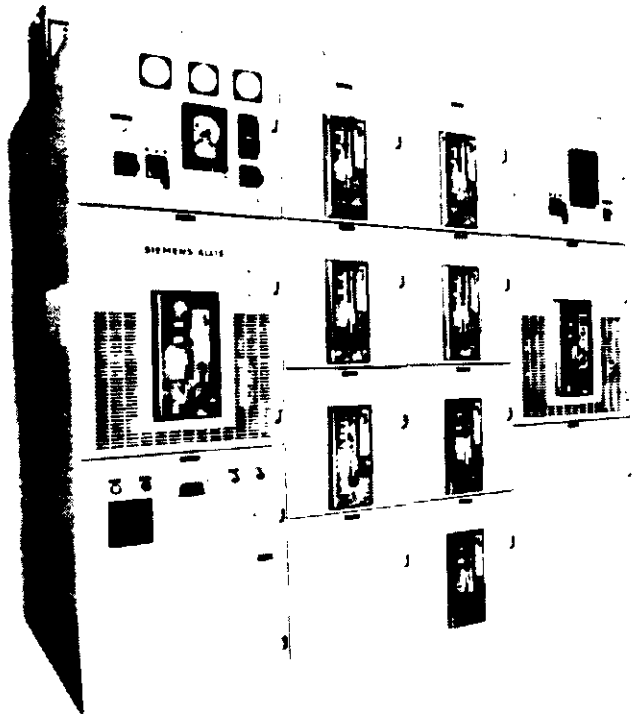
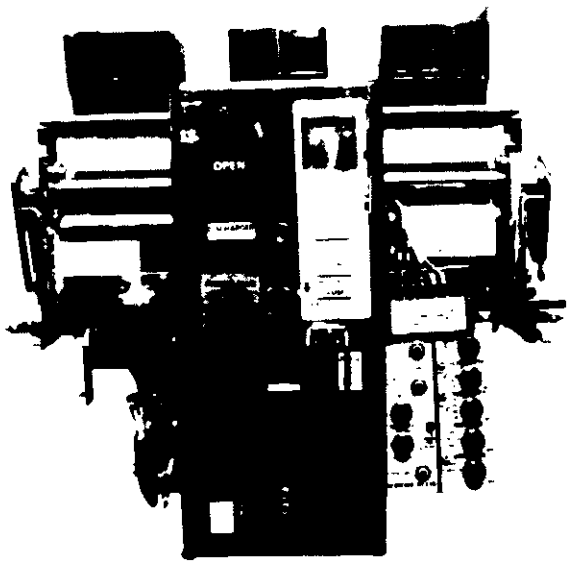
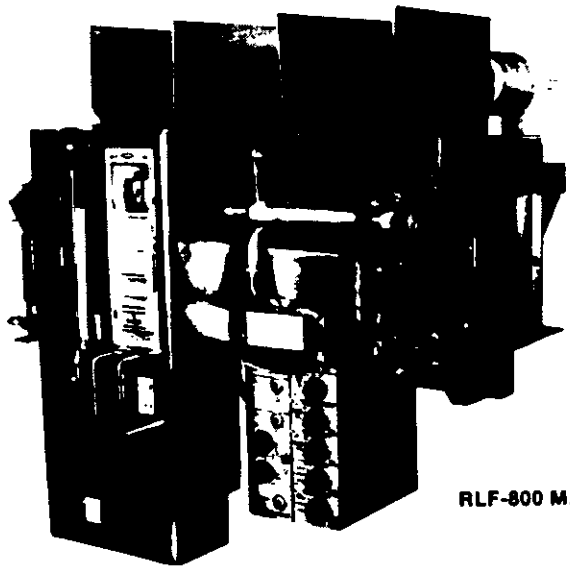
Description





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

- **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

Description

GENERAL INDEX

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
- [illegible]able compartment barriers between adjacent units.
- [illegible]sulated main bus optionally available
- [illegible]etal barriers for incoming line, bus and cable compartments optionally available
- [illegible]condary wire troughs, with optional covers.
- 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.

[illegible]connected-test- [illegible] Mounted on the station-

Description

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

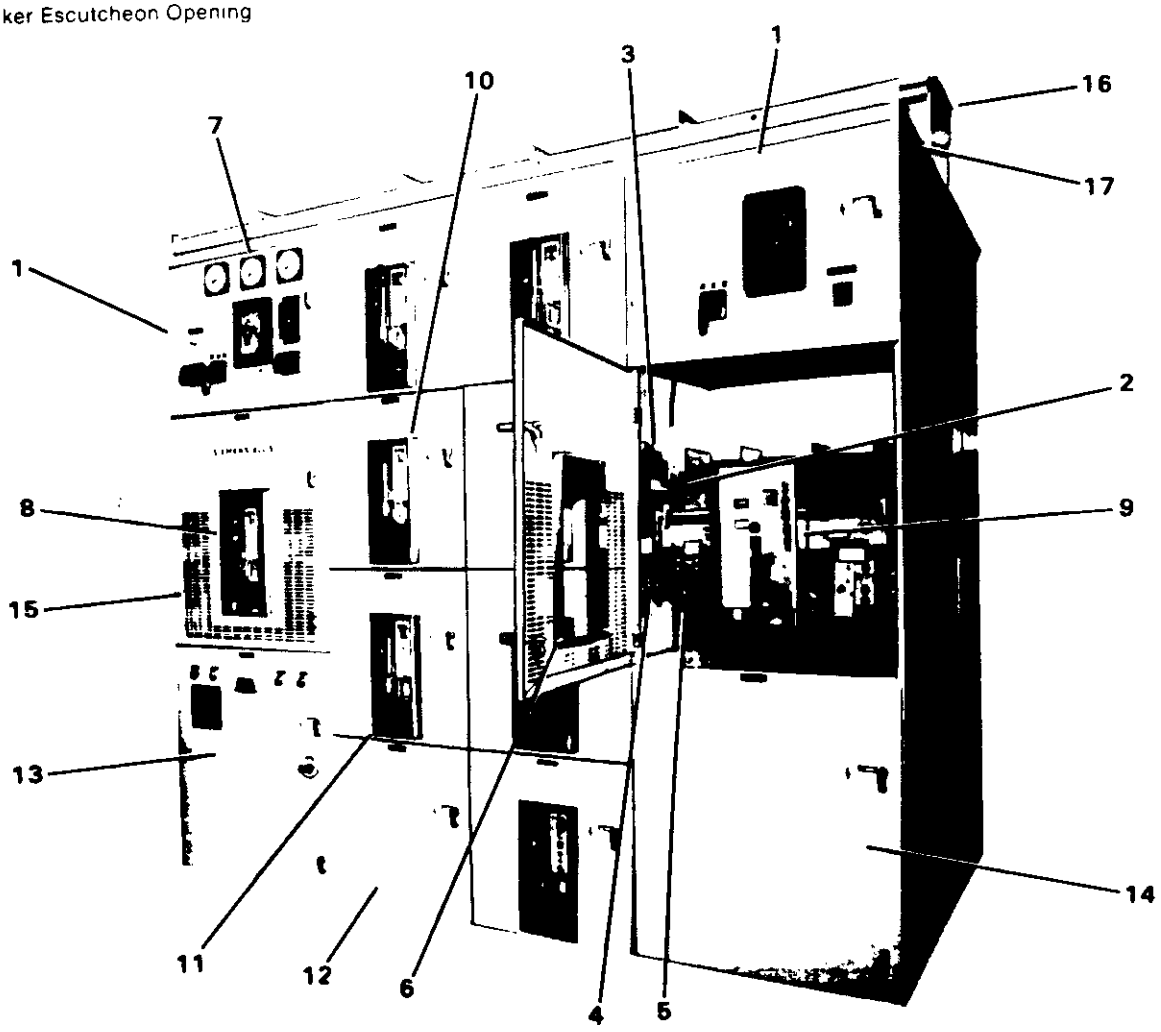


Figure 1. Typical Group Indoor Switchgear.

Description

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. Not Bolting Provisions for Shipping Split or Future Ex

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

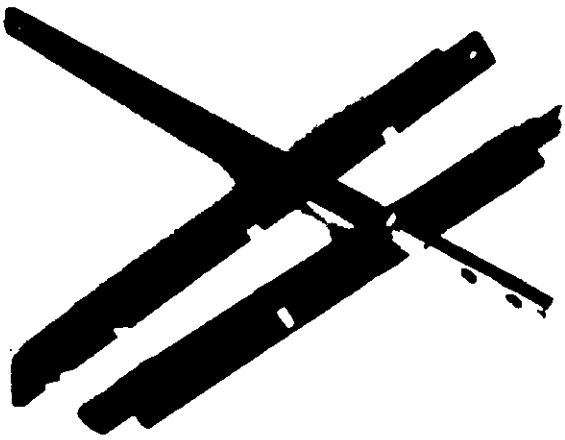


Figure 4.

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 outside the compartment without the need for additional extension 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.

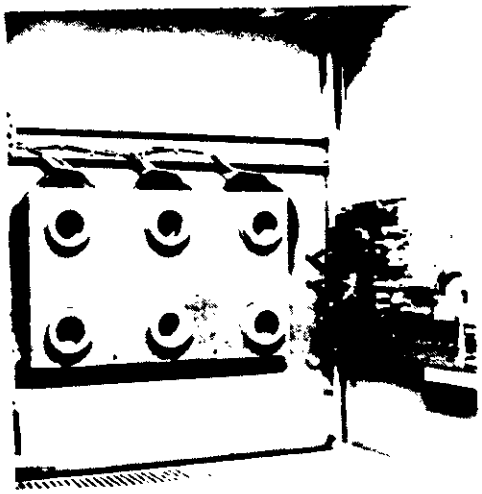


Figure 8. Typical Compartment for RL-3200 or RL-4000. Note

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.

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.

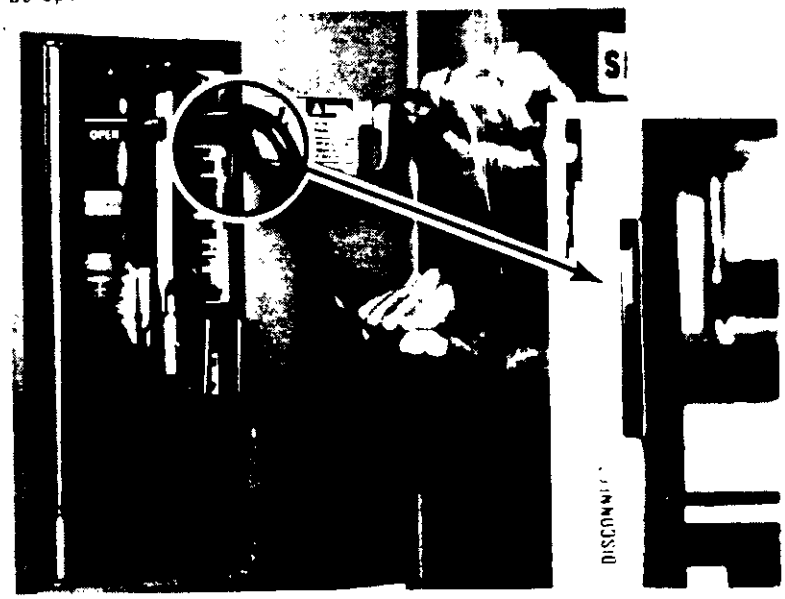


Figure 10. Breaker Racking Between Connected-to-Test Position.

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.

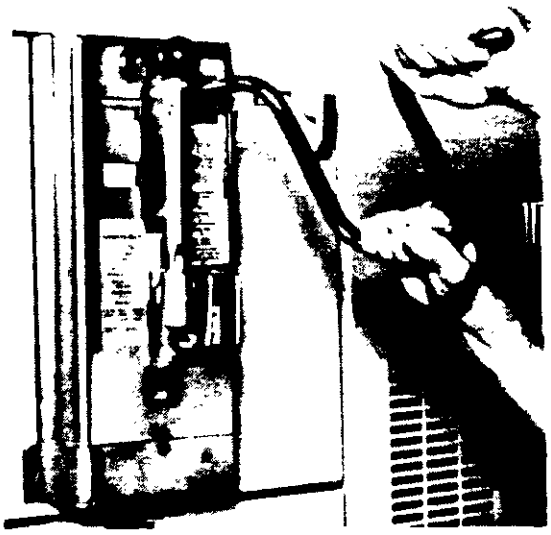


Figure 11. Breaker Racking Between Test-to-Disconnect Position.

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

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
				185

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)					Relay Class
	B-0.1	B-0.2	B-0.5	B-1.0	B-2.0	
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)					Relay Class
	B-0.1	B-0.2	B-0.5	B-1.0	B-2.0	
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

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 10. Watthour meters are switchboard type, and provided with rawout 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.

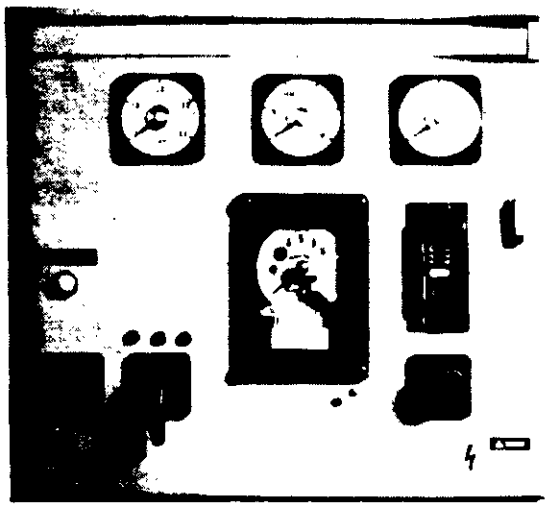


Figure 12. Typical Front Panel of Main Metering Compartment.

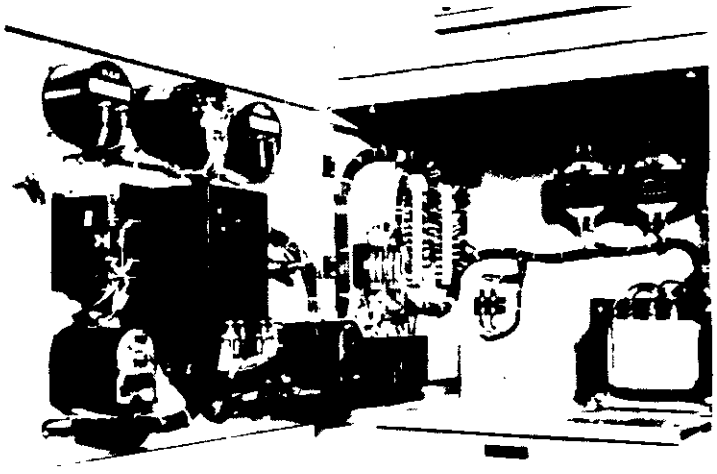


Figure 13. Interior View of Typical Main Metering Compartment with Potential and Control Power Transformers and Optional Wire-End Identification Markers.

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.

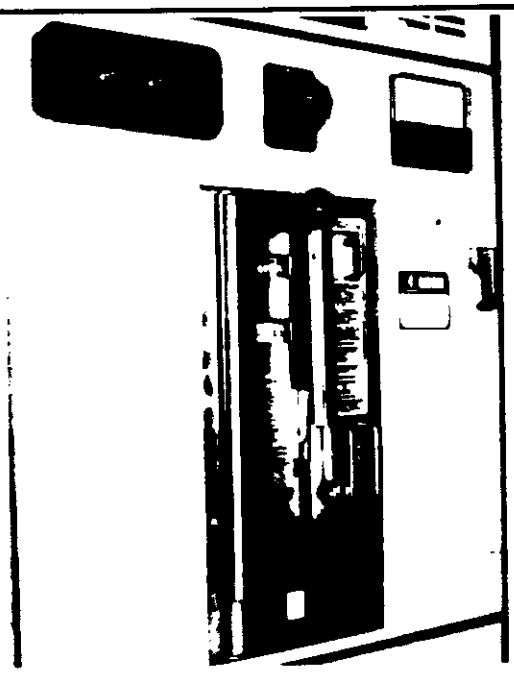


Figure 14.

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

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.

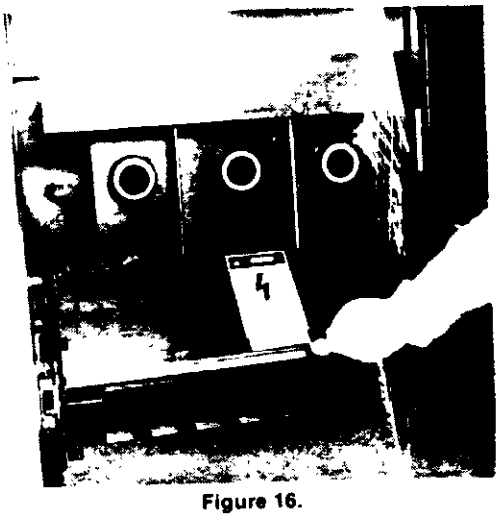


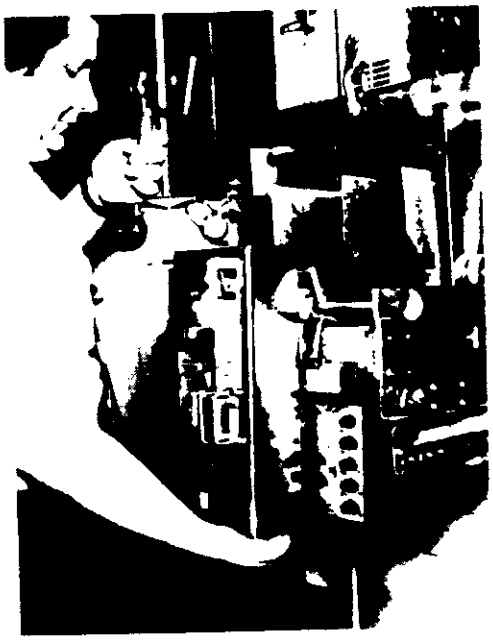
Figure 16.

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.



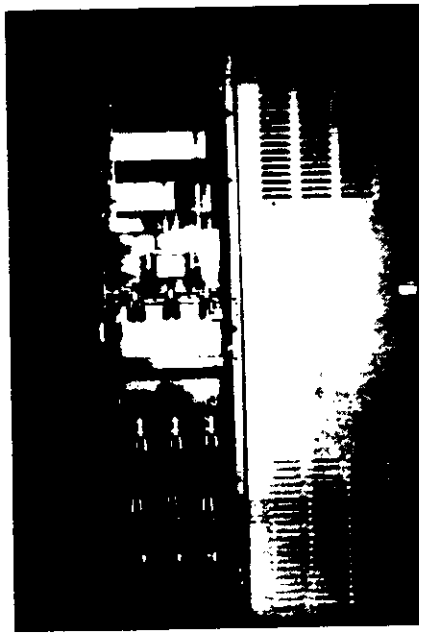


Figure 18. Rear Hinged Doors Offer Eas

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.

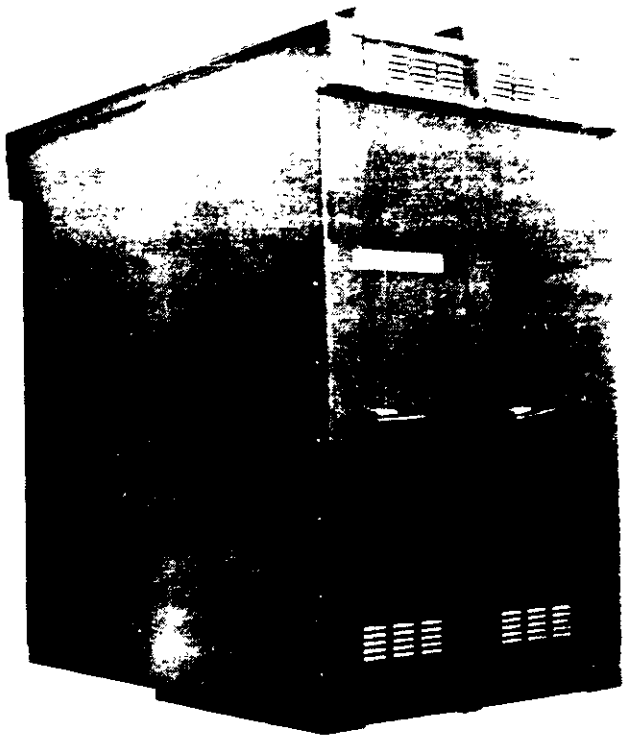


Figure 19. Typical Outdoor Construction. Note Front Aisle Extension on Each End.

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.

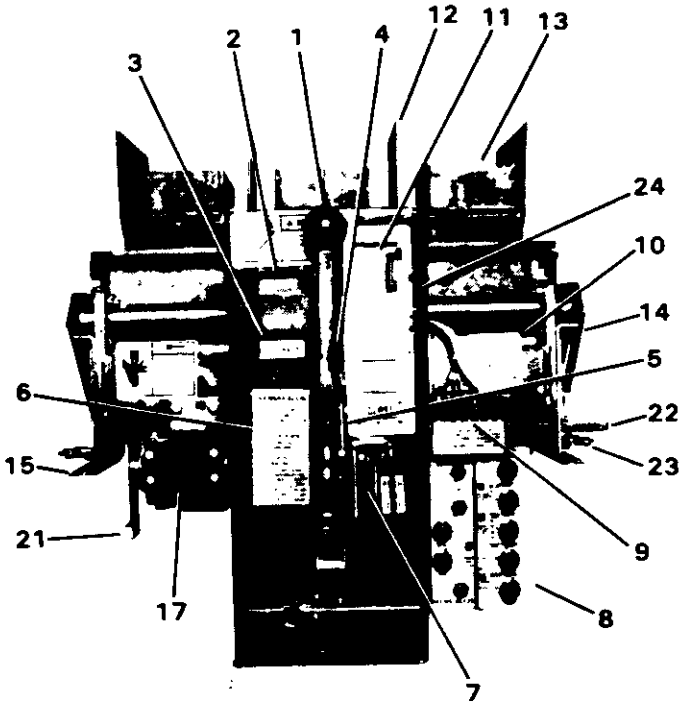


Figure 20. RL-800 Manually Operated Circuit Breaker.

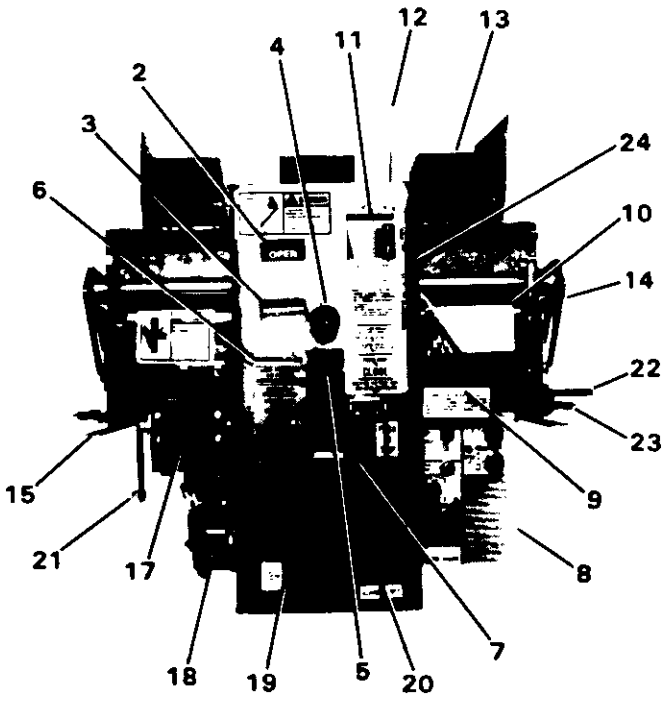


Figure 21. RL-800 Electrically Operated Circuit Breaker.

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.

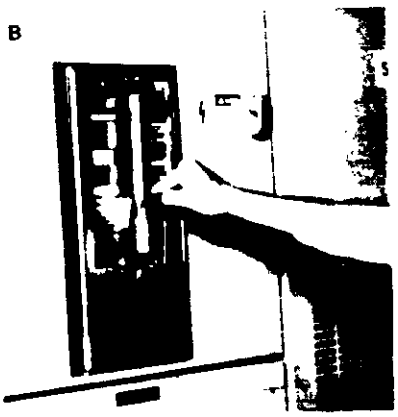
As an option to electrically operated stored energy breakers, a manual spring charging handle as furnished on manually operated breakers can also be supplied, if specified

MANUAL OPERATION

A

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

B



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

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.

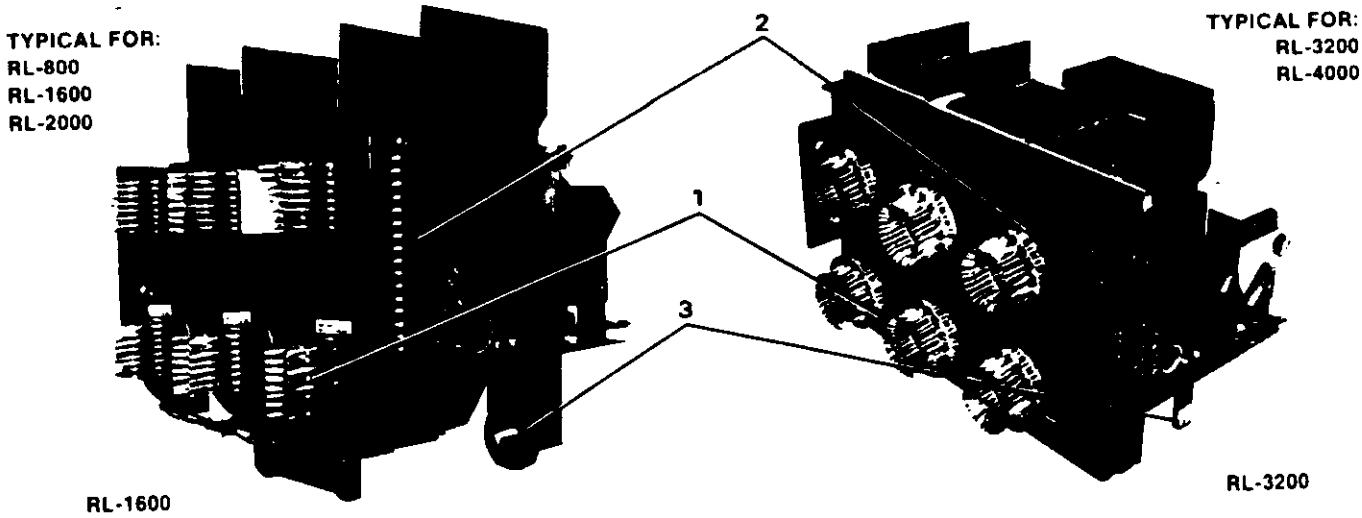


Figure 22. Disconnects Provide the Drawout Capability of:

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 when 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.

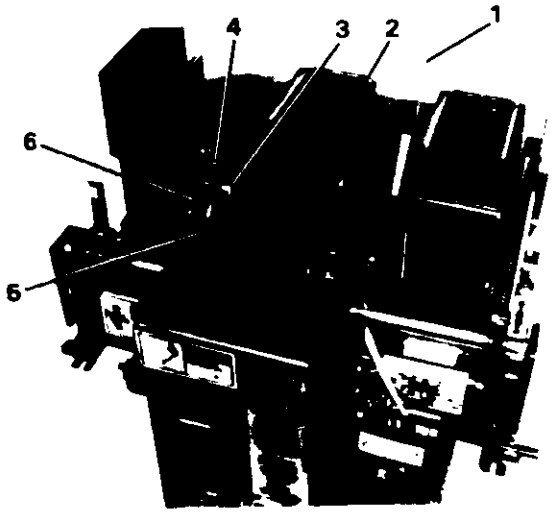


Figure 24. Circuit Breaker Partly Disassembled to Show:

1) Interpole barriers of glass polyester.

2) Arc chute.

3) Stationary main contacts.

4) Stationary arcing contacts.

5) Movable main contacts.

Fused Circuit Breakers

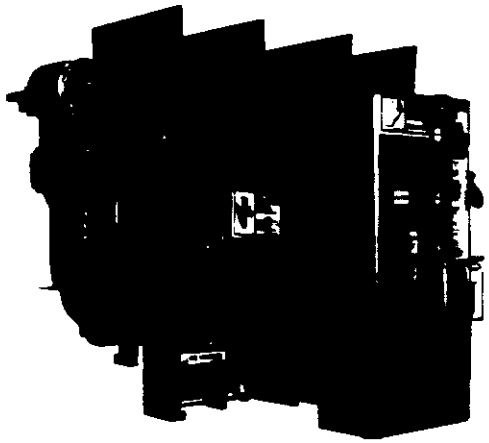
The 800, 1600 and 2000 ampere frame size circuit breakers are available with integrally mounted current limiting fuses, to increase their interrupting rating and/or limit the short circuit current to downstream equipment. The fuses are bolted in series with the upper set of primary disconnects. An open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



Description

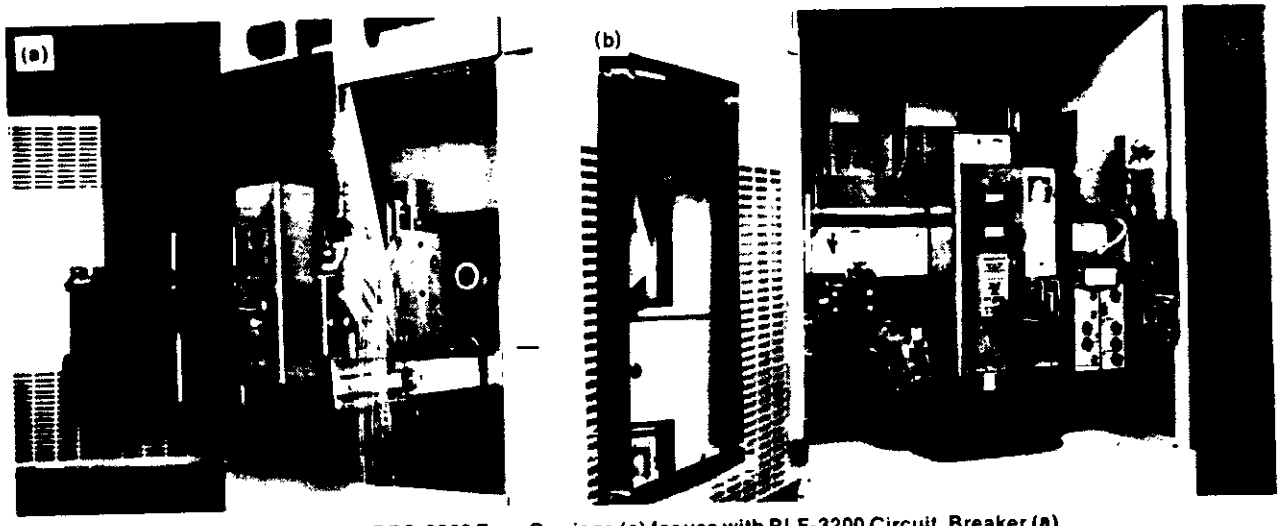


Figure 26. Separate RFC-3200 Fuse Carriage (a) for use with RLF-3200 Circuit Breaker (a).

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.

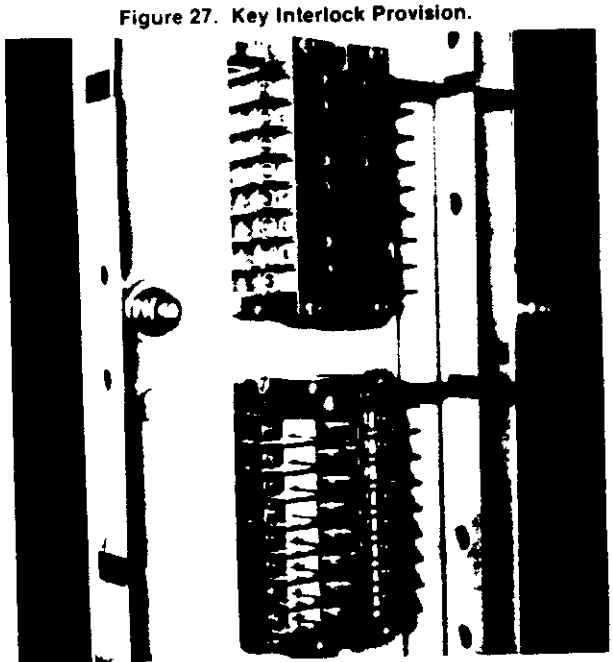


Figure 28. MOC and TOC Switches. Cover Removed to Show Field Convertible Contacts.

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

Volts	DC				AC	
	24	48	125	250	120	240

① For breaker mounted switches, limited to 20 A. continuous rating of standard

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 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.

Table 1. Shunt Trip Coil Rating

Control Voltage			Shunt Trip (Amperes)
Nominal		Operating Range	Inrush
DC	24	14-26	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

Operation Counter (Option)

Mounted beneath the breaker mounted auxiliary switch, this 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.

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.

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

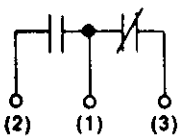
The bell alarm switch is initiated by the operation of the Static Trip Device, and functions to operate a switch.

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

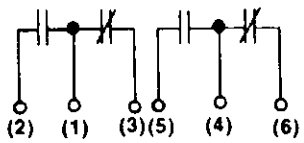
A single pole double throw (SPDT) or a double pole double throw (DPDT) switch is available. Table 3. The switch operator must be reset either manually, or optionally by electrical reset. The contacts of the bell alarm switch can be connected in series with the breaker closing coil, to provide a lockout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

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

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-

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	120	104	36

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.

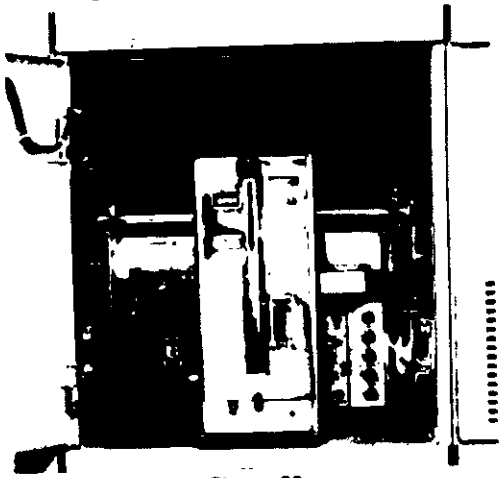


Figure 29.

Tripping Transformers

The tripping system is completely contained on the circuit breaker. The power for tripping the breaker and for operating the [illegible] is drawn from the transformer mounted in the cable compartment. A signal, proportional to prim[illegible] current is taken from these same tripping transformers. This [illegible]nal is applied to the static trip device and causes it to operate [illegible] tripping actuator to trip the breaker in accordance with a [illegible]re-set time delay versus current magnitude relationship.

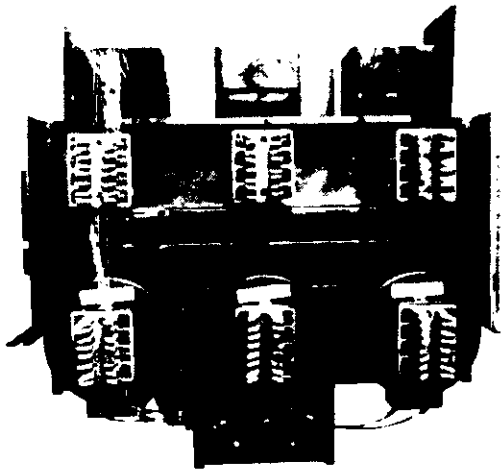
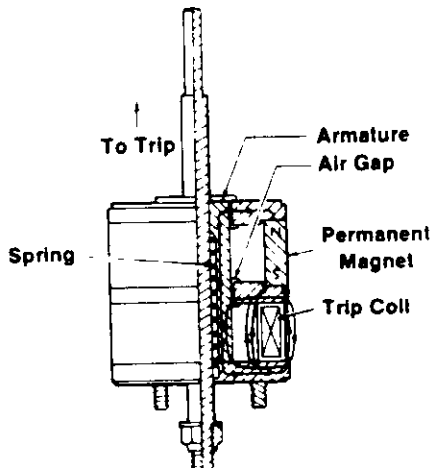


Figure 30. Tripping Transformers Furnish Input Signal to Trip Device in Proportion to Primary Current.

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.



Description of Operation — Static Trip II*

Three-Phase Current System

A [illegible] static trip system is shown below. Figure [illegible] and signal transformers step the secondary [illegible] transformers down to a level suitable for [illegible]. The power supply transformers, unlike the [illegible] are designed to maintain a constant ratio and [illegible] saturate so as to limit maximum power [illegible] device.

[illegible] current relationship of the long time delay circuit is [illegible] as follows: a pulse generator and time shaping [illegible] combination produce a train of pulses whose frequency is proportional to approximately the square of the [illegible] current. Both the pulse generator and the counter are [illegible] when the signal is below the pickup level. If the signal [illegible] the pickup level, both the pulse generator and counter are released, the counting of pulses begins. The counter is a [illegible] binary counter which produces an output from the first stage after one count, from the second stage after two counts, [illegible] third stage after four counts, and so on up to 64 counts [illegible] last stage. The time band switch selects the counter stage [illegible] is connected to operate the tripping actuator through the [illegible] 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.

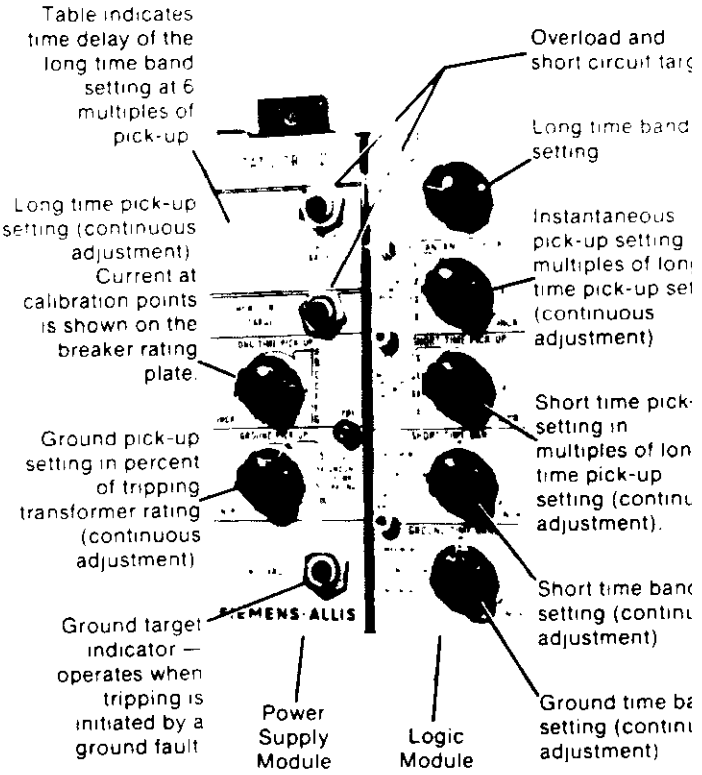


Figure 33.

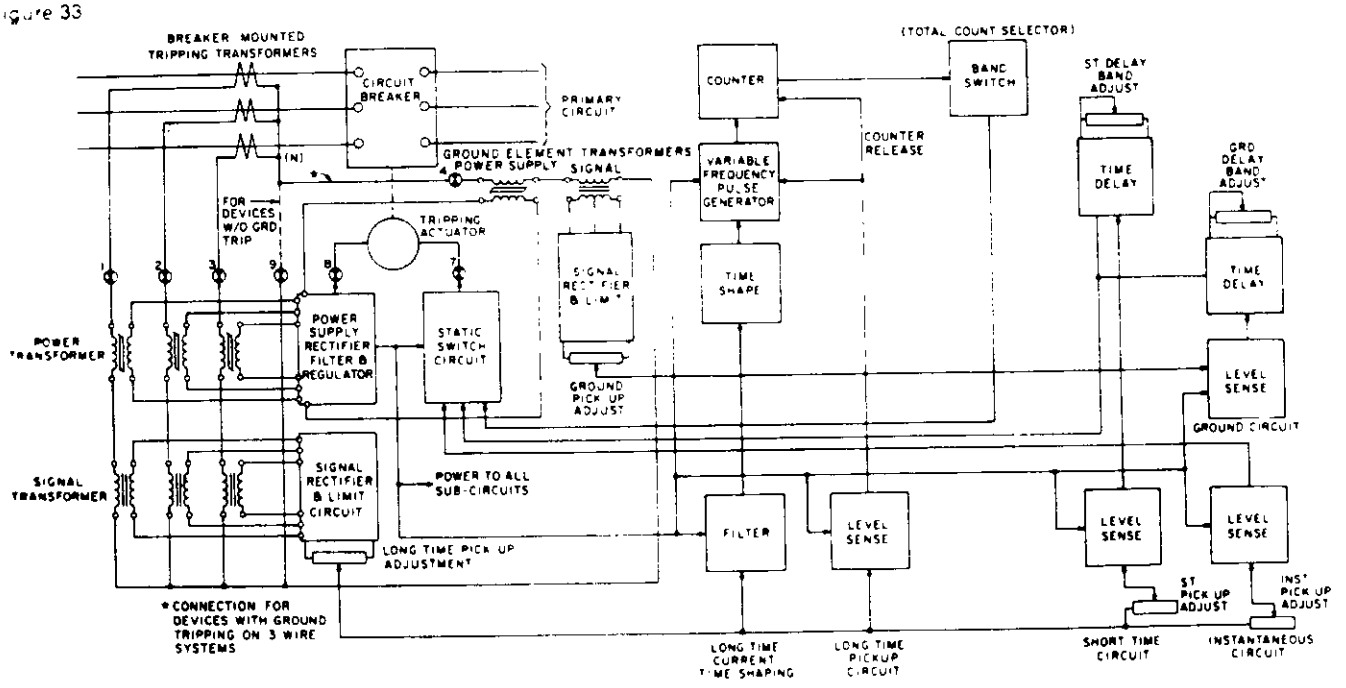


Figure 32. Block Diagram of Static Trip II*

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 long 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.

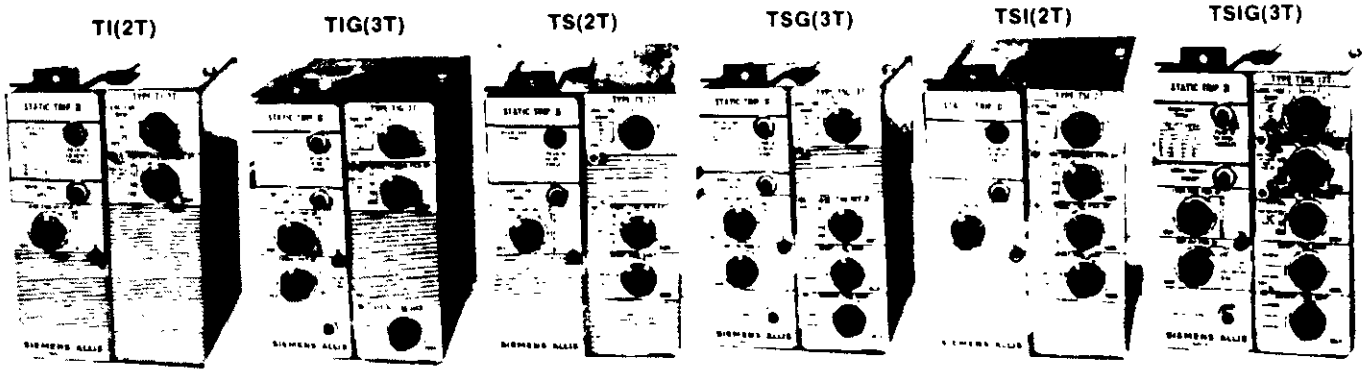


Figure 34. Typical Static Trip II* Trip Devices

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. 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.

Figure 35.

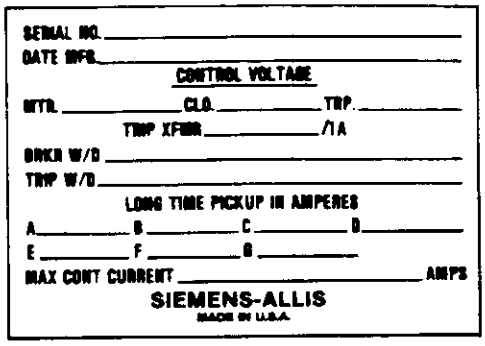


Figure 36. Breaker Rating Plate.

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.

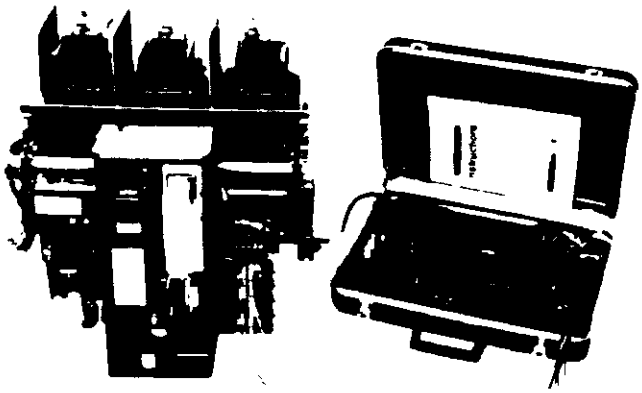


Figure 37. Portable Test Set is Shown Being Used on Breaker Removed from its Cubicle. The Test Set May Also Be Used with the Breaker in "TEST" or "DISCONNECTED" Positions in its Cubicle.

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 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

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.

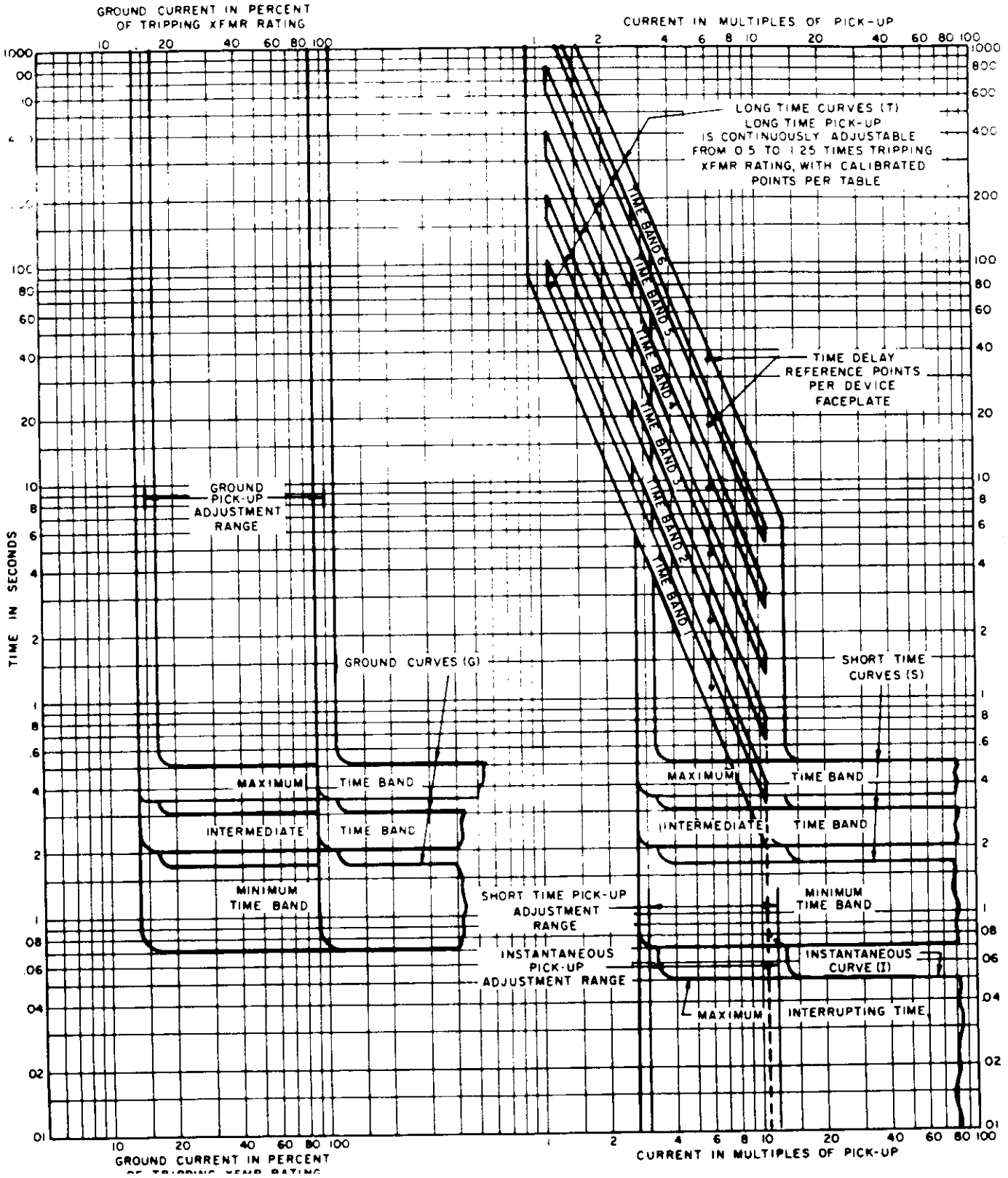
Band 1 — 1.12 seconds Band 4 — 9 seconds
Band 2 — 2.25 seconds Band 5 — 18 seconds
Band 3 — 4.5 seconds Band 6 — 36 seconds

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.

... fault recognition is 25 amperes for


GROUND CURRENT IN PERCENT OF TRIPPING XFMR RATING
CURRENT IN MULTIPLES OF PICK-UP
LONG TIME CURVES (T)
LONG TIME PICK-UP IS CONTINUOUSLY ADJUSTABLE FROM 0.5 TO 1.25 TIMES TRIPPING XFMR RATING, WITH CALIBRATED POINTS PER TABLE
TIME BAND 6
TIME BAND 5
TIME BAND 4
TIME BAND 3
TIME BAND 2
TIME BAND 1
TIME DELAY REFERENCE POINTS PER DEVICE FACEPLATE
GROUND PICK-UP ADJUSTMENT RANGE
TIME IN SECONDS
GROUND CURVES (G)
SHORT TIME CURVES (S)
MAXIMUM
TIME BAND
INTERMEDIATE
TIME BAND
MINIMUM TIME BAND
SHORT TIME PICK-UP ADJUSTMENT RANGE
INSTANTANEOUS PICK-UP ADJUSTMENT RANGE
INSTANTANEOUS CURVE (I)
MAXIMUM
INTERRUPTING TIME
GROUND CURRENT IN PERCENT OF TRIPPING XFMR RATING
CURRENT IN MULTIPLES OF PICK-UP

Description

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

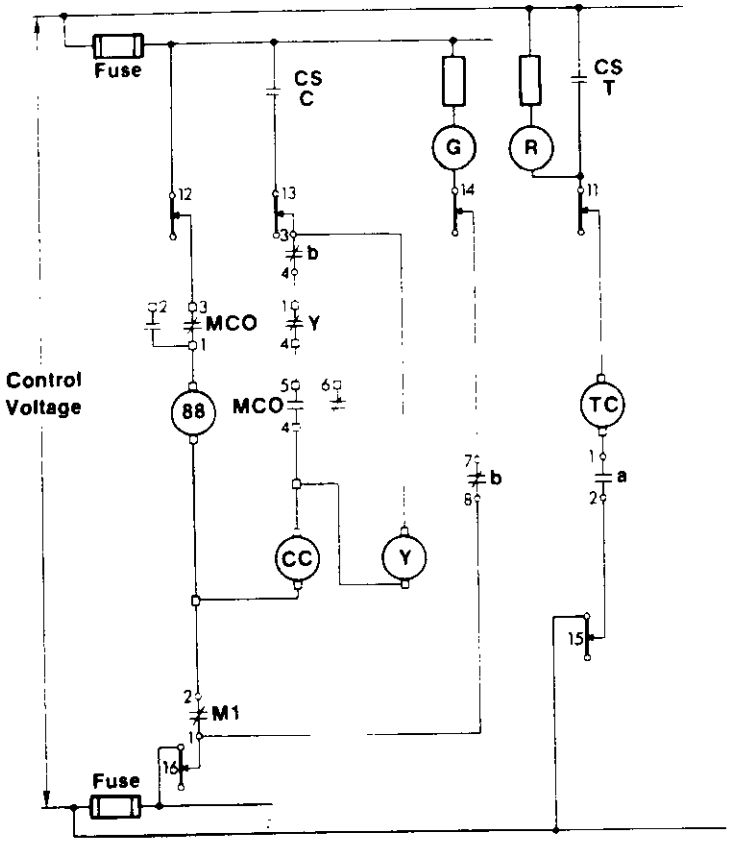
Table 1. Circuit Breaker Operating Time (60 Hertz Basis) and Data

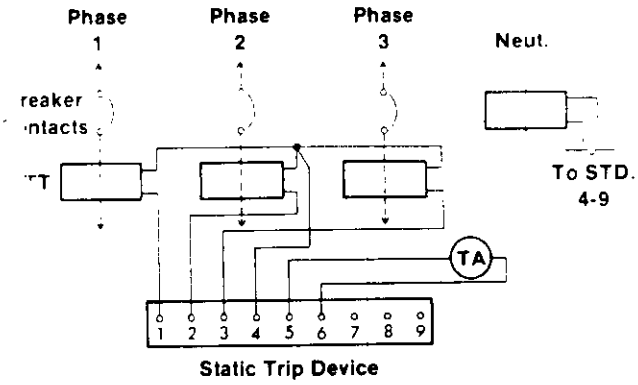
	RL-800 RLX-800 RLF-800	RL-1600 & 2000 RLX-1600 RLF-1600 & 2000	RL-3200 RLF-3200	RL-4000 RLF-4000
Time from Energizing Shunt Trip Coil Until (Cycles)				
Contacts Part	1 5-3 0	1 25-3 0	1 0-3 0	2.0-3 0
Contacts Fully Open	2 2-3.7	2 2-3 5	2 2-3 5	3.0-4 0
Time from Energizing Closing Control Relay Coil (Cycles)				
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

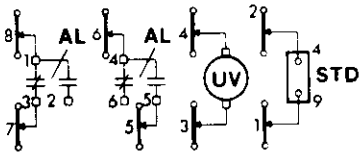
Nominal Control Voltage	120 VAC	240 VAC	48 VDC	125 VDC	250 VDC
Spring Charge Motor Voltage Range	104-127	208-254	38-56	100-140	200-380
Current of Spring Charge Motor					
Cutoff Value — Amperes	0 48	0.36	1 16	0.45	0.21
Inrush Value — Amperes	3 3	1.75	7 5	3 97	1.92
Shunt Trip and Closing Coil Voltage 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

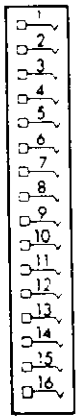
Description



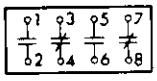


Static Trip Device

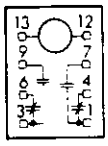




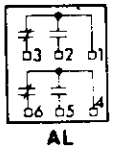
Secondary Disconnect



Aux. Switch



"Y" Relay



AL Trip Alarm

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

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 supplied at 600V or 480V have the same short circuit interrupting capabilities regardless of the type of trip elements.

Basis of Application Tables

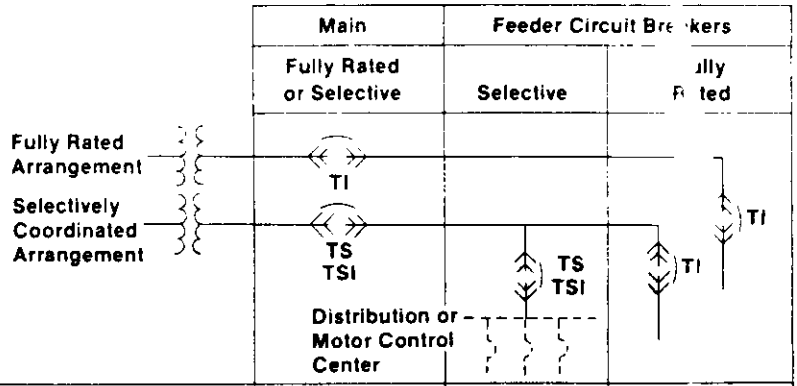
The value of short circuit currents are calculated on basis of:

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 28-32 for Application Tables)

Description

Table 1. Application Table 480 Volts, Three Phase

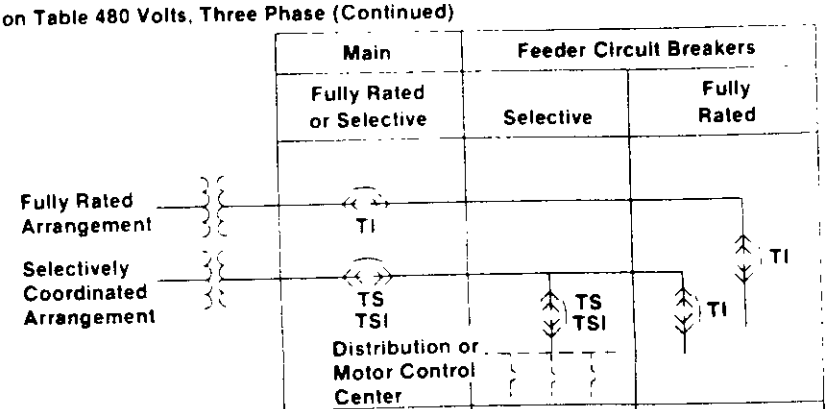


Transformer Rating 3-Phase kVa and Impedance Percent	Maximum Short-Circuit Mva Available from Primary System	Full Load Continuous Current (amperes) ①	Short-Circuit Rating Symmetrical Current (amperes)			Long-Time Instantaneous or Long-Time Short-Time	Long-Time Short-Time	Long-Time Instantaneous
			Transformer 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	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)

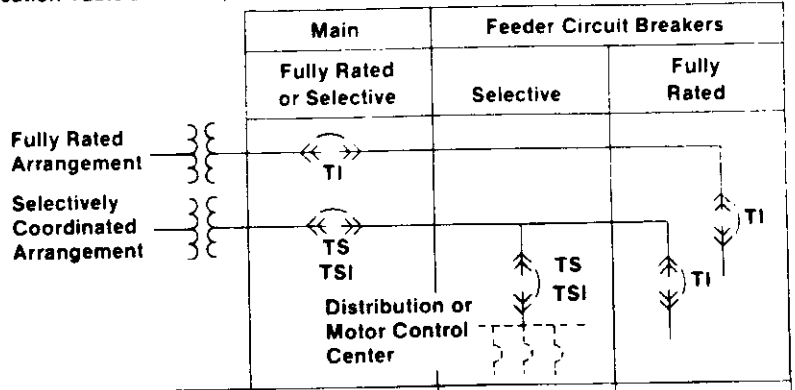
Table 1. Application Table 480 Volts, Three Phase (Continued)



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)			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
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	3607②	30700 41200 46500 51900 56800	14400	45100 55600 60900 66300 71200	② RL-4000	RLX-1600 RL-3200	RLX-1600 RL-3200

Description

Table 2. Application Table 208 Volts, Three Phase

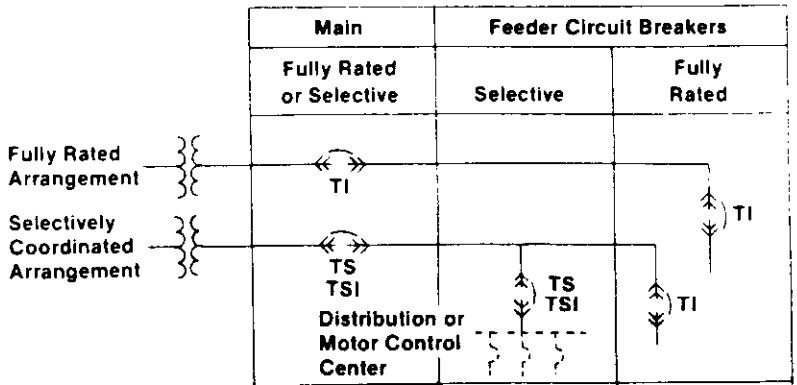


Transformer Rating 3-Phase kVa and Impedance Percent	Maximum Short-Circuit Mva Available from Primary System	Full Load Continuous Current (amperes) ①	Short-Circuit Rating Symmetrical Current (amperes)			Long-Time Instantaneous or Long-Time Short-Time	Long-Time Short-Time	Long-Time Instantaneous
			Transformer 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	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	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-800
							RL-1600	RLX-800
							RLX-1600	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

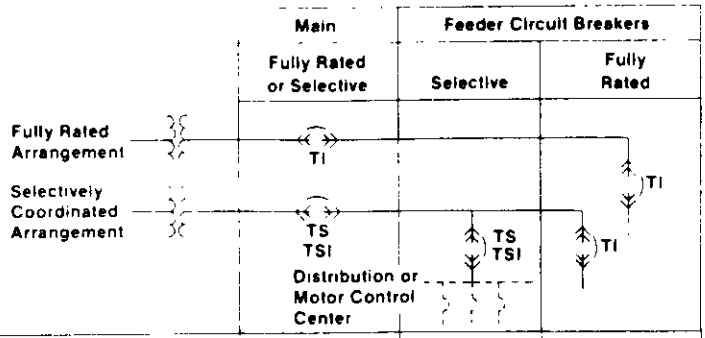
Table 3. Application Table 240 Volts, Three Phase



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
			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	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-800
							RL-1600	RLX-800
							RLX-1600	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-1600
							RL-4000	RL-3200

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

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. Lineups 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 2. 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.

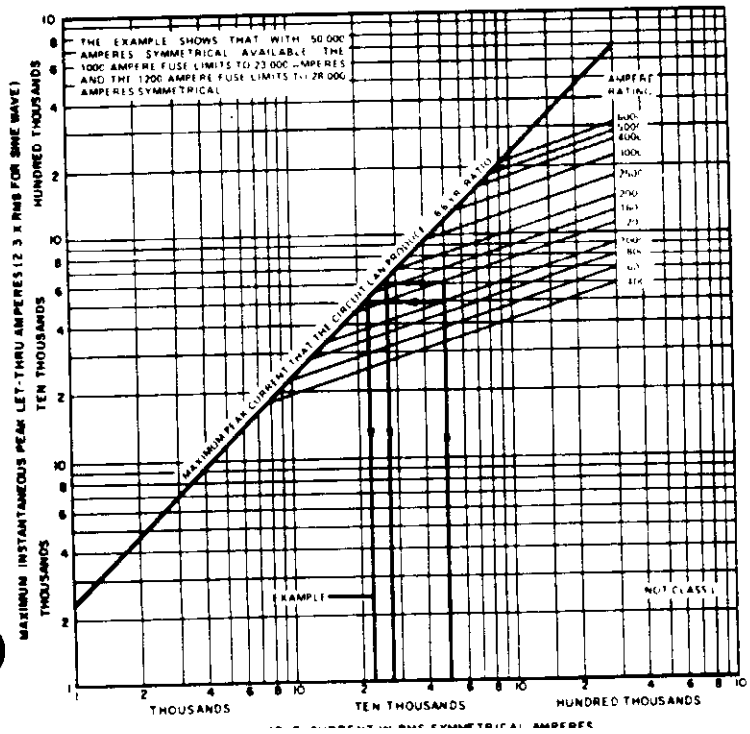
   a A breaker, applied at 90-100% of its frame size continuous current rating, should not use a fuse less than 200% of its frame size rating.

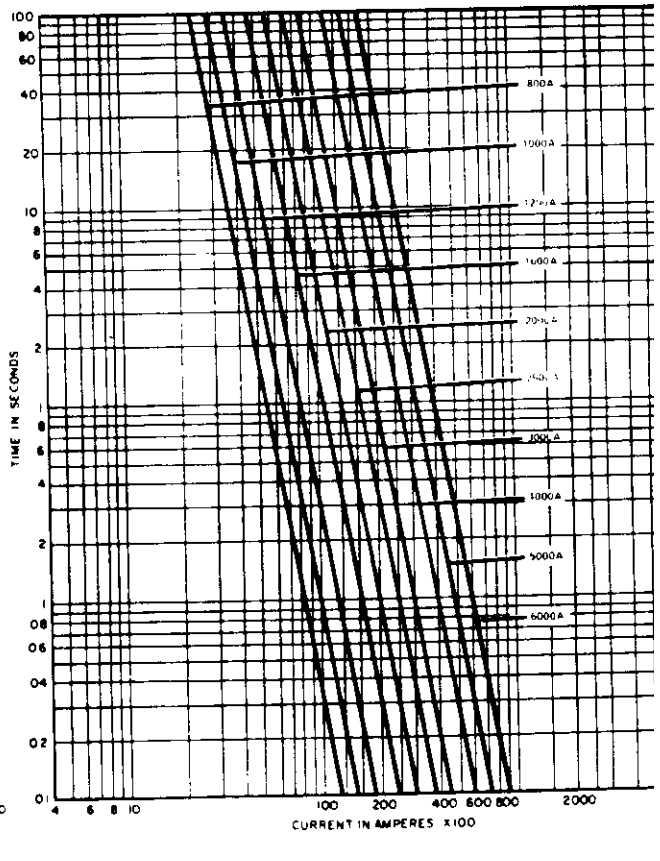
   b A breaker, applied at 80-90% of its frame size continuous current rating, should not use a fuse less than 150% of its frame size rating.

   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 the coordination.





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.