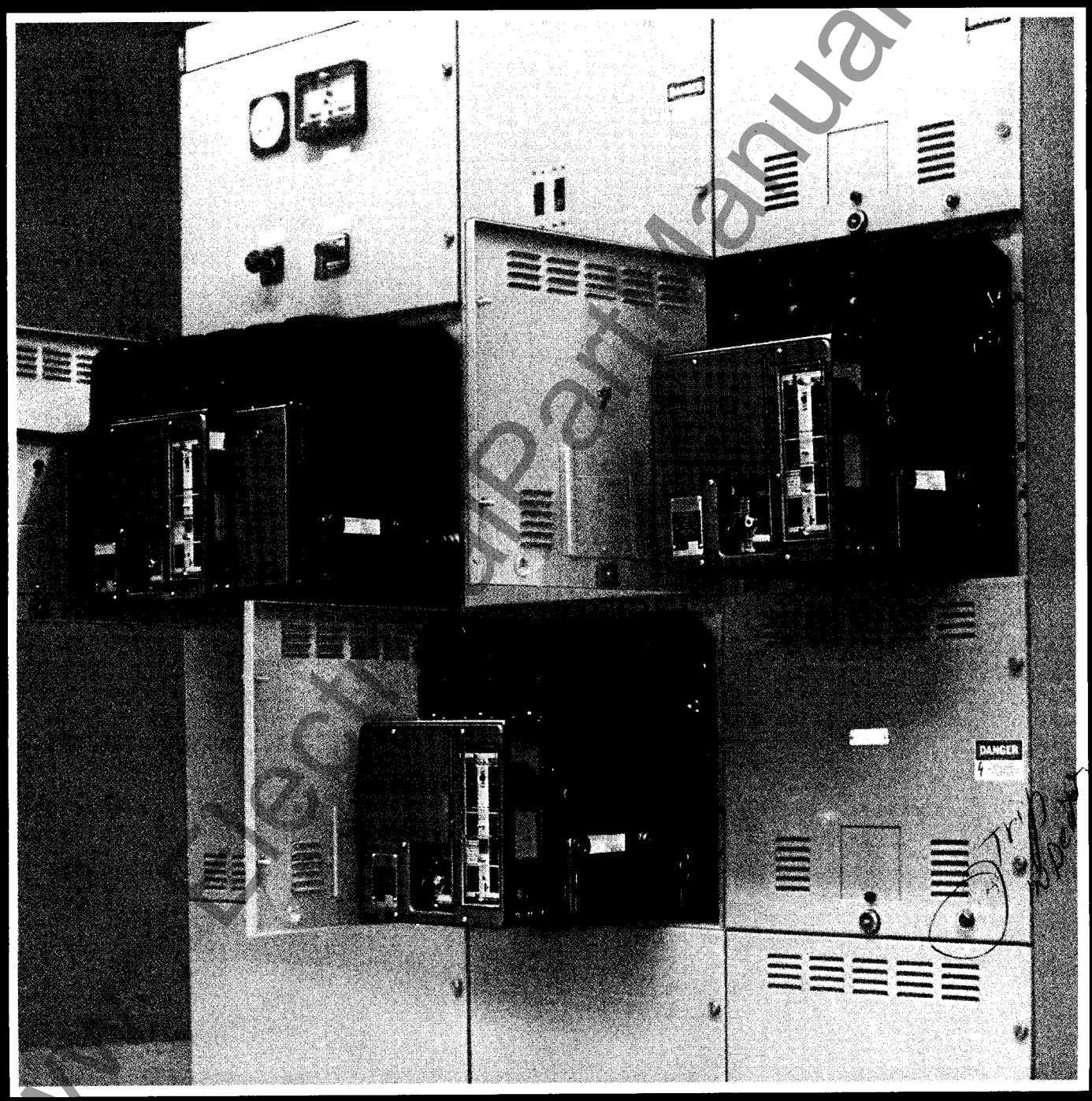
Bulletin 9.10-1A

Type LK
Low Voltage AC Power Circuit Breakers

208 to 600 Vac / 30 kA to 200 kA / up to 4200A. Continuous



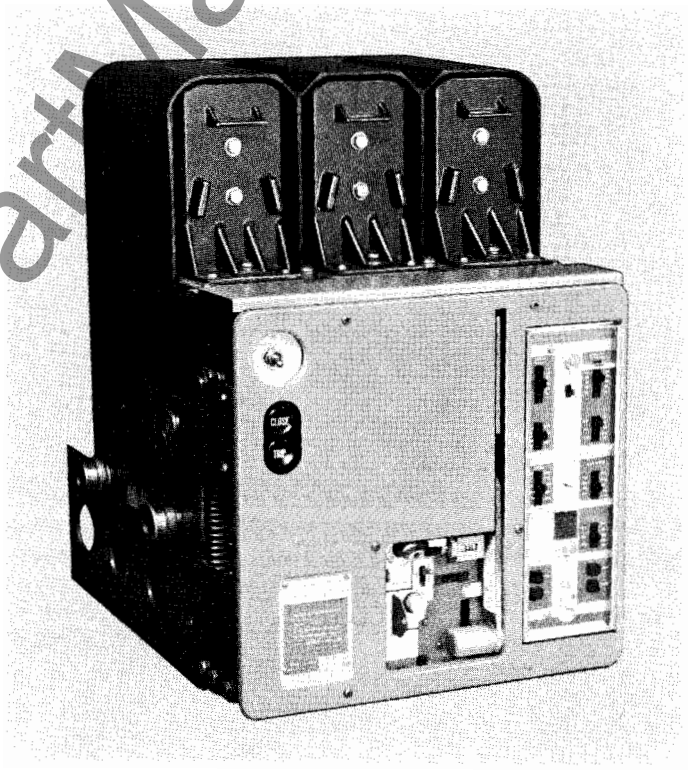
GOULD-BROWN BOVERI

Product Leadership

Since the turn of the century, I-T-E has stood for leadership in designing, engineering and manufacturing of protective electrical devices. K-Line power circuit breakers were the industry's standard of excellence. Today, with the new I-T-E LK circuit breaker family, Gould-Brown Boveri has advanced these standards to new heights.

LK POWER CIRCUIT BREAKERS MAINTAIN I-T-E QUALITY TRADITION WITH THESE PROVEN FEATURES:

- **Same time-proven reliability**
- **Stored energy principle**
- **Air magnetic arc interruption principle**
- **Drawout maintenance flexibility**
- **Rugged cradle design**
- **Automatic secondary control contacts concept**
- **Safe and reliable design, including high-quality polyester-glass insulation**
- **Proven expertise, including solid-state trip systems**
- **Selection of manual or electrical operation.**
- **Rigorous testing program**
- **Seismic qualification**



The new LK 16 with 1600A continuous and interrupting capacity of 50,000 to 65,000 A.

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Accessories	14
Selection and Application	18
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THREE MEMBERS OF THE LK FAMILY NOW OFFER PROTECTION TO 200,000A IN A SINGLE, TOTAL BREAKER DESIGN

The entire family of I-T-E LK power circuit breakers is designed with care and forethought to fill your total requirements today, tomorrow, and for years to come. Totaly new, LK breakers meet complex and ever-growing needs for electrical protection and versatility of application and control.

LK Standard interrupting ratings from 30,000 to 130,000A, 800 to 4200A continuous.

LKE Extended interrupting ratings from 50,000 to 130,000A, 800 to 4200A continuous.

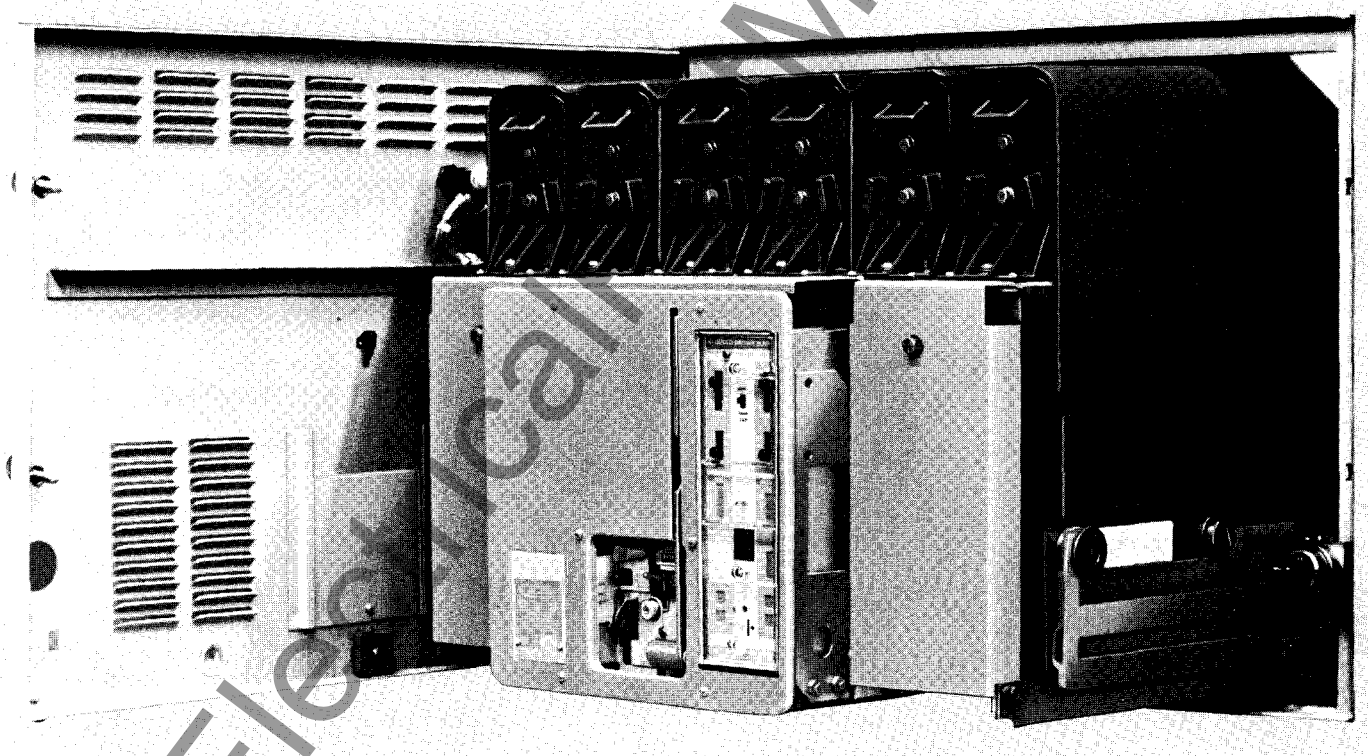
LKD Integral fused current limiting, 200,000A interrupting rating, 800 to 4000A continuous.

TWO PHYSICAL SIZES, FIVE CONTINUOUS RATINGS

All LK and LKE frame sizes have the same depth dimensions for compartment standardization. LKD circuit breakers are 6 inches deeper. Two compartment widths (20 and 32 inches) are recommended to accommodate all the circuit breakers. Uniform heights of the new LK circuit breaker family enables four-high construction for all frame sizes.

Commonality of parts throughout the LK family provides the additional benefit of many interchangeable replacement parts eliminating the need for large renewal parts inventory.

Larger size (below) is 2500, 3200 and 4200 A. Smaller size (left on facing page) is 800 and 1600 A



The new LK32 with 3200A continuous and interrupting capacity of 100 to 130 kA

RATINGS

Circuit Breaker Type	Maximum Continuous A	Symmetrical RMS A Interrupting Capacity		
		240V	480V	600V
LK (5 ratings)	800 to 4200	42,000 to 130,000	30,000 to 100,000	30,000 to 100,000
LKE (5 ratings)	800 to 4200	50,000 to 130,000	50,000 to 130,000	42,000 to 120,000
LKD (5 ratings)	800 to 4000	200,000	200,000	200,000

LK, The Total Breaker

WHY THE NEW LK IS THE TOTAL BREAKER

Gould-Brown Boveri engineers started with clean sheets of paper and designed for this decade's increasingly sophisticated electrical systems with high load densities and complex coordination needs. The result is the LK family with new functional ampacity, economically available with 2500A, 3200A and 4200A continous ratings, with higher interrupting ratings for all frame sizes. These are among the features that give LK, LKE and LKD circuit breakers broader selectivity and overall usability.

The LK Power Shield® solid state trip system is totally self-powered and provides complete choice of settings, including the exclusive ampere range selector, as well as common pickup and time delay settings. In addition, up to a maximum of four targets are available, one for each separate trip element specified.

15 OUTSTANDING LK FEATURES

- Higher Interrupting Ratings
- Functional Ampacity
- Solid-State Trip System
- Ampere Range Selector
- Automatic Trip Indication
- Field Test Features
- Two Step Stored Energy Mechanism
- Uniform Cradle Depths
- Three Cycle Closing
- Main and Arcing Contact Design
- Integral Manual Spring Charging Handle
- Parts Commonality
- Cradle Mounted Accessories
- Safety Shutter (Optional)
- Accessibility

Circuit breaker application has been expanded greatly by the availability of the 2500, 3200, and 4200 A frame sizes. The addition of the new extended interrupting rating LKE breakers makes this family the most flexible design ever offered. The familiar cradle design provides complete freedom in applying LK, LKE and LKD circuit breakers to a variety of switchgear applications.

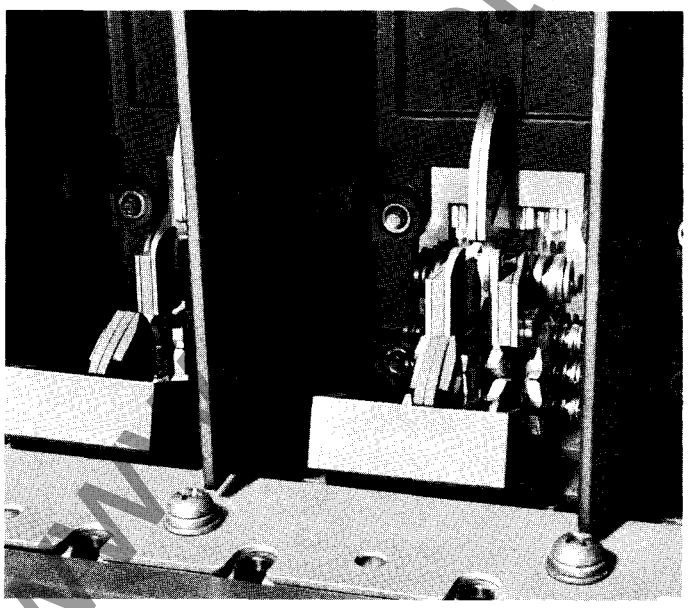
CONVENIENCE, PROTECTION, EFFICIENCY– FEATURES YOU WANT AND NEED

Convenient controls—all clustered in one place, next to built-in charging handle with two-step, stored energy release mechanism.

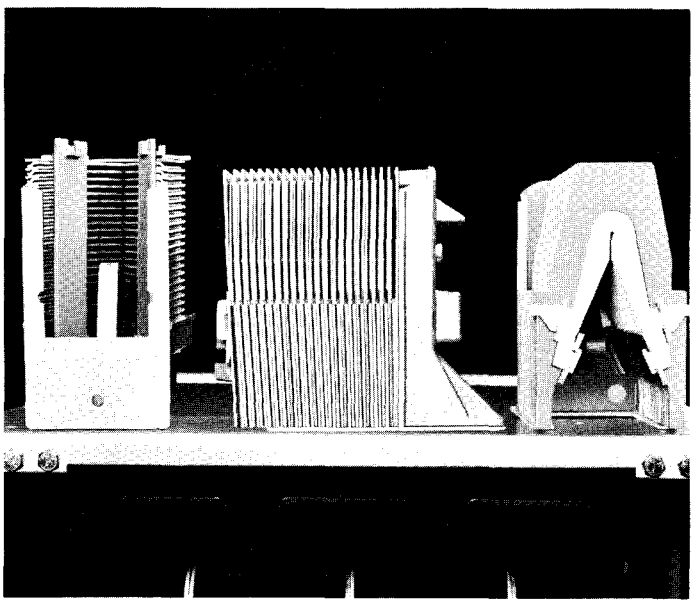
Solid-state tripping mechanism—any or all protective elements available in solid state for maximum protection and coordination.

Contact Structures—main and arcing contact structures are a completely new design across the entire LK family of circuit breakers. Contact parts are common to all circuit breakers. The 1600, 2500, 3200 and 4200 ampere frame sizes use multiple sets of the same contact structures with minor modifications. This design features self-aligning, self-cleaning, wiping action main and arcing contacts for more uniform closing and superior service life. The arcing contacts are made of a durable, high temperature alloy which has both high conductivity and arc resisting properties. The main contacts are heavy silverplated copper. The contact structure is mounted on an impact resistant wraparound base molding which serves as an insulated barrier between current carrying parts and the grounded frame.

Arc chutes—the LK, LKE and LKD arc chutes employ an I-T-E proven design for improved arc extinction in a minimum amount of space. A system of baffles and deflectors confines the interrupting to the arc chute and controls arc-product discharge until after they have been cooled and de-ionized. The resulting interruption is very fast and efficient. Because arc products are de-ionized within the arc chute and wraparound base molding even at the maximum rated short circuit currents, the LK family of circuit breakers require no overhead clearance to ground. These arc chutes are common throughout to all frame sizes. Arc chutes are front accessible and easily removed for inspection of the main and arcing contacts after racking the circuit breaker to the withdrawn position.



Contact Structures



Arc chutes

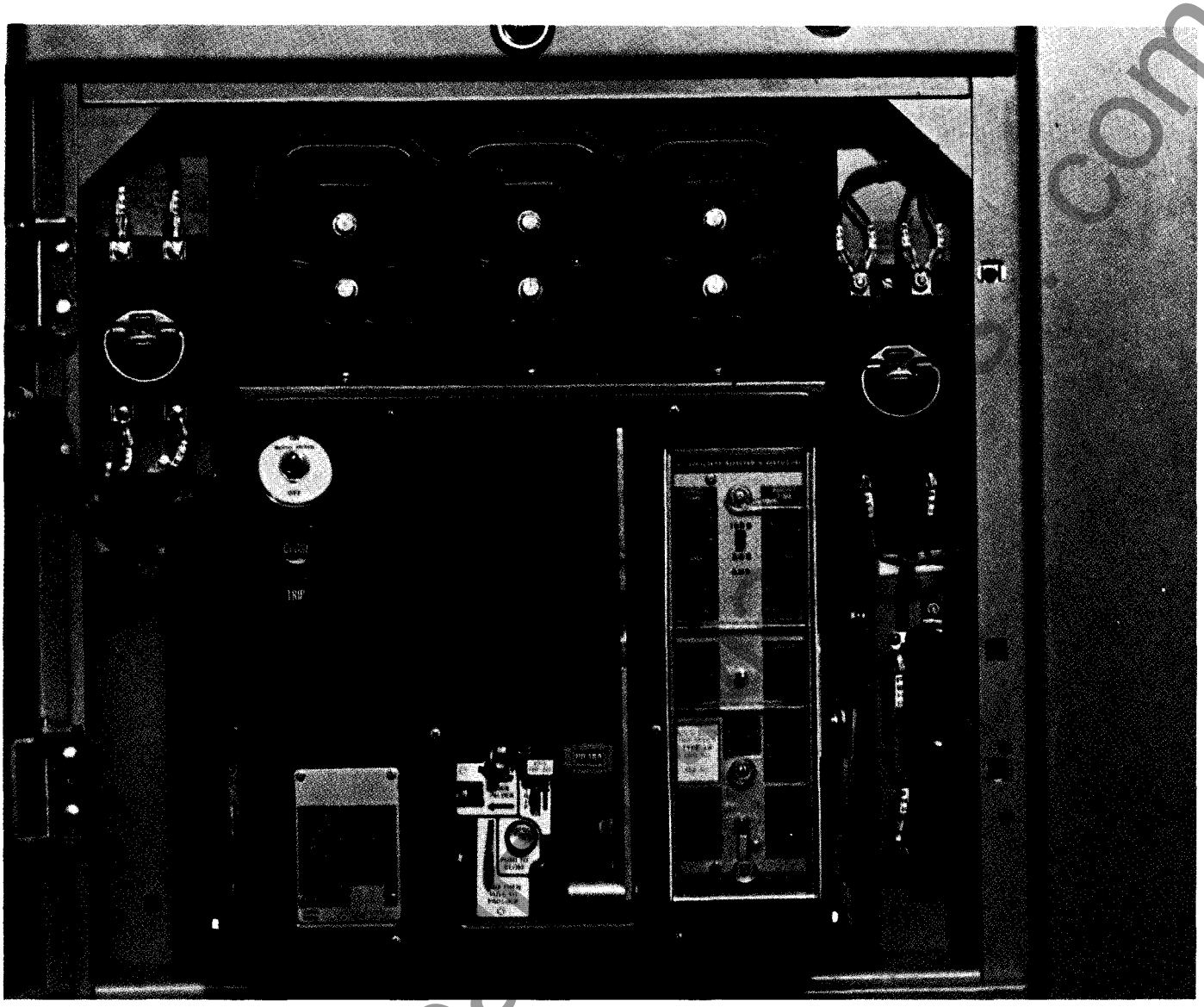


Table 1 LK, LKE and LKD Power Circuit Breaker Ratings

Circuit Breaker Type	*Maximum Continuous Current A	Symmetrical RMS Amperes Interrupting Capacity 240 V	480 V	600 V	Short-Time or Delayed Trip
LK 8	800	42,000	30,000	30,000	30,000
LK 16	1600	65,000	50,000	50,000	50,000
LK 25	2500	130,000	100,000	100,000	100,000
LK 32	3200	130,000	100,000	100,000	100,000
LK 42	4200	130,000	100,000	100,000	100,000
LKE 8	800	50,000	50,000	42,000	42,000
LKE 16	1600	65,000	65,000	65,000	65,000
LKE 25	2500	130,000	130,000	130,000	130,000
LKE 32	3200	130,000	130,000	130,000	130,000
LKE 42	4200	130,000	130,000	120,000	130,000
LKD 8	800		200,000		
LKD 16	1600		200,000		
LKD 25	2500		200,000		
LKD 30	3000		200,000		
LKD 40	4000		200,000		

* Recommended maximum continuous current rating of largest feeder breaker in percent of transformer (self-cooled) rated current, when primary power fuses are included is 40% for current-limiting type and 50% for non-current limiting type.

LK Circuit Breaker Features Offer New Switchgear Design Opportunities

Exclusive new features are insulated shutters and true closed-door racking. Personnel now can work with greater safety and flexibility than ever before. The LK mechanism provides complete control of the closing, tripping, and spring energy storage of the LK circuit breaker with complete separate control of each operation.

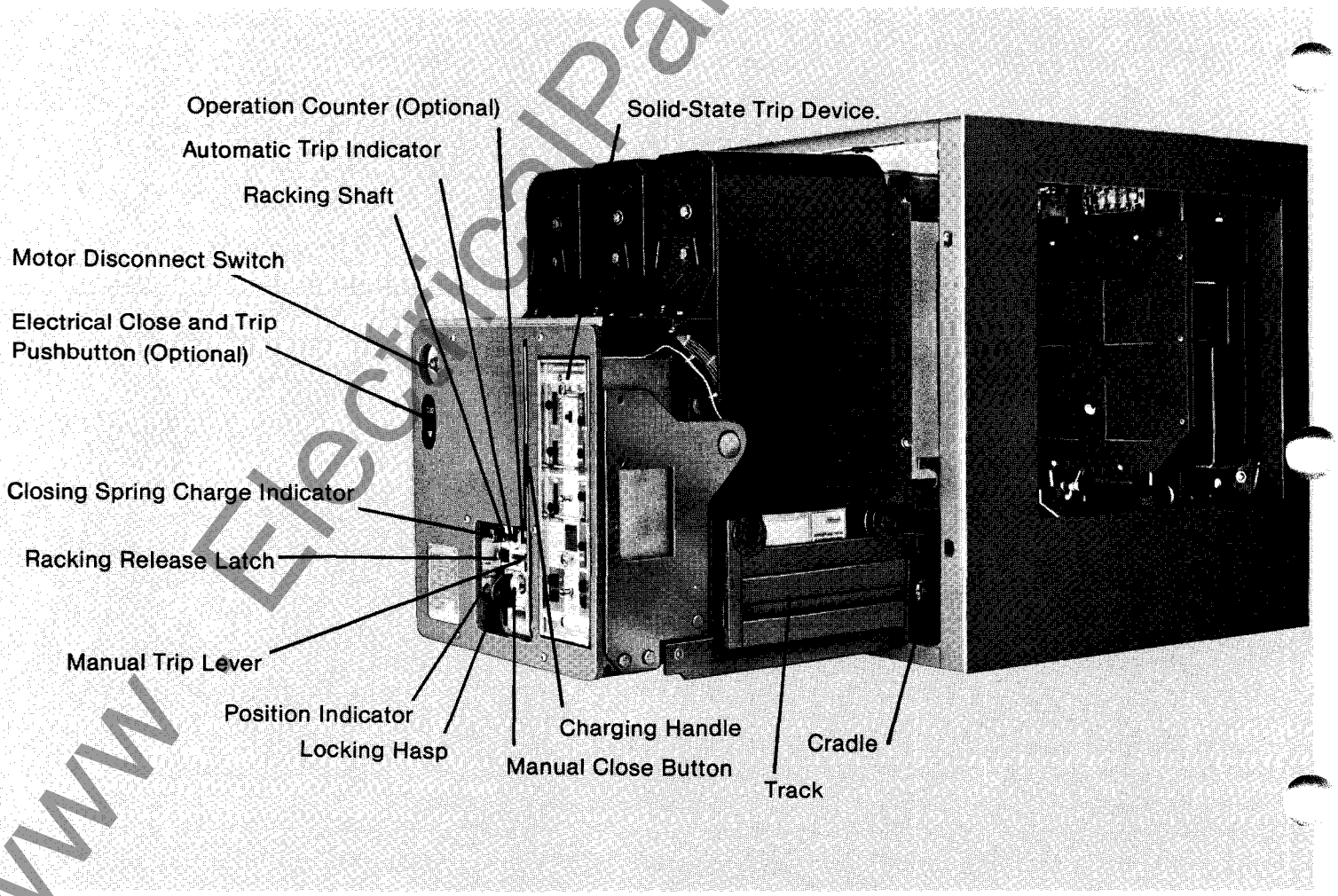
Convenience is designed into the circuit breaker by grouping all breaker control functions to allow complete accessibility via an access port on the closed compartment door.

Front access control wiring now feasible with polyester glass safety shutters that cover upper and lower primary terminals.

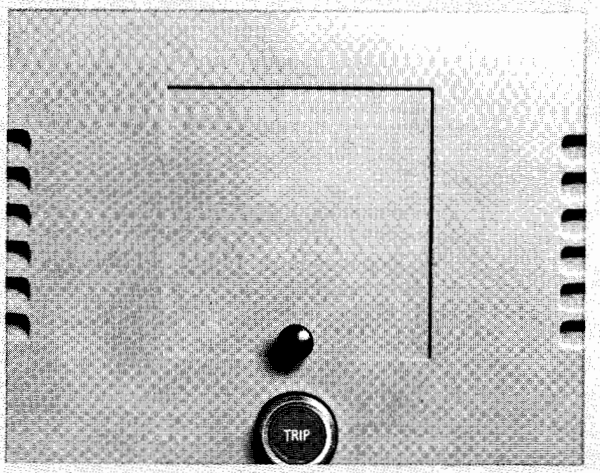
The manual mechanical close push button and the manual mechanical trip lever are located on the circuit breaker control center where they are easily accessible through the access port in the compartment door. The racking shaft, racking release lever, padlock hasp, open-closed position, spring charged-discharged, automatic trip and drawout position indicators are all accessible through the access port. The padlock hasp will accommodate up to three padlocks and mechanically lock the operating mechanism open, as well as prevent racking, thus securing the circuit breaker in the selected drawout position with the contacts open.

Racking operations can be performed through an access port conveniently located on the circuit breaker control center. With the access port raised the racking shaft, manual mechanical trip, racking release lever and the racking position indicator can readily be operated or easily observed.

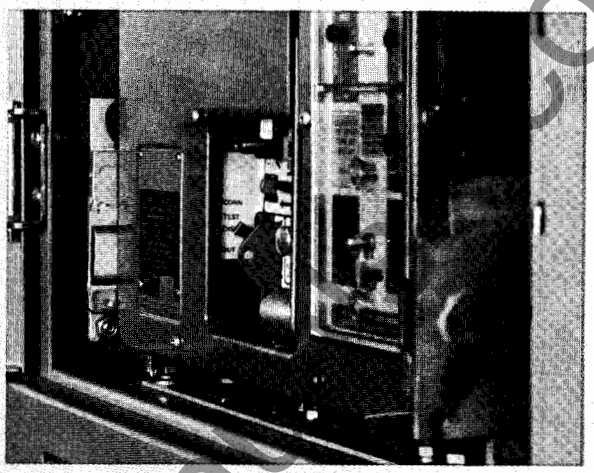
The racking mechanism incorporates positive stops in connected, test and disconnected positions. The manual trip lever must be raised and the racking release lever must be moved to the left before racking can proceed. The racking release lever must be held in the release position during the first 90 degree rotation of the racking crank. The racking mechanism automatically stops and locks precisely in position with an audible "click" whenever "connected", "test" or "disconnect" positions are reached.



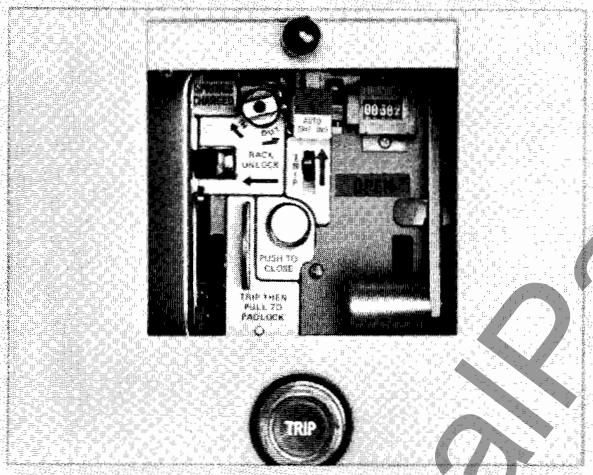
True Closed Door Drawout



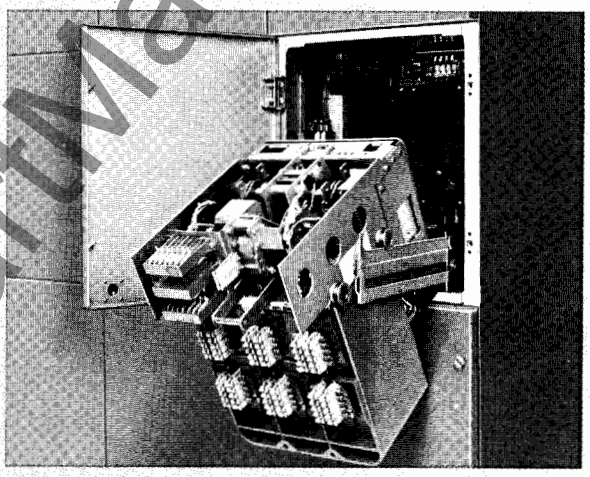
1. Compartment door closed, access port closed.



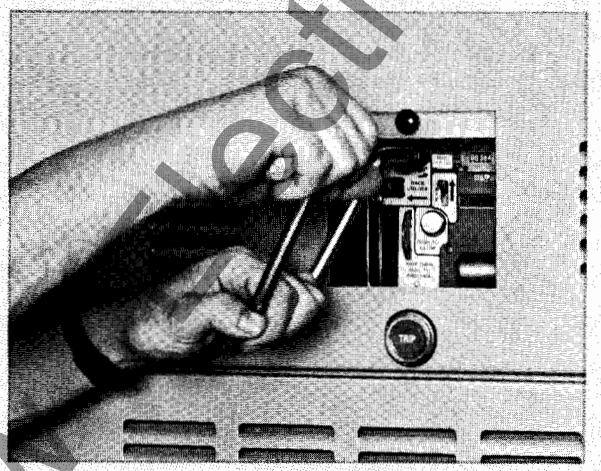
4. In Test position, breaker can be operated even though primary terminals are disconnected.



2. Compartment door closed, access port opened. Note easy accessibility of all controls including those for closed-door racking.

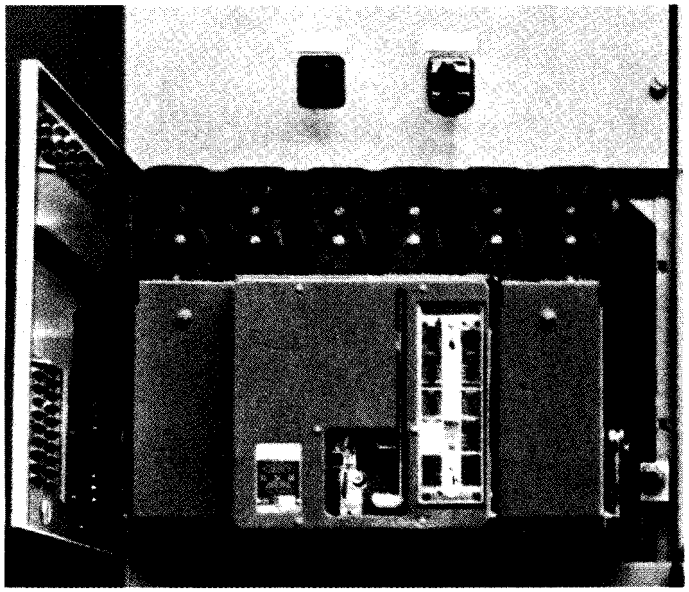


5. Withdrawn, breaker can be rotated easily to either approximately 90 degrees or more than 180 degrees for minor maintenance and inspection.



3. Through access po , breaker can be racked into Connected, Test, Disconnected or Out (withdrawn), position.

For Flexibility, Choose Either Manual or Electrical Operation

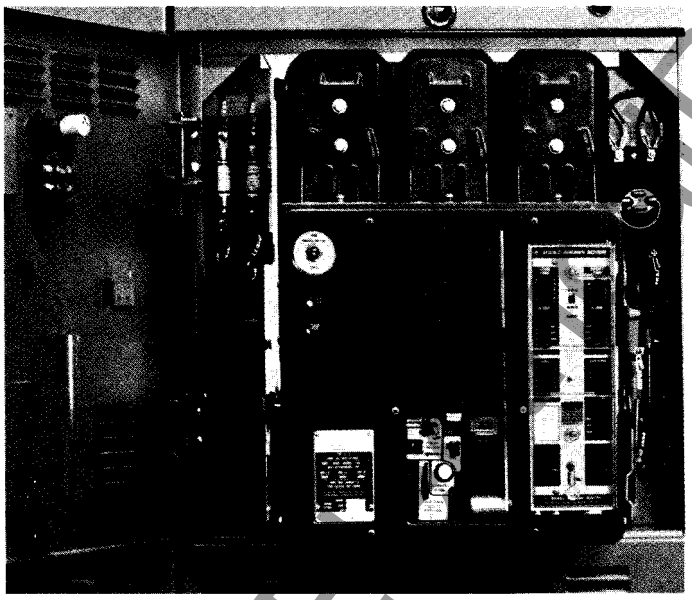


MANUAL OPERATION

Complete control of the closing and tripping operation has been designed into the stored energy operating mechanism of the manually operated LK circuit breakers.

The closing springs are charged with the built in spring charging handle which stores flush with the front of the circuit breaker. Pumping the handle will charge the closing springs; and, when fully charged, will produce an audible "click." The spring charged indicator will now read "charged." The closing springs remain fully charged until released by the manual close push button or the optional electric close release. The closing springs stored energy provides sufficient force to close and latch the breaker safely under any conditions within the circuit breaker's rating. The tripping springs are charged during the closing motion. Their energy is released by a manual mechanical trip lever, optional shunt trip or by the Power Shield® solid-state automatic trip system.

LK manually operated breakers equipped with short-time elements may be safely applied in selective systems where the available fault current does not exceed the short-time rating of the breaker. Manual breakers equipped with an instantaneous element may be safely applied to their maximum interrupting rating.



ELECTRICAL OPERATION

The electrically operated LK, LKE and LKD circuit breakers are selected whenever complete electrical control is required. Electrically operated breakers feature the same two-step stored energy mechanism as the manually operated to assure positive close and latch of the mechanism under delayed trip conditions, but with the added features of closing spring charging by an electric motor and the inclusion of associated electrical close and trip control devices. Closing springs remain fully charged until released by the manual mechanical close push button or the electrical close release coil. The tripping springs are charged during the closing operation. They discharge and open the circuit breaker whenever the Power Shield® solid-state trip system or a manual or electrical trip operation is initiated. The charging springs are automatically charged immediately following a trip operation of the circuit breaker. As an option, automatic spring charging after close is available.

A charging handle is also built in for manual spring charging when desired or if control power is not available. The faceplate of the circuit breaker also includes a charging motor disconnect switch and optional close and trip push buttons, in addition to all the features included in the control center.

Standard Features of the LK, LKE, LKD

ELECTRICAL OR MANUAL

- Two-step stored energy mechanism
- Manual mechanical close push button
- Spring charged-discharged indicator
- Integral manual charging handle
- Manual mechanical trip lever
- Circuit breaker open-closed position indicator
- Circuit breaker actuated, cradle mounted open-closed indicator
- Circuit breaker racking position indicator
- Racking interlocks
- Positive racking stops
- Padlock hasp
- Interchangeability interference interlock
- General Purpose Power Shield® solid-state trip device with long-time and instantaneous elements
- Automatic trip indicator
- Primary disconnect assemblies
- Secondary disconnect assemblies (as required)
- Ground disconnect assembly
- Closing spring automatic discharge between disconnected and withdrawn positions
- Amp Trap® current limiting fuses (LKD only)
- Open fuse trip and lockout (LKD only)
- Open fuse indicator (LKD only)

ELECTRICAL ONLY

- Automatic spring charging following trip operation
- Electric close
- Electric trip
- Anti-pump control
- Charging motor disconnect switch
- Secondary disconnect assemblies
- Integral auxiliary switches for remote red and green indicating lights

Optional Features of the LK, LKE, LKD

ELECTRICAL OR MANUAL

- Local electrical close and trip push buttons (E.O. only)
- Any combination of solid-state trip elements
- Power Shield® operation targets
- Power Shield® load alarm contacts
- Power Shield® ground alarm contact
- Mechanical lockout on automatic trip
- Automatic trip alarm contacts
- Undervoltage trip alarm contacts
- Open fuse trip alarm contact (LKD only)
- Instantaneous undervoltage trip
- Time delay undervoltage trip
- Undervoltage lock open
- Undervoltage trip defeator
- Operation counter
- Automatic spring charge after close (E.O. only)
- Door interlock
- Mechanical transfer interlock
- Operate-position-only (O.P.) secondary disconnect contact
- Test-position-only (T.P.) secondary disconnect contact
- Kirk Key interlocks
- Safety shutter

MANUAL ONLY

- Shunt trip with four contact auxiliary switch
- Remote electrical close release assembly

Power Shield® Solid State Trip Systems

Solid-state trip systems have been supplied on I-T-E low voltage power circuit breakers since 1968. This on-line experience is incorporated into the manufacture of the reliable Power-Shield tripping system featured on all LK circuit breakers to protect your power system in the event of overloads or faults.

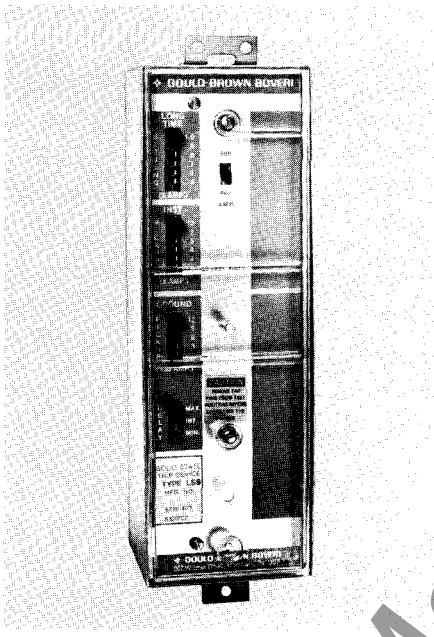
The completely self-powered Power Shield system takes the tripping energy from the primary current flowing through the circuit breaker without the need for an additional power supply.

The system includes the current sensors, solid-state trip unit, magnetic latch and the inter-connecting wiring. A current sensor is integrally mounted on each phase of the circuit breaker and supplies current to the solid-state trip unit. This current has a value directly proportional to the current flowing in the primary circuit. If the current value flowing in the primary exceeds the settings for a given interval of time, the trip unit sends a signal to the magnetic latch and trips the circuit breaker.

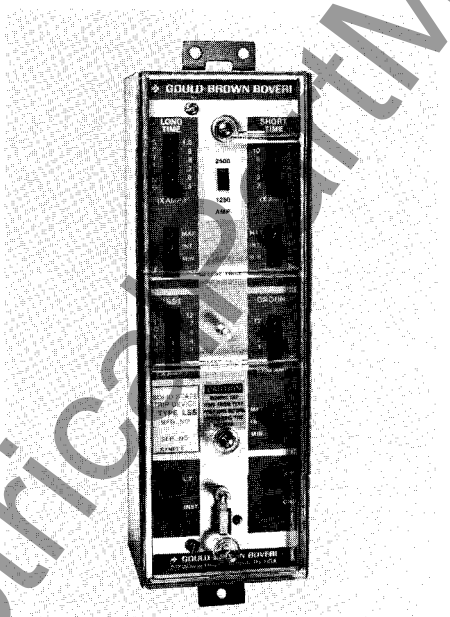
The Power Shield trip unit is available in "General Purpose" and "Total Purpose" types. Four basic trip elements perform the protective functions: long-time, short-time, instantaneous and ground. All applicable combinations of these elements are offered in the "Total Purpose" Power Shield. Some combinations of these elements are offered in the "General Purpose" Power Shield. Selection is based on the protective and coordination requirements of the particular system. Consult Table 2 for available combinations.

order two spare Box's,

General Purpose

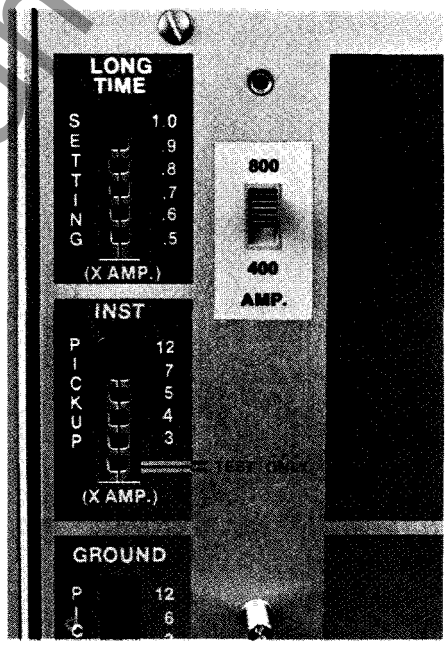


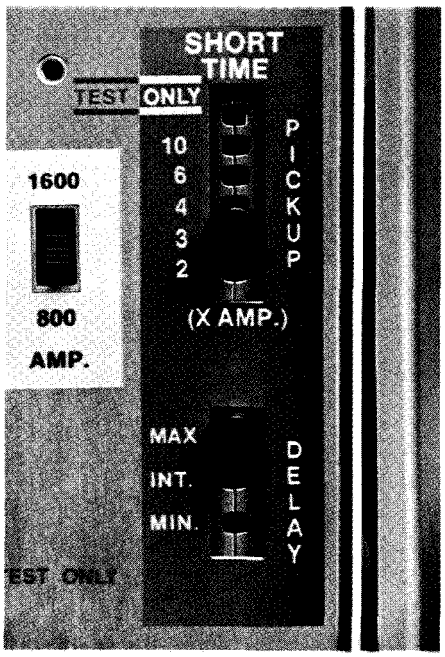
Total Purpose



The Power Shield trip device provides a full range of settings for precise protection and coordination. All settings are visible through a clearsight cover with a sealable feature that also inhibits tampering. Settings that will remain stable over long operation periods are readily made with positive tap selector plugs. The available settings are listed in Table 3. The exclusive ampere range selector doubles the adjustment settings of the basic protective elements: long-time, short-time, and instantaneous. The ampere range selector in providing a broader range of coverage reduces the number of different sensors substantially. As a result, only eight sensors are required for long-time settings ranging from 50 to 4200 A.

All LK, LKD and LKE circuit breakers utilize the Power Shield Type LSS trip unit. The long-time settings assure full use of the circuit breaker continuous current capability by not actuating the solid-state long-time trip pickup unless 100% of the selected ampere rating is exceeded. Accordingly, above unity or above margin settings are not required in order to assure that the circuit breaker will carry 100% of its setting continuously. Application is made simpler and more positive. This exclusive feature assures users full use of their investment for its intended purpose. A portable test is available for field testing.





Special tap positions are provided on the front panel of the Power Shield trip device to facilitate testing. These test positions modify the associated trip element characteristics to assure discrimination of trip function to the element undergoing test.

A clearsight cover protects the Power Shield trip device and may be sealed to inhibit unauthorized changes of settings. As a reminder, this cover also has a built-in interference bar to prevent replacing the cover should any tap plugs be left in a test position. If, however, a tap plug is left in a test position without replacing the clearsight cover, fault protection is still provided. Should a tap plug be left out completely, the setting automatically reverts to its lowest value. In this event nuisance tripping will probably occur calling the operator's attention to this abnormal condition. These features provide additional safety and reliability.

The ground fault element incorporates controlled reset of the ground fault function to cause proper response to arcing ground faults and thereby provide optimum protection.

Each trip unit is completely tested before shipping. There are no mechanical devices to readjust after shipment. Only the required settings need be made prior to placing the unit in service.

Standard Features of All Power Shield® Types

- Two-position ampere range selector
- Independently adjustable trip functions
- Flexible settings for precise protection and coordination
- True 100% carrying of long-time settings
- Selectable time-current characteristics
- See-through protective cover facilitates inspection and inhibits tampering
- Completely self-powered (additional power source unnecessary)
- Solid-state reliability and long life
- Long-time and instantaneous protective elements
- Convenient location on circuit breaker front panel
- Interchangeability to serve any size LK, LKE and LKD circuit breaker
- Shaped instantaneous characteristic for optimum coordination

Table 2 Available Power Shield Trip Unit Types

TYPE		TRIP PROTECTIVE ELEMENTS						TIME CURRENT CHARACTERISTICS
		LONG-TIME		SHORT-TIME		INST.	GROUND FAULT	
		SETTING	DELAY	PICK-UP	DELAY		PICK-UP DELAY	CURVE
LSS-1	GP	6A	NA			5A		TD-9058
LSS-1G	GP	6A	NA			5A	4A 3A	TD-9058, TD-9062
LSS-2	GP	6A	NA	5A	3A			TD-9068
LSS-4	TP	6A	3A	5A	3A			TD-9060
LSS-4G	TP	6A	3A	5A	3A		4A 3A	TD-9060, TD-9062
LSS-5	TP	6A	3A	5A	3A	5A		TD-9060
LSS-5G	TP	6A	3A	5A	3A	5A	4A 3A	TD-9060, TD-9062
LSS-6	TP	6A	3A			5A		TD-9059
LSS-6G	TP	6A	3A			5A	4A 3A	TD-9059, TD-9062
LSS-7	TP					5A		TD-9058
LSS-8	TP			5A	3A			TD-9060
LSS-8G	TP			5A	3A		4A 3A	TD-9060, TD-9062G

6A—No. of Adjustments
NA—Non Adjustable
The power shield trip unit is completely tested prior to shipment. Since there are no mechanical devices which may have lost adjustment during shipment, no readjustments, other than making the required settings, need be made prior to placing in service.

Table 3 Power-Shield Type LSS Trip Unit Time Delay Settings

	Type	Trip Function	Time Delay Band	Time Delay	
General Purpose	LSS-1	Long Time	Non-Adjustable	† 4 sec.	
	LSS-1G	Ground Fault	Maximum Intermediate Minimum	△ 0.35 Sec. △ 0.20 Sec. △ 0.08 Sec.	
	LSS-2	Long Time	Non-Adjustable	† 4 sec.	
		Short Time	Maximum Intermediate Minimum	△ 0.35 Sec. △ 0.20 Sec. △ 0.08 Sec.	
Total Purpose	LSS-4 LSS-4G LSS-5 LSS-5G	Long Time Short Time Ground Fault	Maximum Intermediate Minimum	† 15.0 Sec. † 5.0 Sec. † 2.0 Sec.	Long Time
	LSS-6 LSS-6G	Long Time Ground Fault	Maximum Intermediate Minimum	△ 0.35 Sec. △ 0.20 Sec. △ 0.08 Sec.	Short Time
	LSS-8 LSS-8G	Short Time Ground Fault	Maximum Intermediate Minimum	△ 0.35 Sec. △ 0.20 Sec. △ 0.08 Sec.	Ground Fault

† Measured at six (6) times range selector amperes at the lower limit of the time delay band.
△ Measured at the lower limit of the maximum, intermediate, or minimum short time and ground time delay bands at any point above pickup. (Definite Time Delay)

Table 4 LK, LKE and LKD Phase Sensor Ampere Ratings and Ground Pick-Up Ranges

Circuit Breaker Type	Available Sensor Rating A	SETTINGS / PICKUP			Primary Ground Pickup A
		Long-Time	Short-Time	Instantaneous	
		Times Range Selector Amperes			
LK 8 LKE 8 LKD 8	200, 800	1.0 0.9 0.8 0.7 0.6 0.5	10 6 4 3 2	12 7 5 4 3	1200 600 300 100
LK 16 LKE 16 LKD 16	200, 800 1600	1.0 0.9 0.8 0.7 0.6 0.5	10 6 4 3 2	12 7 5 4 3	1200 600 300 100 1200 900 600 300
LK 25 LKE 25 LKD 25	2500	1.0 0.9 0.8 0.7 0.6 0.5	10 6 4 3 2	12 7 5 4 3	1200 900 600 300
LK 32 LKE 32 LKD 30	3200 *3000	1.0 0.9 0.8 0.7 0.6 0.5	10 6 4 3 2	12 7 5 4 3	1200 1000 800 500
LK 42 LKE 42 LKD 40	4200 *4000	1.0 0.9 0.8 0.7 0.6 0.5	10 6 4 3 2	12 7 5 4 3	1200 1000 800 500

*Maximum continuous current rating

Features of Different Power Shield Types

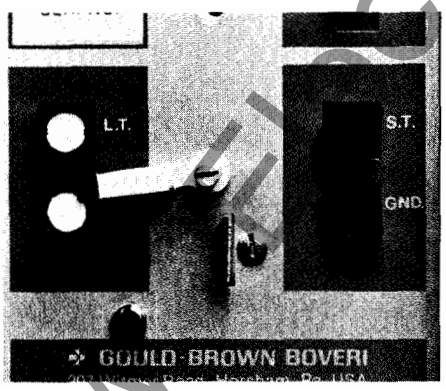
Table 5 Features of Different Power Shield Types

	GENERAL PURPOSE		TOTAL PURPOSE
	LSS-1	**LSS-2**	**LSS-4, LSS-5, LSS-6, LSS-7, LSS-8 provide varying combinations—see Table 2**
6 adjustable long-time carry settings	X	X	X
Non-adjustable long-time delay	X	X	No
3 adjustable long-time delay taps	No	No	X
5 adjustable instantaneous pickup taps	X	No	X
4 adjustable ground pickup taps	Optional	No	X
3 adjustable ground delay taps	Optional	No	X
5 adjustable short-time pickup taps	No	X	X
3 adjustable short-time delay taps	No	X	X
Electromechanical target for each element selected, up to 4	No	No	Optional
Test provisions (with optional Type 505 Portable Test Set)	X	X	X
Load alarm contact	Optional	Optional	Optional
Ground-trip alarm contact	Optional	No	Optional
Hi-set instantaneous (24 times range selector amperes)	Optional	No	Optional

Optional Power Shield Features

TARGETS

Optional electromechanical targets are available on total purpose trip units only. If targets are specified, one will be provided for each tripping function: long-time, short-time, instantaneous and ground. Up to four targets will be supplied, depending on the number of tripping functions on the particular unit. When a trip occurs, the target for that function will show orange until it is manually reset to black. The target position is not affected by shock or vibration and is independent of control power.



LOAD ALARM CONTACT

A load alarm contact is available with one normally open contact that closes when the primary current exceeds the set value. The load alarm contact setting is adjustable from 50 to 100 % of the range selector amperes. This contact is brought out to a terminal where remote alarm circuit may be connected. For contact rating see Table 7, Page 27.

GROUND FAULT ALARM CONTACT

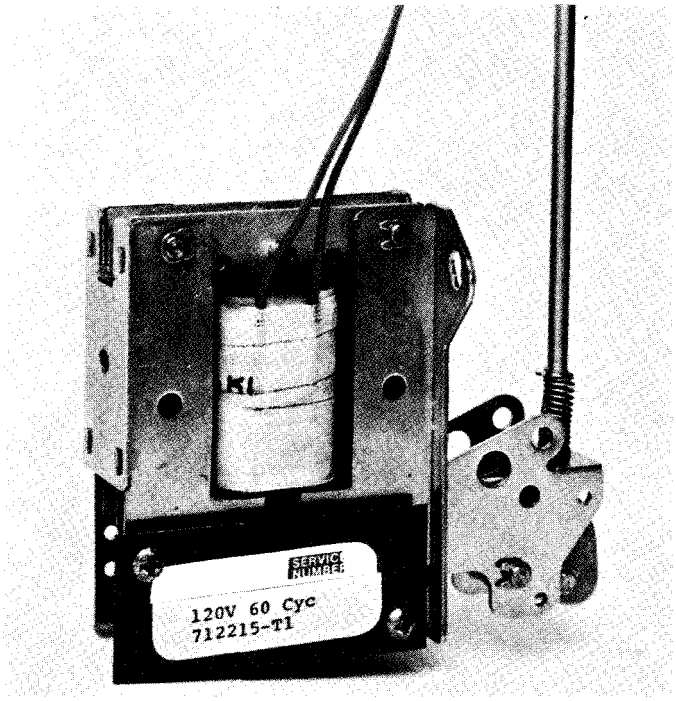
This feature provides a momentary contact closure when a ground trip operation occurs. This contact is brought out to a terminal where a remote alarm circuit may be connected. Contacts are suitably rated for use with a remote mounted annunciator.

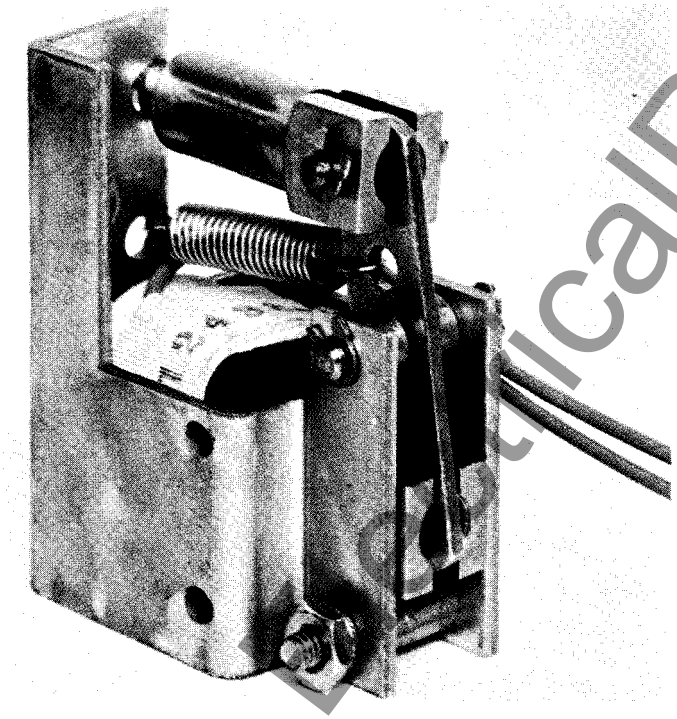
POWER SHIELD PORTABLE TEST SET (TYPE 505)

A compact, portable test set is available to test all Power Shield Type LSS trip units on-site. With the circuit breaker drawn out to the test position or removed to a worktable, this test set verifies operation of the Power Shield Trip System in accordance with the settings selected and the characteristics desired.

order one now

Optional Circuit Breaker Mounted Accessories





UNDERVOLTAGE TRIP DEVICE

This single-phase voltage detection device automatically trips the circuit breaker when voltage applied to its operating coil decreases to 30-60% of its rated value. It will not allow circuit breaker closing until the coil voltage is approximately 80% of rated value. The undervoltage trip device has either instantaneous trip operation or a factory-adjusted time delay trip of 0-15 seconds, and can be either factory or field installed. Alarm contacts are available as an additional option if specified. See Table 8, for additional data.

UNDERVOLTAGE TRIP DEFEAT

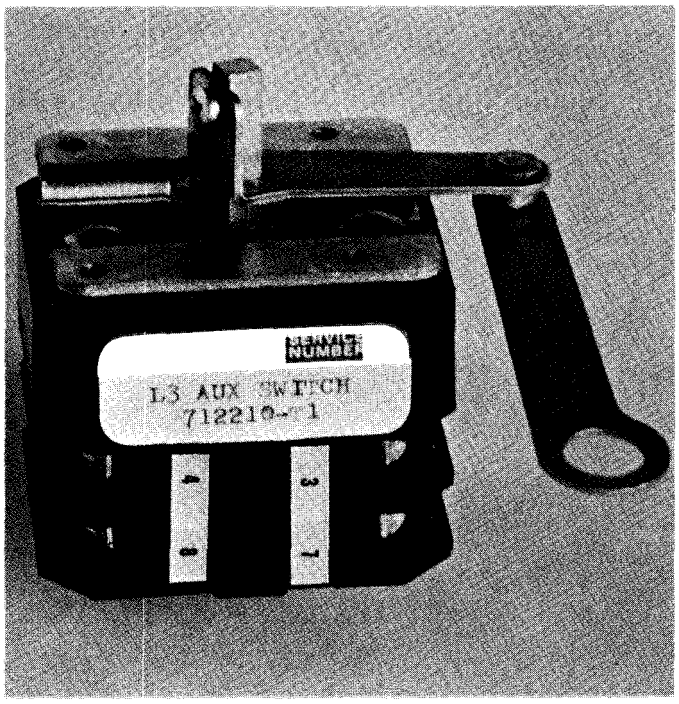
The undervoltage trip device can be defeated by inserting an Allen wrench in the location provided on the circuit breaker front plate and rotating it clockwise three turns. To reinstate the trip defeat, insert the Allen wrench and rotate counterclockwise three turns.

UNDERVOLTAGE LOCK OPEN DEVICE

The undervoltage lock open device utilizes single phase voltage detection to keep the circuit breaker open, and prevents closing unless a minimum of 85% of normal voltage is applied to its operating coil. However, this device does not trip the circuit breaker on conditions of low or loss of voltage. Alarm contacts are available as an additional option if specified.

SHUNT TRIP
(Optional on M.O.)

The shunt trip provides electrical tripping of the circuit breaker. It is available for use with all common standard control voltages as shown in Table 9. It acts directly on the trip mechanism to assure dependable and trouble-free opening of the circuit breaker contacts. It is standard on electrically operated breakers and optional on manually operated breakers. Whenever a shunt trip is supplied an internally mounted auxiliary switch is also provided.

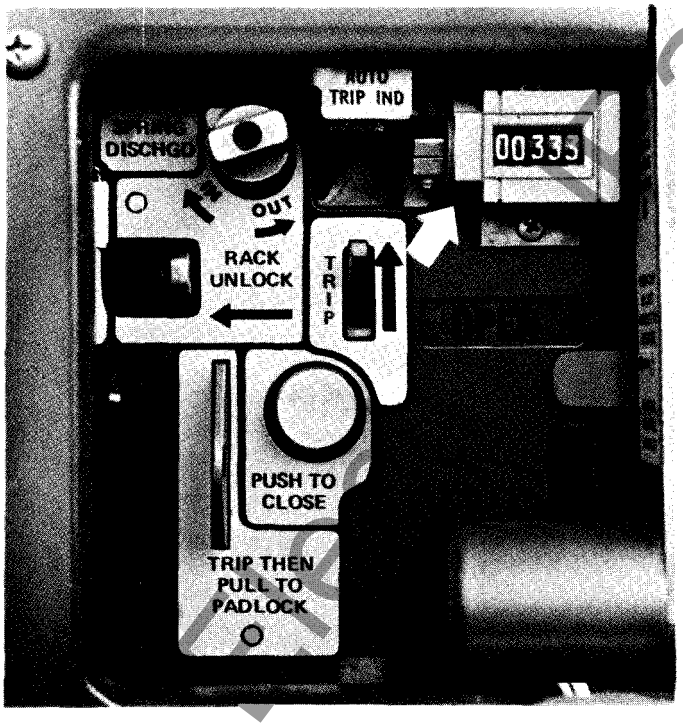


ELECTRICAL CLOSE RELEASE
(Optional on M.O.)

The electrical close release provides electrical release of the closing spring stored energy to permit electrical closing of a manually operated breaker. It is available for use with all common standard control voltages. Whenever an electrical close release is supplied, an internally mounted auxiliary switch is also provided.

AUXILIARY SWITCHES
(Optional on M.O.)

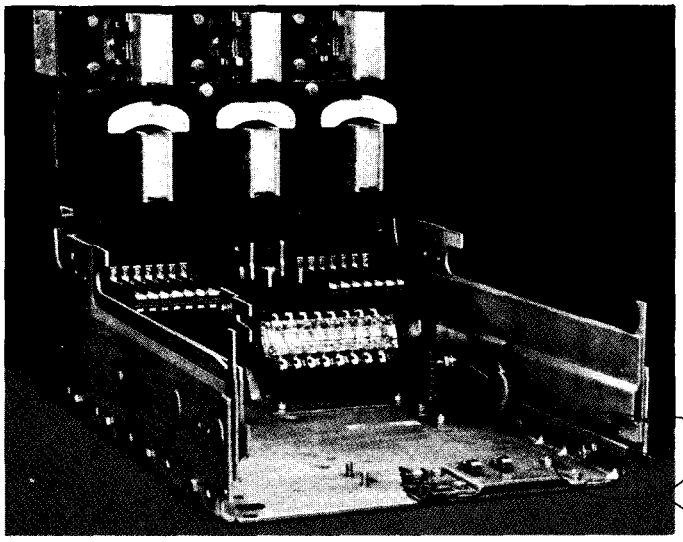
An internally mounted multi-contact auxiliary switch is used to complete electrical circuits for internal circuit breaker control. It is mechanically operated by the circuit breaker. The auxiliary switch has contacts which may be open or closed when the circuit breaker is open. For electrically operated circuit breakers one normally open (N.O.) and one normally closed (N.C.) contact is available for operation of remote red and green breaker contact position indicating lights. When supplied with manually operated breakers incorporating an optional shunt trip or electrical close release, up to three sets of contacts are available for other than breaker control. These contacts are wired out to a terminal for connection to external wiring as required.



OPERATION COUNTER

The operation counter is a non-resettable five (5) digit device that maintains a cumulative total of circuit breaker opening operations.

Circuit Breaker Cradle and Accessories

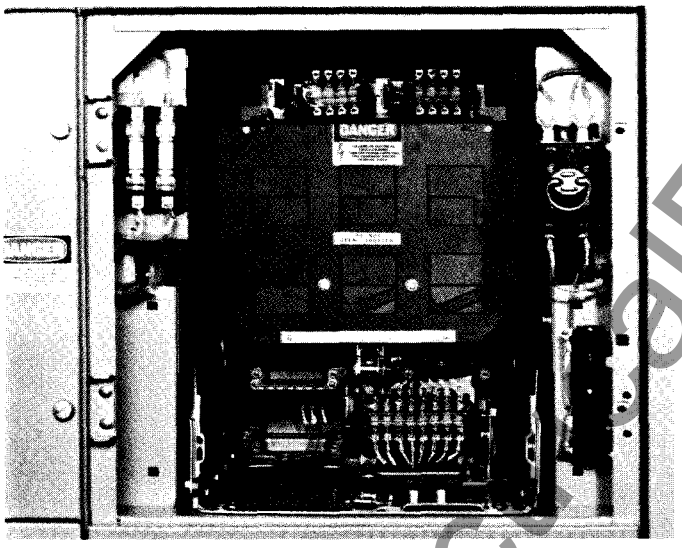


CIRCUIT BREAKER CRADLE

The base mounting assembly for the LK family of circuit breakers is a specially designed cradle. The cradle provides the interface between the circuit breaker and its external connections. The circuit breaker cradle contains primary, ground, and secondary contacts as well as all other drawout equipment in a complete self-aligning rigid assembly. There is no dependence on the mounting frame for any critical alignment.

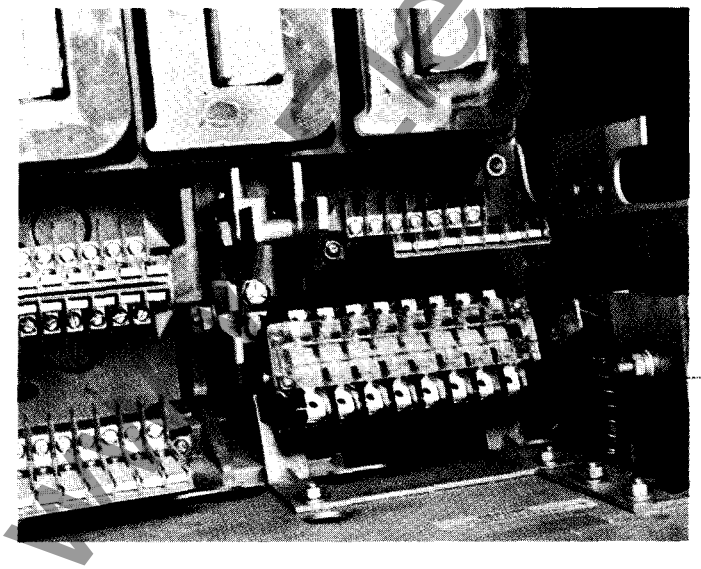
Optional cradle mounted equipment includes the mechanism operated cell auxiliary contacts (M.O.C.), truck operated cell auxiliary contacts (T.O.C.), current transformers, mechanical interlocks, Kirk Key interlocks, and door interlocks. Any size cradle can be installed into any compartment its own size or larger. The circuit breaker cradle is designed to accommodate either front or rear control wiring.

Optional Cradle Mounted Accessories



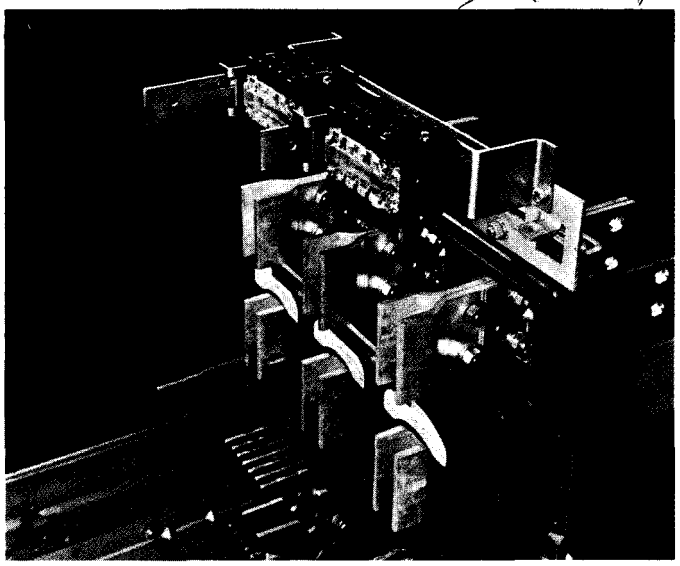
SHUTTERS

For extraordinary safety, the LK family of circuit breakers feature polyester-glass insulating shutters which automatically cover the primary stationary contacts whenever the circuit breaker is withdrawn, or removed, shielding the operator from the live primary contacts. The shutter covers both upper and lower stationary primary contacts when the circuit breaker is withdrawn. As the circuit breaker is racked in, the shutter opens to allow the contacts to engage. This unique personnel safety feature is another LK family design exclusive, and it's now available for the first time in the U.S. on low voltage power circuit breakers.



TRUCK OPERATED CELL (T.O.C.) SWITCH

The T.O.C. switch is a multi-contact auxiliary switch for remote indication of the circuit breaker's drawout position. It is available in either a four or eight contact arrangement and offers a choice of operation between the connected and test **or** between the test and disconnected positions. See Table 7, on Page 27 for contact ratings.



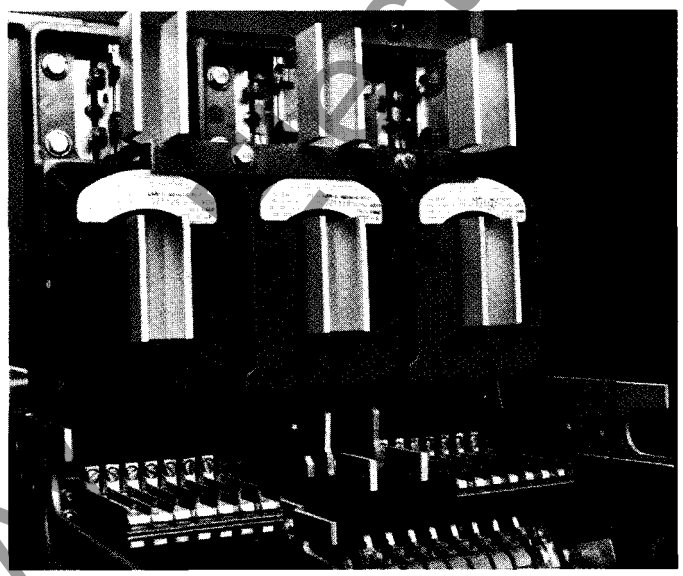
MECHANISM OPERATED CELL (M.O.C.) SWITCH

The M.O.C. switch is a multi-contact auxiliary switch that changes position whenever the position of the circuit breaker primary contacts change. These auxiliary contacts are used for electrical interlocking and indicating circuits. M.O.C. switches are available in either a four or eight contact arrangement which operate only in the connected position. An optional arrangement can be specified to require the M.O.C. switch operation in both the connected and test positions. See Table 7 for contact ratings, on Page 27.

KIRK KEY INTERLOCK

Provisions for Kirk Key® interlocking permit circuit breaker operation only in a pre-arranged sequence. This interlocking can be used to assure safe working conditions, as well as preventing an authorized person from committing an unauthorized act.

The Kirk Key® interlock assembly is cradle mounted and the keyed cylinder is accessible through an opening in the closed compartment door. Normally, the key can be removed only when the circuit breaker is locked open in the connected position. The breaker cannot be closed until the key is inserted and turned, thereby unblocking the trip mechanism.



CURRENT TRANSFORMERS

Fully insulated, high-dielectric, epoxy-molded toroidal current transformers can be located on the stationary primary contacts of the circuit breaker cradle. Their location eliminates the need for mounting CTs on the bus in the power cable termination compartment.

Standard low voltage current transformers have metering accuracies that conform with ANSI Standard C37.20.

Provisions are made for mounting one current transformer per phase around the lower primary disconnects of the 800A and 1600A cradles. They are designed for mounting around each of the upper primary disconnects on the 2500A, 3000A, 3200A, 4000A and 4200A cradles.

Circuit Breaker Selection and Application

SELECTION OF BREAKER TRIPPING CHARACTERISTICS

The degree of service continuity provided by a low voltage distribution system depends on the degree of coordination between circuit breaker tripping characteristics and the load.

Two methods of tripping coordination are in general use. Each represents a different degree of service continuity, and initial cost.

These methods, or systems, combine circuit breaker ratings and tripping characteristics as follows:

NON-SELECTIVE SYSTEM

A non-selective system is one in which both the main, tie (if applicable) and the feeder circuit breakers have adequate interrupting capacity for the fault current available at the point of application.

Each circuit breaker is equipped with non-selective long-time delay and instantaneous overcurrent trips. On low level faults normally the circuit breaker nearest the fault will open. However, should the fault current exceed the breaker's instantaneous trip setting, even though a circuit breaker nearer to the fault is in the process of tripping, any breaker including the main will trip. Service continuity will be broken.

SELECTIVE SYSTEM

In a selective system the main, tie (if applicable) and the feeder circuit breakers each have adequate interrupting capacity for the fault current available at the point of application.

All LK low voltage power circuit breakers have a short-time rating, as well as, delayed trip up to a maximum of 30 cycles, with full close, latch and carry capability. These characteristics offer the ultimate in selective application and continuity in modern electrical systems.

In a selective system only the breakers furtherest downstream are supplied with instantaneous trip elements. All other upstream breakers are provided with overcurrent trip devices having long-time delay and short-time delay elements.

Coordinated short time delay is selected in lieu of instantaneous tripping to allow adequate time for the circuit breaker nearest fault to trip. Maximum service continuity is maintained through all other circuit breakers.

Normally the feeder circuit breakers are equipped with overcurrent trip devices having long-time delay and instantaneous functions, unless they are required to be selective with other protective devices nearer the load. In that case, the feeder circuit breakers are equipped with overcurrent trip devices having long-time and short-time delay.
Any fault on a feeder circuit would then cause the instantaneous trip on the downstream circuit breaker to operate, while the delayed main and feeder circuit breakers would remain closed due to the selected time delay. Depending upon application requirements as many as three short-time delay equipped circuit breakers could be in series for selective operation.

The selective system offers a maximum of service continuity at a slightly higher initial cost than the non-selective system. For applications where downtime must be minimized or operating costs or problems become prohibitive the selective system is demanded. There are many factors to consider when selecting the proper low voltage air magnetic circuit breaker. All are covered in the following tables.

CASCADED SYSTEM

The cascaded system is no longer permitted.

SELECTION AND APPLICATION LK CIRCUIT BREAKERS

Selection

After sytem requirements have been established, four basic factors determine circuit breaker selection.

1. System voltage and frequency
2. Continuous load currents
3. Available fault current (short circuit, short-time, close and latch)
4. Service Conditions

Svstem Voltage and Frequency

All LK circuit breakers are designed to operate on AC power systems at the interrupting ratings shown in Table 1, which apply at the following maximum voltages.

Nominal System Voltage
Volts-AC 50/60 Hertz
240, 480, 600

Maximum Voltage
Volts-AC 50/60 Hertz
254, 508, 635

Continuous Current

The rated continuous current is the designated limit in RMS amperes which the circuit breaker will carry continuously, based on an average air temperature inside the enclosure which does not exceed 40°C ambient by more than 15°C. Circuit breakers are maximum rated devices and can never be applied to carry current in excess of their continuous current rating, including any one or two hour overload. Refer to Table 1 for LK current ratings.

An important consideration in circuit breaker application is the long-time overcurrent setting associated with the specific tripping device used. All LK circuit breakers use the Power Shield Type LSS trip unit. This device assures full use of the circuit breaker continuous current capability by not actuating the solid-state long-time trip pick-up unless 100% of the selected ampere rating is exceeded. Accordingly, above unity or above margin settings are not required in order to assure that the circuit breaker will carry 100% of its setting continuously. Application is made simpler and more positive. This assures the users full use of their investment for its intended purpose. Refer to Table 3 and Table 4.

Available Fault Current

The rated short-circuit current (interrupting rating) is the highest current in RMS symmetrical Amperes at rated maximum voltage which the circuit breaker can interrupt during the operating duty of "open", wait 15 seconds and the "close"-"open" operation.

These values are shown in Table 1. No circuit breaker should be applied in a circuit at any point in which the available short-circuit current is greater then the interrupting capacity of the circuit breaker. LK circuit breakers, which are equipped with either instantaneous trip or short-time elements may be safely applied up to their full respective interrupting rating. The LK circuit breaker family has a minimum short-circuit rating of 30,000 amperes symmetrical with the LKE designation given to those with extended short-circuit current ratings. Note that all LK frame sizes have a corresponding LKE extended rating for broader application. Should the circuit requirements exceed the LKE ratings, the LKD, integrally fused current limiting circuit breaker with 200,000 ampere interrupting ratings for all sizes may be applied. The LKD family of circuit breakers incorporate all the features of the LK family in addition to integrally mounted, completely coordinated current limiting fuses in series for 800, 1600, 2500, 3000 and 4000 ampere frame sizes.

The rated short-time current of a low

voltage power circuit breaker is the RMS symmetrical current at rated maximum voltage ½ cycle after fault initiation, which the circuit breaker is required to carry for two periods of ½ second duration each with a 15 second interval of zero current between those ½ second periods. See Table 1, for those ratings. This rating is applied when using external means for tripping the circuit breaker; for example, relay tripping. Also, LK and LKE circuit breakers, equipped with short-time delay, may be safely applied in selective systems where the available fault current does not exceed the short-time rating of the circuit breaker.

The close, latch, and carry rating permits the circuit breaker to provide system coordination even as it closes on a fault. The delayed trip test establishes this rating as the highest current in RMS Symmetrical Amperes at rated maximum voltage which the circuit breaker is required to carry during the operating duty of "open" wait 15 sec. "close-open" without instantaneous trip elements and the short time delay set at maximum time delay.

All LK and LKE circuit breakers are rated for close, latch and carry operation and can be safely applied in selective systems where available fault current does not exceed the delayed trip rating of the circuit breaker. See Table 1.

Service Conditions

The service conditions affecting low-voltage power circuit breaker application include:

a. Ambient temperature
Low voltage power circuit breakers are designed for use within their rating where the outside ambient temperature does not exceed 40°C (104°F).

b. Altitude
Low voltage power circuit breakers are for use within their rating where the altitude does not exceed 2000 meters (6,600 feet). When using circuit breakers above this altitude, the dielectric, voltage and current ratings shall be multiplied by the factors in Table 6 to obtain new ratings for the altitude at which the breakers will be applied.

c. Unusual Service Conditions
Unusual service conditions may require unusual construction or operation, and these should be brought to the attention of those responsible for the application, manufacture and operation of the circuit breaker. Wherever possible, steps should be taken at the site of the installation to nullify the deleterious poisonous effects of unusual service conditions. Among such unusual conditions are:

1. Exposure to damaging fumes or vapor
2. Exposure to steam
3. Exposure to salt air
4. Exposure to oil vapors
5. Exposure to dripping moisture
6. Exposure to hot and humid climate
7. Seasonal or infrequent use
8. Exposure to extreme temperatures, or sudden change in temperatures
9. Exposure to excessive abrasive magnetic or metallic dust
10. Exposure to explosive mixtures of dust or gases
11. Exposure to water in the form of a steam such as is used for cleaning, etc.
12. Exposure to submersion
13. Exposure to abnormal vibration, shocks or tilting
14. Exposure to unusual transportation or storage
15. Unusual space limitations
16. Unusual insulation requirements
17. Unusual configuration of enclosing rooms, causing hot air pockets, rooms not having normal ventilation or rooms containing large amounts of magnetic material or stray magnetic fields.
18. Unusual operating duty, frequency of operation or difficulty of maintenance
19. Operation at unstable control voltages
20. Unusual or special operation requirements
21. Exposure to extreme sun temperatures

Table 6 Low Voltage Power Circuit Breaker Altitude Derating Factors

Altitude Feet	Correction Factor			
	Interrupting Capacity	Voltage	Current	Dielectric
6,600	1.00	1.00	1.00	1.00
8,500	1.00	.95	.99	.95
13,000	1.00	.80	.96	.80
20,000	1.00	.56	.90	.56

Note: Value for intermediate altitudes may be derived by linear interpolation.

OPERATING CONDITIONS
See Table 14, Page 29

The various operating conditions are outlined here and should be used with the appropriate tables.

(A) Servicing consists of adjusting, cleaning, lubricating, tightening, etc., as recommended by the manufacturer. When current is interrupted, dressing of contacts may be required as well. The operations listed are on the basis of servicing at intervals of six months or less.

(B) When closing and opening no-load.

(C) With rated control voltage applied.

(D) Frequency of operation not to exceed 20 in 10 minutes or 30 in an hour. Rectifiers or other auxiliary devices may further limit the frequency of operation.

(E) Servicing at no greater intervals than shown in Column 2.

(F) No functional parts should have been replaced during the listed operations.

(G) The circuit breaker should be in a condition to carry its rated continuous current at rated maximum voltage and perform at least one opening operation at rated short-circuit current. After completion of this series of operations, functional part replacement and general servicing may be necessary.

(H) When closing and opening current up to the continuous-current rating of the circuit breaker at voltages up to the rated maximum voltage and at 85% power factor or higher for A.C. circuits.

(I) When closing currents up to 600% and opening currents up to 100% (80% power factor or higher) of the continuous-current rating of the circuit breaker at voltages up to the rated maximum voltage.
When closing currents up to 600% and opening currents up to 600% (50% power factor or less) of the continuous-current rating of the circuit breaker at voltages up to the rated maximum voltage, the number of operations shown shall be reduced to 10% of the number listed.

(J) If a fault operation occurs before the completion of the listed operations, servicing is recommended and possible functional part replacements may be necessary, depending on previous accumulated duty, fault magnitude, and expected future operations.

Operating Sequence
Type LK, LKE & LKD Circuit Breakers

ELECTRICALLY OPERATED

With the circuit breaker open, the closing springs uncharged, the control power source energized, and the motor disconnect switch (MDS) closed, operation occurs as follows:

1. Immediately upon availability of control power, the spring charging motor (M) is energized, which in turn charges the closing springs. When the closing springs are charged, limit switch contact "LS/1" is open and the limit switch contact "LS/2" is closed (unless the "Y"-relay (Y) is energized).
2. Operation of the "close" switch energizes the close coil (X) through the circuit breaker auxiliary switch "b" contact and limit switch contact "LS/2". The close coil (X) releases the closing latch. The springs then discharge to close the circuit breaker.
3. When the springs discharge, limit switch contact "LS/1" closes.
4. When the circuit breaker closes, all auxiliary switch "b" contacts open and all auxiliary switch "a" contacts close.
5. When the "Y"-relay coil (Y), is energized the limit switch contact "LS/2" is open and de-energizes the close coil (X) as long as a "close" contact is maintained. The purpose of the "Y"-relay is to prevent pumping of the closing mechanism when closing against a faulted circuit. A second close operation can not occur until the "Y"-relay (Y) is de-energized.
6. On maintained control, opening the "close" switch de-energizes the "Y"-relay (Y) and unlatches the limit switch contact "LS/2" and allows the "LS/2" contact to close. On momentary control, the limit switch contact "LS/2" is closed and the "Y"-relay is de-energized.
7. The circuit breaker can be tripped by operation of the "trip" control switch which energizes the circuit breaker trip coil (TC) through the auxiliary switch "a" contact.
8. The closing springs recharge when the circuit breaker is in the open or tripped position (except as otherwise noted) because the auxiliary switch "b" contact closes.

MANUALLY OPERATED

With the circuit breaker open, the closing springs uncharged, the manual spring charging handle is ratcheted to charge the springs.

1. The circuit breaker may be closed manually at the breaker by pushing the manual close button.
2. The circuit breaker may be tripped locally by the manual trip lever on the circuit breaker escutcheon, the trip button on the compartment door or it may be tripped remotely when provided with an electrical trip feature.
3. The closing springs may be charged manually when the circuit breaker is in the open or closed position.

GENERAL

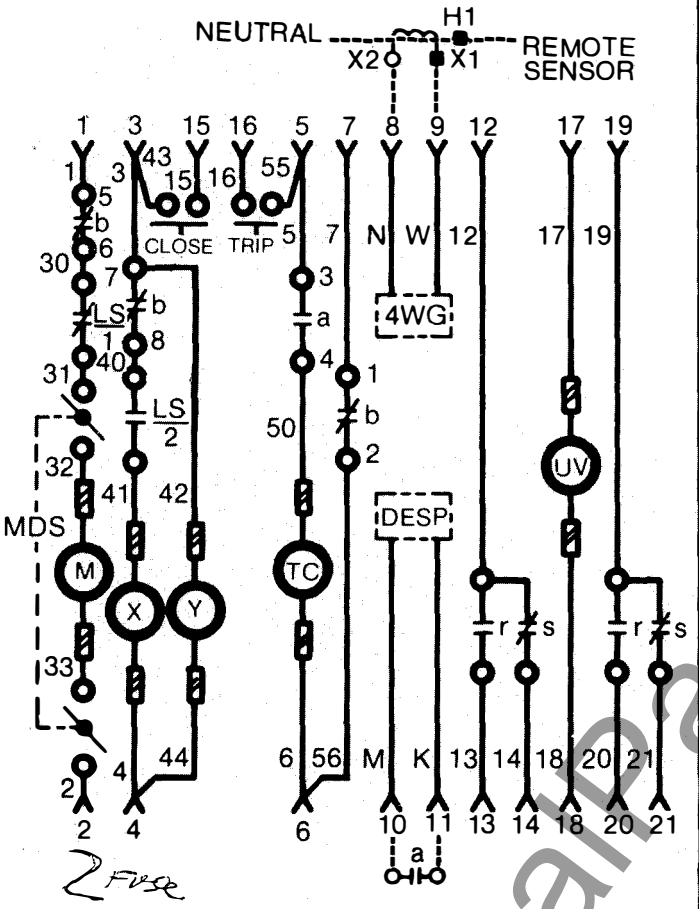
1. the undervoltage device, if applicable, provides a direct acting lockopen and undervoltage tripping feature. This device must be energized to initially close the breaker, and also to maintain the circuit breaker in a closed position.
2. The undervoltage lock open feature (optional) locks the circuit breaker open until control power is available. It also does not trip the circuit breaker on loss of control power.

SYMBOL	DESCRIPTION
a	AUXILIARY SWITCH CONTACT, OPEN WHEN BREAKER IS OPEN.
b	AUXILIARY SWITCH CONTACT, CLOSED WHEN BREAKER IS OPEN.
LS	LIMIT SWITCH CONTACT.
2	CONTACT OPEN WHEN CLOSING SPRINGS ARE DISCHARGED AND IS LATCHED OPEN WHEN "Y"-COIL IS ENERGIZED. CONTACT UNLATCHED CLOSED WHEN "Y"-COIL IS DE-ENERGIZED.
CLOSE	LOCAL ELECTRICAL CLOSE PUSHBUTTON.
TRIP	LOCAL ELECTRICAL TRIP PUSHBUTTON.
LS	LIMIT SWITCH CONTACT.
1	CLOSED WHEN SPRINGS ARE DISCHARGED. OPEN WHEN SPRINGS ARE CHARGED.
M	MOTOR, CLOSING SPRING CHARGING.
MDS	MOTOR DISCONNECT SWITCH.
r	ALARM CONTACT CLOSES ON OVERCURRENT (AND/OR GROUND) TRIP, MANUALLY RESET.
r (uv)	UNDERVOLTAGE ALARM SWITCH CONTACT. CLOSES ON UV TRIP. OPEN WHEN UV PICKS UP.
s	ALARM CONTACT OPENS ON OVERCURRENT (AND/OR GROUND) TRIP, MANUALLY RESET.
TC	SHUNT TRIP COIL.
UV	UNDERVOLTAGE DEVICE (TRIP OR LOCK OPEN).
SS ALARM	SOLID-STATE ALARM SWITCH (GROUND TRIP ALARM OR HIGH LOAD ALARM FUNCTION).
AR	ALARM RELAY COIL (GROUND TRIP ALARM OR HIGH LOAD ALARM FUNCTION).
X	CLOSE COIL, CLOSING LATCH RELEASE.
Y	"Y" RELAY COIL (PREVENTS PUMPING).
□	TERMINAL BLOCK.
—□/□—	WIRE DISCONNECTS.
—	MOVABLE SECONDARY DISCONNECT CONTACTS.
HI	PRIMARY SIDE OF NEUTRAL SENSORS.
X1 & X2	SECONDARY SIDE OF NEUTRAL SENSORS. ORIENT NEUTRAL SENSOR PRIMARY POLARITY (HI) TOWARD SOURCE IF BREAKER UPPER TERMINALS ARE SOURCE
■	POLARITY MARK—TERMINALS. REVERSE IF BREAKER UPPER TERMINALS ARE LOAD TERMINALS.
4WG	4 WIRE GROUND TRIP FUNCTION.
DESP	DOUBLE ENDED SUB-PROTECTION 4 WIRE GROUND FUNCTION.

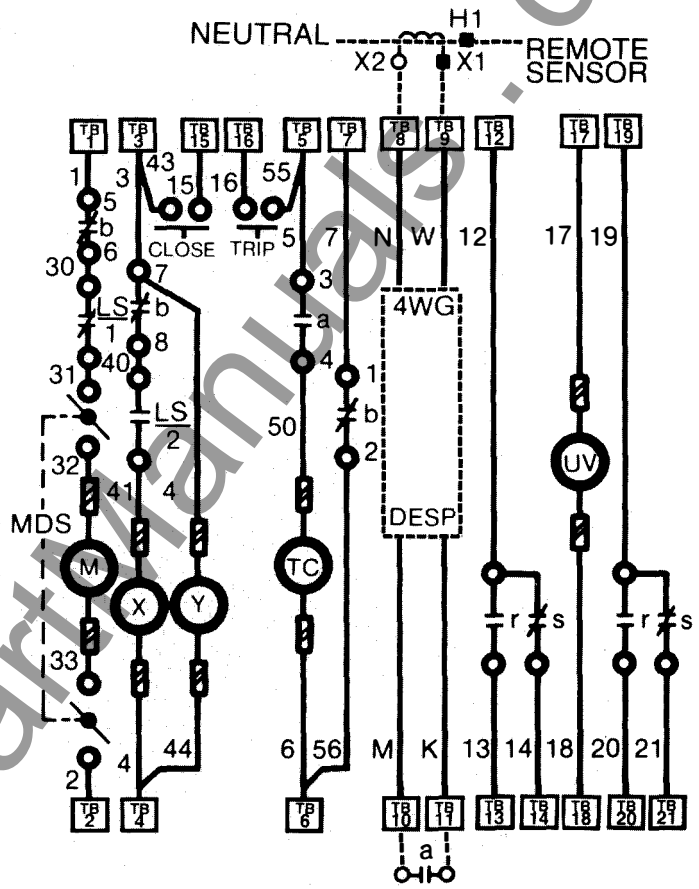
NOTE: a AND b CONTACTS FOR CUSTOMER USE ARE MOUNTED ON CRADLE AND WIRED DIRECTLY.

WIRING DIAGRAM LEGEND

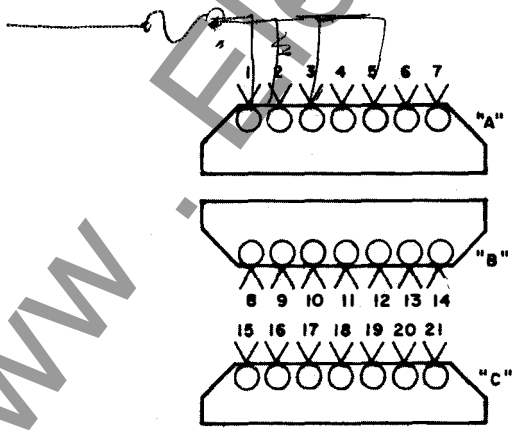
Typical Schematic Diagram of Control Circuit

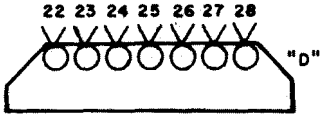


TIE BREAKER
DRAWOUT

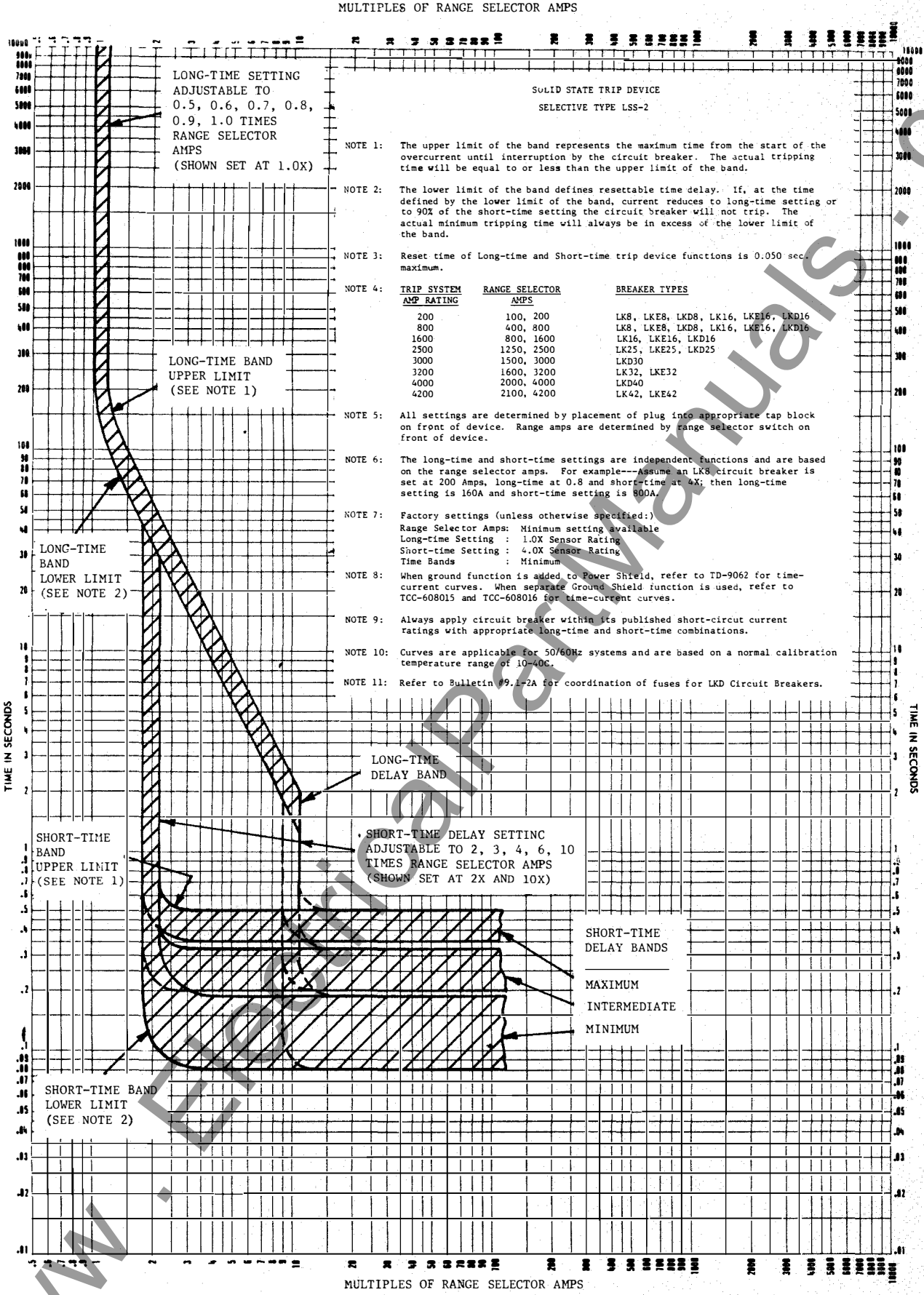


TIE BREAKER
STATIONARY





STATIONARY SECONDARY DISCONNECT CONTACTS ON CRADLE (FRONT VIEW)



SOLID STATE TRIP DEVICE
SELECTIVE TYPE LSS-2

NOTE 1: The upper limit of the band represents the maximum time from the start of the overcurrent until interruption by the circuit breaker. The actual tripping time will be equal to or less than the upper limit of the band.

NOTE 2: The lower limit of the band defines resettable time delay. If, at the time defined by the lower limit of the band, current reduces to long-time setting or to 90% of the short-time setting the circuit breaker will not trip. The actual minimum tripping time will always be in excess of the lower limit of the band.

NOTE 3: Reset time of Long-time and Short-time trip device functions is 0.050 sec. maximum.

NOTE 4:

TRIP SYSTEM AMP RATING	RANGE SELECTOR AMPS	BREAKER TYPES
200	100, 200	LK8, LKE8, LKD8, LK16, LKE16, LKD16
800	400, 800	LK8, LKE8, LKD8, LK16, LKE16, LKD16
1600	800, 1600	LK16, LKE16, LKD16
2500	1250, 2500	LK25, LKE25, LKD25
3000	1500, 3000	LKD30
3200	1600, 3200	LK32, LKE32
4000	2000, 4000	LKD40
4200	2100, 4200	LK42, LKE42

NOTE 5: All settings are determined by placement of plug into appropriate tap block on front of device. Range amps are determined by range selector switch on front of device.

NOTE 6: The long-time and short-time settings are independent functions and are based on the range selector amps. For example---Assume an LK8 circuit breaker is set at 200 Amps, long-time at 0.8 and short-time at 4X; then long-time setting is 160A and short-time setting is 800A.

NOTE 7: Factory settings (unless otherwise specified:)
Range Selector Amps: Minimum setting available
Long-time Setting : 1.0X Sensor Rating
Short-time Setting : 4.0X Sensor Rating
Time Bands : Minimum

NOTE 8: When ground function is added to Power Shield, refer to TD-9062 for time-current curves. When separate Ground Shield function is used, refer to TCC-608015 and TCC-608016 for time-current curves.

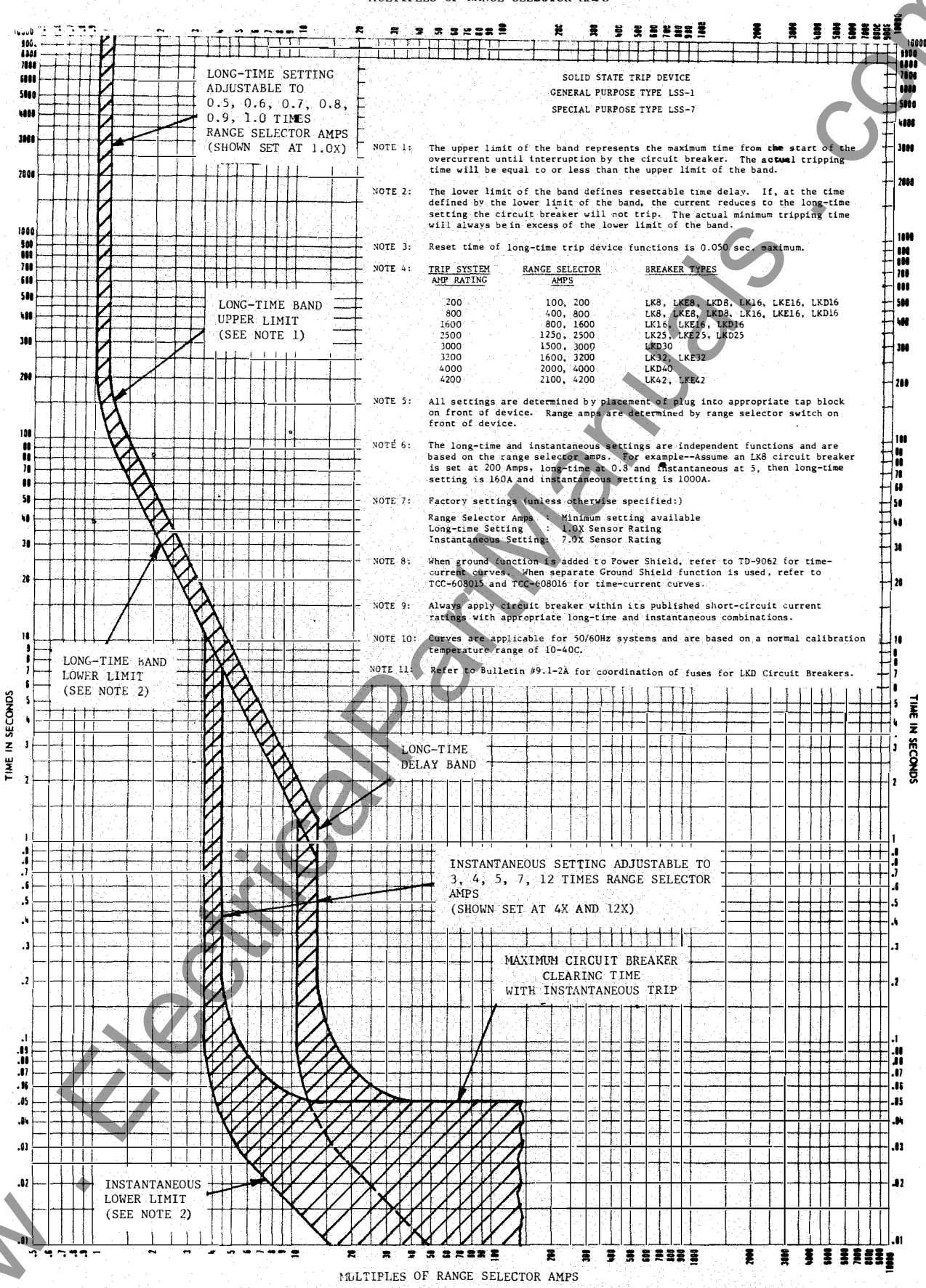
NOTE 9: Always apply circuit breaker within its published short-circut current ratings with appropriate long-time and short-time combinations.

NOTE 10: Curves are applicable for 50/60Hz systems and are based on a normal calibration temperature range of 10-40C.

NOTE 11: Refer to Bulletin #9.1-2A for coordination of fuses for LKD Circuit Breakers.

TIME CURRENT CHARACTERISTICS CURVES
Solid State Trip Device I-T-E type:
LSS-2 Long-Time and Short-Time for Type LK, LKE and LKD
Low Voltage Power Circuit Breakers

NO. **TD-9068**



SOLID STATE TRIP DEVICE
GENERAL PURPOSE TYPE LSS-1
SPECIAL PURPOSE TYPE LSS-7

NOTE 1: The upper limit of the band represents the maximum time from the start of the overcurrent until interruption by the circuit breaker. The actual tripping time will be equal to or less than the upper limit of the band.

NOTE 2: The lower limit of the band defines resettable time delay. If, at the time defined by the lower limit of the band, the current reduces to the long-time setting the circuit breaker will not trip. The actual minimum tripping time will always be in excess of the lower limit of the band.

NOTE 3: Reset time of long-time trip device functions is 0.050 sec. maximum.

NOTE 4:

TRIP SYSTEM AMP RATING	RANGE SELECTOR AMPS	BREAKER TYPES
200	100, 200	LK8, LKE8, LKD8, LK16, LKE16, LKD16
800	400, 800	LK8, LKE8, LKD8, LK16, LKE16, LKD16
1600	800, 1600	LK16, LKE16, LKD16
2500	1250, 2500	LK25, LKE25, LKD25
3000	1500, 3000	LKD30
3200	1600, 3200	LK32, LKE32
4000	2000, 4000	LKD40
4200	2100, 4200	LK42, LKE42

NOTE 5: All settings are determined by placement of plug into appropriate tap block on front of device. Range amps are determined by range selector switch on front of device.

NOTE 6: The long-time and instantaneous settings are independent functions and are based on the range selector amps. For example--Assume an LK8 circuit breaker is set at 200 Amps, long-time at 0.8 and instantaneous at 5, then long-time setting is 160A and instantaneous setting is 1000A.

NOTE 7: Factory settings (unless otherwise specified:)
Range Selector Amps : Minimum setting available
Long-time Setting : 1.0X Sensor Rating
Instantaneous Setting: 7.0X Sensor Rating

NOTE 8: When ground function is added to Power Shield, refer to TD-9062 for time-current curves. When separate Ground Shield function is used, refer to TCC-608015 and TCC-608016 for time-current curves.

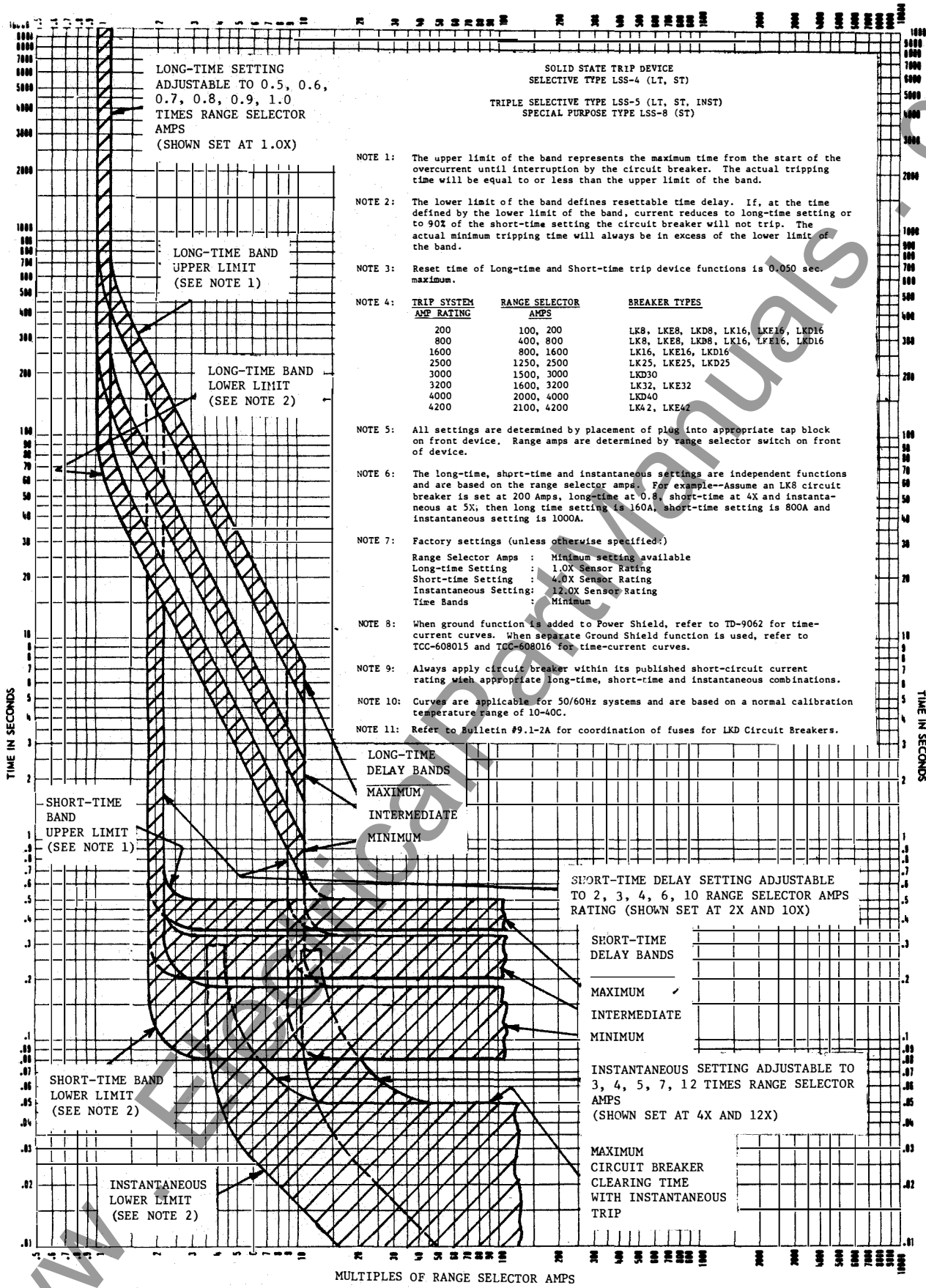
NOTE 9: Always apply circuit breaker within its published short-circuit current ratings with appropriate long-time and instantaneous combinations.

NOTE 10: Curves are applicable for 50/60Hz systems and are based on a normal calibration temperature range of 10-40C.

NOTE 11: Refer to Bulletin #9.1-2A for coordination of fuses for LKD Circuit Breakers.

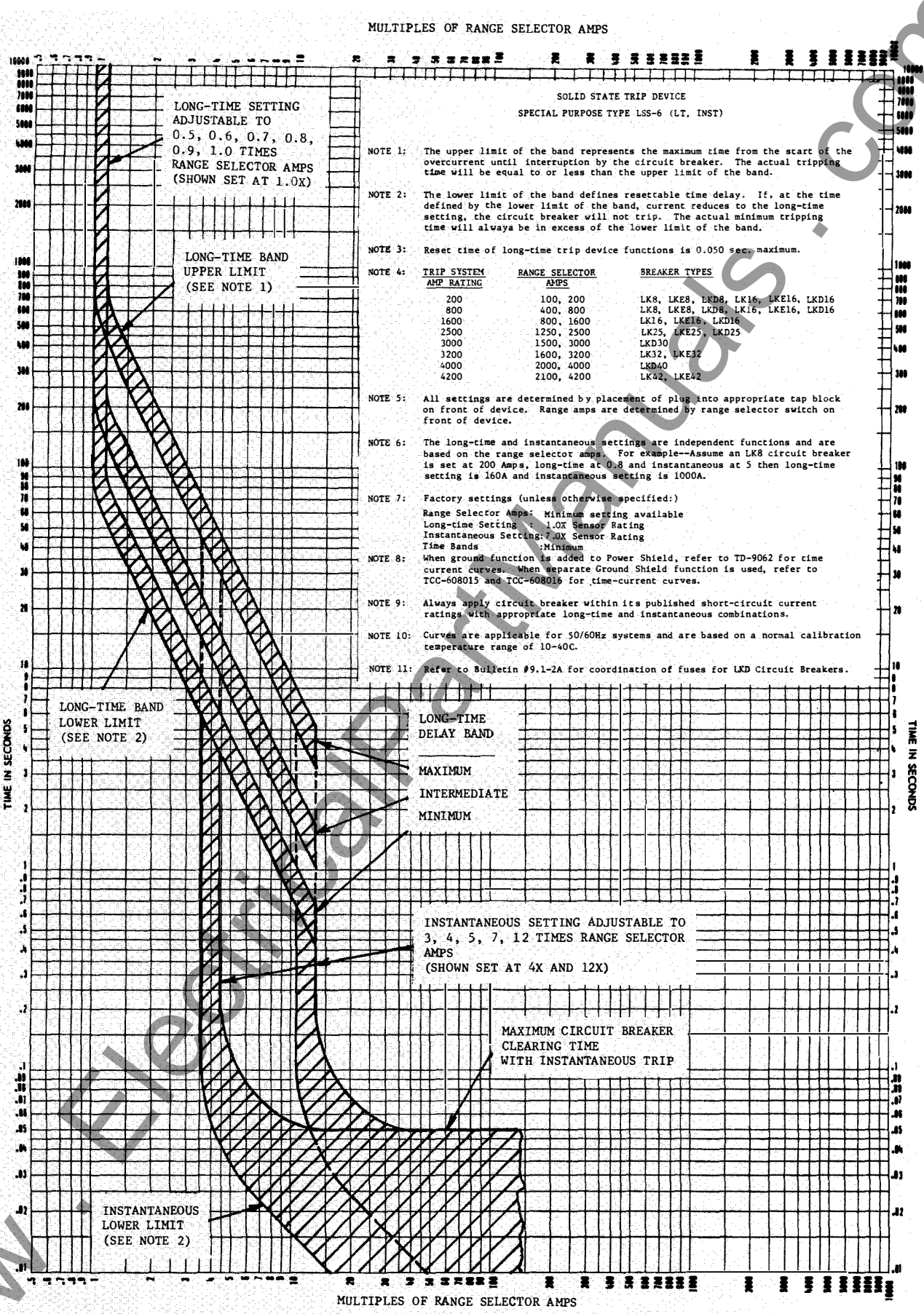
TIME CURRENT CHARACTERISTIC CURVES
Solid State Trip Device I-T-E types:
LSS-1 Long-Time and Instantaneous, General Purpose
LSS-7 Instantaneous, Special Purpose
for LK, LKE and LKD Low Voltage Power Circuit Breakers

NO. **TD-9058**



TIME CURRENT CHARACTERISTIC CURVES
Solid State Trip Device I-T-E types:
LSS-4 Long-Time and Short Time, Selective
LSS-5 Long-Time, Short-Time and Instantaneous, Triple Selective
LSS-8 Short-Time, Special Purpose
for Type LK, LKE and LKD Low Voltage Power Circuit Breakers

NO. **TD-9060**



SOLID STATE TRIP DEVICE

SPECIAL PURPOSE TYPE LSS-6 (LT, INST)

NOTE 1: The upper limit of the band represents the maximum time from the start of the overcurrent until interruption by the circuit breaker. The actual tripping time will be equal to or less than the upper limit of the band.

NOTE 2: The lower limit of the band defines resettable time delay. If, at the time defined by the lower limit of the band, current reduces to the long-time setting, the circuit breaker will not trip. The actual minimum tripping time will alwaya be in excess of the lower limit of the band.

NOTE 3: Reset time of long-time trip device functions is 0.050 sec. maximum.

NOTE 4:

TRIP SYSTEM AMP RATING	RANGE SELECTOR AMPS	BREAKER TYPES
200	100, 200	LK8, LKE8, LKD8, LK16, LKE16, LKD16
800	400, 800	LK8, LKE8, LKD8, LK16, LKE16, LKD16
1600	800, 1600	LK16, LKE16, LKD16
2500	1250, 2500	LK25, LKE25, LKD25
3000	1500, 3000	LKD30
3200	1600, 3200	LK32, LKE32
4000	2000, 4000	LKD40
4200	2100, 4200	LK42, LKE42

NOTE 5: All settings are determined by placement of plug into appropriate tap block on front of device. Range amps are determined by range selector switch on front of device.

NOTE 6: The long-time and instantaneous settings are independent functions and are based on the range selector amps. For example--Assume an LK8 circuit breaker is set at 200 Amps, long-time at 0.8 and instantaneous at 5 then long-time setting is 160A and instantaneous setting is 1000A.

NOTE 7: Factory settings (unless otherwise specified:)
Range Selector Amps: Minimum setting available
Long-time Setting : 1.0X Sensor Rating
Instantaneous Setting: 7.0X Sensor Rating
Time Bands :Minimum

NOTE 8: When ground function is added to Power Shield, refer to TD-9062 for time current curves. When separate Ground Shield function is used, refer to TCC-608015 and TCC-608016 for time-current curves.

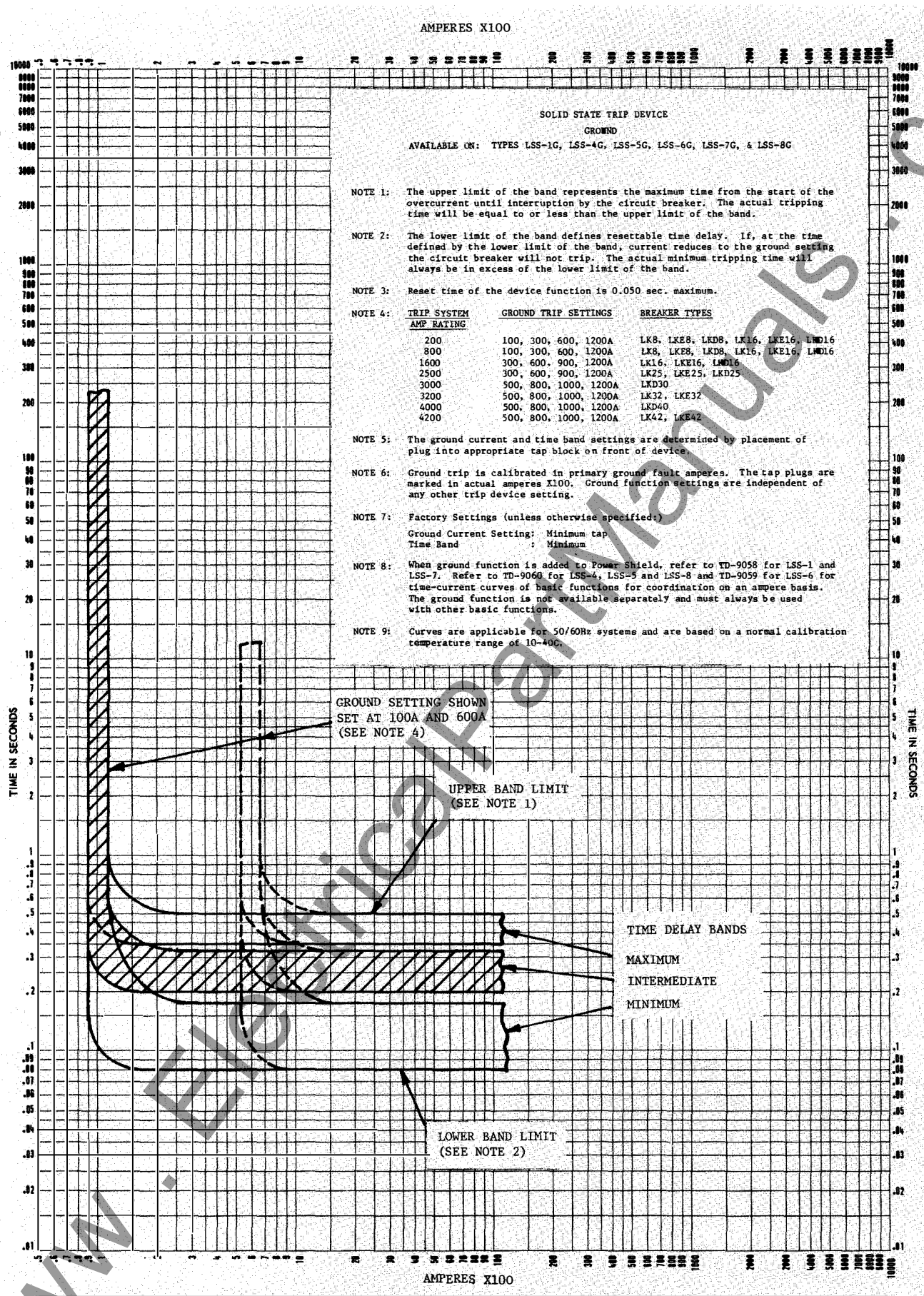
NOTE 9: Always apply circuit breaker within its published short-circuit current ratings with appropriate long-time and instantaneous combinations.

NOTE 10: Curves are applicable for 50/60Hz systems and are based on a normal calibration temperature range of 10-40C.

NOTE 11: Refer to Bulletin #9.1-2A for coordination of fuses for LKD Circuit Breakers.

TIME CURRENT CHARACTERISTIC CURVES
Solid State Trip Device I-T-E type:
LSS-6 Long-Time and Instantaneous, Special Purpose
for type LK, LKE and LKD Low Voltage Power Circuit Breakers

NO. **TD-9059**



TIME CURRENT CHARACTERISTIC CURVES
Solid State Trip Device for ground function I-T-E types:
LSS-1G LSS-5G
LSS-4G LSS-6G
for type LK, LKE and LKD Low Voltage Power Circuit Breakers

NO. **TD-9062**

Table 7 Electrical Ratings of Auxiliary and Alarm Contacts

Nominal Control Voltage	High Load Alarm, Ground Alarm	Contact Rating A		
		Auto Trip Alarm Undervoltage Alarm Open Fuse Trip Alarm	Integral Aux. Contacts	M.O.C. T.O.C.
110-120 VAC 60/50 HZ	5	11 / 4 (Lamp Load)	40	30
208-240 VAC 60/50 HZ	Not Applicable	11	25	20
480 VAC 60/50 HZ	Not Applicable	Not Applicable	15	10
600 VAC 60/50 HZ	Not Applicable	Not Applicable	8	7
24 VDC	5	6.0 / 10 Lamp Load	10	20
48 VDC	5	2.5	8	15
125 VDC	5	.5	5	10
250 VDC	Not Applicable	.25	1	5

Table 8 Undervoltage Trip Device

Nominal Control Voltage	Current A at Rated Volts	Minimum Pick-up Voltage Value, V	Dropout Voltage Range	
			Minimum V	Maximum V
120 V ac	.44	93	36	72
240 V ac	.22	187	72	144
480 V ac	.11	374	144	288
600 V ac	.09	480	180	345
48 V dc	.33	41	14	29
125 V dc	.14	106	38	75
250 V dc	.07	212	75	150

Table 9 Circuit Breaker Control Power Requirements

Circuit Breaker Type	Nominal Control Voltage	Average Charging Motor Current, A	Shunt Trip Current A	Close Current, A		Closing Circuit Range, V	Trip-Circuit Range, V	Recommended Control Circuit Fuse Size, A
				Anti-Pump Y Coil	Release X Coil			
*LK 8	120V ac	10	9.0	.36	9.0	104-127	104-127	10
LK 16	240V ac	5	4.5	.18	4.5	208-254	208-254	10
LK 25	48V dc	15	6.6	.24	6.6	38-56	28-56	15
LK 32	125V dc	6	2.6	.12	2.6	100-140	70-140	10
LK 42	250V dc	3	1.3	.06	1.3	200-280	140-280	10
LKD 8	120V ac	10	9.0	.36	9.0	104-127	104-127	10
LKD 16	240V ac	5	4.5	.18	4.5	208-254	208-254	10
LKD 25	48V dc	15	6.6	.24	6.6	38-56	28-56	15
LKD 30	125V dc	7	2.6	.12	2.6	100-140	70-140	10
LKD 40	250V dc	3.5	1.3	.06	1.3	200-280	140-280	10

* Control voltage applies to all ratings within the bracket. Values shown for LK are also applicable to LKE

Table 10 LK, LKE and LKD Circuit Breaker Load Switching Time (Cycles on 60 HZ Base)

Type	Charging*	Closing	Opening +
LK & LKE 8	2 Seconds	2.5 Cycles	2.0 Cycles
LK & LKE 16	2 Seconds	2.5 Cycles	2.0 Cycles
LK & LKE 25	2.5 Seconds	3.0 Cycles	2.0 Cycles
LK & LKE 32	2.5 Seconds	3.0 Cycles	2.0 Cycles
LK & LKE 42	2.5 Seconds	3.0 Cycles	2.0 Cycles

* Electrically operated spring charging motor
+ Full load switching current

Table 11 LK, LKE and LKD Circuit Breaker and Cradle Weights in Pounds*

Breaker Type	Manual Operation	Electrical Operation	Cradle
LK & LKE 8	152	167	89
LK & LKE 16	170	185	104
LK & LKE 25	280	295	158
LK & LKE 32	290	305	173
LK & LKE 42	294	309	177
LKD 8	228	243	109
LKD 16	266	281	124
LKD 25	380	395	183
LKD 30	390	405	200
LKD 40	394	409	204

* Circuit Breakers and Cradles weighed fully equipped.

Table 12 Integral Fused Current Limiting Power Circuit Breaker Ratings

Circuit Breaker Type	Frame Size, A	System Voltage AC	Maximum Continuous Current, A	Maximum Interru ting Symmetrical Rating RMS A	Range of Circuit Breaker Pickup, A	Amp-trap Continuous Rating, A
LKD 8	800	Up to 600	800	200,000	50-800	300-1600
LKD 16	1600	Up to 600	1600	200,000	50-1600	300-2500
LKD 25	2500	Up to 600	2500	200,000	625-2500	5000
LKD 30	3000	Up to 600	3000	200,000	750-3000	6000
LKD 40	4000	Up to 600	4000	200,000	1000-4000	6000

Table 13 LKD Circuit Breaker Application

1	2	3	4	5
Type of Application	Purpose of Circuit Breaker	Continuous Current Rating of Circuit Breaker	Recommended Settings of Overcurrent Trip Device	
			Time Delay	Instantaneous
BRANCH CIRCUITS (GENERAL)				
Sevice entrance (general)	(a) To protect source transformer windings from overheating, due to overload of fault current flow. (b) To protect circuit conductors from effects of overcurrent flow. (c) To provide safe and rapid means for connecting and disconnecting of load circuit.	Based upon 125% of the current rating	125% of the transformer current rating	700%
Service feeder (general)	(a) To protect circuit conductors from effects of overcurrent flow. (b) To protect connected electrical equipment from effects of fault current flow.	Based upon 115% of estimated load current	115% of estimated load current	700%
Individual Motor Circuit	(a) To protect motor windings from overheating due to overcurrent or fault current flow. (b) To protect circuit conductors and other connected electrical equipment from oversized or fault current flow. (c) To provide safe and rapid means of connecting and disconnecting motor circuit.	Based upon 115% of rated full-load current of motor	115% of rated full-load current of motor	1200%
Group motor circuit	(a) To protect circuit conductors from overheating. (b) To protect circuit conductors, motor windings and other connected electrical equipment from fault current flow. (c) To provide safe and rapid means of connecting and disconnecting common motor circuit from supply source.	Based upon 115% of largest motor full-load current plus sum of other motor currents	100% of circuit-breaker current rating	1200%
Combined motor and lighting	(a) To protect circuit conductors from overheating. (b) To protect circuit conductors, motor windings and other connected electrical equipment from fault current flow. (c) To provide safe and rapid means of connecting and disconnecting common load circuit from supply source.	Based upon 115% of largest motor full-load current plus sum of other motor and lighting load currents	100% of circuit-breaker current rating other motor	1200%
Lighting circuit	(a) To protect circuit conductors from effects of overload or fault current flow. (b) To provide safe and rapid means of connecting and disconnecting lighting circuit from supply source.	Based upon 125% of estimated maximum lighting current	100% of circuit-breaker current rating	700%

Table 14 LK Circuit Breaker Operations for Repetitive Duty and Maintenance

Circuit Breaker Frame Size A Col. 1	Number of Operations Between Servicing Col. 2		Number of Operations					
			No Load Mechanical Col. 3		Rated Continuous Current Col. 4		Inrush Current Switching Col. 5	
Operating Conditions (See Page 17)	* Para. A	△ GBB	* Para. A thru G	△ GBB	* Para. A, C thru H and J	△ GBB	* Para. C thru G I and J	△ GBB
800	1750	1750	9700	9700	2800	2800	1400	1400
1600	500	500	3200	3200	800	800	400	400
2500	250	500	1100	3200	400	800	★	400
3000 LKD	250	500	1100	3200	400	800	★	400
3200	250	500	1100	3200	400	800	★	400
4000 LKD	250	500	1100	3200	400	800	★	400
4200	250	500	1100	3200	400	800	★	400

* Per ANSI Standard C37.16-1973
★ Not included in the standard.
△ All LK, LKE and LKD circuit breakers are built to meet and exceed industry standards. Table indicates the capabilities of the LK design when operated under usual service conditions. The exerptfrom the ANSI standards, specifically paragraphs A to J inclusive list the conditions which must be considered in order to achieve the number of circuit breaker operations shown in Table.

Speciafications Guide for I-T-E Type LK Circuit Breakers

NOTE: Blank space and italics denotes information to be added by purchaser regarding either:

- Choice of alternatives
- Addition of optional features

Stationary Construction
AC Power circuit breakers shall be three (3) pole, 635 volts maximum service at 50/60 Hz. The arcing contacts shall be made of silver tungsten alloy and the main contacts to be made of heavy silverplated copper with both sets operating with a wiping, self-cleaning action. The *(Manual) (Electrical)* operating mechanism is to be of the *(Manual) (Motor)* spring charged, stored energy type with an integral manual charging handle supplied on all manually operated or electrically operated breakers. The closing operation shall be separate from the charging operation and shall be initiated after charging by a manual closing push button which releases the spring energy to close the circuit breaker contacts. A control center shall be provided as part of the breaker face plate containing manual trip lever, manual close push button, primary contact position indicator, automatic trip indicator, and a hasp that can receive up to three padlocks when the breaker is in the open position positively preventing unauthorized closing of the breaker. The control center shall be accessible through an access port in the circuit breaker compartment door.

Each electrically operated circuit breaker shall be equipped with a spring charging motor ___Volts **(AC) (DC),** ___Hz., and closed by using either the manual close push button or the electrical closing coil assembly ___Volts **(AC) (DC)** ___Hz energized by a pushbutton on the face plate (and/or a remote breaker control switch). A shunt trip coil assembly ___Volts **(AC) (DC)** ___Hz., energized by a pushbutton on the face plate (and/or a remote breaker control switch) shall be included to electrically open all electrically operated circuit breakers. A charging motor disconnect switch will be provided on the face plate to facilitate maintenance and emergency test operation with the motor disconnected.

Each circuit breaker shall be provided with a solid-state trip device equipped with *(Long Time) (Short Time) (Instantaneous) (Ground Fault)* trip elements coordinated with *(Long Time) (Short Time) (3-wire Ground Fault) (4-wire Ground Fault)* time delay adjustments, each capable of being set using accurate, easy to use tap plugs. *A target is to be provided with each trip element supplied and is to be displayed independent of control power. All solid-state trip devices are to be capable of being tested using a portable test set which can also be used to test the current sensors and automatic trip indicator.*

Add With Drawout Construction:
The circuit breakers shall be of the drawout type using a proven cradle design with self-aligning primary and secondary disconnecting contacts. The drawout mechanism shall hold the circuit breaker rigidly in the connected, test, disconnected and withdrawn positions. The rails shall extend forward from the cell and allow the circuit breaker to be withdrawn to the out position and rotated to expose both the back and the bottom of the breaker for maintenance and inspection. Interlocks shall prevent racking of the breaker to any of the drawout positions unless the main contacts are open. Provision shall be made for padlocking the breaker open and in any of the positions noted above. Racking of the breaker shall be controlled by a positive stop latch in connected, test and disconnect positions. This stop latch must be released by a racking release lever in order to rack breaker from one position to the next. All racking provisions including cranking, racking release lever, breaker position indicator shall be located in the control center and be accessible through an access port with the breaker compartment door closed.

The drawout cradle shall include provisions to mount up to three (3) current transformers (one per phase) around the stationary primary contacts and an interference block to allow only the circuit breaker with correct frame rating to be inserted into the cradle.

Add For Fused (LKD) Circuit Breakers:
Circuit Breakers shall include current limiting "Amp-Trap" fuses integrally mounted and coordinated with the solid-state trip device so as to avoid unnecessary operation of the current limiting fuses. All fused breakers will be equipped with an open fuse trip lockout device that is visible from the front face plate and trips the breaker when a fuse opens. The open fuse indicator shall display which fuse has opened and its associated lockout shall prevent the breaker from being reclosed until the fuses are replaced and the lockout is manually reset.

Ordering Information

When ordering circuit breakers, please supply the following information (Cross out terms not required):
___(Quantity) Three pole circuit breaker(s)
(Stationary) (Drawout), Mounting for
Type **LK, LKE (8) (16) (25) (32) (42)**
Type **LKD (8) (16) (25) (30) (40)**
(Manual) (Electrical) Operation; *control voltage Trip___ Close___ Spring charge Motor___.
(800) (1600) (2500) (3000) (3200) (4000) (4200) A Continuous Current rating; system voltage **(208/120) (240) (480/277) (550) (600)** AC Power Shield Trip Unit with **Long-time, Short-time, Instantaneous, Ground, 3W, 4W** trip functions; (200) (800) (1600) (2500) (3000) (3200) (4000) (4200) A sensor. Targets **are/are not** required for each function specified.

*NOTE: Control voltage and frequency must be given for close coil, trip coil, spring charging motor and any other auxiliary device.

Optional Features

Add description for circuit breaker optional features:
Alarm Switches
- Automatic trip (1r & 1s) or (2r & 2s) contacts
- High Load (no trip), 1-N.O. contact
- Undervoltage trip, 1-N.O. contact
- Ground Trip, 1-N.O. contact (momentary)
- Open fuse trip (LKD only), 1-N.O. contact

Local electrical close and trip pushbuttons
Overcurrent lockout (manual reset)
Undervoltage trip—Instantaneous (___V___Hz)
Undervoltage trip—Factory set Time Delay 0-15 sec. (___V___Hz)
Shunt Trip (State ___V___Hz)
Operation Counter
Wiring change to charge close springs after close
Additional secondary disconnects (up to 28 total)
Test set for Power-Shield type LSS—Solid-state trip unit

When ordering circuit breaker drawout cradle, please supply the following information (Cross out terms not required): ___Quantity; Three pole circuit breaker drawout cradle(s) for
Type **LK, LKE (8) (16) (25) (32) (42)**
Type **LKD (8) (16) (25) (30) (40)**
(Manual) (Electrical) operation; **(800) (1600) (2500) (3000) (3200) (4000) (4200)** A continuous current rating; system voltage **(208/120) (240) (480) (480/277) (550) (600)** A.C. **(50) (60)** Hz.

Add description for cradle optional features:
Auxiliary Switches
- MOC—4 or 8 contacts, 4 (2a &2b), 8 (4a & 4b)
- TOC—4 or 8 contacts, 4 (2S & 2H), 8 (4H & 4S), all to operate between connect and test or test and disconnect positions or 4 to operate between connect and test and 4 to operate between test and disconnect positions.

Key Interlock (provisions)
Key Interlock (provisions and lock)
Circuit Breaker contact position indicator—operates in connected or connected and test positions.
Mechanical transfer interlock (between two adjacent breakers)
Additional secondary disconnects (28 total)
Secondary disconnects—connected or test position

In addition to completely specifying the required circuit breaker, ordering information should include any unusual conditions concerning application, the required shipping date, the method of shipment desired, and any other considerations that are applicable.

Example No. 1
One (1), three pole circuit breaker(s) **Stationary** mounting; Type **LK16; Manual** operation; control voltage **None. 1600 amperes** continuous current rating; system voltage **480 volts** AC, **60** Hz. LSS-**1, General** purpose Power-Shield Trip Unit with **Long-time and Instantaneous** trip functions; 800A sensor. Targets **are not** required.

Example No. 2
One (1); three pole circuit breaker **Drawout** mounting, Type LK***; Electrical** operation; control voltage **125 volts AC,** 60 Hz. spring charge motor. **800** amperes continuous current rating; system voltage **480 volts AC,** 60 Hz. LSS-**5G total** purpose Power-Shield Trip unit with **Long-time, Short-time, Instantaneous, Ground, 3W** trip

Type LK8*; **Electrical** operation; control voltage **120 volts AC,** 60 Hz. trip, close, spring charge motor. **800** amperes continuous current rating; system voltage **480 volts AC,** 60 Hz. LSS-**5G total** purpose Power-Shield Trip unit with **Long-time, Short-time, Instantaneous, Ground, 3W** trip functions; 200A sensor. Targets **are** required for each function supplied.

Example No. 3 (Cradle for Example No. 2)
One (1); three pole drawout cradle for Type **LK8. Electrical** operation; **800** amperes continuous current rating; system voltage **480 volts** AC, 60 Hz.

(Refer to tables in Product Catalog Section 9.1., pages 1 and 2 for pricing.)

Gould-Brown Boveri
Switchgear Division
Spring House, Pa. 19477

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The Power Delivery Company

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