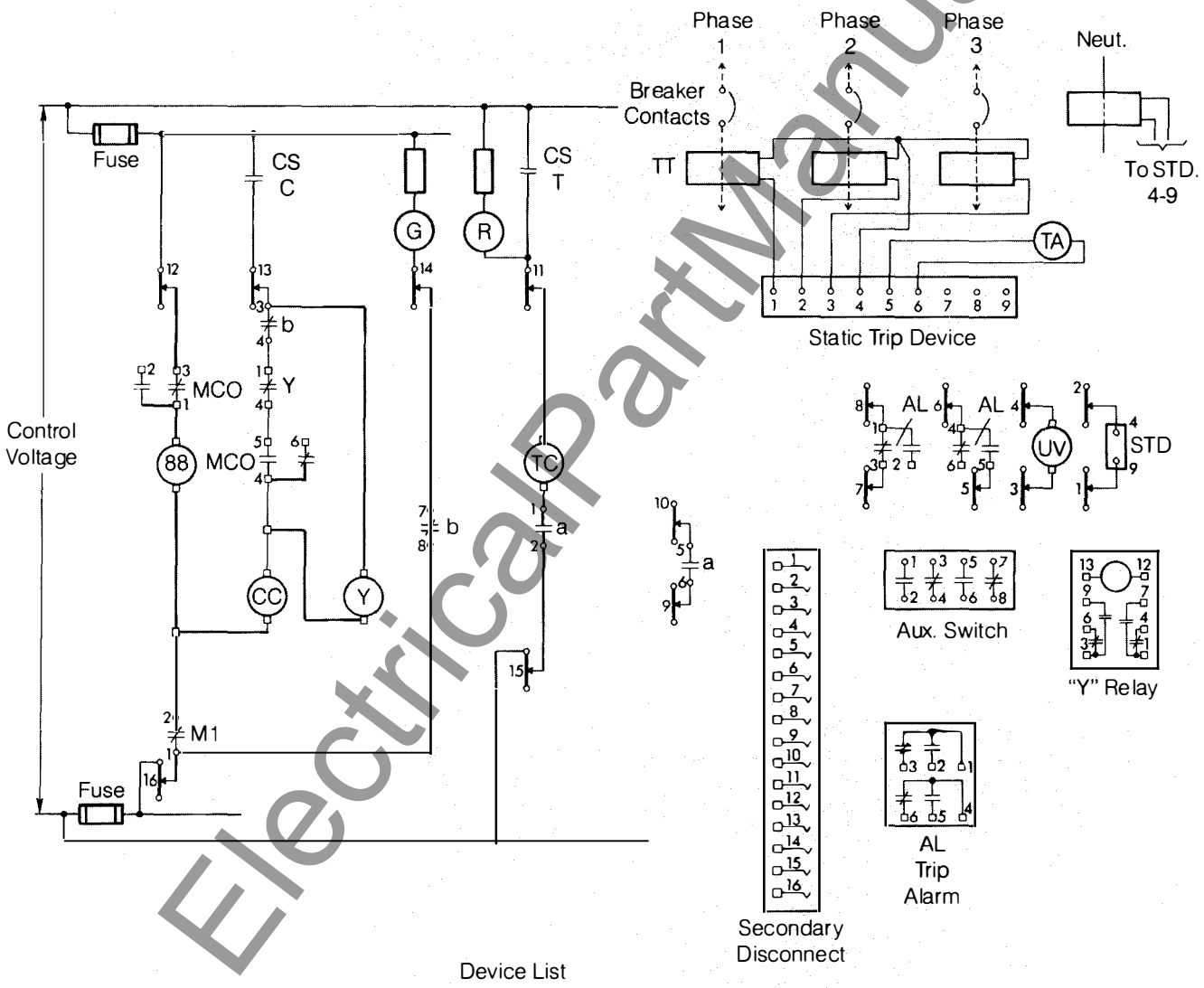
Description

Table 1. Circuit Breaker Operating Time (60 Hertz Basis) and Data

	RL-800 RLX-800 RLX-800	RL-1600 & 2000 RLX-1600 RLF-1600 & 2000	RL-3200 RLF-3200	RL-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):				
Minimum Between Mains	1.0	1.0	1.0	1.0
Between Arcing Contacts	1.1	1.1	1.1	1.1

Table 2. 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	200-380
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	5.45/5.45	2.76/2.76	1.85/1.85
Closing Coil Current (Seal-in/Inrush)—Amperes	1.65/7.7	0.71/3.4	5.45/5.45	2.76/2.76	1.85/1.85
Y-Relay Current (Max. Value—Amperes)	0.026	0.015	0.15	0.02	0.01



Device List

TT —Tripping Transformer
STD —Static Trip Device
TA —Trip Actuator
CC —Circuit Breaker Closing Coil
TC —Circuit Breaker Trip Coil
Y —Aux. Closing Relay—Anti-Pump
MCO —Motor Cutoff Switch
88 —Spring Charging Motor
MI —Mechanical Interlock

a —Aux. Switch—Open when Breaker is Open
b —Aux. Switch—Closed when Breaker is Open
CSC —Control Switch—Close Contact
CST —Control Switch—Trip Contact
R —Red Indicating Lamp
G —Green Indicating Lamp
AL —Automatic Trip Alarm Device (Bell Alarm) (Manual Reset)
UV —Undervoltage Trip Coil

Figure 39. Typical Control Schematic for Electrically Operated Breaker and Wiring Diagram, Showing Optional Attachments.

Switchgear Division

Type R
600 Volts

Description

Circuit Breaker Selection Data

Tables 1 through 4 on the following pages list recommended low voltage circuit breakers for use in Siemens secondary unit substation applications. The breakers have been co-ordinated with standard transformer capacities, and system parameters to meet the electrical, thermal and mechanical requirements.

The tables are to be used as guidelines, with other factors being taken into account which affect the final selection of proper breaker rating for the specific application. Such factors as voltage, power factor, temperature, altitude, circuit configurations, large motor loads, high inertia (WK^2) motor loads, unusual or cyclic load characteristics may require going to a larger rated breaker.

For applications where short circuit interrupting capacity must be increased, this can be accomplished either with higher rated RLX breakers or RLF fused circuit breakers.

The short circuit currents are established using assumptions and approximations which have proven valid. However, if the indicated circuit breaker is marginal when comparing its interrupting rating to the indicated value of short circuit current, then 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. 242-1975, Chapter 2.

Recommendations for breaker selection are given for the two types of system in the tables, using standard unfused circuit breakers. If continuous current requirements would permit using a smaller circuit breaker than shown in columns 8 or 9, consider fused circuit breakers, which have sufficient interrupting capacity for all applications shown.

Main breaker listed in Column 7 may be with, or without, instantaneous trip element. When supplied without, it provides selective tripping with its downstream feeder. (Column 8 or 9)

Feeder breakers listed in Column 8 are supplied with, or without, instantaneous trip element, in order to provide selective tripping with additional protective devices at the downstream load.

Feeder breakers listed in Column 9 are supplied with instantaneous trip element, which are not required to co-ordinate in their tripping with downstream load protective devices.

Over the years, "fully rated" breakers have been recognized as those having a rating capability of interrupting the maximum fault available at its point of application within the system. Such breakers generally had instantaneous elements, giving them higher interrupting capabilities than when not so equipped.

However today, as can be seen in Table 1, Page 24, (Breaker Rating Table), breakers applied at 600V or 480V have the same short circuit interrupting capabilities regardless of the type of trip elements.

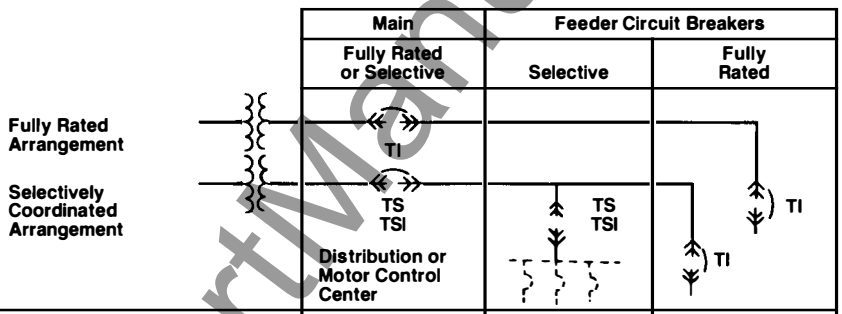
Basis of Application Tables

The value of short circuit currents are calculated on basis of:

1. The fault is 3 phase bolted fault at the outgoing terminals of the feeder breaker.
2. Impedance of the transformer is as listed in the table. For impedances other than those listed, short circuit currents are inversely proportional.
3. The only power source to the secondary switchgear is the substation transformer.
4. The short circuit current contribution from connected motor load is included in the calculations based on use of standard motors. This contribution is approximated as two times (2x) transformer full-load current for 208Y systems, and four times (4x) transformer full load current for 240, 480 and 600v systems.
5. Total connected motor KVA does not exceed 50 percent of transformer base KVA for 208Y systems and 100 percent for systems of 240, 480, or 600 volt. For motor loads of some other percentage, the motor contribution will be in direct proportion.
6. All short circuit current values are rms symmetrical.
7. 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%. For open ventilated dry type with 115/150°C dual temperature rise, continuous capacities increase by 15%; with 80/150°C dual temperature rise, increase by 135%. For fan cooled ratings, increase liquid type by 15%, (except 2500 KVA units which increase 25%); dry type by 33 1/3%.

(Refer to Pages 33-37 for Application Tables)

Table 1. 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)			Long-Time Instantaneous or Long-Time Short-Time	Long-Time Short-Time	Long-Time Instantaneous
			Trans-former Alone	100% Motor Load	Combined	Minimum Rating Breaker		
						Breaker	Breaker	Breaker
1	2	3	4	5	6	7	8	9
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 5.750%	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	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.

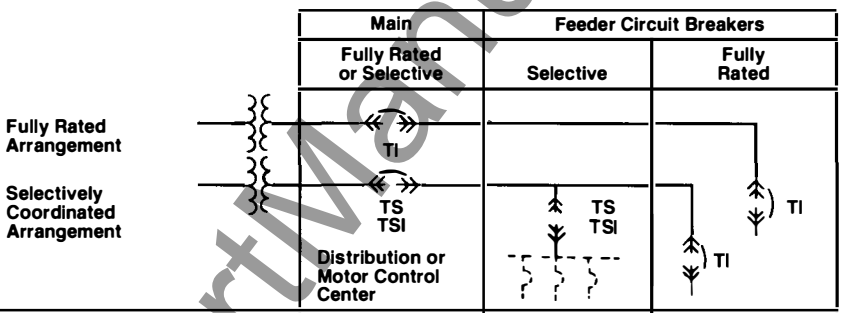
② The main circuit breaker shown does not have sufficient continuous current carrying capacity for full capacity application if the transformer is dual temperature rise and/or if ever fan cooled.

Switchgear Division

Type R
600 Volts

Description

Table 1. Application Table 480 Volts, Three Phase (Continued)

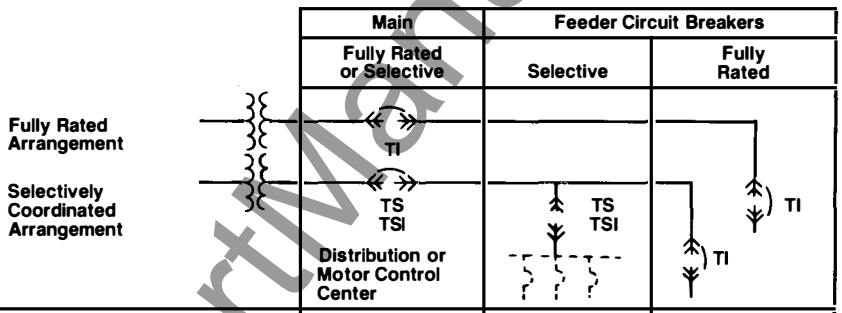


Transformer Rating 3-Phase kVa and Impedance Percent	Maximum Short-Circuit Mva Available From Primary System	Full Load Continuous Current (amperes) ①	Short-Circuit Rating Symmetrical Current (amperes)			Main: Long-Time Instantaneous or Long-Time Short-Time	Feeder: Long-Time Short-Time	Feeder: Long-Time Instantaneous
			Transformer Alone	100% Motor Load	Combined	Minimum Rating Breaker		
						Breaker	Breaker	Breaker
1	2	3	4	5	6	7	8	9
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	② RL-2000	RL-800 RLX-800	RL-800 RLX-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	② RL-2000	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	RLX-800 RL-1600 RLX-1600	RLX-800 RL-1600 RLX-1600
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	② RL-3200	RL-1600 RLX-1600	RL-1600 RLX-1600
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	② RL-4000	RLX-1600 RL-3200	RLX-1600 RL-3200

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.

Table 2. 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	
			Transformer 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
1	2	3	4	5	6	7	8	9
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 RLX-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	RLX-800	RL-800
1000 5.75%	50 100 150 250 500 750 Unlimited	2780	35900 41200 43300 45200 46700 47300 48300	5600	41500 46800 48900 50800 52300 52900 53900	RL-3200	RLX-800 RL-1600 RLX-1600	RL-800 RLX-800 RL-1600

① With transformer operating on base temperature rise.

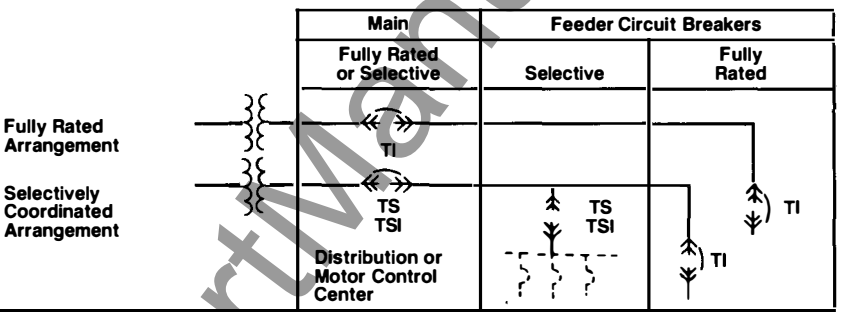
② The main circuit breaker shown does not have sufficient continuous current carrying capacity for full capacity application if the transformer is dual temperature rise and/or if ever fan cooled.

Switchgear Division

Type R
600 Volts

Dimensions

Table 3. Application Table 240 Volts, Three Phase

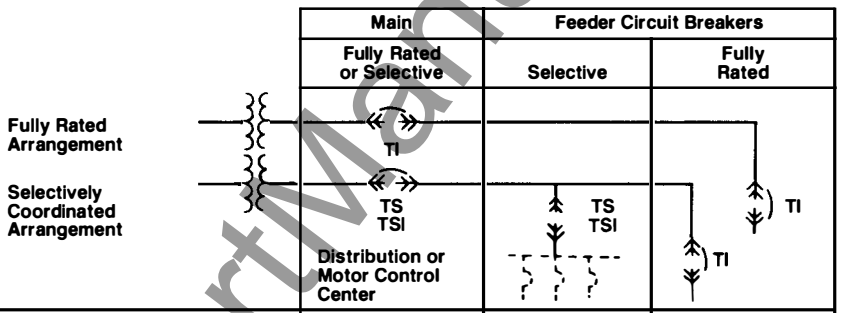


Transformer Rating 3-Phase kVa and Impedance Percent	Maximum Short-Circuit Mva Available From Primary System	Full Load Continuous Current (amperes) ①	Short-Circuit Rating Symmetrical Current (amperes)			Main	Feeder Circuit Breakers	
			Transformer Alone	100% Motor Load	Combined	Fully Rated or Selective	Selective	Fully Rated
						Long-Time Instantaneous or Long-Time Short-Time	Long-Time Short-Time	Long-Time Instantaneous
						Minimum Rating Breaker		
						Breaker	Breaker	Breaker
1	2	3	4	5	6	7	8	9
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	② RL-800	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	② RL-2000	RLX-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	RLX-800 RL-1600 RLX-1600	RL-800 RLX-800 RL-1600
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	② RL-4000	RLX-1600 RL-4000	RL-1600 RL-3200

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.

Table 4. Application Table 600 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)			Long-Time Instantaneous or Long-Time Short-Time	Long-Time Short-Time	Long-Time Instantaneous
			Trans-former Alone	100% Motor Load	Combined	Minimum Rating Breaker		
						Breaker	Breaker	Breaker
1	2	3	4	5	6	7	8	9
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	② RL-800	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.

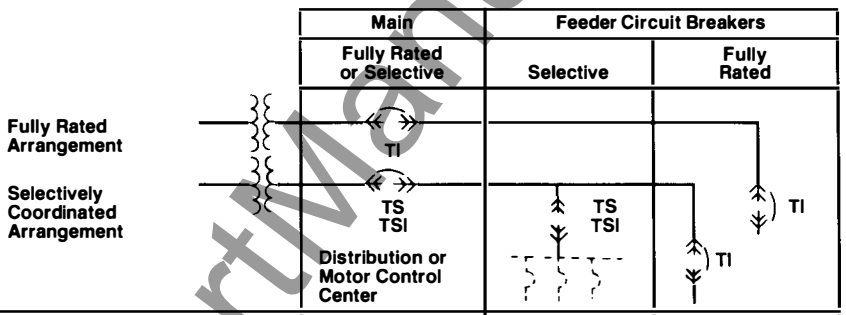
② The main circuit breaker shown does not have sufficient continuous current carrying capacity for full capacity application if the transformer is dual temperature rise and/or if ever fan cooled.

Switchgear Division

Type R
600 Volts

Dimensions

Table 4. Application Table 600 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	
						Long-Time Instantaneous or Long-Time Short-Time	Long-Time Short-Time	Long-Time Instantaneous
			Transformer Alone	100% Motor Load	Combined	Minimum Rating Breaker		
						Breaker	Breaker	Breaker
1	2	3	4	5	6	7	8	9
1500 5.75%	50 100 150 250 500 750 Unlimited	1444②	16500 20000 21400 22700 23900 24200 25100	5800	22300 25800 27200 28500 29700 30000 30900	② RL-1600	RL-800	RL-800
							RLX-800	RLX-800
2000 5.75%	50 100 150 250 500 750 Unlimited	1924②	19700 24800 27200 29400 31300 32000 33500	7800	27500 32600 35000 37200 39100 39800 41300	② RL-2000	RL-800	RL-800
							RLX-800	RLX-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	RLX-800	RLX-800
							RL-1600	RL-1600
							RLX-1600	RLX-1600

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.

Fused Breaker Application

Type RLF fused low voltage power circuit breakers are a combination of current limiting fuses mounted in conjunction with RL circuit breakers for use in low voltage switchgear. Line-ups of switchgear may include both standard and fused circuit breakers. Because the fuses clear short circuits very rapidly and have high interrupting capacity, fused breakers can be used for protection of:

1. The circuit breaker, when applied on systems with available short circuit currents exceeding the interrupting rating of the circuit breaker, particularly for feeders to small loads.
2. Load side equipment (motor control centers, panelboards, bus ducts), which may have ratings below the available short circuit currents, or be damaged unless faults are rapidly cleared and limited by the current-limiting action of the fuses.

Various fuse sizes can be used on the RLF-800, RLF-1600, RLF-2000, RLF-3200 and RLF-4000 as given in Table 2, Page 24. The size selected for a specific application will depend on which of the above reasons led to the use of the fused circuit breaker.

1. When used to increase the interrupting rating of the circuit breaker, then a large fuse can be used, such as the 1200 ampere fuse for the RLF-800. This will minimize the possibility of fuse blowing, since most faults will be cleared by the circuit breaker, as detected by the instantaneous element of the static trip device.
2. When used to protect downstream equipment, the fuse must limit the fault to less than the rating of the protected equipment. This can be checked using the "Let-Thru" chart, Figure 40, which contains an example of the limiting effect of the fuse.

It is also necessary to check three types of coordination:

1. Thermal conditions. To maintain thermal coordination between the fuse and the breaker in an enclosure, the following general rules apply:
   a. A breaker, applied at 90-100% of its frame size continuous current rating, should not use a fuse less than 200% of its frame size rating.
   b. A breaker, applied at 80-90% of its frame size continuous current rating, should not use a fuse less than 150% of its frame size rating.

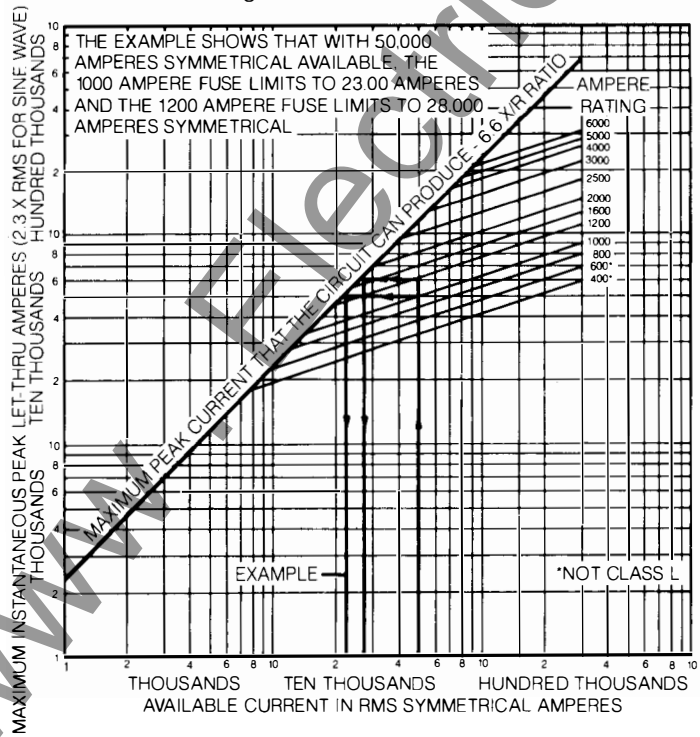


Figure 40. Fuse Peak Left-Thru Characteristic.

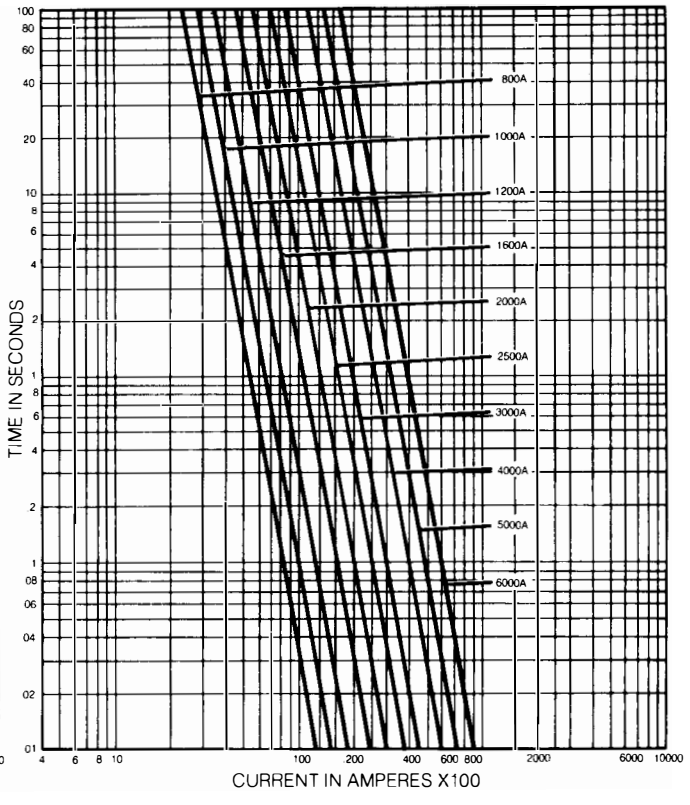


Figure 41. Fuse Time-Current Characteristic.

Switchgear Division

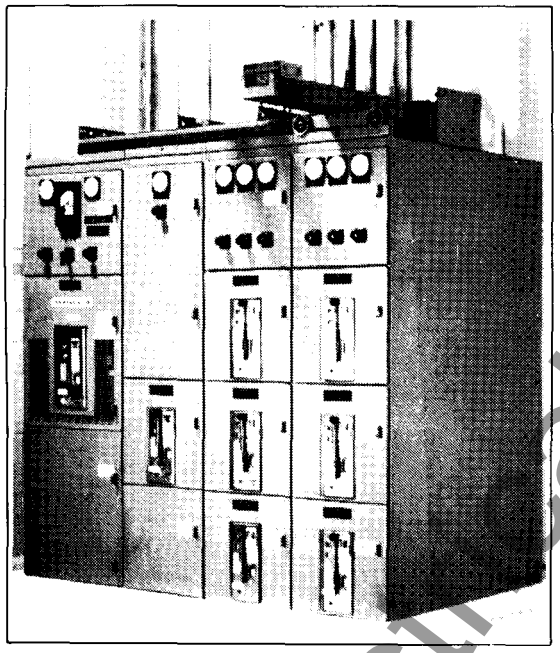
Type R
600 Volts

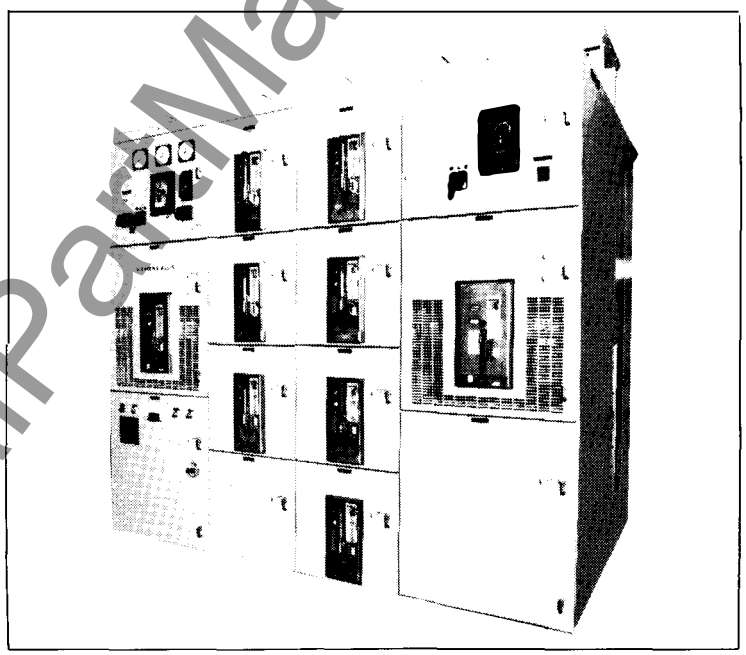
Dimensions

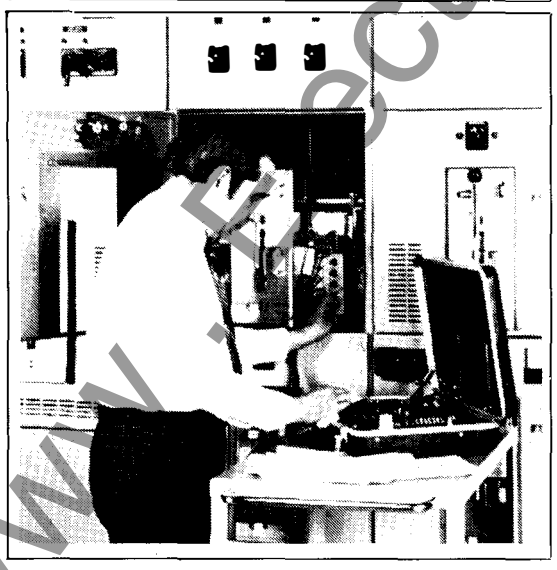
c. The fuse size should NEVER be less than 125% of the breaker pickup setting.

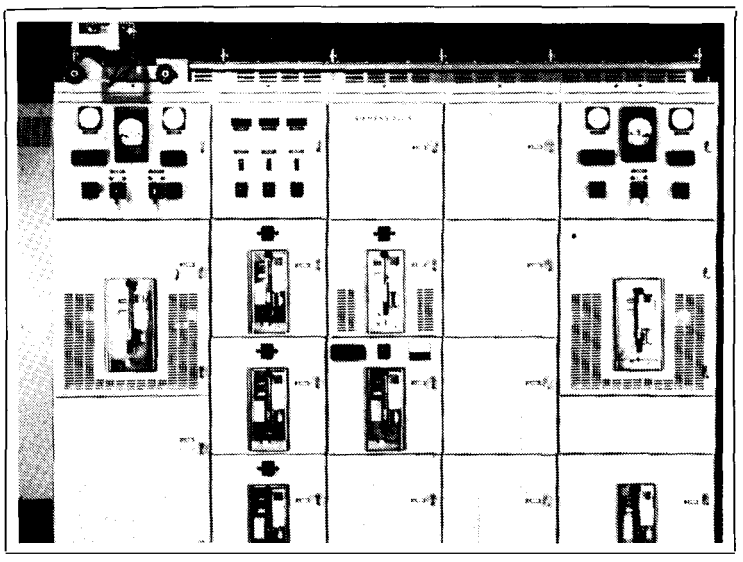
2. Coordination between a fuse and the static trip device. The melting time of a fuse should be at least double the total clearing time of the breaker at the current level where the static trip device transfers to instantaneous pickup. Refer Figure 41, for melting characteristics.

3. Coordination with up-stream circuit breakers, fuses or relays. Time-current curves should be prepared to demonstrate this coordination.









Type R
600 Volts

Dimensions

Typical Installations

Central Stations—Protect and distribute power to station auxiliaries—blowers, compressors, fans, pumps, motors.

Commercial and Residential Buildings—For protection and distribution of power for lighting, elevators, air conditioning, plus blowers, fans, motors and pumps.

Industrial Plants—For power and lighting networks, power and lighting feeders, plus power generation and auxiliaries, provide power for machine tolls and material handling equipment drives.

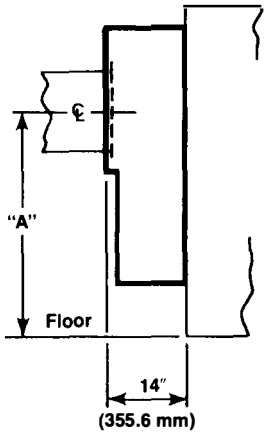
Basic Cubicle Arrangements (Front Elevations) And Weights

Type R—Indoor Equipment ①

Transition Sections

1. Transition to liquid filled transformer with side wall throat enclosed bushings.
2. Side entry bus duct.

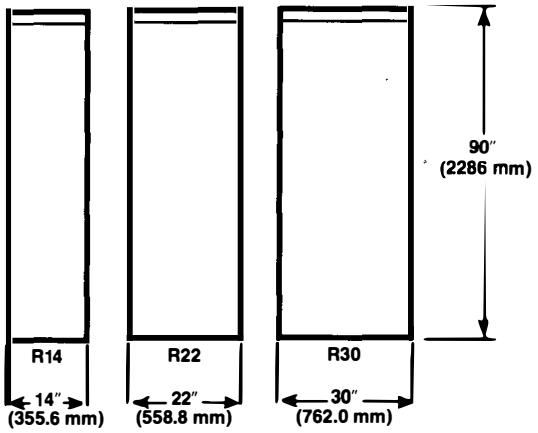
	"A"	Weight
Indoor	55 (1397 mm)	500 (227.0)
Outdoor	61 (1549.4 mm)	550 (249.0)



Auxiliary Sections ② ③

1. Metering section for substation not containing main breaker.
2. Incoming bus duct or cable entrance for substation not containing main breaker.

	Weights		
	R14	R22	R30
Indoor	600 (272.0)	1000 (454.0)	1200 (544.0)
Outdoor ④	1600 (726.0)	2000 (907.0)	2400 (1088.0)

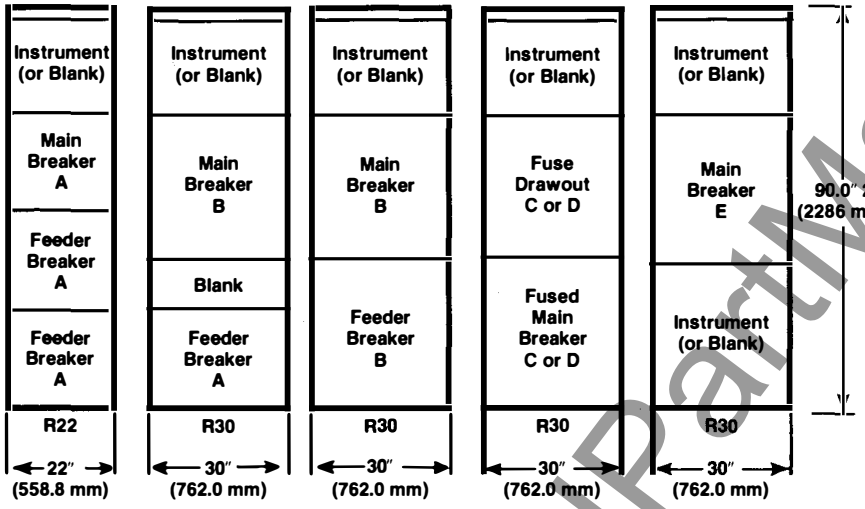


Switchgear Division

Type R
600 Volts

Dimensions

Main Breaker Sections and Combinations ②③



R22	Weight† R30	
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.

① Maximum shipping group is five (5) vertical sections in addition to transition section.

② All vertical sections are 90″ high. Add 11″ for top mounted lifting structure shipped mounted, 101.0″ (2565 mm) overall height (2591 mm).

③ All units are 60″ (1524 mm) deep.

④ For outdoor lineup, add 1200 lbs. (544 kg) to total weight of individual sections for end walls and hoist.

Breaker Key:

A. Any of the following:
RL-800; RLX-800; RLF-800; RL-1600; RLX-1600; RLF-1600; RL-2000; RLF-2000.

B. RL-3200

C. RLF-3200 in one cell/RFC-3200 fuse drawout in other cell

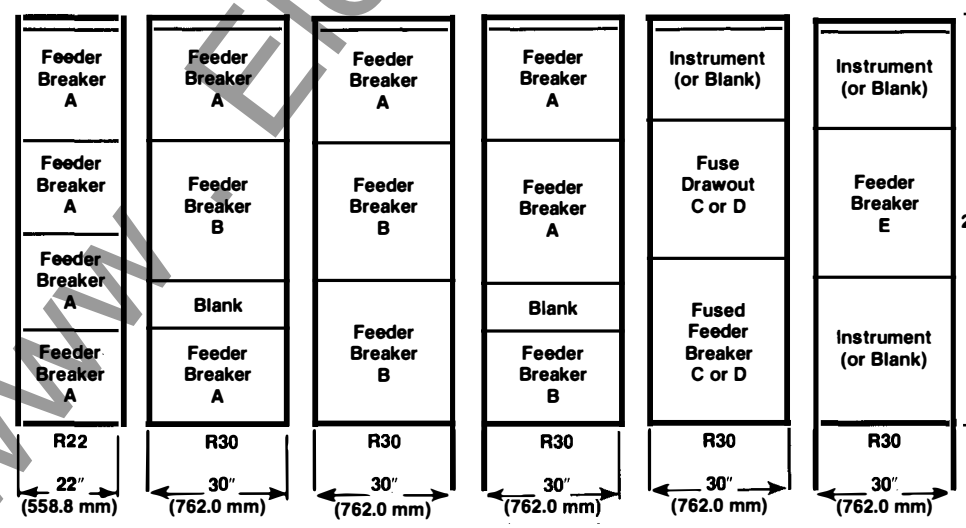
D. RLF-4000 in one cell/RFC-4000 fuse drawout in other cell

E. RL-4000

Instrument or blank cells can be substituted for any breaker cell shown.

NOTE: All weights are approximate in pounds and (kg) based on aluminum bus.

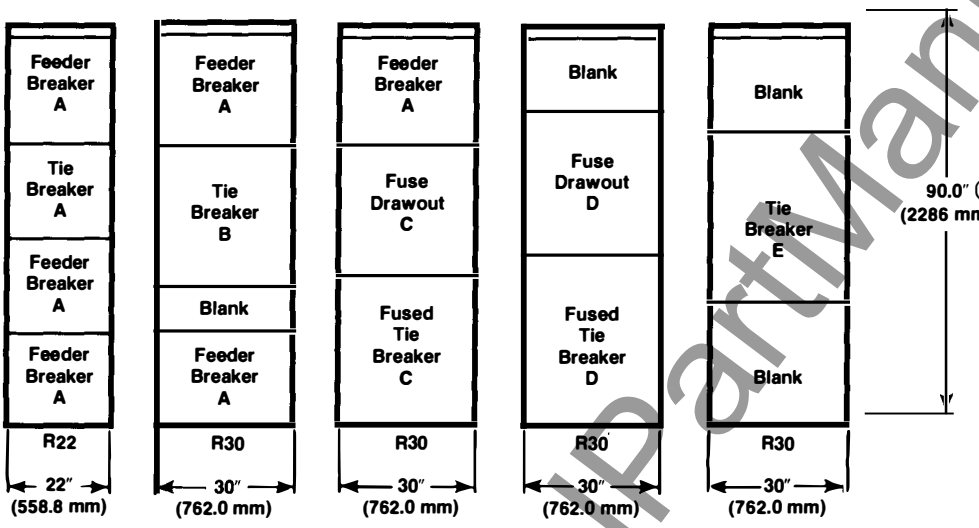
Basic Cubicle Arrangements (Front Elevations) And Weights
Feeder Breaker Sections and Combinations ②②



	Weights† R22	R30
Indoor	1400 (635.0)	1900 (862.0)
Outdoor ④	2400 (1088.0)	3100 (1406.0)

† Weights shown do not include weight of circuit breaker removable elements

Tie Breaker Sections and Combinations ② ③ ⑤



	Weights†	
	R22	R30
Indoor	1400 (635.0)	1900 (862.0)
Outdoor ④	2400 (1088.0)	3100 (1406.0)

† Weights shown do not include weight of circuit breaker removable elements.

① Maximum shipping group is five (5) vertical sections in addition to transition section.

② All vertical sections are 90″ high. Add 11″ for top mounted lifting structure shipped mounted, 101″ overall height (2565 m).

③ All units 60″ (1524 mm) deep. 8″ (203 mm) or 12″ (305 mm) rear extensions optionally available for indoor units.

④ For outdoor lineup, add 1200 lbs. (544 kg) to total weight of individual vertical sections for end walls and hoist.

⑤ Feeder breakers physically above tie breaker must be electrically on opposite side of tie breaker from the feeder breakes which are physically below the tie breaker.

Breaker Key:

A. Any of the following:
RL-800; RLX-800; RLF-800; RL-1600; RLX-1600; RLF-1600; RL-2000; RLF-2000.

B. RL-3200

C. RLF-3200 in one cell/RFC-3200 fuse drawout in other cell

D. RLF-4000 in one cell/RFC-4000 fuse drawout in other cell

E. RL-4000

Instrument or blank cells can be substituted for any breaker cell shown.

Switchgear Division

Type R
600 Volts

Dimensions

Table 1. Breaker Element Weights

	Element Type	RL-800	RLX-800	RL-1600	RLX-1600	RL-2000	RL-3200	RL-4000
Operation	Manual	140 (63 5)	170 (77.1)	175 (79 4)	200 (90 7)	210 (95.3)	290 (131 5)	350 (158.8)
	Electrical	150 (68 0)	180 (81.6)	185 (83 9)	210 (95.3)	220 (99.8)	300 (136 1)	360 (163.8)
Additional Weight for Shipping		45 (20.4)	45 (20.4)	45 (20.4)	45 (20.4)	45 (20.4)	50 (22.7)	50 (22.7)

Table 2. Fused Element Weights

	Element Type	RLF-800	RLF-1600	RLF-2000	RLF-3200 ④	RFC-3200 ①	RLF-4000 ④	RFC-4000 ②
Operation	Manual	195 (83.9)	310 (140.6)	325 (147.4)	290 (131.5)	390 ③ (176 9)	350 (158.8)	450 ③ (204.1)
	Electrical	205 (93.0)	320 (145.2)	335 (152.0)	300 (136.1)		360 (163 3)	
Additional Weight for Shipping		45 (20.4)	45 (20.4)	45 (20.4)	50 (22.7)	50 (22 7)	50 (22 7)	50 (22.7)

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.

NOTE: All weights are approximate in pounds and (kg).

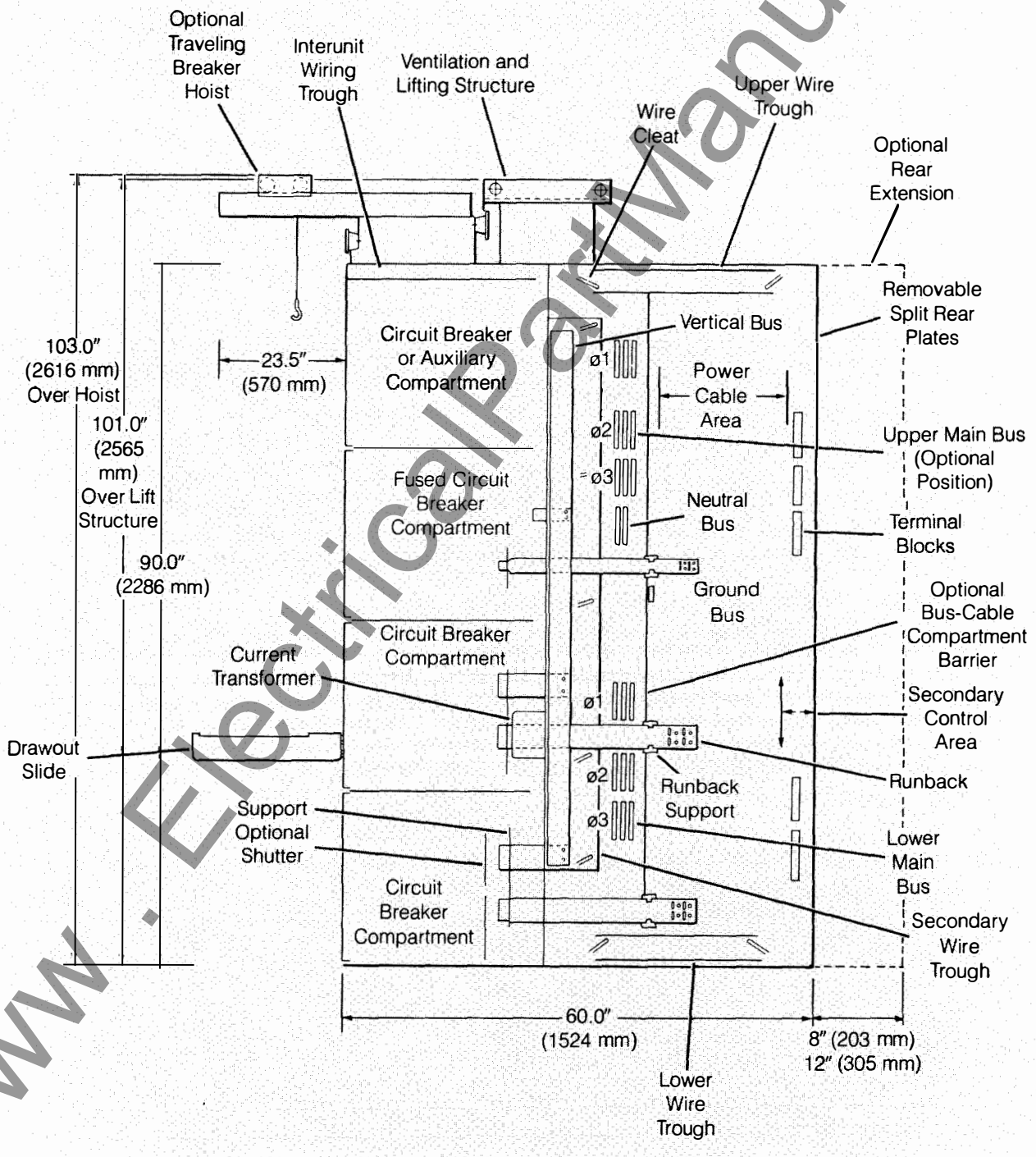


Figure 1. Typical Side View "R22" Unit

Switchgear Division

Type R
600 Volts

Dimensions

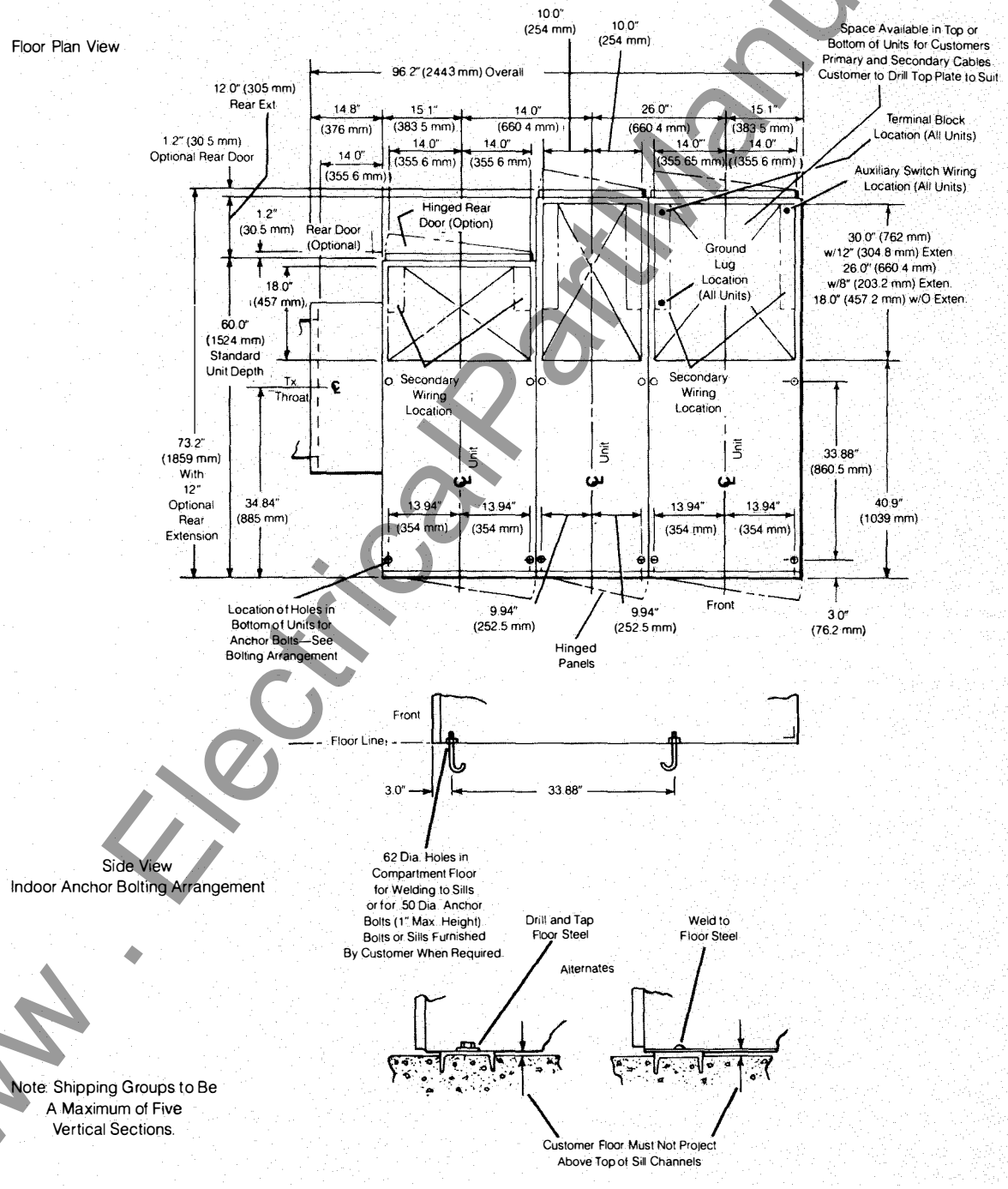
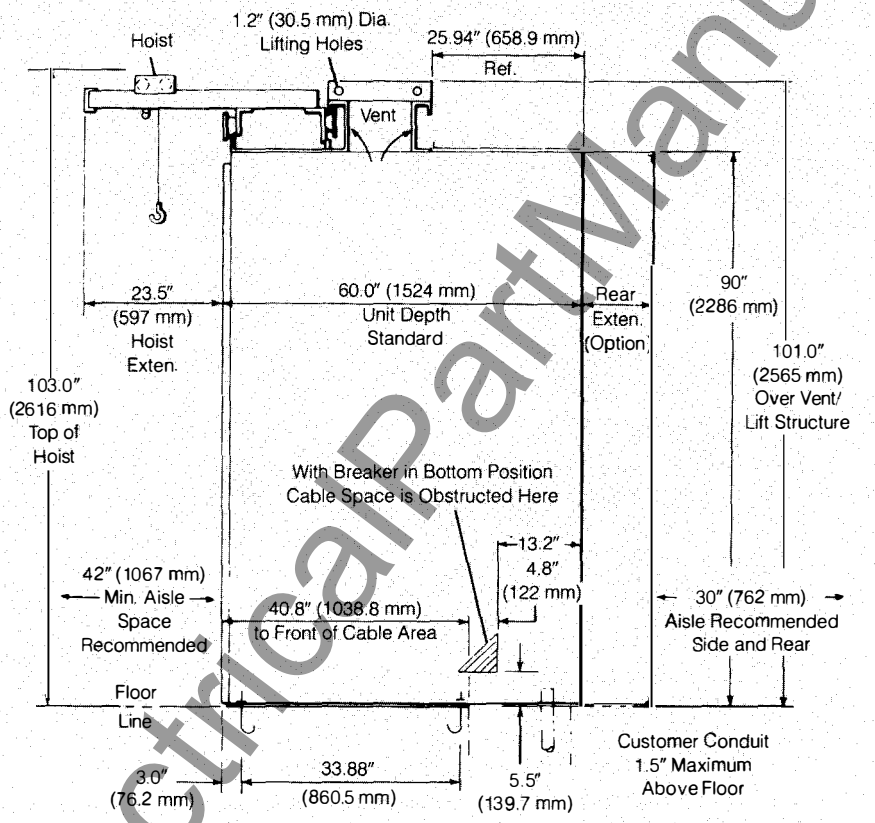


Figure 2. Dimensions, Floor Plan and Side View Type "R" Indoor Switchgear.



Side View w/Hoist and Anchor Bolting

Figure 2 Continued

Switchgear Division

Type R
600 Volts

Dimensions

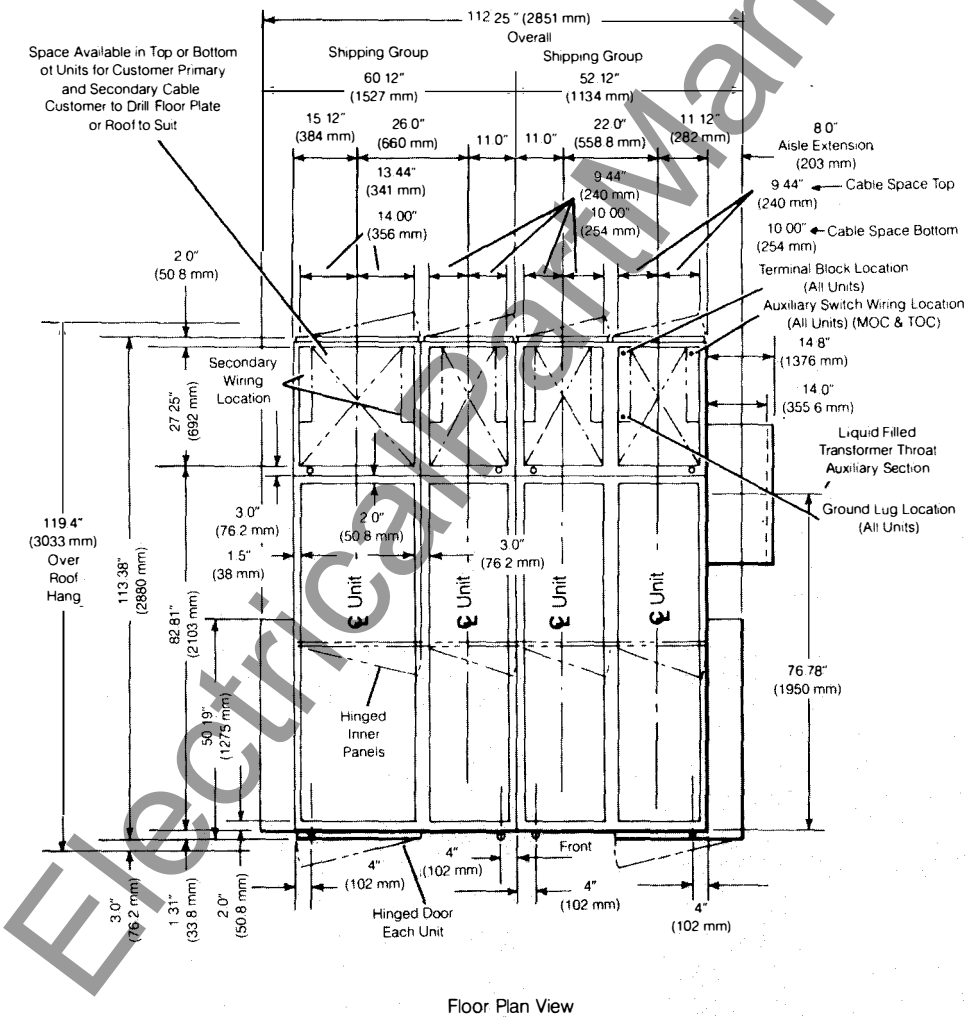
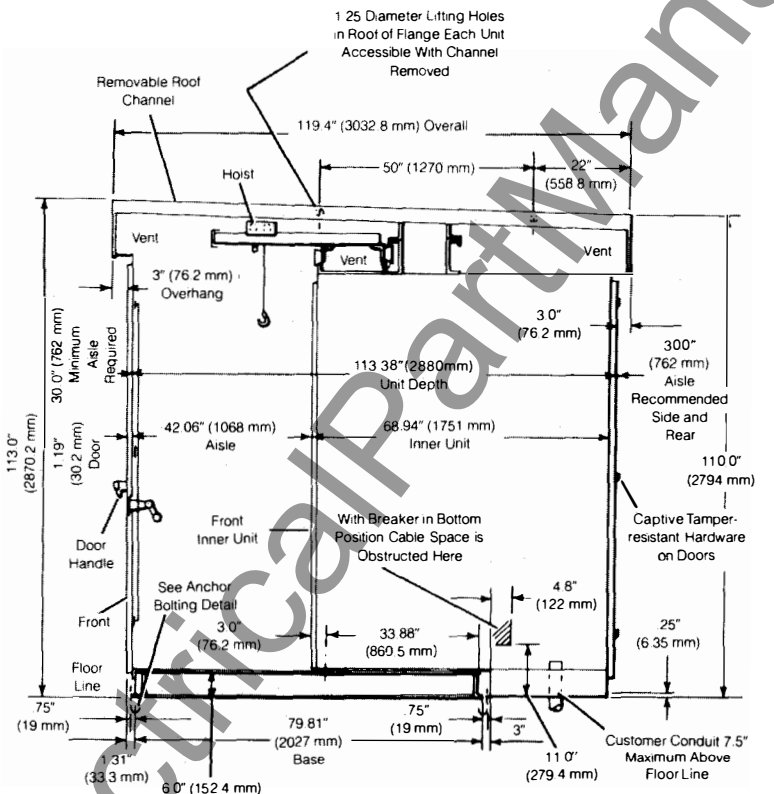
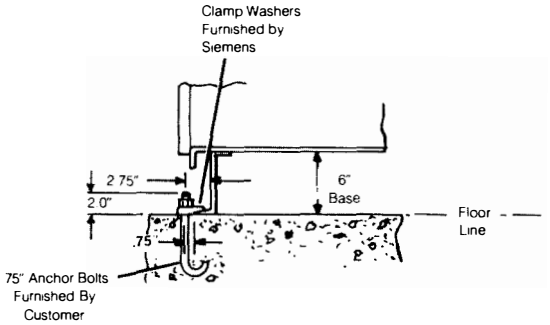


Figure 3. Dimensions, Floor Plan and Side View Type "SR" Outdoor Switchgear.



Side Section With
Outdoor Anchor Bolting



Side View
Outdoor Bolting Arrangement

Note: Shipping Groups to Be A Maximum of Five Vertical Sections.

Suggested Location for Customers Anchor Bolts See Bolting Arrangement and Note. If Required, Additional Bolts Other Than Location Shown Must Be Located on Unit

Figure 3 Continued

Switchgear Division

Type R
600 Volts

Specifications

NOTE: This preparation guide form requires information to be supplied by Purchaser. Those items preceeded by ☐ check box are optional. Those items denoted _____ require quantity or data to be added.

General

The equipment outlined in this specification will consist of Siemens type R METAL ENCLOSED LOW VOLTAGE POWER CIRCUIT BREAKER SWITCHGEAR with drawout Low Voltage Power Circuit Breakers, compartments, bus work and miscellaneous equipment for this application. General construction features will be as described. The complete switchgear sections will be of coordinated design so that shipping groups are easily connected together in the field into a continuous line-up. Necessary standard connecting materials will be furnished.

Suitable solderless cable lugs will be provided for each of the customers feeder cables. Nameplates will be provided for each circuit breaker compartment.

Codes and Standards

The Siemens switchgear covered in this specification will be designed, manufactured, and tested in accordance with the latest revisions of the applicable standards of:

ANSI - American National Standards Institute
NEMA - National Electrical Manufacturers Association
ASTM - American Society for Testing and Materials
IEEE - Institute of Electrical and Electronics Engineers
NEC - National Electric Code
OSHA - Occupational Safety and Health Administration
UL - Underwriters Laboratories

Service

The switchgear sections will be Siemens Type ☐ R, indoor, ☐ "SR", outdoor rated 600 volts. This equipment will operate on service voltage of ____ volts, ☐ 50, ☐ 60 hertz, 3-phase, ☐ 3, ☐ 4 wire.

Framework and Compartmentation

The framework of indoor low voltage switchgear is constructed of preformed steel channels, angles and side sheets bolted together and reinforced to form a rigid, self-supporting, compact assembly. Steel side sheets are attached to this framework. The side sheets are pre-wired. Horizontal barriers are provided to form the individual circuit breaker/metering cells.

The circuit breakers are barriered from the bus/cable compartment with the primary disconnect support assembly which completes the circuit breaker compartmentation. A hinged front door, secured with 1 or 2 rotary fastener, is provided for each cell.

The bus compartment includes the main horizontal bus, vertical bus connections from the main bus to the upper set of primary disconnects, and load side insulated "run-back" copper bus from the lower set of primary disconnects in each circuit breaker compartment. The cable lugs are accessible in the cable compartment without reaching over the main bus.

The switchgear is of totally metal-enclosed ventilated multiple until construction. The front of the switchgear is comprised of individually enclosed circuit breaker, metering and auxiliary cells divided one from another by 14 gauge side sheets and compartment barriers of 11 gauge steel. Each vertical unit consists of three or four circuit breaker and/or metering cells in a width of 22 or 30 inches. End units normally include provisions for future main bus extension and installation of additional units.

Circuit Breakers

Circuit breakers will be Siemens low voltage power circuit breaker types RL, RLX or RLF. Interrupting ratings, as listed in the detailed specifications meet or exceed the industry's standard for type "RL" circuit breakers, as listed in ANSI C37.16-1973. Type "RLX" circuit breakers exceed this standard. Circuit breakers are 600-volt class, three pole, single throw, drawout mounted, electrically and mechanically trip free with stored energy operator. Each will have arc quenchers, main and arcing contact structure, a three phase solid state overcurrent trip device, trip actuator, three tripping transformers, contact position indicator (open-closed), stored energy mechanical indicator (charged-discharged), primary disconnecting devices, and a mechanical interlock to prevent making or breaking contact of the primary disconnects when the circuit breaker is closed.

Overcurrent Trip Device

Each low voltage power circuit breaker will be equipped with an integrally mounted Static Trip II overcurrent trip device providing any combination of continuously adjustable Long Time, Short Time, Instantaneous and Ground Fault protection.

Bus

The main bus runs horizontally in a vertical, edge to edge arrangement behind the vertical riser bus. Available ratings are 1600, 2000, 3200, 4000 and 5000 Amps.

Main bus (horizontal and vertical) can be optionally insulated.

Weatherproof Housing (Optional)

Outdoor walk-in weatherproof construction will be provided. Front and rear doors will be gasketed and hinged. Front doors, located at each end, will include panic hardware, three-point latches and provision for padlocking, while rear doors will be

bolted. An aisle approximately 42 inches deep and accessible from either of the front doors will be provided at the front of the switchgear line-up to facilitate inspection and testing of the circuit breakers and associated equipment while protected from the weather. One hand-operated crane, mounted above the switchgear aisle-way, will be provided to facilitate removal and handling of the circuit breaker elements. An 8" extension on both ends of the operating aisle eliminates the need for special enclosure design to accommodate doors on end units that have instrumentation and metering, and provides additional space for convenient circuit breaker handling.

The following equipment will be furnished within the outdoor weatherproof switchgear: light sockets for interior illumination of the aisle, convenience receptacles and space heaters in the switchgear to prevent condensation of moisture, a switch for all the space heaters, and a switch for the lamps.

The complete assembly will rest on a formed steel base built up from units provided under each vertical section and running perpendicular to the length of the switchgear. The underside of the enclosure and base structure will be undercoated with coal tar emulsion material.

Detailed Specifications

This detailed specification will describe ____ group(s) of Siemens METAL-ENCLOSED LOW VOLTAGE POWER CIRCUIT BREAKER SWITCHGEAR, type ☐ R, ☐ SR, with type ☐ RL, ☐ RLX (extended ratings), ☐ RLF (Fused) Circuit Breakers. These assemblies will be equipped as follows:

1-Set ☐ 5000A, ☐ 4000A, ☐ 3200A, ☐ 2000A, ☐ 1600A, 3-Phase, 3 Wire,

- ☐ Copper Main bus, bolted and silver-plated at connection points.
- ☐ Aluminum main bus, welded at connection points.

☐ 1-Neutral bus, ☐ Copper, ☐ Aluminum, ☐ 50%, ☐ 100% of main bus rating (optional).

1-Ground bus, Copper

☐ 1-Set of space heaters, one located in the main bus compartment, and one space heater per cell of each vertical unit.

☐ 1-Set thermostats as required for space heater control.

1-Set of nameplates as required.

☐ 1-Set of metal barriers between the incoming line bus and main bus.

1-Set of barriers between the main bus sections at the tie circuit breaker.

___ Transition section(s), for connection to liquid-filled transformer.

___ Bus connection(s) to dry-type transformer.

☐ 1-Transition section, for connection to Motor Control Center.

☐ Switchgear to be labeled per UL 1558, where component selection permits.

☐ Switchgear is to be designed per NEC service entrance requirements.

Circuit breaker, auxiliary and metering cells will be as specified below:

Incoming Metering Cell No. _____ .

The cell will contain:

___ Potential transformer(s), _____ /120 volt ratio, dry type, complete with primary current limiting fuses and secondary fuses.

___ Current transformers, _____ /5 ampere ratio (when no main breaker).

☐ 1-Control power transformer, dry type, ☐ 3, ☐ 5, ☐ 10 KVA, single phase, _____ -120/240 volt ratio, complete with primary current limiting fuses and secondary fuses, to supply auxiliary power.

___ RQ 21 3-phase thermal overload relays for motor protection.

___ Auxiliary relays, multi-contact.

___ Auxiliary relays, single-contact.

___ Ground detection transformers, complete with primary current limiting fuses.

___ Auxiliary current transformers.

___ Voltage transducer(s).

___ Current transducer(s).

___ Capacitor trip device (one per breaker or auxiliary relay if required).

On the front of the panel will be:

___ Voltmeter(s), single-phase, indicating, 270° scale, switchboard class, 1% accuracy.

___ Voltmeter(s), single-phase, indicating, 180° scale, 2% accuracy.

___ Voltmeter transfer switches, 3-phase.

___ Ammeter(s), single-phase, indicating, 270° scale, switchboard class, 1% accuracy.

___ Ammeter(s), single-phase, indicating, 180° scale, 2% accuracy.

Switchgear Division

Type R
600 Volts

Specifications

___ Ammeter transfer switches, 3-phase.

___ Wattmeter(s), 3-phase, indicating.

___ Power factor meter(s), indicating.

___ Varmeter(s), 3-phase, indicating.

___ Watthour meter(s), _____ element.

___ Watthour meter(s), _____ element, with demand attachment.

___ Overcurrent relay(s), device No. ___ .

___ Undervoltage relay(s) device No. 27.

___ Overvoltage relay(s). Device No. 59.

___ Lockout relay(s), device No. 86.

☐ Current test block.

☐ Potential test block.

☐ 1-Set of theee (3) ground detector lights indicating, with test pushbutton.

___ Circuit breaker control switch(es), Siemens type "210", complete with one red and one green indicating lights.

Main Breaker Cell No. _____ .

___ Type RL-_____ air circuit breaker, ☐ electrically, ☐ manually operated. Mounted on the circuit breaker will be:

☐ 1-Static Trip II solid state overcurrent trip device with Type ☐ TI(OT), ☐ TS(OT), ☐ TSI(OT), tripping characteristics.

☐ 1-Static Trip II solid state overcurrent trip device with Type ☐ TI(2T), ☐TIG(3T), ☐ TS(2T), ☐ TSG(3T), ☐ TSI(2T), ☐TSIG(3T) tripping characteristics and indicating trip targets.

☐ 1-Set of three current limiting fuses with an interrupting rating of 200,000A symmetrical, plus blown fuse indication and a lockout system to trip circuit breaker upon blowing of any fuse.

☐ 1-Undervoltage trip device, instantaneous.

☐ 1-Undervoltage trip device, time delay.

☐ 1-Shunt trip device.

☐ 1-Overcurrent bell alarm device.

☐ 1-Operation counter.

☐ 1-4 Stage auxiliary switch, mechanism operated. (MOC)

☐ 1-Shutter assembly, of grounded metal, to isolate primary disconnects upon withdrawal of circuit breaker element.

☐ Cable lugs, for connection of _____ cable/phase.

___ Current transformers, _____ /5 ampere ratio.

☐ 1-8 Stage cell mounted auxiliary switch, mechanism operated. (MOC)

☐ 1-8 Stage cell mounted cell swtich (TOC).

☐ 1-Set insulated copper "run back" bus for connection of customer's cables to main circuit breaker line side primary disconnects.

☐ 1-Set bus risers rated _____ A, _____ wire, for connection of bus duct to main breaker line side primary disconnects.

☐ 1-Key interlock for interlocking circuit breaker with primary switch.

☐ Key interlock for interlocking main breaker with tie breaker.

On the front of the panel will be:

☐ 1-Circuit breaker control switch, miniature rotary type, complete with one red and one green indicating lights.

☐ 1-Ammeter, single-phase, indicating, 180° scale, 2% accuracy.

☐ 1-Ammeter transfer switch, 3-phase.

☐ 1-Current test block.

Feeder Breaker Cell No. _____ .

___ Type RL _____ air circuit breaker, ☐ electrically, ☐ manually operated. Mounted on the circuit breaker will be:

☐ 1-Static Trip II solid state overcurrent trip device with Type ☐TI(OT), ☐TS(OT), ☐TSI(OT) tripping characteristics.

☐ 1-Static Trip II solid state overcurrent trip device with Type ☐TI(2T), ☐ TIG(3T), ☐ TS(2T), ☐ TSG(3T), ☐ TSI(2T) ☐TSIG(3T) tripping characteristics and indicating trip targets.

☐ 1-Set of three current limiting fuses with an interrupting rating of 200,000A symmetrical, plus blown fuse indication and a lockout system to trip circuit breaker upon blowing of any fuse.

☐ 1-Undervoltage trip device, instantaneous.

☐ 1-Undervoltage trip device, time delay.

☐ 1-Shunt trip device.

☐ 1-Overcurrent bell alarm device.

☐ 1-Operation counter.

☐ 1-4 Stage auxiliary switch, mechanism operated (MOC)

☐ 1-Shutter assembly, of grounded metal, to isolate primary disconnects upon withdrawal of circuit breaker element.

☐ Cable lugs, for connection of _____ cable/phase.

___ Current transformers, _____ /5 ampere ratio.

☐ 1-8 Stage cell mounted auxiliary switch, mechanism operated. (MOC)

☐ 1-8 Stage cell mounted cell switch (TOC).

☐ 1-Set insulated copper "run-back" bus for connection of customer's cables to feeder circuit breaker load side primary disconnects.

On the front of the panel will be:

☐ 1-Circuit breaker control switch, miniature rotary type, complete with one red and one green indicating lights.

☐ 1-Ammeter, single-phase, indicating, 180° scale, 2% accuracy.

☐ 1-Ammeter transfer switch, 3-phase.

☐ 1-Current test block.

☐ 1-Key interlock for interlocking circuit breaker with primary switch.

☐ 1-Key interlock for interlocking circuit breaker with main breaker.

Tie Breaker Cell No. _____ .

___ Type RL _____ air circuit breaker, ☐ electrically, ☐ manually operated. Mounted on the circuit breaker will be:

☐ 1-Static Trip II solid state overcurrent trip device with Type ☐TI(OT), ☐TS(OT), ☐TSI(OT) tripping characteristics.

☐ 1-Static Trip II solid state overcurrent trip device with Type ☐TI(2T), ☐ TIG(3T), ☐ TS(2T), ☐ TSG(3T), ☐ TSI(2T), ☐TSIG(3T) tripping characteristics and indicating trip targets.

☐ 1-Set of three current limiting fuses with an interrupting rating of 200,000A symmetrical, plus blown fuse indication and a lockout system to trip circuit breaker upon blowing of any base.

☐ 1-Undervoltage trip device, instantaneous.

☐ 1-Undervoltage trip device, time delay.

☐ 1-Shunt trip device.

☐ 1-Overcurrent bell alarm device.

☐ 1-Operation counter.

☐ 1-4 Stage auxiliary switch, mechanism operated. (MOC)

☐ 1-Shutter assembly, of grounded metal, to isolate primary disconnects upon withdrawal of circuit breaker element.

☐ Current transformers, _____ /5 ampere ratio.

☐ 1-8 Stage cell mounted auxiliary switch, mechanism operated. (MOC)

☐ 1-8 Stage cell mounted cell switch (TOC).

☐ 1-Key interlock for interlocking tie CB with both main CB's.

On the front of the panel will be:

☐ 1-Circuit breaker control switch, miniature rotary type, complete with one red and one green indicating lights.

☐ 1-Ammeter, single-phase, indicating, 180° scale, 2% accuracy.

☐ 1-Ammeter transfer switch, 3-phase.

☐ 1-Current block.

Future Feeder Cell No. _____ .

☐ This cell will be equipped for the future addition of a _____ circuit breaker ☐ manually, ☐ electrically operated. (Specify Frame Size).

Blank Cell No. _____ .

☐ This cell will be blank.

Accessories

1 Crank for manual operation of the circuit breaker drawout mechanism.

1 Lifting yoke for lifting circuit breaker elements.

1 Quart of touch-up paint.

1 Maintenance closing device for electricity operated circuit breakers.

☐ 1-Test plug, less cable, for drawout watthour meters and/or switchboard class relays.

☐ 1-Portable test set, type PTS-3, for testing of the solid state trip devices.

☐ 1-Overhead breaker lifting device. (Standard for outdoor switchgear.)

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SIEMENS

Low Voltage
Metal-Enclosed Switchgear

SG3061

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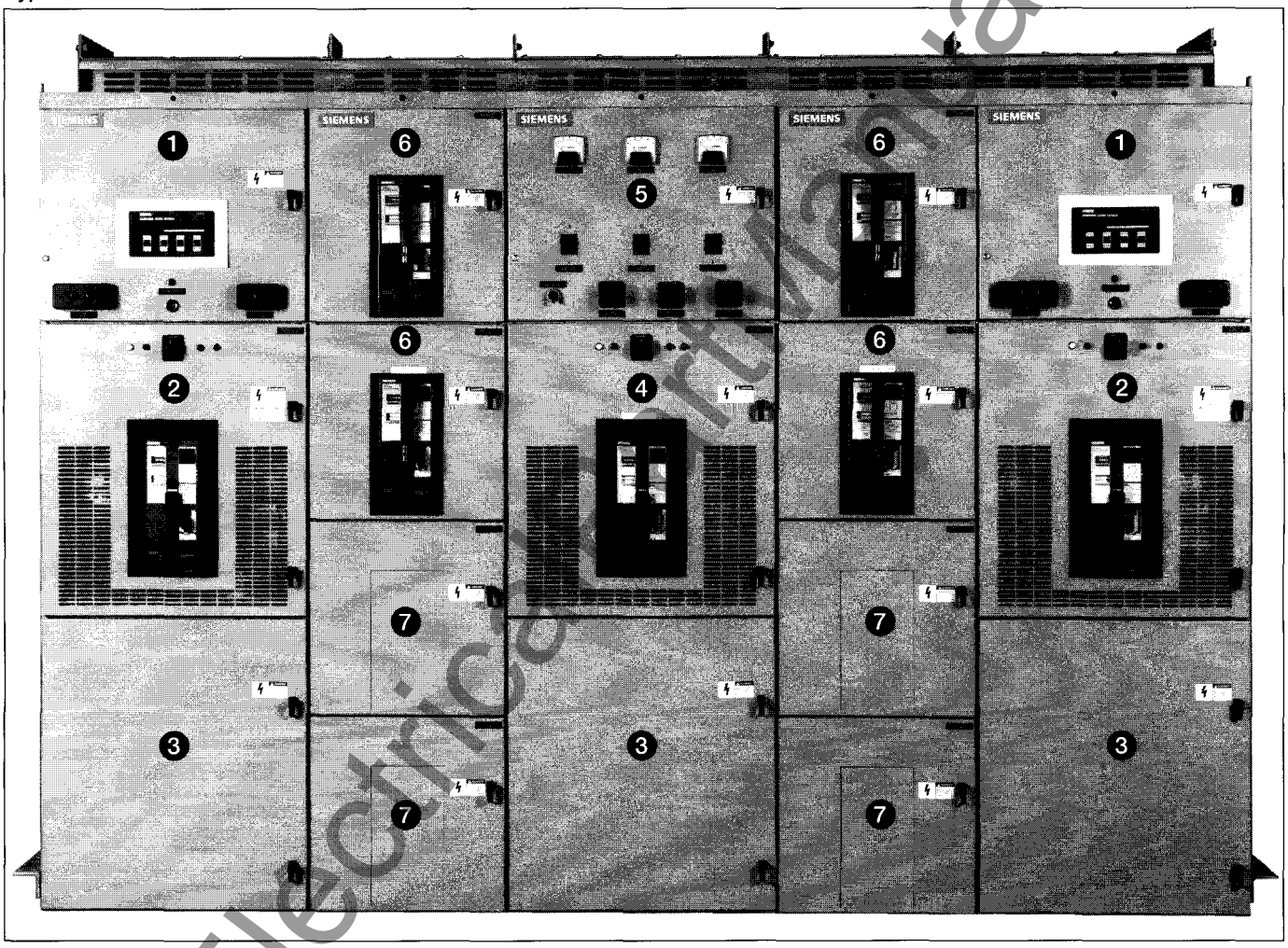
General Description

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.

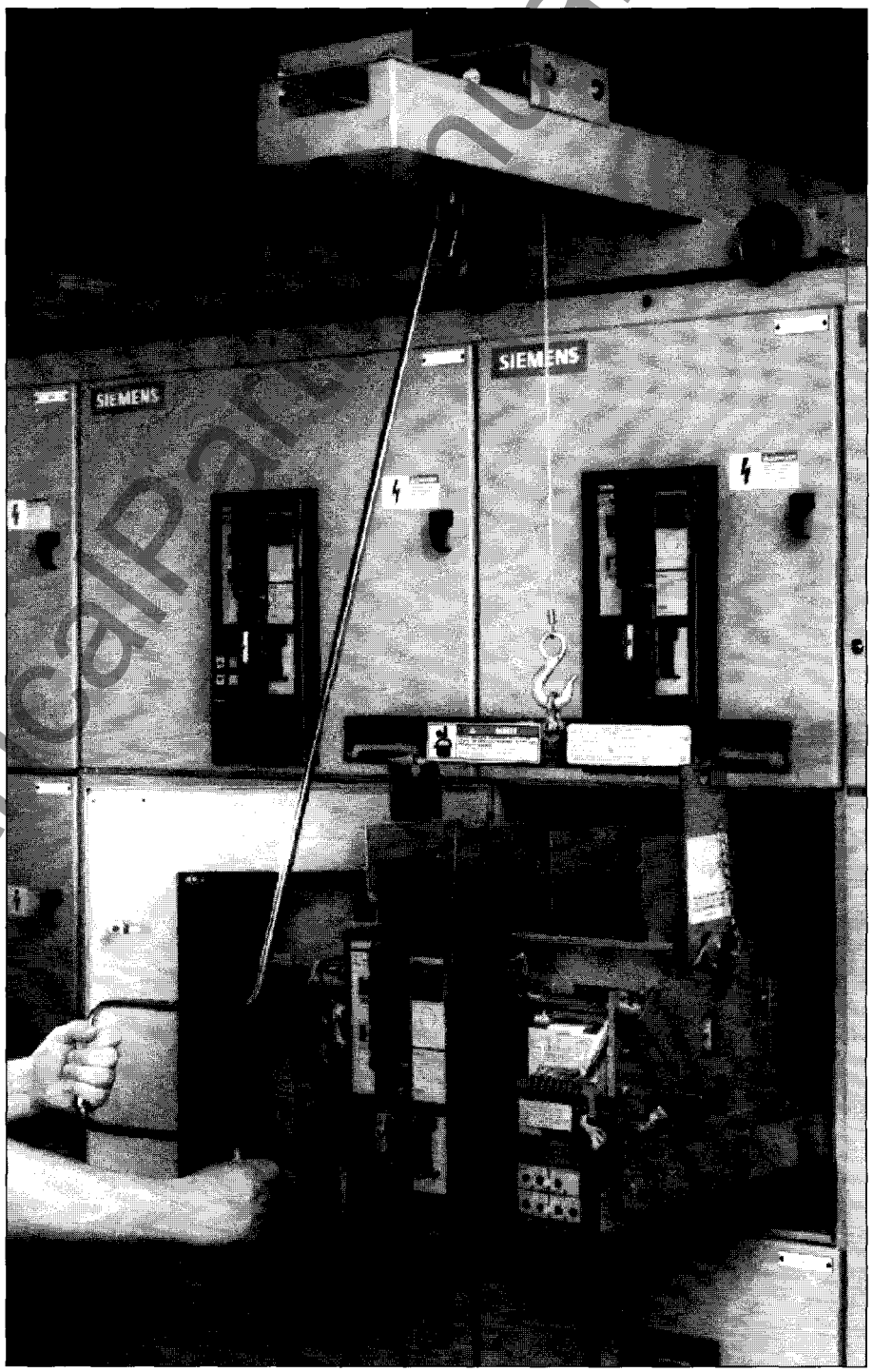
All switchgear equipment, including circuit breakers, is **manufactured, assembled and tested in one location**. This assures an integrated fit and high quality. The overall effect is guaranteed reliability.

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 build-up 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.

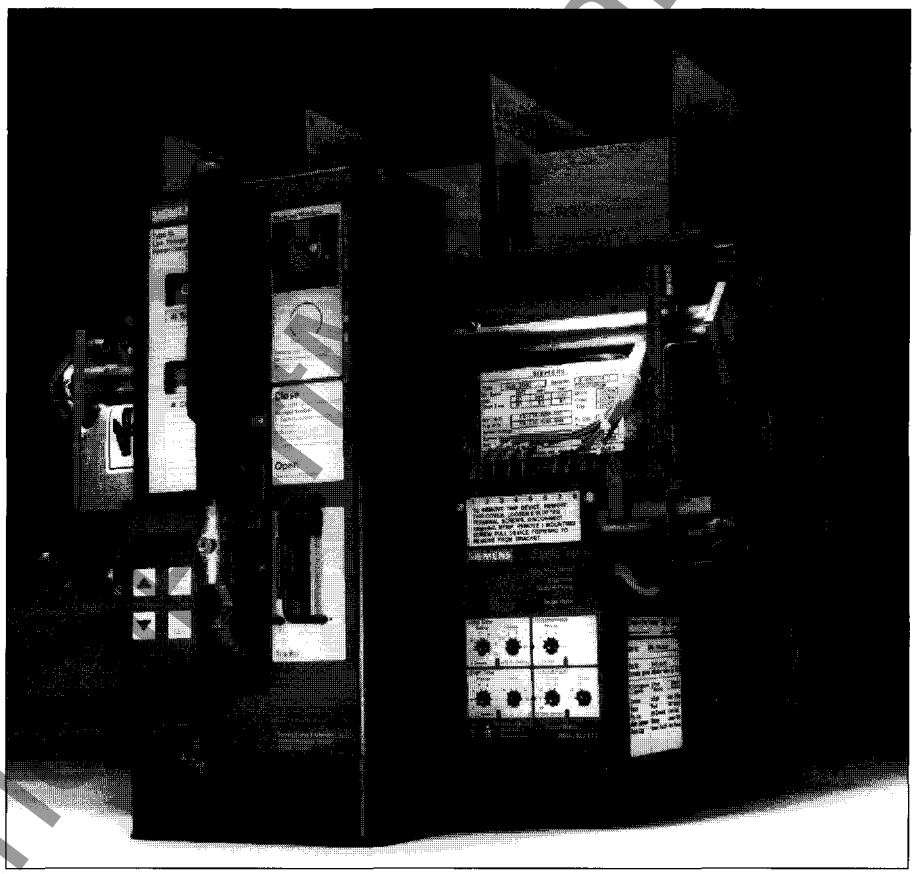
Typical breaker features are arc quenchers, main and arcing contact structures, inductive tripping sensors, control wiring, auxiliary switches, interlocks, and position indicators. Other features include interpole barriers, and a mechanical trip bar. Each circuit breaker is a complete 3-pole, single-throw 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

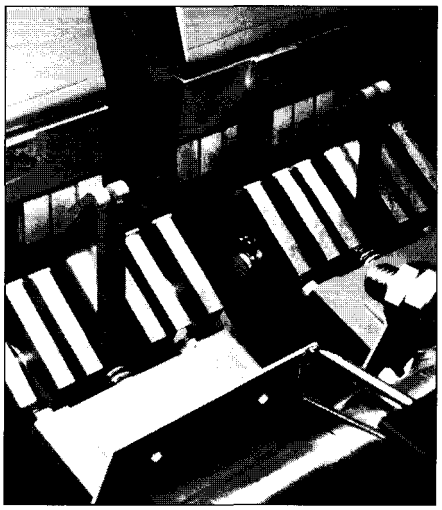
Racking can be done with the compartment **door open or closed**. Racking is accomplished by turning a racking screw on the front of the breaker with a crank.

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)

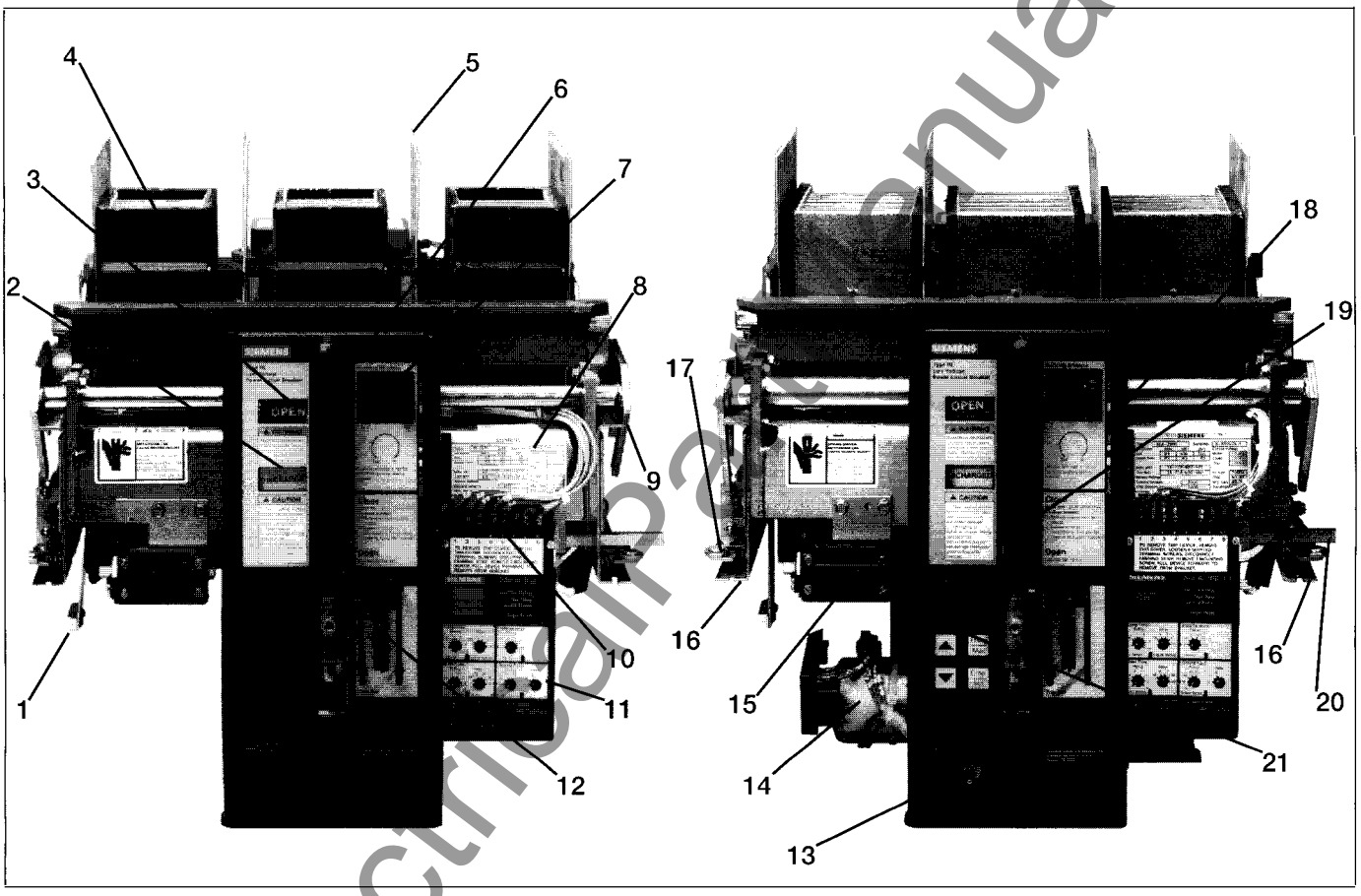
As the racking screw is turned counterclockwise, the breaker frame moves out of the compartment and disconnects the primary contacts followed by the secondary contacts. With only the secondary contacts connected (test position), the breaker may be closed and opened for testing without energizing the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

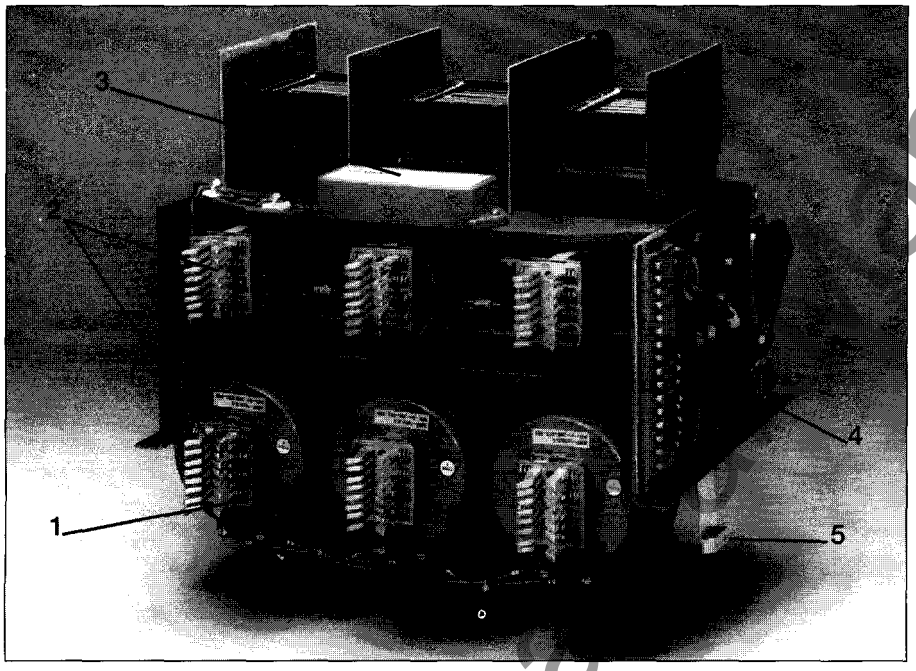


1. Ground shoe contact
2. Stored energy mechanism position indicator
3. Contact position indicator
4. Arc chutes
5. Inter-phase barriers
6. Handle for manually charging stored energy closing springs*
7. Racking mechanism shutter (with padlocking provisions)
8. Circuit breaker rating nameplate
9. Clevis 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.

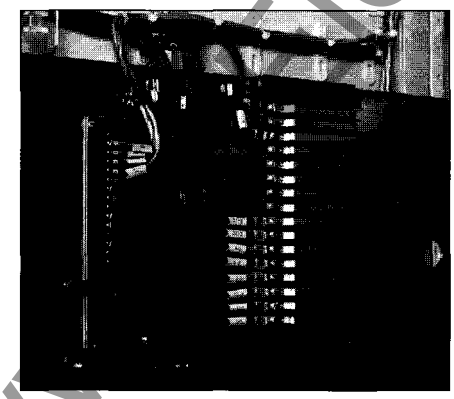
Stainless steel springs provide pressure to the finger contacts in the connected position. Low contact resistance is maintained by these self-aligning contacts.

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

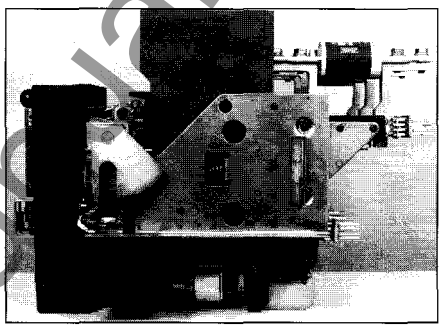
Arc Interruption

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]

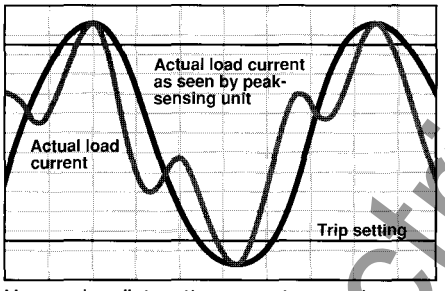
[1] Optionally available with integral 2000A ground sensor winding to meet NEC 230-95 requirements.

Power Circuit Breakers

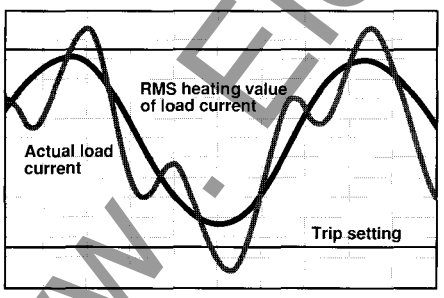
Static Trip III Trip Unit

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.



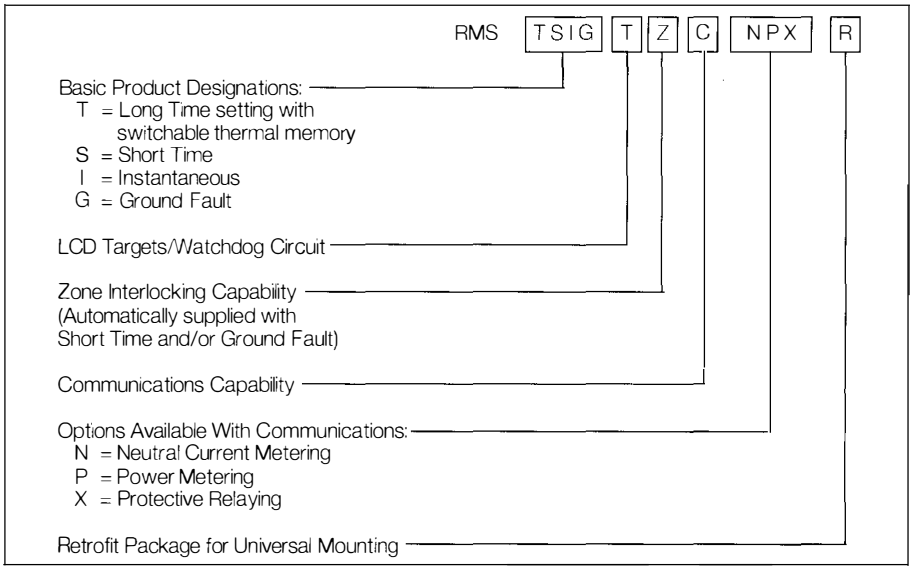
Harmonics distort the current wave shape and can increase its peak value. Normal peak-sensing units may trip, causing nuisance shutdowns.



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



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 setpoint 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	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				•

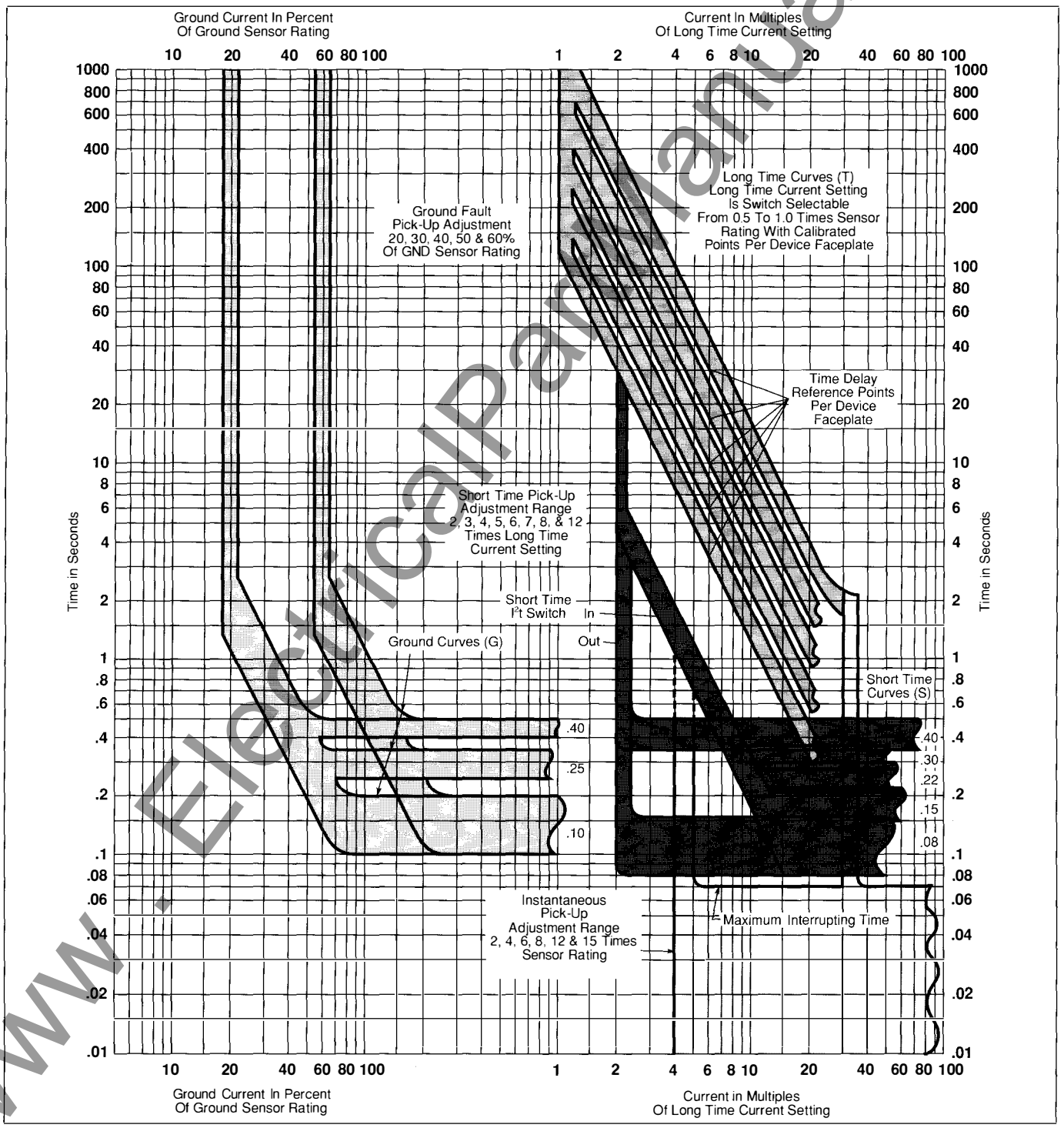
[1] Requires additional wiring to meet specific application.
[2] Supports optional Breaker Display Unit accessory.
[3] Included when ground fault protection specified.
[4] Requires "N" option and neutral current sensor.
[5] Open command uses alarm relay output and restricts use for other alarm functions.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

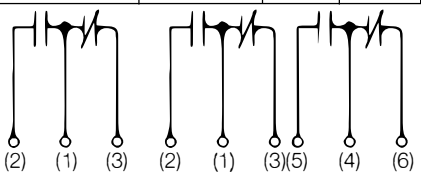
The interlock has a mechanical link that goes to the main shaft of the breaker. The interlock is held in the picked-up position when the breaker is closed. Once closed, the interlock can be de-energized without tripping the breaker. There are no adjustments for pickup or dropout voltages. The interlocks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



SPDT Contact DPDT Contact

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.

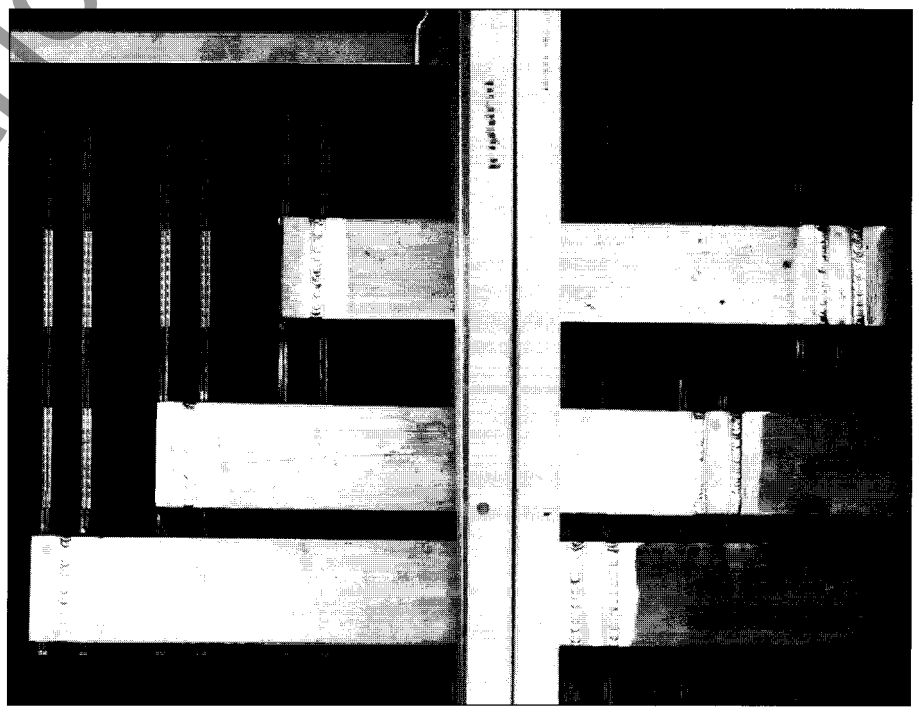
Bolted steel/glass polyester compartments housing each power circuit breaker are mounted in the vertical section to form the switchgear assembly. This assembly isolates the circuit breakers from the bus/cable section and from adjacent circuit breaker compartments.

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

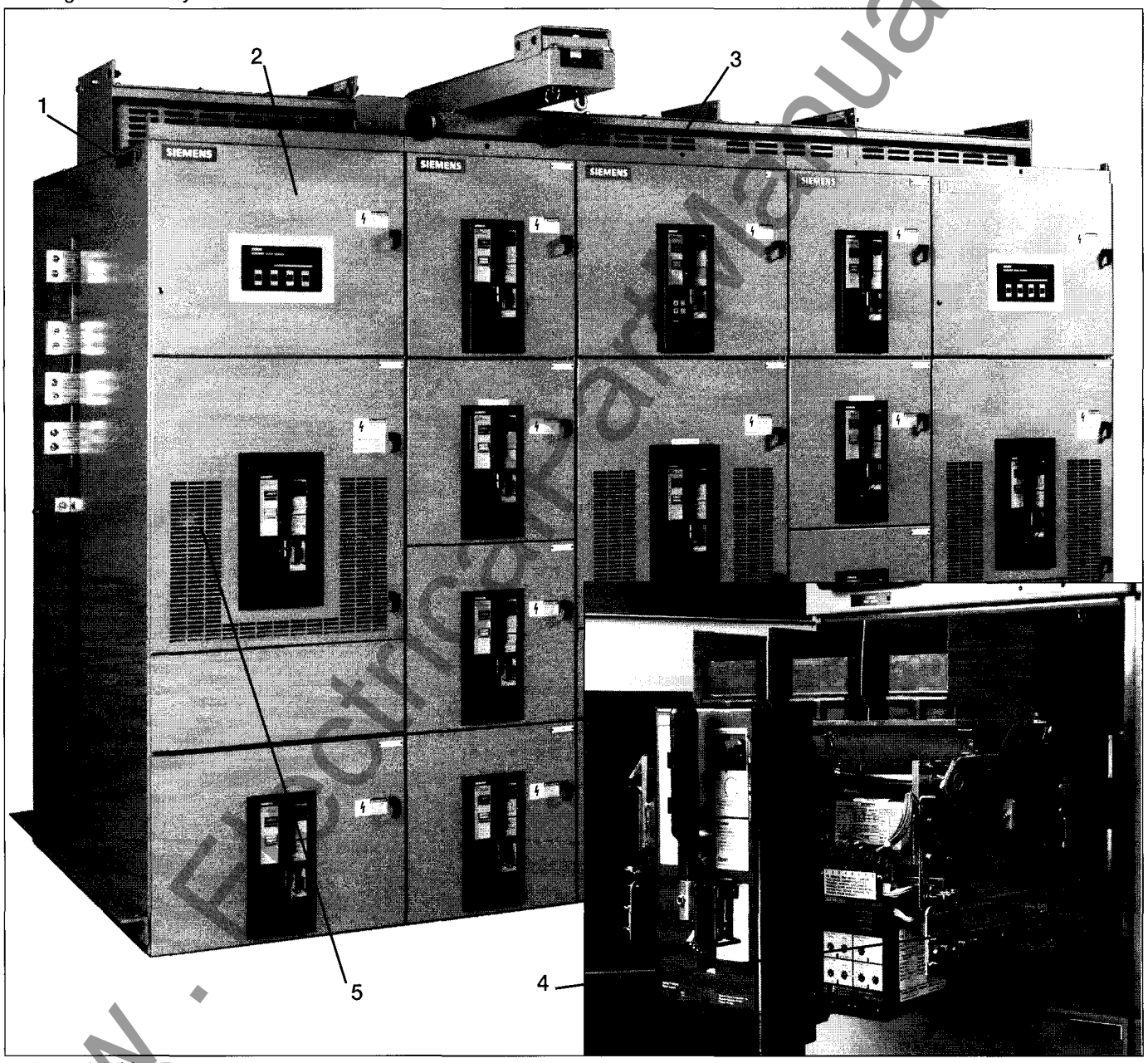
The standard main bus is **welded aluminum**. Provisions for future extension of main bus conductors include tin-plated joints with high tensile strength steel hardware and conical (Belleville) washers. This allows for bolted connections that eliminates field welding of the bus. Optionally available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

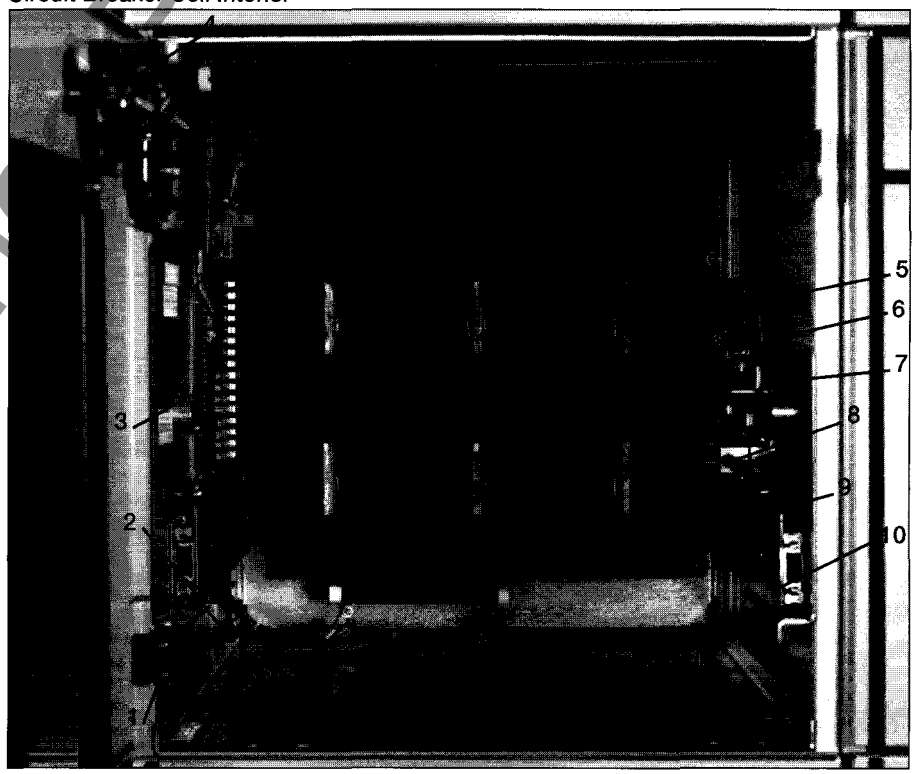
Circuit Breaker Compartments

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.

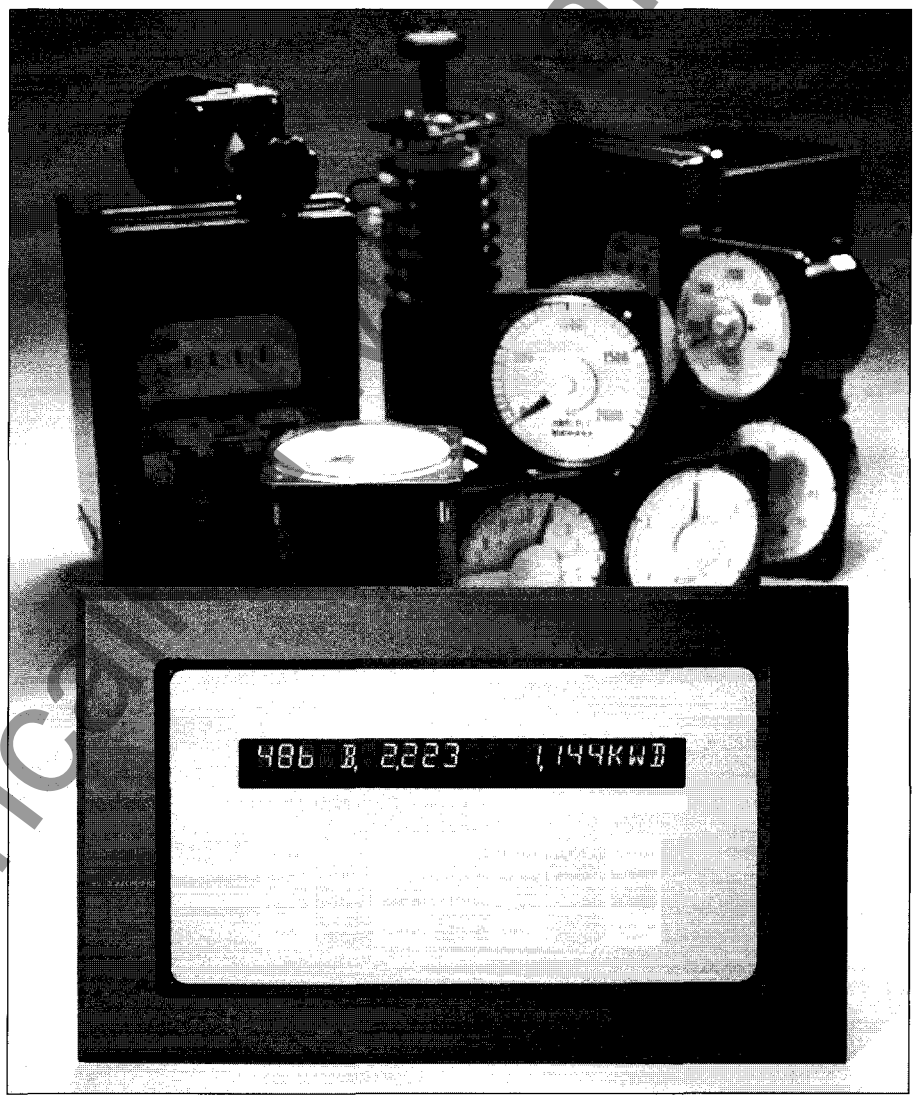
Table 18. 4700 Measured Parameters

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

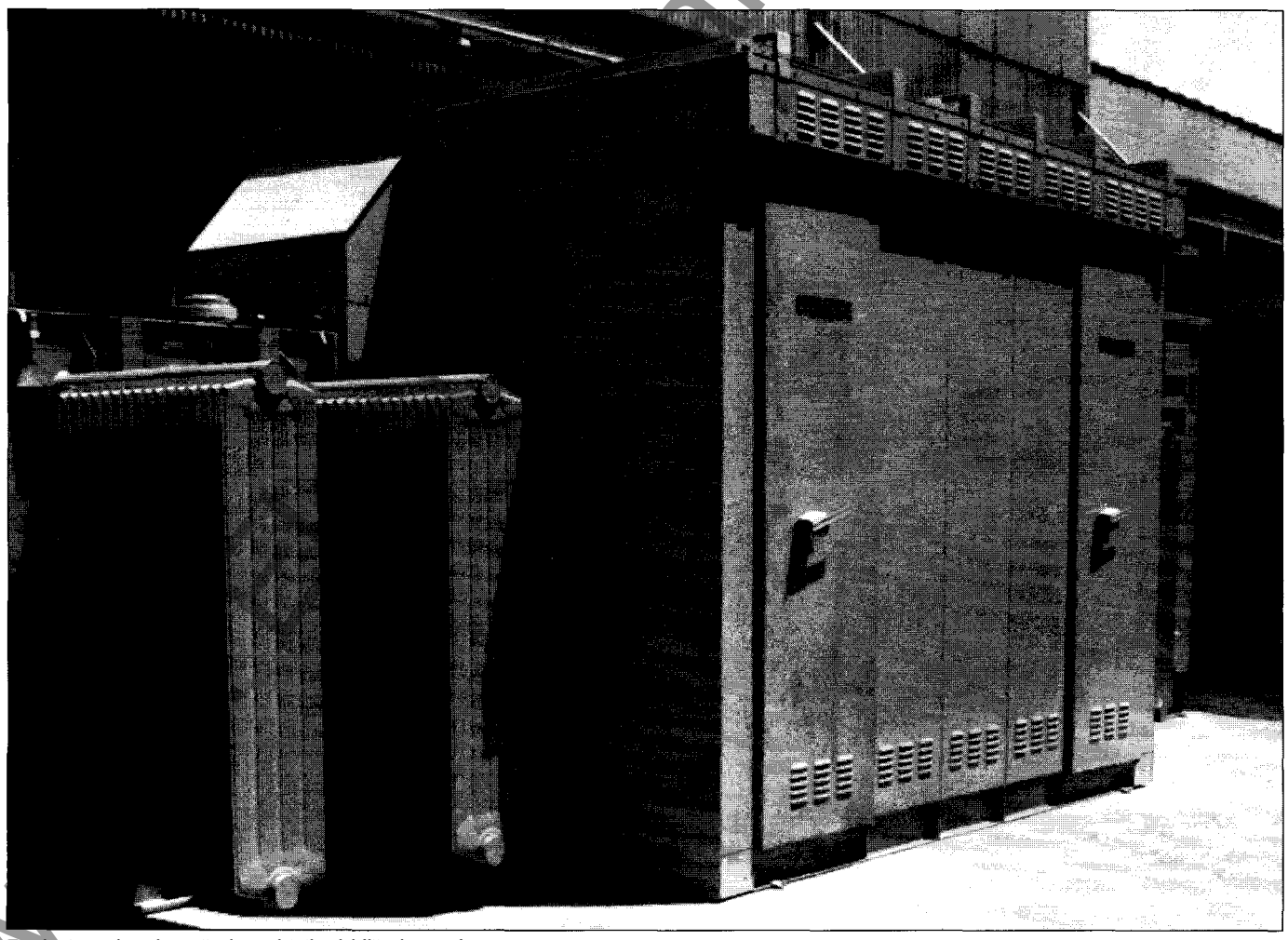
As an optional accessory, a test cabinet is available for indoor use that is wall mounted with necessary equipment for testing electrically operated breakers that have been removed from the breaker compartment.

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:

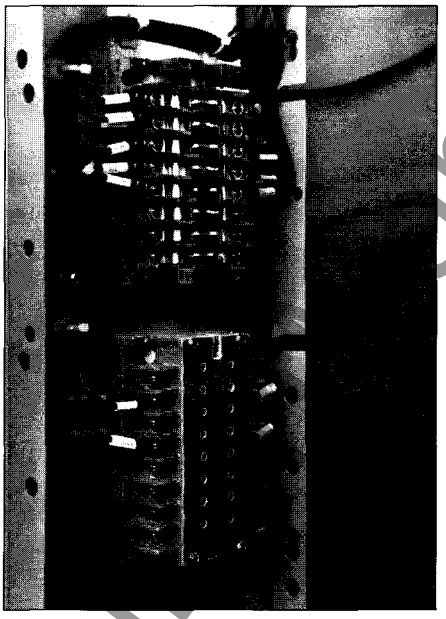
- Switchgear Mounted Hoist
- Breaker Compartment Shutters
- Wire Trough Covers
- Hinged Rear Doors
- Key Interlocks
- TOC and MOC Switches
- PTS4 Static Trip Test Set

• **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.

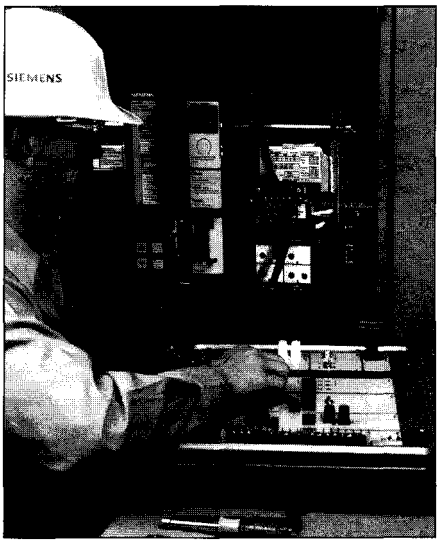
• **Shutters** - Shutters are available to provide protection against accidental contact with primary disconnects in a compartment when the breaker is removed. The shutter assembly is driven by the movement of the breaker.

• **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.

Power Monitor display and monitoring unit with sealed input panel

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.

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.

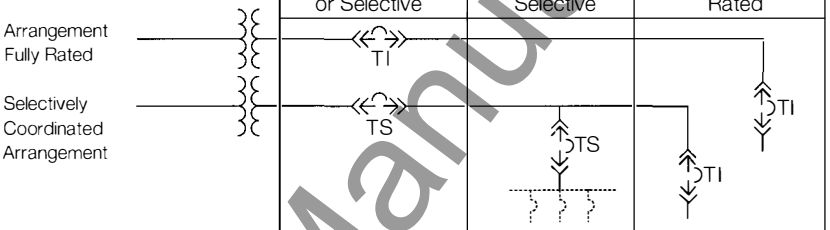
Assumptions

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

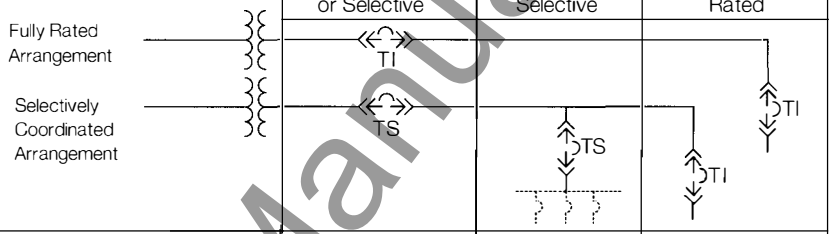


Transformer Rating 3-Phase kVA and Impedance Percent	Maximum Short-Circuit MVA Available From Primary System	Full Load Continuous Current (amperes)[1]	Short-Circuit Rating Symmetrical Current (amperes)			Main	Feeder Circuit Breakers	
						Fully Rated or Selective	Selective	Fully Rated
			Trans-former 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

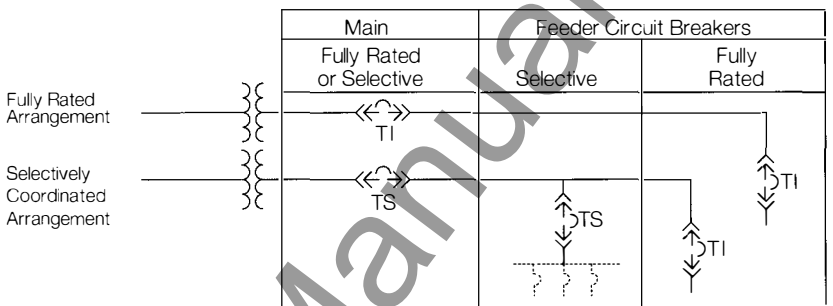


Transformer Rating 3-Phase kVA and Impedance Percent	Maximum Short-Circuit MVA Available From Primary System	Full Load Continuous Current (amperes)[1]	Short-Circuit Rating Symmetrical Current (amperes)			Main: Long-Time Instantaneous or Long-Time Short-Time	Feeder: Long-Time Short-Time	Feeder: Long-Time Instantaneous
			Trans-former Alone	100% Motor Load	Combined	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

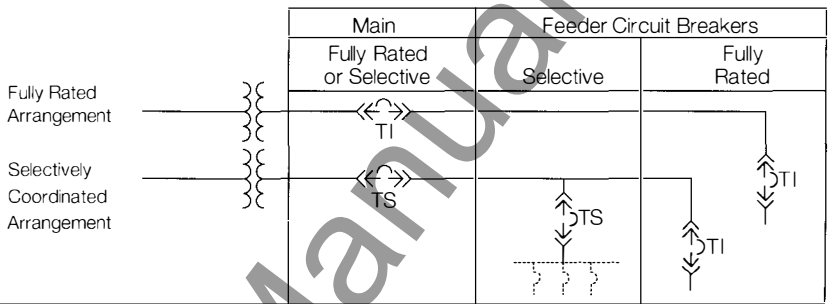


Transformer Rating 3-Phase kVA and Impedance Percent	Maximum Short-Circuit MVA Available From Primary System	Full Load Continuous Current (amperes)[1]	Short-Circuit Rating Symmetrical Current (amperes)			Main	Feeder Circuit Breakers	
			Trans-former Alone	100% Motor Load	Combined	Long-Time Instantaneous 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)

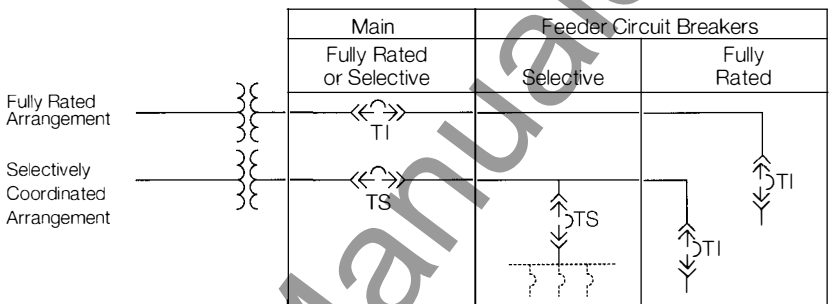


Transformer Rating 3-Phase kVA and Impedance Percent	Maximum Short-Circuit MVA Available From Primary System	Full Load Continuous Current (amperes)[1]	Short-Circuit Rating Symmetrical Current (amperes)			Long-Time Instantaneous or Long-Time Short-Time	Long-Time Short-Time	Long-Time Instantaneous
			Trans-former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

[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

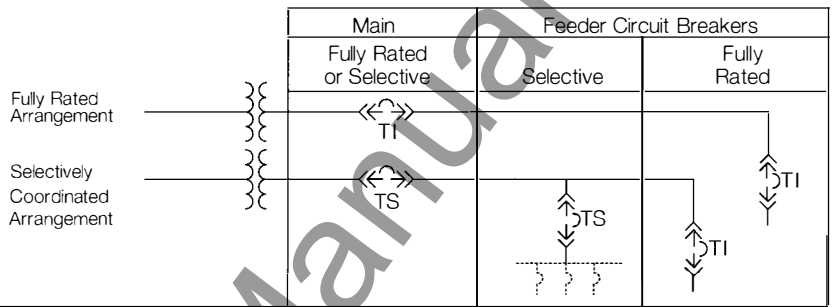


Long-Time Transformer Rating 3-Phase kVA and Impedance Percent	Maximum Short-Circuit MVA Available From Primary System	Full Load Continuous Current (amperes)[1]	Short-Circuit Rating Symmetrical Current (amperes)			Long-Time Instantaneous or Long-Time Short-Time	Long-Time Short-Time	Long-Time Instantaneous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

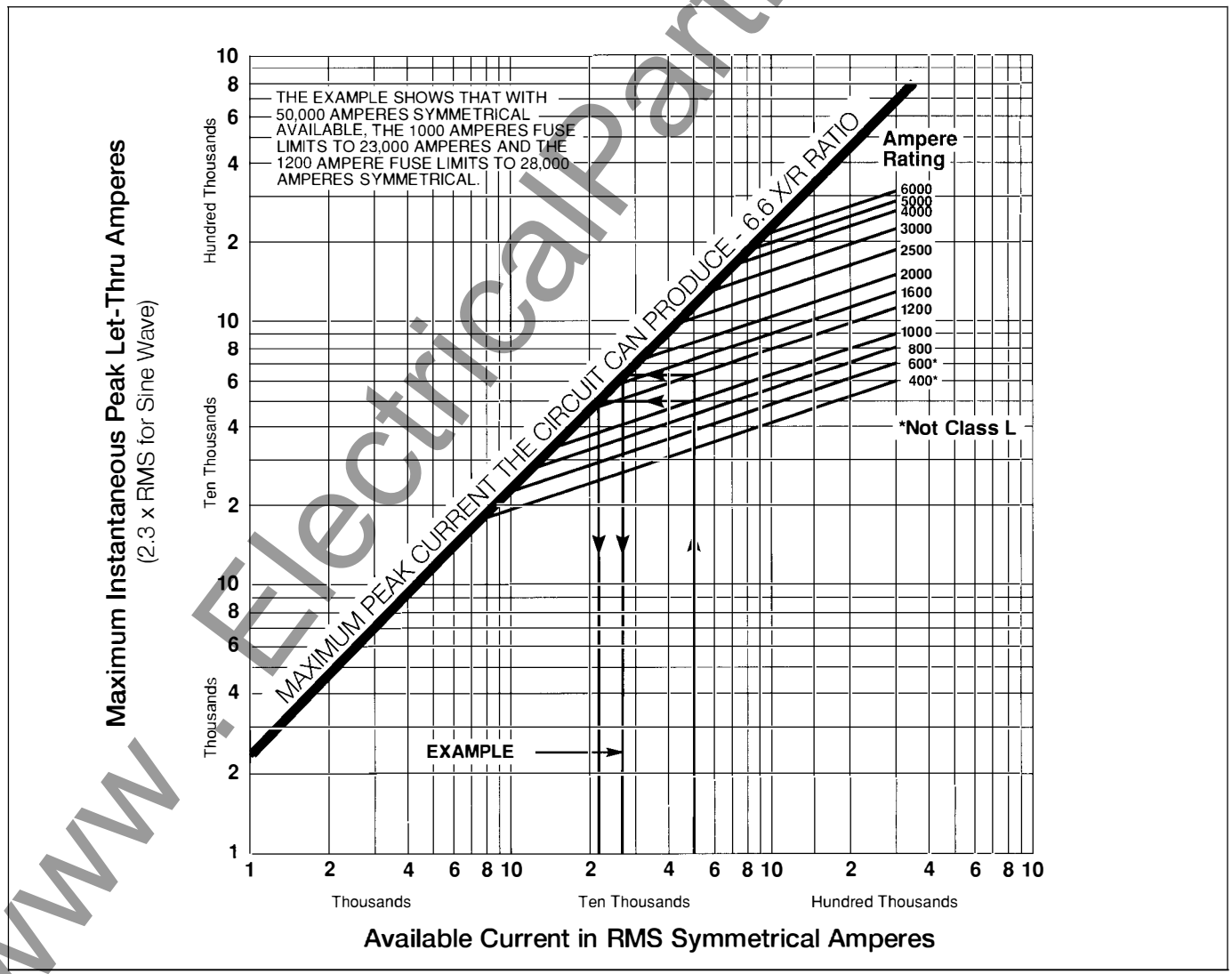
Type RLF fused circuit breakers are a combination of current limiting fuses and RL circuit breakers. Fused breakers clear short circuits rapidly and have high interrupting capacity. Various fuse sizes are available. Fused breakers are typically used to protect:

- 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.

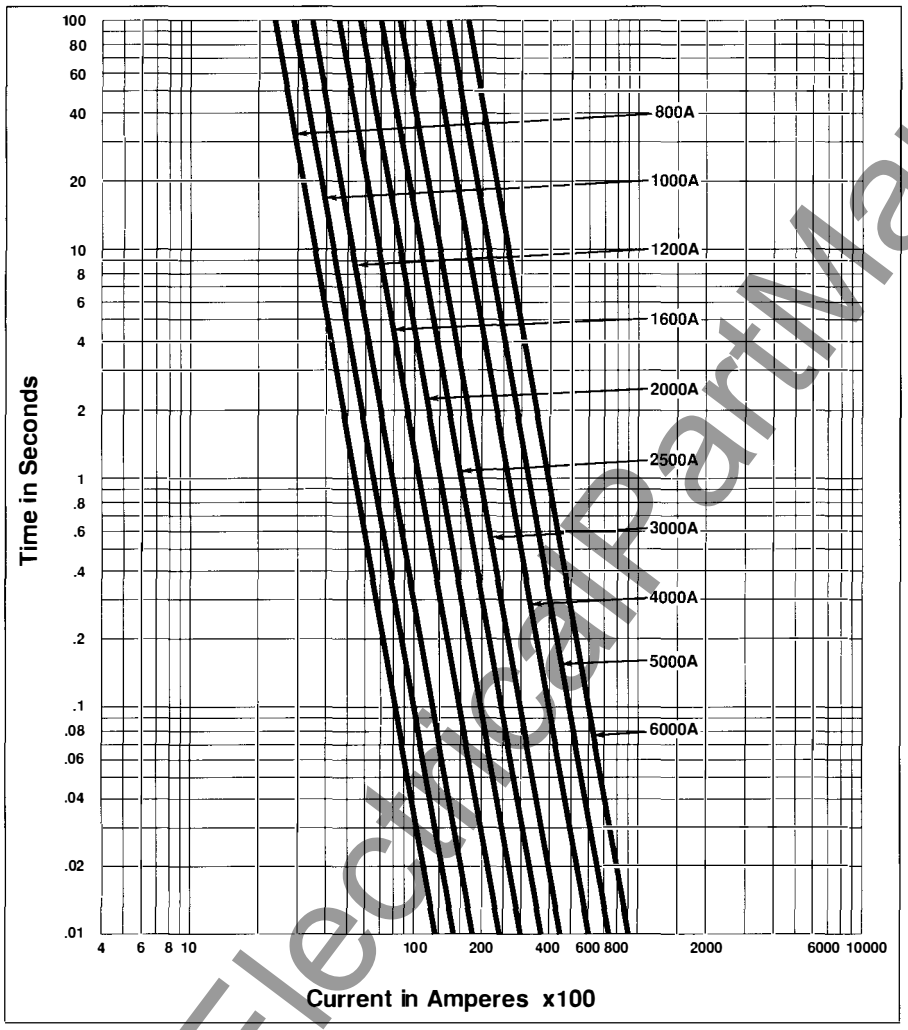
For protecting loads, use a fuse rating that limits the fault to less than the rating of the equipment. Check the limiting effect of the fuse with the following Let-Thru characteristic chart, Figure 2. When selecting fuse values, also consider thermal conditions, upstream devices, and melting time.

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).

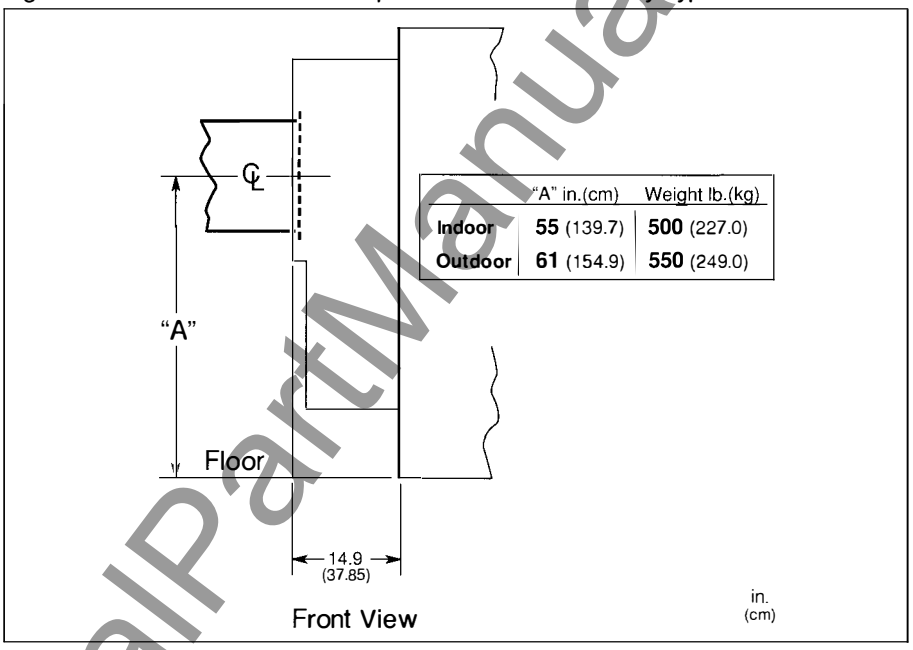
Normal indoor vertical sections are 101 inches (256.5 cm) high and 60 inches (152.4 cm) deep. A top mounted hoist, which is shipped as an accessory in a separate container, adds 2 inches (5.1 cm) for a total installed height of 103 inches (261.5 cm).

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)

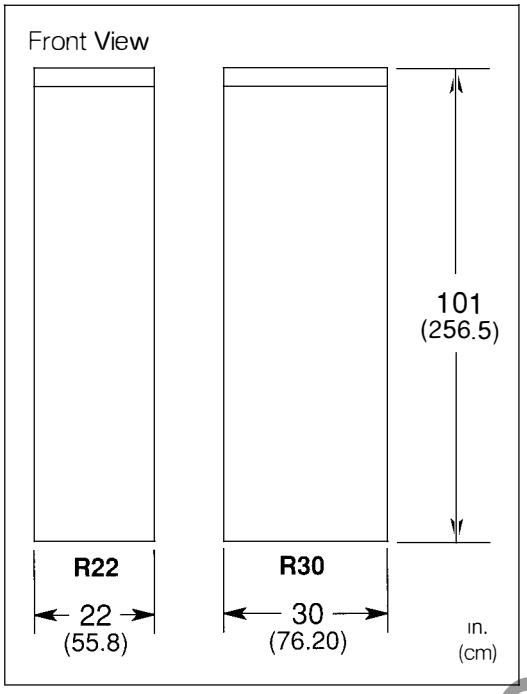
Fused Element Weight

	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)

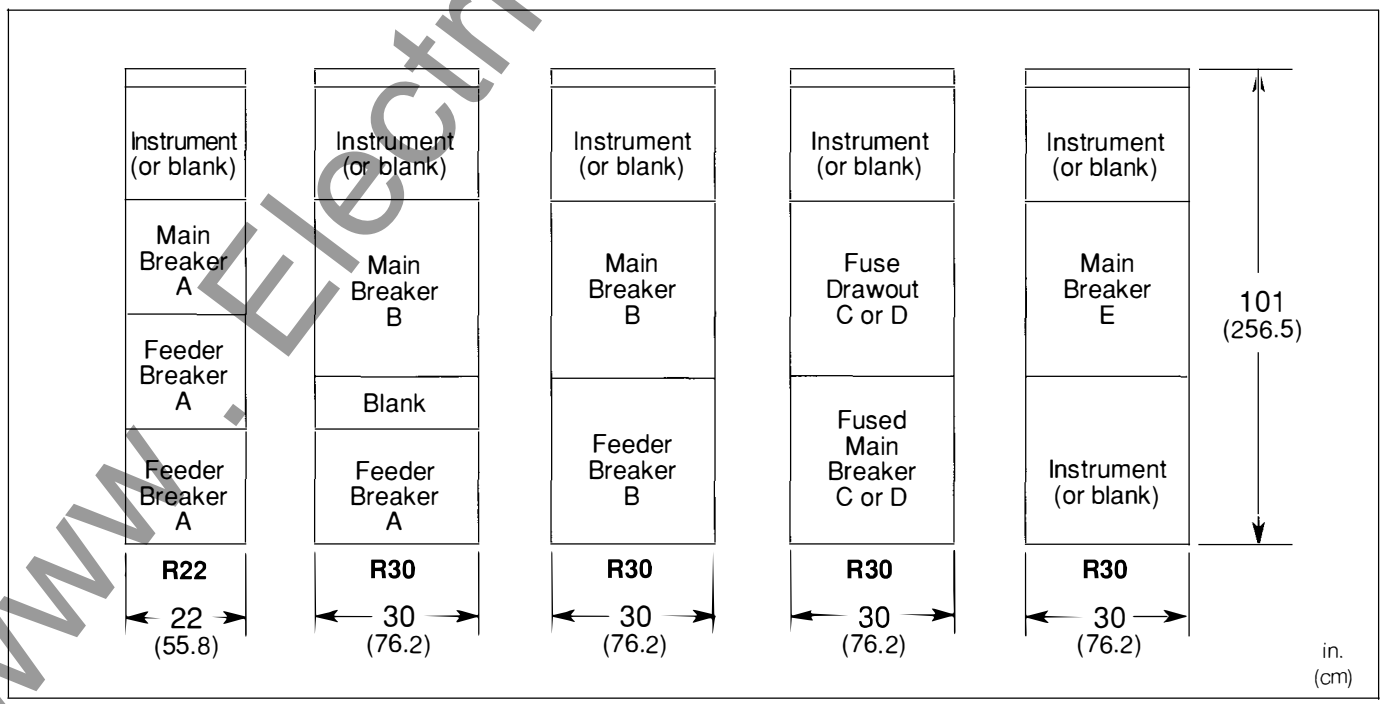
*Weights shown do not include weight of circuit breaker removable elements. All weights are approximate based on aluminum bus. For outdoor lineup, add 1200 lb. (544 kg) to total weight of individual sections for end walls and hoist.

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

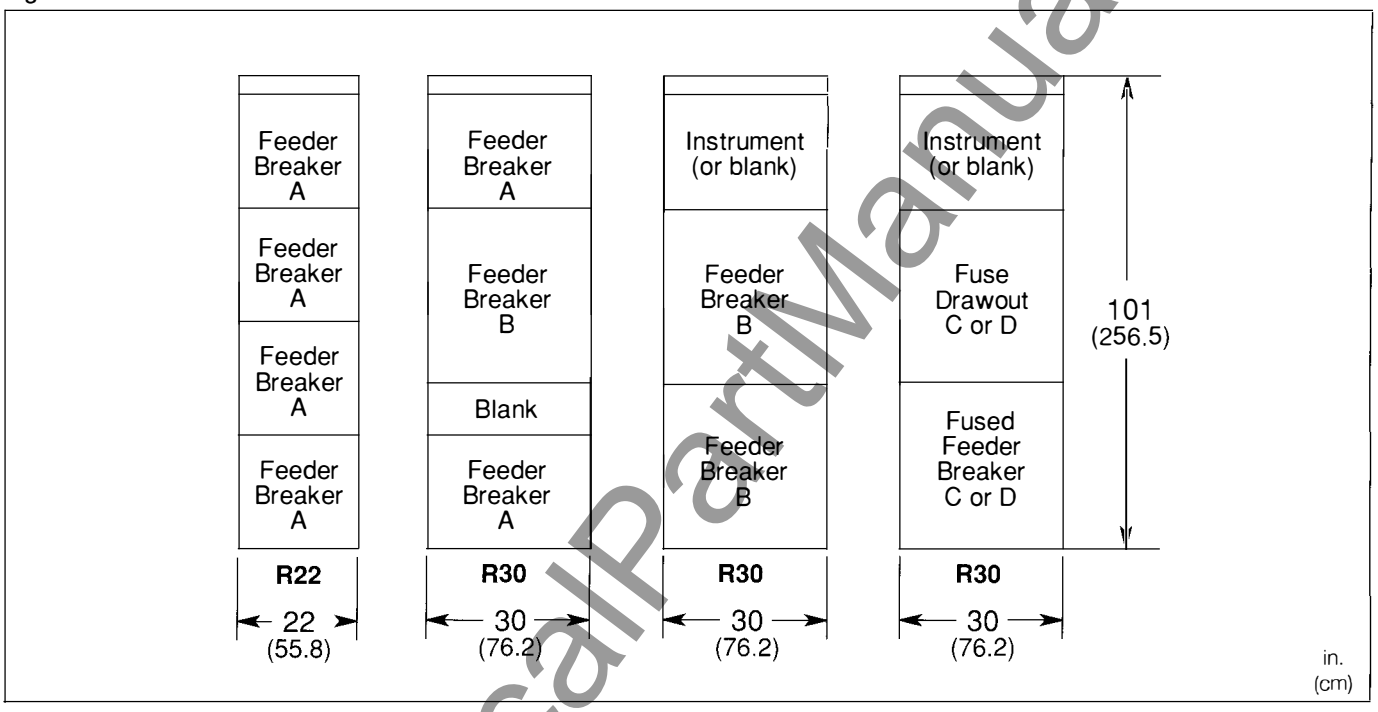
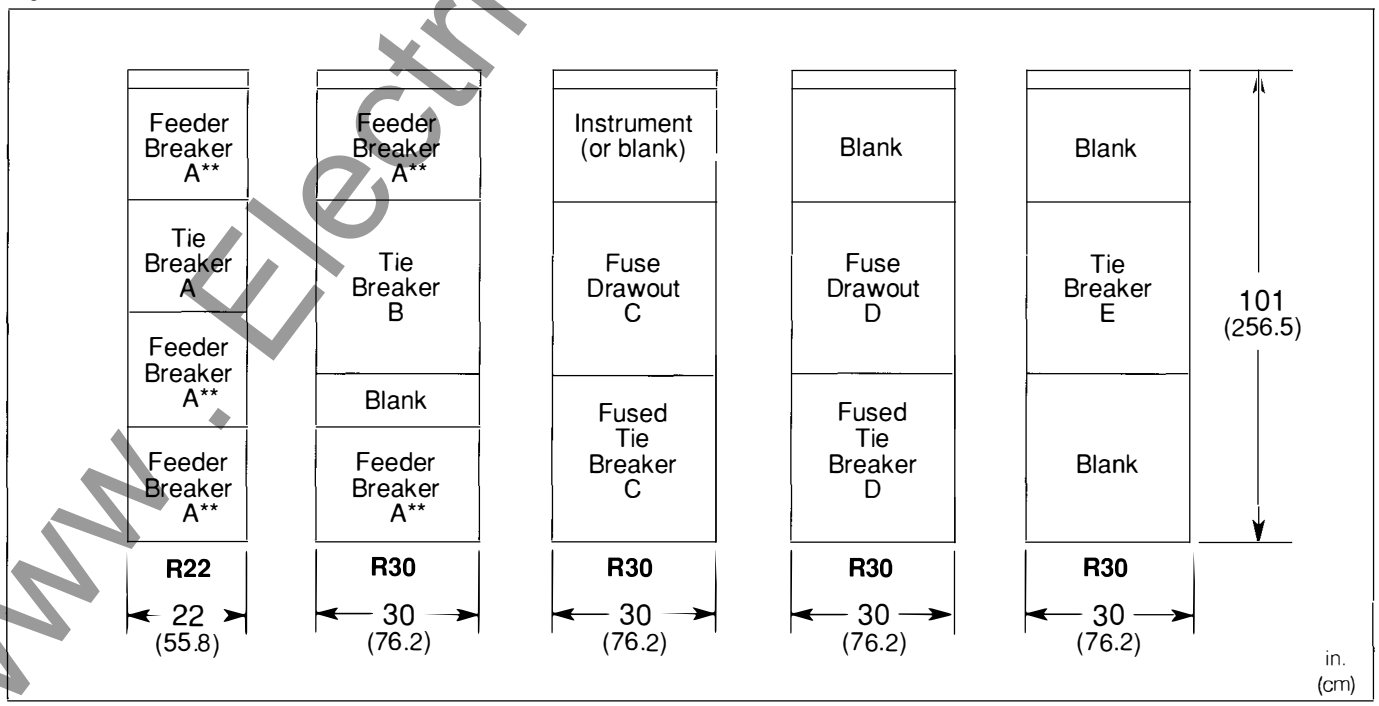
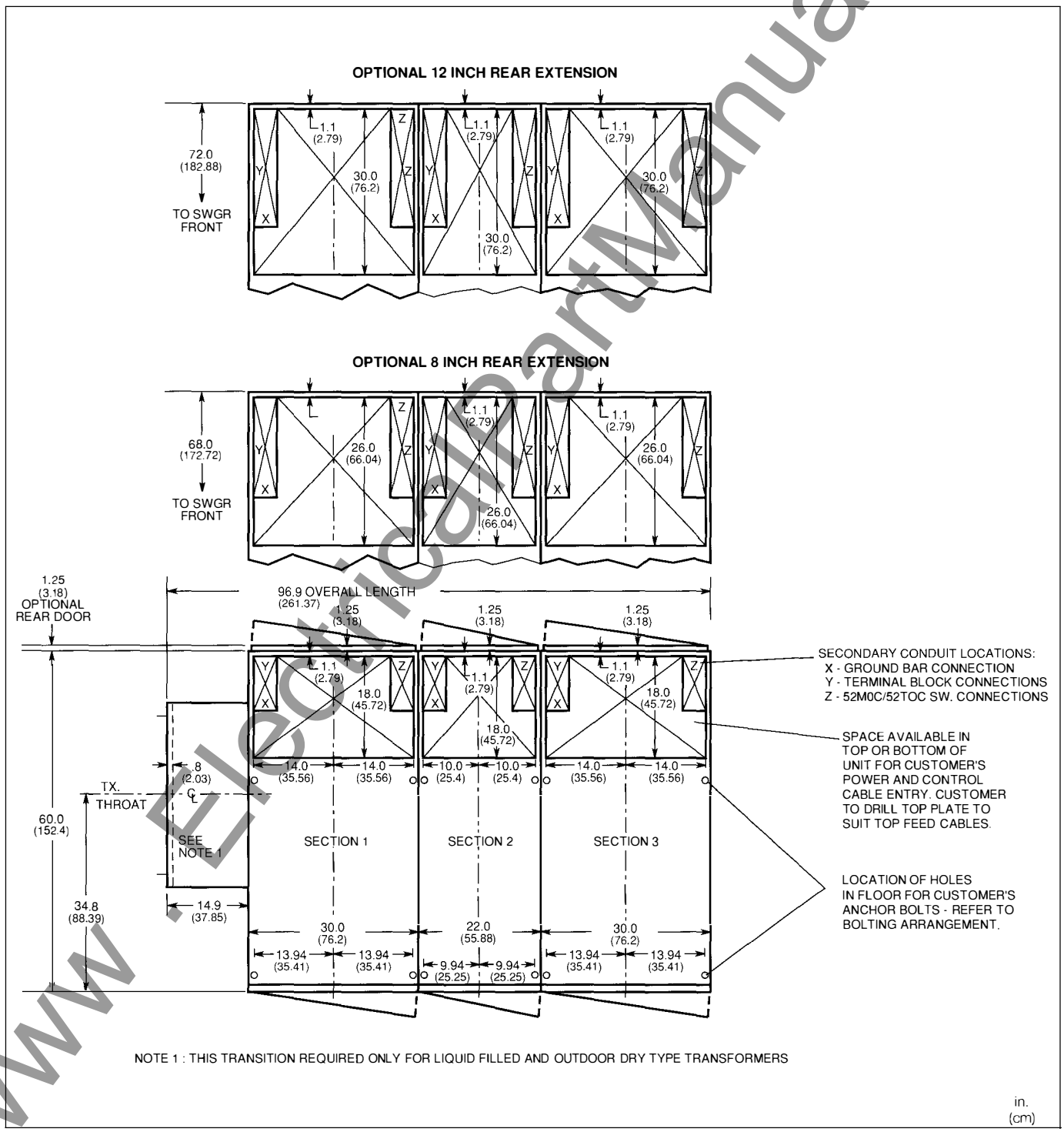


Figure 9. Tie Breaker Sections and Combinations



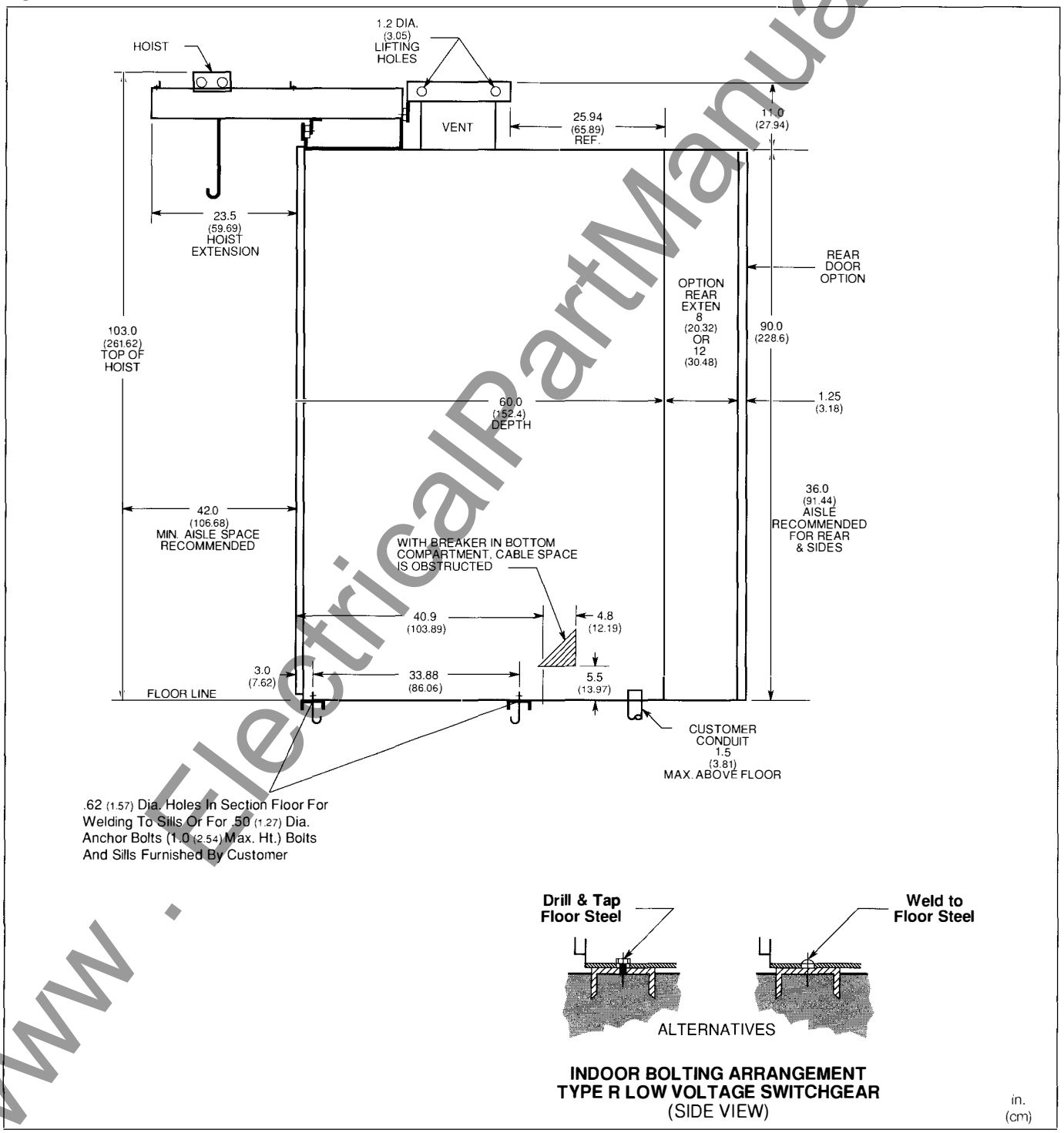
Dimensions & Configurations

Figure 10. Indoor Floor Plan



Dimensions & Configurations

Figure 11. Indoor Side View

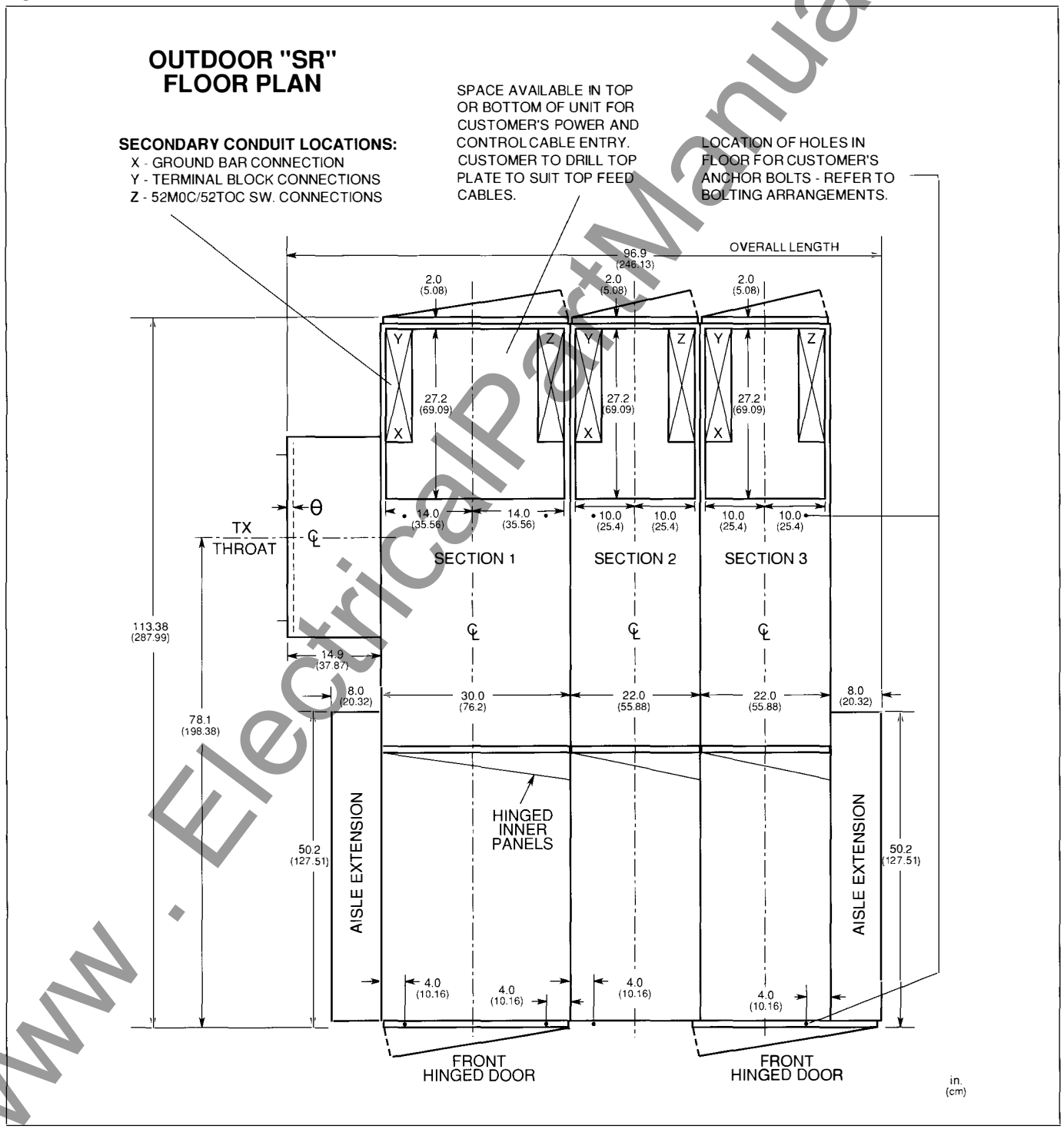


INDOOR BOLTING ARRANGEMENT
TYPE R LOW VOLTAGE SWITCHGEAR
(SIDE VIEW)

in.
(cm)

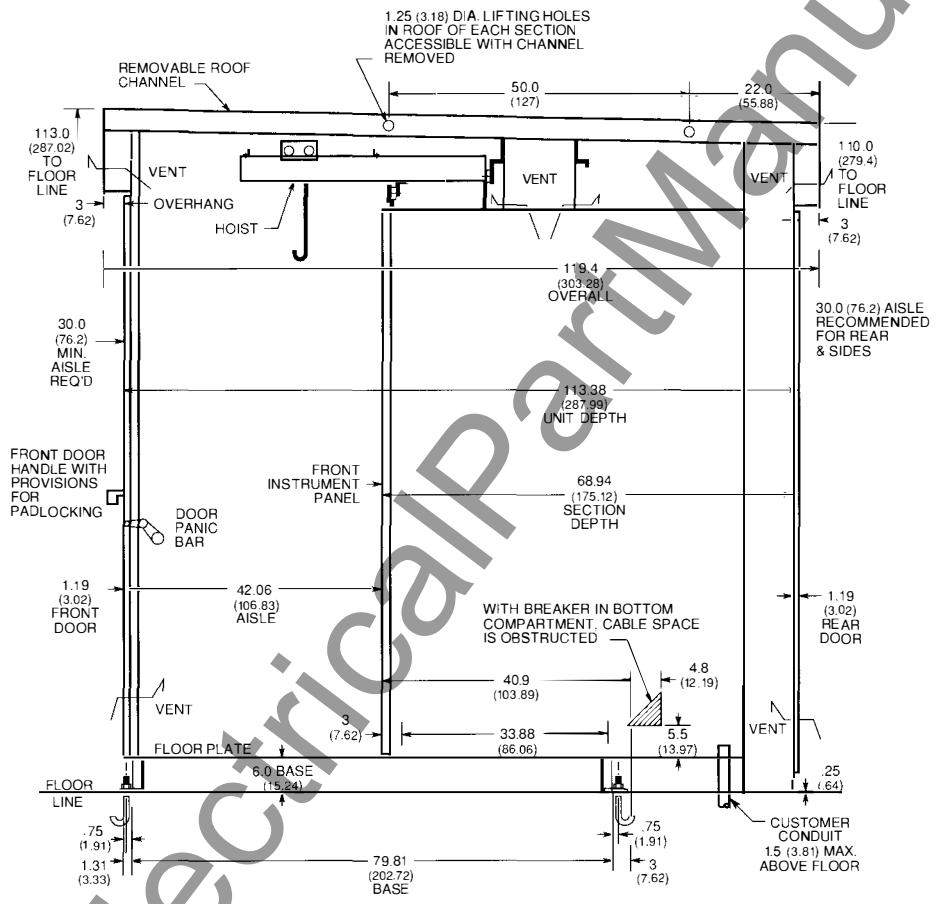
Dimensions & Configurations

Figure 12. Outdoor Floor Plan

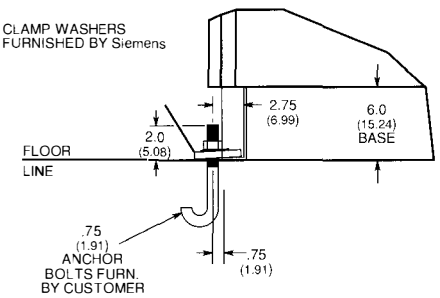


Dimensions & Configurations

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

Typical Equipment Specification

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

Typical Equipment Specification

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

Notes

SIEMENS

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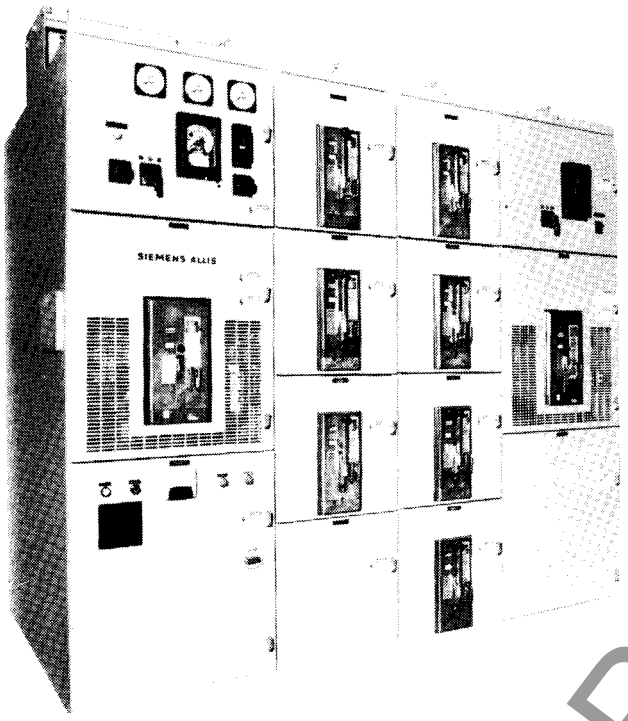
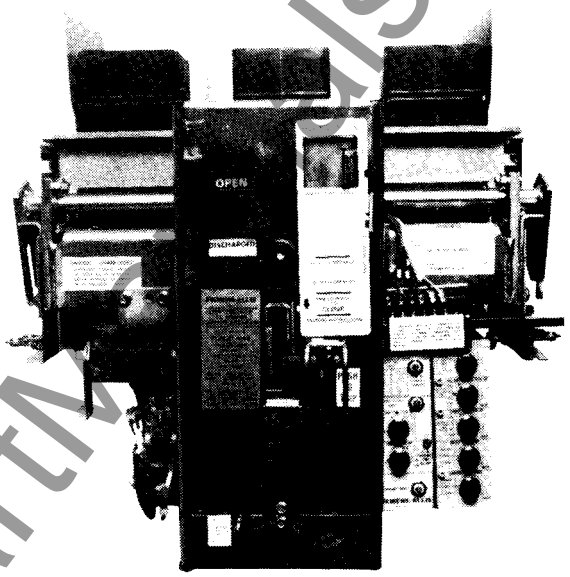
P.O. Box 29503
Raleigh, NC 27626-0503
(919) 365-6660
Fax: (919) 365-2523

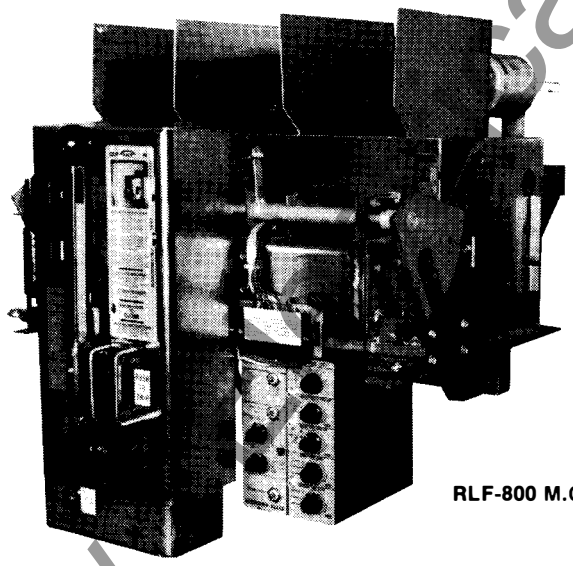
SG3061 15M3/92TD

Description





RL-1600 E.O.



RLF-800 M.O.

Low voltage metal-enclosed switchgear with drawout type low voltage power circuit breakers is used in electric power distribution systems for the control and protection of circuit conductors and equipment.

It is installed in industrial power distribution systems, generating station auxiliary substations and in commercial buildings as the service equipment for such typical applications as:

- **Industrial Plants** — For power and lighting networks, power and lighting feeders, plus power generation and auxiliaries. Also to provide power for machine tools and material handling equipment drives.
- **Central Stations** — Protect and distribute power to station auxiliaries — blowers, compressors, fans, pumps, motors.
- **Commercial and Residential Buildings** — For protection and distribution of power for lighting, elevators, air conditioning, plus blowers, fans, motors and pumps.

Available in indoor "R" and outdoor walk-in "SR" construction, it is applied at system voltages of 600, 480, 240 and 208 volts. The circuit breakers may be either manually or electrically operated, unfused or fused and are designated:

Standard Interrupting Rating Type	Extended Interrupting Rating Type	Fused Type
RL-800	RLX-800	RLF-800 integrally fused
RL-1600	RLX-1600	RLF-1600 integrally fused
RL-2000		RLF-2000 integrally fused
RL-3200		RLF-3200
RL-4000		RLF-4000

Fuses for use with the RLF-3200 and RLF-4000 fused circuit breakers are furnished mounted on a separate drawout carriage.

Static Trip II® solid state trip devices are provided on all low voltage power circuit breakers.

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For Arrangements, Weights and Dimensions, See Section SG 3063.

FEATURES & BENEFITS

- Two design widths of units: 30 inch and 22 inch. All breaker sizes can be accommodated in a combination of units of the two widths.
- Flexibility of mounting arrangements: Four-high stacking of ratings from 800A through 2000A in 22 wide unit.
- Five circuit breaker frame sizes: 800, 1600, 2000, 3200 and 4000 amperes
- Extended interrupting capacities optionally available
- UL listing optionally available for cubicles (UL 1558)
- UL listing of circuit breakers is standard
- Increased cable termination area
- Uniform depth: All units are 60" deep for all breaker ratings.
- Welded aluminum main and vertical bus joints: increased reliability and reduced maintenance. Bolted copper bus with silver-plated connections is optionally available.
- Cable compartment barriers between adjacent units.
- Insulated main bus optionally available
- Metal barriers for incoming line, bus and cable compartments — optionally available.
- Secondary wire troughs, with optional covers.
- Closed door drawout of circuit breakers with connected-test-disconnect positions.
- Primary disconnect shutters - optionally available.
- Convenient Inspection — With door open and the circuit breaker fully withdrawn, key components can be inspected without removal from the rails.
- Telescoping, full drawout, self contained, ball bearing breaker drawout rails.
- True Stored Energy Operator — Charging of the closing springs does not close the circuit breaker. A separate closing lever is operated to release the stored energy.
- "Pyro-Shield" Coordinated Insulation System — High strength, track-resistant, flame retardant, fiberglass-reinforced polyester insulation, bus supports and moldings provide high momentary short circuit strength. Edge-to-edge bus bar arrangements which incorporate high creepage allowances resist dust build-up and the effects of contaminants.
- Static Trip II® solid state overcurrent tripping systems first introduced in 1971 assures years of trouble free, reliable service and provides optimum distribution system protection. Any available type of device will fit all low voltage power circuit breakers.
- Trip Target Indicators — Aid in determining the cause of tripping — optionally available on Static Trip II® devices.
- Simple Breaker Rating Change — Changes in continuous current or pickup setting can be made without any special tools by merely adjusting the knob settings on the Static Trip II® system.
- Plug-in testing of Static Trip II® system. Portable test set is optionally available.
- Front Access Current Transformers — Mounted on the stationary disconnects in the breaker compartment where they can be easily replaced when a change in current rating is required.

GENERAL

Type "R" Low Voltage Switchgear Assembly includes a bolted steel framework, sheet steel enclosure, individual breaker compartments, hinged breaker and auxiliary compartment panels, drawout breaker guide rails, interlocks, three-phase buswork and supports, stationary primary and secondary disconnecting devices, ground bus, power cable termination connectors, control cable terminations, instruments and relays, control wiring, terminal blocks and instrument transformers.

1. Meter and Auxiliary Compartment (Page 9)
2. Control Wiring (Page 9)
3. Control Circuit Fuses (Page 6)
4. Telescopic Breaker Drawout Rails (Page 6)
5. Stationary Secondary Disconnects (Page 6)
6. Breaker Escutcheon Opening
7. Indicating Instruments
8. RL-3200 Electrically Operated Breaker in Connected Position
9. RL-3200 Electrically Operated Breaker in Test Position
10. RL-1600 Manually Operated Breaker in Connected Position
11. RL-800 Manually Operated Breaker in Connected Position
12. Future Breaker Compartment (Page 6)
13. Auxiliary Compartment
14. Blank Compartment
15. Ventilation Openings (RL-2000, RL-3200 and RL-4000)
16. Ventilation and Lifting Structure
17. Interunit Wiring Trough

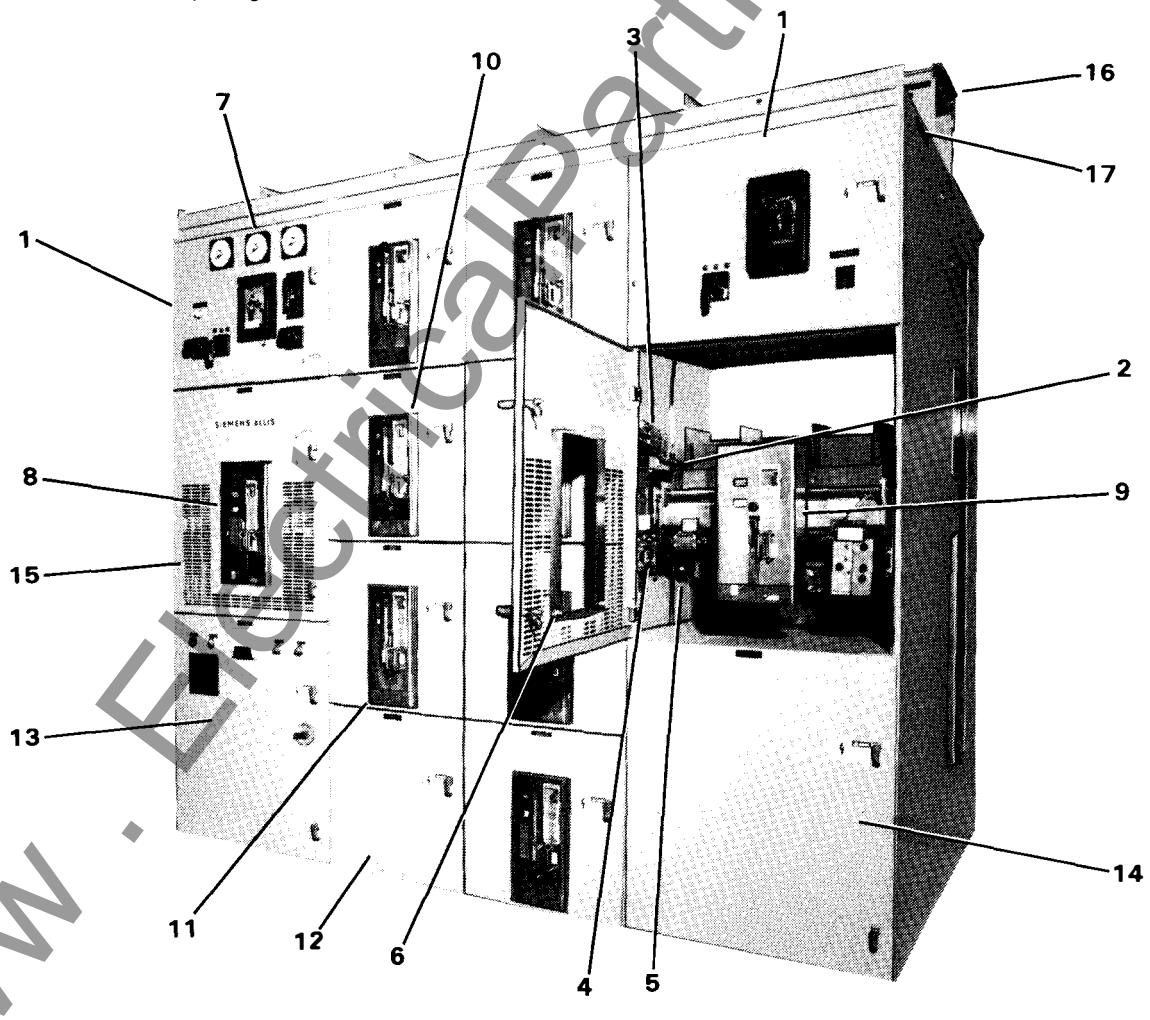


Figure 1. Typical Group Indoor Switchgear.

STANDARDS & RATINGS

Siemens-Allis Type "R" and "SR" metal-enclosed low voltage switchgear with drawout power air circuit breakers is designed, tested and constructed to be in accordance with ANSI C37.20, "Switchgear Assemblies", and other related ANSI standards, as well as the applicable standards of IEEE and NEMA, and meets the applicable requirements of the National Electric Code (NEC).

The Type "RL" drawout circuit breakers are in accordance with ANSI C37.13, C37.16 and C37.17 for the frame sizes from 800 to 4000A.

Optionally available, an Underwriters Laboratory (UL) listing mark (label) can be supplied for each vertical unit provided the specific unit contains only devices which are UL listed or are UL recognized components found suitable for intended use.

When the assembly is specified for application as "Service (Entrance) Equipment", the additional features and modifications as required by NEC are incorporated.

All circuit breaker drawout elements are UL list marked as standard.

The assembly is UL listed in accordance with UL 1558 entitled "Low Voltage Power Circuit Breaker Switchgear", conforming to ANSI C37.20, C37.50 and C37.51.

SPECIFICATIONS — CUBICLES

Framework and Compartments

The switchgear is totally metal-enclosed ventilated multiple unit construction, wherein the switching structure basically is comprised of an assembly of individual standardized enclosed breaker compartments to form a single, compact switchgear unit. Each unit consists of three or four circuit breaker and/or metering compartments as determined by standard engineering practice to provide uniform height of the switchgear. Construction is of 11 gauge steel or equal, except doors, top plates and rear plates are 14 gauge. Side sheets are 14 gauge with 2 thicknesses between units.

The switchgear assembly is composed of as many vertical units as required. Normally the end units include provisions for the future installation of additional units.

Low voltage metal-enclosed switchgear has the accepted features of complete dead-front construction, with totally metal-enclosed circuit breakers; metal-enclosed top, rear and ends of the complete switchgear and including complete interlocking features, all in accordance with ANSI C37.20-1974.

The steel framework of Type R low voltage switchgear is constructed of preformed, full depth, #14 gauge steel side sheets bolted together and reinforced with cross-member braces to form a rigid, self-supporting, compact assembly. Compartments housing each low voltage power circuit breaker are bolted steel subassemblies mounted within the framework to form the complete switchgear assembly. The top, side and rear sections are fitted with removable steel sheets securely bolted to the framework forming a rigid assembly. Where two vertical breaker sections are to be mounted together side by side, there are two thicknesses of #14 gauge steel between adjacent circuit breaker compartments.

The circuit breakers are barriered from the bus/cable compartment by the compartment housing the breaker.

The bus/cable compartment includes the main horizontal bus which can be provided at either of two levels, riser bus, connections from the main bus to one set of primary disconnects, and load side "run-back bus" so that cable lugs are accessible without reaching over main bus (see below).

Main and Ground Bus

Standard main bus construction incorporates aluminum bus with welded connection of main bus conductors to vertical riser buses and welded connection at main bus joints Figure 2. Shipping splits and provisions for future extension of main bus conductors using tin-plated joints with high tensile strength steel hardware and conical (Belleville) washers are designed for bolted connection and are incorporated as standard eliminating any need for field welding. The main three phase horizontal bus is vertically arranged one phase above the other with edge-to-edge alignment providing a high short circuit strength system. Bolted copper bus with silver-plated joints is optionally available. Insulated bus is also available as an option.

Main bus ratings are 1600, 2000, 3200, 4000 and 5000 amperes continuous. Bus bracing is based on smallest breaker short circuit rating. Minimum bracing is 65,000 amperes RMS symmetrical. Other symmetrical bracings are 85,000 and 130,000 amperes.

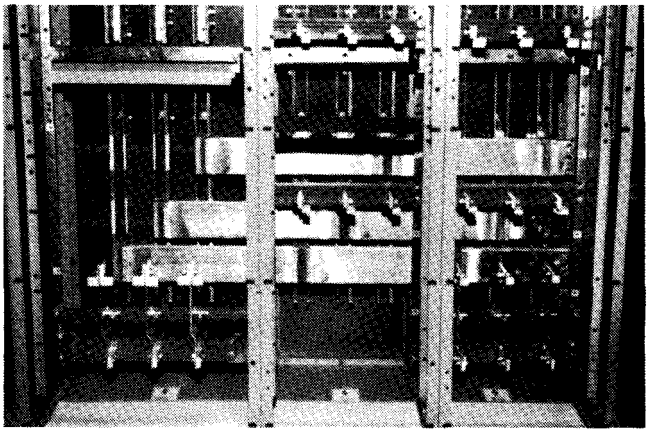


Figure 2. Rear View Showing Welded Aluminum Main Bus. Note Bolting Provisions for Shipping Split or Future Expansion.

A neutral bus is furnished when specified, and can be rated 1600, 2000, 2300, 3200 or 4000 amperes continuous.

A 1/4" x 2" copper ground bus is furnished as standard extending through all units and securely bolted to the structure. Provision is made within each unit for mounting of grounding cable lug.

Optional barriers as shown in Figure 3 can be provided between the bus and cable areas, to isolate the cable area. Barriers are also available to isolate the incoming bus of main circuit breakers from the main bus (not shown).

The assembly is designed for temperature limitations as defined by ANSI C37.20, paragraph 4.4.

The units are designed for a 50° C maximum total temperature of parts handled by the operator. The bus is designed for 65° C maximum rise above 40° C ambient. Air surrounding the switchgear cable connection points is limited to 45° C rise above 40° C ambient. ANSI C37.20, paragraph 7 includes application requirements.

Load side (runback) conductors for feeder circuits are a single piece copper design through 1600 amperes, with no bolted joints from circuit breaker disconnect to the cable lug mounting surface Figure 4. Runbacks are insulated with sleeve tubing where passing through the main bus area, and are supported in a high strength glass polyester molding. Feeder circuit breaker cells are consistently arranged with top studs connected to the main bus, and lower studs to outgoing cable terminations.

Figure 3. Rear View Showing Bolted Copper Main Bus and Bus-Cable Compartment Barriers.

Insulation System

Track-resistant Pyro-Shield insulation is used throughout in the coordinated insulation system and designed to provide liberal creepage allowances. Pyro-Shield insulation, a fiberglass-reinforced polyester material, has high impact strength which eliminates risk of damage due to short circuit stress and assures low moisture absorption. Other advantages are high flame retardance, long life — even at high temperatures — plus high resistance to chemical fumes.

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 mounted on Pyro-Shield sheets in the cubicle. The high momentary strength provided by the edge-to-edge bus bar arrangement is coupled with high creepage distance Pyro-Shield insulation to provide the bus bar bracing.

A completely insulated bus bar insulation system is optionally available for the main and vertical bus within the breaker units.

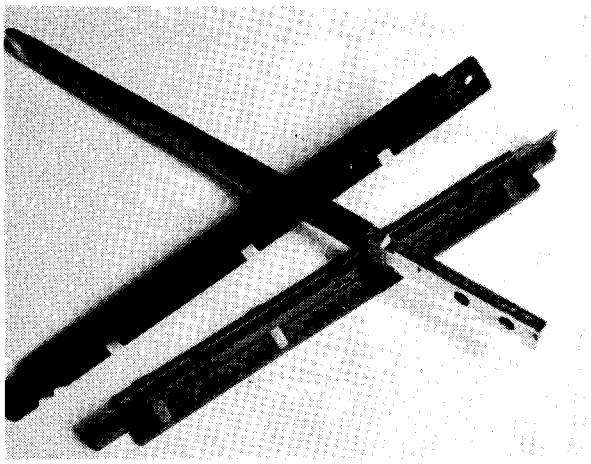


Figure 4.

Description

Circuit Breaker Compartments

Each circuit breaker compartment includes as standard the stationary primary disconnects, ground disconnect, and the telescoping drawout rails, plus the associated safety interlocks.

Circuit breakers can be fully withdrawn on compartment rails, which include ball bearings to reduce friction. The rails telescope to allow the breaker to extend fully out of the compartment without the need for additional extensions or adapters. Figure 5.

Cells for electrically operated circuit breakers also include the spring mounted secondary disconnect molding plus control circuit fusing with clear plastic dead front fuse holders. Refer Figure 6.

The pull-out fuse holder Figure 7 is designed with a set of clips to allow the storage of the holder in the fuse block when circuit is disconnected. This feature provides benefit of not misplacing or interchanging of fuses while performing maintenance on a breaker.

Each circuit breaker cell includes provisions for mounting up to three "RD" current transformers for metering or relaying. Figure 6 shows three current transformers installed in an RL-800 cell, with the glass polyester barrier removed to show the transformers. Figure 8 shows an RL-3200 cell with glass polyester barrier installed over the current transformers.

Figure 5. Fully Withdrawn RL-800 on Telescoping Rails.

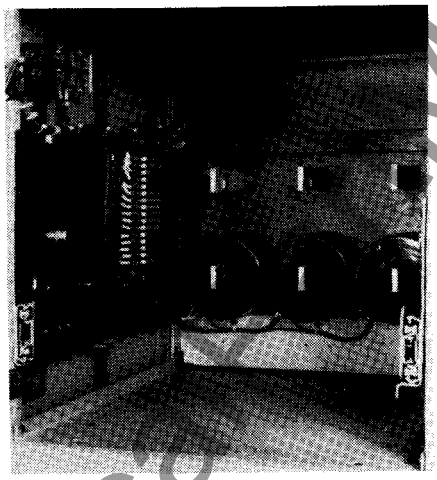


Figure 6. Typical Compartment for Electrically Operated Breaker with Secondary Disconnect and Fuse Holder. Note Barrier Removed from CT's.

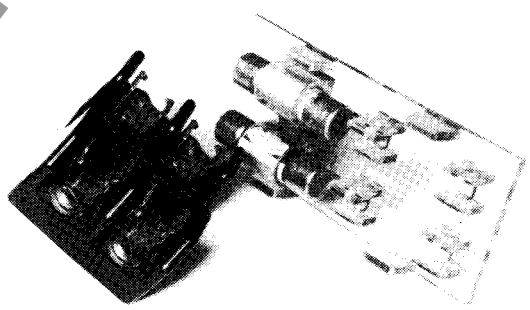


Figure 7. Control Circuit Dead Front Fuse Holder.

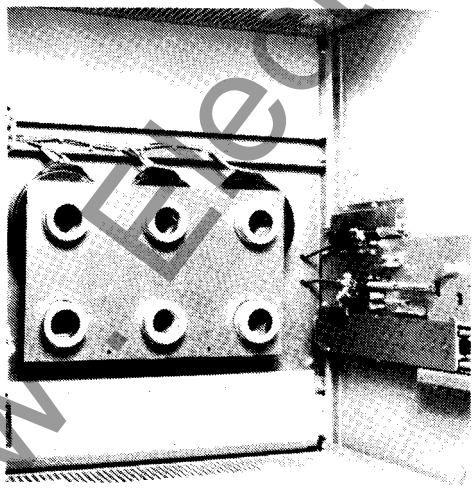


Figure 8. Typical Compartment for RL-3200 or RL-4000. Note MOC and TOC Switch Actuating Mechanisms.

Future Circuit Breaker Compartments

To prevent accidental contact with live parts, a Pyro-Shield sheet barrier is used to cover the primary disconnect contacts of compartment arranged for future addition of breaker.

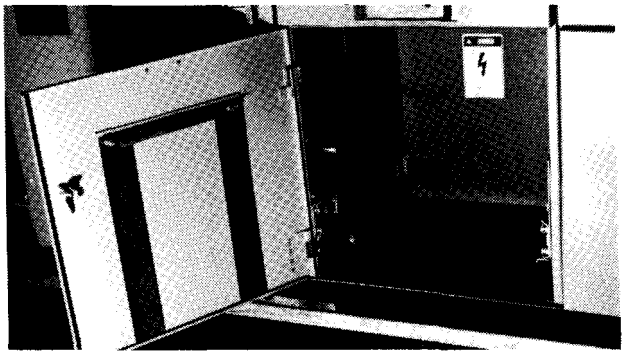


Figure 9.

Circuit Breaker Closed-Door Racking

Racking the breaker in or out is accomplished by operating a racking screw with a crank as shown in the illustrations. The screw operates a clevis on each side of the breaker that fits into pins mounted on the compartment wall. The motion of the clevis around the stationary pins moves the breaker into or out of the compartment and provides positive positioning of the breaker throughout its movement from disconnect to connected position.

When the breaker is completely racked in, it is said to be in the CONNECTED position. Figure 10. This is the normal operating position. As it is drawn out, it passes into a TEST position where the primary disconnects no longer make contact, but the secondary circuits remain connected. In this position the breaker may be opened and closed for testing without energizing the load.

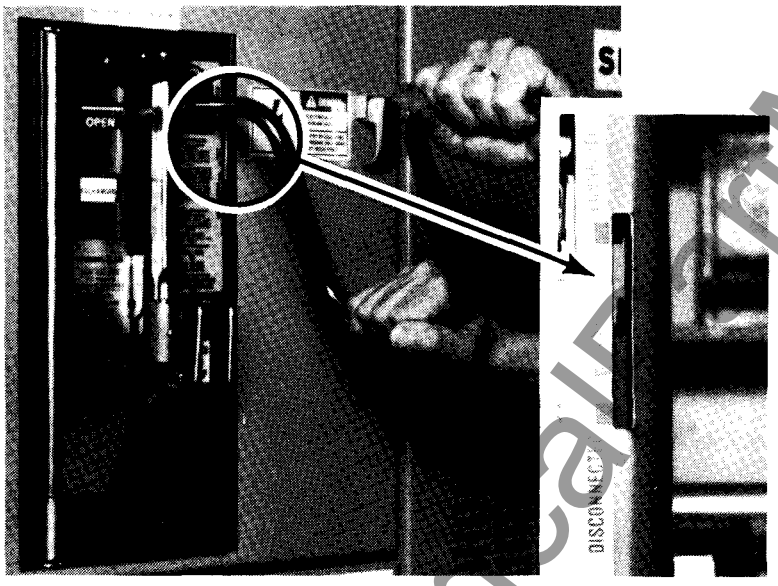


Figure 10. Breaker Racking Between Connected-to-Test Position.

Beyond the test location the breaker is in the DISCONNECTED position where all contacts are parted. Racking of the breaker can be done while the compartment door is open or closed. Figure 11.

A position indicator is located on the front of the breaker mechanism cover. The breaker movement relative to the Connect, Test and Disconnect positions may be observed while turning the racking crank.

Figure 11. Breaker Racking Between Test-to-Disconnect Position.

INSTRUMENT AND CONTROL TRANSFORMERS

Potential Metering Transformers

These are mounted within metering compartments, and are protected by primary pull-out type current limiting fuses. Secondary fuses are also provided.

Table 1. Type BT Potential Transformers

Ratio	Accuracy Class @ 60 Hz Burden W	X	Y	Volt-Amp Rating	Thermal Rating VA	Cycles	Weight Lbs.
600/120	0.6	0.6	1.2	100	500	50/60	16
480/120	0.6	0.6	1.2	100	500	50/60	
288/120	0.6	0.6	1.2	100	500	50/60	

NOTE: Thermal rating based on 30° C rise above 55° C ambient.

Control Power Transformers

These are normally mounted within metering compartments, and are protected by primary pull-out type current limiting fuses. Secondary fuses are also provided. Where size prevents location in metering compartment, they are located in a separate compartment.

Table 2. Type BT Control Power Transformers — 115° C Rise

KVA	Phase	Primary Voltage	Secondary Voltage	Weight Lbs.
3	1	240/480	120/240	60
5				85
10①				135
15①				185

① Requires complete compartment.

INSTRUMENT TRANSFORMERS

Current Transformers

Most arrangements have current transformers mounted on the stationary primary disconnect studs where they are readily accessible when a feeder circuit change requires replacement of CT's for those of a different rating. No need to enter bus or cable compartment and disturb primary buswork or disconnect cables when replacing CT's.

Table 1. "RD-100": For RL-800, RL-1600 or RL-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	4.8			C5
150/5	1.2	1.2	2.4	4.8		C10
200/5	0.6	1.2	2.4	2.4		C15
250/5	0.6	0.6	1.2	2.4	4.8	C20
300/5	0.3	0.6	1.2	1.2	2.4	C20
400/5	0.3	0.3	0.6	1.2	2.4	C30
500/5	0.3	0.3	0.6	0.6	1.2	C40
600/5	0.3	0.3	0.3	0.6	0.6	C50
800/5	0.3	0.3	0.3	0.6	0.6	C40
1000/5	0.3	0.3	0.3	0.3	0.6	C60
1200/5	0.3	0.3	0.3	0.3	0.3	C70
1500/5	0.3	0.3	0.3	0.3	0.3	C80
1600/5	0.3	0.3	0.3	0.3	0.3	C80
2000/5	0.3	0.3	0.3	0.3	0.3	C30
2500/5	0.3	0.3	0.3	0.3	0.3	C30

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

Table 2. "RD-200": For RL-3200 ① or RL-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	0.3	0.3	0.6	C70
1200/5	0.3	0.3	0.3	0.3	0.3	C80
1500/5	0.3	0.3	0.3	0.3	0.3	C110
2000/5	0.3	0.3	0.3	0.3	0.3	C80
2500/5	0.3	0.3	0.3	0.3	0.3	C100
3000/5	0.3	0.3	0.3	0.3	0.3	C70
3200/5	0.3	0.3	0.3	0.3	0.3	C70
4000/5	0.3	0.3	0.3	0.3	0.3	C50

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.

Metering and Auxiliary Compartments

Instruments, meters and switches for main bus metering are normally grouped on a panel above the main breaker. This compartment also serves to enclose auxiliary devices, potential transformers, control power transformers, and the like.

Standard indicating instruments are rectangular panel type with 2 percent accuracy, semi-flush mounted. Standard instrument transfer and breaker control switches are miniature rotary type. Optional switchboard indicating instruments are available, with one percent accuracy and 250° scales. Optional switches are Siemens-Allis Type 210. Watthour meters are switchboard type, and provided with drawout cases which include built-in test facilities.

Primary fuses for potential transformers and control power transformers are installed in pull-out range type fuse holders. The secondary fuses may be supplied in pull-out type fuse holders as an option.

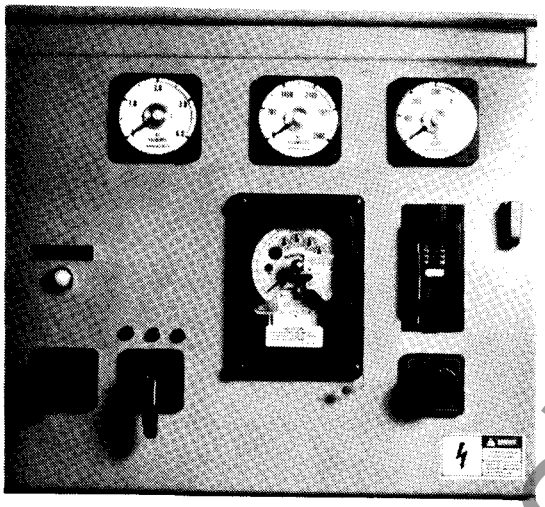


Figure 12. Typical Front Panel of Main Metering Compartment.

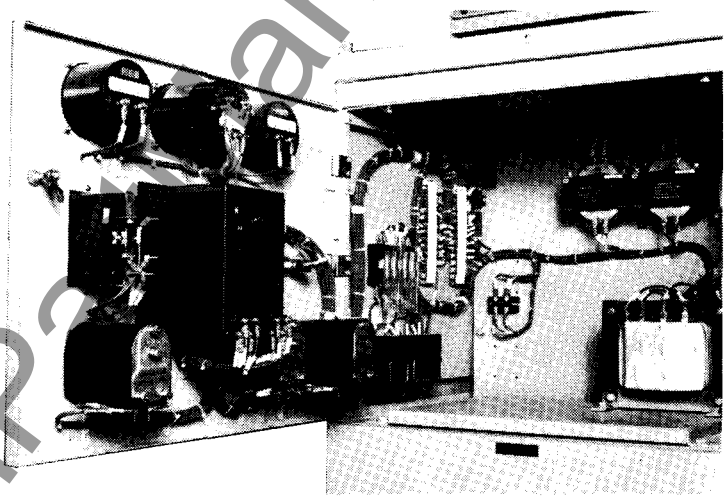


Figure 13. Interior View of Typical Main Metering Compartment with Potential and Control Power Transformers and Optional Wire-End Identification Markers.

Feeder Metering

Common instrumentation and control devices can be accommodated on feeder circuit breaker cell doors, including any or all of the following:

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

Control Wiring

All secondary and control wiring is No. 14 (minimum) extra flexible stranded copper type SIS. Termination is by compression type, insulated ring terminals for connection to screw type terminal blocks and screw type device terminals. For termination to devices not having screw type terminals, sleeve connectors, locking fork terminals or tab type disconnects will be employed. Optional wire-end identification markers can be supplied as either adhesive backed vinyl wrap-around or vinyl sleeve type.

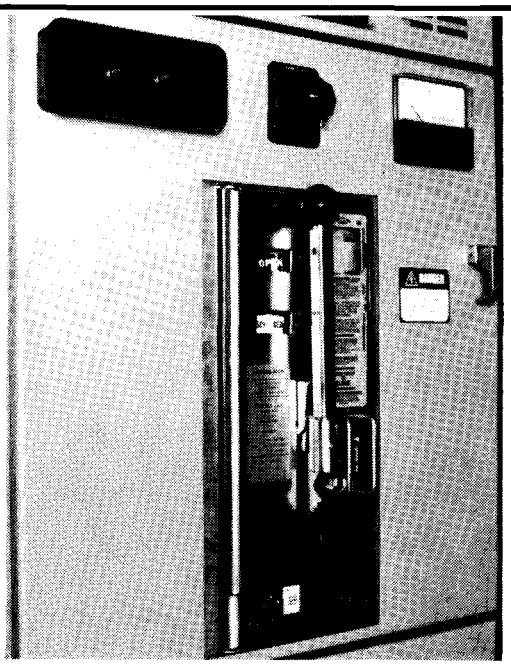


Figure 14.

Description

Accessories

Standard Accessories

Each switchgear assembly will include as standard:

- Crank for circuit breaker racking
- Lifting bar assembly for all circuit breaker types
- Manual spring charging handle if electrically operated circuit breakers are included
- Quart of touch-up paint

Optional Accessories

Inspection and test cabinet, indoor wall mounted with necessary control for testing electrically operated breakers while breaker is outside of unit.

Traveling Crane — Optional on Indoor

A hoist for ease of breaker handling, which is mounted on top of each switchgear group, travels along rails to locate above any unit. To remove a breaker it must first be drawn completely out and the lifting bar attached forming a two point lift. Then the hook from the crane is connected to the bar and by turning a crank which reels up the cable attached to the hook, the breaker is raised or lowered. Figure 15.

This hoist is optional on indoor groups, but is standard with outdoor lineups.

Optional Features

Shutters

Grounded metal shutters are optionally available to provide protection against accidental contact with energized primary disconnects when the breaker is withdrawn from its cell. The shutter assembly drive mechanism positively drives the shutter in both opening and closing function.

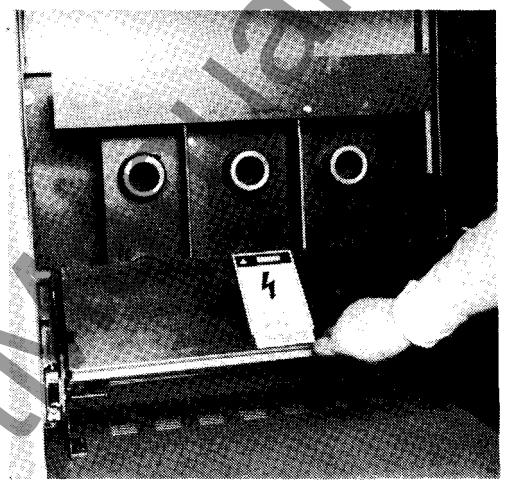


Figure 16.

Wire Trough Covers

Removable trough covers are available for enclosing secondary wiring within each vertical section in the primary bus and outgoing cable areas. Figure 17.

Hinged Rear Doors — Indoor

Full height formed rear door with removable pin hinges are available in place of standard split, bolted on plates. Doors are secured by hex head hardware. Figure 18.

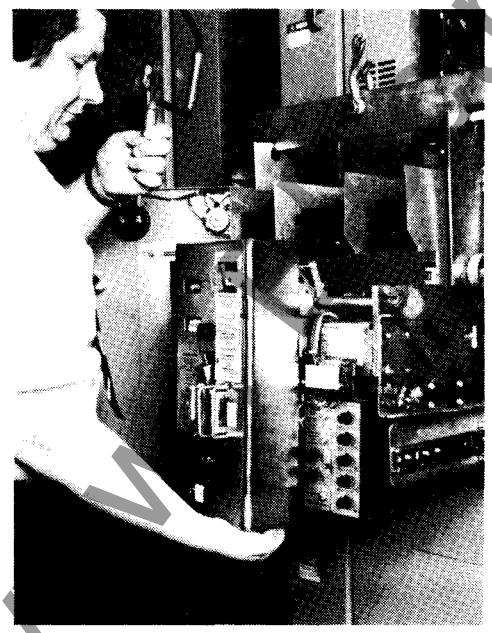


Figure 15. Overhead Hoist Utilizes Universal Lifting Bar for all Sizes of Breakers.

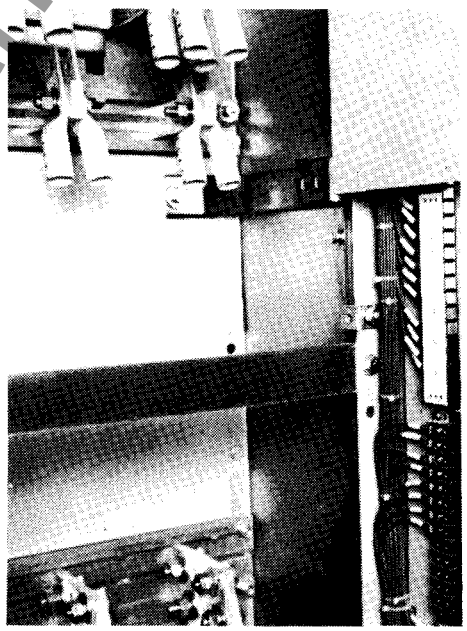


Figure 17. Cable Area Wire Trough with Lower Cover Removed.

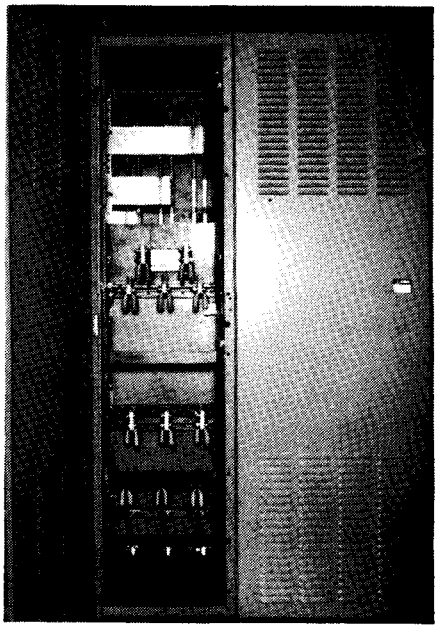


Figure 18. Rear Hinged Doors Offer Ease of Access to Cable Compartments.

Outdoor Switchgear

Outdoor switchgear, type "SR" is similar to indoor switchgear, except that it is enclosed in a weather resistant (NEMA 3R) steel housing. The equipment is designed so that weather conditions will not affect operation of the switchgear. An illuminated expanded service aisle is provided at the front of the switchgear allowing inspection and maintenance without exposure to the elements. An access door is provided at each end of the front aisle wall with panic bar latch release inside the aisle. The rear of each cubicle is equipped with a door for access to the primary cable entrance area and secondary terminal blocks. The full length front doors are hinged and may be padlocked. Rear doors are hinged and secured with tamper-resistant screws. They extend below the floor line to assure complete enclosure. Synthetic rubber gasketing around front and rear doors insures thorough sealing of the unit. Shielded ventilation housings are appropriately located to permit proper air circulation, but to exclude dust, dirt and insects.

For protection from snow, rain and dust, each group is mounted on an integral six inch formed sheet steel base assembly which provides a rigid support for switchgear units and a tight bottom seal. A bituminous undercoating is applied to all undersurfaces as protection against moisture and corrosion.

Hinged front doors provide easy access to wide, unobstructed service aisle.

Space heaters in the breaker, bus and auxiliary compartments eliminate excessive condensation. One thermostat, if specified, in the bus compartment of each unit controls operation of the space heaters.

Standard accessories for outdoor units include all those provided for indoor switchgear. In addition, a light is mounted inside the aisle opposite the front of each unit and are controlled by 3-way switches on each end wall. Each group of units contains a convenience outlet and wall mounted panelboard with four molded case circuit breakers for control and protection of switchgear auxiliary circuits.

A traveling hoist is standard for outdoor units.

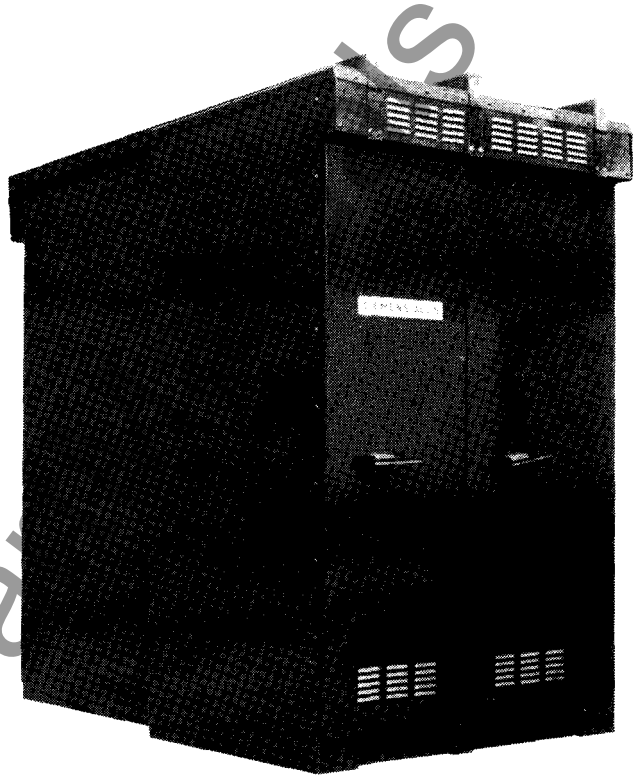


Figure 19. Typical Outdoor Construction. Note Front Aisle Extension on Each End.

Finish

The structural steel parts and cubicles are conveyed through a spray tunnel where they are degreased and exposed to a hot phosphate chemical treating mixture followed by a hot sealing solution and drying agent. The panels are treated similarly.

The hot phosphate bath effects a chemical conversion of the metallic surface to a nonmetallic phosphate coating. Insoluble in water, this coating is effective in retarding corrosion. It is an excellent undercoating for paint.

After cleaning and stabilization, the framework and panels receive a coat of rust-resisting paint. The framework, panels and other detail parts are conveyed through two zone baking ovens to insure adequate curing. All exterior surfaces of outdoor weather-resistant equipment are given an additional finish coat of paint. Standard indoor finish is light gray ANSI 61; outdoor, dark gray ANSI 24 or sky gray ANSI 70. Standard finish paints are air-dry alkyd enamel.

Circuit breaker parts receive a protective zinc di-chromate plating which provides a contrasting gold color, eliminating any need for periodic repainting.

SPECIFICATIONS — CIRCUIT BREAKERS

General Description and Operation

The RL series low voltage power circuit breakers are designed for 600-volt and below service with current carrying capacities up to 4000 amp and interrupting capacities up to 200,000 amperes. These compact, fast operating, dead-front circuit breakers incorporate a stored energy operating mechanism for fast, positive closing.

RL series low voltage power circuit breaker includes a stored energy operating mechanism (either manually or electrically operated), arc quenchers, main and arcing contact structure, inductive tripping sensors, static overcurrent trip device, control wiring, auxiliary switches, interlocks and position indicators.

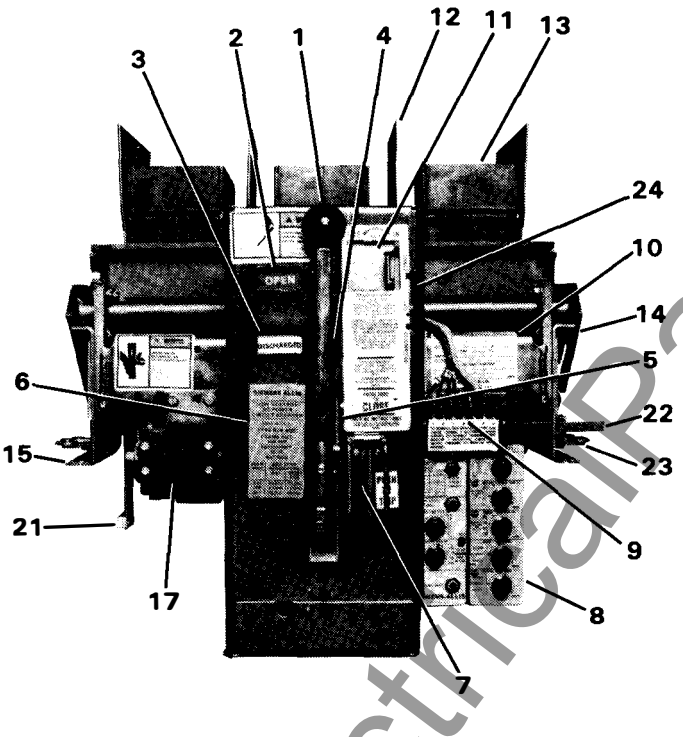


Figure 20. RL-800 Manually Operated Circuit Breaker.

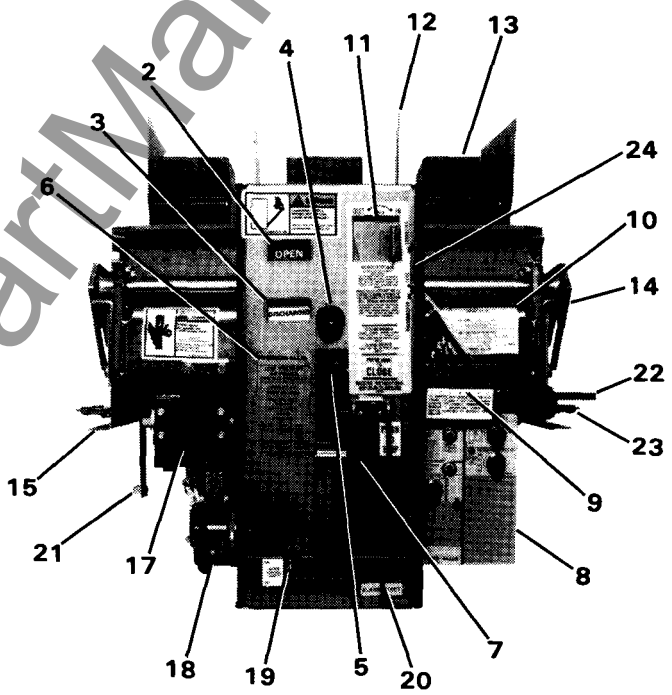


Figure 21. RL-800 Electrically Operated Circuit Breaker.

1. Handle for manually charging stored energy closing springs**
2. Contact position indicator
3. Stored energy mechanism position indicator
4. Handle stop
5. Contact closing release lever
6. Circuit breaker rating nameplate
7. Tripping lever (with padlocking provisions) with guard
8. Static Trip II® overcurrent device
9. Static Trip II® test points
10. Static Trip II® rating nameplate
11. Racking mechanism shutter (with padlocking provisions)
12. Inter-phase barriers
13. Arc chutes
14. Clevis attached to racking drive screw
15. Drawout rails
16. Secondary disconnects* (not illustrated)
17. Auxiliary switch*
18. Spring charging motor (electrically operated breaker only)
19. Power switch for spring charging motor (electrically operated breaker only)
20. Bell alarm manual reset lever
21. Ground shoe contact
22. Racking interlock bar
23. Racking position detent
24. Racking position indicator

* Optional on manual breakers.
** Optional on electrical breakers.

Manually operated circuit breakers consist of 3 pole single throw element mechanically trip free, complete with static overcurrent trip device, manually charged stored energy closing mechanism, interpole barriers, arc quenchers, operating handle, push button mechanical trip, position indicator, all mounted to provide the drawout feature.

Electrically operated circuit breakers consist of 3 pole single throw element mechanically and electrically trip-free, complete with static overcurrent trip device, electrically charged stored energy closing mechanism, interpole barriers, arc quenchers, electrically operated spring release solenoid, shunt trip device, push button mechanical trip, position indicator, four auxiliary switches, all mounted to provide the drawout feature.

Stored energy provides a quick-make switching mechanism that assures high speed closing of breaker primary contacts, independent of the operator. Positive, controlled closing prevents unnecessary arcing between the movable and stationary breaker contacts as would be the case with slow or hesitant manual closing. This prevents the potentially dangerous result of improper closing, thereby lengthening contact and breaker life.

Manual operated stored energy breakers are charged by one downward stroke of the handle, Figure A; when handle is released it returns to the normal position. A closing lever, located on the front of the breaker behind the manual charging handle releases the stored energy to close the breaker, Figure B.

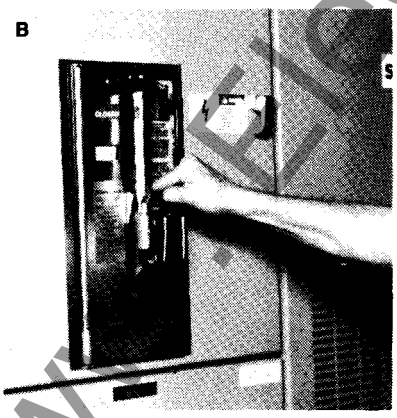
Electrically operated stored energy breakers are closed smoothly and positively by the action of springs that have been precharged by an electric motor. The springs remain charged indefinitely until the breaker is to be closed. When energy is released to close the breaker, the motor automatically recharges the springs for another closing operation.

Manual tripping of manual and electrically operated breakers is accomplished by operation of the manual trip lever, Figure C.

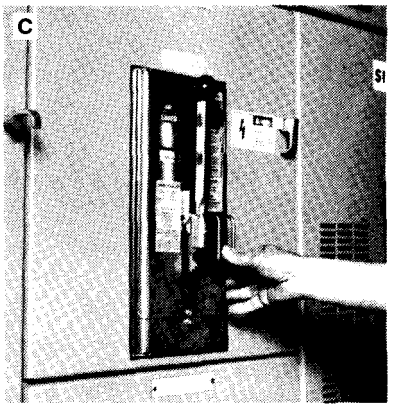
As an option to electrically operated stored energy breakers, a manual spring charging handle as furnished on manually operated breakers can also be supplied, if specified.

MANUAL OPERATION

A) A single, complete downward movement of the handle manually charges the circuit breaker closing springs. A ratchet insures a complete closing stroke.



B) With the manual handle returned to vertical position, the closing release lever is depressed, releasing the spring energy and closing the breaker contacts. This simultaneously charges the opening springs.



C) Depressing the manual trip lever opens the circuit breaker contacts. Note the provision for padlocking.

Provision for Padlocking "Trip Free"

The push button mechanical trip lever includes a slot with provision with 3 padlocks. When padlocked in the depressed position, the circuit breaker is trip free, and the contacts will not move even if the closing release or electric close coil operates. If charged, this closing spring will discharge, but the contacts will remain in the open position.

The racking mechanism shutter includes provisions for one padlock, to prevent unauthorized racking.

Description

Primary Disconnects

Primary circuit connections between the removable circuit breaker and the switchgear assembly are made by sets of silver-plated contacts on the circuit breaker with silver-plated stationary contacts in breaker compartment. The finger contacts are mounted on the studs of the circuit breaker, facilitating inspection and maintenance. The stationary contacts are mounted on a solid Pyro-Shield insulation sheet which is bolted to the rear wall of the breaker cubicle.

Primary disconnecting devices are arranged so that contact is made only when the removable circuit breaker is in the operating or connected position. In the test position the primary contacts are separated by a safe distance.

Firm contact pressure is maintained by means of stainless steel back-up springs. As the circuit breaker is moved into the operating position, the wiping action of the self-aligning contacts assures low contact resistance.

Secondary Disconnects

Secondary circuit connections between the circuit breaker and stationary switchgear structure are made by means of automatic, self-aligning, multi-contact, silver-plated, slide-type connectors.

The contact surfaces on the stationary element are heavily silver-plated copper strips mounted on a molded base of Pyro-Shield insulation. The stationary contact surfaces are recessed to properly guide the movable fingers and to prevent accidental short-circuiting of the control circuits.

The movable secondary disconnect elements are located on the lower left side of the low voltage power circuit breaker, well below the arc quenching area to avoid contamination from rapidly rising arc product gases. With the panel door open, the engagement of the secondary disconnecting elements is clearly visible to the operator.

The secondary connections automatically make contact when the breaker is in both the test and connected positions.

Ground Connection

A ground contact on the removable low voltage power circuit breaker engages with the ground circuit through a contact in the breaker compartment in both the test and connected positions.

Draw-Out Interlocks

Integral parts of the circuit breaker mechanism include provisions to:

1. Rack the circuit breaker in or out of the cubicle compartment.
2. Interlocking to prevent racking a closed circuit breaker into or out of the connected position.
3. Interlocking to prevent closing a circuit breaker until it is fully racked to the connected position.
4. Interlocking to prevent withdrawing a circuit breaker from the cubicle while the closing springs are charged.

In order to rack the breaker into its compartment, the manual trip bar must be depressed and the racking mechanism shutter opened to gain access to the racking screw. Figure 23. As the trip

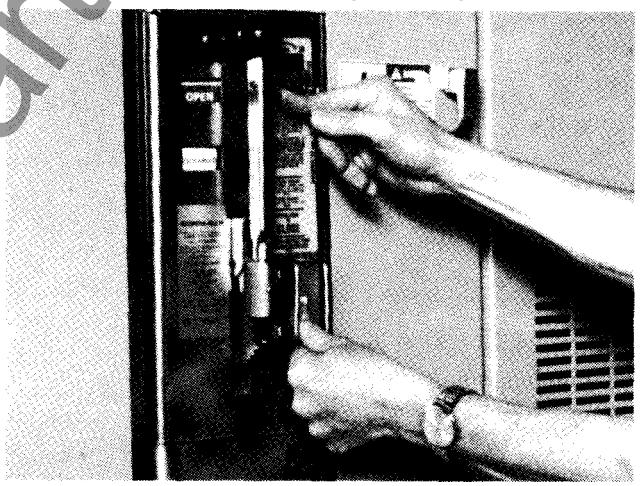


Figure 23.

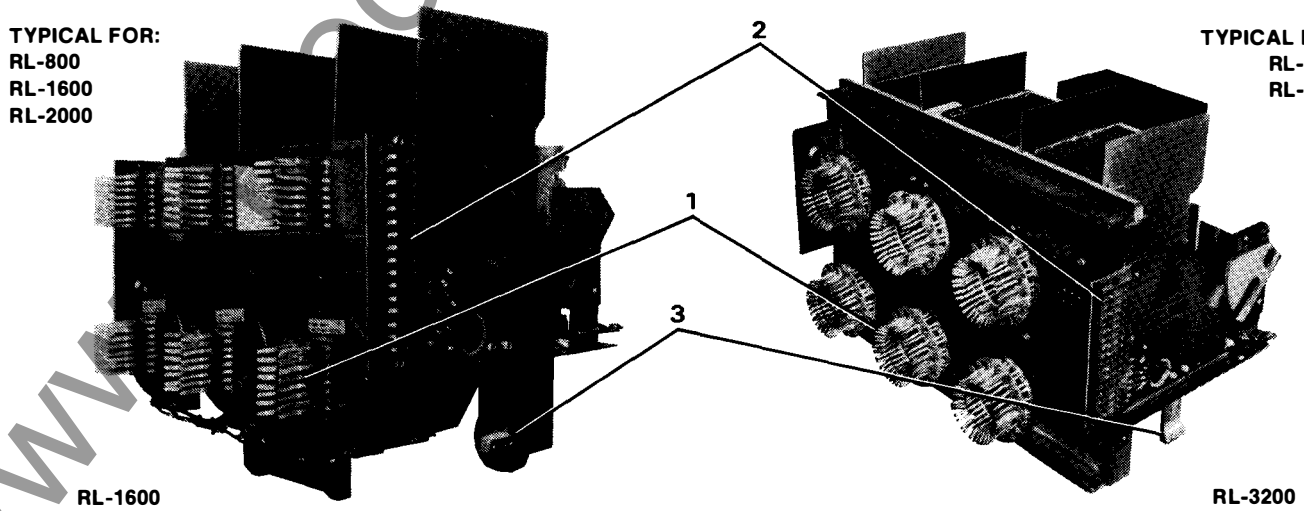


Figure 22. Disconnects Provide the Drawout Capability of:

1) Primary disconnects. 2) Secondary disconnects. 3) Ground disconnect.

bar is depressed, a shaft connected to it moves to permit opening the shutter, which holds the bar in. As long as the bar is pressed in and the shutter is open, the breaker is trip free, and cannot be closed. This interlock arrangement prevents racking the breaker in or out while it is closed.

The cubicle interlock rod is also directly actuated by the movement of the manual trip bar. With the manual trip bar in its normal position the interlock rod is extended; with trip bar pressed in, the rod is withdrawn. At positions corresponding to Test and Connected, the extended rod is engaged in a position hole on the side of the cubicle. This is aided by a detent on the breaker which engages the cubicle to assure proper alignment.

Rotation of the racking screw will rack the breaker into the TEST position. At the TEST position, the racking shutter can be closed, causing the trip bar to reset and the interlock rod to engage the cubicle position hole allowing the breaker to be closed. The breaker can then be operated for test if desired.

The same procedure is followed for movements into the connected position. In the CONNECTED position, the interlock will similarly engage the cubicle position hole and reset, allowing the circuit breaker to be closed. This prevents closing a circuit breaker which is not in the CONNECTED position.

With the circuit breaker between positions, the interlock bar will not engage the position holes of the cubicle. If the interlock bar is not in its reset position the breaker will be held TRIP-FREE and cannot be closed.

To withdraw the breaker from the CONNECTED position, the racking screw is rotated in the opposite direction.

When racking the circuit breaker out from TEST to the DISCONNECTED position, the closing springs will automatically discharge, at or before reaching the Disconnect position.

Arc Interruption

The RL series low voltage power circuit breakers interrupt in air, using arc chutes to elongate and cool the arc for high speed interruption. Circuit breakers equipped with instantaneous trip will interrupt a bolted three phase short circuit in 3 cycles or less.

A short circuit or overload will be detected by the solid state trip device, which will trip the circuit breaker via the tripping actuator. The opening springs will cause the movable contacts to open. The main contacts open first, to transfer the fault current to the arcing contacts. As these part, the thermal and electromotive characteristics of the arc cause it to be forced into the arc chute, where the metal plates elongate, constrict and cool it.

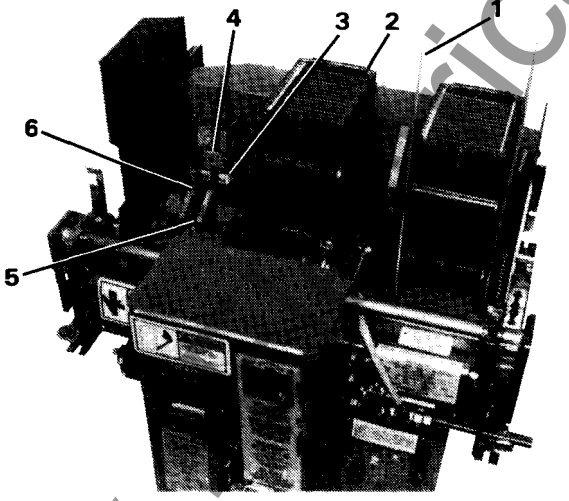


Figure 24. Circuit Breaker Partly Disassembled to Show:

1) Interpole barriers of glass polyester.

2) Arc chute.

3) Stationary main contacts.

4) Stationary arcing contacts.

5) Movable main contacts.

6) Movable arcing contacts.

Fused Circuit Breakers

The 800, 1600 and 2000 ampere frame size circuit breakers are available with integrally mounted current limiting fuses, to increase their interrupting rating and/or limit the short circuit current to downstream equipment. The fuses are bolted in series with the upper set of primary disconnects. 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. It also indicates which main fuse has interrupted.

The larger frame size circuit breakers, 3200 and 4000 ampere, are available with current limiting fuses mounted on a separate drawout element, which is key interlocked with the circuit breaker to prevent racking the fuse element unless the circuit breaker is racked to the disconnect position.

The breakers have been qualified to all required standards and are UL list marked, based on use of either Gould-Shawmut or Reliance current limiting fuses, which are specially designed for use with Siemens-Allis Type RL circuit breakers.

Fuses rated 600 amperes and below are Class J, Chase-Shawmut Cat. No. A4J or Reliance Cat. No. LEF.

Fuses rated 800 amperes and above are Class L, Chase-Shawmut Cat. No. A4BY or Reliance Cat. No. LEF.

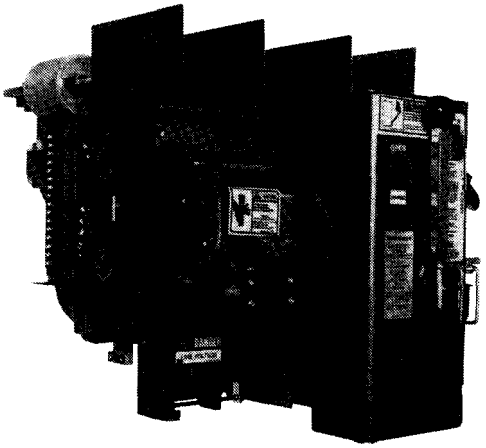


Figure 25. Integrally Fused RLF-1600 Circuit Breaker.

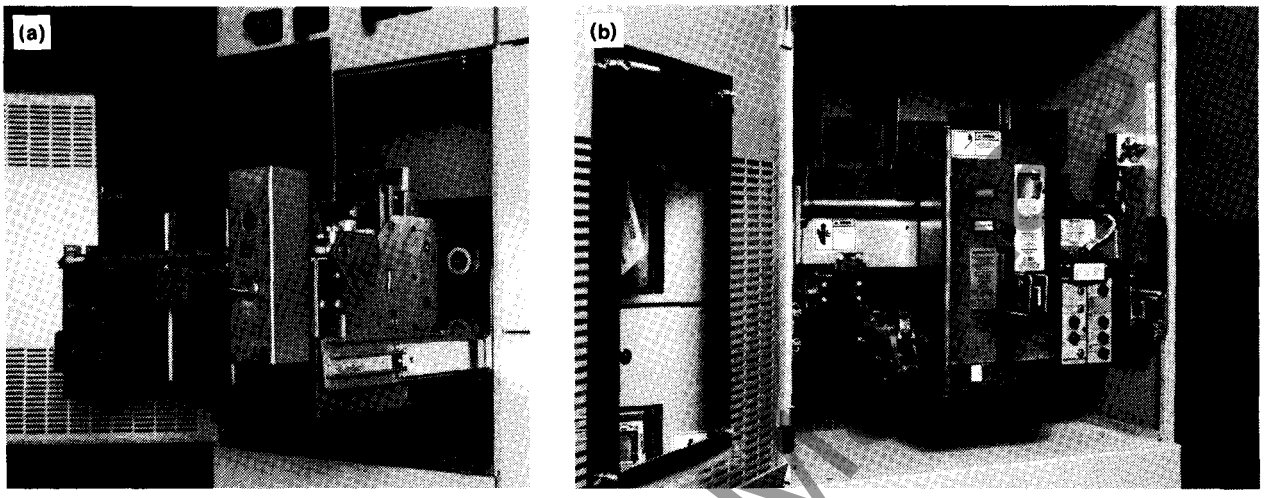


Figure 26. Separate RFC-3200 Fuse Carriage (a) for use with RLF-3200 Circuit Breaker (a).

Key Interlocks (Optional)

Provision is included for mounting of key interlock assembly of the Superior or Kirk type within the breaker compartment. See Figure 27.

Key interlocks can be provided which will hold the key captive when the circuit breaker is closed, thus preventing operation of a remote device unless breaker is open. These are also used to interlock main and tie breakers and to interlock main breakers with disconnects or interrupter switches.

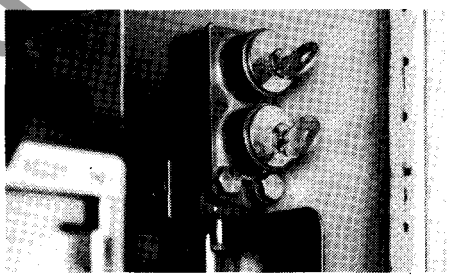


Figure 27. Key Interlock Provision.

Truck Operated (TOC) Cell Switch

Used for providing control interlocking or remote indication based on breaker drawout position (Connected vs. Test Position).

The switches containing 4 or 8 contacts are mounted in the rear termination area. The switch is actuated by a reliable push-pull mechanism from 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. See Table 1 for ratings.

Cubicle Mounted Auxiliary Switches (Mechanism Operated — MOC)

Used for providing indication (remote) or control interlocking based on main contact position (open vs. closed). When auxiliary switch contacts are required beyond the 4 contacts available on the circuit breaker, a Mechanism-Operated auxiliary switch (MOC), containing 4 or 8 contacts is mounted in the rear termination area. The switch is actuated by a reliable push-pull mechanism from 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. See Table 1 for ratings.

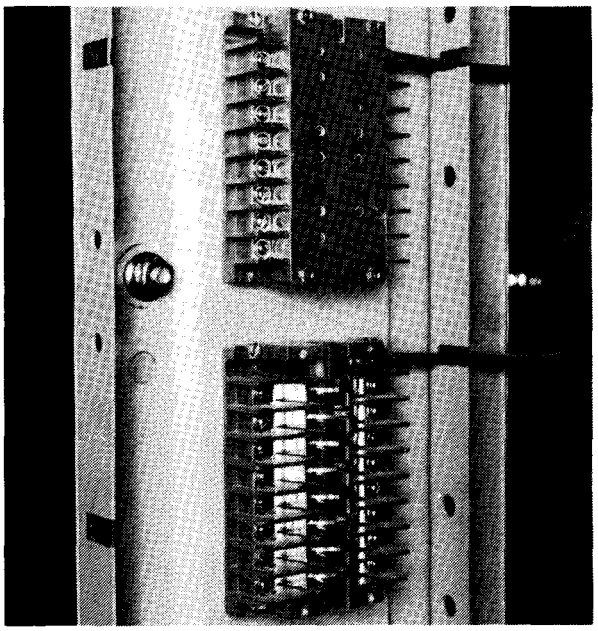


Figure 28. MOC and TOC Switches. Cover Removed to Show Field Convertible Contacts.

Table 1. "Q-11" Breaker Mounted Auxiliary Switch① and MOC and TOC Switch Ratings

Volts	DC				AC	
	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 20 A. continuous rating of standard No. 14 wire, unless otherwise specified.

Shunt Trip

Provides means to electrically trip from a remote device, such as pushbutton, switch or relay for automatic tripping. It is standard on all electrically operated breakers and optionally available on manually operated breakers.

Since the shunt trip coil is designed for a momentary duty cycle, an "a" auxiliary contact switch is used to interrupt its circuit immediately after the breaker is tripped. Energization of the coil causes the armature to pick up and rotate the trip latch to trip the breaker. A compression spring returns the armature to its normal position.

Operation Counter (Option)

Mounted beneath the breaker mounted auxiliary switch, the mechanically operated, 5 digit non-resettable counter is actuated from the auxiliary switch operating mechanism.

Undervoltage Trip Device (Option)

The undervoltage trip device provides protection against the effects of a drop in normal bus voltage and functions to directly trip the breaker. Pick-up is 85% or less of rated value, drop-out is between 30% and 60% of the rated value. Pick-up and drop-out are individually adjustable. Either instantaneous or time-delay operation can be supplied. The integral static timing unit is adjustable from 0.04 to 4 seconds for providing a time delay between the detection of the undervoltage condition and breaker trip to ride over system momentary voltage dips.

Automatic Trip Alarm Contact (Bell Alarm), with Lockout (Option)

The bell alarm switch is initiated by the operation of the Static Trip Device, and functions to operate a switch.

The contacts may be used for remote indication of an automatic trip.

A single pole double throw (SPDT) or a double pole double throw (DPDT) switch is available. Table 3. The switch operator must be reset either manually, or optionally by electrical reset. The contacts of the bell alarm switch can be connected in series with the breaker closing coil, to provide a lockout feature to prevent reclosing after a fault.

Electrically Operated Interlock (Option)

This interlock provides a means to electrically interlock two breakers to prevent both being closed at the same time. These electro-mechanical devices amount to an additional solenoid that must be energized before the breaker can be closed. When the device is de-energized the breaker is held trip-free so that it cannot be closed either electrically or manually. The devices are available for 48, 125 and 250 volt D.C. as well as for 120 and 240 volt A.C. They are similar in construction and mount in the same location as the undervoltage trip device. The electrical interlock has a mechanical link from the device to the main shaft of the breaker to hold the device in the picked-up position when the breaker is closed. Once closed the device can be de-energized without tripping the breaker. There are no adjustments for pick-up or drop-out voltages of the device. The devices are designed to be energized continuously.

Table 1. Shunt Trip Coil Rating

Control Voltage		Shunt Trip (Amperes)	
Nominal		Operating Range	Inrush
DC	24	14-28	17.7
	32	18-38	15.0
	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

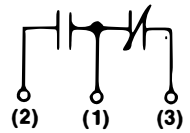
Table 2. Undervoltage Coil Rating

Nominal Control Voltage		Voltage	
		Pickup	Dropout
DC	48	40	24
	125	105	62
60 Hz AC	120	100	60
	240 or 480①	—	—

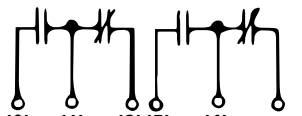
① Not available. Use 120 VAC undervoltage device with appropriate 240-120 or 480-120 voltage transformer in cubicle.

Table 3. Bell Alarm Contact Rating

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
60 Hz AC	120	10.0	10.0	10.0
	240	10.0	10.0	10.0



a. SPDT Contact



b. DPDT Contact

Table 4. Interlock Coil Rating

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

OVERCURRENT TRIPPING DEVICES

Static overcurrent tripping systems have been standard on the Siemens-Allis LA line of circuit breakers since 1961. The tripping system was updated in 1971 to make use of the latest integrated circuit components and is called STATIC TRIP II®. Based on its time proven service record, it continues as the standard tripping system for the RL series breakers.

Static Trip II® Trip Device Features

- Ease and accuracy in making field adjustments.
- Excellent repeatability.
- Negligible change in characteristics with normal temperature variations.
- Continuous pick-up adjustment over a wide range — no taps to change.
- Ground current tripping available without an external relay.
- Targets available to indicate the cause of tripping.
- Simple field testing without need of a primary current source —portable test set available as an option.
- Minimum maintenance — only one moving part.
- Simple breaker rating change.
- Flexibility — many combinations available including long time delay, short time delay, instantaneous and ground fault elements in the same device.

Trip Device Accessibility

Located in the lower right side of the breaker compartment, the trip device is readily accessible to the operator for simple adjustment of all settings.

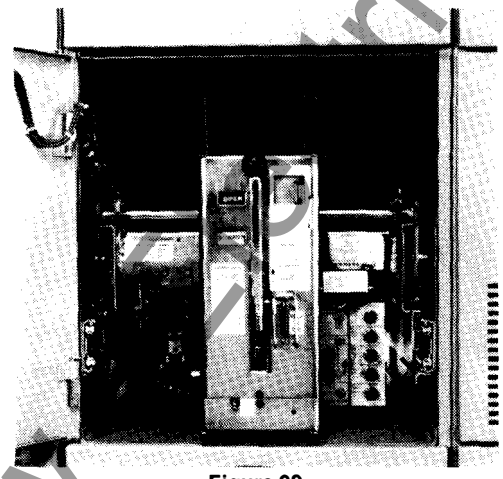


Figure 29.

Tripping Transformers

The tripping system is completely contained on the circuit breaker. The power for tripping the breaker and for operating the solid state circuitry in the static trip device is drawn from the primary current through tripping current transformers mounted on the breaker. Four-wire ground applications include a fourth transformer mounted in the cable compartment. A signal, proportional to primary current, is taken from these same tripping transformers. This signal is applied to the static trip device and causes it to operate the tripping actuator to trip the breaker in accordance with a pre-set time delay versus current magnitude relationship.

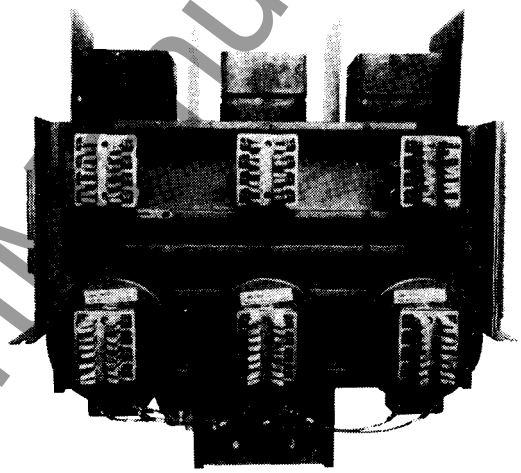


Figure 30. Tripping Transformers Furnish Input Signal to Trip Device in Proportion to Primary Current.

Tripping Actuator

Fast action tripping of the breaker is achieved with a low energy flux-shifting tripping actuator. When the breaker is in the closed position, the spring is reset mechanically and held in that position by a permanent magnet. Most of the flux from the magnet flows through the armature rather than through the higher reluctance path of the air gap inside the coil. The magnetic force holds the armature and spring firmly in position. When the flux-shifting coil is energized by the static trip device, the flux of the coil and air gap cancels the flux of the permanent magnet, releasing the armature which allows the spring to act to trip the breaker.

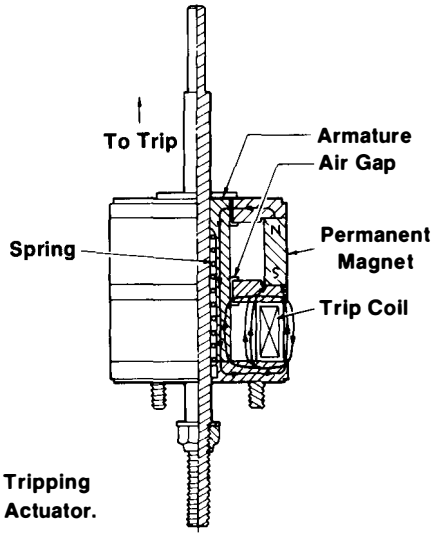


Figure 31. Tripping Actuator.

Description of Operation — Static Trip II® Overcurrent System

A block diagram of the static trip system is shown below, Figure 32. The power supply and signal transformers step the secondary current of the tripping transformers down to a level suitable for the solid state circuits. The power supply transformers, unlike the signal transformers, do not need to maintain a constant ratio and are therefore designed to saturate so as to limit maximum power input to the static trip device.

The desired time-current relationship of the long time delay circuit is accomplished as follows: a pulse generator and time shaping circuit in combination produce a train of pulses whose frequency is proportional to approximately the square of the primary current. Both the pulse generator and the counter are blocked when the signal is below the pickup level. If the signal reaches the pickup level, both the pulse generator and counter are released, the counting of pulses begins. The counter is a 7-stage binary counter which produces an output from the first stage after one count, from the second stage after two counts, from the third stage after four counts, and so on up to 64 counts for the last stage. The time band switch selects the counter stage which is connected to operate the tripping actuator through the static switch circuit. This scheme results in each time band having a delay precisely twice that of the next lower band.

The tripping transformer neutral (N) is wired to terminal 9 for systems without ground tripping and to terminal 4 for 3 wire systems with ground fault tripping. Ground fault protection is available for 4-wire circuits also with only the addition of an external tripping transformer.

Adjustment knobs are available on the front of the static trip unit for all the applicable adjustments shown in the block diagram, Figure 33.

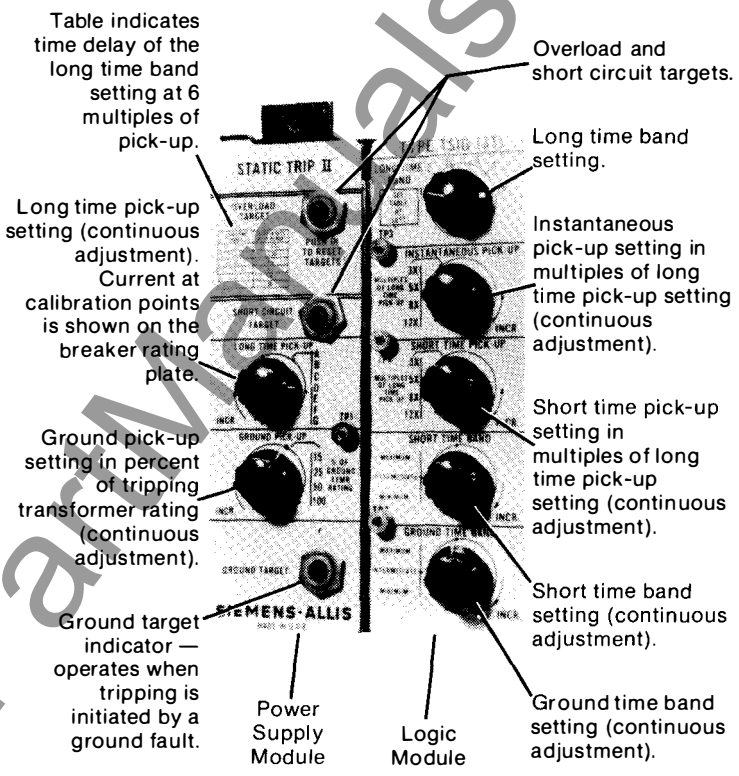


Figure 33.

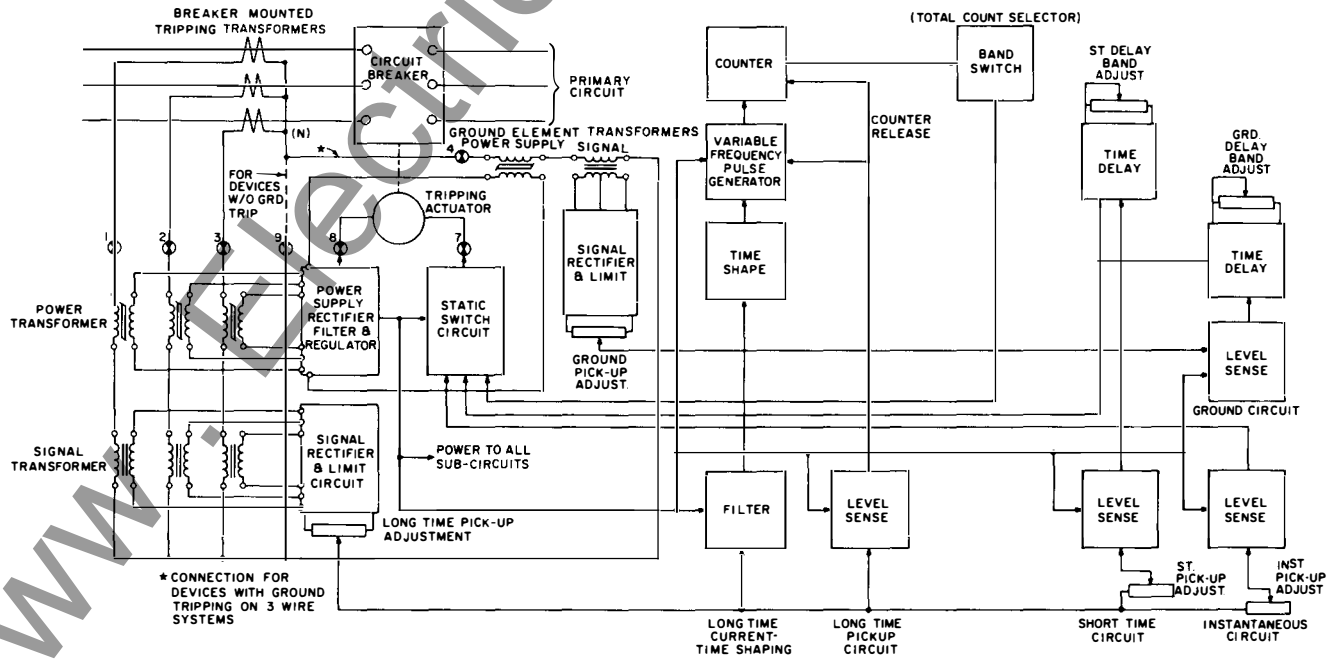


Figure 32. Block Diagram of Static Trip II®

Types and Application of Static Trip II® Overcurrent System

Available Types

Nine types of Static Trip II devices are available. Similar in many respects, they differ only in their specific application. All use identical tripping transformer inputs and provide output signals to the tripping actuator. Several types are shown in the picture below, Figure 34.

The type designation is coded to indicate the functional elements: T = LONG-TIME delay elements, S = SHORT-TIME delay element, I = INSTANTANEOUS element, G = ground current element, (0T) indicates that the device does not have trip indication targets, (2T) two targets that indicate tripping on short circuit (short time or instantaneous) or overload (Long Time) current, and (3T) for three targets that indicate tripping on overload, short circuit or ground current. For each element except instantaneous there are two adjustment knobs on the front of the device, one for pick-up setting and one for delay setting. The instantaneous element has only one knob for pick-up setting. Targets are optional on all devices. Following are brief descriptions of the different types.

1. Type TI(0T) (Standard) and TI(2T) (Optional) — A dual trip device normally used for phase overcurrent protection. The long time pick-up range is selected from the trip rating table and is continuously adjustable from "A" thru "G" in the field. The instantaneous element is continuously field adjustable from 3 to 12 multiples of the long time pick-up setting selected. The long time delay is field adjustable with a choice of six bands.

2. Type TIG(3T) (optional) — A dual trip device which provides phase overcurrent protection same as Type TI plus sensitive ground fault protection for 3-wire and 4-wire circuits on systems with either phase-to-phase or phase-to-neutral loading. Ground current pick-up settings are independent of the phase pick-up settings, and continuously adjustable in the field from 15% through 100% of the tripping transformer rating. When used on 4-wire circuits, a fourth tripping transformer is required. It is mounted in the cubicle, and wired to the breaker through secondary disconnects.

3. Type TS(0T) and TS(2T) (optional) — A selective trip device used for phase overcurrent protection which provides time delay tripping only. It allows complete field adjustment of the long time band and pick-up plus the short time band and pick-up. The short time pick-up can be adjusted from 3 to 12 multiples of the long time pick-up setting. Any one of the three short time bands can be used with any of the six long time bands.

4. Type TSG(3T) (optional) — A selective trip device which provides phase overcurrent protection same as Type TS plus sensitive ground fault protection for 3-wire and 4-wire circuits on systems with either phase-to-phase or phase-to-neutral loading. Ground current pick-up settings are independent of the phase pick-up settings, and continuously adjustable in the field from 15% through 100% of the tripping transformer rating. When used on 4-wire circuits, a fourth tripping transformer is required. It is mounted in the cubicle and wired to the breaker through secondary disconnects.

5. Type TSI(0T) and TSI(2T) (optional) — A triple selective trip device used for phase overcurrent protection which provides long time delay, short time delay, and instantaneous elements. It allows complete field adjustment of the long time band and pick-up, the short time band and pick-up and the instantaneous pick-up. Both the short time and instantaneous elements can be adjusted to pick up at 3 to 12 multiples of the long time pick-up setting. Any one of the three short time bands can be chosen to be used with any of the six long time bands.

6. Type TSIG(3T) (optional) — A triple selective trip device which provides phase overcurrent protection same as Type TSI plus sensitive ground fault protection for 3-wire and 4-wire circuits on systems with either phase-to-phase or phase-to-neutral loading. Ground current pick-up settings are independent of the phase pick-up settings, and continuously adjustable in the field from 15% through 100% of the tripping transformer rating. When used on 4-wire circuits, a fourth tripping transformer is required. It is mounted in the cubicle, and wired to the breaker through secondary disconnects.

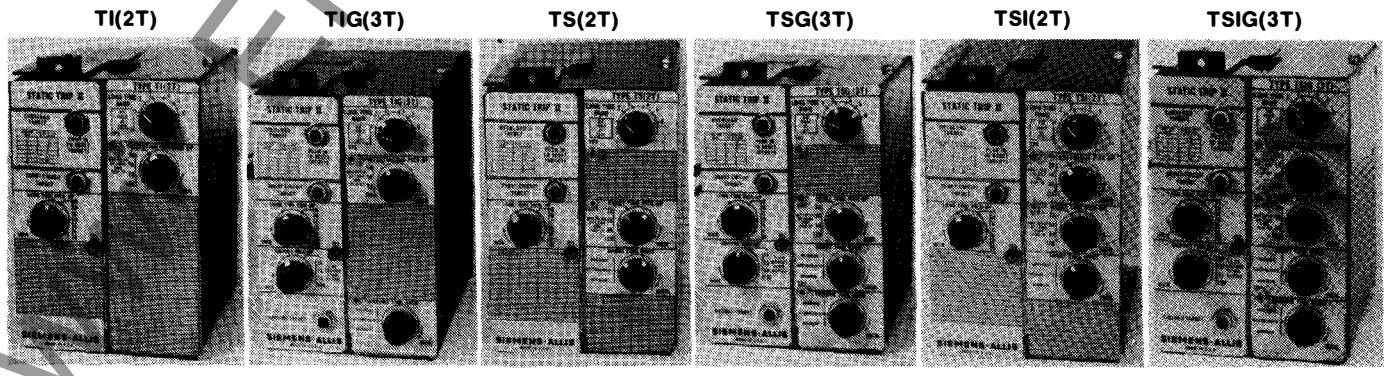


Figure 34. Typical Static Trip II® Trip Devices.

Ground Fault Trip (Optional)

Solidly grounded low voltage systems are prone to relatively low magnitude arcing ground faults which can go undetected by the phase overcurrent protecting elements. By including the sensitive ground trip element as an integral part of the Static Trip II® System, coordinated ground fault protection is provided.

Ground Fault Trip System is optionally available with the Static Trip II® device. The ground trip element characteristics are shown on the left side of the characteristic, Figure 38 on page 23. This element is connected in the neutral of the three tripping transformer secondaries so that it senses ground current only, and not load current. This arrangement permits more sensitive settings below normal load current values, thereby providing better protection against ground faults, which are often limited to low levels by ground return impedance and by arc resistance of arcing faults.

Arcing ground faults can be very destructive, so it is desirable to clear them as quickly as possible. However, some adjustable delay is needed if coordination is to be provided between breakers at various levels in the system. Consequently ground trip elements are provided with the same fixed short delays as the short time element and with the same calibrated points. Mininum, Intermediate and Maximum, corresponding to nominal values of 0.1, 0.25 and 0.45 seconds. The ground pickup dial is calibrated in percent of breaker current rating with calibrated points at 15%, 25%, 50% and 100% (Figure 33). The ground element is designed for application to solidly grounded systems only.

Temperature Range of Operation

Operation of the static tripping system is extremely stable over a wide range of temperature. From -40° C to 55° C (-40° F to 131° F) the variation from performance at room temperature is less than 10 percent in pick-up value and timing. If they must be operated in environments beyond these limits, heating or ventilation is recommended. They will operate at 65° C (149° F) indefinitely without any permanent change in characteristics.

Simplified Breaker Rating Change

The continuous rating of the circuit breaker may be readily changed in the field by replacing the tripping transformers mounted on the circuit breaker studs. Refer Figure 35. The transformer rating listed in primary amperes will be found on the rating plate of each circuit breaker, Figure 36. Whenever a breaker rating is changed, a new rating plate is also furnished.

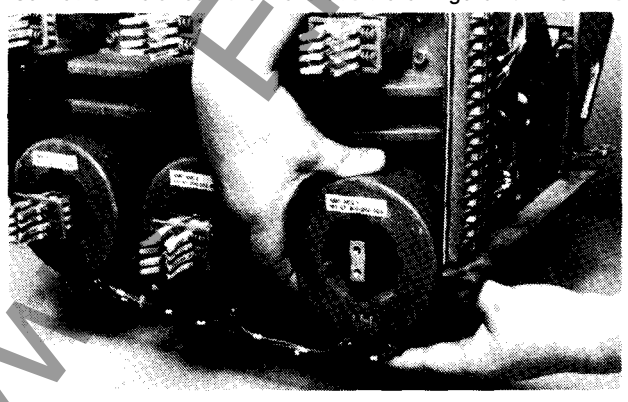


Figure 35.

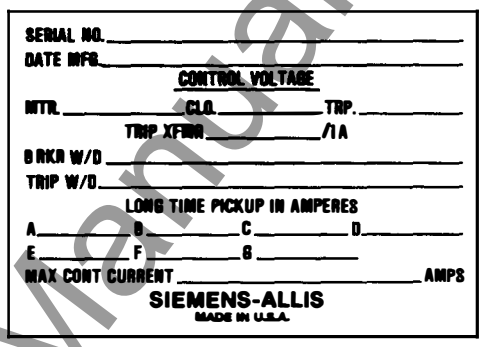


Figure 36. Breaker Rating Plate.

Field Testing

Static tripping enables simple and economical field testing of the static trip devices. An inexpensive portable test set using 115-volt power is available to make function and timing tests to indicate if the device is working properly. Operation of a circuit breaker may also be checked by whether or not it trips when supplied an appropriate signal. Figure 37.

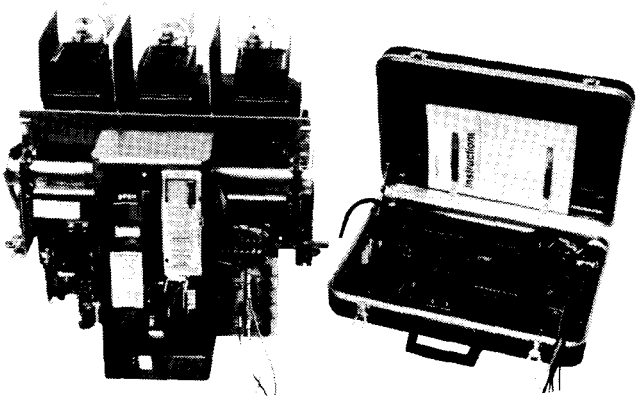


Figure 37. Portable Test Set is Shown Being Used on Breaker Removed from its Cubicle. The Test Set May Also Be Used with the Breaker in "TEST" or "DISCONNECTED" Positions in its Cubicle.

Target Indicators (Optional)

STATIC TRIP II® Overcurrent Trip Devices have target indicators available as an option. The type of fault which caused the circuit breaker to trip can be determined at a glance. A red button pops out indicating "Overload", (long time trip) "Short Circuit" (short time and/or instantaneous trip) or "Ground" (ground fault). Refer Figure 33, Page 19.

You save time and money while simplifying maintenance. All STATIC TRIP II® devices feature solid state circuitry and are continuously adjustable, permitting pinpoint settings. Choose from nine models to suit your particular application.

Description

Table 1. Static Trip II Rating Table — Amperes

Breaker Frame Size Type	Tripping XFMR Rating (Primary Amps)	Long Time Element Calibrated Pick-Up Settings†							Max. Cont. Rating	Ground Element Calibrated Pick-Up Settings			
		A	B	C	D	E	F	G		15%	25%	50%	100%
800A Frame:													
RL-800	80	40	50	60	70	80	90	100	100	θ	θ	40	80
RLF-800													
800A Frame:													
RL-800	200	100	125	150	175	200	225	250	250	θ	50	100	200
RLF-800	400	200	250	300	350	400	450	500	500	60	100	200	400
RLX-800	800	400	500	600	700	800	900*	1000*	800	120	200	400	800
1600A Frame:													
RL-1600	200	100	125	150	175	200	225	250	250	θ	50	100	200
RLX-1600	400	200	250	300	350	400	450	500	500	60	100	200	400
RLF-1600	800	400	500	600	700	800	900	1000	1000	120	200	400	800
	1600	800	1000	1200	1400	1600	1800*	2000*	1600	240	400	800	1600
2000A Frame:	200	100	125	150	175	200	225	250	250	θ	50	100	200
RL-2000	400	200	250	300	350	400	450	500	500	60	100	200	400
RLF-2000	800	400	500	600	700	800	900	1000	1000	120	200	400	800
	1600	800	1000	1200	1400	1600	1800	2000	2000	240	400	800	1600
	2000	1000	1250	1500	1750	2000	2250*	2500*	2000	300	500	1000	2000
3200A Frame:	1600	800	1000	1200	1400	1600	1800	2000	2000	240	400	800	1600
RL-3200	2000	1000	1250	1500	1750	2000	2250	2500	2500	300	500	1000	2000
RLF-3200	2400	1200	1500	1800	2100	2400	2700	3000	3000	360	600	1200	2400
	3200	1600	2000	2400	2800	3200	3600*	4000*	3200	480	800	1600	3200
4000A Frame:													
RL-4000	3200	1600	2000	2400	2800	3200	3600	4000	4000	480	800	1600	3200
RLF-4000	4000	2000	2500	3000	3500	4000	4500*	5000*	4000	600	1000	2000	4000

* Exceeds maximum continuous current rating of frame — do not use these settings. † Long time element continually adjustable from A through G.

θ Breaker may not trip with this ground fault setting.

Types Available

TI(0T): Long Time and Instantaneous
TS(0T): Long Time and Short Time
TSI(0T): Long Time, Short Time, and Instantaneous
TI(2T): Long Time and Instantaneous
TS(2T): Long Time and Short Time
TSI(2T): Long Time, Short Time, and Instantaneous.
TIG(3T): Same as TI(2T), plus ground fault
TSG(3T): Same as TS(2T), plus ground fault
TSIG(3T): Same as TSI(2T), plus ground fault

Devices with (0T) designation do not include targets.

Devices with (2T) designation include targets to indicate overload trip and short circuit trip, while those with (3T) designation also include a ground trip target.

GENERAL NOTES
Static Trip II Overcurrent Device

1. The "Tripping XFMR Rating" values represent the primary value of the current transformer ratio in amperes. The secondary value is one ampere.
2. The pick-up settings of the long time element are continuously adjustable, and are calibrated at points "A" through "G" as shown in the rating table.
3. The pick-up settings of the instantaneous and short time delay elements are continuously adjustable, and are calibrated at 3, 5, 8 and 12 multiples of the long time pick-up setting.
4. The pick-up settings of the ground elements are continuously adjustable, and are calibrated in percent of the tripping transformer rating as shown in the rating table.
5. The long time element has 6 bands which are field selectable. The time delay at 6 multiples of pickup is as follows:

   Band 1 — 1.12 seconds
   Band 2 — 2.25 seconds
   Band 3 — 4.5 seconds
   Band 4 — 9 seconds
   Band 5 — 18 seconds
   Band 6 — 36 seconds

6. The short time element and ground element have 3 bands which are calibrated at minimum, intermediate and maximum, but are continuously adjustable.
7. The maximum interrupting time is the maximum length of time that fault current flows, including arcing time.
8. Instantaneous maximum interrupting time may be greater when breakers are closed in on a fault depending on actual fault conditions. The maximum potential increase for a 3-phase fault is 0.01 seconds and for a single-phase ground fault is 0.02 seconds.
9. The lower limit of ground fault recognition is 25 amperes for the RL-800 or RLF-800 and 40 amperes for the RLX-800, RL-1600, RLX-1600 and RLF-1600.

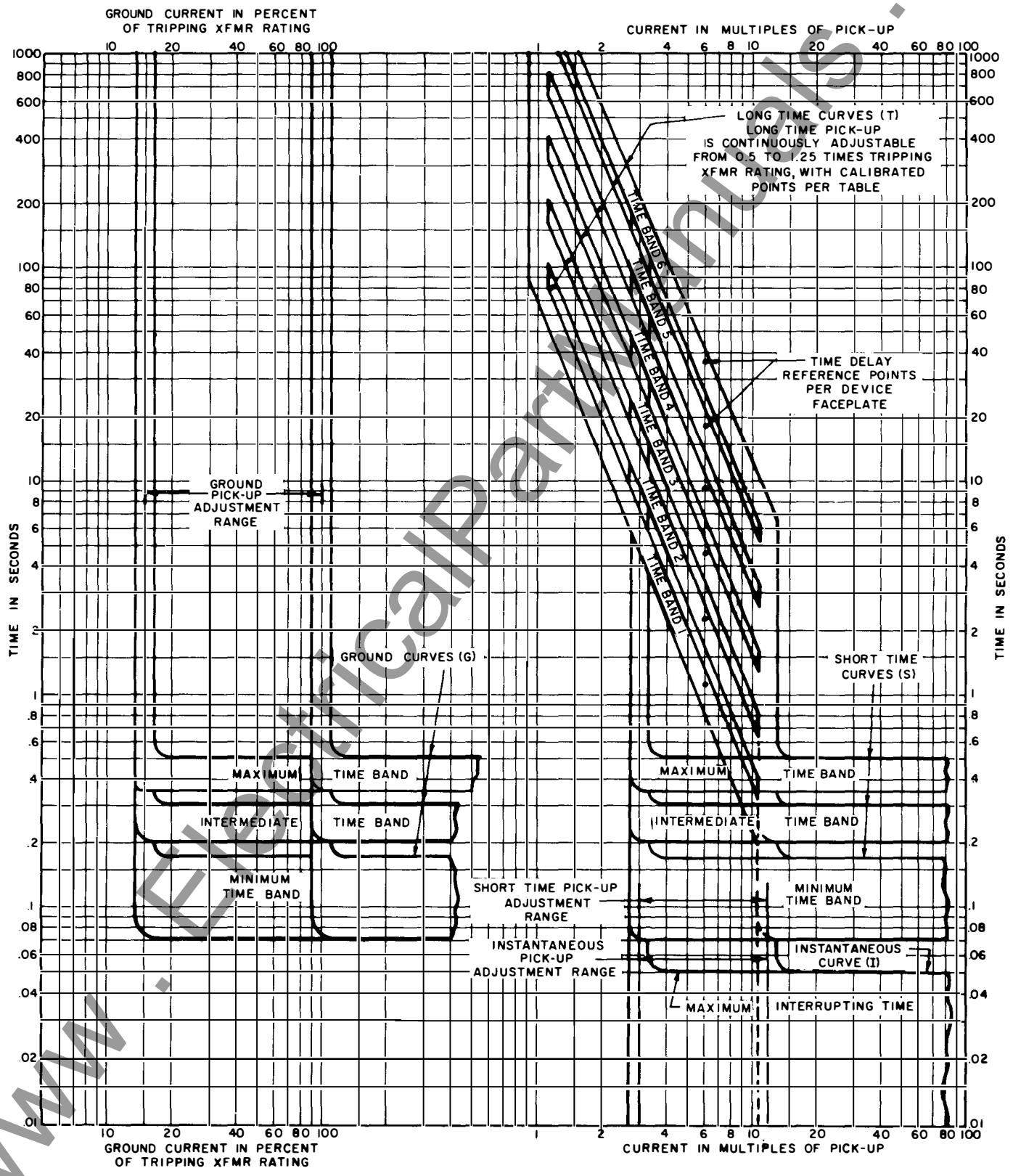


Figure 38. Static Trip II® Time-Current Characteristic.

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

Voltage Ratings						Short Circuit Rating Symmetrical Current		Continuous Current Rating Amperes
Rated Volts	Rated Max. Volts	Type	Frame Size Amperes	Insulation Level Dielectric Withstand Volts	Short Time Rating Symmetrical Amps	With Instantaneous Trip	Without Instantaneous Trip	
1	2	3	4	5	6	7	8	9
600	635	RL-800	800	2200	30,000	30,000	30,000	40-800
		RLX-800	800	2200	42,000	42,000	42,000	100-800
		RL-1600	1600	2200	50,000	50,000	50,000	100-1600
		RLX-1600	1600	2200	65,000	65,000	65,000	100-1600
		RL-2000	2000	2200	65,000	65,000	65,000	100-2000
		RL-3200	3200	2200	65,000	65,000	65,000	1000-3200
		RL-4000	4000	2200	85,000	85,000	85,000	2000-4000
480	508	RL-800	800	2200	30,000	30,000	30,000	40-800
		RLX-800	800	2200	42,000	42,000	42,000	100-800
		RL-1600	1600	2200	50,000	50,000	50,000	100-1600
		RLX-1600	1600	2200	65,000	65,000	65,000	100-1600
		RL-2000	2000	2200	65,000	65,000	65,000	100-2000
		RL-3200	3200	2200	65,000	65,000	65,000	1000-3200
		RL-4000	4000	2200	85,000	85,000	85,000	2000-4000
240 & 208	254	RL-800	800	2200	30,000	42,000	30,000	40-800
		RLX-800	800	2200	42,000	50,000	42,000	100-800
		RL-1600	1600	2200	50,000	65,000	50,000	100-1600
		RLX-1600	1600	2200	65,000	65,000	65,000	100-1600
		RL-2000	2000	2200	65,000	65,000	65,000	100-2000
		RL-3200	3200	2200	65,000	85,000	65,000	1000-3200
		RL-4000	4000	2200	85,000	130,000	85,000	2000-4000

All circuit breakers are UL listed.

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

Voltage Ratings							
Rated Volts	Rated Max. Volts	Type	Frame Size Amperes	Insulation Level Dielectric Withstand Volts	Short Circuit Rating Symmetrical Amps	Range of Fuse Ratings Amperes	Continuous Current Rating Amperes
1	2	3	4	5	6	7	8
208 to 600	600	RLF-800	800	2200	200,000	250-1600	40-800
		RLF-1600	1600	2200	200,000	800-3000	100-1600
		RLF-2000	2000	2200	200,000	4000	100-2000
		RLF-3200 & RFC-3200 Fuse Carriage	3200	2200	200,000	2000-5000	1000-3200
		RLF-4000 & RFC-4000 Fuse Carriage	4000	2200	200,000	2000-6000	2000-4000

The fuse drawout carriage is located in a separate compartment and is interlocked with the associated circuit breaker.
All circuit breaker (and drawout fuse carriage, if applicable) are UL listed.

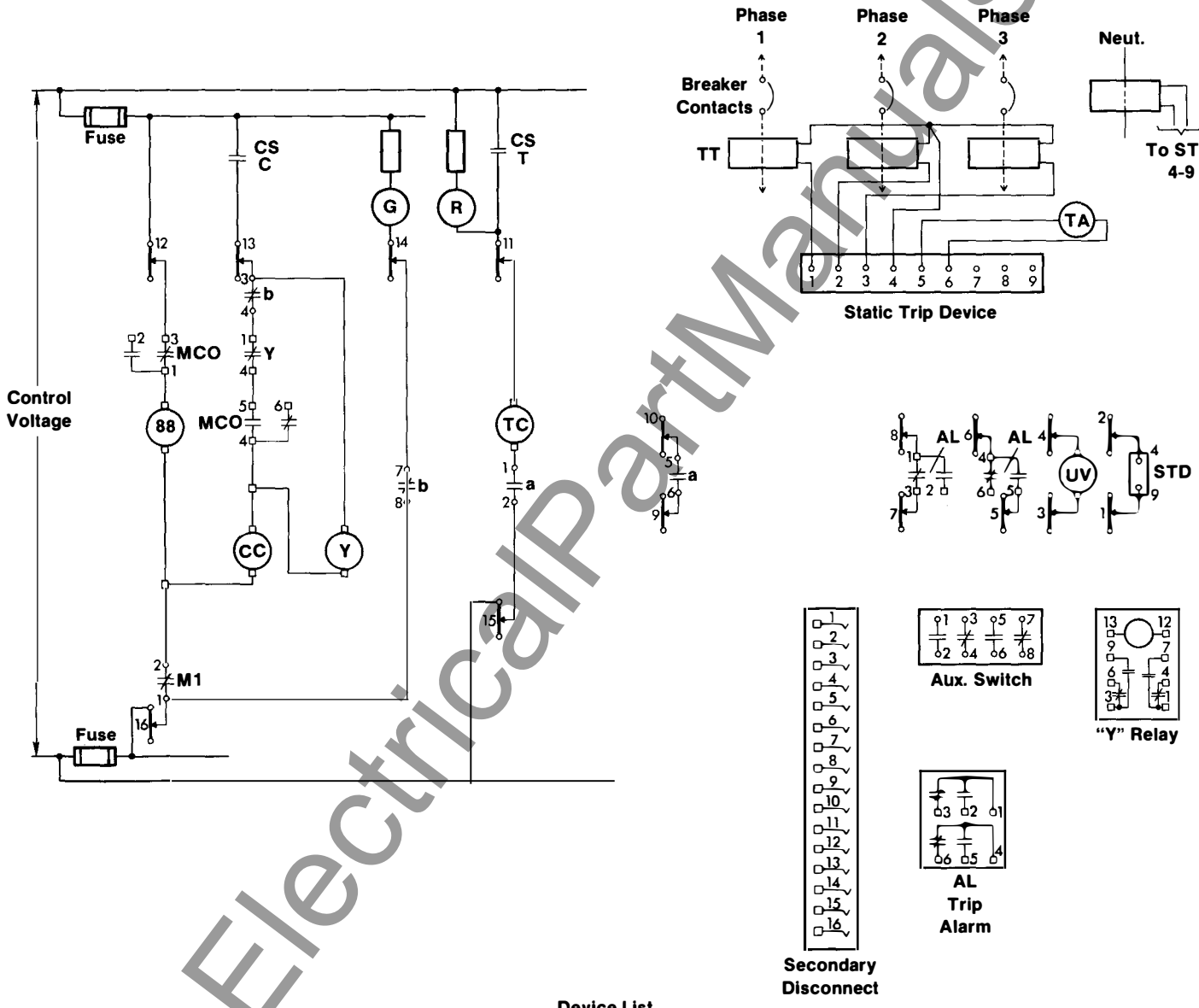
Table 1. Circuit Breaker Operating Time (60 Hertz Basis) and Data

	RL-800 RLX-800 RLF-800	RL-1600 & 2000 RLX-1600 RLF-1600 & 2000	RL-3200 RLF-3200	RL-4000 RLF-4000
Time from Energizing Shunt Trip Coil Until (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):				
Minimum Between Mains	1.0	1.0	1.0	1.0
Between Arcing Contacts	1.1	1.1	1.1	1.1

Table 2. 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	200-380
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	5.45/5.45	2.76/2.76	1.85/1.85
Closing Coil Current (Seal-in/Inrush) — Amperes	1.65/7.7	0.71/3.4	5.45/5.45	2.76/2.76	1.85/1.85
Y-Relay Current (Max. Value — Amperes)	0.026	0.015	0.15	0.02	0.01

Description



Device List

- **TT** — Tripping Transformer
- **STD** — Static Trip Device
- **TA** — Trip Actutator
- **CC** — Circuit Breaker Closing Coil
- **TC** — Circuit Breaker Trip Coil
- **Y** — Aux. Closing Relay — Anti-Pump
- **MCO** — Motor Cutoff Switch
- **88** — Spring Charging Motor
- **MI** — Mechanical Interlock
- **a** — Aux. Switch — Open when Breaker is Open
- **b** — Aux. Switch — Closed when Breaker is Open
- **CSC** — Control Switch — Close Contact
- **CST** — Control Switch — Trip Contact
- **R** — Red Indicating Lamp
- **G** — Green Indicating Lamp
- **AL** — Automatic Trip Alarm Device (Bell Alarm) (Manual Reset)
- **UV** — Undervoltage Trip Coil

Figure 39. Typical Control Schematic for Electrically Operated Breaker and Wiring Diagram, Showing Optional Attachments.

CIRCUIT BREAKER SELECTION DATA

Tables 1 through 4 on the following pages list recommended low voltage circuit breakers for use in Siemens-Allis secondary unit substation applications. The breakers have been co-ordinated with standard transformer capacities, and system parameters to meet the electrical, thermal and mechanical requirements.

The tables are to be used as guidelines, with other factors being taken into account which affect the final selection of proper breaker rating for the specific application. Such factors as voltage, power factor, temperature, altitude, circuit configurations, large motor loads, high inertia (WK^2) motor loads, unusual or cyclic load characteristics may require going to a larger rated breaker.

For applications where short circuit interrupting capacity must be increased, this can be accomplished either with higher rated RLX breakers or RLF fused circuit breakers.

The short circuit currents are established using assumptions and approximations which have proven valid. However, if the indicated circuit breaker is marginal when comparing its interrupting rating to the indicated value of short circuit current, then 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. 242-1975, Chapter 2.

Recommendations for breaker selection are given for the two types of systems in the tables, using standard unfused circuit breakers. If continuous current requirements would permit using a smaller circuit breaker than shown in columns 8 or 9, consider fused circuit breakers, which have sufficient interrupting capacity for all applications shown.

Main breaker listed in Column 7 may be with, or without, instantaneous trip element. When supplied without, it provides selective tripping with its downstream feeder. (Column 8 or 9)

Feeder breakers listed in Column 8 are supplied with, or without, instantaneous trip element, in order to provide selective tripping with additional protective devices at the downstream load.

Feeder breakers listed in Column 9 are supplied with instantaneous trip element, which are not required to co-ordinate in their tripping with downstream load protective devices.

Over the years, "fully rated" breakers have been recognized as those having a rating capability of interrupting the maximum fault available at its point of application within the system. Such breakers generally had instantaneous elements, giving them higher interrupting capacities than when not so equipped.

However today, as can be seen in Table 1, Page 24, (Breaker Rating Table), breakers applied at 600V or 480V have the same short circuit interrupting capabilities regardless of the type of trip elements.

Basis of Application Tables

The value of short circuit currents are calculated on basis of:

1. The fault is 3 phase bolted fault at the outgoing terminals of the feeder breaker.

2. Impedance of the transformer is as listed in the table. For impedances other than those listed, short circuit currents are inversely proportional.

3. The only power source to the secondary switchgear is the substation transformer.

4. The short circuit current contribution from connected motor load is included in the calculations based on use of standard motors. This contribution is approximated as two times (2x) transformer full-load current for 208Y systems, and four times (4x) transformer full load current for 240, 480 and 600v systems.

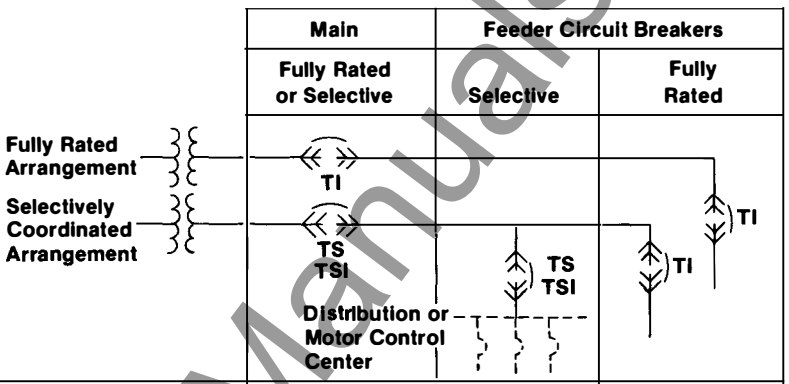
5. Total connected motor KVA does not exceed 50 percent of transformer base KVA for 208Y systems and 100 percent for systems of 240, 480, or 600 volt. For motor loads of some other percentage, the motor contribution will be in direct proportion.

6. All short circuit current values are rms symmetrical.

7. 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%. For open ventilated dry type with 115/150° C dual temperature rise, continuous capacities increase by 15%; with 80/150° C dual temperature rise, increase by 135%. For fan cooled ratings, increase liquid type by 15%, (except 2500 KVA units which increase 25%); dry type by 33 l/3%.

(Refer to Pages 28-32 for Application Tables)

Table 1. Application Table 480 Volts, Three Phase

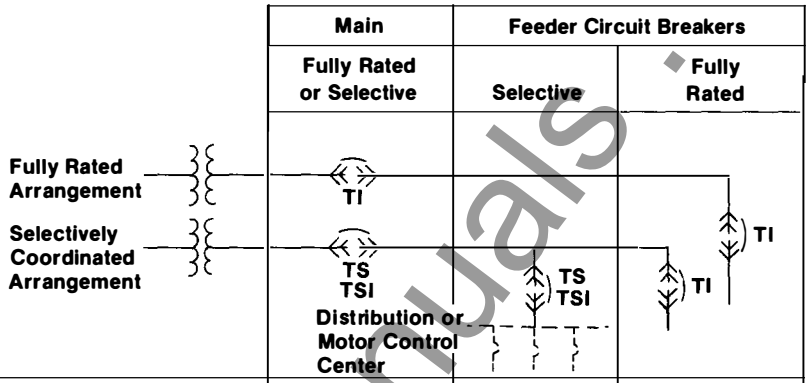


Transformer Rating 3-Phase kVa and Impedance Percent	Maximum Short-Circuit Mva Available from Primary System	Full Load Continuous Current (amperes) ①	Short-Circuit Rating Symmetrical Current (amperes)			Minimum Rating Breaker		
			Transformer Alone	100% Motor Load	Combined	Long-Time Instantaneous or Long-Time Short-Time Breaker	Long-Time Short-Time Breaker	Long-Time Instantaneous Breaker
1	2	3	4	5	6	7	8	9
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	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

① With transformer operating on base temperature rise.

(480 Volt Table 1 Continued on Page 29)

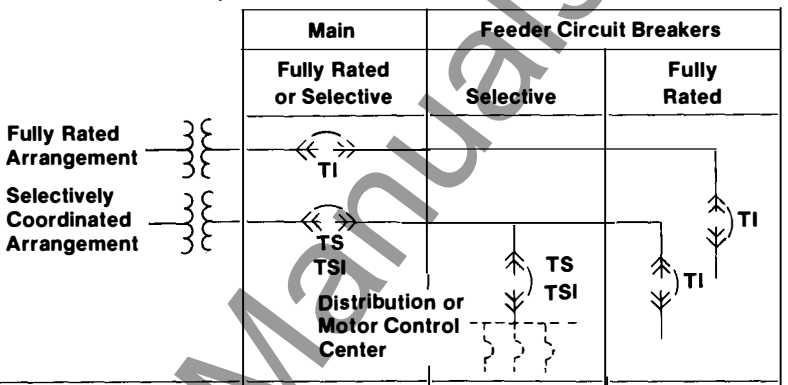
Table 1. Application Table 480 Volts, Three Phase (Continued)



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: Fully Rated or Selective — Long-Time Instantaneous or Long-Time Short-Time	Feeder Circuit Breakers: Selective — Long-Time Short-Time	Feeder Circuit Breakers: Fully Rated — Long-Time Instantaneous
			Transformer Alone	100% Motor Load	Combined	Minimum Rating Breaker		
						Breaker	Breaker	Breaker
1	2	3	4	5	6	7	8	9
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
1500 5.75%	50 100 150 250 500 750 Unlimited	1804②	20600 24900 26700 28400 29800 30300 31400	7200	27800 32100 33900 35600 37000 37500 38600	② RL-2000	RL-800 RLX-800	RL-800 RLX-800
1500 8.0%	50 100 150 250 500 750 Unlimited	1804②	16400 18900 20000 20900 21700 22000 22500	7200	23600 26100 27200 28100 28900 29200 29700	② RL-2000	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	RL-1600 RLX-1600	RL-1600 RLX-1600
2500 5.75%	50 100 150 250 500 750 Unlimited	3008②	28000 36500 40500 44600 48100 49400 52300	12000	40000 48500 52500 56600 60100 61400 64300	② RL-3200	RL-1600 RLX-1600	RL-1600 RLX-1600
3000 5.75%	50 100 150 250 500 750 Unlimited	3607②	30700 41200 46500 51900 56800 58700 62700	14400	45100 55600 60900 66300 71200 73100 77100	② RL-4000	RLX-1600 RL-3200	RLX-1600 RL-3200

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.

Table 2. Application Table 208 Volts, Three Phase

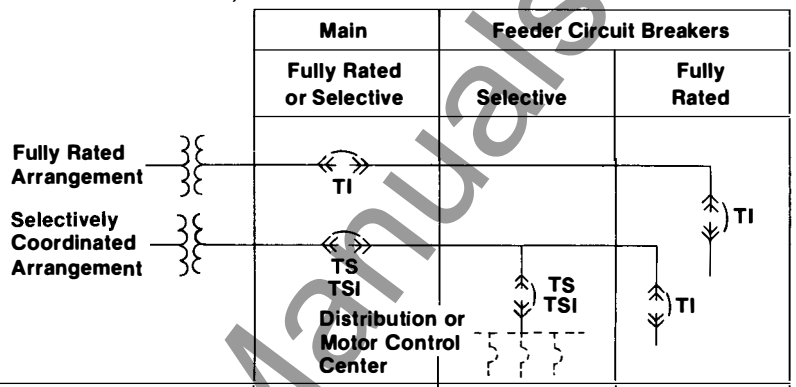


Transformer Rating 3-Phase kVa and Impedance Percent	Maximum Short-Circuit Mva Available from Primary System	Full Load Continuous Current (amperes) ①	Short-Circuit Rating Symmetrical Current (amperes)			Long-Time Instantaneous or Long-Time Short-Time	Long-Time Short-Time	Long-Time Instantaneous
			Transformer Alone	50% Motor Load	Combined	Minimum Rating Breaker		
						Breaker	Breaker	Breaker
1	2	3	4	5	6	7	8	9
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 RLX-800	RL-800 RL-800
750 5.75%	50 100 150 250 500 750 Unlimited	2080	28700 32000 33300 34400 35200 35600 36200	4200	32900 36200 37500 38600 39400 39800 40400	RL-3200	RLX-800	RL-800
1000 5.75%	50 100 150 250 500 750 Unlimited	2780	35900 41200 43300 45200 46700 47300 48300	5600	41500 46800 48900 50800 52300 52900 53900	RL-3200	RLX-800 RL-1600 RLX-1600	RL-800 RLX-800 RL-1600

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.

Table 3. Application Table 240 Volts, Three Phase



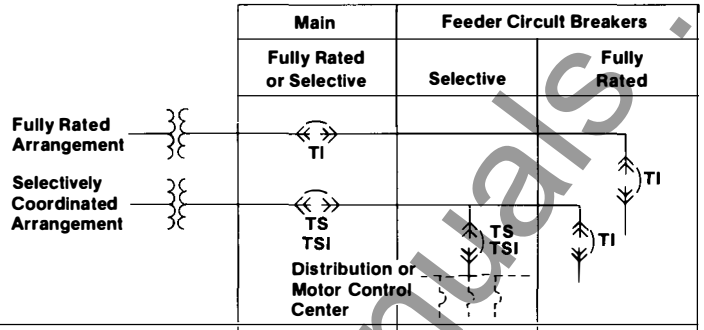
Transformer Rating 3-Phase kVa and Impedance Percent	Maximum Short-Circuit Mva Available from Primary System	Full Load Continuous Current (amperes) ①	Short-Circuit Rating Symmetrical Current (amperes)			Long-Time Instantaneous or Long-Time Short-Time	Long-Time Short-Time	Long-Time Instantaneous
			Trans-former Alone	100% Motor Load	Combined	Minimum Rating Breaker		
						Breaker	Breaker	Breaker
1	2	3	4	5	6	7	8	9
300 5%	50 100 150 250 500 750 Unlimited	722②	12900 13600 13900 14100 14300 14325 14400	2900	15800 16500 16800 17000 17200 17225 17300	② RL-800	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	1804②	24900 27800 28900 29800 30600 30800 31400	7200	32100 35000 36100 37000 37800 38000 38600	② RL-2000	RLX-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	RLX-800 RL-1600 RLX-1600	RL-800 RLX-800 RL-1600
1500 5.75%	50 100 150 250 500 750 Unlimited	3609②	41200 49800 53500 56800 59600 60600 62800	14400	55600 63200 67900 71200 74000 75000 77200	② RL-4000	RLX-1600 RL-4000	RL-1600 RL-3200

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.

Description

Table 4. Application Table 600 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)			Long-Time Instantaneous or Long-Time Short-Time	Long-Time Short-Time	Long-Time Instantaneous
			Transformer Alone	100% Motor Load	Combined	Minimum Rating Breaker		
						Breaker	Breaker	Breaker
1	2	3	4	5	6	7	8	9
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	722②	10000 11100 11600 11900 12200 12300 12600	2900	12900 14000 14500 14800 15100 15200 15500	② RL-800	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
1500 5.75%	50 100 150 250 500 750 Unlimited	1444②	16500 20000 21400 22700 23900 24200 25100	5800	22300 25800 27200 28500 29700 30000 30900	② RL-1600	RL-800 RLX-800	RL-800 RLX-800
2000 5.75%	50 100 150 250 500 750 Unlimited	1924②	19700 24800 27200 29400 31300 32000 33500	7800	27500 32600 35000 37200 39100 39800 41300	② RL-2000	RL-800 RLX-800	RL-800 RLX-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	RLX-800 RL-1600 RLX-1600	RLX-800 RL-1600 RLX-1600

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.

FUSED BREAKER APPLICATION

Type RLF fused low voltage power circuit breakers are a combination of current limiting fuses mounted in conjunction with RL circuit breakers for use in low voltage switchgear. Line-ups of switchgear may include both standard and fused circuit breakers. Because the fuses clear short circuits very rapidly and have high interrupting capacity, fused breakers can be used for protection of:

1. The circuit breaker, when applied on systems with available short circuit currents exceeding the interrupting rating of the circuit breaker, particularly for feeders to small loads.
2. Load side equipment (motor control centers, panelboards, bus ducts), which may have ratings below the available short circuit currents, or be damaged unless faults are rapidly cleared and limited by the current-limiting action of the fuses.

Various fuse sizes can be used on the RLF-800, RLF-1600, RLF-2000, RLF-3200 and RLF-4000 as given in Table 2, Page 24. The size selected for a specific application will depend on which of the above reasons led to the use of the fused circuit breaker:

1. When used to increase the interrupting rating of the circuit breaker, then a large fuse can be used, such as the 1200 ampere fuse for the RLF-800. This will minimize the possibility of fuse blowing, since most faults will be cleared by the circuit breaker, as detected by the instantaneous element of the static trip device.
2. When used to protect downstream equipment, the fuse must limit the fault to less than the rating of the protected equipment. This can be checked using the "Let-Thru" chart, Figure 40, which contains an example of the limiting effect of the fuse.

It is also necessary to check three types of coordination:

1. Thermal conditions. To maintain thermal coordination between the fuse and the breaker in an enclosure, the following general rules apply:
   a. A breaker, applied at 90-100% of its frame size continuous current rating, should not use a fuse less than 200% of its frame size rating.
   b. A breaker, applied at 80-90% of its frame size continuous current rating, should not use a fuse less than 150% of its frame size rating.
   c. The fuse size should NEVER be less than 125% of the breaker pickup setting.
2. Coordination between a fuse and the static trip device. The melting time of a fuse should be at least double the total clearing time of the breaker at the current level where the static trip device transfers to instantaneous pickup. Refer Figure 41, for melting characteristics.
3. Coordination with up-stream circuit breakers, fuses or relays. Time-current curves should be prepared to demonstrate this coordination.

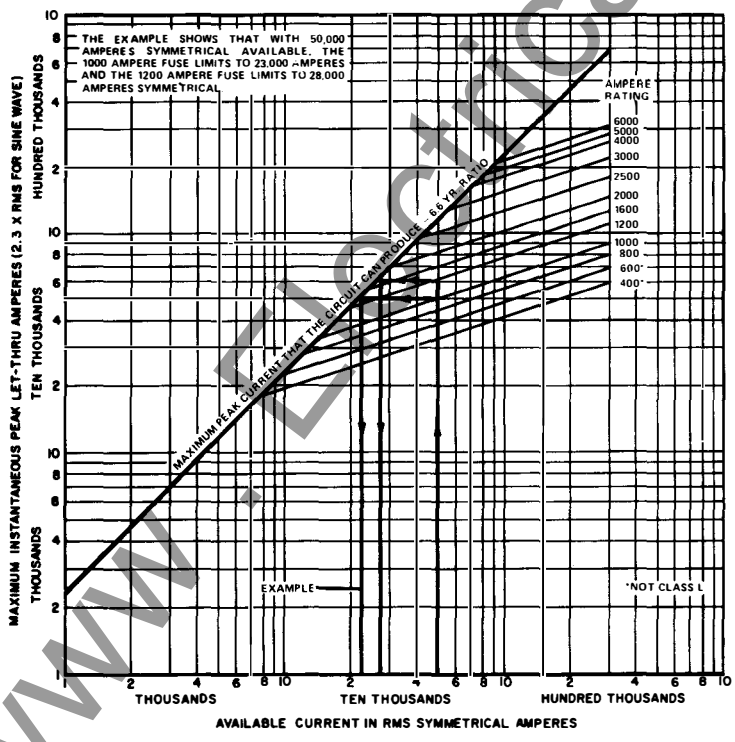


Figure 40. Fuse Peak Let-Thru Characteristic.

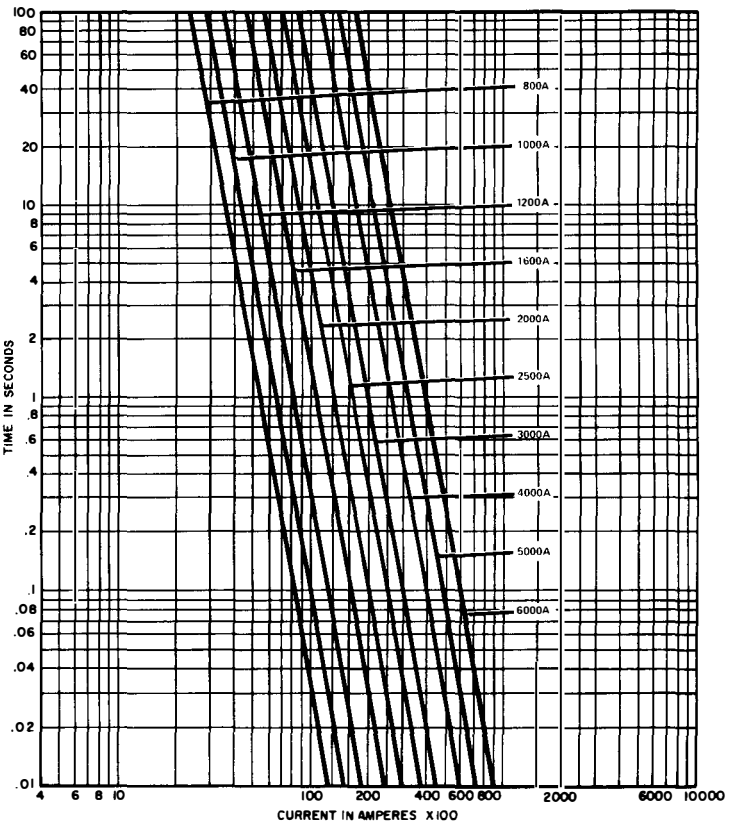


Figure 41. Fuse Time-Current Characteristic.

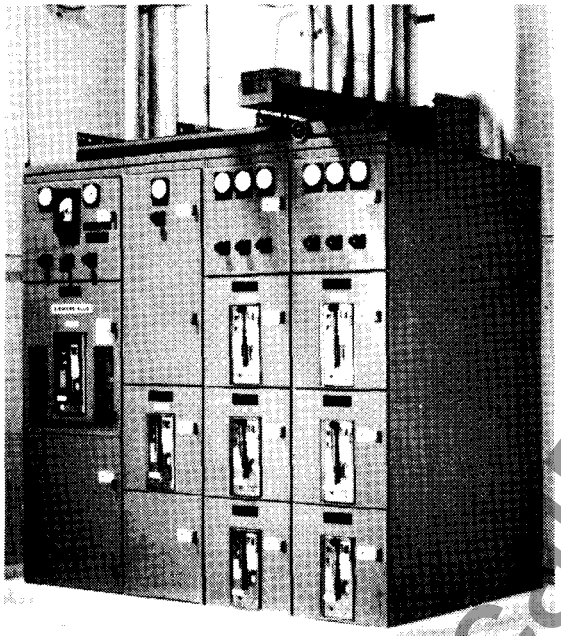
Description

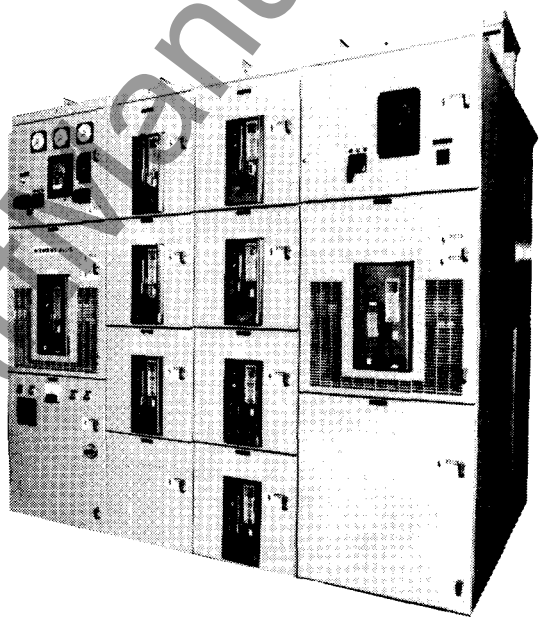
TYPICAL INSTALLATIONS

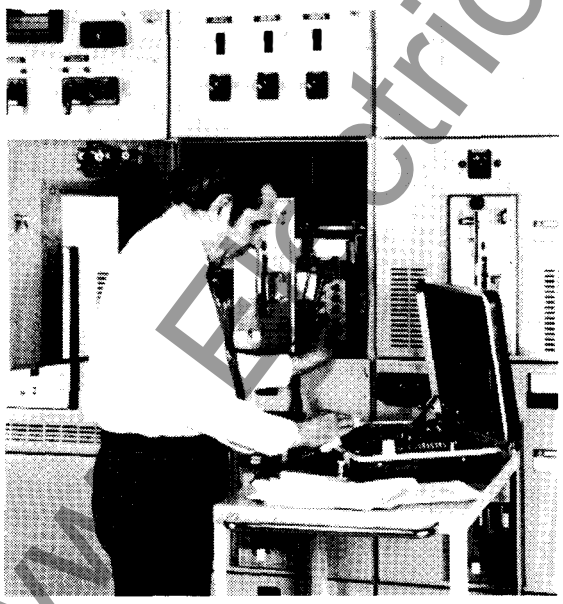
Central Stations — Protect and distribute power to station auxiliaries — blowers, compressors, fans, pumps, motors.

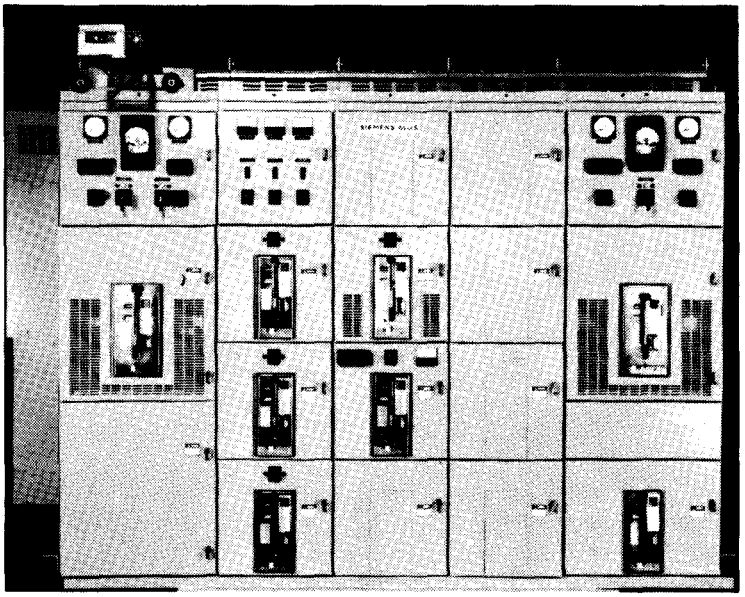
Commercial and Residential Buildings — For protection and distribution of power for lighting, elevators, air conditioning, plus blowers, fans, motors and pumps.

Industrial Plants — For power and lighting networks, power and lighting feeders, plus power generation and auxiliaries, provide power for machine tools and material handling equipment drives.









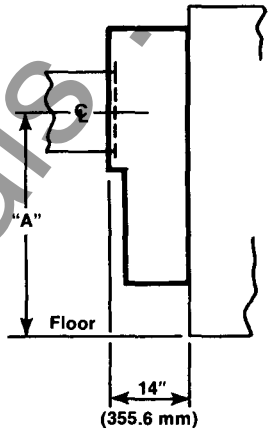
BASIC CUBICLE ARRANGEMENTS (FRONT ELEVATIONS) AND WEIGHTS

Type R — Indoor Equipment①

Transition Sections

1. Transition to liquid filled transformer with side wall throat enclosed bushings.
2. Side entry bus duct.

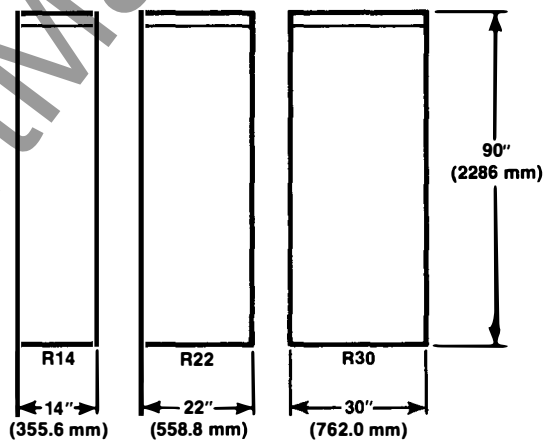
	"A"	Weight
Indoor	55 (1397 mm)	500 (227.0)
Outdoor	61 (1549.4 mm)	550 (249.0)



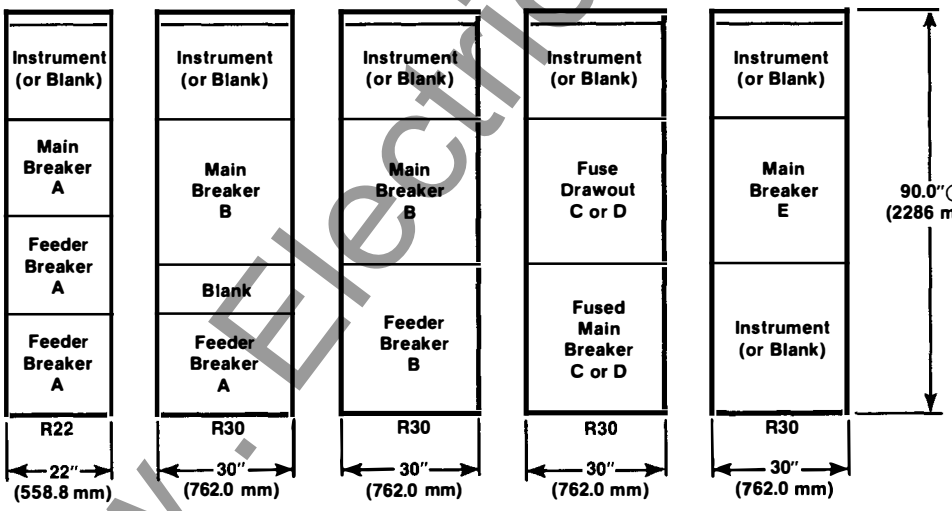
Auxiliary Sections ② ③

1. Metering section for substation not containing main breaker.
2. Incoming bus duct or cable entrance for substation not containing main breaker.

	Weights		
	R14	R22	R30
Indoor	600 (272.0)	1000 (454.0)	1200 (544.0)
Outdoor④	1600 (726.0)	2000 (907.0)	2400 (1088.0)



Main Breaker Sections and Combinations ② ③



	Weight†	
	R22	R30
Indoor	1400 (635.0)	1900 (862.0)
Outdoor④	2400 (1088.0)	3100 (1406.0)

† Weights shown do not include weight of circuit breaker removable elements.

① Maximum shipping group is five (5) vertical sections in additon to transition section.

② All vertical sections are 90" high. Add 11" for top mounted lifting structure shipped mounted, 101.0" (2565 mm) overall height (2591 mm).

③ All units are 60" (1524 mm) deep.

④ For outdoor lineup, add 1200 lbs. (544 kg) to total weight of individual sections for end walls and hoist.

Breaker Key:

A. Any of the following:
RL-800; RLX-800; RLF-800; RL-1600; RLX-1600; RLF-1600; RL-2000; RLF-2000.

B. RL-3200

C. RLF-3200 in one cell/RFC-3200 fuse drawout in other cell

D. RLF-4000 in one cell/RFC-4000 fuse drawout in other cell

E. RL-4000

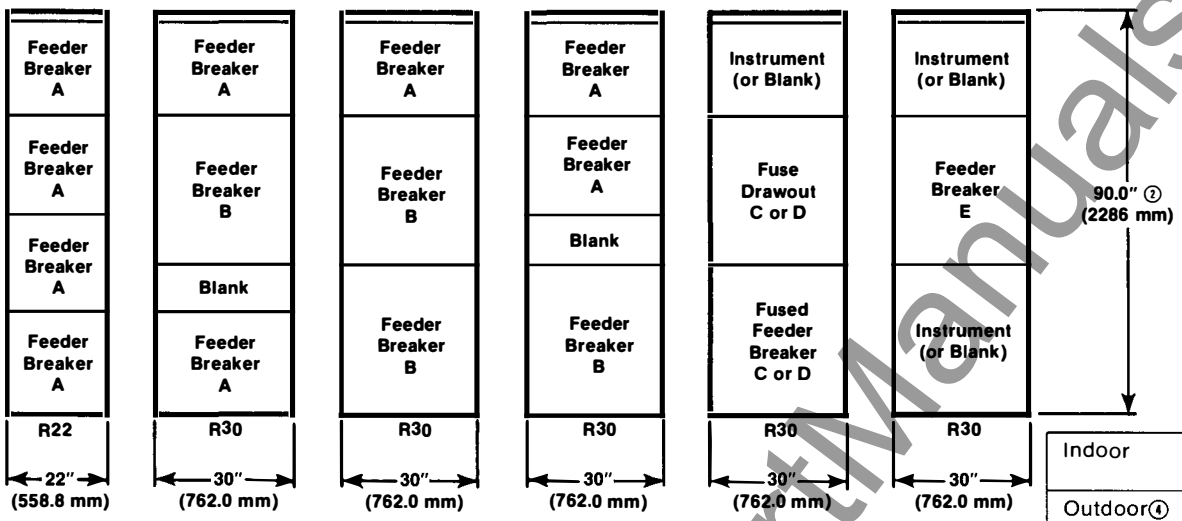
Instrument or blank cells can be substituted for any breaker cell shown.

NOTE: All weights are approximate in pounds and (kg) based on aluminum bus.

Dimensions

BASIC CUBICLE ARRANGEMENTS (FRONT ELEVATIONS) AND WEIGHTS

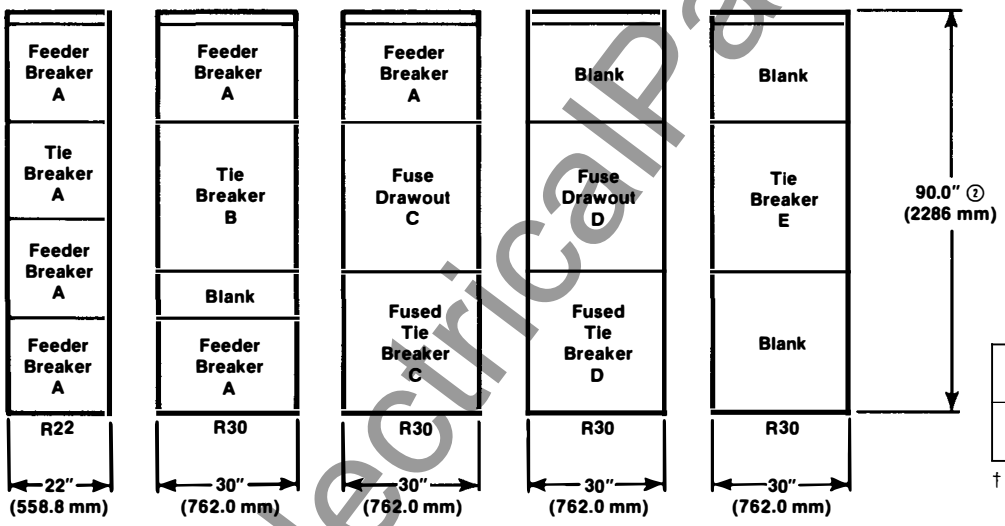
Feeder Breaker Sections and Combinations ② ③



	Weights†	
	R22	R30
Indoor	1400 (635.0)	1900 (862.0)
Outdoor④	2400 (1088.0)	3100 (1406.0)

† Weights shown do not include weight of circuit breaker removable elements.

Tie Breaker Sections and Combinations ② ③ ⑤



	Weights†	
	R22	R30
Indoor	1400 (635.0)	1900 (862.0)
Outdoor④	2400 (1088.0)	3100 (1406.0)

† Weights shown do not include weight of circuit breaker removable elements.

① Maximum shipping group is five (5) vertical sections in addition to transition section.
② All vertical sections are 90" high. Add 11" for top mounted lifting structure shipped mounted, 101" overall height (2565 mm).
③ All units 60" (1524 mm) deep. 8" (203 mm) or 12" (305 mm) rear extensions optionally available for indoor units.
④ For outdoor lineup, add 12.00 lbs. (544 kg) to total weight of individual vertical sections for end walls and hoist.
⑤ Feeder breakers physically above tie breaker must be electrically on opposite side of tie breaker from the feeder breakers which are physically below the tie breaker.

Breaker Key:

A. Any of the following:
RL-800; RLX-800; RLF-800; RL-1600; RLX-1600; RLF-1600; RL-2000; RLF-2000.

B. RL-3200

C. RLF-3200 in one cell/RFC-3200 fuse drawout in other cell

D. RLF-4000 in one cell/RFC-4000 fuse drawout in other cell

E. RL-4000

Instrument or blank cells can be substituted for any breaker cell shown.

Table 1. Breaker Element Weights

	Element Type	RL-800	RLX-800	RL-1600	RLX-1600	RL-2000	RL-3200	RL-4000
Operation	Manual	140 (63.5)	170 (77.1)	175 (79.4)	200 (90.7)	210 (95.3)	290 (131.5)	350 (158.8)
	Electrical	150 (68.0)	180 (81.6)	185 (83.9)	210 (95.3)	220 (99.8)	300 (136.1)	360 (163.3)
Additional Weight for Shipping		45 (20.4)	45 (20.4)	45 (20.4)	45 (20.4)	45 (20.4)	50 (22.7)	50 (22.7)

Table 2. Fused Element Weights

	Element Type	RLF-800	RLF-1600	RLF-2000	RLF-3200④	RFC-3200①	RLF-4000④	RFC-4000②
Operation	Manual	195 (83.9)	310 (140.6)	325 (147.4)	290 (131.5)	390③ (176.9)	350 (158.8)	450③ (204.1)
	Electrical	205 (93.0)	320 (145.2)	335 (152.0)	300 (136.1)		360 (163.3)	
Additional Weight for Shipping		45 (20.4)	45 (20.4)	45 (20.4)	50 (22.7)	50 (22.7)	50 (22.7)	50 (22.7)

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.
NOTE: All weights are approximate in pounds and (kg).

Dimensions

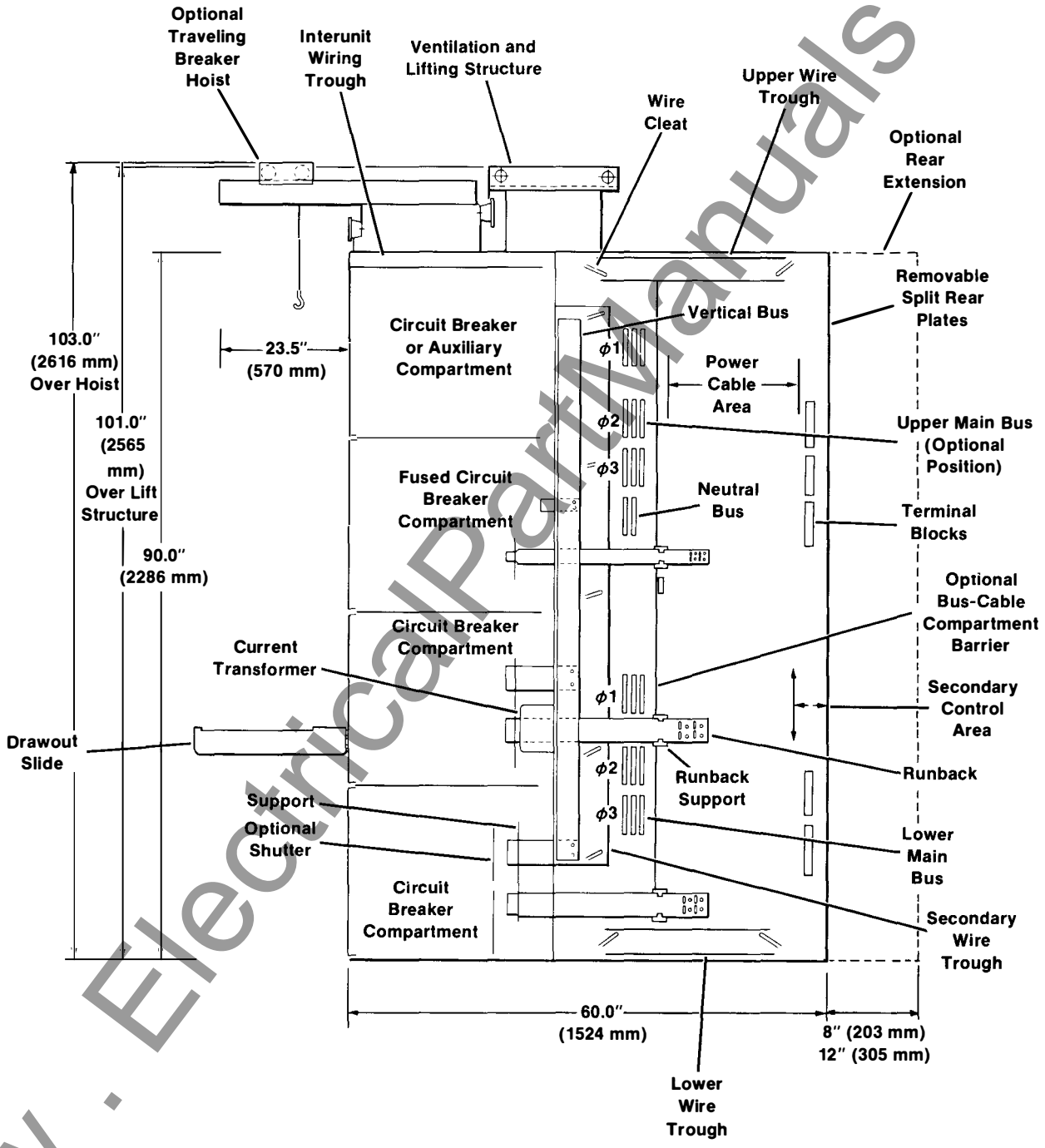


Figure 1. Typical Side View "R22" Unit

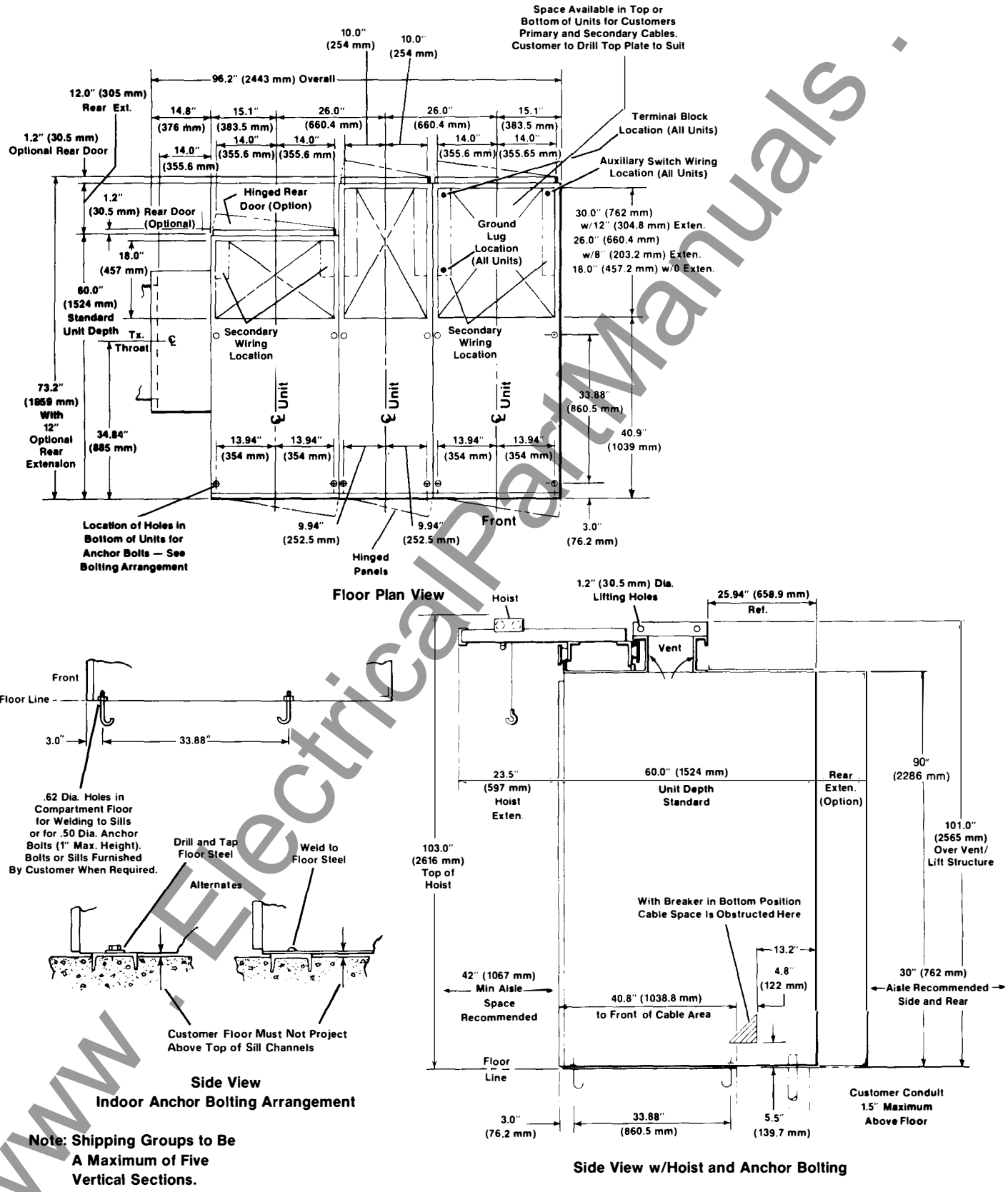


Figure 2. Dimensions, Floor Plan and Side View Type "R" Indoor Switchgear.

Dimensions

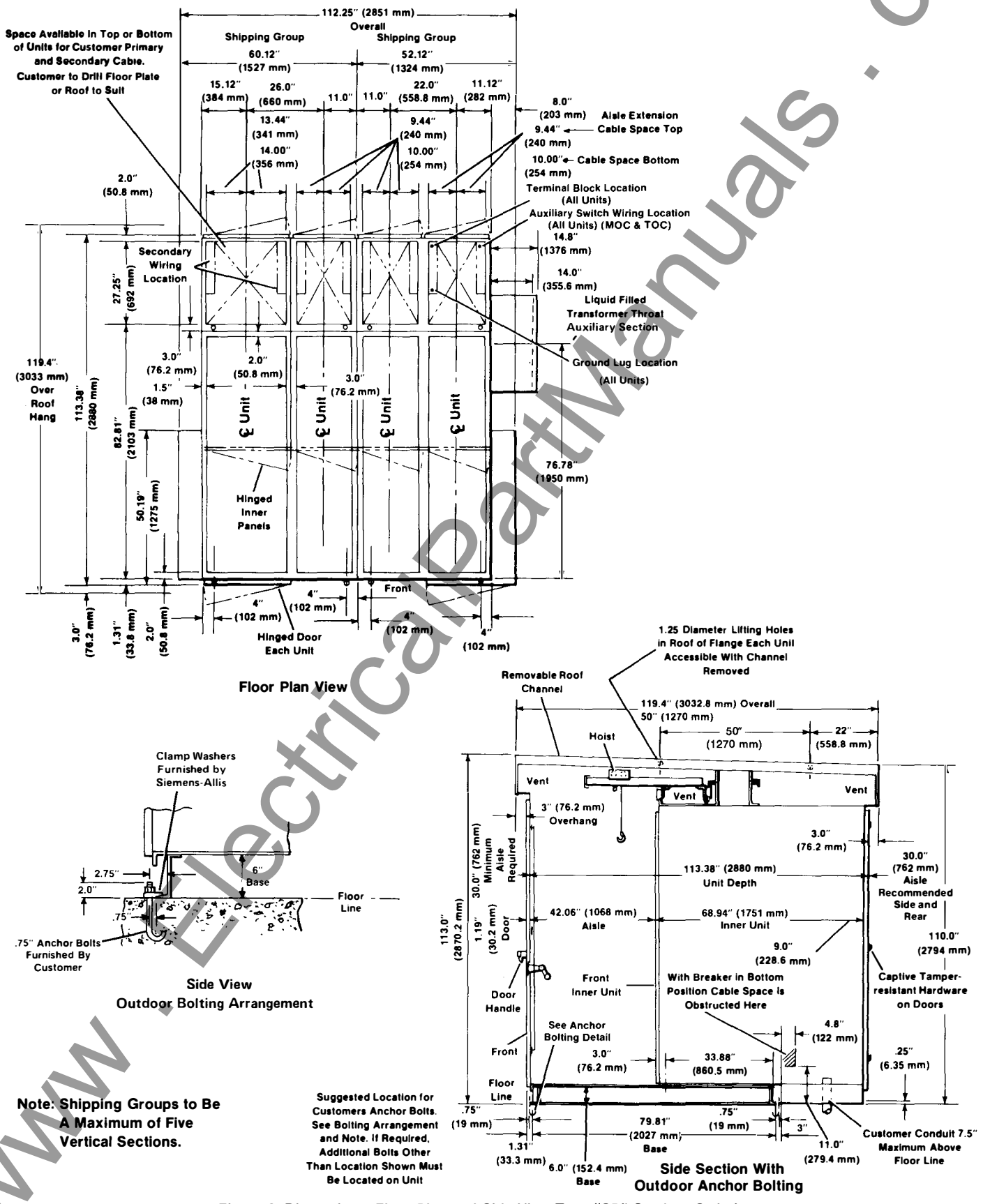


Figure 3. Dimensions, Floor Plan and Side View Type "SR" Outdoor Switchgear.

NOTE: This preparation guide form requires information to be supplied by Purchaser. Those items preceeded by ☐ check box are optional. Those items denoted _____ require quantity or data to be added.

GENERAL

The equipment outlined in this specification will consist of Siemens-Allis type R METAL ENCLOSED LOW VOLTAGE POWER CIRCUIT BREAKER SWITCHGEAR with drawout Low Voltage Power Circuit Breakers, compartments, bus work and miscellaneous equipment for this application. General construction features will be as described. The complete switchgear sections will be of coordinated design so that shipping groups are easily connected together in the field into a continuous line-up. Necessary standard connecting materials will be furnished.

Suitable solderless cable lugs will be provided for each of the customers feeder cables. Nameplates will be provided for each circuit breaker compartment.

CODES AND STANDARDS

The Siemens-Allis switchgear covered in this specification will be designed, manufactured, and tested in accordance with the latest revisions of the applicable standards of:

ANSI - American National Standards Institute
NEMA - National Electrical Manufacturers Association
ASTM - American Society for Testing and Materials
IEEE - Institute of Electrical and Electronics Engineers
NEC - National Electric Code
OSHA - Occupational Safety and Health Administration
UL - Underwriters Laboratories

SERVICE

The switchgear sections will be Siemens-Allis Type ☐ R, indoor, ☐ "SR", outdoor rated 600 volts. This equipment will operate on service voltage of ____ volts, ☐ 50, ☐ 60 hertz, 3-phase, ☐ 3, ☐ 4 wire.

FRAMEWORK AND COMPARTMENTATION

The framework of indoor low voltage switchgear is constructed of preformed steel channels, angles and side sheets bolted together and reinforced to form a rigid, self-supporting, compact assembly. Steel side sheets are attached to this framework. The side sheets are pre-wired. Horizontal barriers are provided to form the individual circuit breaker/metering cells.

The circuit breakers are barriered from the bus/cable compartment with the primary disconnect support assembly which completes the circuit breaker compartmentation. A hinged front door, secured with 1 or 2 rotary fastener, is provided for each cell.

The bus compartment includes the main horizontal bus, vertical bus connections from the main bus to the upper set of primary disconnects, and load side insulated "run-back" copper bus from the lower set of primary disconnects in each circuit breaker compartment. The cable lugs are accessible in the cable compartment without reaching over the main bus.

The switchgear is of totally metal-enclosed ventilated multiple unit construction. The front of the switchgear is comprised of individually enclosed circuit breaker, metering and auxiliary cells divided one from another by 14 gauge side sheets and compartment barriers of 11 gauge steel. Each vertical unit consists of three or four circuit breaker and/or metering cells in a width of 22 or 30 inches. End units normally include provisions for future main bus extension and installation of additional units.

CIRCUIT BREAKERS

Circuit breakers will be Siemens-Allis low voltage power circuit breaker types RL, RLX or RLF. Interrupting ratings, as listed in the detailed specifications meet or exceed the industry's standard for type "RL" circuit breakers, as listed in ANSI C37.16-1973. Type "RLX" circuit breakers exceed this standard. Circuit breakers are 600-volt class, three pole, single throw, drawout mounted, electrically and mechanically trip free with stored energy operator. Each will have arc quenchers, main and arcing contact structure, a three phase solid state overcurrent trip device, trip actuator, three tripping transformers, contact position indicator (open-closed), stored energy mechanical indicator (charged-discharged), primary disconnecting devices, and a mechanical interlock to prevent making or breaking contact of the primary disconnects when the circuit breaker is closed.

OVERCURRENT TRIP DEVICE

Each low voltage power circuit breaker will be equipped with an integrally mounted Static Trip II overcurrent trip device providing any combination of continuously adjustable Long Time, Short Time, Instantaneous and Ground Fault protection.

BUS

The main bus runs horizontally in a vertical, edge to edge arrangement behind the vertical riser bus. Available ratings are 1600, 2000, 3200, 4000 and 5000 Amps.

Main bus (horizontal and vertical) can be optionally insulated.

WEATHERPROOF HOUSING (OPTIONAL)

Outdoor walk-in weatherproof construction will be provided. Front and rear doors will be gasketed and hinged. Front doors, located at each end, will include panic hardware, three-point latches and provision for padlocking, while rear doors will be bolted. An aisle approximately 42 inches deep and accessible from either of the front doors will be provided at the front of the switchgear line-up to facilitate inspection and testing of the circuit breakers and associated equipment while protected from the weather. One hand-operated crane, mounted above the switchgear aisle-way, will be provided to facilitate removal and handling of the circuit breaker elements. An 8" extension on both ends of the operating aisle eliminates the need for special enclosure design to accommodate doors on end units that have instrumentation and metering, and provides additional space for convenient circuit breaker handling.

The following equipment will be furnished within the outdoor weatherproof switchgear: light sockets for interior illumination of the aisle, convenience receptacles and space heaters in the switchgear to prevent condensation of moisture, a switch for all the space heaters, and a switch for the lamps.

The complete assembly will rest on a formed steel base built up from units provided under each vertical section and running perpendicular to the length of the switchgear. The underside of the enclosure and base structure will be undercoated with coal tar emulsion material.

DETAILED SPECIFICATIONS

This detailed specification will describe ____ group(s) of Siemens-Allis METAL-ENCLOSED LOW VOLTAGE POWER CIRCUIT BREAKER SWITCHGEAR, type ☐ R, ☐ SR, with type ☐ RL, ☐ RLX (extended ratings), ☐ RLF (Fused) Circuit Breakers. These assemblies will be equipped as follows:

1-Set ☐ 5000A, ☐ 4000A, ☐ 3200A, ☐ 2000A, ☐ 1600A, 3-Phase, 3 Wire,

☐ Copper Main bus, bolted and silver-plated at connection points

☐ Aluminum main bus, welded at connection points.

☐ 1-Neutral bus, ☐ Copper, ☐ Aluminum, ☐ 50%, ☐ 100%, of main bus rating (optional).

1-Ground bus, Copper.

☐ 1-Set of space heaters, one located in the main bus compartment,and one space heater per cell of each vertical unit.

☐ 1-Set thermostats as required for space heater control.

1-Set of nameplates as required.

☐ 1-Set of metal barriers between the incoming line bus and main bus.

1-Set of barriers between the main bus sections at the tie circuit breaker.

____ -Transition section(s), for connection to liquid-filled transformer.

____ -Bus connection(s) to dry-type transformer.

☐ 1-Transition section, for connection to Motor Control Center.

☐-Switchgear to be labeled per UL 1558, where component selection permits.

☐-Switchgear is to be designed per NEC service entrance requirements.

Circuit breaker, auxiliary and metering cells will be as specified below:

INCOMING METERING CELL NO. _____ .

This cell will contain:

____-Potential transformer(s), ____/120 volt ratio, dry type, complete with primary current limiting fuses and secondary fuses.

____-Current transformers, _____/5 ampere ratio (when no main breaker).

☐ 1-Control power transformer, dry type, ☐ 3, ☐ 5, ☐ 10 KVA, single phase, ____-120/240 volt ratio, complete with primary current limiting fuses and secondary fuses, to supply auxiliary power.

____-RQ 21 3-phase thermal overload relays for motor protection.

____-Auxiliary relays, multi-contact.

____-Auxiliary relays, single-contact.

____-Ground detection transformers, complete with primary current limiting fuses.

____-Auxiliary current transformers.

____-Voltage transducer(s).

____-Current transducer(s).

____-Capacitor trip device (one per breaker or auxiliary relay if required).

On the front of the panel will be:

____-Voltmeter(s), single-phase, indicating, 270° scale, switchboard class, 1% accuracy.

____-Voltmeter(s), single-phase, indicating, 180° scale, 2% accuracy.

____-Voltmeter transfer switches, 3-phase.

____-Ammeter(s), single-phase, indicating, 270° scale, switchboardclass, 1% accuracy.

____-Ammeter(s), single-phase, indicating, 180° scale, 2% accuracy.

____-Ammeter transfer switches, 3-phase.

____-Wattmeter(s), 3-phase, indicating.

____-Power factor meter(s), indicating.

____-Varmeter(s), 3-phase, indicating.

____-Watthour meter(s), ____-element.

____-Watthour meter(s), ____-element, with demand attachment.

____-Overcurrent relay(s), device No. ____ .

____-Undervoltage relay(s), device No. 27.

____-Overvoltage relay(s). Device No. 59.

____-Lockout relay(s), device No. 86.

☐-Current test block.

☐-Potential test block.

☐ 1-Set of three (3) ground detector lights indicating, with test pushbutton.

____-Circuit breaker control switch(es), Siemens-Allis type "210", complete with one red and one green indicating lights.

MAIN BREAKER CELL NO. _____ .

____-Type RL- _____ air circuit breaker, ☐ electrically, ☐ manually operated. Mounted on the circuit breaker will be:

☐ 1-Static Trip II solid state overcurrent trip device with Type ☐ TI(OT), ☐ TS(OT), ☐ TSI(OT), tripping characteristics.

☐ 1-Static Trip II solid state overcurrent trip device with Type ☐ TI(2T), ☐ TIG(3T), ☐ TS(2T), ☐ TSG(3T), ☐TSI(2T), ☐TSIG(3T) tripping characteristics and indicating trip targets.

☐ 1-Set of three current limiting fuses with an interrupting rating of 200,000A symmetrical, plus blown fuse indication and a lockout system to trip circuit breaker upon blowing of any fuse.

☐ 1-Undervoltage trip device, instantaneous.

☐ 1-Undervoltage trip device, time delay.

☐ 1-Shunt trip device.

☐ 1-Overcurrent bell alarm device.

☐ 1-Operation counter.

☐ 1-4 Stage auxiliary switch, mechanism operated. (MOC)

☐ 1-Shutter assembly, of grounded metal, to isolate primary disconnects upon withdrawal of circuit breaker element.

☐ Cable lugs, for connection of ____ cable/phase.

____ -Current transformers, _____/5 ampere ratio.

☐ 1-8 Stage cell mounted auxiliary switch, mechanism operated. (MOC)

☐ 1-8 Stage cell mounted cell switch (TOC).

☐ 1-Set insulated copper "run back" bus for connection of customer's cables to main circuit breaker line side primary disconnects.

☐ 1-Set bus risers rated _____ A, _____ wire, for connection of bus duct to main breaker line side primary disconnects.

☐ 1-Key interlock for interlocking circuit breaker with primary switch.

☐ Key interlock for interlocking main breaker with tie breaker.

On the front of the panel will be:

☐ 1-Circuit breaker control switch, miniature rotary type, complete with one red and one green indicating lights.

☐ 1-Ammeter, single-phase, indicating, 180° scale, 2% accuracy.

☐ 1-Ammeter transfer switch, 3-phase.

☐ 1-Current test block.

FEEDER BREAKER CELL NO. _____.

____-Type RL- _____ air circuit breaker, ☐ electrically, ☐ manually operated. Mounted on the circuit breaker will be:

☐ 1-Static Trip II solid state overcurrent trip device with Type ☐TI(OT), ☐ TS(OT), ☐ TSI(OT) tripping characteristics.

☐ 1-Static Trip II solid state overcurrent trip device with Type ☐TI(2T), ☐ TIG(3T), ☐ TS(2T), ☐ TSG(3T), ☐ TSI(2T) ☐TSIG(3T) tripping characteristics and indicating trip targets.

☐ 1-Set of three current limiting fuses with an interrupting rating of 200,000A symmetrical, plus blown fuse indication and a lockout system to trip circuit breaker upon blowing of any fuse.

☐ 1-Undervoltage trip device, instantaneous.

☐ 1-Undervoltage trip device, time delay.

☐ 1-Shunt trip device.

☐ 1-Overcurrent bell alarm device.

☐ 1-Operation counter.

☐ 1-4 Stage auxiliary switch, mechanism operated (MOC)

☐ 1-Shutter assembly, of grounded metal, to isolate primary disconnects upon withdrawal of circuit breaker element.

☐ Cable lugs, for connection of ____ cable/phase.

____-Current transformers, _____/5 ampere ratio.

☐ 1-8 Stage cell mounted auxiliary switch, mechanism operated. (MOC)

☐ 1-8 Stage cell mounted cell switch (TOC).

☐ 1-Set insulated copper "run-back" bus for connection of customer's cables to feeder circuit breaker load side primary disconnects.

On the front of the panel will be:

☐ 1-Circuit breaker control switch, miniature rotary type, complete with one red and one green indicating lights.

☐ 1-Ammeter, single-phase, indicating, 180° scale, 2% accuracy.

☐ 1-Ammeter transfer switch, 3-phase.

☐ 1-Current test block.

☐ 1-Key interlock for interlocking circuit breaker with primary switch.

☐ 1-Key interlock for interlocking circuit breaker with main breaker.

TIE BREAKER CELL NO. _____.

____-Type RL- _____ air circuit breaker, ☐ electrically, ☐ manually operated. Mounted on the circuit breaker will be:

☐ 1-Static Trip II solid state overcurrent trip device with Type ☐ TI(OT), ☐ TS(OT), ☐ TSI(OT) tripping characteristics.

☐ 1-Static Trip II solid state overcurrent trip device with Type ☐TI(2T), ☐ TIG(3T), ☐ TS(2T), ☐ TSG(3T), ☐ TSI(2T), ☐ TSIG(3T) tripping characteristics and indicating trip targets.

☐ 1-Set of three current limiting fuses with an interrupting rating of 200,000A symmetrical, plus blown fuse indication and a lockout system to trip circuit breaker upon blowing of any base.

☐ 1-Undervoltage trip device, instantaneous.

☐ 1-Undervoltage trip device, time delay.

☐ 1-Shunt trip device.

☐ 1-Overcurrent bell alarm device.

☐ 1-Operation counter.

☐ 1-4 Stage auxiliary switch, mechanism operated. (MOC)

☐ 1-Shutter assembly, of grounded metal, to isolate primary disconnects upon withdrawal of circuit breaker element.

☐ -Current transformers, _____/5 ampere ratio.

☐ 1-8 Stage cell mounted auxiliary switch, mechanism operated. (MOC)

☐ 1-8 Stage cell mounted cell switch (TOC).

☐ 1-Key interlock for interlocking tie CB with both main CB's.

On the front of the panel will be:

☐ 1-Circuit breaker control switch, miniature rotary type, complete with one red and one green indicating lights.

☐ 1-Ammeter, single-phase, indicating, 180° scale, 2% accuracy.

☐ 1-Ammeter transfer switch, 3-phase.

☐ 1-Current test block.

FUTURE FEEDER CELL NO. _____.

☐ This cell will be equipped for the future addition of a _____ circuit breaker ☐ manually, ☐ electrically operated. (Specify Frame Size).

BLANK CELL NO. _____.

☐ This cell will be blank.

ACCESSORIES

1- Crank for manual operation of the circuit breaker drawout mechanism.

1- Lifting yoke for lifting circuit breaker elements.

1- Quart of touch-up paint.

1- Maintenance closing device for electricity operated circuit breakers.

☐ 1-Test plug, less cable, for drawout watthour meters and/or switchboard class relays.

☐ 1-Portable test set, type PTS-3, for testing of the solid state trip devices.

☐ 1-Overhead breaker lifting device. (Standard for outdoor switchgear.)

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