Molded Case Circuit Breakers

Application and Selection

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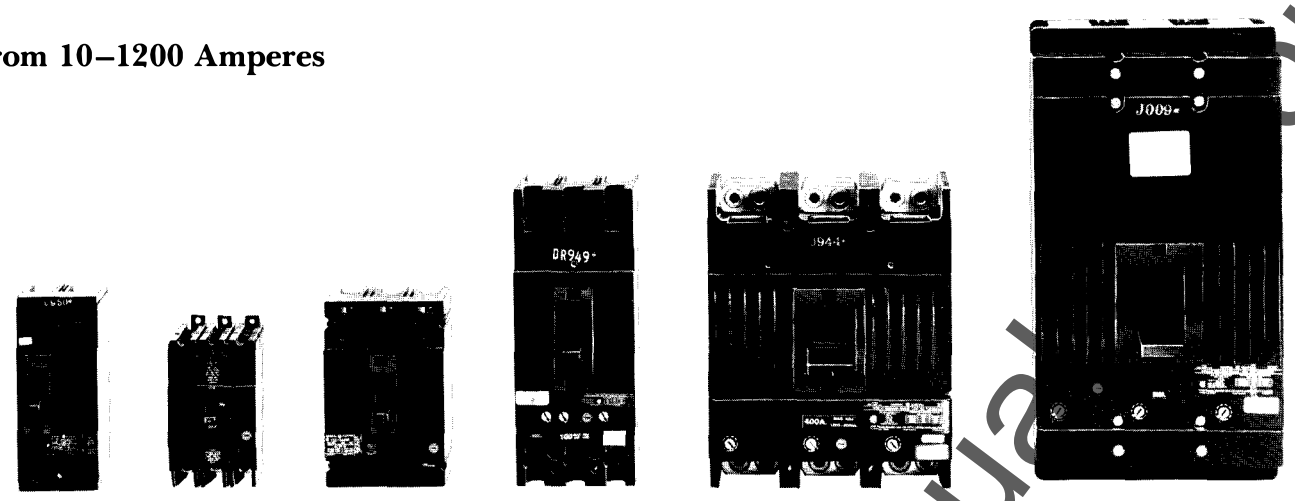
Refer to GE publications GEA-11884 and GET-7002 for information on new, solid-state, RMS sensing Spectra RMS™ molded case circuit breakers.

The GE Family of Molded Case Circuit Breakers

From 10–1200 Amperes



Q-LINE TEY E150 F225 J600 K1200

- **APPLICATION FLEXIBILITY**
  In switchboards, motor control centers and lighting and in power panelboards, General Electric molded case circuit breakers increasingly are being used to provide reliable circuit protection. Molded case circuit breakers in individual enclosures are also being used in numerous applications.

- **MINIMUM DOWNTIME**
  Downtime is reduced and fuse replacement is eliminated with circuit breakers. In case of overload or short circuit, the breaker trips, opening the circuit and protecting the conductors. When normal conditions are restored, the breaker can be closed ("ON") again.

- **TRIP-FREE MECHANISM**
  The breaker's *trip-free* mechanism opens the breaker contacts under overload or short circuit conditions, even with the breaker handle held in the ON position.

- **ELIMINATES SINGLE-PHASING**
  Circuit breakers eliminate single-phasing. When an overload or short circuit occurs on any one conductor, a common trip bar simultaneously disconnects all three conductors of a three-phase circuit.

- **EASY SYSTEM UPGRADING**
  With General Electric circuit breakers, the circuit can be uprated, even after the breaker has been installed. Interchangeable trips provide a wide range of ratings within the same frame size.

- **ACCESSORY FUNCTIONS**
  Application flexibility of molded case circuit breakers are enhanced by a breaker accessory line.Remote closing or opening, voltage-drop protection, indication of "tripped" condition at a remote location, electrical or mechanical interlocking, automatic reclosing, and primary or sequential operation are some of the functions practical with accessories.

- **SPACE SAVINGS**
  Space savings can be an important factor in selecting General Electric molded case circuit breakers as equipment components. Higher rated breakers in particular, offer major space economies over fused switches.

- **INTERRUPTING ABILITY**
  Interrupting ratings of General Electric molded case circuit breakers are based on actual short circuit tests. Breakers are rated for RMS symmetrical ac amperes and for maximum dc amperes.

- **STANDARDS AND SPECIFICATIONS**
  General Electric molded case circuit breakers meet standards established by Underwriters' Laboratories, National Electrical Manufacturers Association, Federal Specifications, Institute of Electrical and Electronic Engineers, National Electrical Code and General Electric Company's own high quality standards.

Rugged, Dependable Construction

1. **Molded case** is ruggedly constructed insulating material.

2. **Trip indication** is shown by handle position midway between ON and OFF. To reset the trip mechanism, move the handle to extreme OFF, then to ON position.

3. **Quick-make, quick-break, trip-free mechanism** minimizes arcing during breaker operation. Contacts cannot be "teased" into position. Trip-free mechanism is independent of manual handle control. The breaker trips under short circuit or overload, even though the operating handle is held in ON position.

4. **Front-adjustable magnetic trip** provides instantaneous trip in event of short circuit. Any current surge above the trip setting produces a magnetic field which instantly actuates the trip mechanism and opens the circuit.

5. **VERIFIER™ "Twist-to-Trip"** mechanically simulates over-current tripping through actuation of linkages not operated by the ON-OFF handle. Experience has shown that thermal magnetic circuit breakers in industrial applications better maintain their original protective characteristics when regularly exercised.

6. **Thermal trip** provides protection against sustained overloads. A bi-metallic element, not shown, reacts time-wise in inverse proportion to the current. If a circuit is overloaded, heat resulting from excessive current flow causes the bi-metal to bend, actuating the trip mechanism to open the circuit.

7. **Common-trip bar** assumes instant disconnect of all conductors when an overload or short circuit occurs on any one conductor in the circuit, or an accessory trip device operates.

8. **Interchangeable trip units** (for frames over 150 ampere rating) simplify stocking and reduce inventory requirements. Field interchangeability assures maximum flexibility.

9. **Silver alloy contacts** combine the conductive properties of silver with other elements for clean, positive electrical contacting. Pitting and burning are minimized for longer contact life.

10. **Arc chutes** of heat-absorbing insulating material and metal grid plates quickly "extinguish" arcs.

11. **UL listed lugs** for copper or aluminum cable, at full frame rating. Easy access, and simple straight-in wiring.

12. **Front adjustable programming functions** provide a high degree of flexibility and convenience in making and checking settings.

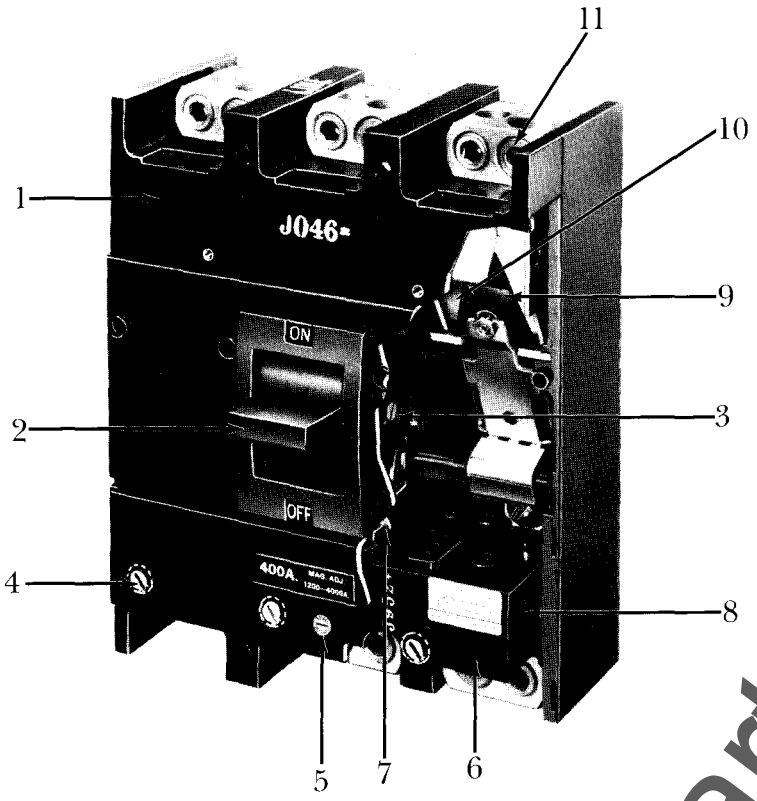
13. **Long time pick up light** is illuminated whenever the breaker is experiencing an overload condition. The light is extinguished by removing the overload or tripping the breaker.

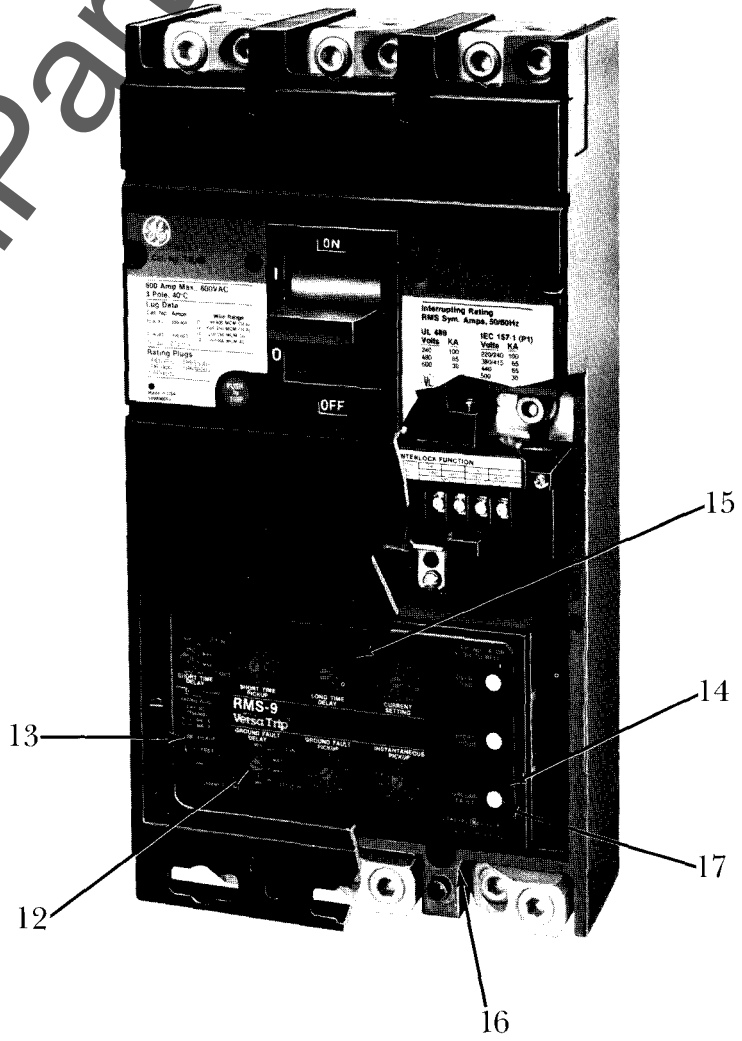
14. **Glass epoxy printed circuit boards, not shown, with epoxy conformal coding** over all assembled components provide long life with error free operation.

15. **Switch contacts and board interconnectors, not shown,** provide corrosion resistance and long product life.

16. **Neutral current sensor connections** located between the breaker lugs allow panelboard mounting of breakers without special fillers or increased panel space.

17. **Fault trip indicators** for overload, short circuit and ground fault are available for local indication.





THERMAL MAGNETIC AND SOLID STATE TRIP UNITS

Thermal magnetic trip units are available in all GE molded case circuit breakers from Q Line through K frame. Solid state trip units may be alternately selected for J and K frame circuit breakers. Additionally, non-automatic circuit interrupters, or molded case switches, are available. These interrupters have no automatic overload or short circuit trip elements. They are used for manual switching and isolation.

ENCLOSURE COMPENSATED THERMAL TRIP: 40°C

An enclosure compensated thermal trip is constructed to permit an enclosed circuit breaker in a 25°C room ambient to carry 100% of its nameplate current intermittently and 80% of its nameplate current continuously when cabled with conductor sized per the UL 489 standard (see Table 1, page 30).

The thermal trip action is accomplished by a bimetallic strip. The movement of the bimetal and thus tripping is proportional to current—high current fast response, low current slow response. This action provides a time delay which prevents service interruptions from normal inrush currents or temporary overloads. Continuous overloads will cause the bimetal to deflect sufficiently to release the latch and open the breaker contacts. However, the bimetal is also sensitive to ambient temperatures. If the room ambient is above or below 25°C, or the enclosure is warmer than normal, the breaker rating will vary inversely to the temperature; higher ambient-lower current, lower ambient-higher current. Enclosure compensation is furnished on Q-Line TEB, TEY, TB-1, TED 277 volt and TED 480 volt circuit breakers.

AMBIENT TEMPERATURE COMPENSATING THERMAL TRIP: 10° TO 50°C

An ambient compensating or "Ambient Compensated," thermal trip is the same as an enclosure compensated trip with one notable exception. It has a reduced sensitivity to changes in ambient temperature. In an ambient compensating thermal trip an additional bimetal is added to the circuit breaker. This bimetal responds to breaker ambient and modifies the characteristics of the current sensing bimetal to compensate for ambient temperature changes.

Ambient compensating thermal trips are provided as standard in all 600 volt thermal-magnetic molded case circuit breakers.

ADJUSTABLE MAGNETIC TRIP—F225, J600, K1200 and TEC, TEML, TFC, TJC, TKC, TFL, THLC-2, THLC-4, TLB4

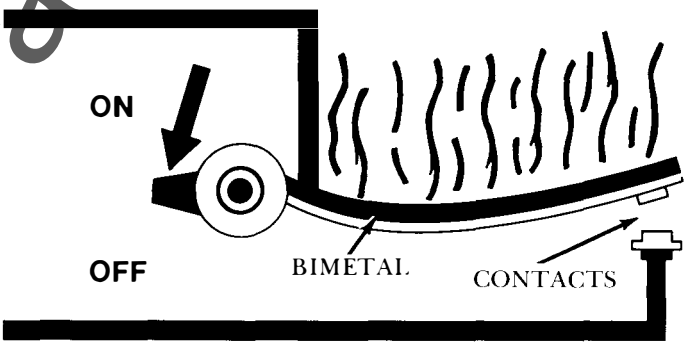
An electromagnet which partially surrounds the bimetal is used to provide instantaneous trip in the event of a short circuit. The high current creates a strong magnetic field attracting the armature and releasing the trip latch in the same manner as the bimetal does on overload.

For short circuit protection, the adjustable magnetic trip provides **high, low** and **intermediate** trip settings.

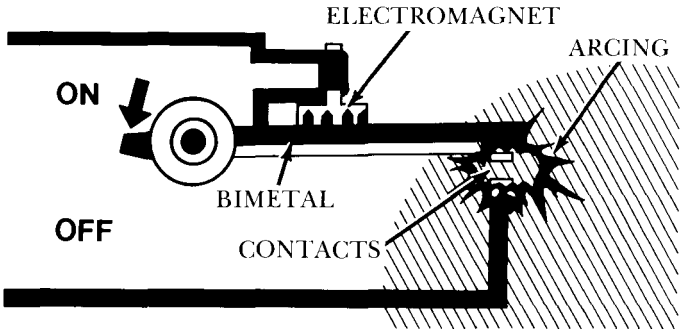
SOLID STATE TRIP: −20° TO +55°C

Solid state MicroVersaTrip® RMS-9 trip units meet the same standards as thermal trip units. Complete circuit breakers equipped with MicroVersaTrip® trip units are rated to carry 100% of their current sensor rating intermittently and 80% continuously in a 40°C breaker ambient. Some MicroVersaTrip® RMS-9 equipped breakers are rated to carry 100% continuously and are so marked.

In addition to the protection of conductors as required by codes and standards, MicroVersaTrip® RMS-9 can be set to provide protection for equipment such as motors, generators or transformers and provide improved distribution system selectivity.



Overload Protection



Short Circuit Protection

Figure 6.1 Operation of Thermal-Mag Trip Units

TABLE 7.1 BREAKER TRIP TYPES

	Breaker Type	Trip Type
Q-LINE	A11	Non-Interchangeable
E-150	TEB	Non-Interchangeable
	TED	Non-Interchangeable
	THED Hi-Break	Non-Interchangeable
F-225	TFJ	Non-Interchangeable
	TFK	Interchangeable
	THFK Hi-Break	Interchangeable
J-600	TJJ	Non-Interchangeable
	TJK	Interchangeable
	THJK Hi-Break	Interchangeable
	TJ4V	Non-Interchangeable
	TJH4V Hi-Break	Non-Interchangeable
	TJL4V Hi-I.C.	Non-Interchangeable
	TJH Hi-Break RMS-9	Interchangeable (Rating Plug)①
	TJL Hi-I.C. RMS-9	Interchangeable (Rating Plug①)
K-1200	TKM-800	Interchangeable
	TKM-1200	Interchangeable
	THKM Hi-Break	Interchangeable
	TK4V	Non-Interchangeable
	TKL4V Hi-I.C.	Non-Interchangeable
	TKH Hi-Break RMS-9	Interchangeable (Rating Plug①)
	TKL Hi-I.C. RMS-9	Interchangeable (Rating Plug①)
Hi-I.C.	TEY	Non-Interchangeable
	TEL, TEML	Non-Interchangeable
	TFL	Non-Interchangeable
	TLB-2	Non-Interchangeable
	TLB-4	Non-Interchangeable
Current Limiting	THLC-1	Non-Interchangeable
	THLC-2	Non-Interchangeable
	THLC-4	Non-Interchangeable
Tri-Break (fused)	TB-1	Non-Interchangeable
	TB-4	Non-Interchangeable
	TB-6	Non-Interchangeable
	TB-8	Non-Interchangeable

① MicroVersaTrip® RMS-9 incorporates programmers with field replaceable rating plugs providing ease of changing ratings within frame size and sensor rating, with minimum downtime. See Table 7.2 for rating plug selection.

TABLE 7.2 J/K RATING PLUG SELECTION

Frame Type	Sensor Rating (Amps)	Current Rating (Amps)	Frame Type	Sensor Rating (Amps)	Current Rating (Amps)
J400	150	60 125 80 150 100	J600	600	300 500 400 600 450
J400	300	150 250 200 300 225	K800	800	300 600 400 700 500 800
J400	400	150 250 200 300 225 400	K1200	1200	600 1000 800 1200

Tripping Functions MicroVersaTrip RMS-9™

MicroVersaTrip RMS-9 is a trip device developed for J and K frame circuit breakers. It incorporates the newest technological advancements in over-current protection for improved reliability, long life, and flexibility. Operation is fully automatic and normally no external logic or control power inputs are required. The MicroVersaTrip system for molded case circuit breakers consists of three parts, a plug-in protection programmer, a flux shift trip device, and current sensor package.

PROGRAMMABLE MICROELECTRONIC PROCESSOR

This forms the basis of the MicroVersaTrip protection programmer. This miniaturization of circuitry provides the increased flexibility required to incorporate nine adjustable time-current functions, three mechanical fault indicators (local), a long-time pickup LED indicator (local) and zone selective interlocking. All adjustable programmer functions are automatic and self-contained. This compilation of functions provides the basis for the most flexible and useful breaker design presently available anywhere.

SPECIALLY TREATED PRINTED CIRCUIT CARDS

Each printed circuit card is given a protective conformal epoxy coating to prevent moisture absorption, fungus growth and signal leakage. All electronics are housed within a metallic enclosure designed to protect against hi-fault interruption arcs, magnetic interference, dust and other contaminants.

FLUX-SHIFT TRIP DEVICE

A low energy, positive action tripping device is automatically powered and controlled by the protection programmer.

Current Sensor Package

Three-phase current sensors are incorporated into a single package providing greater flexibility and reliability.

TABLE 8.1 MICROVERSATRIP RMS-9™ PROGRAMMER FUNCTIONS

		LI	LIT1	LIGT2	LIGT2Z1	LSIT1	LSIGT2	LSIGT2Z1	LSIGT2Z2
Long Time	Adjustable Current Setting	X	X	X	X	X	X	X	X
	Adjustable Long Time Delay	X	X	X	X	X	X	X	X
Short Time	Adjustable Pick-Up					X	X	X	X
	Adjustable Delay					X	X	X	X
	I^2t Switch					X	X	X	X
Adjustable Instantaneous Pick-Up		X	X	X	X	X	X	X	X
Ground Fault	Adjustable Pick-Up			X	X		X	X	X
	Adjustable Delay			X	X		X	X	X
	I^2t Switch			X	X		X	X	X
Targets	OL-SC		X			X			
	OL-SC-GF			X	X		X	X	X
Zone Interlock	GF				X			X	
	GF-ST								X

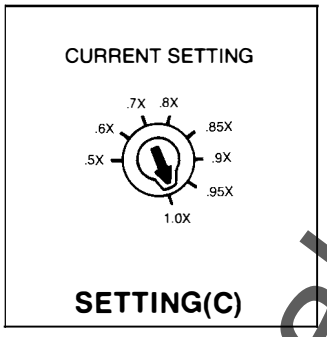
MICROVERSATRIP®—RMS-9 FUNCTION PROGRAMMER CHARACTERISTICS

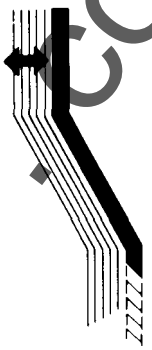
Frame Type	Sensor Rating (Amps)	Current Setting (Multiple of Rating Plug Amp) (X)	Long-Time③ Delay (Seconds)	Short-Time Pick Up (Multiple of Current Setting) (C)	Short-Time Delay (Seconds)	Adjustable Instantaneous Pick Up (Multiple of Rating Plug Amp) (X)	Ground Fault Pick Up (Multiple of Sensor Amp Rating) (S)	Ground Fault Delay (Seconds)
J400	150, 300, 400	1.0, .95, .90, .85, .80, .70, .60, .50	2.4, 4.9, 9.8, 20 at 600% of current setting at lower limit of each band	1.5, 2.0, 2.5, 3.0, 4.0, 5.0, 7.0, 9.0	I^2T in.④ .40 I^2T out.① .10, .21, .35	1.5, 2.0, 3.0, 5.0, 7.0, 9.0, 10.0 without short-time 1.5, 2.0, 3.0, 5.0, 7.0, 9.0, 10.0, 13.0, 15.0② with short-time	.2, .25, .3, .35, .4, .45, .5, .6	I^2T in.⑤ .40 I^2T out.① .10, .21, .35
J600	600							
K800	800							
K1200	1200							

① Time delay shown at lower limit of each band. Pick up tolerances ± 10%. Ground fault pick up not to exceed 1200 amps.
② J600 frame with 600-amp sensor for high IC 65kA rating (TJL) limited to 10X.
● Pick up fixed at 1.05C.
④ Time delay at 600% of current setting at lower limit of band.
⑤ Time delay at 200% of pick up setting at lower limit of band.
X = rating plug amps
S = sensor amp rating
C = current setting

CURRENT SETTING (STANDARD)

The adjustable current setting determines the nominal long time current setting with a ±10% band width. With a 1.0 setting the breaker will carry indefinitely without tripping the rating plug rating. Changing the setting changes the nominal current rating for the breaker.



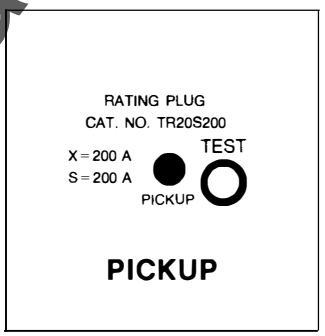


LONG-TIME DELAY (STANDARD)

This long-time delay adjustment varies the time it will take the breaker to trip under sustained overload conditions. It provides the function of withstanding momentary overloads such as motor starting, welding, or other overcurrent conditions without interrupting the service.

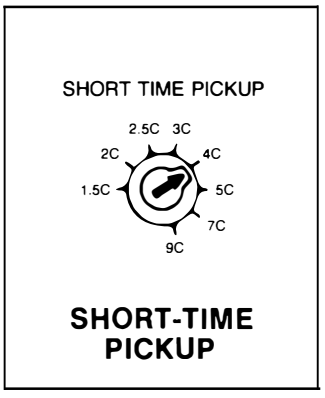
LONG-TIME PICKUP LIGHT (STANDARD)

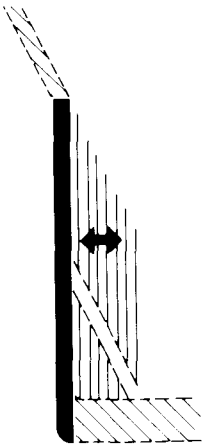
The long-time pickup light provides visual indication that the breaker is experiencing an overload condition. Indication is provided by a light-emitting diode (LED). Light flashes when current value is 95% of pickup and is on continuously at 100% of pickup. Saves test and system start up time.



SHORT-TIME PICKUP (OPTIONAL)

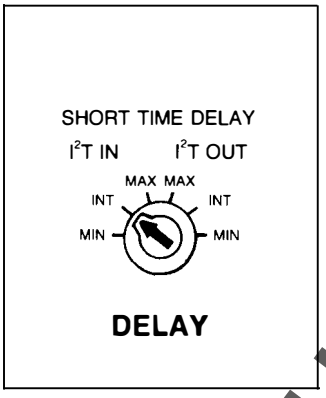
This short-time pickup adjustment controls the level of high current the breaker can carry for short periods of time without tripping. Permits downstream breakers to clear short circuit faults without tripping out the upstream protective device.

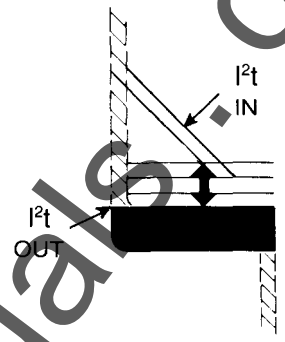




SHORT-TIME DELAY (OPTIONAL)

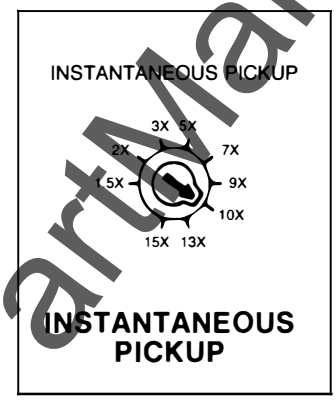
The short-time delay adjustment is used in conjunction with the short-time pickup setting to provide a further refinement of coordination between circuit breakers. It establishes the time interval the breaker will wait before responding to the short-circuit current level selected on the short-time trip point adjustment.

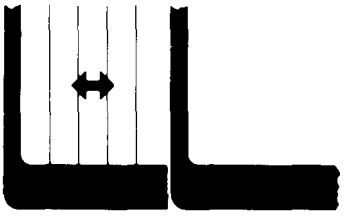




ADJUSTABLE INSTANTANEOUS PICKUP (STANDARD)

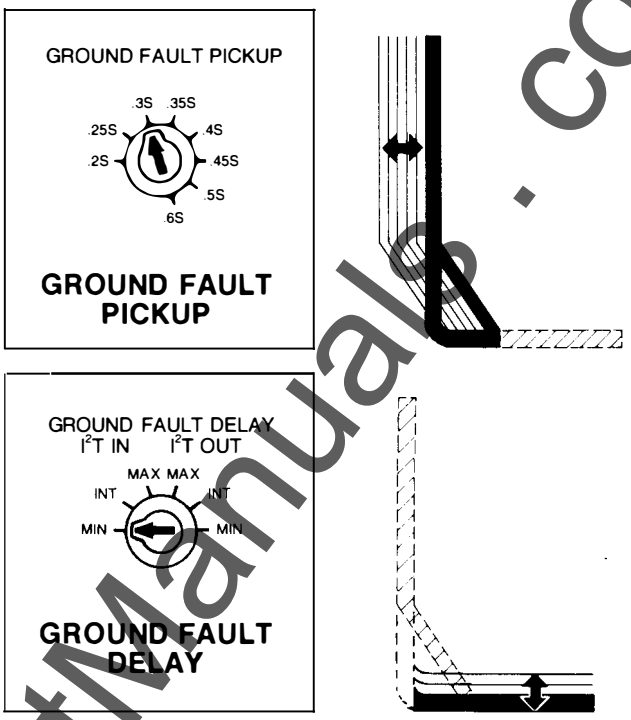
The instantaneous trip point determines the level at which the breaker will trip without intentional time delay (0.025 seconds or less). This immediate interruption occurs only as a result of a severe overcurrent condition, thereby minimizing damage to the electrical system and equipment.





GROUND FAULT PICKUP AND GROUND FAULT DELAY (OPTIONAL)

The ground fault pickup adjustment controls the level of ground fault current at which circuit interruption will occur. To comply with the National Electrical Code (NEC 230-95), no trip point exceeds 1200 amperes. The common square knee of the curve can be replaced with an I^2t function to facilitate coordination with downstream devices such as thermal-magnetic breakers and fuses whose time-current curves do not easily relate to the square-shape sensing characteristics common to solid state trip devices. The ground fault delay adjustment is used to add a pre-determined delay in time to the trip point once the ground fault pickup level has been reached. This provides tripping selectivity between main and feeder or other downstream breakers. The ground fault unit also includes as standard an inverse I^2t ramp to substantially improve coordination with downstream protective devices such as fuses and thermal magnetic circuit breakers.



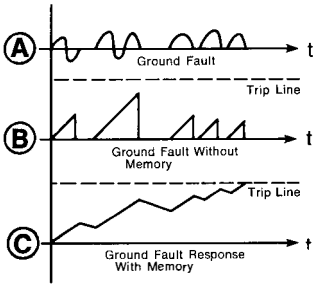
MEMORY CIRCUIT

Because of the highly intermittent and erratic nature of arcing ground faults, a memory circuit has been incorporated in all MicroVersaTrip ground fault sensing circuits as standard. The memory circuit integrates arcing fault current with time, essentially summing the intermittent ground current spikes. In the diagrams, it can be seen how the memory function works.

Diagram A shows a typical ground fault with half-cycles, whole cycles and multiple cycles missing, as normally occurs.

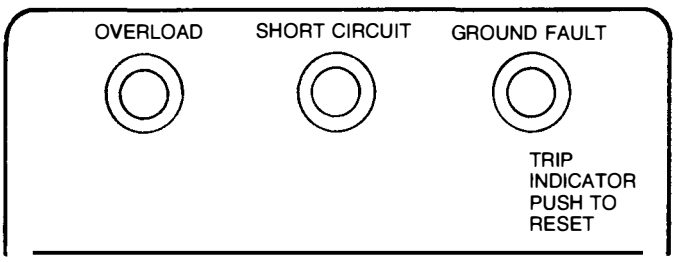
Diagram B shows trip response of a typical ground fault function which does not include memory. The breaker never trips because the time delay circuits are reset with every missing cycle.

Diagram C shows response of MicroVersaTrip ground fault circuits to the same ground fault; the circuit's memory carries through the missing cycles and generates a trip signal after the preset time delay.



FAULT TRIP INDICATORS (OPTIONAL)

Indicators are designed to reduce system downtime by analyzing any overcurrent fault and identifying its cause. Mechanical pop-out type indicators are available on the programmers for identifying overload or short circuit overcurrent faults when breakers are ordered without integral ground fault protection. Indicators are available to identify overload, short circuit and ground fault trips—for breakers supplied with integral ground fault protection.



ZONE SELECTIVE INTERLOCKING

The standard means of obtaining selectivity between main and feeder breakers is by incorporating programmers with time-coordinated trip characteristics. This consists of setting the farthest downstream breaker with a small time delay, and progressively increasing the time delay as you get closer to the main protective device. The disadvantage in this method is that the system must now endure the stress of the high current fault until time-out occurs.

The Zone Selective Interlock module, Figure 12.1, receives a signal from a downstream MicroVersaTrip programmer (Logic 0) which causes the module to transmit a low-level interlock signal to a MicroVersaTrip programmer upstream. The interlock signal activates the LED portion of an LED-Transistor Opto-isolator in the upstream programmer causing the fixed delay band to shift from "MIN" to the programmer delay band setting. Both the Short-Time and Ground Fault functions are capable of being interlocked.

Zone Selective Interlocking is available for both the short-time function and the ground fault function, or the ground fault function only. If no short-time function is supplied.

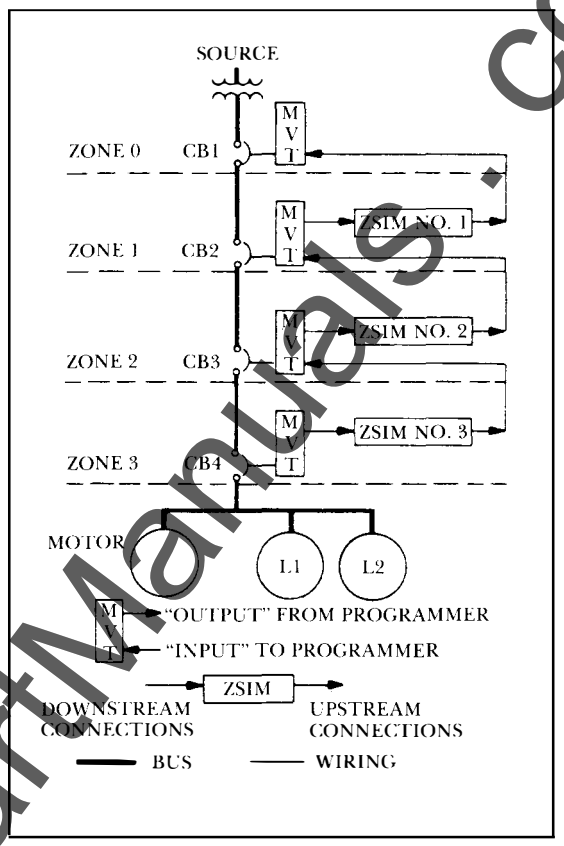
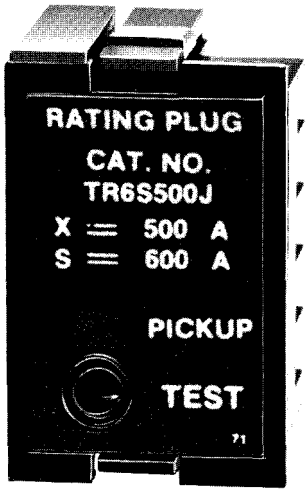


Figure 12.1 Multi-Zone Interlocking

TEST JACK

The Test Jack located on the front of the rating plug accepts a test cable supplied with a portable, battery operated test kit separately available. The test kit will test the circuit breaker while the circuit breaker is carrying load, and provides either a trip or no trip test. The test kit will simulate a time-over current condition for the long-time, short-time and ground fault functions. It will also read trip unit switch settings, and provide a report on the trip unit self-test feature.



RATING PLUG (STANDARD)

Various ratings plugs are available to fix the ampere rating equal to or lower than the sensor ampere rating as in Table 7.2.

Tripping Functions MicroVersaTrip® 4

MicroVersaTrip-4 is a trip device developed for GE J&K Frame circuit breakers. It incorporates technological advancements in overcurrent protection for improved reliability, long life, and flexibility.

Operation is fully automatic and normally no external logic or control power inputs are required. The MicroVersaTrip system for molded case circuit breakers consists of three parts, a plug-in protection programmer, a flux shift trip device, and a current sensor package.

PROTECTION PROGRAMMER

The current sensor-powered solid-state logic unit incorporates rotary adjustment knobs for up to four functions. The four functions available are standard Current Setting and Instantaneous Pickup or optional Short-time Pickup with fixed instantaneous, plus Ground Fault Delay and Ground Fault Pick Up which are optional.

FLUX-SHIFT TRIP DEVICE

A low energy positive action tripping device is automatically powered and controlled by the protection programmer.

CURRENT SENSOR PACKAGE

Three phase current sensors are incorporated into a single package providing maximum flexibility and reliability.

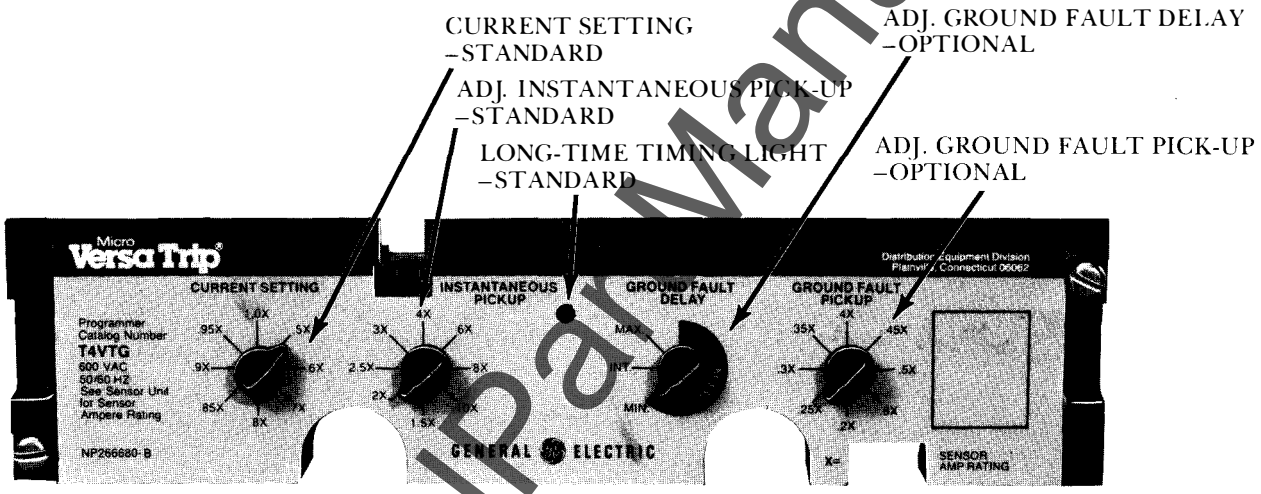


TABLE 13.1 MICROVERSATRIP-4 PROGRAMMER CHARACTERISTICS

Frame Type	Max. Amps.	(X) Fixed Sensors: Sensor Current Ratings (Amps)	Current Setting (Multiple of Sensor Current Rating) (X)	Long-Time: Pick-Up (Multiple of Current Setting) (C)	Long-Time: Delay① (Seconds)	Short-Time③: Pick-Up (Multiple of Current Setting) (C)	Short-Time③: I²t Delay Ramp① (Seconds)	Adjustable Instantaneous Pick-Up③ (Multiple of Sensor Current Rating) (X)	Ground Fault: Pick-Up (Multiple of Sensor Current Rating) (X)	Ground Fault: Delay② (Seconds)
J600	600	150, 200, 300, 400, 500, 600	.5, .6, .7, .8, .85, .9, .95, 1.0 (X)	Fixed at 1.1C	12.5	1.5, 2, 2.5, 3, 4, 5, 7, 9 (C)	0.4	1.5, 2, 2.5, 3, 4, 6, 8, 10 (X)	.2, .25, .3, .35, .4, .45, .5, .6 (X)	0.10, 0.22, 0.36
K1200	1200	800, 1000, 1200								

①Time delay shown at 600% of current setting at lower limit of each band.
②Time delay shown at lower limit of each band.
All pick-up tolerances are ± 10%.
Ground Fault pick-up not to exceed 1200 amperes.
③When optional adjustable short-time pick-up is provided, instantaneous is fixed at 15X.

X = Sensor Current Rating
C = Current Setting

Current-Limiting Circuit Breakers

To meet increased demands for electrical service by residential, commercial, and industrial users, and to reduce system power losses and cost, larger low-impedance transformers are being installed by power companies. The result is systems with higher available short circuit currents. Traditional branch circuit equipment cannot handle the fault currents available in these systems which can reach 150,000 rms symmetrical amperes or more.

THLC current-limiting circuit breakers (CLB) react far more quickly to high-level short circuits than conventional breakers. In fact, the *higher the short circuit current, the faster the THLC operates,* because of its magnetic repulsion design.

Example: if a 150,000 RMS symmetrical ampere short circuit at 480 volts ac were to threaten your system, the THLC1 would interrupt it in *just 3 milliseconds*. At the same time, the THLC1 would limit peak let-through current to less than 42,000 amperes—only 13% of the destructive energy that would flow through without THLC1 protection, and a small enough current to be controlled by standard series-connected circuit breakers.

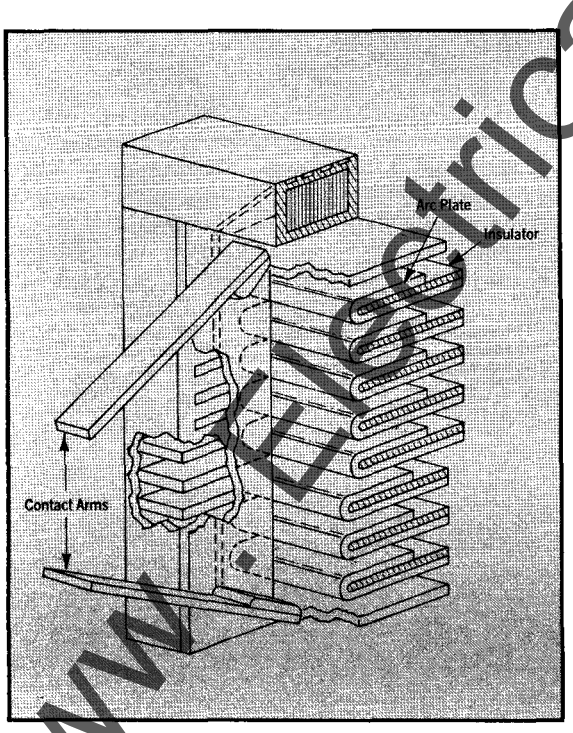
But a fast break isn't enough; a CLB must control arc voltage quickly and efficiently, too.

GE THLC current limiting breakers force the arc into patented, U-shaped arc plates where sufficient voltage is developed to "dominate" the short circuit *fast*. During a 480 volt interruption, for example, the THLC1 quickly counters the driving voltage with a peak arc-voltage in the range of 800 volts—sufficient voltage to quench the short circuit without causing unwanted dielectric breakdown elsewhere down the line.

And for long, reliable life, the THLC is also equipped with special baffles to vent hot gases out of the breaker during the arc-quenching process.

The THLC current-limiting circuit breaker is designed to protect standard circuit breakers with ratings as low as 10,000 AIC on systems with available currents up to 200,000 RMS symmetrical amps at 240 Vac or at 480 Vac. It's available in amp ratings ranging from 15 to 400 amps.

- *UL-listed and CSA certified IC ratings* of 200kAIC at 240 and 480 volts and 50kAIC at 600 volts.
- *Patended arc plates* provide fast, efficient control of short-circuit conditions
- *Resettable, fuse-free construction* minimizes downtime
- *Magnetic repulsion contact design* interrupts short-circuit currents of up to 200,000 amperes at 480 volts in less than 3 milliseconds—the higher the current, the faster the breaker operates
- *Standard circuit breaker protection* with ratings as low as 10,000 AIC on systems with available currents up to 200,000 symmetrical rms amperes
- *150-ampere frame size* with ampere ratings ranging from 15 to 150 amperes
- *225-ampere frame size* with ampere ratings ranging from 125–225 amperes
- *400-ampere frame size* with ampere ratings ranging from 250–400 amperes



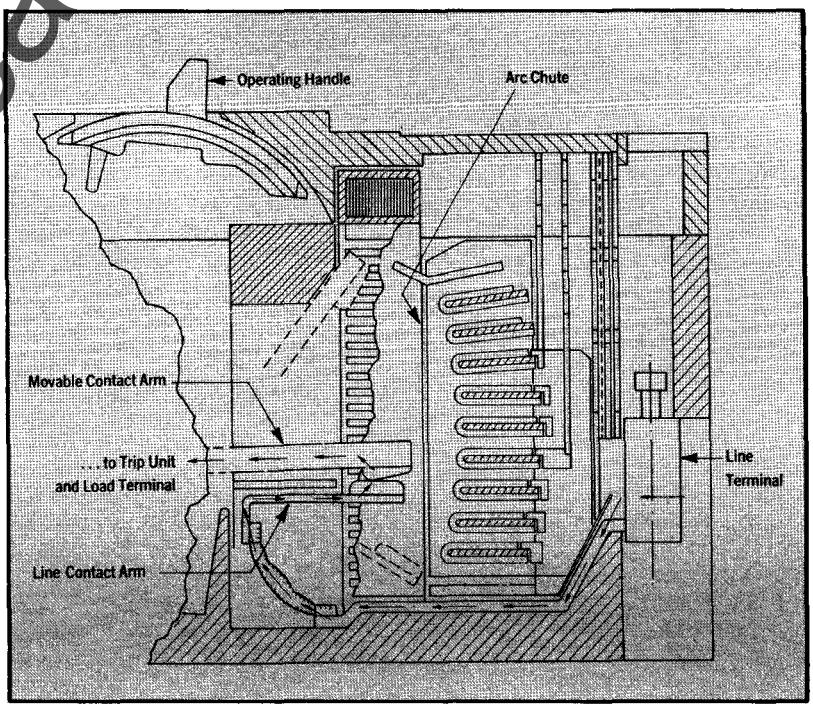


TABLE 15.1 TRIP UNIT RATINGS

Type	Trip Unit Type	Trip Unit Ratings (Amperes)	Instantaneous Type
Q-Line (THQB, L, C)	Fixed	10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100	Fixed
TEY	Fixed	15, 20, 30, 40, 50, 60, 70, 80, 90, 100	Fixed
E150 Line	Fixed	10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 110, 125, 150	Fixed
TEL	Fixed	15, 20, 25, 30, 35, 40, 50, 60, 70, 80, 90, 100, 125, 150	Fixed
THLC-1	Fixed	15, 20, 30, 40, 50, 60, 70, 80, 90, 100, 125, 150	Fixed
TB-1	Fixed	15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100	Fixed
TQD	Fixed	100, 125, 150, 175, 200, 225	Fixed
F225	Fixed and Interchangeable	70, 80, 90, 100, 110, 125, 150, 175, 200, 225	Adjustable
TFL	Fixed	70, 80, 90, 100, 125, 150, 175, 200, 225	Adjustable
THLC-2	Fixed	125, 150, 175, 200, 225	Adjustable
TJD	Fixed	250, 300, 350, 400	Fixed
J-400	Fixed and Interchangeable	125, 150, 175, 200, 225, 250, 300, 350, 400	Adjustable
J-600	Interchangeable	250, 300, 350, 400, 450, 500, 600	Adjustable
TLB-4	Fixed	250, 300, 350, 400	Adjustable
THLC-4	Fixed	250, 300, 350, 400	Adjustable
TB-4	Interchangeable	125, 150, 175, 200, 225, 250, 300, 350, 400	Adjustable
TB-6	Interchangeable	300, 350, 400, 500, 600	Adjustable
K-800 Line	Interchangeable	300, 350, 400, 450, 500, 600, 700, 800	Adjustable
K-1200 Line	Interchangeable	600, 700, 800, 1000, 1200	Adjustable
TB-8	Interchangeable	600, 700, 800	Adjustable

Adjustable Magnetic Ratings—Molded Case Circuit Breakers

TABLE 16.1 ADJUSTABLE MAGNETIC RANGES① (in rms symmetrical amperes, nominal)

F225, TFL			J400			J600			K800			K1200		
Trip Unit	Lo	Hi	Trip Unit	Lo	Hi	Trip Unit	Lo	Hi	Trip Unit	Lo	Hi	Trip Unit	Lo	Hi
70	600	900	125	375	1250	250	750	2500	300	900	3000	600	1800	6000
80	600	900	150	450	1500	300	900	3000	350	1050	3500	700	2100	6400
90	600	900	175	525	1750	350	1050	3500	400	1200	4000	800	2400	6400
100	600	1250	200	600	2000	400	1200	4000	450	1350	4500	1000	3000	10,000
110	600	1250	225	675	2250	450	1350	4500	500	1500	5000	1200	3600	10,000
125	600	1250	250	750	2500	500	1500	5000	600	1800	6000			
150	700	1500	300	900	3000	600	1800	6000	700	2100	6400			
175	800	1750	350	1050	3500				800	2400	6400			
200	900	2000	400	1200	4000									
225	1000	2250												

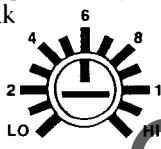
THLC-2			THLC-4, TLB-4			TB-4, TB-6			TB-8		
Trip Unit	Lo	Hi	Trip Unit	Lo	Hi	Trip Unit	Lo	Hi	Trip Unit	Lo	Hi
125	600	1250	250	1100	2500	125	375	1250	600	1800	3000
150	700	1500	300	1400	3000	150	450	1500	700	2100	4000
175	800	1750	350	1600	3500	175	525	1750	800	2400	4000
200	900	2000	400	1800	4000	200	600	2000			
225	1000	2250				225	675	2250			
						250	750	2500			
						300	900	3000			
						350	1050	3500			
						400	1200	3500			
						500	1500	3000 TB-6			
						600	1800	3000 TB-6			

① Consult published trip-time curves for tolerances.

Mag-Break® Motor Circuit Protectors

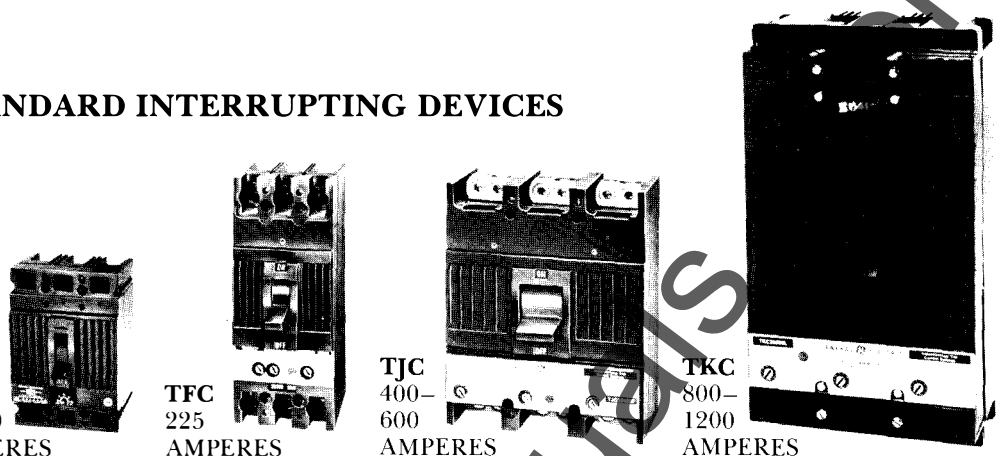
Mag-Break provides accurate and fast clearing of faults on motor circuits—including low level faults—the type most prevalent in motor installations. Mag-Break serves to minimize damage to motors and motor control apparatus in addition to protecting motor branch circuit conductors. Continuous current ratings and adjustable instantaneous trip ranges have been designed to meet NEC requirements concerning motor full load and locked rotor current. The Mag-Break instantaneous trip point can be set low and precisely (just above asym. motor inrush) assuring fault protection and eliminating nuisance tripping.

Each pole of the Mag-Break breaker contains a current sensing element to trip the breaker instantaneously when the preselected current setting is exceeded. Mag-Break's unique magnetic system permits independent factory calibration of both the Hi and Lo ends of the trip range. This provides field adjustability with accuracy and repeatability at all Mag-Break trip scale positions.



In addition to the two independent factory calibrations, Mag-Break is field adjustable by screwdriver adjustments on the front of each breaker. The field adjustable setting is continuous over the entire range from Hi to Lo, and each breaker rating label contains a table converting setting position to amperes. An overcurrent on any pole will cause all three poles to trip simultaneously, thus preventing costly single phasing problems.

STANDARD INTERRUPTING DEVICES



TEC 3–150 AMPERES

TFC 225 AMPERES

TJC 400–600 AMPERES

TKC 800–1200 AMPERES

LIMITER ASSISTED DEVICES

TEC & TECL 3-150 AMPERES

TBC 4 400 AMPERES

TBC 6 600 AMPERES

TBC 8 800 AMPERES

Table 17.1 TRIP SET POSITIONS TO TRIP AMPERES

Cat. No. 3-Pole	Cont. Amperes	Trip Setting Positions②						
		Lo	2	4	6	8	10	Hi
TEC36003, TEML36003	3	8	13	18	23	28	33	38
TEC36007, TEML36007	7	18	30	42	54	66	78	90
TEC36015, TEML36015	15	42	68	94	120	146	172	198
TEC36030, TEML36030	30	90	140	190	240	290	340	390
TEC36050, TEML36050	50	180	260	340	420	500	580	660
TEC36100, TEML36100	100	300	468	636	804	972	1140	1300
TEC36150, TEML36150	150	600	950	1300	1650	2000	2350	2700

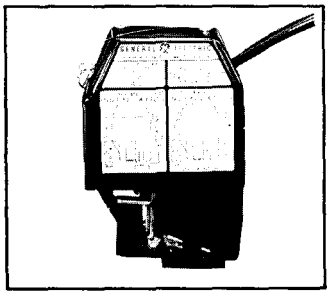
Cat. No. 3-Pole	Cont. Amperes	Trip Setting Positions②				
		Lo	2	4	6	Hi
TFC36225	225	600	780	1020	1200	1400
TFC36225A	225	1000	1200	1630	1920	2250
TJC36400B	400	1200	1400	1850	3250	4000
TJC36400E	400	330	435	600	860	1100
TJC36400F	400	550	720	945	1280	1670
TJC36400G	400	1000	1280	1780	2360	3300
TJC36600G	600	1000	1280	1780	2360	3300
TJC36600H	600	1800	2100	2600	3600	6000
TKC36800L①	800	3000	3600	4300	5100	6000
TKC36800M①	800	5000	6000	7000	8400	10000
TKC361200L①	1200	3000	3600	4300	5100	6000
TKC361200M①	1200	5000	6000	7000	8400	10000
LIMITER ASSISTED DEVICES						
TBC43225F14F	225	550	720	945	1280	1670
TBC43400F14G	400	1000	1280	1780	2360	3300
TBC63600J14L	600	3000	3600	4300	5100	6000
TBC83800K18	800	2400	—	—	—	6000

①For motors above 350 Hp use MicroVersaTrip equipped breakers. ②Tolerance is ±20% of nominal value.

Accessories

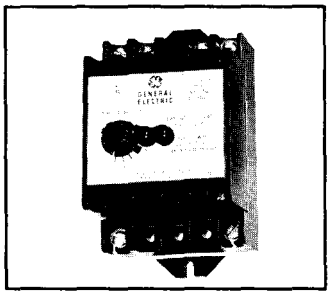
MOLDED CASE CIRCUIT BREAKERS

Undervoltage Protection



The Undervoltage Release instantaneously trips the breaker when voltage drops to 35–70% of normal rating. The device retrips the breaker if it is closed before normal voltage is restored.

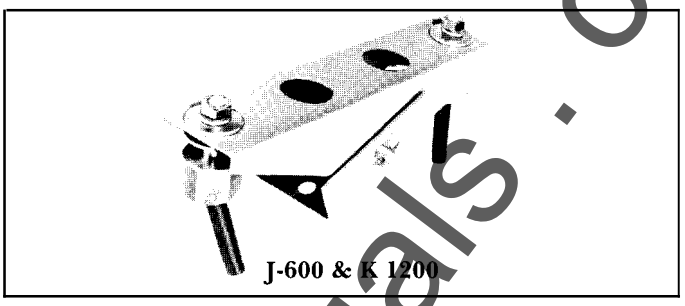
Standard duty and heavy duty types are available.



Time delay Unit—For use with UVR
This unit prevents nuisance tripping due to momentary loss of voltage.

A separate, externally mounted unit has 120 volt ac input and 125 volt dc output with delay adjustable from .1 to .5 seconds. It is used in conjunction with 125 volt dc undervoltage release, which must be ordered separately.

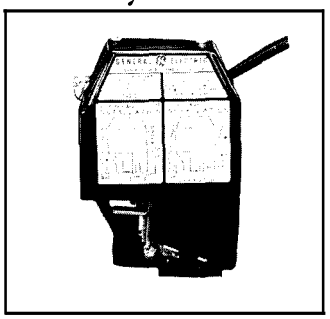
Mechanical Interlocking



The Mechanical Interlock is a walking beam type external link between two breakers mounted in a switchboard structure.

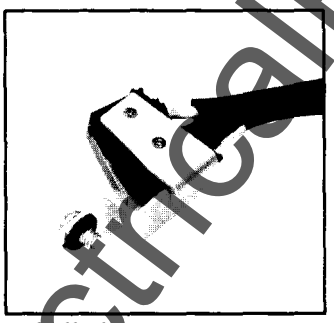
The interlock permits only one breaker to be on at a time; however, both breakers can be OFF at the same time.

Auxiliary Switch



An auxiliary switch can be used to operate other accessories, indicating lights, relays, for automatic reset, etc. Available with one to four SPDT elements for flexibility. Switches open and close as the breaker is either manually or remotely operated.

Bell Alarm

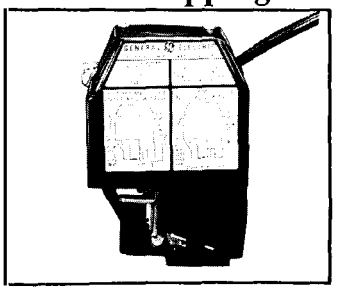


A bell alarm actuates a warning signal or other circuitry when the breaker is tripped under overload, short circuit, shunt trip, undervoltage trip, and 3 coil shunt trip conditions. Not actuated during normal ON-OFF operation.

Motor Operator for Remote "On-Off"

A motor-operated mechanism can open, close or reset a breaker, remotely. This convenient attachment mounts integrally with the breaker, without modification to the breaker or its handle. Just lift the cover of the accessory mechanism to operate the breaker manually. Breaker ON-OFF is indicated in the operating mechanism cover.

Shunt Trip for Remote Tripping



Standard
A Shunt Trip Device can be used to trip and open a breaker by remote control. When the breaker opens, the shunt trip coil circuit is de-energized by means of an auxiliary switch. They meet UL requirements for operation at 55% of rated voltage for use on ground fault systems.

Three-coil (not illustrated)
This provides single-phase protection for fused circuit breaker combinations, factory installed only.

It mounts in right pole for TEB, TED, and in left pole for TFK, TJK, TKM. Installed internally similar to standard shunt trip with leads connected across the fuses. It trips breaker when a fuse blows or if the breaker is closed under load with a fuse open and fits all breaker types including molded case switches. Suitable for system voltages 208 to 600 volts ac.

Accessory Availability

Breaker Type	Bell Alarm Switch				Auxiliary Switch③ or Shunt Trip			Undervoltage Release			Blown Fuse Trip Device			Combination Accessories			Total Number of Accessories Within any One Circuit Breaker
	Mounting Pole			Inst. Sheet	Mounting Pole		Inst. Sheet	Mounting Pole		Inst. Sheet	Mounting Pole		Inst. Sheet	Mounting Pole		Inst. Sheet	
	L	C	R	GEH–	L	R	GEH–	L	R	GEH–	L	R	GEH–	L	R	GEH–	
Q-Line					⑥ UL		N/A										One only
TQD, THQD						UL											One only
E150 TEB, TEC, TED, THED, TEL, TEML TB1②, THLC-1	① UL	—	UL	4576 5402	① UL	UL	3418 Aux 3416 S.T. 5403 Aux 5401 S.T.	—	UL	3417 5400	—	⑤ UL	3434	—	—	—	2-pole circuit breaker—any one 3-pole circuit breaker—any two except UVR and 3-coil shunt trip
F225⑥ TFC, TFJ, TFK, THFK, TFL, TLB-2 THLC-2, TLB-4 THLC-4	—	—	⑤⑥ UL	4620 5406	UL	UL	4653 5406	UL	UL	4653 5406	⑤ UL	—	4622	—	—		Any two
J600 TJC, TJD, TJJ, TJK, THJK TB4②, TBC4②	—	⑤ UL	—	3320	UL	UL	3321 Aux 3435 S.T.		UL	5407	⑤ UL	—	3346	—	—	—	Any two plus bell alarm
K1200 TKC, TKM, THKM TB6②, TBC6②, TB8, TBC8		⑤ UL	—	4305	UL	UL	3321 Aux 3344 S.T.		UL	5408	⑤ UL	—	3346	—	—	—	Any two plus bell alarm
MicroVersaTrip™ 4 and RMS-9, TJ4V, THJ4V, TJL4V, TK4V, TKL4V, TJH, TJL, TKH, TKL	—	UL	—	4626 4663	—	UL	4623 Aux 4623 S.T.	—	UL	4623	—	UL	⑦ 4624	—	UL	4323	Any one plus bell alarm UL Listed for field installation except bell alarm
Accessory Lead⑨ Color Coding	Purple Yellow Brown Bell Alarm Switch				Auxiliary Switch Red White Brown/white Shunt Trip Black Black			Blue Blue Undervoltage Release			Red Brown/white Blue White Yellow Black			Same as individual accessories			All accessory contacts shown with the circuit breaker in tripped position.

①Left pole mounting not available for 2 pole TEB, TED.
②UL listed at 200,000 AIC without internal accessories. 100,000 AIC with internally mounted accessories.
③600 volts AC auxiliary switches are not UL listed.
④Formerly green.
⑤Not available with lead exit from the back of breaker.
⑥UL listed interrupting capacity with accessories: 10K AIC at 600 volts AC, 22K AIC at 480 volts AC, 22K AIC at 240 volts AC.
⑦Maximum available short circuit application is 85,000 sym rms A.
⑧Accessory mounts in a one-inch frame and increases overall breaker size by one pole added to left side.
⑨Leads are #18 AWG 125°C Vulkene® insulated.

THQL, THQB, THQC, TQD, THQD

Auxiliary Switch

Circuit Breaker	Catalog Number	Number of Switches	Switch Rating
TQB, THQB, TQL, THQL	TQAS2A1	1-SPST (A)	6 amperes—120 V.A.C. 3 amperes—24 V.A.C.
TQC, THQC	TQCAS2A1	1-SPST (A)	6 amperes—120 V.A.C. 3 amperes—24 V.A.C.
TQD, THQD	TQDAS2AB1RS	1-SPDT (AB)	6 amperes—240 V.A.C. ½ ampere—125 V.D.C. ¼ ampere—250 V.D.C.

Shunt Trip

Circuit Breaker	Catalog Number	Volts		Amperes (Inrush)	
		ac	dc	ac	dc
TQB, THQB, TQL, THQL	TQST 1	120		2	
	TQST 2	240		3	
	TQST 7		12		4
	TQST 8		24-48		2.4
TQC, THQC	TQCST 1	120-240		2	
	TQCST 7		12		4
	TQCST 8		24		2.4
TQD, THQD	TQDST 1	120		.9	
	TQDST 2	240		.8	
	TQDST 7		12		7.5
	TQDST 8		24		4.8
	TQDST 9		48		2.4

Auxiliary Switch (Installation Instructions GEH-3418 or GEH-5403)

Catalog Number①	Number of Switches	Switch Ratings
TEDAS2AB1R TEDAS2AB2	1 2	6 amperes, ½ horsepower, 120, 240 volts ac 5 amperes, 120 volts ac "Lamp Load" ½ ampere, 125 volts dc ¼ ampere, 250 volts dc

①For TEL, TEML breakers substitute TEL for TED in catalog number (second installation instruction noted applies).

Shunt Trip (Installation Instructions GEH-3416 or GEH-5401)

Catalog Number①	Volts		Amperes (Inrush)	
	ac	dc	ac	dc
TEDST12	120/240	125	1.0/1.9	1.0
TEDST13	480/600	—	1.5/1.9	—
TEDST 7	—	12	—	7.5
TEDST 8	—	24	—	4.6
TEDST 9	—	48	—	2.4
TEDST11	—	250	—	0.4

①For TEL, TEML breakers substitute TEL for TED in catalog number (second installation instruction noted applies).

Undervoltage Release (Installation Instructions GEH-5400 or GEH-3417)

Catalog Number①② Heavy Duty/Std. Duty	Current mA	Volts		Dropping (25 watt) Resistor
		ac	dc	
TEDXUVAR / —	100	24	—	—
TEDXUVBR /UV 1	18	120	—	—
TEDXUVCR /UV 2	18	240	—	7,500
— /UV 4	18	480	—	20,000
— /UV 6	18	600	—	30,000
TEDXUVDR /UV 7	200	—	12	—
TEDXUVER /UV 8	100	—	24	—
— /UV 9	50	—	48	—
TEDXUVFR —	33	—	60	—
TEDXUVGR /UV10	18	—	125	—
TEDXUVHR /UV11	18	—	250	7,500

①For TEL, TEML breakers substitute TEL for TED in catalog number (second installation instruction noted applies).
②For TEL, TEML breakers standard duty only.

Bell Alarm (Installation Instructions GEH-4576 or GEH-5402)

Catalog Number①	Mounting	Switch Rating
TEDBAR TEDBAL	Right Pole Left Pole	5 amperes, 240 volts ac 5 amperes resistive, 2½ amperes inductive at 28 volts dc

①For TEL, TEML breakers substitute TEL for TED in catalog number (second installation instruction noted applies).

Motor Operators (Installation Instructions GEH-5007)

Catalog Number	Control			Timing (Seconds)		Recommended Fuse
	Voltage	Amperes		Closing	Opening Reset	
		Inrush	Running			
TEDMOMA1	120 volts ac	3.0	1.6	1.5	1.75	0.5 Ampere (Time Delay)
TEDMOMA2	240 volts ac	2.2	.57	1.5	1.75	
TEDMOMA8	24 volts	2.0	1.0	1.5	1.75	

TFJ, TFC, TFK, THFK, THLC-2, THLC-4, TFL, TLB-4

Auxiliary Switch (Installation Instructions GEH-4653 or GEH-5406)

Catalog Number①	Number of Switches	Switch Ratings
TFKASA2AB2 TFKASA2AB4	2 4	5 amperes, 240 volts ac 5 amperes resistive, 2½ amperes inductive at 28 volts dc

①For TFL breakers substitute TFL for TFK in catalog number (second installation instruction noted applies).

Shunt Trip (Installation Instructions GEH-4653 or GEH-5406)

Catalog Number①	Volts		Amperes (Inrush)	
	ac	dc	ac	dc
TFKSTA12	120/240	125	2.6/5.2	2.7
TFKSTA13	480/600	—	1.5/1.9	—
TFKSTA 7	—	12	—	4.2
TFKSTA 8	—	24	—	4.2
TFKSTA 9	—	48	—	1.0
TFKSTA11	—	250	—	0.2

①For TFL breakers substitute TFL for TFK in catalog number (second installation instruction noted applies).

Undervoltage Release (Installation Instructions GEH-4653 or GEH-5406)

Catalog Number①	Current mA	Volts		Dropping (25 watt) Resistor
		ac	dc	
TFKUVA 1	18	120	—	—
TFKUVA 2	18	240	—	7,500
TFKUVA 4	18	480	—	20,000
TFKUVA 6	18	600	—	30,000
TFKUVA 7	200	—	12	—
TFKUVA 8	100	—	24	—
TFKUVA 9	50	—	48	—
TFKUVA10	18	—	125	—
TFKUVA11	18	—	250	7,500

①For TFL breakers substitute TFL for TFK in catalog number (second installation instruction noted applies).

Bell Alarm (Installation Instructions GEH-4620 or GEH-5406)

Catalog Number①	Switch Rating
TFKBAAR②③	5 amperes, 240 volts ac 5 amperes, resistive 2½ amperes inductive at 28 volts dc

①For TFL breakers substitute TFL for TFK in catalog number (second installation instruction noted applies).
②Changes circuit breaker interrupting capacity to: 10KA @ 600 Vac, 22KA @ 480 Vac, 22KA @ 240 Vac.
③UL listed for field installation with model 4 frames and trips.

Motor Operators④ (Installation Instructions GEH-3313)

Catalog Number	Control			Timing (Seconds)		Recommended Fuse
	Volts	Amperes		Closing	Opening Reset	
		Inrush	Running			
TFKMOMA1	120 Vac 125 Vdc	9.5 7.0	5.5 4.5	0.25	0.25	1 Ampere (Time Delay)
TFKMOMA2	240 Vac 250 Vdc	5.0 6.0	2.5 4.0			
TFKMOMA8	24 Vdc	24	16	0.45	0.50	2 Ampere (Time Delay)
TFKMOMA9	48 Vdc	14	9	0.25	0.25	

④ Not Available For THLC-2, THLC-4.

Auxiliary Switch (Installation Instructions GEH-3321)

Catalog Number	Number of Switches	Switch Ratings
TJKASA2AB1	1	6 amperes, ½ horsepower, 120, 240 volts ac
TJKASA2AB2	2	5 amperes, 120 volts ac "Lamp Load"
TJKASA2AB3	3	½ ampere, 125 volts dc
TJKASA2AB4	4	¼ ampere, 250 volts dc

Shunt Trip (Installation Instructions GEH-3435)

Catalog Number	Volts		Amperes (Inrush)	
	ac	dc	ac	dc
TJKSTA12	120/240	125	1.9	1.0
TJKSTA13	480/600	—	1.9	—
TJKSTA7	—	12	—	4.3
TJKSTA8	—	24	—	4.6
TJKSTA9	—	48	—	2.4
TJKSTA11	—	250	—	0.4

Undervoltage Release (Installation Instructions GEH-5407)

Catalog Number	Current mA	Volts		Dropping (25 watt) Resistor
		ac	dc	
TJUV1R	18	120	—	—
TJUV2R	18	240	—	7,500
TJUV4R	18	480	—	20,000
TJUV6R	18	600	—	30,000
TJUV7R	200	—	12	—
TJUV8R	100	—	24	—
TJUV9R	50	—	48	—
TJUV10R	18	—	125	—
TJUV11R	18	—	250	7,500

Bell Alarm (Installation Instructions GEH-3320)

Catalog Number	Mounting	Switch Rating
TJKBAAL	Center Pole	5 amperes, 240 volts ac, 5 amperes resistive, 2½ amperes inductive at 28 volts dc

Heavy Duty Undervoltage Release (Installation Instructions GEH-5409)

Catalog Number	Current mA	Volts		Dropping (25 watt) Resistor
		ac	dc	
TJMDVAS	100	24	—	—
TJMDVBS	17	120	—	—
TJMDVCS	25	240	—	5000
TJMDVDS	200	—	12	—
TJMDVES	100	—	24	—
TJMDVFS	33	—	60	—

Motor Operators (Installation Instructions GEH-4676)

Catalog Number①	Control			Timing (Seconds)		Recommended Fuse
	Volts	Amperes		Closing	Opening Reset	
		Inrush	Running			
TJKMOMA1	120 volts ac	9.5	5.5	.30	.30	1 Ampere (Time Delay)
	125 volts dc	10.0	3.5			
TJKMOMA2	240 volts ac	5.0	3.0			
	250 volts dc	5.5	2.5			
TJKMOMA8	24 volts dc	22.0	15.0	.60	.35	2 Ampere (Time Delay)
TJKMOMA9	48 volts dc	14.0	10.0	.35	.30	

①TJ4V, TJH-S breaker requires mounting plate Cat. No. 286A7558G8.

TKC, TKMA, THKMA, TB6, TBC6, TB8, TBC8

Auxiliary Switch (Installation Instructions GEH-3321)

Catalog Number	Number of Switches	Switch Ratings
TKMAAS2AB1	1	6 amperes, ½ horsepower, 120, 240 volts ac
TKMAAS2AB2	2	5 amperes, 120 volts ac "Lamp Load"
TKMAAS2AB3	3	¼ ampere, 250 volts dc
TKMAAS2AB4	4	½ ampere, 125 volts dc

Shunt Trip (Installation Instructions GEH-3344)

Catalog Number	Pole Mounting Suffix		Volts		Amperes (Inrush)	
			ac	dc	ac	dc
TKMASTA12	R	L	120/240	125	1.9	1.0
TKMASTA13			480/600		1.9	—
TKMASTA 7			—	12	—	4.3
TKMASTA 8			—	24	—	4.6
TKMASTA 9			—	48	—	2.4
TKMASTA11			—	250	—	.4

Undervoltage Release (Installation Instructions GEH-5408)

Catalog Number	Pole Mounting Suffix		Current mA	Volts		Dropping (25 watt) Resistor
				ac	dc	
TKUV 1	R		18	120	—	—
TKUV 2			18	240	—	—
TKUV 4			18	480	—	7,500
TKUV 6			18	600	12	20,000
TKUV 7			200	—	24	30,000
TKUV 8			100	—	48	—
TKUV 9			50	—	125	—
TKUV10			18	—	250	7,500
TKUV11			18			

Bell Alarm

Catalog Number	Mounting	Switch Rating
TKMABAAL	Center Pole	5 amperes, 240 volts ac, 5 amperes resistive, 2½ amperes inductive at 28 volts dc

Heavy Duty Undervoltage Release (Installation Instructions GEH-5410)

Catalog Number	Current mA	Volts		Dropping (25 watt) Resistor
		ac	dc	
TKMDVAS	100	24	—	—
TKMDVBS	17	120	—	—
TKMDVCS	25	240	—	5,000
TKMDVDS	200	—	12	—
TKMDVES	100	—	24	—
TKMDVFS	33	—	60	—

Motor Operators (Installation Instructions GEH-4675)

Catalog Number	Control			Timing (Seconds)		
All K1200①	Volts	Amperes		Closing	Opening Reset	Recommended Fuse
		Inrush	Running			
TKMMOMA1	120 Vac 125 Vdc	9.0 10.5	6.0 4.5	0.30	0.30	1 Ampere (Time Delay)
TKMMOMA2	240 Vac 250 Vdc	5.0 4.5	3.0 3.0			
TKMMOMA8	24 Vdc	22	15	0.60	0.35	2 Ampere (Time Delay)
TKMMOMA9	48 Vdc	14	10	0.40	0.30	

①TK4V, TKH-S breaker requires mounting plate Cat. No. 286A7558G7.

MICROVERSATRIP ACCESSORIES RIGHT POLE MOUNTING

Auxiliary Switch Catalog Number	No. of Switch Elements	Switch Rating	Installation Instructions
TVAS2AB2R	2	6 amperes—240 volts ac ½ amperes—125 volts dc ¼ amperes—250 volts dc	GEH-4623
TVAS2AB4R	4		
TVAS6AB2R①	2	6 amperes—600 volts ac ½ amperes—125 volts dc ¼ amperes—250 volts dc	
TVAS6AB4R①	4		

① Not UL listed

Shunt Trip Catalog Number	Voltage (Volts)		Current (Inrush) (Amperes)		Coil Resistance	Installation Instructions
	ac	dc	ac	dc		
TVST7R		12		4.3	1.6	GEH-4623
TVST8R		24		4.6	5.2	
TVST9R		48		2.4	46.0	
TVST11R		250		0.4	1250.0	
TVST12R	120	125	1.9	1.0	130.0	
	240		1.9			
TVST13R	480		1.9		313.0	
	600		1.9			

Undervoltage Catalog Number	Voltage (Volts)		Current (mA)		Coil Resistance	Bridge Rectifier	External Resistor		Installation Instructions
	ac	dc	ac	dc			Ohms	Watts	
TVUV1R	120		18		7100	YES	None		GEH-4623
TVUV2R	240		18		7100		7,100	12W	
TVUV3R	380		18		7100		15,000	25W	
TVUV4R	480		18		7100		20,000	25W	
TVUV6R	600		18		7100		30,000	25W	
TVUV7R		12		200	60	NO	NONE		
TVUV8R		24		100	240				
TVUV9R		48		50	960				
TVUV10R		125		18	7100				
TVUV11R		250		18	7100		7,500	12W	

CENTER POLE MOUNTING ONLY

Bell Alarm Switch Catalog Number	Single-Pole Double-Throw Switch Rating	Installation Instructions
TJVBALS	5 amperes—240 volts ac 2.5 amperes— 28 volts ac	GEH-4626
TKVBALS		GEA-4663

MICROVERSATRIP ACCESSORIES RIGHT POLE MOUNTING

Combination Shunt Trip/Two Aux. Switches

Catalog Number 600 Volt Aux Sw	Catalog Number 250 Volt Aux Sw	Shunt Trip Voltage (Volts) ac	Shunt Trip Voltage (Volts) dc	Coils	Switch Rating	Installation Instructions
TV6AB2ST7R	TV2AB2ST7R		12	Same as Shunt Trips	Same as Auxiliary Switches	GEH-4623
TV6AB2ST8R	TV2AB2ST8R		24			
TV6AB2ST9R	TV2AB2ST9R		48			
TV6AB2ST11R	TV2AB2ST11R		250			
TV6AB2ST12R	TV2AB2ST12R	120	125			
		240				
TV6AB2ST13R	TV2AB2ST13R	480				
		600				

Combination Undervoltage/Two Aux. Switches

Catalog Number 600 Volt Aux Sw	Catalog Number 250 Volt Aux Sw	Voltage (Volts) ac	Voltage (Volts) dc	Coils	Switch Rating	Installation Instructions
TV6AB2UV1R	TV2AB2UV1R	120		Same as Under-Voltage Release	Same as Auxiliary Switches	GEH-4623
TV6AB2UV2R	TV2AB2UV2R	240				
TV6AB2UV3R	TV2AB2UV3R	380				
TV6AB2UV4R	TV2AB2UV4R	480				
TV6AB2UV6R	TV2AB2UV6R	600				
TB6AB2UV7R	TV2AB2UV7R		12			
TV6AB2UV8R	TV2AB2UV8R		24			
TV6AB2UV9R	TV2AB2UV9R		48			
TV6AB2UV10R	TV2AB2UV10R		125			
TV6AB2UV11R	TV2AB2UV11R		250			

Motor Operator All J600 Frames (Installation Instructions GEH-4676)

Catalog Number ②	Control Volts	Control Amperes Inrush	Control Amperes Running	Timing (Seconds) Closing	Timing (Seconds) Opening Reset	Recommended Fuse
TJKMOMA1	120 volts ac	9.5	5.5	.30	.30	1 Ampere (Time Delay)
	125 volts dc	10.0	3.5			
TJKMOMA2	240 volts ac	5.0	3.0			
	250 volts dc	5.5	2.5			
TJKMOMA8	24 volts dc	22.0	15.0	.60	.35	2 Ampere (Time Delay)
TJKMOMA9	48 volts dc	14.0	10.0	.35	.30	

②Requires mounting plate Cat. No. 286A7758G8.

Motor Operator All K1200 Frames

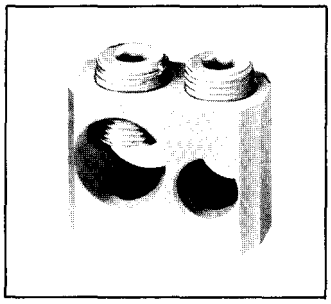
Catalog Number All K1200③	Control Volts	Control Amperes Inrush	Control Amperes Running	Timing (Seconds) Closing	Timing (Seconds) Opening Reset	Recommended Fuse
TKMMOMA1	120 Vac	9.0	6.0	0.30	0.30	1 Ampere (Time Delay)
	125 Vdc	10.5	4.5			
TKMMOMA2	240 Vac	5.0	3.0			
	250 Vdc	4.5	3.0			
TKMMOMA8	24 Vdc	22	15	0.60	0.35	2 Ampere (Time Delay)
TKMMOMA9	48 Vdc	14	10	0.40	0.30	

③Requires mounting plate Cat. No. 286A7558G7.

Accessories-Mechanical Data

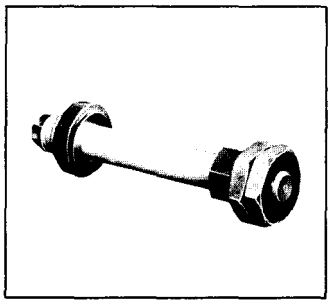
MOUNTING HARDWARE

Front Connections



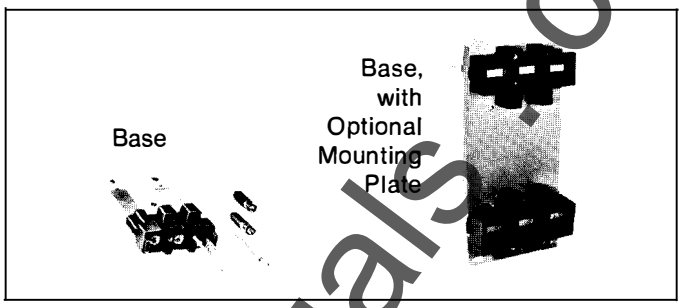
Front-connected Cu-Al lugs allow easy cable feed. The lug mounts directly to the mounting surface with screws and lockwashers.

Back Connections



Back-connected studs need to be supported by a sub-base, but make positive contact with each line and load terminal. Studs stay in place while the breaker can be removed or installed.

Plug-in Mounting



A plug-in base assembly provides for quick changeout of breakers. The assembly backplate mounts to angle-iron cross-pieces.

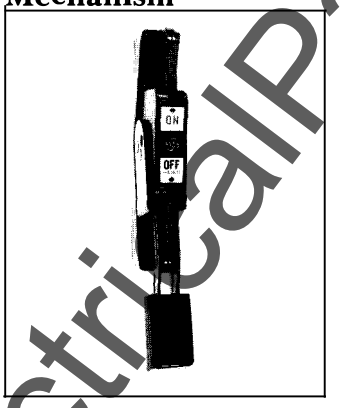
Breaker plug-in terminals align with one-piece backplate assembly.

HANDLES AND OPERATING MECHANISMS

TDR Rotary Operating Handle

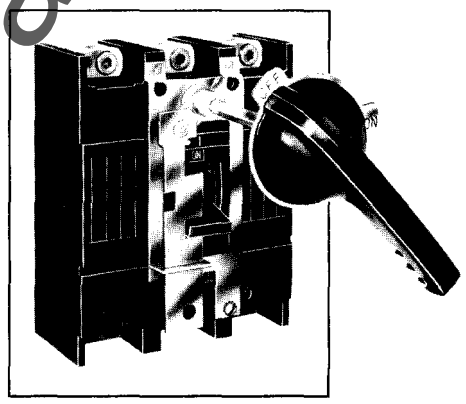
The Rotary-Operating Integral Handle mounts directly to the breaker, and operates through the door of the enclosure. A mechanical interlock prevents unauthorized opening of the enclosure when the handle is in the ON position. The locking hasp accommodates up to three padlocks. Suitable for horizontally or vertically mounted breakers. For NEMA 12K and NEMA 12 enclosures.

TDA Flange Handle and Variable Depth Operating Mechanism



The TDA Flange Handle is for use with all 150–1200 ampere frame circuit breakers. It is designed to meet automotive duty specifications, and NEMA 12. UL recognized components are used. The mechanism is of the Quick-Make, Quick-Break type with an integral mounting plate and low operating force. Mounting dimensions fit standard flange enclosures 8′–24′ deep. Drilling templates and detailed installation instructions are provided.

TDM Adjustable Depth Handles



TDM Door-Mounting Handles are available in shallow mounting types and extended shaft type for vertical or horizontal breaker mounting. The mechanism provides interlocking. The door-mounted handle accommodates up to three padlocks. Suitable for NEMA 12K and NEMA 12 enclosures.

NOTE: A pendulum-type handle designated Cat. No. THCH 45 is also available for NEMA 4, NEMA 4X and 5 enclosures.

Application Data—Molded Case Circuit Breakers

Molded case circuit breakers are circuit protective devices that primarily perform two functions: (1) manual switching operation to open and close a circuit by means of a toggle handle and (2) automatic opening of the circuit under sustained overload and/or short circuit conditions. Circuit breakers inherently provide the automatic protective function of opening the circuit under abnormal sustained overload, or short circuit conditions, without the use of fuses. When a circuit breaker opens to clear a fault, the toggle handle goes to a TRIPPED position mid-way between the ON and OFF positions, thus clearly indicating that a circuit breaker has opened. When the cause of the fault has been removed, the circuit breaker can again be closed simply by moving the toggle handle to the RESET position, and then moving the handle to the ON position.

Circuit breakers have an advantage over fusible elements. A fault on one pole of a multi-pole breaker actuates a common trip bar that opens all poles simultaneously, thus avoiding single phasing a motor circuit, as could occur in a fusible device. Molded case circuit breakers are "trip free" in construction. This means that the circuit breaker contacts cannot be held closed against a fault condition. Molded case circuit breakers are designed to protect insulated conductors against unsafe overheating that would ultimately damage the insulation and conductor.

Thermal-magnetic molded case circuit breakers are not designed to provide motor running overload protection. This function is normally performed by overload relays supplied in manual or magnetic motor starters. However, for infrequently started motors, MicroVersaTrip equipped molded case circuit breakers can be used to provide motor overload, overcurrent and ground fault protection.

Molded case circuit breakers meet applicable UL Standard 489 covering "Branch Circuit and Service Circuit Breakers" and meet NEMA Standard AB-1—Molded Case Circuit Breakers.

UL Standard 489 makes provision for two classes of products—UL Standard rated and UL 100 percent rated. The basis of these ratings for molded case and Insulated case circuit breakers is as follows:

A. Standard rated under UL 489

1. Circuit breakers are rated to carry 100 percent of their nameplate current continuously in free air at 25°C when cabled per Table on page 32.
2. Enclosed circuit breakers are rated to carry 100 percent of their nameplate current intermittently (up to 3 hours maximum) and 80 percent continuously, with the enclosure in a 25°C ambient, and cabled per Table on page 32.
3. Group mounted circuit breakers may require derating of the circuit breaker and cable in room ambient temperatures other than 25°C and with cable other than specified in Table on page 32.

B. 100-percent rated under UL 489

1. Circuit breakers are rated to carry 100 percent of their nameplate current continuously in an enclosure with ventilation and volume as specified on the device in a room ambient of 25°C when cabled as specified in Table on page 32 using 90°C insulation.
2. Room ambient temperatures other than 25°C, cable other than specified in Table on page 32, or enclosure volume and/or ventilation other than specified on the devices may require derating of the system.

Standards and References

Underwriters' Laboratories
UL 489 Branch Circuit and Service Circuit Breakers—Order from UL Publications Stock, 333 Pfingsten Road, Northbrook, Illinois 60062.

National Electrical Manufacturers Association (NEMA)
AB-1 Standards Publication—Molded Case Circuit Breakers Order from NEMA Publications, 155 East 44th Street, New York, New York 10017

Federal Specifications
WC-375 Circuit Breaker, Molded Case; Branch Circuit and Service

National Electrical Code (NEC)
Latest Issue
Order from National Fire Protection Association, Batterymarch Park, Quincy, Ma. 02269.

FEDERAL SPECIFICATIONS

WC375a

Federal Class	Circuit Breaker Type	Poles	Voltage (ac)
1a	THQL, THQAL, THQB, THQC	1 pole	120/240
1b	THQL, THQAL, THQB, THQC	2 and 3 pole	240
2a	TED, TEY	1 pole	277
2b	THQL, THQAL, THQB, THQC	1 pole	120
2c	THQL, THQAL, THQB, THQC	2 and 3 pole	240
2d	TED	2 and 3 pole	
2e	TB1	2 and 3 pole	
2f	THED	2 and 3 pole	
3a	TFJ, TFK	2 and 3 pole	
3b	THFK	2 and 3 pole	
3c	TB4	2 and 3 pole	600 volts max
3d	TJJ, TJK	2 and 3 pole	
4a	TB4	2 and 3 pole	
4b	TJJ, TJK	2 and 3 pole	
4c	THJK	2 and 3 pole	
5a	TJK6, TKM8	2 and 3 pole	
5b	THJK6, THKM8	2 and 3 pole	
6	TB6	2 and 3 pole	

WC375b

Federal Class	Circuit Breaker Type	Poles	Voltage
10a① 10b 11a 11b 12a	THQB, THQL, THQC, THHQB, THHQL, THHQC, THQBGF, THQLGF, THQCGF, THHQLGF, THHQBGF TEB, TED, TEY	1 or 2 2 or 3	120/240 volts 240 volts
12b①	TQD, THQD, THQL, THQG, THQC, TEY, TED4	2 and 3 poles	240 volts
12c	TEY, TED4	1 pole	277 volts
13a	TEY, TED4	1 pole	277 volts
13b	TED4, 15–50 amps	1 pole	480 volts
	TEY, TED-4, 15–100 amps	1, 2, & 3 poles	277/480 volts
14a①	THHQL, THHQB, THHQC, TEY	1 and 2 poles	120/240 volts
14b	THQP, TJD, TEY	2 and 3 poles	240 volts
15a①	TXQL, TXQB, TXQC, TEY	1 and 2 poles	120/240 volts
15b	TEY, THFK	2 and 3 poles	240 volts
16a③	TB1, TB4	2 and 3 poles	480 volts
16b③	TB1, TB4, TB6	2 and 3 poles	600 volts
17a③	TB4, TB6, TB8	2 and 3 poles	600 volts
18a	TED6 15–100 amps		
19a	TFJ, TFK		
20a	TFJ, TFK		
21a	TJJ, TJK, TKM, TJRV, TK4V		
22a	THED 15–100 amps	2 and 3 poles	600 volts max
23a	THJK, THKM, THJ4V, TJH		
24a	TPMM, TP, TC, TKH		
25a	THPMM, THP, THC②		
	TPMM, TP, TC 3000 & 4000 amp only		
26a	TB-1, TB-4, TB-6, TB-8		
Not defined	TED 4, TED 6 110–150 amps	3 poles	
	THED 4, THED 6 110–150 amps	3 poles	
	TEL, TFL, TLB, THLC		

①Single unit or duplex construction must be specified.
②800 amp frame not included.
③This class may incorporate a current limiting device within the breaker case.

CURRENT RATINGS

Molded case circuit breakers are designed to protect insulated cable, therefore the characteristics of breakers are closely tied to the Underwriters' Laboratories specified size and type of wire for each rating as well as the load characteristics. The following items should be considered when applying and using molded case circuit breakers:

A. Cable size must be equal to, or greater than that specified by Underwriters' Laboratories Inc. Standard for Safety 489. Thermal current measuring systems (bimetals and fuses) incorporate a resistance element which generates heat at a rate proportional to the square of the current. The cable is used as a heat sink to control the temperature of the bimetal; reducing the size of the conductor raises the temperature and the breaker will carry less current. In general the effect of cable size on breaker thermal calibration is illustrated in Fig. 30.1.

B. Ambient temperatures have an even wider effect on the rating of the breaker-cable system. High ambient temperatures not only affect the calibration of the breaker but may cause internal temperatures to exceed the temperature limits of the insulating materials. Cable may be adapted through the use of higher rated materials such as glass or mineral, but this is not possible with switching devices due to mechanical requirements and fabrication techniques. Low temperatures, on the other hand, substantially increase the current carrying ability of the system until other limiting factors occur, such as lubricant failure or binding due to differential contraction of parts. In general the effect of ambient temperature on an ambient compensating breaker calibration looks like Fig. 31.1.

Notice that the above curve specifies the ambient temperature of the air surrounding the breaker *not room temperature*. To convert this information to room ambient it is necessary to know the temperature rise of the equipment housing the circuit breaker. This must include factors for group mounting of devices, ventilation, solar insulation or other radiant heat sources, etc. The above curve also applies *only* to devices connected with the UL sized conductor.

C. System operating frequency also has a major effect on the rating and performance of molded case circuit breakers. Most circuit breakers may be directly applied at their published ratings on 50 or 60 Hertz systems, but molded case circuit breakers should not be applied at other frequencies without the concurrence of the General Electric Company except as described on page 36, "FACTOR C—FREQUENCY RATING".

Two separate effects occur at frequencies above 60 Hertz depending on the method of current sensing. In thermal magnetic devices, the bimetal, which provides overload protection, responds accurately to the applied current. However, the instantaneous element, which is a solenoid constructed of copper and steel, becomes hot. This raises the temperature of

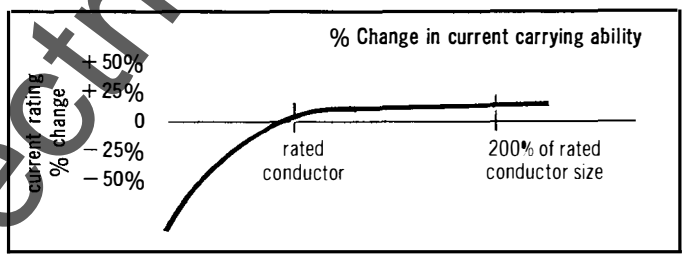


Figure 30.1 Breaker current rating and conductor size are a matched pair; any insulation type may be used but the cross section must remain constant.

the breaker, thereby reducing the continuous current rating of the device. The instantaneous trip solenoid becomes hot because of the nature of its construction and materials. In addition to adding heat to the breaker, the instantaneous trip does not respond to current correctly and the higher the frequency, the less accurate the response.

At nominal system frequencies less than 50 hertz but above direct current, solid-state trip devices become inoperative due to sensor saturation. Thermal trip devices remain accurate while instantaneous trip solenoids lose accuracy. On direct current systems, solid-state trip units are completely inoperative, thermal trip units calibrate accurately and instantaneous trip solenoids may or may not be accurate depending on the specific construction technique used.

D. Another factor to be considered is the altitude at which the breaker will be applied. The design altitude for molded case circuit breakers is 0 to 6000 feet. At altitudes above 6000 feet the thin atmosphere affects the heat transfer of the breaker as well as its ability to interrupt short circuits. So an additional derating of 4 percent is applied at altitudes from 6000 to 10,000 feet.

E. Load type and duty cycle must also be considered in the application of molded case circuit breakers. Loads such as capacitors and electromagnets require a substantial, continuous current derating factor if the breaker is normally used to switch the load. Group mounted devices require additional derating due to the lack of free air circulation around the devices.

With loads such as resistance welders, the breaker continuous current rating must be no less than 125 percent of the welder 100 percent duty-cycle rating.

In general, where load protection in addition to cable protection is desired, the load characteristics and protection requirements must be fully evaluated.

F. The final factor which needs to be considered is a safety factor. If the circuit breaker is run at the current level derived from factors A–E continuously, it will be within its rating and the conductor ratings, but it will be on the verge of tripping, and any perturbation from nominal could cause the circuit breaker to trip. A safety factor of at least 10 percent should be applied to prevent possible nuisance tripping. Other conditions such as excessive load break operations, overload tripping or severe load cycling can affect breaker life and should be factored into the rating.

The above information is summarized and tabulated in the following pages for your convenience.

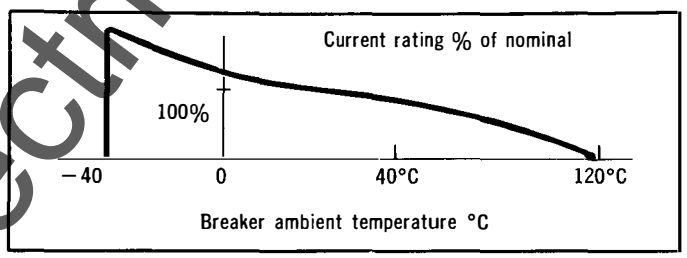


Figure 31.1 The effect of ambient temperature on the continuous current carrying ability of the breaker and cable system is shown on page 35, "FACTOR B—AMBIENT TEMPERATURE."

CURRENT RATING SELECTION

Circuit breaker ampere rating (I_p) = $I_a \times A \times B \times C \times D \times E \times F \times G$

where **I_a** = Actual full-load current or RMS current
A = Wire size factor
B = Ambient temperature rating factor
C = Frequency rating factor
D = Altitude rating factor
E = Load class rating factor
F = Safety factor
G = 1.0 for intermittent load or 1.25 for continuous load

TABLE 32.1 WIRE AND CABLE SIZE BY AMPERE RATING

Circuit breakers are calibrated and rated for use with the following wire sizes by ampere rating

Circuit Breaker Ampere Rating	Copper Conductor		Alum num or Copper-clad Aluminum Conductor		Circuit Breaker Ampere Rating	Copper Conductor		Aluminum or Copper-clad Aluminum Conductor	
	Paralleled	Size	Paralleled	Size		Paralleled	Size	Paralleled	Size
15 or less	.....	14 AWG	.....	12 AWG	400	two	3/0 AWG	two	250 kcmil
20	.....	12 AWG	.....	10 AWG	450	two	4/0 AWG	two	300 kcmil
25	.....	10 AWG	.....	10 AWG	500	two	250 kcmil	two	350 kcmil
30	.....	10 AWG	.....	8 AWG	550	two	300 kcmil	two	500 kcmil
35	.....	8 AWG	.....	8 AWG	600	two	350 kcmil	two	500 kcmil
40	.....	8 AWG	.....	8 AWG	700	two	500 kcmil	three	350 kcmil
45	.....	8 AWG	.....	6 AWG	800	three	300 kcmil	three	400 kcmil
50	.....	8 AWG	.....	6 AWG	1000	three	400 kcmil	four or	350 or
60	.....	6 AWG	.....	4 AWG				three	600 kcmil
70	.....	4 AWG	.....	3 AWG	1200	four	350 or	four	500 kcmil
80	.....	4 AWG	.....	2 AWG		three	600 kcmil		
90	.....	3 AWG	.....	2 AWG②	1400	four	500 kcmil	five	500 kcmil
					1600	five	400 or	six	600 kcmil
100	.....	3 AWG	.....	1 AWG②		four	600 kcmil		
110	.....	2 AWG	.....	1/0 AWG	2000	six	400 or	six	600 kcmil
125	.....	1 AWG①	.....	2/0 AWG		five	600 kcmil		
150	.....	1/0 AWG	.....	3/0 AWG					
175	.....	2/0 AWG	.....	4/0 AWG	2500	eight	400,	eight	600,
200	.....	3/0 AWG	.....	250 kcmil		seven	500, or	seven	750, or
						six	600 kcmil	nine	500 kcmil
225	.....	4/0 AWG	.....	300 kcmil	3000	nine	400,	ten	500,
250	.....	250 kcmil	.....	350 kcmil		eight	500, or	nine	600, or
275	.....	300 kcmil	.....	500 kcmil		seven	600 kcmil	eight	750 kcmil
300	.....	350 kcmil	.....	500 kcmil	4000	twelve	400,	thirteen	500,
325	.....	400 kcmil	two	4/0 AWG		eleven	500, or	twelve	600, or
350	.....	500 kcmil	two	4/0 AWG		ten	600 kcmil	eleven	750 kcmil

①No. 1 Type RH, RHW, RUH, THW, THWN, or XHHW copper conductor may be used if the circuit breaker is so marked.

②No. 1 RH, RHH, RHW, THW, THWN, or XHHW aluminum conductor may be used if the circuit breaker is so marked.

TABLE 32.2 PROPERTIES OF CONDUCTORS RATED FOR USE WITH MOLDED CASE CIRCUIT BREAKERS

Size AWG, KCM	Area Cir. Mils	Concentric Lay Stranded Conductors		Bare Conductors		Dc Resistance Ohms/M Ft. At 25°C, 77°F.		
		No Wires	Diam. Each Wire Inches	Diam. Inches	①Area Square Inches	Copper		Aluminum
						Bare Conductor	Tin'd. Conductor	
18	1620	Solid	.0403	.0403	.0013	6.51	6.79	10.7
16	2580	Solid	.0508	.0508	.0020	4.10	4.26	6.72
14	4110	Solid	.0641	.0641	.0032	2.57	2.68	4.22
12	6530	Solid	.0808	.0808	.0051	1.62	1.68	2.66
10	10380	Solid	.1019	.1019	.0081	1.018	1.06	1.67
8	16510	Solid	.1285	.1285	.0130	.6404	.659	1.05
6	26240	7	.0612	.184	.027	.410	.427	.674
4	41740	7	.0772	.232	.042	.259	.269	.424
3	52620	7	.0867	.260	.053	.205	.213	.336
2	66360	7	.0974	.292	.067	.162	.169	.266
1	83690	19	.0664	.332	.087	.129	.134	.211
0	105600	19	.0745	.372	.109	.102	.106	.168
00	133100	19	.0837	.418	.137	.0811	.0843	.133
000	167800	19	.0940	.470	.173	.0642	.0668	.105
0000	211600	19	.1055	.528	.219	.0509	.0525	.0836

TABLE 33.1 PROPERTIES OF CONDUCTORS RATED FOR USE WITH MOLDED CASE CIRCUIT BREAKERS (CONT.)

Size AWG, KCM	Area Cir. Mils	Concentric Lay Stranded Conductors		Bare Conductors		Dc Resistance Ohms/M Ft. At 25°C, 77°F.		
		No Wires	Diam. Each Wire Inches	Diam. Inches	①Area Square Inches	Copper		Aluminum
						Bare Conductor	Tin'd. Conductor	
250	250000	37	.0822	.575	.260	.0431	.0449	.0708
300	300000	37	.0900	.630	.312	.0360	.0374	.0590
350	350000	37	.0973	.681	.364	.0308	.0320	.0505
400	400000	37	.1040	.728	.416	.0270	.0278	.0442
500	500000	37	.1162	.813	.519	.0216	.0222	.0354
600	600000	61	.0992	.893	.626	.0180	.0187	.0295
700	700000	61	.1071	.964	.730	.0154	.0159	.0253
750	750000	61	.1109	.998	.782	.0144	.0148	.0236
800	800000	61	.1145	1.030	.833	.0135	.0139	.0221
900	900000	61	.1215	1.090	.933	.0120	.0123	.0197
1000	1000000	61	.1280	1.150	1.039	.0108	.0111	.0177
1250	1250000	91	.1172	1.289	1.305	.00863	.00888	.0142
1500	1500000	91	.1284	1.410	1.561	.00719	.00740	.0118
1750	1750000	127	.1174	1.526	1.829	.00616	.00634	.0101
2000	2000000	127	.1255	1.630	2.087	.00539	.00555	.00885

①Area given is that of a circle having a diameter equal to the over-all diameter of a stranded conductor.

The values given in the table are those given in Handbook 100 of the National Bureau of Standards except that those shown in the 8th column are those given in Specification B33 of the American Society for Testing and Materials, and those shown in the 9th column are those given in Standard No. S-19-81 of the Insulated Power Cable Engineers Association and Standard No. WC3 of the National Electrical Manufacturers Association.

TABLE 33.2 FACTOR A—WIRE SIZE

Applied Wire Crossectional Area as a Percent of Rated Crossectional Area	Percent								
	50	60	70	80	90	100①	125	150	200
Factor A	1.4	1.25	1.15	1.07	1.03	1.0	0.99	0.97	0.97

①The correct size wire should be used with every circuit breaker. The values shown above can be useful in understanding the response of the breaker in some misapplications or in applications where cable ampacity is not required to match breaker ampacity.

TABLE 33.3 FACTOR B—CIRCUIT BREAKER AMBIENT TEMPERATURE①

Circuit Breaker Type	Circuit Breaker Ambient Temperature											
	25°C		40°C		50°C		60°C		70°C		80°C	
	B =	Minimum Wire Insulation Rating	B =	Minimum Wire Insulation Rating	B =	Minimum Wire Insulation Rating	B =	Minimum Wire Insulation Rating	B =	Minimum Wire Insulation Rating	B =	Minimum Wire Insulation Rating
Q-LINE	1.0	60/75	1.0	90	1.16	105	1.19	105	1.27	125	1.38	125
TQD, THQD	1.0	75	1.0	90	1.08	105	1.17	105	1.26	125	1.38	125
TEB, TED, TEY, TB-1 100A	1.0	60/75	1.0	90	1.0	105	1.05	105	1.14	125	1.25	125
TED, THED, TEL—150A THLC-1	1.0	75	1.0	90	1.0	105	1.1	105	1.21	105	1.38	105
TFJ, TFK, THFK, TFL, TLB-2, THLC-2	1.0	75	1.0	90	1.0	105	1.08	105	1.14	125	1.38	125
TJJ, TJK-4, THJK4, TB4, TLB-4, THLC-4	1.0	75	1.0	90	1.0	105	1.05	105	1.14	105	1.25	125
TJK6, THJK6	1.0	75	1.0	90	1.0	105	1.08	105	1.21	105	1.33	105
TKMA8, THKMA8, TB-8, TB-6	1.0	75	1.0	90	1.0	105	1.05	105	1.18	105	1.25	125
TKMA12, THKMA12	1.0	75	1.0	105	1.0	105	1.1	105	1.15	125	1.25	125
TJ4V, THJ4V, TJL4V, TJH, TJL	1.0	75	1.0	90	1.0	105	—	—	—	—	—	—
TK4V, TKL4V, TKH, TKL	1.0	75	1.0	105	1.0	105	—	—	—	—	—	—

①This is the air temperature around the outside of the breaker molded case, but inside the enclosure.

NOTE: All temperatures are °C

TABLE 34.1 FACTOR C—FREQUENCY RATING

Circuit Breaker Type	C (Frequency) Rating Factor at						
	Dc	50/60 Hz	100/120 Hz	150/180 Hz	200/240 Hz	300/360 Hz	400/415 Hz
Q-LINE	1.0	1.0	1.01	1.02	1.03	1.04	1.05
TEB, TED, THED, TEY, TEL, THLC-1	1.0	1.0	1.02	1.04	1.06	1.08	1.08
TFJ, TFK, THFK, TFL, TLB-2, THLC-2	1.0	1.0	1.02	1.05	1.09	1.18	1.18
TFC	1.0	1.0	1.02	—	—	—	—
TJJ, TJK, THJK, TLB-4, THLC-4	1.0	1.0	1.02	1.04	1.06	1.15	1.15
TJC	1.0	1.0	1.02	—	—	—	—
TKM8, THKMA8,	1.0	1.0	1.02	1.04	1.15	1.35	1.35
TKMA12, THKMA12	—	1.0	1.02	—	—	—	—
TKC	1.0	1.0	1.02	—	—	—	—
TJ4V, THJ4V, TJL4V, TJH, TJL	—	1.0	1.02	1.04	1.06	1.15	1.15
TK4V, TKL4V, TKH, TKL	—	1.0	1.02	1.04	1.15	1.35	1.35

Factor D—Altitude Rating

1.00 for −100 to +6000 feet
1.04 for 6001 to 10000 feet
1.08 for 10001 to 15000 feet

TABLE 34.2 FACTOR E—LOAD CLASS RATING TOTAL①

Group Mounted (12 or more breakers)	Switching Capacitors	Switching Electro-magnets	Single Motor Branch Circuit Protection (Normal Duty)	Single Motor Branch Circuit Protection (Heavy Duty) ②	All other (Normal) Load Types	Transformer Primary Protection with Secondary Protection ≤600V		Transformer Primary Protection Only—No Secondary Protection ≤600V
						Primary Breaker	Secondary Breaker	
1.1	1.35	1.5	1.5	1.75	1.0	2.5	1.25	1.25

① E equals the product of the load class rating factors which apply to the circuit in question.
② Use this factor for plugging duty or cycling loads with over 25 starts per hour where the RMS current cannot be reliably calculated.

Factor F—Safety Factor ≥ 1.1

TABLE 34.3 FACTOR G—DUTY FACTOR

Continuous duty (operation at essentially constant load for three hours or more)	Intermittent or short-time duty (constant load for less than three hours or intermittent load)
1.25	1.00

SELECTION OF CIRCUIT BREAKER CURRENT RATING

Circuit breakers are primarily used to provide overload and short circuit protection for insulated conductors. In this regard, the National Electrical Code Article 240-5 requires that conductors be protected in accordance with their ampacities, as given in NEC Tables 310-12 through 310-15. Exceptions are listed in the article for certain specific applications or conditions including protection for conductors in motor circuits.

The size and type of conductors required for a given circuit is usually calculated by the consulting engineer or other specifying authority, and specified on the job plans. It is in these instances, relatively simple to select a standard circuit breaker rating that matches the ampacity of the conductor. Where standard circuit breaker ratings do not correspond to the ampacity of the conductor, the NEC allows the next higher rating to be used where rating is 800 amperes or less.

For applications where only load currents are known, and motor circuits, ambient temperature, special duty cycles, frequency and altitude are involved, the following formula for selection of standard circuit breaker ratings is used:

Circuit Breaker Ampere Rating = Actual Load Current × A × B × C × D × E × F × G.

The procedure for using this formula is explained in the following steps.

Step 1. Determine the ACTUAL CURRENT of the circuit by adding the continuous load amperes for each load on the circuit. If the load is intermittent, the actual load current is equal to the RMS current over a time period equal to one-tenth of the frame ampere rating in minutes—100 ampere frame = 10 minutes, 225 ampere frame—23 minutes, etc.

Example:
An air-conditioning compressor cycles on and off at a maximum rate of four per hour and has the following characteristics:

—62 full load amperes
—248 locked rotor amperes
—6 second starting time
—5 minute off-time between starts

If we use an E frame breaker (150 ampere maximum) we must calculate the RMS current during the worst 10 minute period, which is START and RUN in this example.

$$I_{RMS} = \sqrt{\frac{(1\ \text{start})^2\,(\text{T start}) + (1\ \text{run})^2\,(\text{T run})}{\text{T total}}} = \sqrt{\frac{(248)^2\,(0.1\ \text{minute}) + (62)^2\,(9.9\ \text{minutes})}{10\ \text{minutes}}}$$

I_{RMS} = 66.5 amperes

If we use an F frame (225 amperes) we must calculate the RMS current during the worst 22.5 minute period which is 0.1 minute START, 9.9 minute RUN, 5 minute OFF, 0.1 minute START, 7.4 minute RUN.

$$I_{RMS} = \sqrt{\frac{(248)^2(.1) + (62)^2(9.9) + (248)^2(.1) + (62)^2(7.4)}{22.5}}$$

= 59.2 amps

Step 2. Using the ACTUAL CURRENT, or RMS current determined in STEP 1, estimate the breaker frame size required by your application. Retain this "estimated" frame size to complete STEP 3.

Step 3. Select the appropriate multiplying factors A to F for the application conditions involved, and substitute in the formula. For applications under the jurisdiction of the National Electrical Code the product of B through F must be equal to or greater than 1.25 for continuous loads on standard rated devices and equal to or greater than 1.0 for 100 percent rated devices.

Step 4. Now compute the proper ampere rating and the proper General Electric circuit breaker for the application by multiplying the ACTUAL CURRENT by each of the four factors determined under STEP 3.

Ampere Rating = Actual Current × A × B × C × D × E × F × G = amperes

Select a breaker having a rating equal to or next above your answer.

Example:
To illustrate: Assume a 480 v three phase circuit of 50 amperes continuous such as a computer power supply. The available short circuit current is less than 10kA the protective device is to be group mounted in a panelboard with a total of thirty circuits.

The conductor supplying the load will be selected to be equal to the protective device rating.

Ambient temperatures inside the box will not exceed 40°C.

There are no appreciable harmonics associated with the load.

The mounting location will be at 7200 ft.

Circuit Breaker Ampere Rating = 1 continuous × A × B × C × D × E × F × G.

Rating = 50 × 1.0 × 1.0 × 1.0 × 1.04 × 1.1 × 1.1 × 1.25 = 78.65 amperes.

The next standard rating would be 80 amperes. Therefore select a TED134080 and #3 AWG copper conductor.

INTERRUPTING RATINGS

Circuit breakers must not only carry the circuit current at all times under normal conditions, and trip open under overload conditions, but must have sufficient interrupting capacity to successfully interrupt the short circuit current that will flow under the worst fault conditions that can occur.

BASIS OF INTERRUPTING RATINGS

Short-Circuit Current Interrupting ratings depend upon knowing the magnitude of the short-circuit current that may flow through the circuit breaker or molded case switch. Devices rated in accordance with UL Standard 489 list their interrupting capacity of withstand capability in terms of rms symmetrical amps.

The procedures for calculating short-circuit current and the X/R ratios are described in detail in GE Publication GET3550.

Generally, electrical power system engineers calculate the X/R ratios rather than the power factors of protected circuits during their short-circuit studies. The magnitude of the momentary peak current to be interrupted—or withstood—is a function of the maximum peak current displacement from the zero current axis. That displacement is a function of the X/R ratio (or power factor) of the faulted circuit. The higher the X/R ratio, the lower the power factor, and the greater the magnitude of peak current displacement.

Listed interrupting ratings (Table 37.1) are subject to derating where circuit power factors are below listed values. Table 38.2 lists rating factors versus X/R ratios and power factors to allow the user to compensate the interrupting rating of a circuit breaker for circuit power factor, where necessary.

Frequency Frequency has an effect upon the interrupting capability of a molded case circuit breaker. Exhaustive testing has been conducted at the two worldwide standard frequencies, 50 Hz and 60 Hz. Less testing has been conducted on industrial circuit breakers at 25 Hz and 400 Hz. Table 38.3 lists suggested application guidelines for circuit breakers in 400 Hz circuits.

The data shown takes into account the lack of world test facilities to verify 400 Hz performance, but does represent the existing best engineering judgment of General Electric.

Power Factor, or X/R Ratio Interrupting ratings of molded case circuit breakers are based upon a specific ratio of reactance-to-resistance, or a specific power factor. Since practical ac circuits contain some reactance, there is some displacement between current and voltage waveforms. Because a short-circuit can literally occur during any point of the voltage wave, an actual trace of short-circuit current may display considerable initial displacement from the zero axis.

Figure 36.1 shows a symmetrical ac current waveform that would occur if a purely resistive circuit was short-circuited (or even a circuit containing reactance if the short circuit occurred at precisely the right point in the voltage waveform—which is unlikely).

Figure 36.2 shows the current trace of a short circuited ac circuit where displacement about the zero axis exists as a consequence of when the short circuit is applied and the amount of reactance in the short-circuited circuit, compared to its resistance.

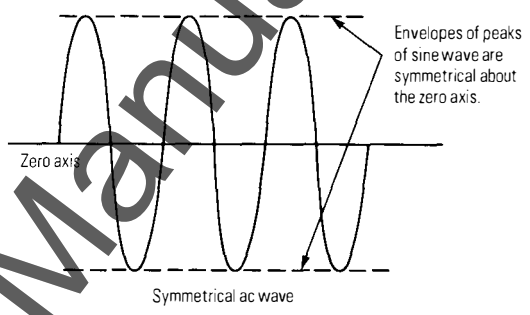


Figure 36.1 Symmetrical Ac Waveform

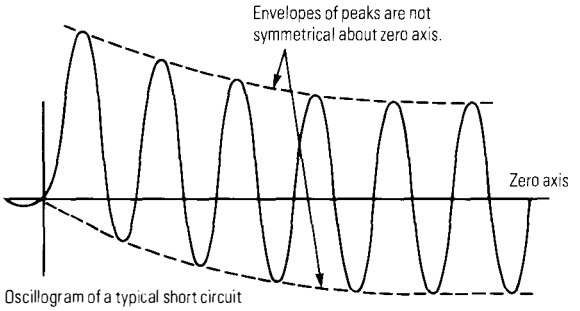


Figure 36.2 Asymmetrical Ac Waveform

INTERRUPTING RATINGS

There is a simple relationship between the power factor of a short-circuited circuit and its X/R ratio. It is:

$$\text{Power Factor (in Percent)} = \frac{R}{Z} \times 100$$

and: $Z = \sqrt{R^2 + X^2}$

therefore $PF = \dfrac{R}{\sqrt{R^2 + X^2}} \times 100$

I/C ratings not UL listed are based on tests per NEMA Standard AB-1 "Molded Case Circuit Breakers." The basic rating is given in RMS symmetrical amperes, the preferred basis for selection and application.

Values for dc, UL listed interrupting ratings are maximum amperes.

The following interrupting ratings are UL listed except where footnoted.

TABLE 37.1—AC INTERRUPTING RATINGS—UL LISTED

Circuit Breaker Type	Max. Ampere Rating	Max. ac Voltage	Voltage									
			120/240		240		277		480		600	
			Multi-Pole	1 Pole	Multi-Pole	1 Pole	277/480 Multi-Pole	277 1 Pole	Multi-Pole	1 Pole	Multi-Pole	1 Pole
			(2P)		(3P)							
THQB, C, L	100 70⑤	120/240	10000	5000								
THHQB, C, L	100 70⑤	120/240	22000	5000	22000	8660						
TXQB, C, L	30		65000	5000	65000	8600						
TQD	225		10000	5000	10000	8660						
TQDL	200		10000	5000								
THQD	225		22000	5000	22000	8660						
THQDL	200	120/240	22000	5000								
TEB	100	120		10000								
TEB	100	240			10000	8660						
TEY	100	277/480	65000	65000	65000	8660②	14000	14000				
TED	100	480								10000		
TED	100	277						14000				
TED	100	480			18000	8660			14000	8660		
TB-1	100	600			200000	8660			200000	8660	200000	8660
TEC	150	600			10000	8660			10000	8660	10000	8660
TEC and TECL	150	600			100000	8660			100000	8660	100000	8660
TED	150	600			18000	8660			14000	8660	14000	8660
THED	30	277						65000				
THED	150	600			42000	8660			25000	8660	18000	8660
TEL	150	600			100000	8660			65000	8660	25000	8660
TEML	150	600			100000	8660			65000	8660	25000	8660
THLC-1⑥	150	480			200000	8660			150000	8660	50000	8660
TFJ, TFK④, TFC	225	600			25000	8660			22000	8660	18000	8660
THFK④	225	600			65000	8660			25000	8660	18000	8660
TFL	225				100000	8660			65000	8660	25000	8600
TLB-2	225	480			85000	8660			50000	8660		
THLC-2⑥	225	480			200000	8660			150000	8660	50000	8660
TJD	400	240	22000	10000	22000	8660						
TJ①④	600	600			42000	8660			30000	8660	22000	8660
THJ①④	600	600			65000	8660			35000	8660	25000	8660
TLB-4	400	480			85000	8660			50000	8660		
TJH	600	600			65000	8660			35000	8660	25000	8660
TJL	600	600			100000	8660			65000	8660	30000	8660
THLC-4⑥	400	480			200000	8660			150000	8660	50000	8660
TB-4	400	600			200000	8660			200000	8660	200000	8660
TB-6	600	600			200000	8660			200000	8660	200000	8660
TK④	1200	600			42000	12120			30000	12120	22000	12120
THKMA④	1200	600			65000	12120			35000	12120	25000	12120
TKH	1200	600			65000	12120			50000	12120	25000	12120
TKL③	1200	600			100000	12120			65000	12120	42000	12120
TB-8	800	600			200000	8660			200000	8660	200000	8660

①Includes J, K, C, 4V suffixes.
②Includes C, MA and 4V suffixes.
③Includes 4V suffixes.
④Interchangeable thermal-magnetic trip circuit breakers are not U.L. listed for reverse feed.
⑤Single pole limit.
⑥If model is rated for 600 volts.

NOTE: The single pole interrupting ratings shown are the UL listed values for three pole devices and are not necessarily the maximum capability of the device. Single pole interrupting capability must be considered when molded case circuit breakers are used on ungrounded or resistance grounded distribution systems.

NOTE: For series-connected ratings with main circuit breakers or fuses, refer to General Electric Company.

TABLE 38.1 DC INTERRUPTING RATINGS—UL LISTED EXCEPT AS NOTED BY (*)

Circuit Breaker Type	125 Volts	250 Volts		300 Volts		400 Volts		500 Volts			600 Volts		700 Volts	
	1 Pole	1 Pole	2 Pole	1 Pole	2 Pole	1 Pole	2 Pole	1 Pole	2 Pole	3 Pole①	1 Pole	2 Pole	1 Pole	2 Pole
TEB	5000	—	5000											
TED4, TEC, TED6	10000	—	14000*							10000				
THED	20000*	—	22000*		20000*		20000*							
TFJ, TFK, TFC	10000	—	10000							10000				
THFK	20000*	—	20000*		20000*		20000*							
TJJ, TJK4, TJC, TJD	10000	10000	10000		20000*					20000				
THJK4, THJK6	20000*	10000	22000*		20000*		20000*		20000*					
TKMA8, TKC800	10000	10000	10000	10000*						22000②				
TKC361200L	22000*	22000*	23000*	10000*	23000*	10000*	23000*		23000*			23000*		
THKMA8	20000*	20000*	20000*	10000*	20000*	10000*	20000*	10000*	20000*					

*Not UL Listed. ①UL listed for 500 volts 3 poles in series ungrounded battery applications ②600 volts

NOTES:

1. Direct current interrupting ratings are based on a system fault time constant of 8 ms (milliseconds) or less.
2. Multi-pole ratings (2 or 3) are based on midpoint grounded systems with one pole in positive leg and one pole in negative leg, or end grounded systems with two or three poles wired in series in the ungrounded leg.
3. Single pole ratings are for application in ungrounded systems.

TABLE 38.2
INTERRUPTING RATING MULTIPLYING FACTORS FOR POWER FACTORS LOWER THAN (OR X/R RATIOS HIGHER THAN) TEST VALUES

Power Factor (Percent)	X/R Ratio	Rated Maximum Interrupting Rating		
		1 to 10 kA①	11 to 20 kA	21 kA and Higher
		Multiplier	Multiplier	Multiplier
4	24.980	0.61	0.72	0.81
5	19.974	0.62	0.74	0.82
6	16.637	0.63	0.75	0.83
7	14.251	0.64	0.76	0.84
8	12.460	0.65	0.77	0.85
9	11.066	0.66	0.78	0.87
10	9.950	0.67	0.79	0.88
11	9.036	0.68	0.80	0.89
12	8.273	0.69	0.81	0.90
13	7.627	0.69	0.82	0.91
14	7.072	0.70	0.83	0.93
15	6.591	0.71	0.84	0.94
16	6.169	0.72	0.85	0.95
17	5.797	0.73	0.86	0.96
18	5.465	0.74	0.87	0.97
19	5.167	0.75	0.88	0.98
20	4.899	0.76	0.89	1.000
21	4.656	0.77	0.90	1.000
22	4.434	0.77	0.91	1.000
23	4.231	0.78	0.92	1.000
24	4.045	0.79	0.94	1.000
25	3.873	0.80	0.95	1.000
26	3.714	0.81	0.96	1.000
27	3.566	0.82	0.97	1.000
28	3.429	0.83	0.98	1.000
29	3.300	0.83	0.99	1.000
30	3.180	0.84	1.000	1.000
31	3.067	0.85	1.000	1.000
32	2.961	0.86	1.000	1.000
33	2.861	0.87	1.000	1.000
34	2.766	0.88	1.000	1.000
35	2.676	0.88	1.000	1.000
36	2.592	0.89	1.000	1.000
37	2.511	0.90	1.000	1.000
38	2.434	0.91	1.000	1.000
39	2.361	0.91	1.000	1.000
40	2.291	0.92	1.000	1.000
41	2.225	0.93	1.000	1.000
42	2.161	0.94	1.000	1.000
43	2.100	0.95	1.000	1.000
44	2.041	0.95	1.000	1.000
45	1.984	0.96	1.000	1.000
46	1.930	0.97	1.000	1.000
47	1.878	0.97	1.000	1.000
48	1.828	0.98	1.000	1.000
49	1.779	0.99	1.000	1.000
50	1.732	1.000	1.000	1.000

①kA = Kiloamps (1 kA is 1,000 amps) rms, symmetrical.

TABLE 38.3
ESTIMATED 400–415 HZ INTERRUPTING RATINGS IN AMPERES—NOT UL LISTED

Circuit Breaker Type	Volts			
	120	120/208 and 120/240	277/480	346/600
THQL, B, C		1000		
THHQL, B, C		2200		
TXQL, B, C		6500		
TQD, TQDL		1000		
THQD, THQDL		2200		
TEY	6500	6500	1400	
TEB	1000	1000	—	—
TED 4	1800	1800	1400	—
TED 6	1800	1800	1400	1400
THED	6500	6500	2500	1800
TFL, TEL	10000	10000	6500	2500
TFJ, TFK	2500	2500	2200	2200
THFK	6500	6500	2500	2200
THLC-1	20000	20000	15000	5000
TJD		2200	2200	
TJJ, TJK	4200	4200	3000	2200
TJ①	4200	4200	3000	2200
THJ①	6500	6500	3500	2500
TJH	6500	6500	3500	2500
TJL	10000	10000	6500	3000
TK①	4200	4200	3000	2200
THK①	6500	6500	5000	2500
TKH	6500	6500	5000	2500
TKL	10000	10000	6500	4200

①Includes solid state trips.

400-Hertz interrupting ratings are based on engineering judgement, taking into consideration the operating characteristics of molded case circuit breakers and the worldwide lack of test facilities to verify performance.

TABLE 39.1 Q-LINE AND TEB MOLDED CASE SWITCH SHORT CIRCUIT WITHSTAND RATING①

Molded Case Switch Catalog Number	Maximum Rating Protective Device②		Short Circuit Withstand Rating
	Voltage	Amps	Amps rms Sym.
TQL, TQB, TQC21Y690	120/240	60	10,000
TQL, TQB, TQC21Y100	120/240	100	10,000
TQL, TQB, TQC22Y60	240	60	10,000
TQL, TQB, TQC22Y100	240	100	10,000
TQL, TQB, TQC32Y60	240	60	10,000
TQL, TQB, TQC32Y100	240	100	10,000
TEB111Y100	240	100	10,000
TEB122Y100	240	100	10,000
TEB132Y100	240	100	10,000

①Q-Line and TEB molded case switches have a 10,000 amp symmetrical short circuit withstand rating when protected by a fuse or circuit breaker rated 10,000 amps IC or greater and whose ampere rating does not exceed the ampere rating of the switch.
②Protective device must be on line side of molded case switch.
③Three-pole, 600 volt switches cover 2-pole, 600 volt and 2- and 3-pole, 480 volt switches.
④With MicroVersaTrip® 4-function programmer.

TABLE 39.2 MOLDED CASE SWITCH SHORT CIRCUIT WITHSTAND RATING

Molded Case Switch		Protective Device③		Short Circuit Withstand Ratings	
Ampere Rating	Catalog Number	Type	Max. Amp Rating	Amps rms Sym.	Max. Voltage
100	TED113Y100	Any fuse or circuit breaker rated 10,000A 240V	100	10,000	240
100	TED134Y100	TED134100	100	14,000	480
150	TED136Y150	TED136150	150	14,000	600
		TED134150	150	14,000	480
225	TFJ236Y225	TED, THED	150	14,000	600
		TFJ, TFK, THFK	225	14,000	600
		Class J Fuse	400	14,000	600
225	TQD32Y225	TQD	225	14,000	240
400	TJD432Y400	TJD	400	22,000	240
		Class T Fuse	400	50,000	240
400	TJJ436Y400	TFJ, TFK, THFK	225	18,000	600
				22,000	480
		TJJ, THJK,		22,000	600
		TJ4V, THJ4V, THJ9V, THJ9VV	400	30,000	480
		Class J Fuse	400	50,000	600
600	TJK636Y600	TJJ, THJK, TJ4V, THJ4V, THJ9V, THJ9VV	400	22,000	600
				30,000	480
		Class J Fuse	600	50,000	600
		TJK, THJK,		22,000	600
		TJ4V, THJ4V, THJ9V, THJ9VV	600	30,000	480
800	TKMA836Y800	TJK, THJK, TJ4V, THJ4V, THJ9V, THJ9VV	600	22,000	600
				30,000	480
		TKM, THKM,		22,000	600
		TK4V, THK4V, THK9V, THK9VV	800	30,000	480
		Class L Fuse	800	50,000	600
1200	TKMA3Y1200	TJK, THJK, TJ4V, THJ4V, THJ9V, THJ9VV	600	22,000	600
				30,000	480
		TKM, THKM,		22,000	600
		TK4V, THK4V THJ9V, THJ9VV	1200	30,000	480
		Class L Fuse	1200	50,000	600

Electrical Formula—For Obtaining kW, kVA, Horsepower and Amperes

E = Volts; I = Amperes; % Eff. = Percent Efficiency; PF = Power Factor

Wanted	Single-phase	Alternating Current Two-phase, Four-wire	Three-phase	Direct Current
Kilowatts	$\frac{I \times E \times PF}{1000}$	$\frac{I \times E \times 2 \times PF}{1000}$	$\frac{I \times E \times 1.73 \times PF}{1000}$	$\frac{I \times E}{1000}$
kVA	$\frac{I \times E}{1000}$	$\frac{I \times E \times 2}{1000}$	$\frac{I \times E \times 1.73}{1000}$	$\frac{I \times E}{1000}$
Horsepower	$\frac{I \times E \times \%\ Eff. \times PF}{746}$	$\frac{I \times E \times 2 \times \%\ Eff. \times PF}{746}$	$\frac{I \times E \times 1.73 \times \%\ Eff. \times PF}{746}$	$\frac{I \times E \times \%\ Eff.}{746}$
Amperes from kVA	$\frac{kVA \times 1000}{E}$	$\frac{kVA \times 1000}{2 \times E}$	$\frac{kVA \times 1000}{1.73 \times E}$	$\frac{kVA \times 1000}{E}$
Amperes from kW	$\frac{kW \times 1000}{E \times PF}$	$\frac{kW \times 1000}{2 \times E \times PF}$	$\frac{kW \times 1000}{1.73 \times E \times PF}$	$\frac{kW \times 1000}{E}$
Amperes from Hp	$\frac{Hp \times 746}{E \times \%\ Eff. \times PF}$	$\frac{Hp \times 746}{2 \times E \times \%\ Eff. \times PF}$	$\frac{Hp \times 746}{1.73 \times E \times \%\ Eff. \times PF}$	$\frac{Hp \times 746}{E \times \%\ Eff.}$

A.C. SHORT CIRCUIT DETERMINATION— For methods of calculation of short-circuit currents for industrial and commercial power systems, a simplified method and curves request a copy of GET-3550

TABLE 40.1 HORSEPOWER RATINGS

Catalog Number	No. of Poles	Amperes	Volts	Horsepower Ratings					
				240 Volt		480 Volt		600 Volt	
				Single-phase	Three-phase	Single-phase	Three-phase	Single-phase	Three-phase
TEB122Y100	2	100	240 Vac	20	...	...	...	...	...
			250 Vdc	...	...	...	...	...	...
TEB132Y100	3	100	240 Vac	20	30	...	...	...	...
TED124Y100	2	100	480 Vac	20	...	40	...	...	...
			250 Vdc	...	...	...	...	...	...
TED134Y100	3	100	480 Vac	20	30	40	75	...	...
TED126Y100	2	100	600 Vac	20	...	40	...	50	...
			250 Vdc	...	...	...	...	...	...
TED136Y100	3	100	600 Vac	20	30	40	75	50	100
TED136Y150	3	150	600 Vac	30	50	50	100	50	150

Catalog Number	No. of Poles	Amperes	Volts	Horsepower Ratings					
				240 Volt		480 Volt		600 Volt	
				Single-phase	Three-phase	Single-phase	Three-phase	Single-phase	Three-phase
TFJ226Y225	2	225	600	50	...	50	...	50	...
TFK226Y225	2	225	600	50	...	50	...	50	...
TFJ236Y225	3	225	600	50	75	50	150	50	200
TFK236Y225	3	225	600	50	75	50	150	50	200

Catalog Number	No. of Poles	Amperes	Volts	Horsepower Ratings					
				240 Volt		480 Volt		600 Volt	
				Single-phase	Three-phase	Single-phase	Three-phase	Single-phase	Three-phase
TJJ426Y225	2	225	600	50	...	50	...	50	...
TJJ426Y400	2	400	600	50	...	50	...	50	...
TJK426Y400	2	400	600	50	...	50	...	50	...
TJJ436Y225	3	225	600	50	75	50	150	50	200
TJJ436Y400	3	400	600	50	150	50	300	50	400
TJK436Y400	3	400	600	50	150	50	300	50	400
TJD522Y400	2	400	240	...	...	...	...	...	...
TJD432Y400	3	400	240	...	...	...	...	...	...

Catalog Number	No. of Poles	Amperes	Volts	Horsepower Ratings					
				240 Volt		480 Volt		600 Volt	
				Single-phase	Three-phase	Single-phase	Three-phase	Single-phase	Three-phase
TJK626Y600	2	600	600 Vac	50	...	50	...	50	...
			250 Vdc	...	...	...	...	...	...
TJK636Y600	3	600	600 Vac	50	200	50	500	50	500

Catalog Number	No. of Poles	Amperes	Volts	Horsepower Ratings					
				240 Volt		480 Volt		600 Volt	
				Single-phase	Three-phase	Single-phase	Three-phase	Single-phase	Three-phase
TKMA2Y1000	2	1000	600	50	...	50	...	50	...
TKMA3Y1000	3	1000	600	50	250	50	500	50	500
TKMA2Y1200	2	1200	600	50	...	50	...	50	...
TKMA3Y1200	3	1200	600	50	250	50	500	50	500

TIME CURRENT CURVES—INDEX

TIME CURRENT TRIPPING CHARACTERISTICS

Molded case circuit breaker time current curves are the engineering documents which define technical performance characteristics of the devices. The test parameters for the generation of these curves are as follows:

A. Circuit breaker connected with a minimum of four feet of rated conductor per terminal.

B. Circuit breaker in open air at ambient temperature indicated.

C. All tests initiated from the no current condition (cold start).

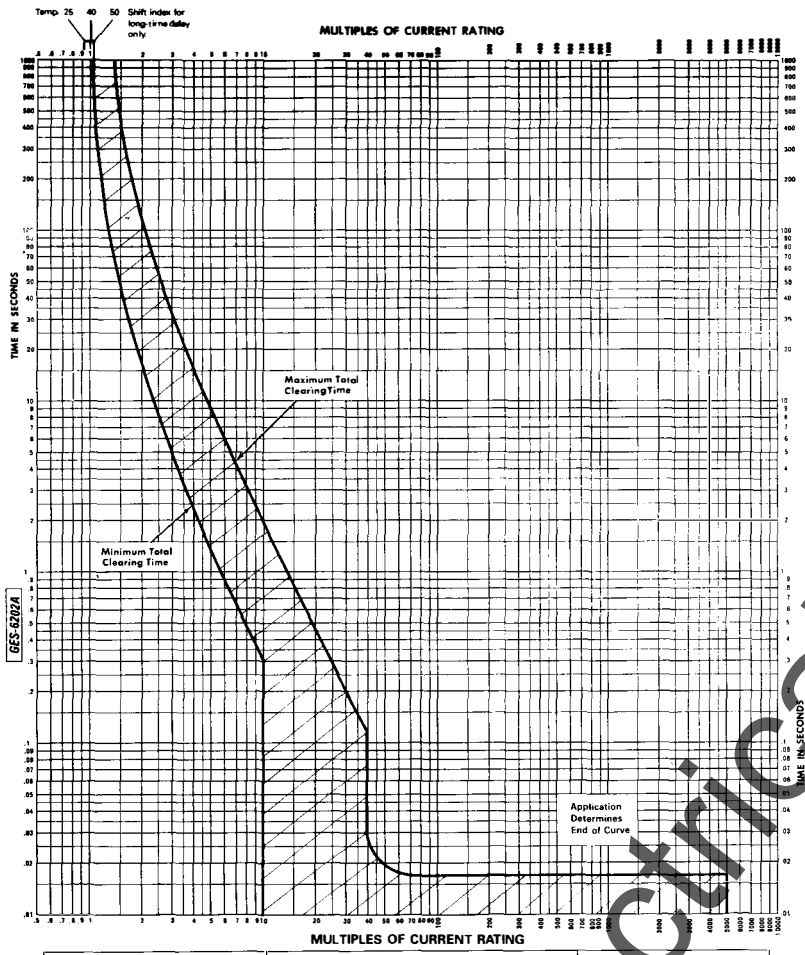
Information provided on the time current curve includes the following:

1. Product family type
2. Specific device type
3. Ampere ratings covered on curve
4. Overcurrent characteristics—long-time, short-time, instantaneous, etc.
5. Maximum total clearing time
6. Maximum and minimum temperature limits
7. Frequency ratings
8. Voltage ratings
9. Specific trip unit ratings
10. Trip unit adjustment ranges
11. Tolerances

Multiples of circuit breaker trip rating are shown on the top and bottom horizontal axis, with time in seconds on the vertical axis. Approximate minimum and maximum clearing time is readily determined from the characteristics curves. For example, a TED134100WL 100 ampere, 3 phase, 480 volt breaker, (reference curve GES-6115B, page 46), under a sustained overload of 200 amperes (2 times trip rating) reading up to curve from the horizontal axis, will clear within 80 to 350 seconds. Curve also shows that this breaker may trip instantaneously at current values within a band ranging from 7.5 to 20 times breaker trip rating but may take up to 14 seconds to trip. Beyond 20 times breaker rating it will always clear instantaneously. This instantaneous clearing time with no intentionally introduced time delay, ranges up to 0.018 seconds as shown on curve.

Tripping characteristics meet National Electrical Manufacturers Association and Underwriters' Laboratories, Inc. standards for rating and calibration.

Q-LINE—15–50



GE Electrical Distribution & Control

General Electric Company
Plainville CT 06062

Current Ratings
15, 20, 25, 30, 35, 40, 45 and 50 Amperes

Voltage Ratings
1- and 2-pole—120/240 Volts Ac
2- and 3-pole—240 Volts Ac

Frequency Ratings
50/60 Hertz

Molded Case Circuit Breakers
"Q" Line
Types THQL, THQB, THQC, THHQL, THHQB, THHQC, TXQL, TXQB, TXQC (30 Amps Max.)
Long-time Delay and Instantaneous Time-current Curves

Curves show circuit breaker in open air, 40 °C ambient, wired with conductors of corresponding rating, no prior load. For all other ambients, use rating shift index at top of sheet.

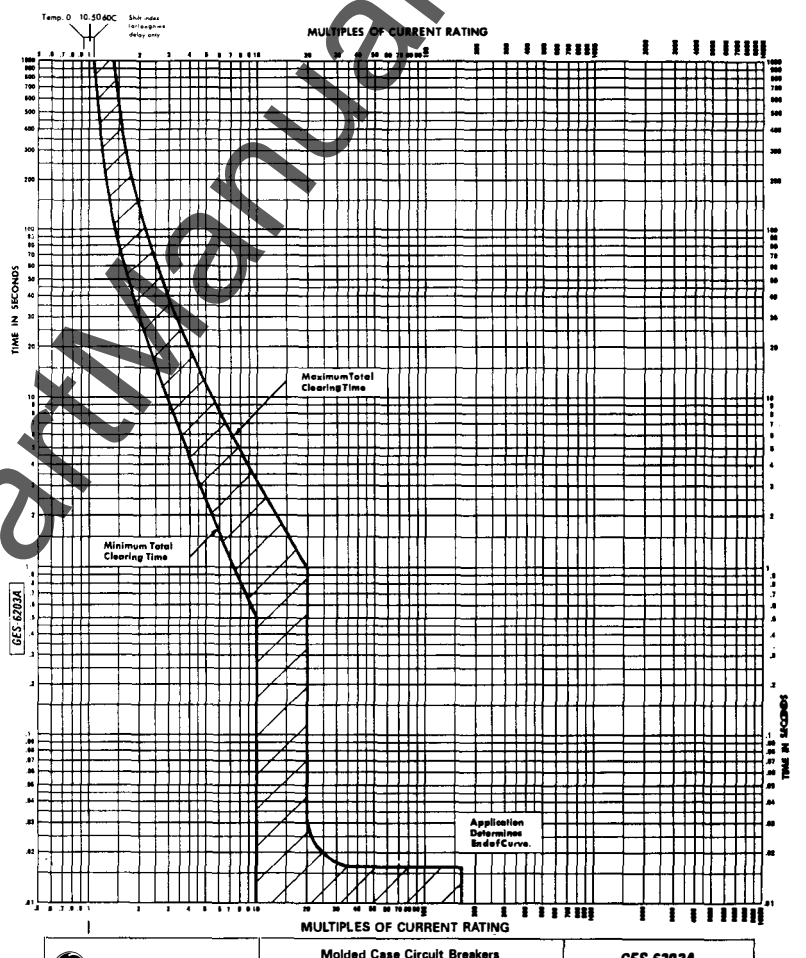
GES-6202A

Adjustments
Long-time delay thermal trip: not adjustable.
Instantaneous magnetic trip: not adjustable.

4/88 (1M)

(K215-63C)

Q-LINE—60–100



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Plainville, CT 06062

Current Ratings
2- and 3-pole—60, 70, 90 and 100 Amperes
1-pole—60 and 70 Amperes
2-pole—110 and 125 Amperes (120/240 Volts Ac)

Voltage Ratings
1- and 2-pole—120/240 Volts Ac
2- and 3-pole—240 Volts Ac

Frequency Ratings
50/60 Hertz

Molded Case Circuit Breakers
"Q" Line
Types THQL, THQB, THQC, THHQL, THHQB, THHQC
Ambient Compensated, Long-time Delay and Instantaneous Time-current Curves

Curves show ambient-compensated circuit breaker in open air, 10-50 °C ambient, wired with conductors of corresponding rating, no prior load. For all other ambients, use rating shift index at top of sheet.

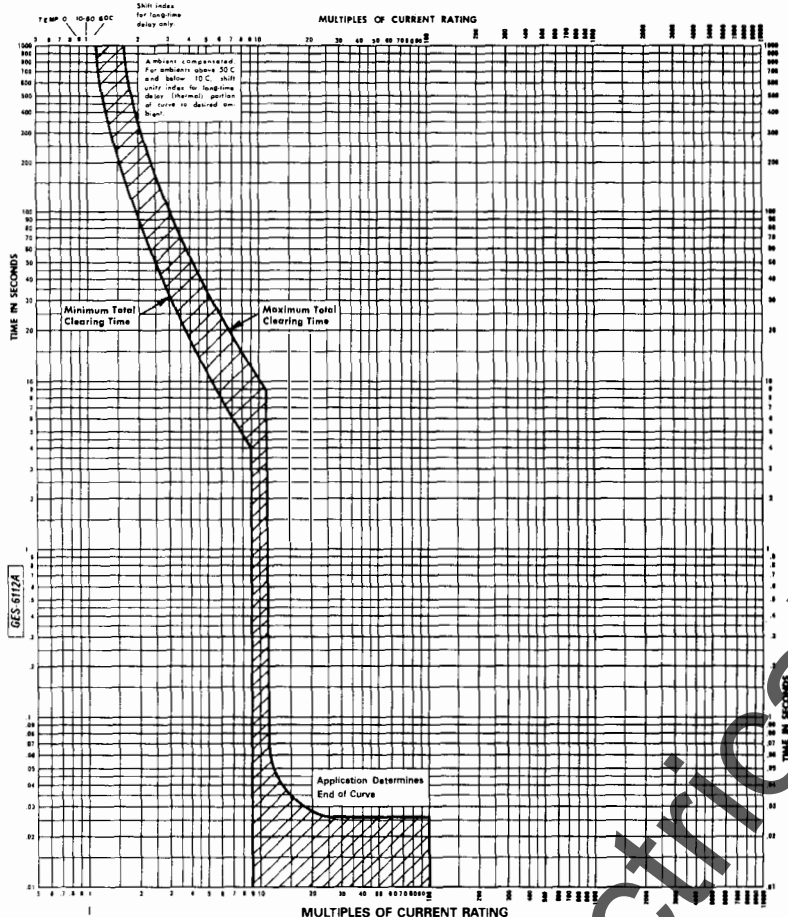
GES-6203A

Adjustments
Long-time delay thermal trip: not adjustable.
Instantaneous magnetic trip: not adjustable.

4/88 (1M)

(K216-64C)

TJD



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Plainville, CT 06062

Molded Case Circuit Breakers
J-600 Line
Type TJD (400 Amps Max.)
Long-time Delay and Instantaneous Time-current Curves

GES-6112A

Adjustments

Long-time delay thermal trip: not adjustable.
Instantaneous magnetic trip: not adjustable.

Current Ratings
250, 300, 350 and 400 Amperes

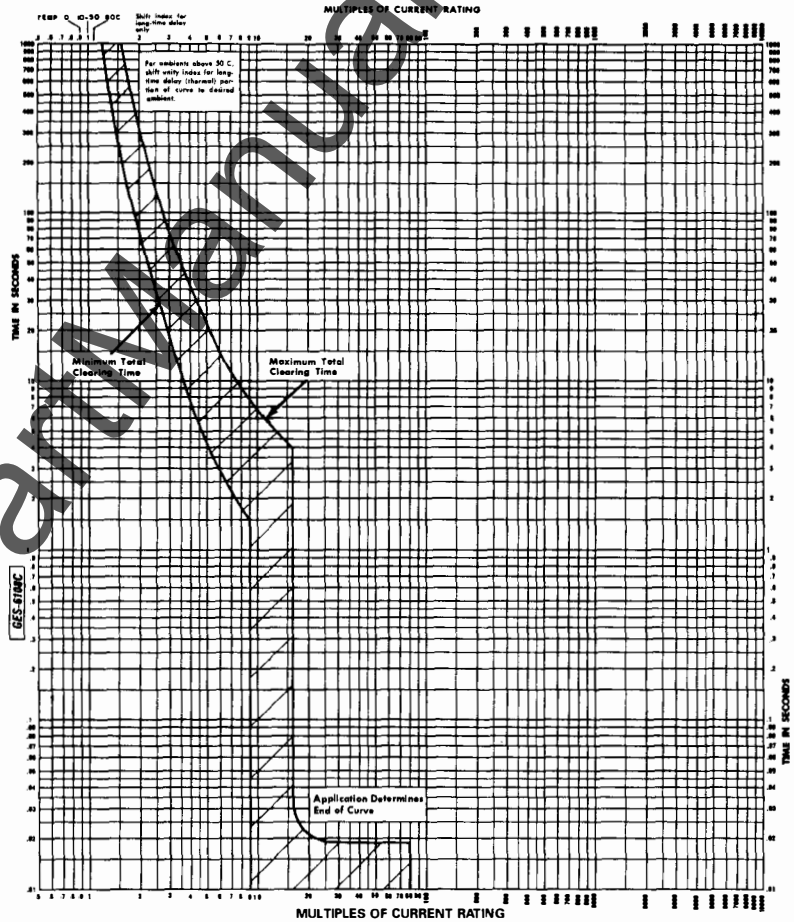
Voltage Ratings
2- and 3-pole—240 Volts Ac (125 Volts Dc)

Frequency Ratings
Dc or 50/60 Hertz

Curves show ambient-compensated circuit breaker in open air, 10-50°C ambient, wired with conductors of corresponding rating, no prior load. For all other ambients, use rating shift index at top of sheet.

4/88 (1M) (K215-86C)

TQD, THQD



GE Electrical Distribution & Control

General Electric Company
Plainville, CT 06062

Molded Case Circuit Breakers
Type TQD
Long-time Delay and Instantaneous Time-current Curves

GES-6108C

Adjustments

Long-time delay thermal trip: not adjustable.
Instantaneous magnetic trip: not adjustable.

Current Ratings
100, 125, 150, 175, 200 and 225 Amperes

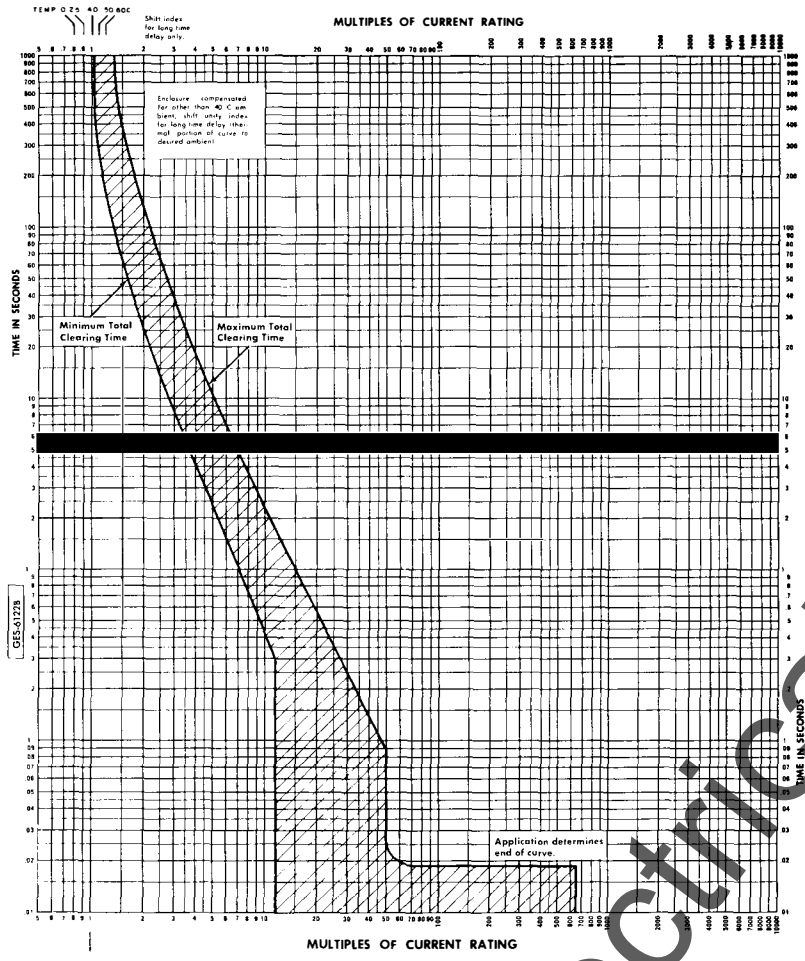
Voltage Ratings
2- and 3-pole—240 Volts Ac

Frequency Ratings
50/60 Hertz

Curves show circuit breaker in open air, 10-50°C ambient, wired with conductors of corresponding rating, no prior load. For all other ambients, use rating shift index at top of sheet.

4/88 (1M) (K215-48C)

TEB 15–50



GENERAL ELECTRIC

MOLDED-CASE CIRCUIT BREAKER

E 100 LINE

Type TEB, 15-50 Amperes

Enclosure Compensated

Long-time Delay and Instantaneous Time-current Curves

(Curves show enclosure compensated circuit breaker in open air, 40 C ambient, wired with conductors of correspondingrating, at rated load. For all other ambients, use shift index at top of sheet.)

GES-6122B

Current Ratings
15, 20, 25, 30, 35, 40, 45 and 50 amperes

Voltage Ratings
2-and 3-pole—240 volts a-c (250 volts d-c)

Frequency Rating
60 Hertz

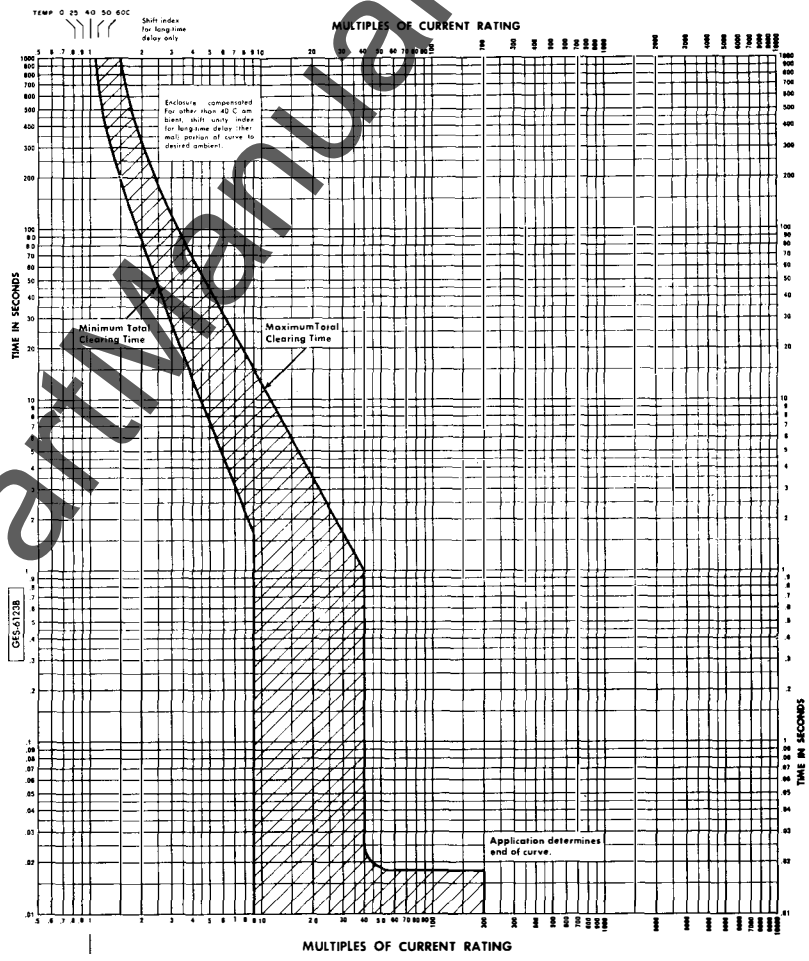
Adjustments
Long-time delay thermal trip: not adjustable.
Instantaneous magnetic trip: not adjustable.

41-151

GENERAL ELECTRIC CO, DISTRIBUTION EQUIPMENT DIVISION, PLAINVILLE, CONN. 06062

K215 93A

TEB 60–80



GENERAL ELECTRIC

MOLDED-CASE CIRCUIT BREAKER

E 100 LINE

Type TEB, 60–80 Amperes

Enclosure Compensated

Long-time Delay and Instantaneous Time-current Curves

(Curves show enclosure compensated circuit breaker in open air, 40 C ambient, wired with conductors of corresponding rating, at rated load. For all other ambients, use shift index at top of sheet.)

GES-6123B

Current Ratings
60, 70 and 80 amperes

Voltage Ratings
2-and 3-pole—240 volts a-c (250 volts d-c)

Frequency Ratings
60 Hertz

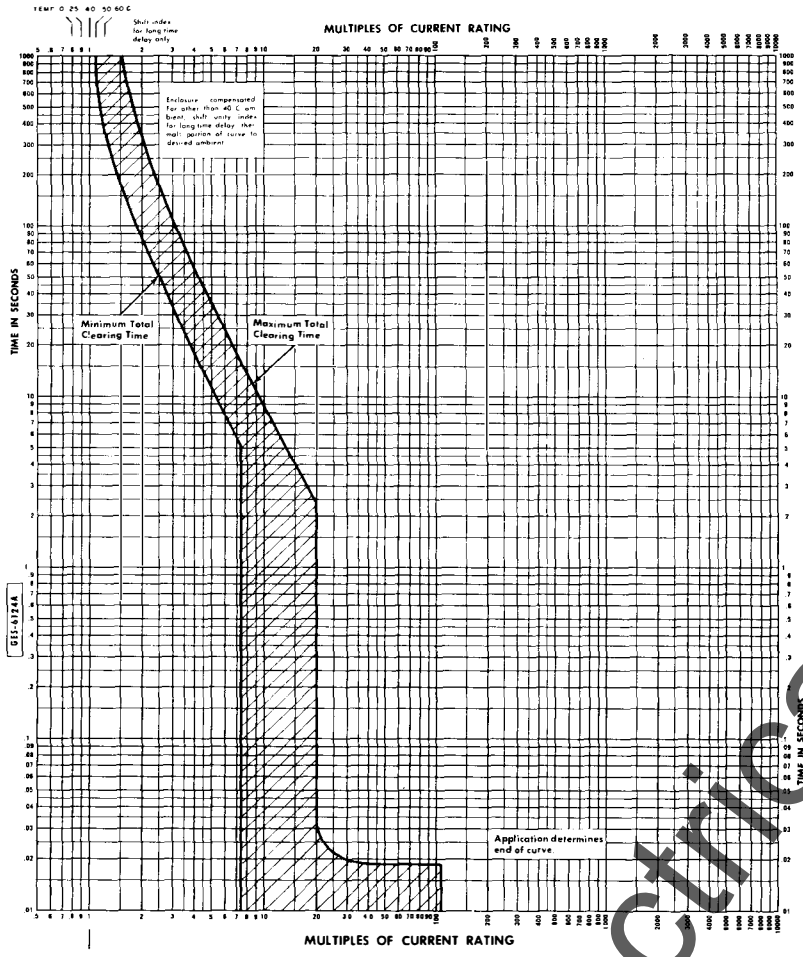
Adjustments
Long-time delay thermal trip: not adjustable.
Instantaneous magnetic trip: not adjustable.

41-151(SM)

GENERAL ELECTRIC CO, DISTRIBUTION EQUIPMENT DIVISION, PLAINVILLE, CONN. 06062

K215 94A

TEB 90, 100



GENERAL ELECTRIC

MOLDED-CASE CIRCUIT BREAKER

E 100 LINE

Type TEB, 90 and 100 Amperes

Enclosure Compensated

Long-time Delay and Instantaneous Time-current Curves

(Curves show enclosure compensated circuit breaker open air, 40 C ambient, wired with conductors of corresponding rating, no prior load. For all other ambients, use shift index at top of chart.)

GES-6124A

Current Ratings
90 and 100 amperes

Voltage Ratings
2- and 3-pole—240 volts ac (250 volts d-c)

Frequency Rating
60 Hertz

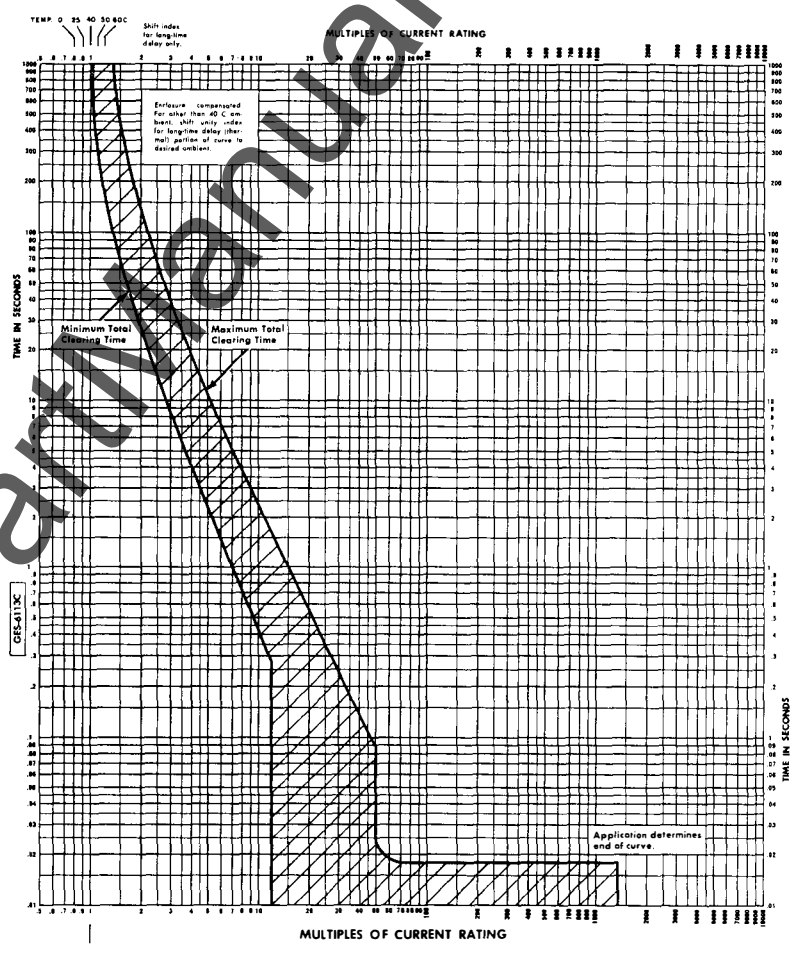
Adjustments
Long-time delay thermal trip, not adjustable.
Instantaneous magnetic trip, not adjustable.

7-85 (1M)

GENERAL ELECTRIC CO., CONTRACTOR EQUIPMENT BUSINESS OPERATIONS, PLAINVILLE, CONN. 06062

K215-95A

TED 15–50



GENERAL ELECTRIC

MOLDED-CASE CIRCUIT BREAKER

E 100 LINE

Type TED, 15–50 amperes

Enclosure Compensated

Long-time Delay and Instantaneous Time-current Curves

(Curves show enclosure compensated circuit breaker in open air, 40 C ambient, wired with conductors of corresponding rating, no prior load. For all other ambients, use shift index at top of chart.)

GES-6113C

Current Ratings
15, 20, 25, 30, 35, 40, 45 and 50 amperes

Voltage Ratings
1-pole—277 volts ac (325 volts d-c)
2- and 3-pole—480 volts ac (250 volts d-c)

Frequency Rating
60 Hertz

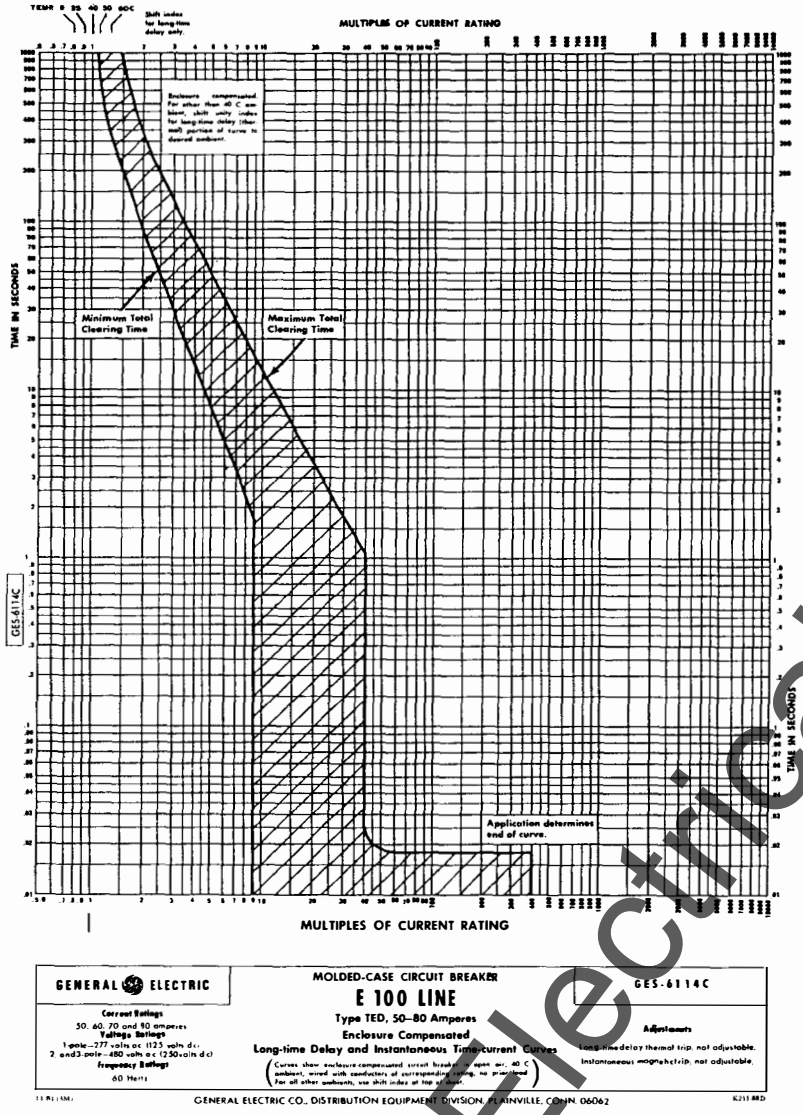
Adjustments
Long-time delay thermal trip, not adjustable.
Instantaneous magnetic trip, not adjustable.

6-76 (1M)

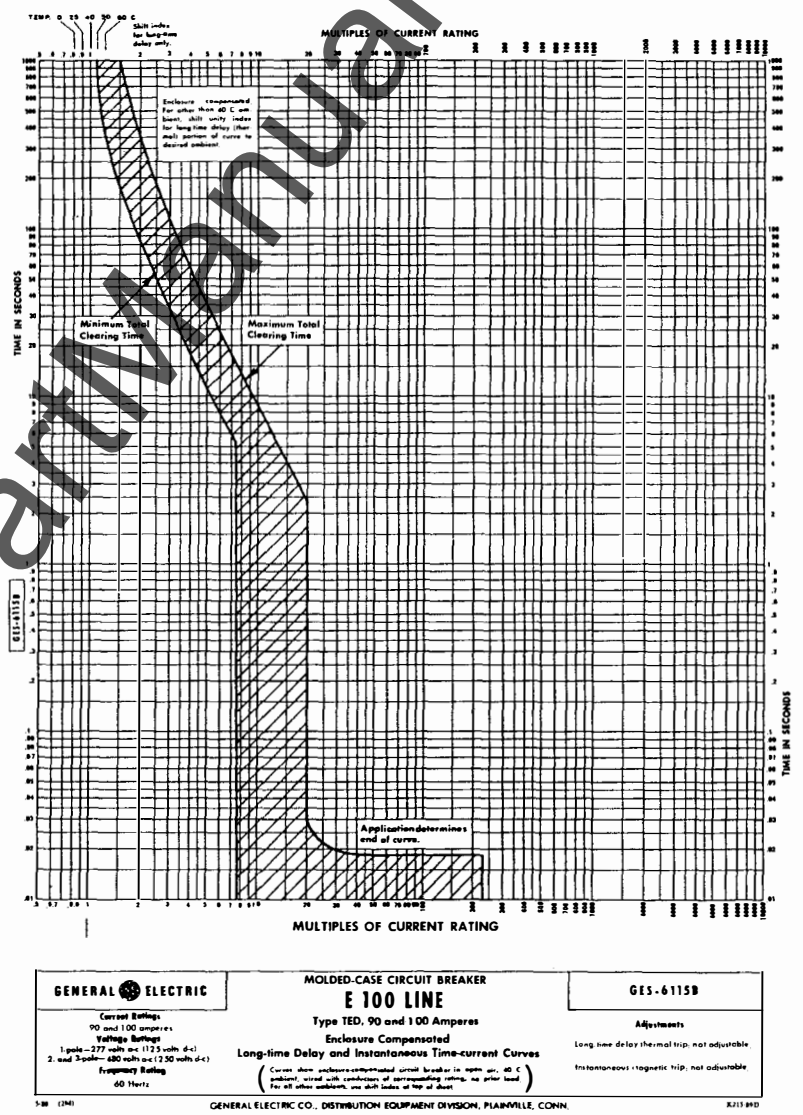
GENERAL ELECTRIC CO., CIRCUIT PROTECTIVE DEVICES DEPT., PLAINVILLE, CONN. 06062

K215-82D

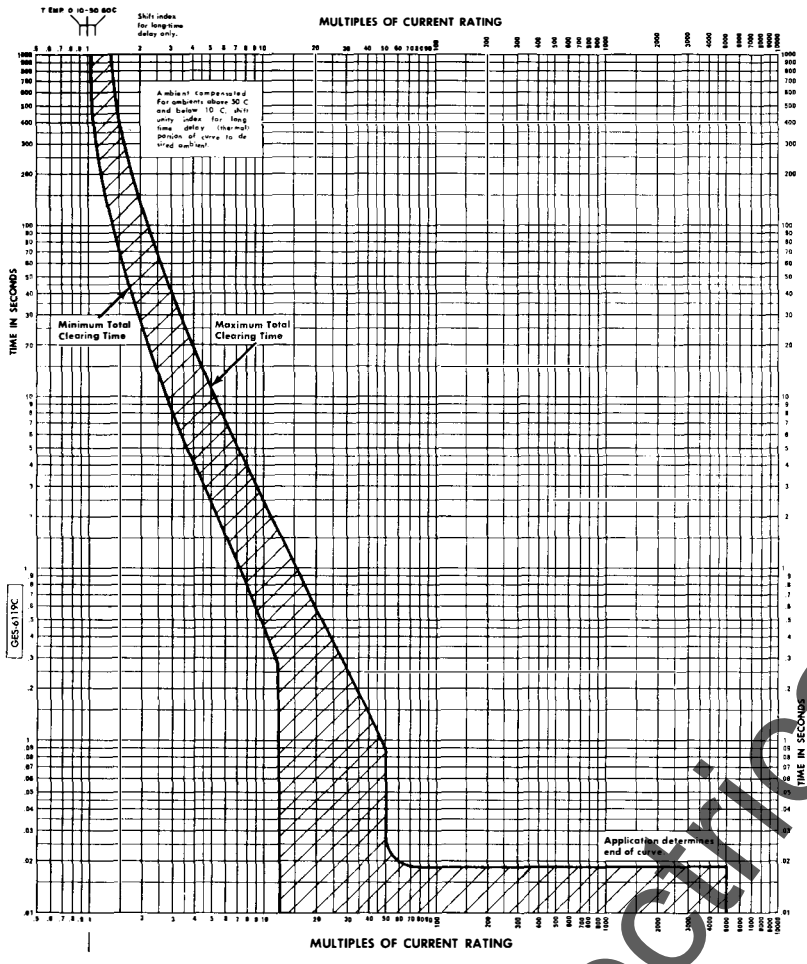
TED 60–80



TED 90, 100



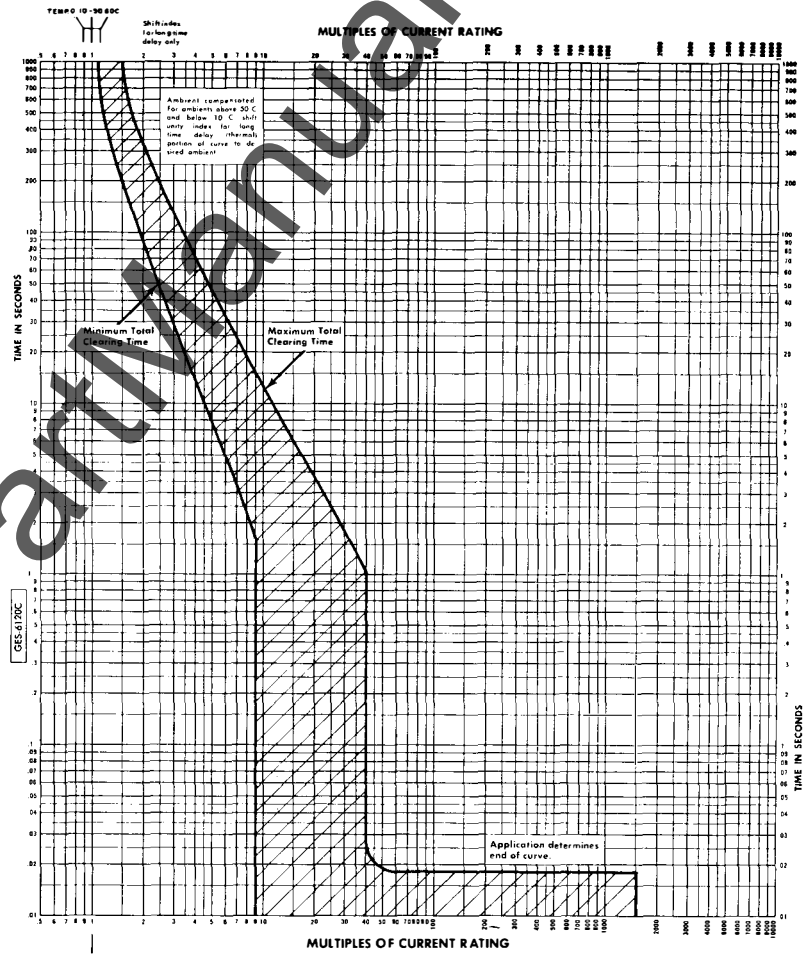
TED6 & THED6 15–50



GENERAL ELECTRIC	MOLDED-CASE CIRCUIT BREAKER E 150 LINE Types TED and THED, 15–50 Amperes Ambient Compensated Long-time Delay and Instantaneous Time-current Curves (Curves show ambient-compensated circuit breaker in open air, 10 to 50 C ambient, wired with conductors of corresponding rating no prior load. For all other ambients, use rating shift index at top of sheet.)	GES-6119C
Current Ratings 15, 20, 25, 30, 35, 40, 45 and 50 amperes **Voltage Ratings** 2-and 3 pole–600 volts a-c **Frequency Rating** 60 Hertz		**Adjustments** Long-time delay thermal trip: not adjustable. Instantaneous magnetic trip: not adjustable.

GENERAL ELECTRIC CO. DISTRIBUTION EQUIPMENT DIVISION, PLAINVILLE, CONN. 06062

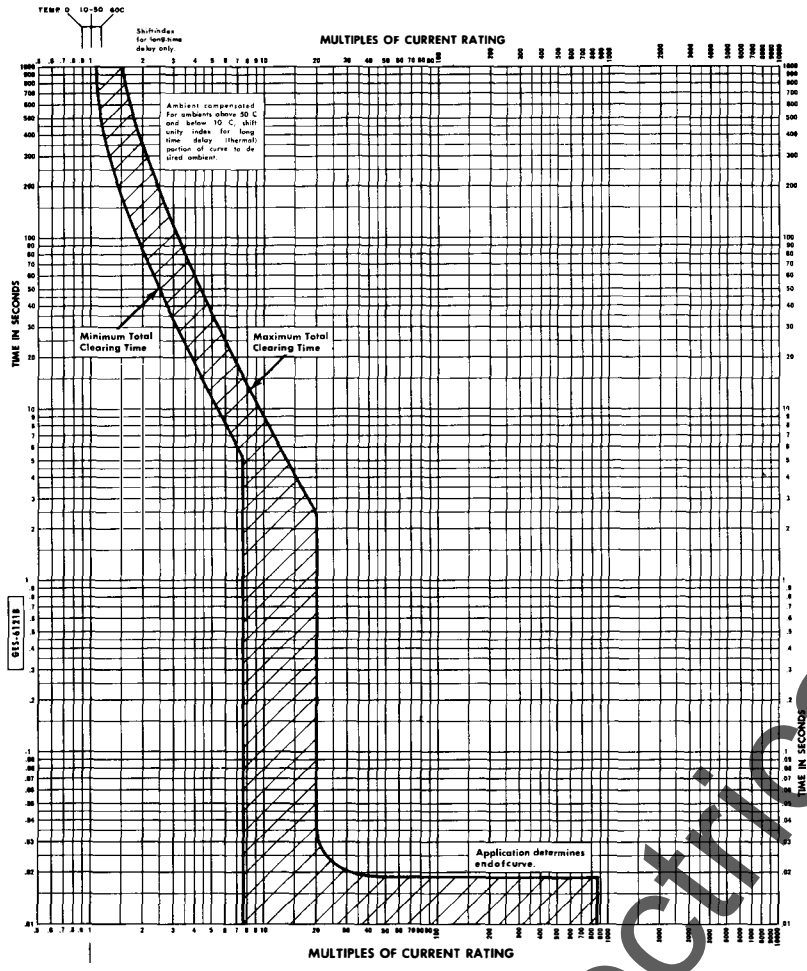
TED6 & THED6 60–80



GENERAL ELECTRIC	MOLDED-CASE CIRCUIT BREAKER E 150 LINE Types TED and THED, 60–80 amperes Ambient Compensated Long-time Delay and Instantaneous Time-current Curves (Curves show ambient compensated circuit breaker in open air, 10 to 50 C ambient wired with conductors of corresponding rating no prior load. For all other ambients, use rating shift index at top of sheet.)	GES-6120C
Current Ratings 60, 70 and 80 amperes **Voltage Ratings** 3 pole–600 volts a-c **Frequency Rating** 60 Hertz		**Adjustments** Long time delay thermal trip: not adjustable. Instantaneous magnetic trip: not adjustable.

GENERAL ELECTRIC CO. CIRCUIT PROTECTIVE DEVICES DEPT., PLAINVILLE, CONN. 06062

TED6 & THED6 90–150



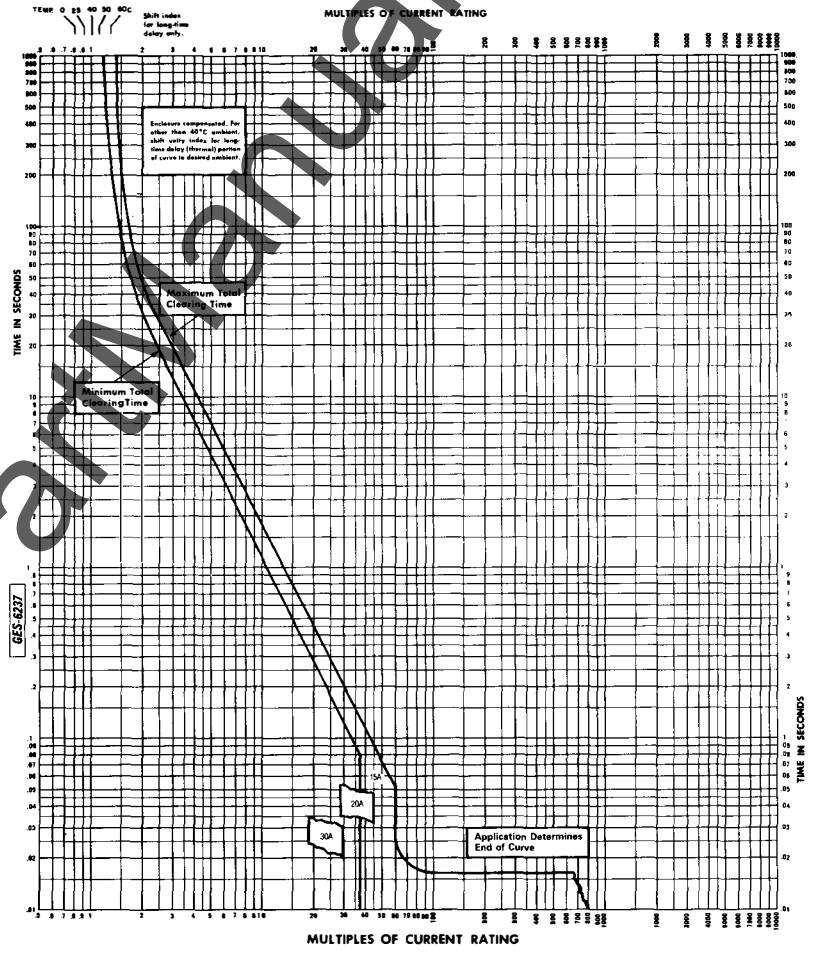
GENERAL ELECTRIC	MOLDED-CASE CIRCUIT BREAKER **E 150 LINE** Types TED and THED, 90 - 150 amperes Ambient Compensated Long-time Delay and Instantaneous Time-current Curves (Curves show ambient-compensated circuit breaker in open air at 10 to 50 C ambient, wired with conductors of corresponding rating, no prior load. For all other ambients, use rating shift index at top of sheet.)	GES-6121B Adjustments Long-time delay thermal trip, not adjustable. Instantaneous magnetic trip, not adjustable.
Current Ratings 90, 100, 110, 125 and 150 amperes Voltage Ratings 3 pole—600 volts a-c Frequency Rating 60 Hertz		

7-81 (3M)

GENERAL ELECTRIC CO., DISTRIBUTION EQUIPMENT DIVISION, PLAINVILLE, CONN. 06062

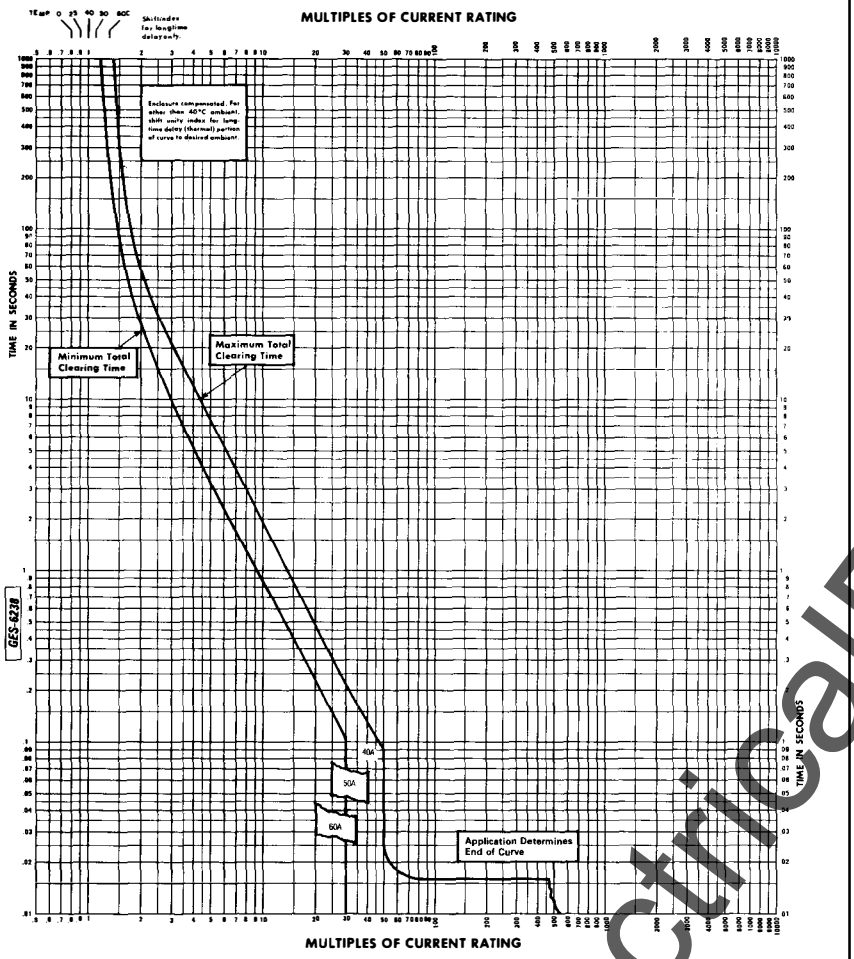
K215-92B

TEY 15–50



GE Electrical Distribution & Control General Electric Company Plainville, CT 06062	Molded Case Circuit Breaker **Type TEY, 15-30 Amperes** Enclosure Compensated, Long-time Delay and Instantaneous Time-current Curves	GES-6237 Adjustments Long-time delay thermal trip: not adjustable. Instantaneous magnetic trip: not adjustable.
Current Ratings 15, 20 and 30 amperes Voltage Ratings 1-pole—277 volts ac (125 volts dc) 2- and 3-pole—480 volts ac (250 volts dc) Frequency Ratings 60 Hertz	Curves show enclosure-compensated circuit breaker in open air, 40°C ambient wired with conductors of corresponding rating, no prior load. For all other ambients, use rating shift index at top of sheet.	

TEY 60



GE Electrical Distribution & Control

General Electric Company
Plainville, CT 06062

Current Ratings
40, 50 and 60 amperes

Voltage Ratings
1-pole—277 volts ac (125 volts dc)
2- and 3-pole—480 volts ac (250 volts dc)

Frequency Ratings
60 Hertz

Molded Case Circuit Breaker
Type TEY, 40-60 Amperes
Enclosure Compensated, Long-time Delay and Instantaneous Time-current Curves

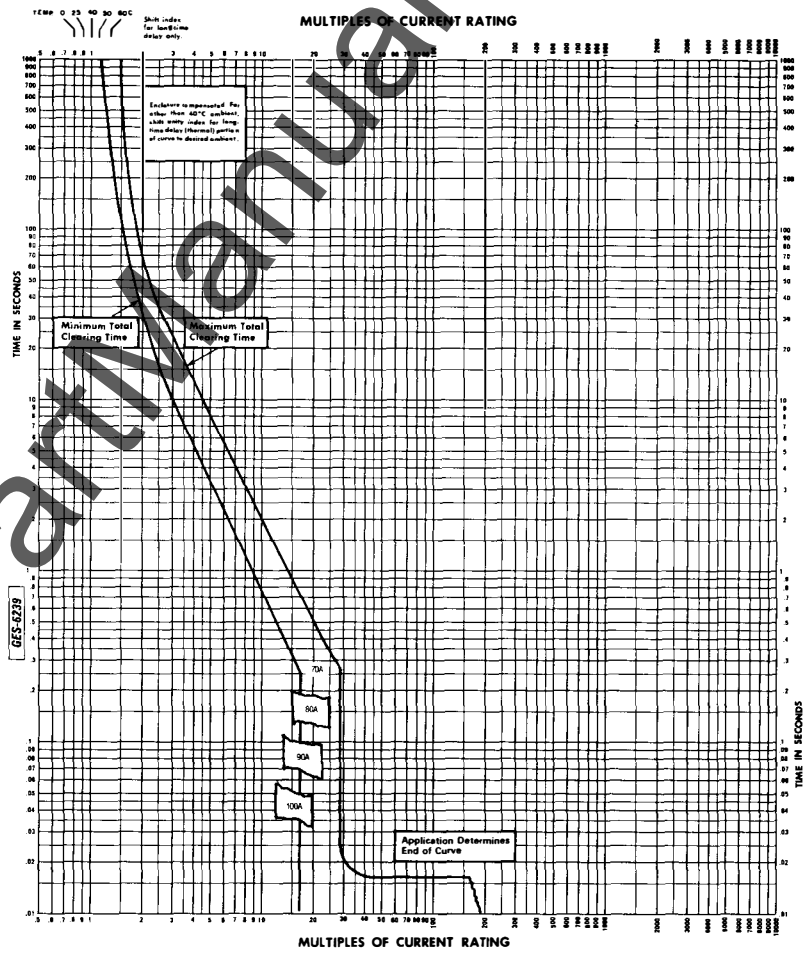
Curves show enclosure compensated circuit breaker in open air, 40°C ambient, wired with conductors of corresponding rating, no prior load. For all other ambients, use rating shift index at top of sheet.

GES-6238

Adjustments
Long-time delay thermal trip: not adjustable.
Instantaneous magnetic trip: not adjustable.

4/88 (3M)

TEY—100



GE Electrical Distribution & Control

General Electric Company
Plainville, CT 06062

Current Ratings
70, 80, 90 and 100 amperes

Voltage Ratings
1-pole—277 volts ac (125 volts dc)
2- and 3-pole—480 volts ac (250 volts dc)

Frequency Ratings
60 Hertz

Molded Case Circuit Breaker
Type TEY, 70-100 Amperes
Enclosure Compensated, Long-time Delay and Instantaneous Time-current Curves

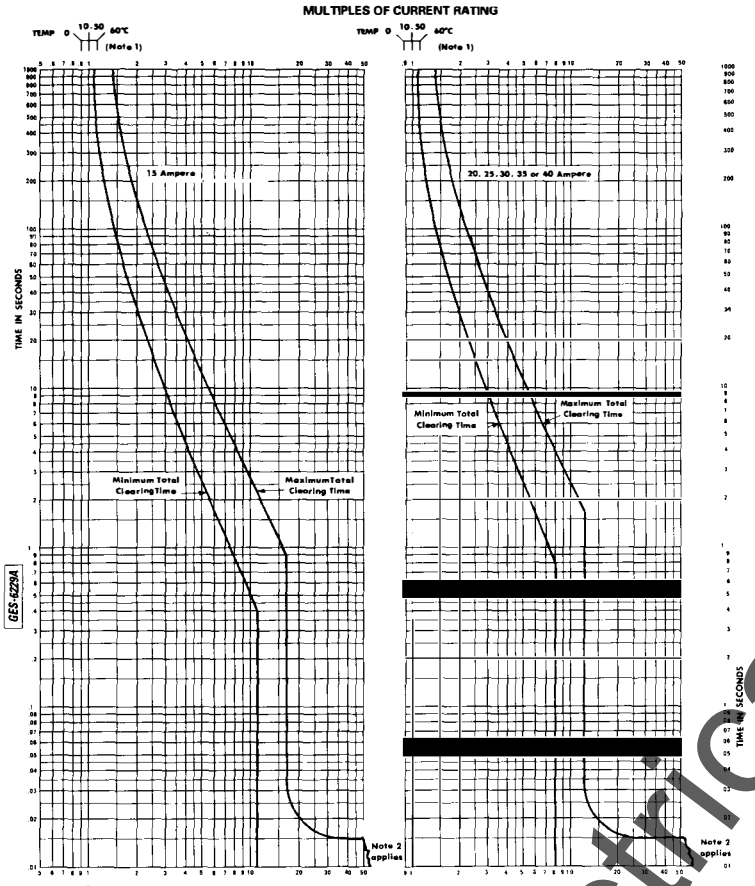
Curves show enclosure compensated circuit breaker in open air, 40 °C ambient, wired with conductors of corresponding rating, no prior load. For all other ambients, use rating shift index at top of sheet.

GES-6239

Adjustments
Long-time delay thermal trip: not adjustable.
Instantaneous magnetic trip: not adjustable.

4/88 (3M)

TEL 15–40



MULTIPLES OF CURRENT RATING

GE Electrical Distribution & Control
General Electric Company
Plainville, CT 06062

Current-Limiting Molded Case Circuit Breaker
Type TEL
Ambient Compensated
Long-time Delay and Instantaneous
Time-current Curves

GES-6229A

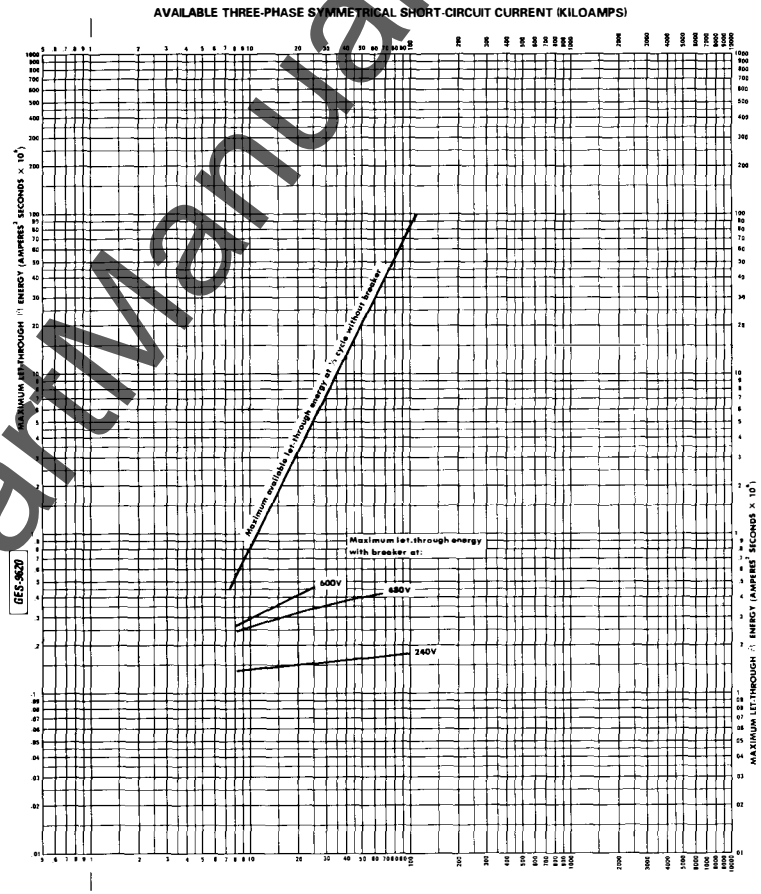
Current Ratings
15, 20, 25, 30, 35 And 40 Amperes
Voltage Ratings
240, 480, 600 Volts ac
Frequency Rating
50/60 Hertz

Adjustments

Curves show ambient compensated circuit breaker response at 10, 30 C ambient, wired with 60/75 C rated conductors, with ampere rating corresponding to circuit breaker ampere rating. No preload.

12/89 (JM)

TEL 15–40 I^2t-MAXIMUM LET-THRU ENERGY



AVAILABLE THREE-PHASE SYMMETRICAL SHORT-CIRCUIT CURRENT (KILOAMPS)

GE Electrical Distribution & Control
General Electric Company
Plainville, CT 06062

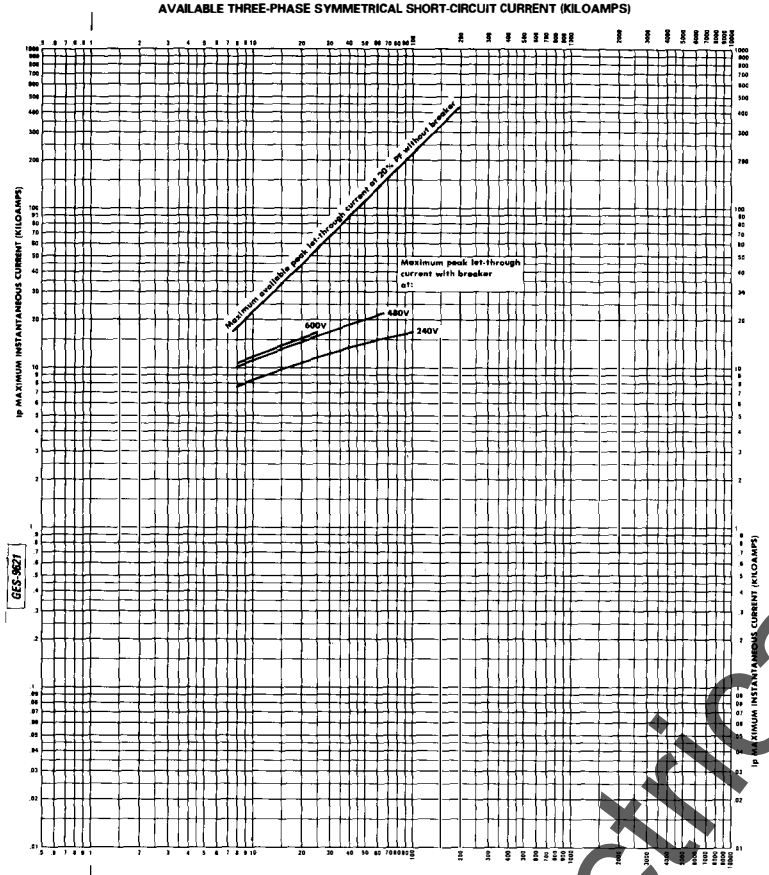
Current-Limiting Molded Case Circuit Breaker
Type TEL
Let-through Energy Curves

GES-9620

Current Ratings
15-40 Amperes
Voltage Ratings
240, 480, 600 Volts ac
Frequency Rating
50/60 Hertz

12/89 (JM)

TEL 15–40 Ip–MAXIMUM INSTANTANEOUS CURRENT



GE Electrical Distribution & Control
General Electric Company
Plainville, CT 06062

Current-Limiting Molded Case Circuit Breaker

GES-9621

Type TEL

Peak Let-through Current Curves

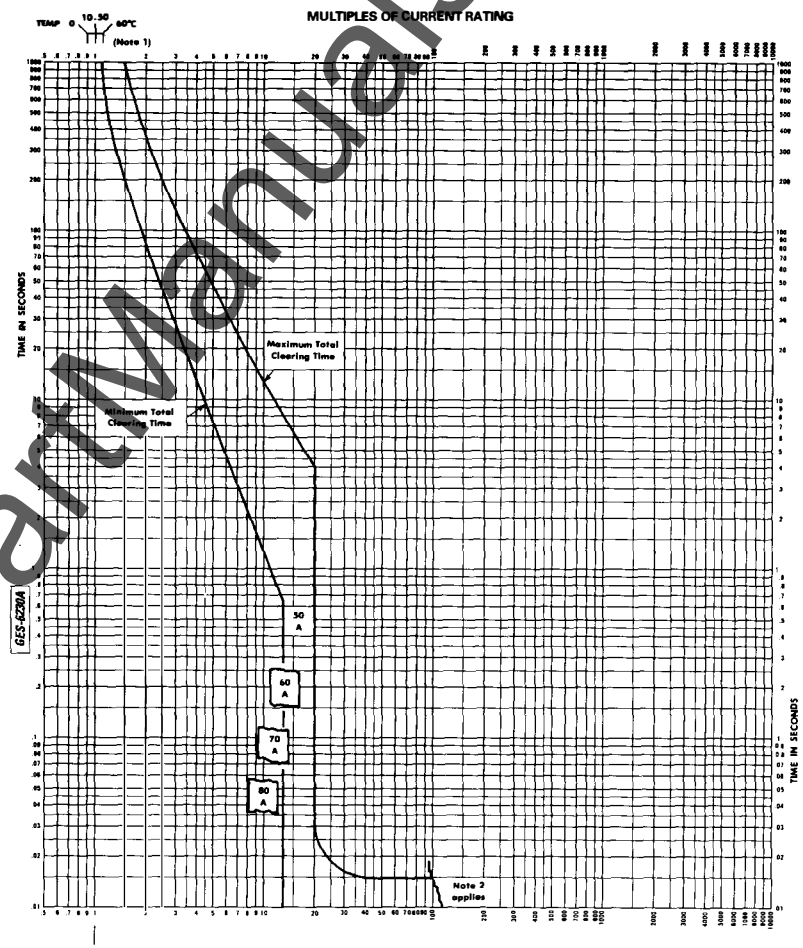
Current Ratings
15-40 Amperes

Voltage Ratings
240, 480, 600 Volts ac

Frequency Rating
50/60 Hertz

12/89 (3M)

TEL 50-80



GE Electrical Distribution & Control
General Electric Company
Plainville, CT 06062

Current-Limiting Molded Case Circuit Breaker

Type TEL

Ambient Compensated
Long-time Delay and Instantaneous
Time-current Curves

GES-6230A

Current Ratings
50, 60, 70 and 80 Amperes

Voltage Ratings
240, 480, 600 Volts ac

Frequency Rating
50/60 Hertz

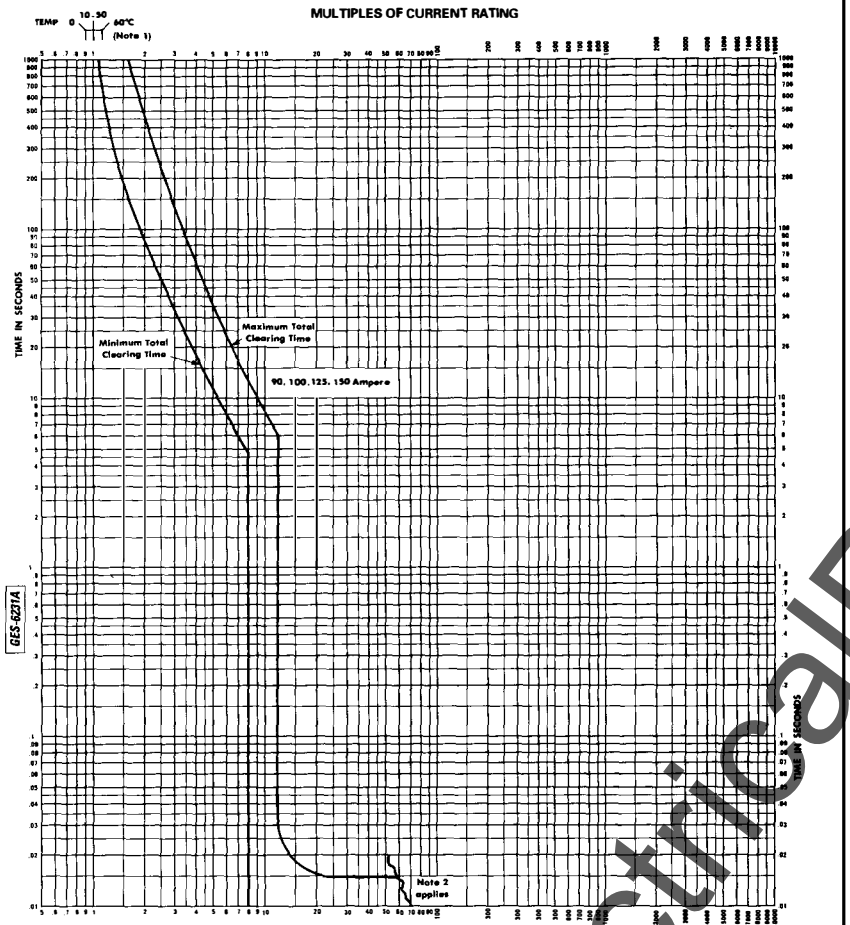
Curves show ambient-compensated circuit breaker in open air 10 50 C ambient, wired with 60/75°C rated conductors with ampere rating corresponding to circuit breaker ampere rating. No prior load.

Adjustments

Long-time delay thermal trip not adjustable
Instantaneous magnetic trip not adjustable
Note 1: For ambient above 50 C and below 10 C, shift trinity index for long-time delay thermal portion of curve to desired ambient.
Note 2: Current binning range, breaker totally clears prior to 0.01 sec. For additional data refer to Ip and I²T curves.

12/89 (3M)

TEL 90–150



GE Electrical Distribution & Control
General Electric Company
Plainville, CT 06062

Current-Limiting Molded Case Circuit Breaker

GES-6231A

Type TEL

Ambient Compensated
Long-time Delay and Instantaneous
Time-current Curves

Current Ratings
90, 100, 125 and 150 Amperes

Voltage Ratings
240, 480, 600 Volts ac

Frequency Rating
50/60 Hertz

Curves show ambient-compensated circuit breaker in open air at 50°C ambient, wired with 75°C rated (90, 100 ampere) 60/75°C) conductors with ampere rating corresponding to circuit breaker ampere rating for motor load.

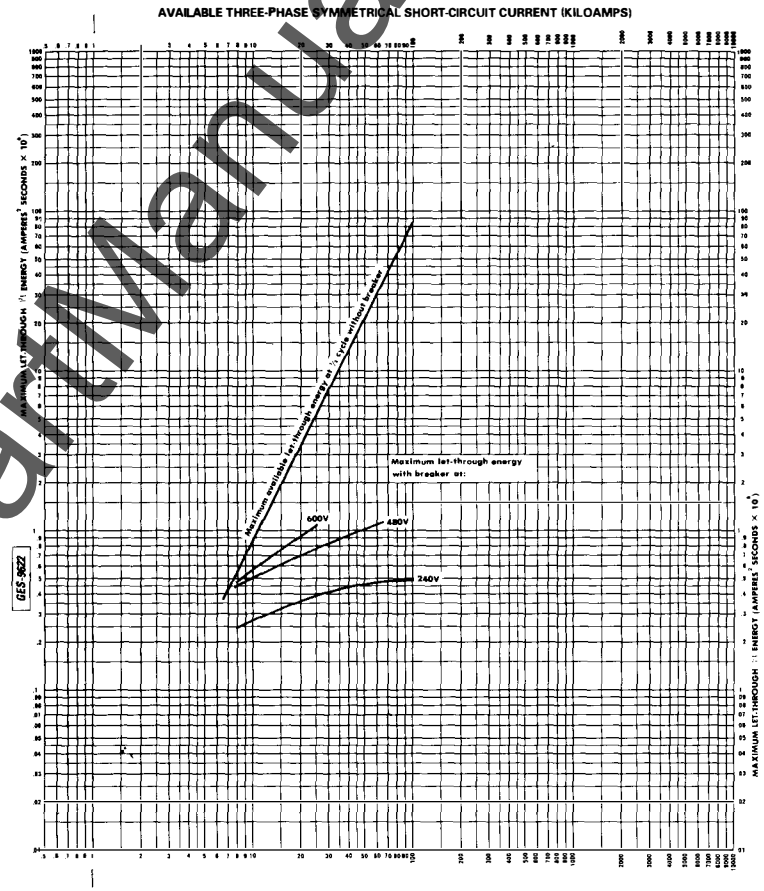
Adjustments
Long-time delay thermal trip: not adjustable
Instantaneous magnetic trip: not adjustable

Note 1: For ambient above 50°C and below 10°C, shift unity index for long-time delay (thermal) portion of curve to desired ambient.

Note 2: Current limiting range, breaker totally clears prior to 0.01 sec. For additional data refer to Ip and I^2T curves.

12/89 (3M)

TEL 50–150 i^2t MAXIMUM LET-THRU ENERGY



GE Electrical Distribution & Control
General Electric Company
Plainville, CT 06062

Current-Limiting Molded Case Circuit Breaker

GES-9622

Type TEL

Let-through Energy Curves

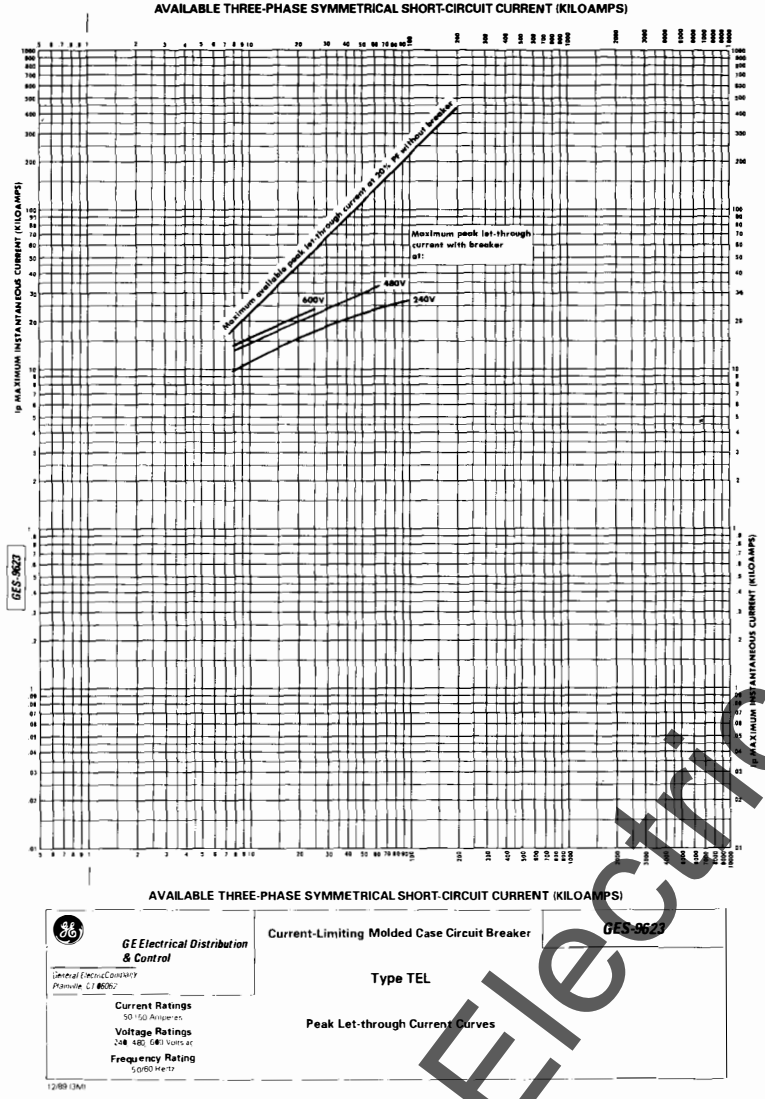
Current Ratings
50, 150 Amperes

Voltage Ratings
240, 480, 600 Volts ac

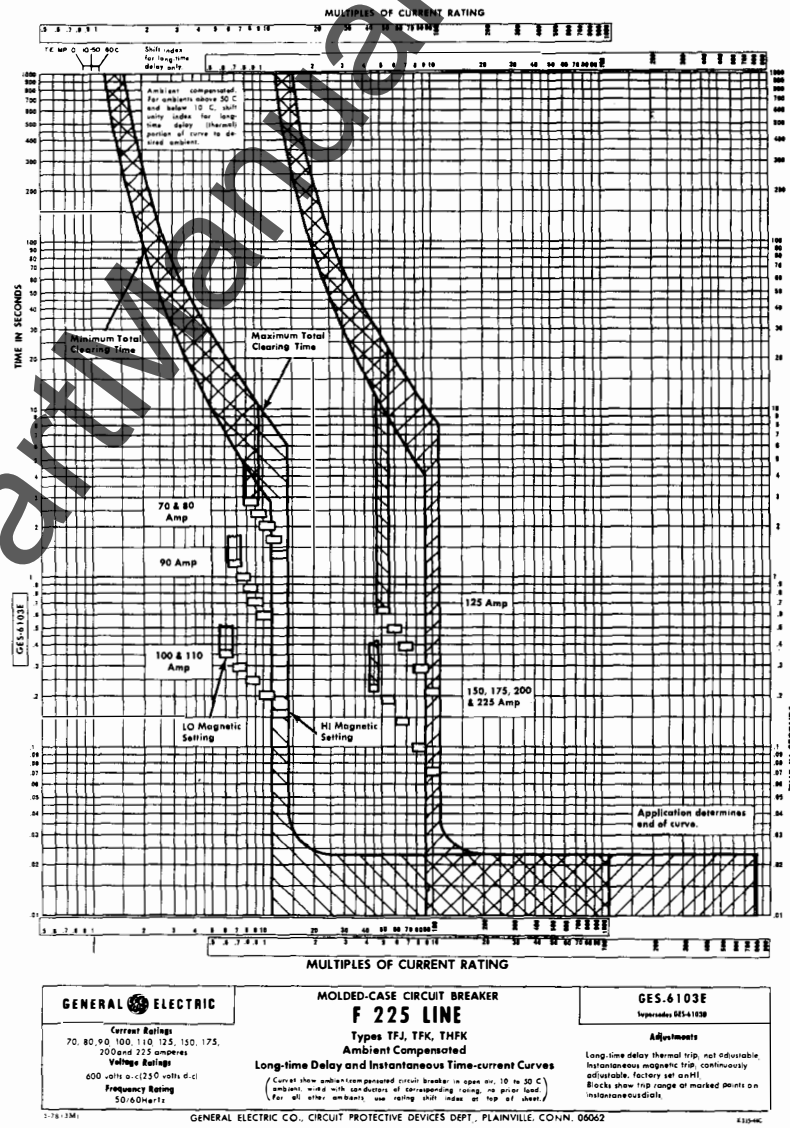
Frequency Rating
50/60 Hertz

12/89 (3M)

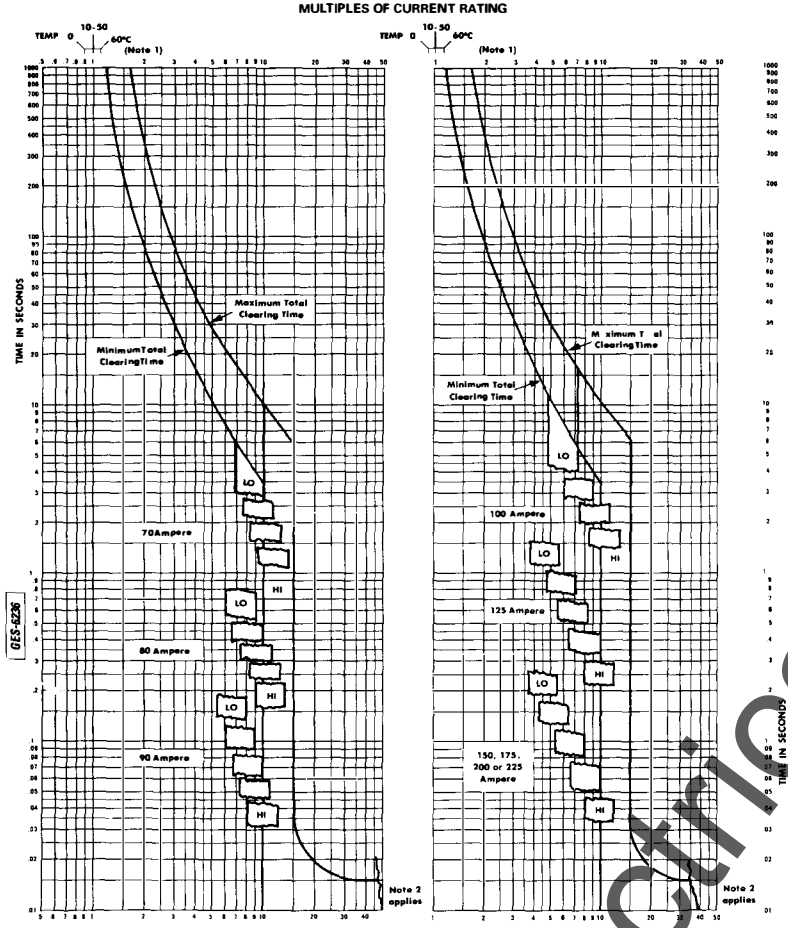
TEL 50–150 Ip–MAXIMUM INSTANTANEOUS CURRENT



TFJ, TFK, THFK



TFL



MULTIPLES OF CURRENT RATING

GE Electrical Distribution & Control
General Electric Company
Plainville, CT06062

Current-Limiting Molded Case Circuit Breaker

GES-6236

Type TFL
Ambient Compensated
Long-time Delay and Instantaneous
Time-current Curves

Current Ratings
70, 80, 90, 100, 125, 150, 175, and 225 Amperes

Voltage Ratings
240, 480, 600V ac

Curves show ambient-compensated circuit breaker in open air, 10-50°C ambient, wired with 75°C rated (100 amperes and below 60°C) conductors with ampere rating corresponding to circuit breaker ampere rating. No prior load.

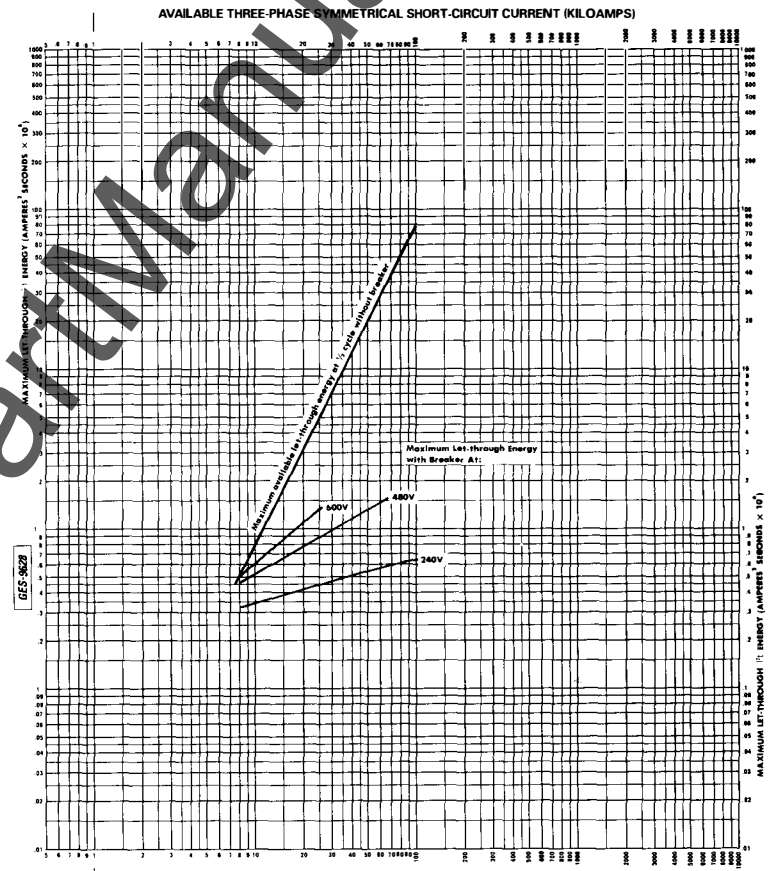
Adjustments
Long-time delay thermal trip not adjustable
Instantaneous magnetic trip continuously adjustable
Blocks indicate trip range at marked points on instantaneous adjustable dial

Note 1. For ambient above 50°C and below 10°C shift unity index for long-time delay (thermal) portion of curve to desired ambient.

Note 2. Current limiting range, breaker totally clears prior to 0.01 sec. For additional data refer to Ip and I²T curves.

12/89 (3M)

TFL i^2t MAXIMUM LET-THRU ENERGY



AVAILABLE THREE-PHASE SYMMETRICAL SHORT-CIRCUIT CURRENT (KILOAMPS)

GE Electrical Distribution & Control
General Electric Company
Plainville, CT06062

Current-Limiting Molded Case Circuit Breaker

GES-9628

Type TFL

Let-through Energy Curves

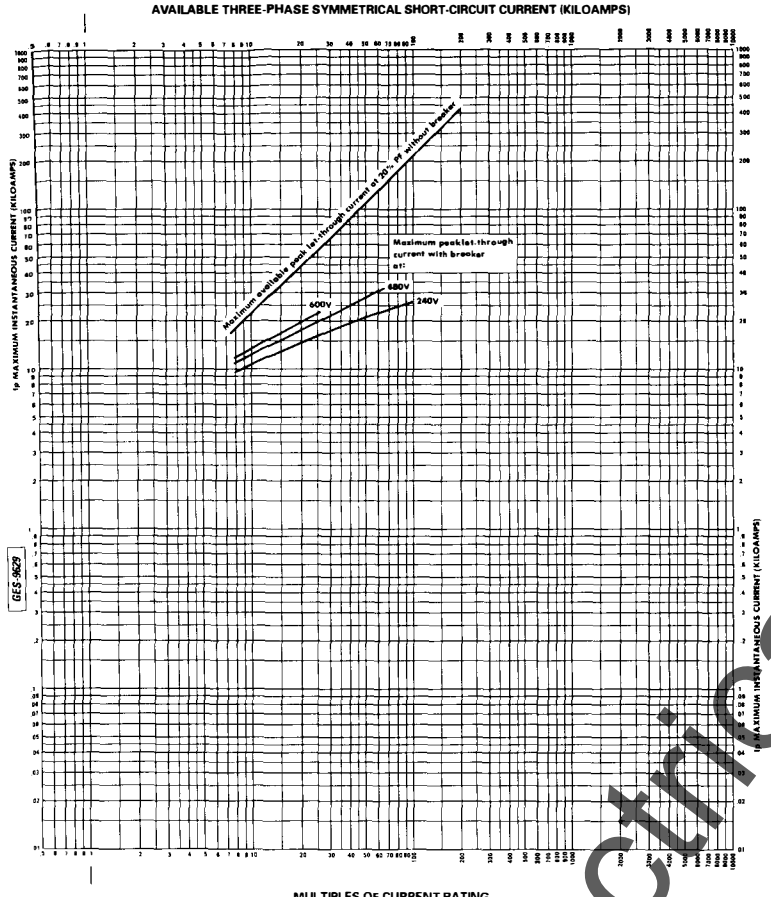
Current Ratings
70 - 225 Amperes

Voltage Ratings
240, 480, 600 Volts ac

Frequency Rating
50/60 Hertz

12/89 (3M)

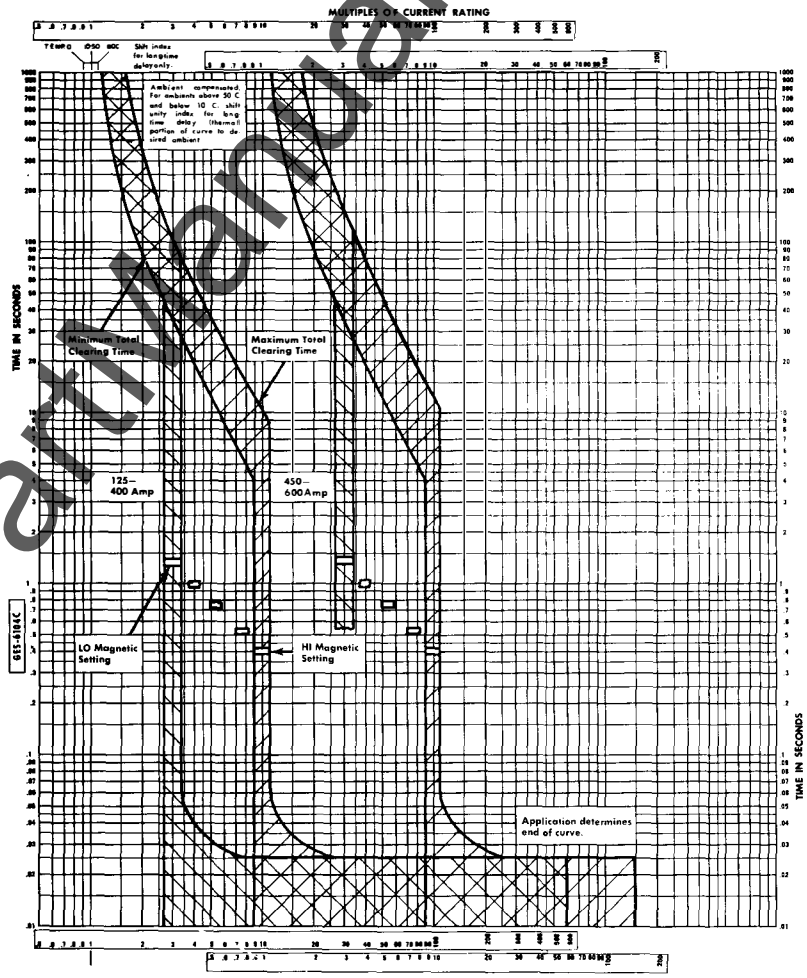
TFL Ip–MAXIMUM INSTANTANEOUS CURRENT



GE Electrical Distribution & Control General Electric Company Plainville, CT 06062	Current-Limiting Molded Case Circuit Breaker GES-9629
Current Ratings 70 - 225 Amperes Voltage Ratings 240, 480, 600 Volts ac Frequency Rating 50/60 Hertz	Type TFL Peak Let-through Current Curves

12/89(3M)

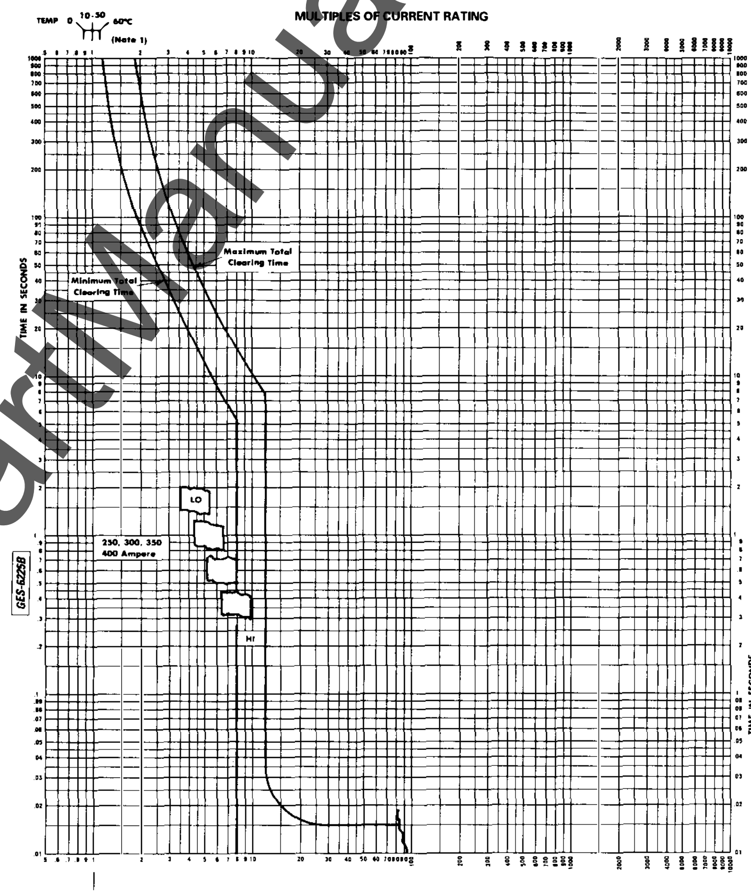
TJJ, TJK, THJK



GENERAL ELECTRIC Current Ratings 125, 150, 175, 200, 225, 250, 300, 350, 400, 450, 500 and 600 amperes Voltage Ratings 600 volts a-c (250 volts d-c) Frequency Rating 60 Hertz	MOLDED-CASE CIRCUIT BREAKER J 600 LINE Types TJJ (400A Max.), TJK, THJK, THJK2 (225A Max.) Long-time Delay and Instantaneous Time-current Curves (Curves show ambient-compensated circuit breaker in open air, 10 to 50 C ambient, wired with conductors of corresponding rating, no prior load. For all other ambients, use rating shift index at top of sheet.)	GES-6104C Supersedes GES-6104B Adjustments Long-time delay thermal trip: not adjustable. Instantaneous magnetic trip: continuously adjustable, factory set on HI. Blocks show trip range at marked points on instantaneous dials.

GENERAL ELECTRIC CO., CONTRACTOR EQUIPMENT BUSINESS OPERATIONS, PLAINVILLE, CONN. 06062

TLB-4



GE Electrical Distribution & Control

General Electric Company
Plainville, CT 06062

Current Ratings
250, 300, 350 and 400 Amperes

Voltage Ratings
240, 480, 600 Volts ac

Frequency Rating
50/60 Hertz

Molded Case Circuit Breaker

Type TLB4

Ambient Compensated
Long-time Delay and Instantaneous
Time-current Curves

Curves show ambient-compensated circuit breaker in open air 10°50°C ambient, wired with 75°C conductors with ampere rating corresponding to circuit breaker ampere rating. No prior load.

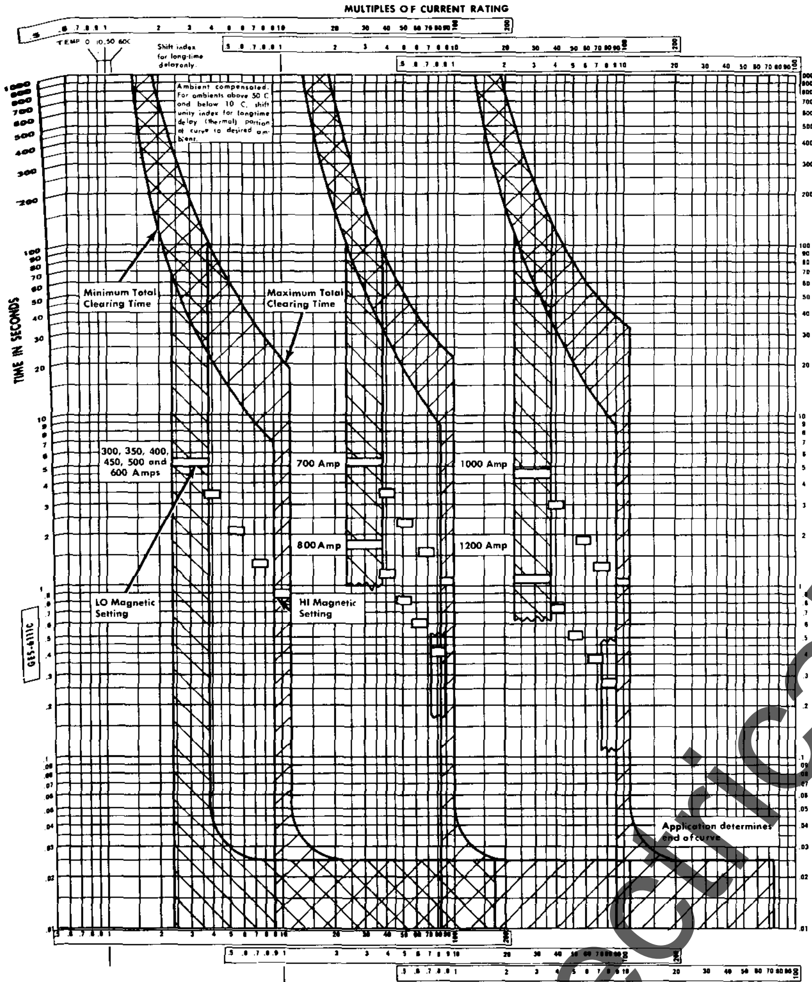
GES-6225B

Adjustments

Long time delay thermal trip: not adjustable.
Instantaneous magnetic trip: continuously adjustable, factory set on Hi.
Note 1: For ambient above 50°C and below 10°C shift unity index for long time delay (thermal) portion of curve to desired ambient.

12/89(3M)

TKMA, THKMA



GENERAL ELECTRIC	MOLDED-CASE CIRCUIT BREAKER	GES-6111C

Current Ratings
300, 350, 400, 450, 500, 600, 700, 800, 1000 and 1200 amperes

Voltage Ratings
600 volts a-c (250 volts d-c)

Frequency Ratings
D-c or 60 Hertz for 300-800 amperes
60 Hertz for 1000-1200 amperes

K-1200 LINE

Types TKMA and THKMA (300–1200 Amperes)

Long-time Delay and Instantaneous Time-current Curves

(Curves show ambient-compensated circuit breaker in open air, 10 to 50 C ambient, wired with conductors of corresponding rating, no prior load. For all other ambients, use rating shift index at top of sheet.)

Supersedes GES-6111A and GES-6111B

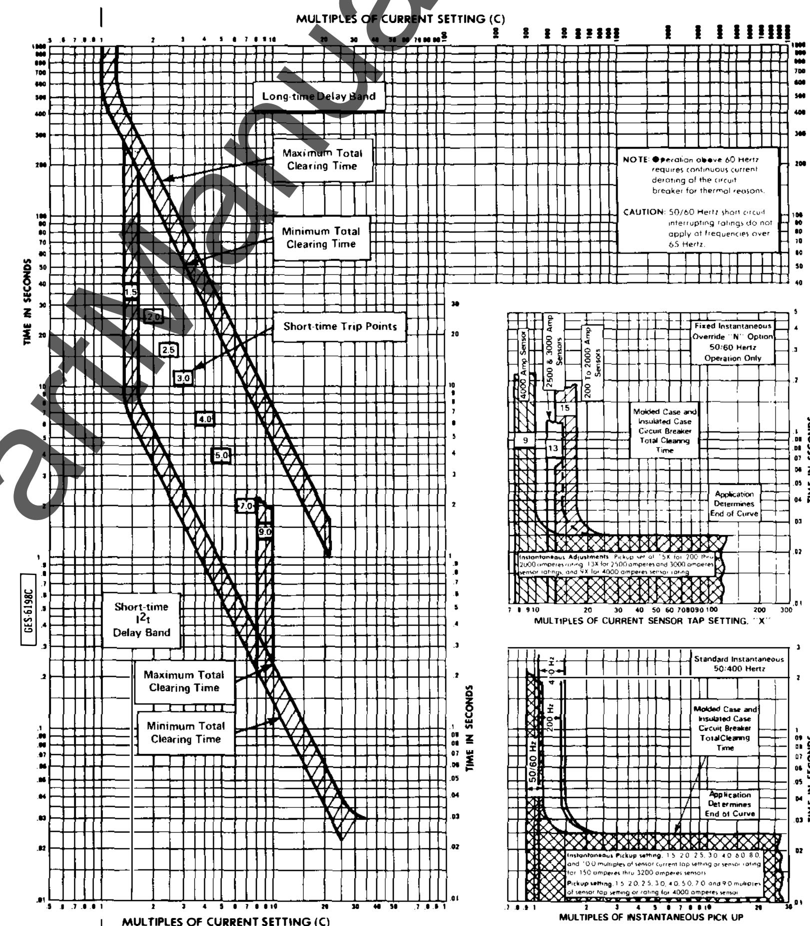
Adjustments
Long-time delay thermal trip: not adjustable.
Instantaneous magnetic trip: continuously adjustable, factory set on HI.
Dcmagnetictrip level approximately 40% higher than Acvalues.
Blocks showtrip range at marked points on instantaneous dials.

2-79 (3M)

GENERAL ELECTRIC CO., CIRCUIT PROTECTIVE DEVICES DEPT., PLAINVILLE, CONN. 06062

K215-77D

TJ4V, THJ4V, TJL4V, TK4V, TKL4V—MVT-4



GENERAL ELECTRIC	INSULATED CASE AND MOLDED CASE CIRCUIT BREAKERS	GES-6198C

INSULATED CASE AND MOLDED CASE CIRCUIT BREAKERS with MicroVersaTrip ™ 4

Long-time-delay and Instantaneous or Long-time-delay, Short-time-delay and Instantaneous Time-current Curves

X=Current Sensor Rating

Current Sensor Rating (Amperes)
400A frame 400,300,200,150
600A frame 600,500,400,300
800A frame 800,600,500,400
1200A frame 1200,1000,800,600
Voltage Rating—600 volts ac maximum

Fixed Current Sensor Ratings (Amperes) ICCB and MCCB
150,200,300,400,500,600,800,1000
1200,1600,2000,2500,3000,4000

Current Sensor Taps (Amperes) ICCB
800 Envelope 400/200 600/300 800/400
1600 Envelope 800/400 1000/500 1200/600 1600/1500
2000 Envelope 2000/1200
2500 Envelope 600/300 800/400 1000/500 1200/600 1600/1000 2000/1200/2500/1800
3000 Envelope 3000/2400
4000 Envelope 4000/3000

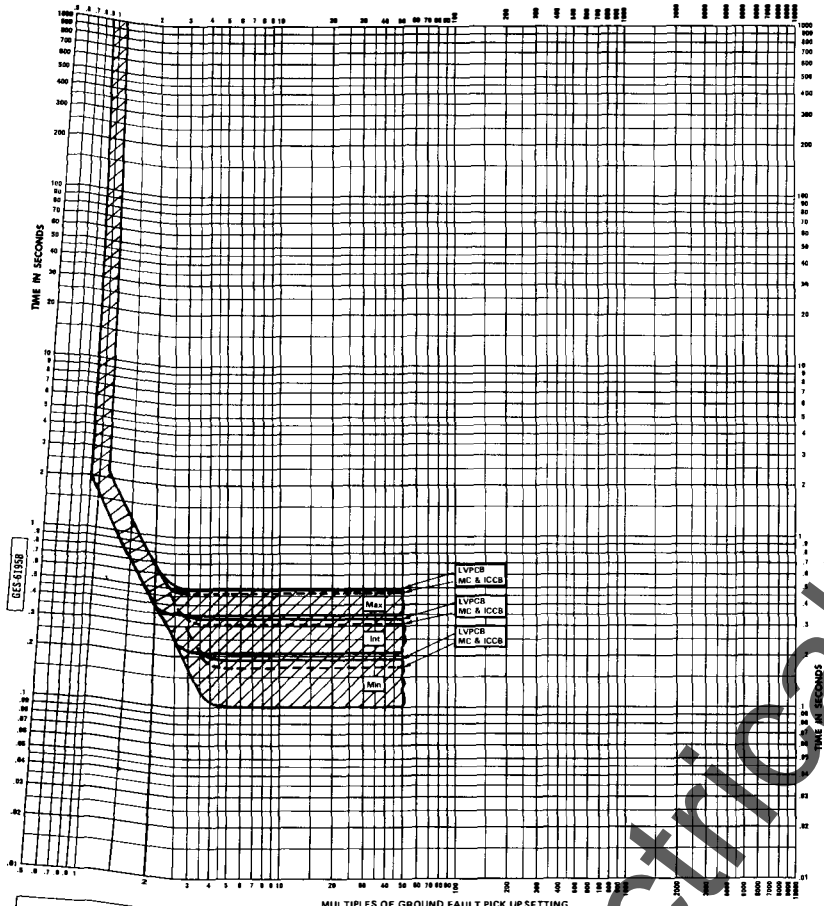
Adjustments
Long-time Delay Unit Current Settings (C) 0.50, 0.60, 0.70, 0.80, 0.85, 0.90, 0.95 and 1.00 multiples of the current sensor rating (X)
Pickup: Fixed at 1.1 multiples of the Current Setting
Short-time Delay Unit (Optional) Pickup Setting: 1.5, 2.0, 2.5, 3.0, 4.0, 5.0, 7.0 and 9.0 multiples of the Current Setting
Delay Bands: One nonadjustable, inverse I^2t = Constant
Instantaneous Unit Pickup setting: fixed at 15 multiples of the current sensor rating thru 2000 amperes, 13 multiples for 2500 and 3000 amperes, and 9 multiples for 4000 amperes when short-time unit is included. Adjustable to 1.5, 2.0, 2.5, 3.0, 4.0, 6.0, 8.0, 10.0 multiples of current sensor rating (X) without short time

(Curves apply at 50 through 400 Hertz and from −20C to +55C breaker ambient)

9/83 (2M)

GENERAL ELECTRIC CO., CONTRACTOR EQUIPMENT BUSINESS OPERATIONS, PLAINVILLE, CONN. 06062

TJ4V, THJ4V, THL4V, TK4V, TKL4V—MVT-4—GROUND



GENERAL ELECTRIC

LOW-VOLTAGE POWER CIRCUIT BREAKERS
INSULATED CASE AND MOLDED CASE CIRCUIT BREAKER with MicroVersaTrip®
Ground Fault Time-current Curves

GES-6195B
Ground Fault Unit

X = Current Sensor Tap Setting or Rating

Current Sensor Taps (Amperes) LVPCB
AKR-25: 70/100/150/225
AKR-30: 150/150/225/300
AKR-50: 300/400/600/800
AKR-50: 300/400/600/800
AKR-75: 600/800/1000/1200
AKR-75: 800/1000/1600/2000
AKR-100: 1200/1600/2000/3200
AKR-100: 1600/2000/3000/4000

Fixed Current Sensor Ratings (Amperes) LVPCB
AKR-30: 150, 225, 300, 400, 600, 800
AKR-50: 300, 400, 600, 800, 1000, 1200, 1600
AKR-75: 800, 1200, 1600, 2000, 2400, 3200
AKR-100: 1600, 2000, 3000, 4000

Voltage Rating: 600 volts ac 50 through 400 Hertz

NOTE: Operation above 60 Hertz requires derating of the continuous current rating of the circuit breaker.

Current Sensor Taps (Amperes) ICCB
800 Envelope: 400/500/600/700/800/400
1600 Envelope: 800/1000/1200/1600/1000

2000 Envelope: 2000/1200
2500 Envelope: 600/800/1000/1200/1600/2000/1500

3000 Envelope: 3000/2400
4000 Envelope: 4000/3000

Fixed Current Sensor Ratings (Amperes)
ICCB and MCCB
150,200,300,400,500,600,800,1000
1200,1600,2000,2500,3000,4000

Ground Fault Pickup Settings: .02, .025, .03, .035, .04, .045, .05, .06 multiples of the current sensor rating (X) for sensors of 150 to 2000 amperes.

Pickup Settings: .02, .022, .024, .026, .028, .030, .034, .040 multiples of the current sensor rating (X) for sensors of up to 3200 amperes.

Pickup Settings: .03, .032, .034, .036, .038, .040 multiples of the current sensor rating (X) for sensors of up to 4000 amperes.

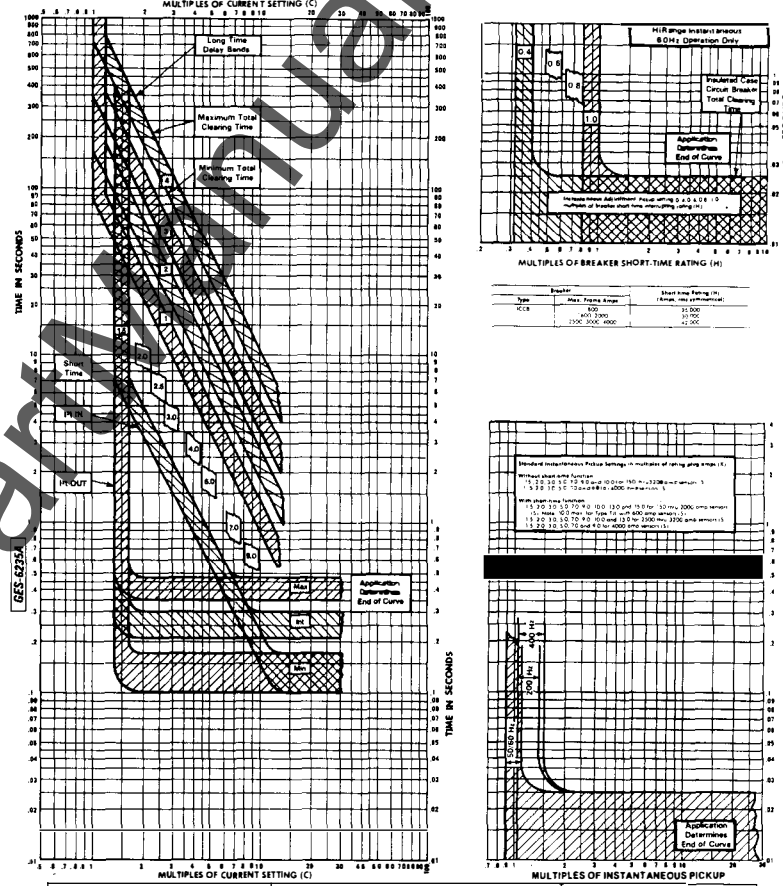
Delay Bands: 3 settings of MIN, INT, MAX for all ratings.

(Curves apply at 50 through 400 Hertz and from −20C to +55C breaker ambient)

GENERAL ELECTRIC CO., CONSTRUCTION EQUIPMENT BUSINESS OPERATIONS, PLAINVILLE, CONN. 06062

6/84 (1M)

TJH, TJL, TKH, TKL—RMS-9



GE Electrical Distribution & Control

General Electric Company
Plainville, CT 06062

Insulated Case Circuit Breakers
Types TP, THP, TC, THC
Molded Case Circuit Breakers
Types TJH, TJL, TKH, TKL
All with MicroVersaTrip® RMS-9
Solid-state Programmer
Long-time delay, Short-time delay, and Instantaneous Time-current Curves

Curves apply at 50 to 400 Hertz and from −20°C to +55°C breaker ambient.

Note: Operation above 60 Hertz requires thermal and interrupting derating of the circuit breaker.

Available Ratings (Amperes)

Type	Breaker Model	Frame	Current Sensor (S)	Rating Plug (X)
MCCB	TJH-TJL	400	150	80, 90, 100, 125, 150
			300	150, 200, 225, 250, 300
		600	450	150, 200, 225, 250, 300, 400
	TKH-TKL		600	300, 400, 500, 600, 700
		800	800	300, 400, 500, 600, 700, 800
		1200	1200	600, 800, 1000, 1200
ICCB	TP-THP-TC-THC	800	250	100, 150, 200
			600	150, 200, 225, 250, 300, 400
			800	300, 400, 500, 600, 700, 800
		1600	1000	400, 500, 600, 800, 1000
			1800	800, 900, 1000, 1200, 1600, 1800
		2000	2000	800, 1000, 1200, 1600, 1800, 2000
		2500	1500	400, 500, 600, 800, 1000, 1200, 1500
			2000	800, 1000, 1200, 1600, 2000
			2500	1600, 2000, 2500
		3000	3000	2000, 2500, 3000
		4000	4000	1500, 2000, 2500, 3000, 4000

Voltage Rating: 500 volts ac, 50-400 Hertz

4/88 (3M)

GES-6235A

Programmer Adjustments

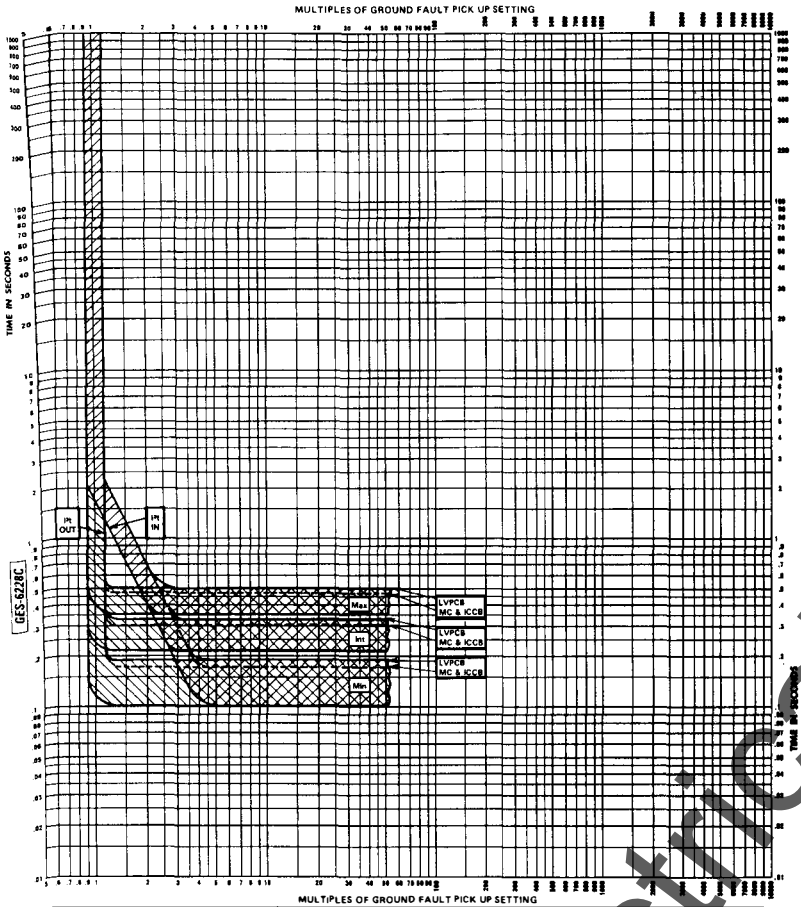
Long-time function:
Current settings (C): 0.50, 0.60, 0.70, 0.80, 0.90, 0.95 and 1.00 multiples of rating plug amps (X)
Delay Bands: 1, 2, 3 and ∢

Short-time function:
Pickup settings: 1.5, 2.0, 2.5, 3.0, 4.0, 5.0, 7.0 and 9.0 multiples of current setting (C)
Delay Bands: Min, Int, Max, I²t In, Out

Instantaneous Adjustments:
See Curves above.

S = Current Sensor Amps
X = Rating Plug Amps
C = Current Setting Amps
H = Breaker Short-time Rating Amps

TJH, TJL, TKH, TKL—GROUND



GE Electrical Distribution & Control

General Electric Company
Plainville, CT 06062

Available Ratings (Amperes)

Type	Breaker 1600#	Frame	Current Sensor (S)
MCCB	TJH-TJL	400	150, 300, 400
		600	600
	TKH-TKL	800	800
		1200	1200
ICCB	TP-THP-TC-THC	800	200, 400, 800
		1600	1000, 1600
		2000	2000
		2500	1000, 2000, 2500
		3000	3000
		4000	4000
LVPCB	AKR-30S-30H	800	150, 400, 800
	AKR-50-50H	1600	800, 1600
	AKRT-50H	2000	2000
	AKR-75	3200	3200
	AKR-100	4000	4000

Voltage Rating: 600 volts ac, 50 through 400 Hertz

4-88 (3M)

Low Voltage Power Circuit Breakers
Type AKR
Insulated Case Circuit Breakers
Types TP, THP, TC, THC
Molded Case Circuit Breakers
Types TJH, TJL, TKH, TKL
All with MicroVersaTrip® RMS-9 or Epic MicroVersaTrip™ Solid-state Programmer
Ground Fault Time-current Curves

Curves apply at 50 to 400 Hertz and from −20°C to +55°C breaker ambient.

Note: Operation above 60 Hertz requires thermal and interrupting derating of the circuit breaker.

GES-6228C

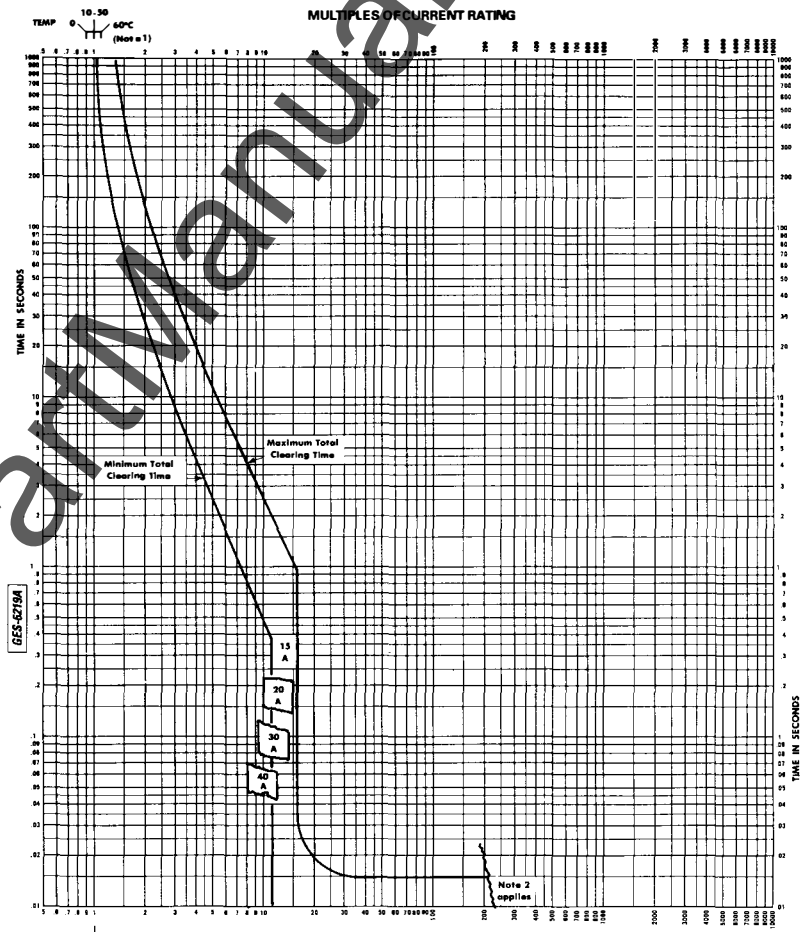
Programmer Adjustments

Ground Fault function:
Pickup settings (in multiples of current sensor amps (S)):
0.2, 0.24, 0.3, 0.35, 0.4, 0.45, 0.5 and 0.6 for 150 thru 2000 amp sensors (S)
0.2, 0.22, 0.24, 0.26, 0.28, 0.30, 0.34 and 0.37 for 2500 thru 3200 amp sensors (S)
0.2, 0.22, 0.24, 0.26, 0.28 and 0.30 for 4000 amp sensors (S)

Delay bands:
Min. I²t, Max. I²t In/Out

S = Current Sensor Amps

THLC-1 15–40



GE Electrical Distribution & Control

General Electric Company
Plainville, CT 06067

Current Ratings
15, 20, 30 and 40 Amperes

Voltage Ratings
240, 480, 600 Volts ac

Frequency Rating
50/60 Hertz

Current-Limiting Molded Case Circuit Breaker

Type THLC1

Ambient Compensated
Long-time Delay and Instantaneous
Time-current Curves

Curves show ambient-compensated circuit breaker in open air, 10-50°C ambient, wired with 60/75°C rated conductors with ampere rating corresponding to circuit breaker ampere rating. No prior load.

GES-6219A

Adjustments

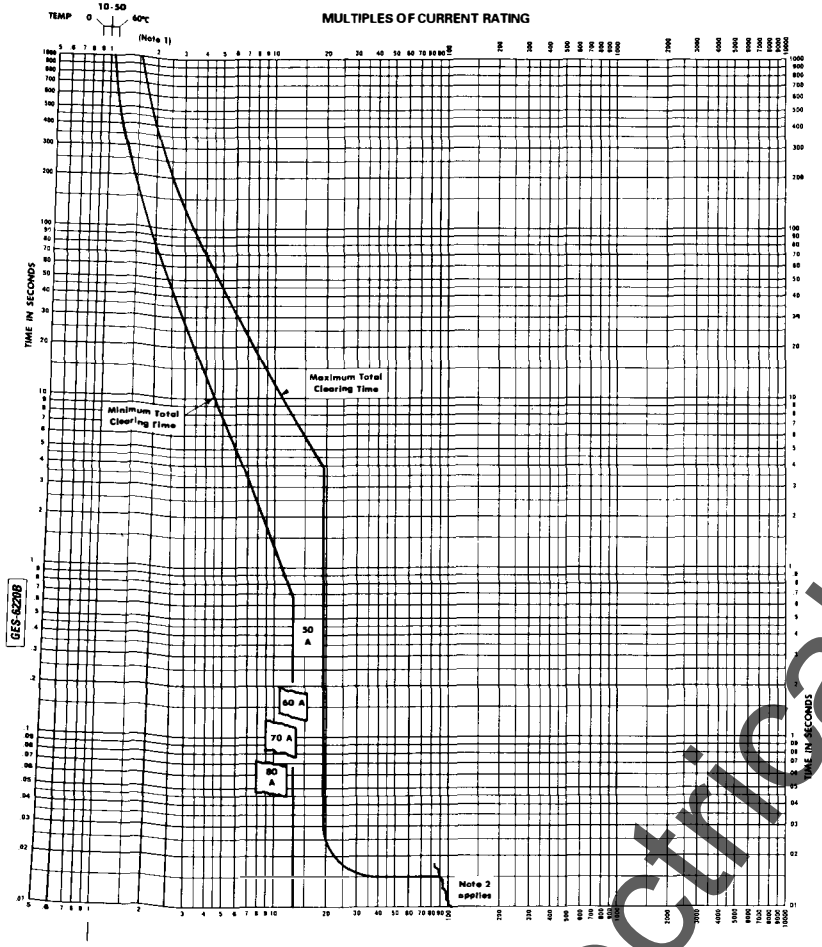
Long time delay thermal trip: not adjustable
Instantaneous magnetic trip: not adjustable

Note 1: For ambient above 50°C and below 10°C shift unity index for long time delay (thermal) portion of curve to desired ambient.

Note 2: Current limiting range; breaker totally clears prior to 0.01 sec. For additional data refer to I²t and I²T curves.

12/89(3M)

THLC-1 50-80



MULTIPLES OF CURRENT RATING

GE Electrical Distribution & Control
General Electric Company
Plainville, CT 06062

Current-Limiting Molded Case Circuit Breaker
Type THLC1
Ambient Compensated
Long-time Delay and Instantaneous
Time-current Curves

GES-6220B

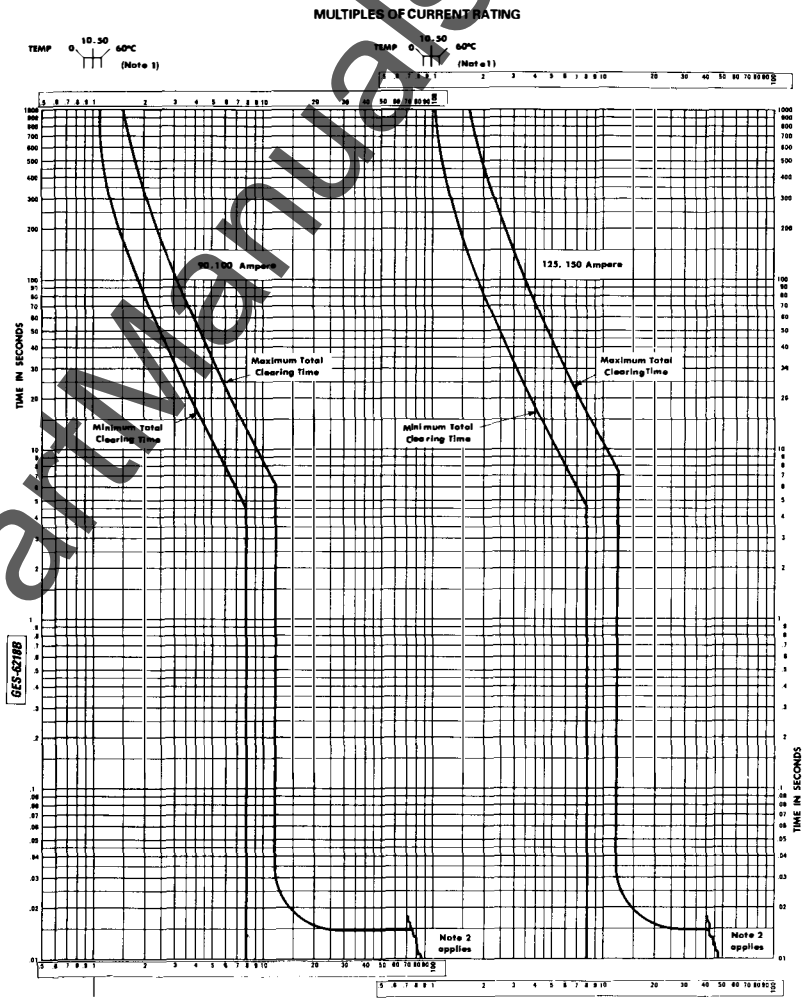
Current Ratings
50,60, 70 and 80 Amperes
Voltage Ratings
240, 480, 600 Volts ac
Frequency Rating
50/60 Hertz

Adjustments
Long-time delay thermal trip: not adjustable
Instantaneous magnetic trip: not adjustable
Note 1: For ambient above 50°C and below 10°C, shift unity index for long-time delay (thermal) portion of curve to desired ambient.
Note 2: Current limiting range; breaker totally clears prior to 0.01 sec. For additional data refer to Ip and I²T curves.

Curves show ambient-compensated circuit breaker in open air, 10-50°C ambient, wired with 60/75°C rated conductors with ampere rating corresponding to circuit breaker ampere rating. No prior load.

12/89 (3M)

THLC-1 90-150



MULTIPLES OF CURRENT RATING

GE Electrical Distribution & Control
General Electric Company
Plainville, CT 06062

Current-Limiting Molded Case Circuit Breaker
Type THLC1
Ambient Compensated
Long-time Delay and Instantaneous
Time-current Curves

GES-6218B

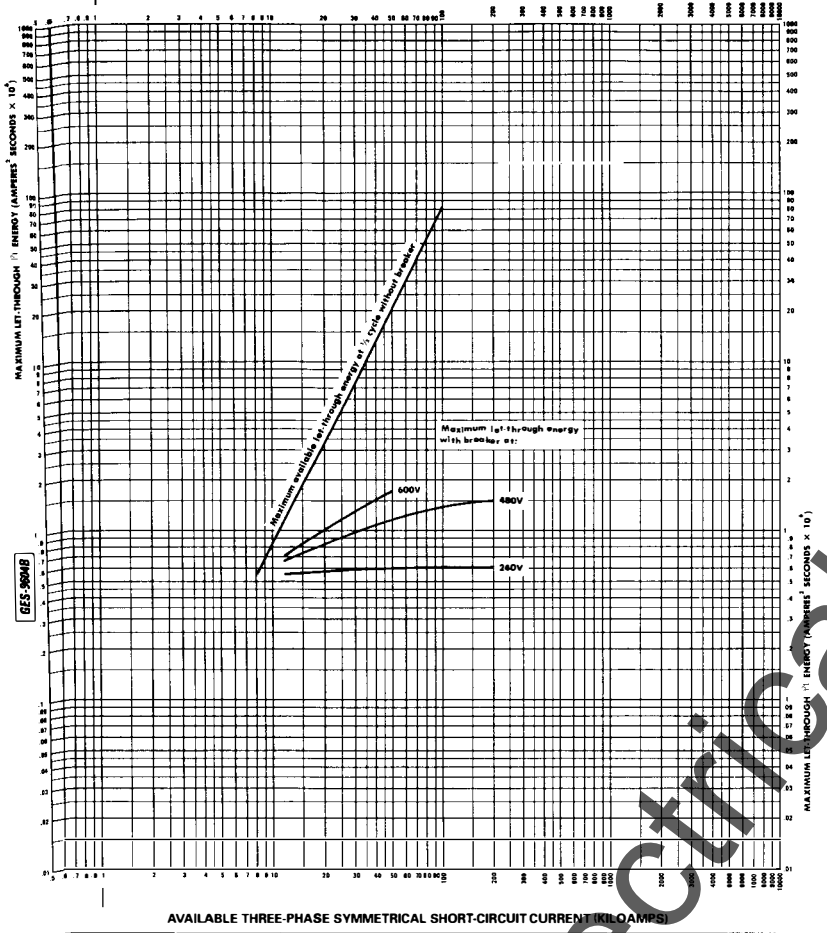
Current Ratings
90, 100, 125 and 150 Amperes
Voltage Ratings
240, 480, 600 Volts ac
Frequency Rating
50/60 Hertz

Adjustments
Long-time delay thermal trip: not adjustable
Instantaneous magnetic trip: not adjustable
Note 1: For ambient above 50°C and below 10°C, shift unity index for long-time delay (thermal) portion of curve to desired ambient.
Note 2: Current limiting range; breaker totally clears prior to 0.01 sec. For additional data refer to Ip and I²T curves.

Curves show ambient-compensated circuit breaker in open air, 10-50°C ambient, wired with 75°C rated (90, 100 ampere 60/75°C) conductors with ampere rating corresponding to circuit breaker ampere rating. No prior load.

12/89 (3M)

THLC-1 i^2t–MAXIMUM LET-THRU ENERGY



GE Electrical Distribution & Control
General Electric Company
Plainville, CT 06062

Current-Limiting Molded Case Circuit Breaker

GES-9604B

Type THLC1

Let-through Energy Curves

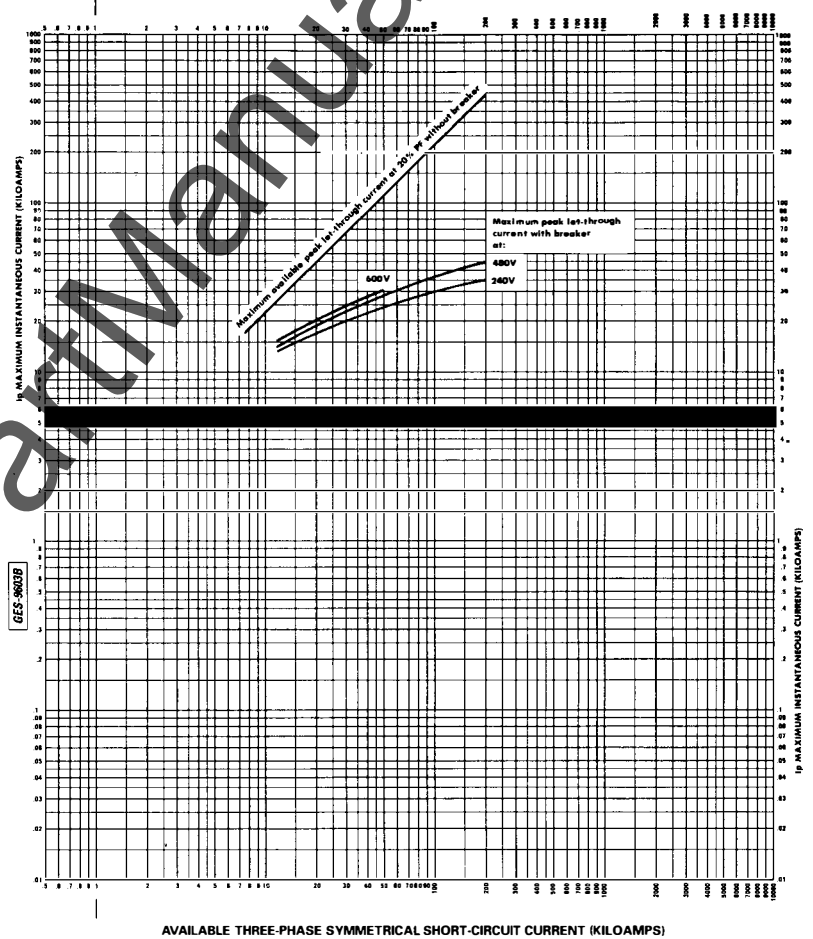
Current Ratings
15-150 Amperes

Voltage Ratings
240, 480, 600 Volts ac

Frequency Rating
50/60 Hertz

12/89 (3M)

THLC-1 Ip–MAXIMUM INSTANTANEOUS CURRENT



GE Electrical Distribution & Control
General Electric Company
Plainville, CT 06062

Current-Limiting Molded Case Circuit Breaker

GES-9603B

Type THLC1

Peak Let-through Current Curves

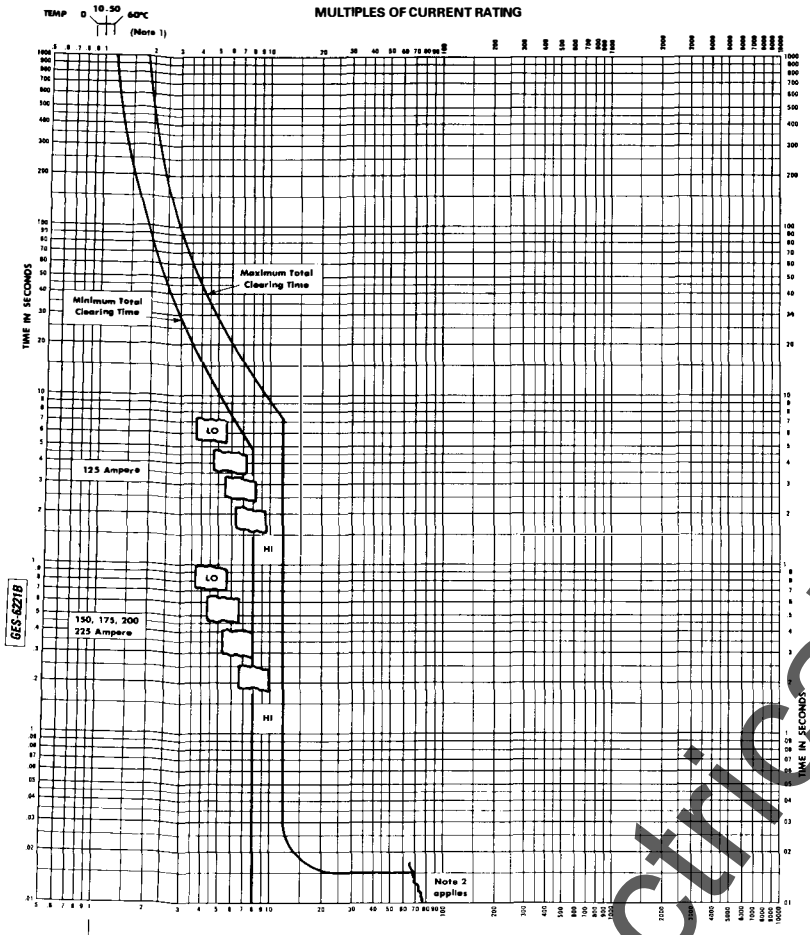
Current Ratings
15-150 Amperes

Voltage Ratings
240, 480, 600 Volts ac

Frequency Rating
50/60 Hertz

12/89 (3M)

THLC-2



GE Electrical Distribution & Control
General Electric Company
Plainville, CT 06062

Current-Limiting Molded Case Circuit Breaker

GES-6221B

Type THLC2

Ambient Compensated
Long-time Delay and Instantaneous
Time-current Curves

Current Ratings
125, 150, 175, 200 and 225 Amperes

Voltage Ratings
240, 480, 600 Volts a.c.

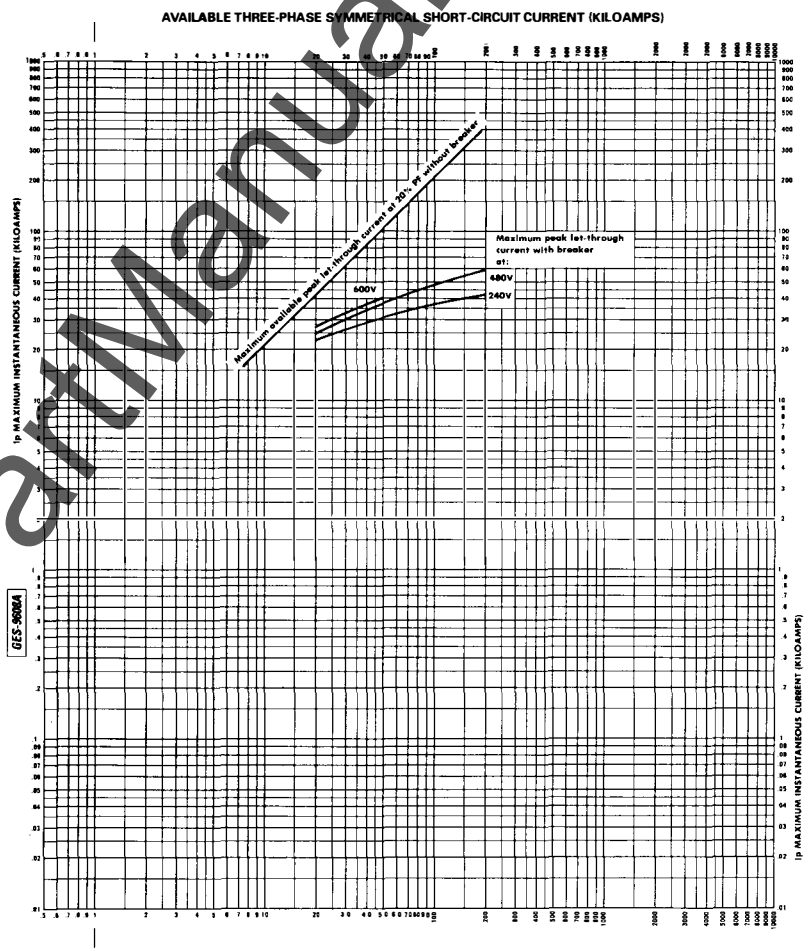
Frequency Rating
50/60 Hertz

Adjustments

Curves show ambient compensated circuit breaker response at 40°C ambient, wired with 75°C rated conductors sized per NEC for the ampere rating corresponding to circuit breaker ampere rating. No prior load

12/89 (3M)

THLC-2 Ip–MAXIMUM INSTANTANEOUS CURRENT



GE Electrical Distribution & Control
General Electric Company
Plainville, CT 06062

Current-Limiting Molded Case Circuit Breaker

GES-9608A

Type THLC2

Peak Let-through Current Curves

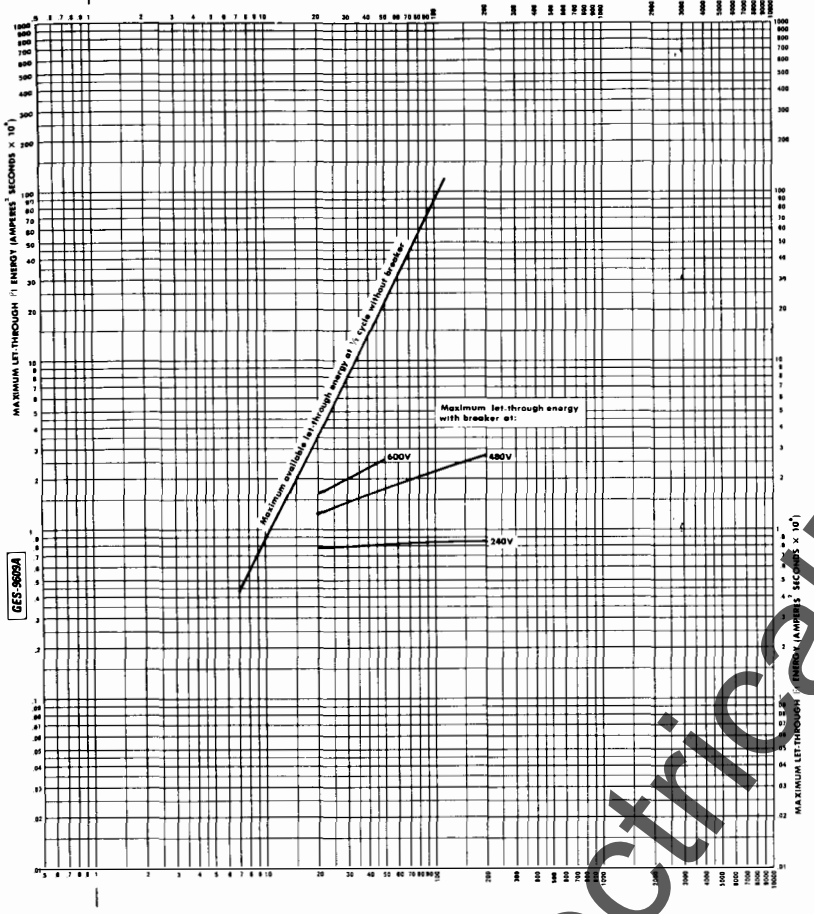
Current Ratings
125 - 225 Amperes

Voltage Ratings
240, 480, 600 volts ac

Frequency Rating
50,60 Hertz

12/89 (3M)

THLC-2 i^2t–MAXIMUM LET-THRU ENERGY

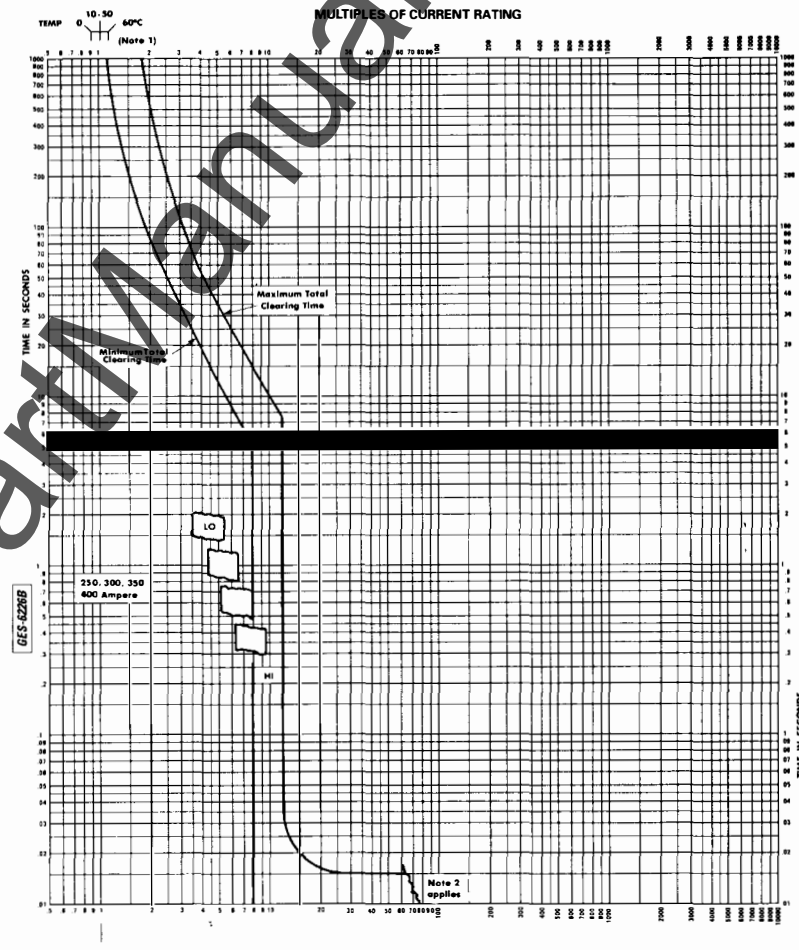


AVAILABLE THREE-PHASE SYMMETRICAL SHORT-CIRCUIT CURRENT (KILOAMPS)

GE Electrical Distribution & Control General Electric Company Plainville, CT 06062	Current-Limiting Molded Case Circuit Breaker Type THLC2 Let-through Energy Curves	GES-9609A
Current Ratings 125-225 Amperes **Voltage Ratings** 240, 480, 600 Volts ac **Frequency Rating** 50/60 Hertz		

12/89 (3M)

THLC-4

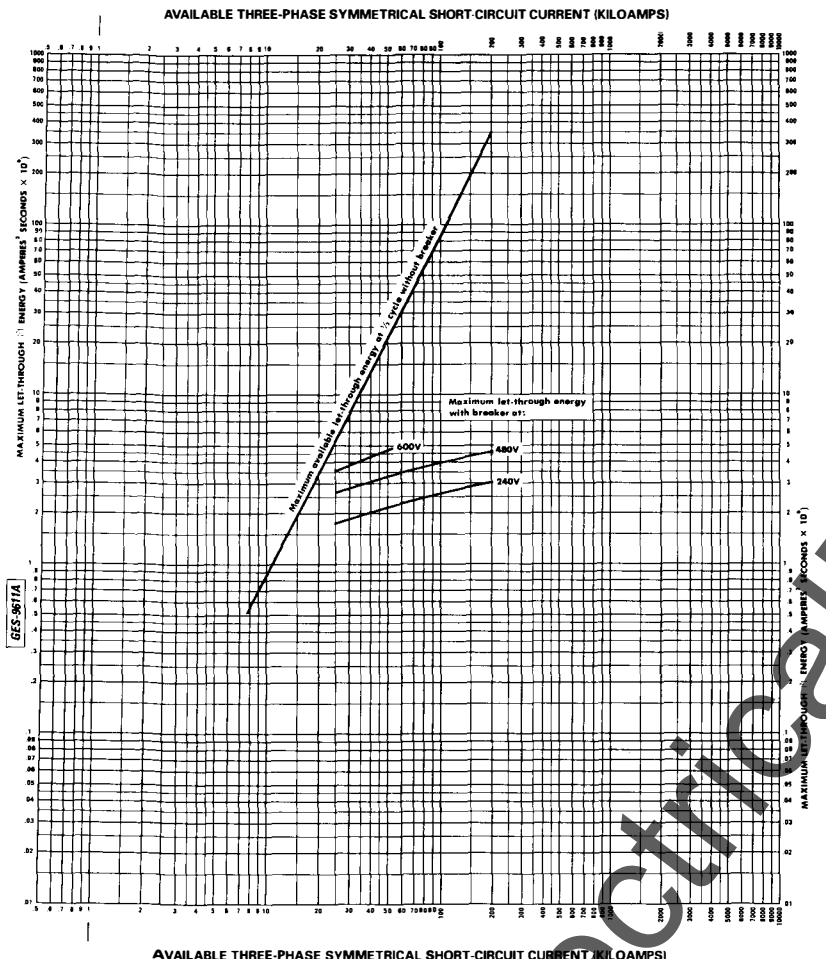


MULTIPLES OF CURRENT RATING

GE Electrical Distribution & Control General Electric Company Plainville, CT 06062	Current-Limiting Molded Case Circuit Breaker Type THLC4 Ambient Compensated Long-time Delay and Instantaneous Time-current Curves	GES-6226B **Adjustments** Long-time delay thermal trip: nonadjustable Instantaneous magnetic trip: continuously adjustable, factory set on HI Blocks show trip range at marked points on instantaneous dials Note 1: For ambient above 50°C and below 10°C shift unity index for long-time delay (thermal) portion of curve to desired ambient Note 2: Current limiting range, breaker totally clears prior to 0.01 sec. For additional data refer to I²t and I²T curves
Current Ratings 250, 300, 350 and 400 Amperes **Voltage Ratings** 240, 480, 600 Volts ac **Frequency Rating** 50/60 Hertz	Curves show ambient-compensated circuit breaker (in open air, 10-50°C ambient, wired with 75°C rated conductors with ampere rating corresponding to circuit breaker ampere rating No prior load	

12/89 (3M)

THLC-4 i^2t–MAXIMUM LET-THRU ENERGY



GE Electrical Distribution & Control
General Electric Company
Plainville, CT 06062

Current-Limiting Molded Case Circuit Breaker **GES-9611A**

Type THLC4

Let-through Energy Curves

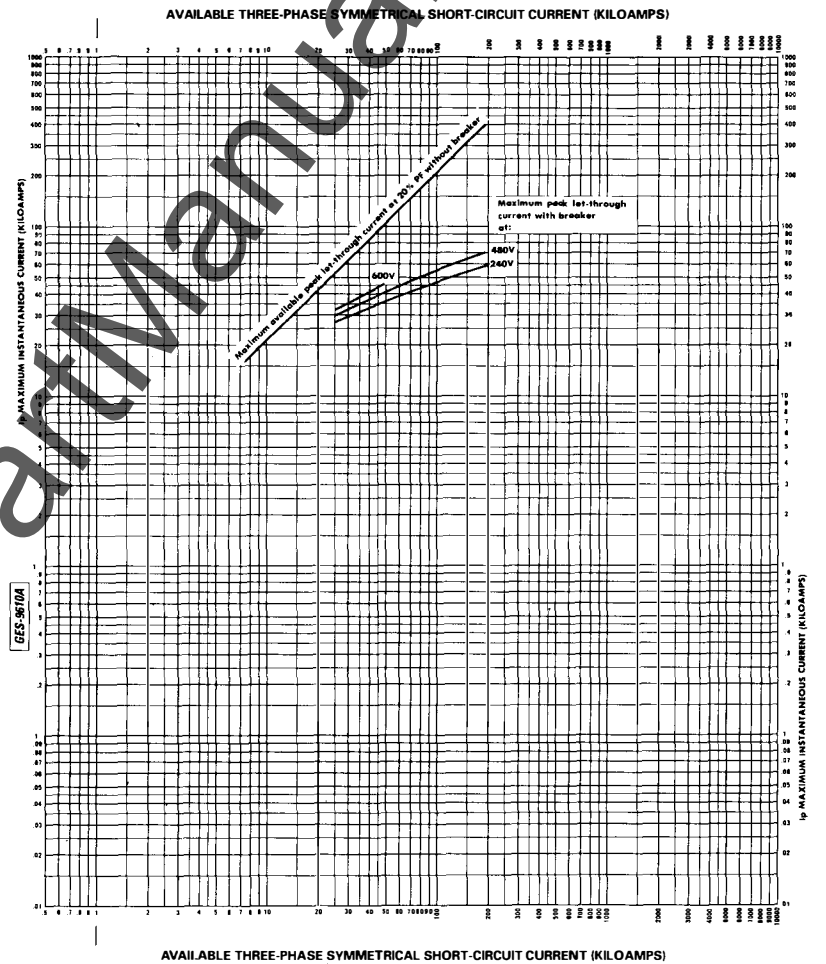
Current Ratings
250, 300, 350 and 400 Amperes

Voltage Ratings
240, 480, 600 Volts ac

Frequency Rating
50/60 Hertz

12/89 (3M)

THLC-4 Ip–MAXIMUM INSTANTANEOUS CURRENT



GE Electrical Distribution & Control
General Electric Company
Plainville, CT 06062

Current-Limiting Molded Case Circuit Breaker **GES-9610A**

Type THLC4

Peak Let-through Current Curves

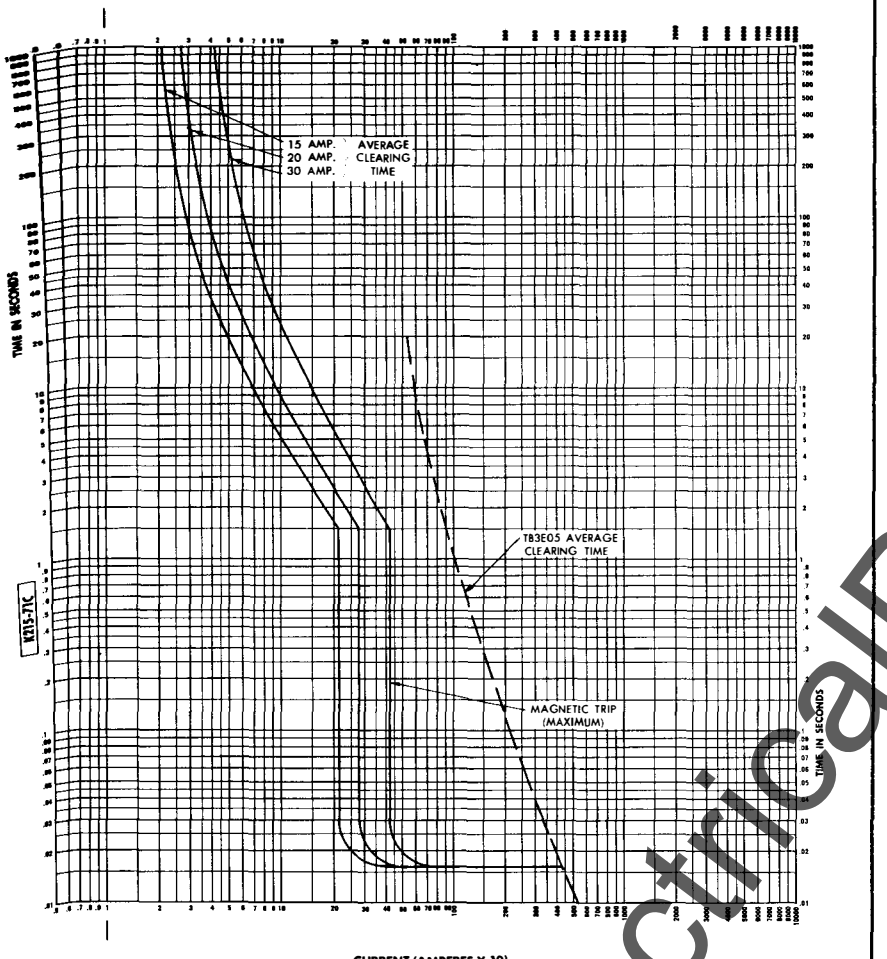
Current Ratings
250, 300, 350 and 400 Amperes

Voltage Ratings
240, 480, 600 Volts ac

Frequency Rating
50/60 Hertz

12/89 (3M)

TB-1 15–30



GENERAL ELECTRIC

Current Ratings
15, 20 and 30 Amperes

Voltage Ratings
600 Volts A-c (250 Volts D-c)

Frequency Ratings
D-c or 60 Cycles

INTEGRALLY FUSED
MOLDED CASE CIRCUIT BREAKER

TRI-BREAK LINE

TYPE TB1 (15-30 AMPERES)
Thermal trip, Magnetic trip &
Current Limiter Characteristics

Time vs RMS Current

K215-71C

Adjustments

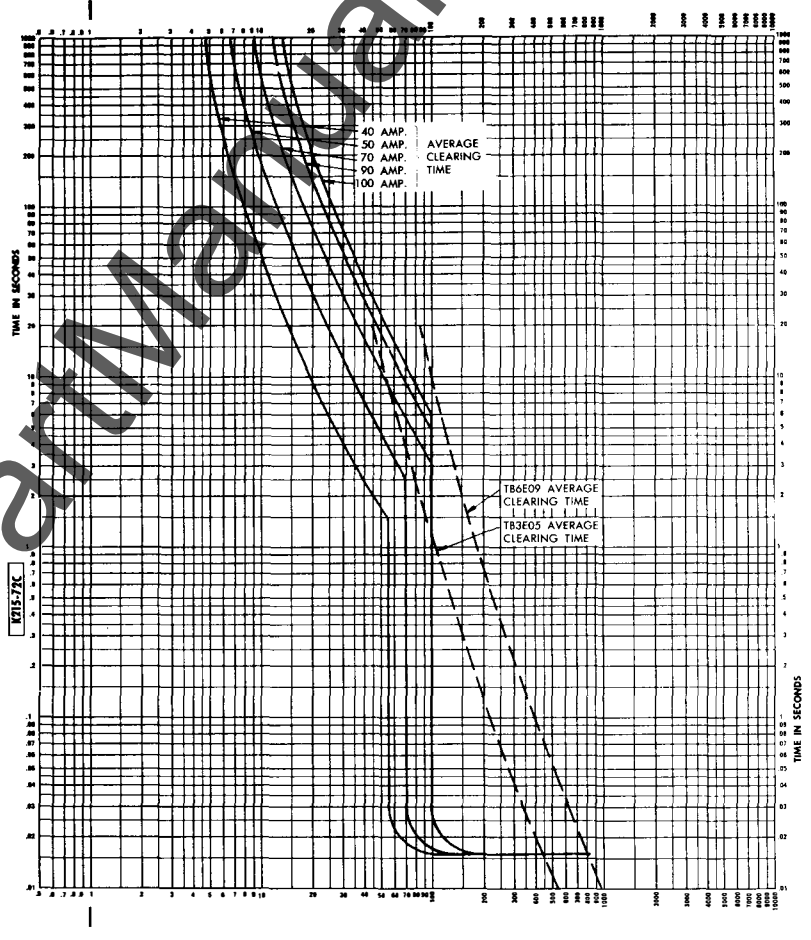
Long time delay thermal trip, not adjustable.

Instantaneous magnetic trip, not adjustable.

REV. 10-17-67

CIRCUIT PROTECTIVE DEVICES DEPARTMENT, PLAINVILLE, CONNECTICUT

TB-1 40–100



GENERAL ELECTRIC

Current Ratings
40, 50, 70, 90 and 100 Amperes

Voltage Ratings
600 Volts A-c (250 Volts D-c)

Frequency Ratings
D-c or 60 Cycles

INTEGRALLY FUSED
MOLDED CASE CIRCUIT BREAKER

TRI-BREAK LINE

TYPE TB1 (40-100 AMPERES)
Thermal trip, Magnetic trip &
Current Limiter Characteristics

Time vs RMS Current

K215-72C

Adjustments

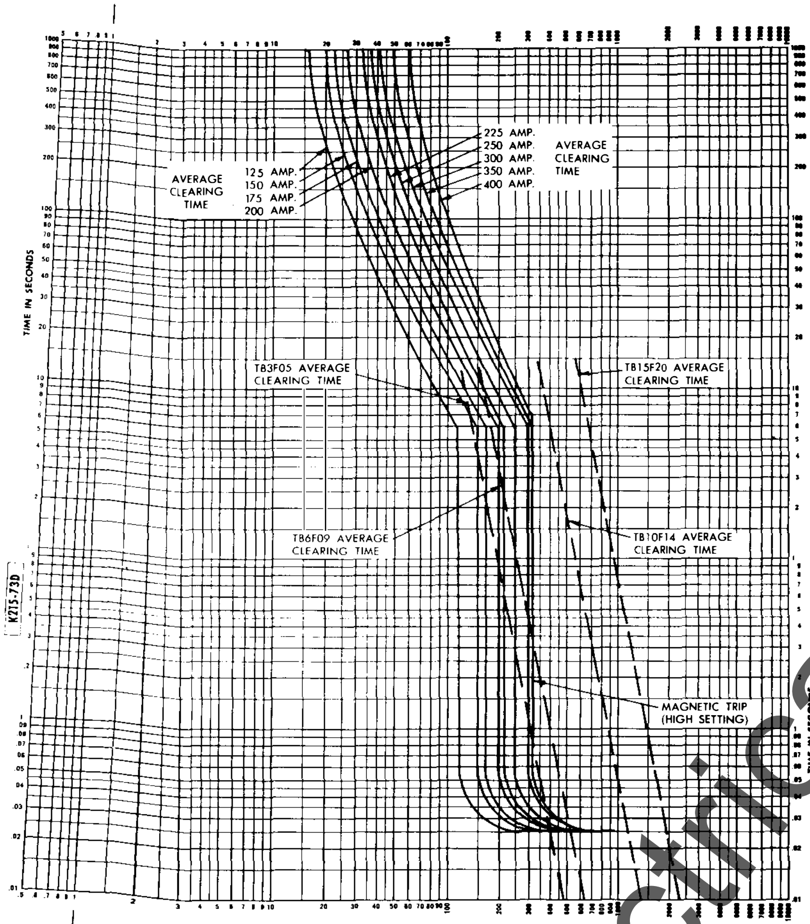
Long time delay thermal trip, not adjustable.

Instantaneous magnetic trip, not adjustable.

REV. 5-13-68

CIRCUIT PROTECTIVE DEVICES DEPARTMENT, PLAINVILLE, CONNECTICUT

TB4



CURRENT (AMPERES X 10)

GENERAL ELECTRIC

Current Ratings
125, 150, 175, 200, 225, 250, 300, 350 & 400 Amperes

Voltage Ratings
600Volts A-c; 250 Volts D-c

Frequency Ratings
D-c or 60 Cycles

INTEGRALLY FUSED
MOLDED CASE CIRCUIT BREAKER

TRI-BREAK LINE

TYPE TB4 (125-400 AMPERES)
Thermal trip, Magnetic trip & Current Limiter Characteristics

Time vs RMS Current

K215-73D

Adjustments

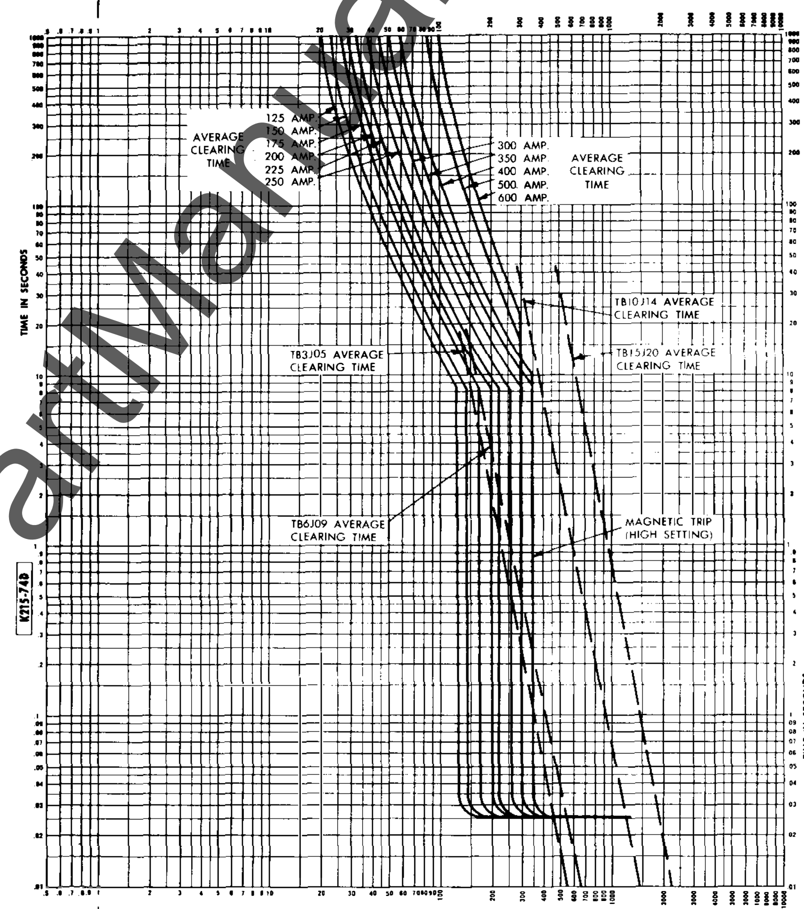
Long time delay thermal trip, not adjustable.

Instantaneous magnetictrip, continuously adjustable, set on HI.

REV. 11-21-68

CIRCUIT PROTECTIVE DEVICES DEPARTMENT, PLAINVILLE, CONNECTICUT

TB6



CURRENT (AMPERES X 10)

GENERAL ELECTRIC

Current Ratings
125, 150, 175, 200, 225, 250, 300, 350, 400,500 and 600 Amperes

Voltage Ratings
600VoltsA-c;250 Volts D-c

Frequency Ratings
D-c or 60 Cycles

INTEGRALLY FUSED
MOLDED CASE CIRCUIT BREAKER

TRI-BREAK LINE

TYPE TB6 (125-600 AMPERES)
Thermal trip, Magnetic trip & Current Limiter Characteristics

Time vs RMS Current

K215-74D

Adjustments

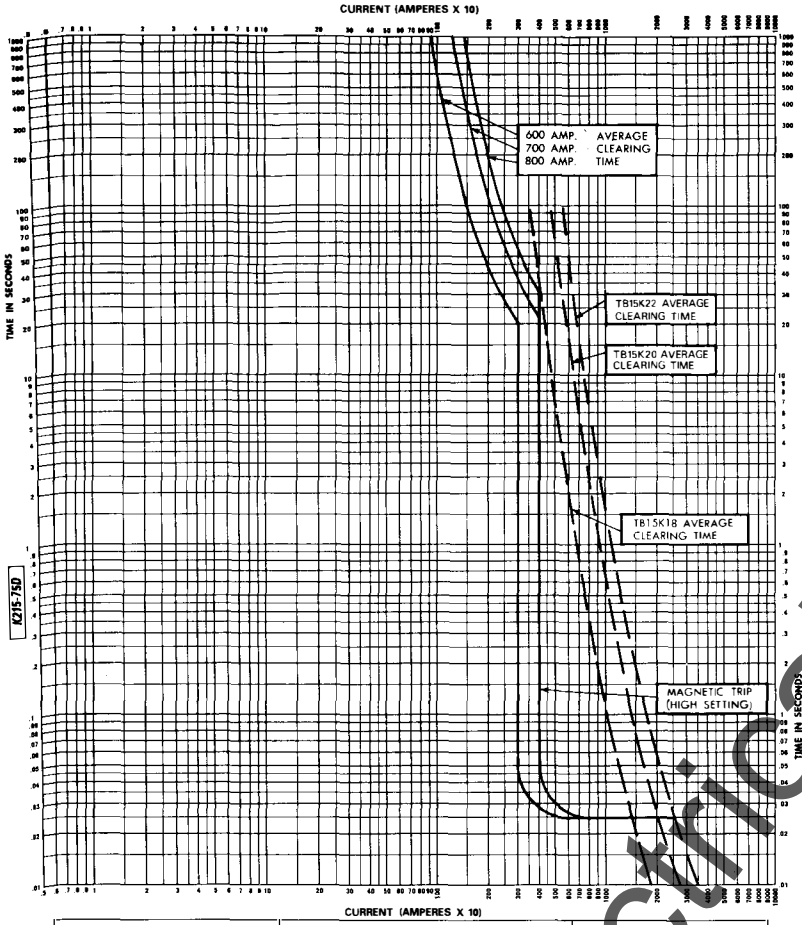
Long time delay thermal trip, not adjustable.

Instantaneous magnetic trip, continuously adjustable, set on HI.

REV. 11-21-68

CIRCUIT PROTECTIVE DEVICES DEPARTMENT, PLAINVILLE, CONNECTICUT

TB8



GE Electrical Distribution & Control

General Electric Company
Plainville, CT 06062

Integrally Fused
Molded Case Circuit Breakers
Tri-Break Line
Type TB8 (600-800 Amperes)

Thermal, Magnetic trip and Current Limiter Time-current Curves

K215-75D

Adjustments

Long time delay thermal trip: nonadjustable.
Instantaneous magnetic trip: continuously adjustable, set on H1.

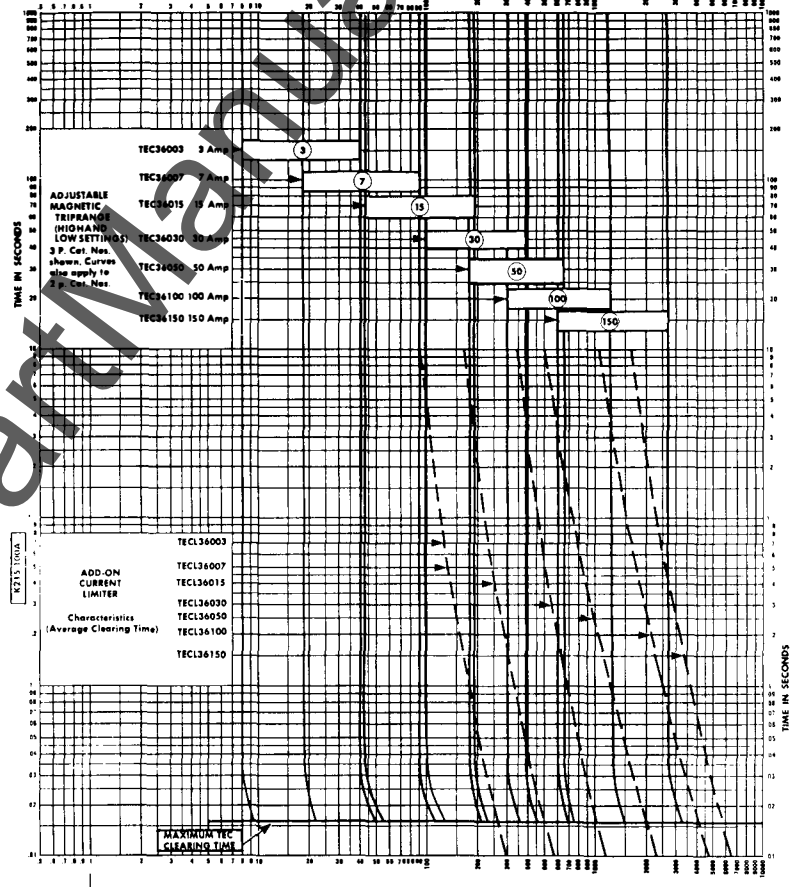
Current Ratings
600, 700 and 800 Amperes

Voltage Ratings
600 Volts Ac (250 Volts Dc)

Frequency Ratings
60 Hertz

4/88 (2M)

TEC, TECL



GENERAL ELECTRIC

"MAG-BREAK" MOTOR CIRCUIT PROTECTOR
TYPE TEC

K215-100A

CONTINUOUS CURRENT RATINGS
3, 7, 15, 30, 50, 100, 150 AMPERES
VOLTAGE RATING
600 VOLTS A.C.
FREQUENCY RATING
50-60 HZ.

TYPE TEC ADJUSTABLE MAGNETIC ONLY PLUS TECL CURRENT LIMITER. MAGNETIC TRIP RANGE AND CURRENT LIMITER CHARACTERISTICS. TIME VS. RMS CURRENT

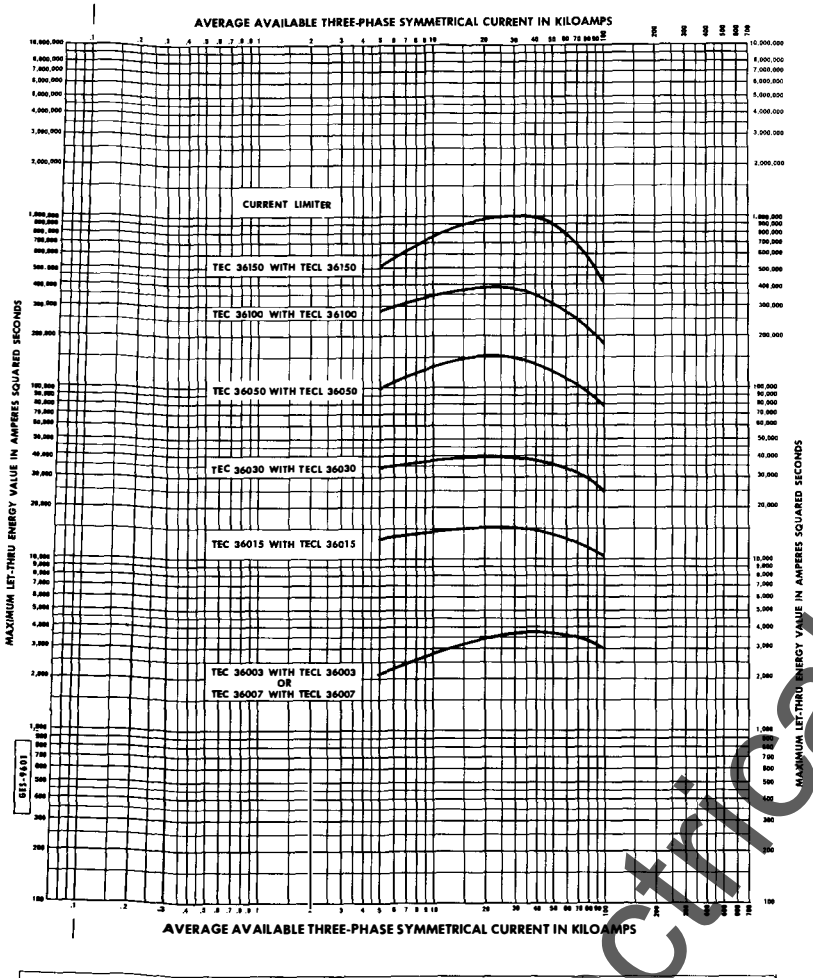
INSTANTANEOUS MAGNETIC TRIP, CONTINUOUSLY ADJUSTABLE

8-78 (1.2M)

GENERAL ELECTRIC CO., CIRCUIT PROTECTIVE DEVICES DEPT., PLAINVILLE, CONN. 06062

K215-100

TEC, TECL i^2t–MAXIMUM LET-THRU CURRENT



GENERAL ELECTRIC | MOLDED-CASE CIRCUIT BREAKER | GES-9601

MAG-BREAK™

Limiter Rating 3-150 Amperes

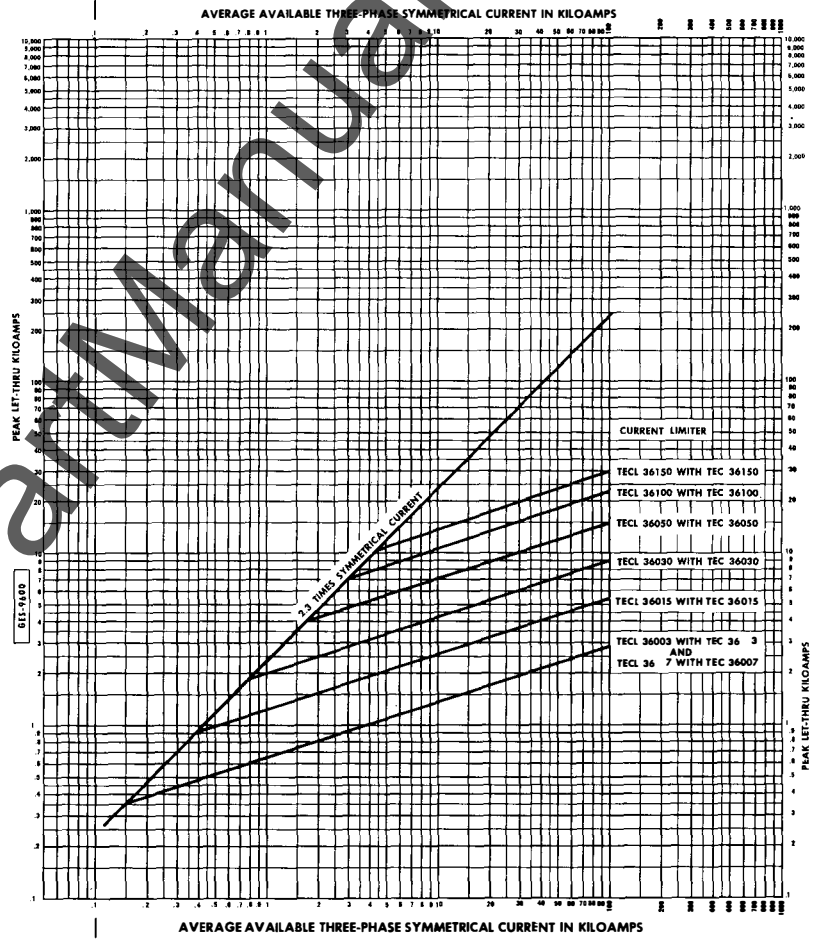
Type TEC With TECL Current Limiter

Maximum Let-Thru Energy (I²T) Available Current Curves

Note: Curves based on 0.15 power factor current through 4 feet, 10 inches of rated wire per phase

GENERAL ELECTRIC CO., CONSTRUCTION EQUIPMENT BUSINESS OPERATIONS, PLAINVILLE, CONN. 06062

TEC, TECL Ip–MAXIMUM INSTANTANEOUS CURRENT



GENERAL ELECTRIC | MOLDED-CASE CIRCUIT BREAKER | GES-9600

MAG-BREAK™

Limiter Rating 3-150 Amperes

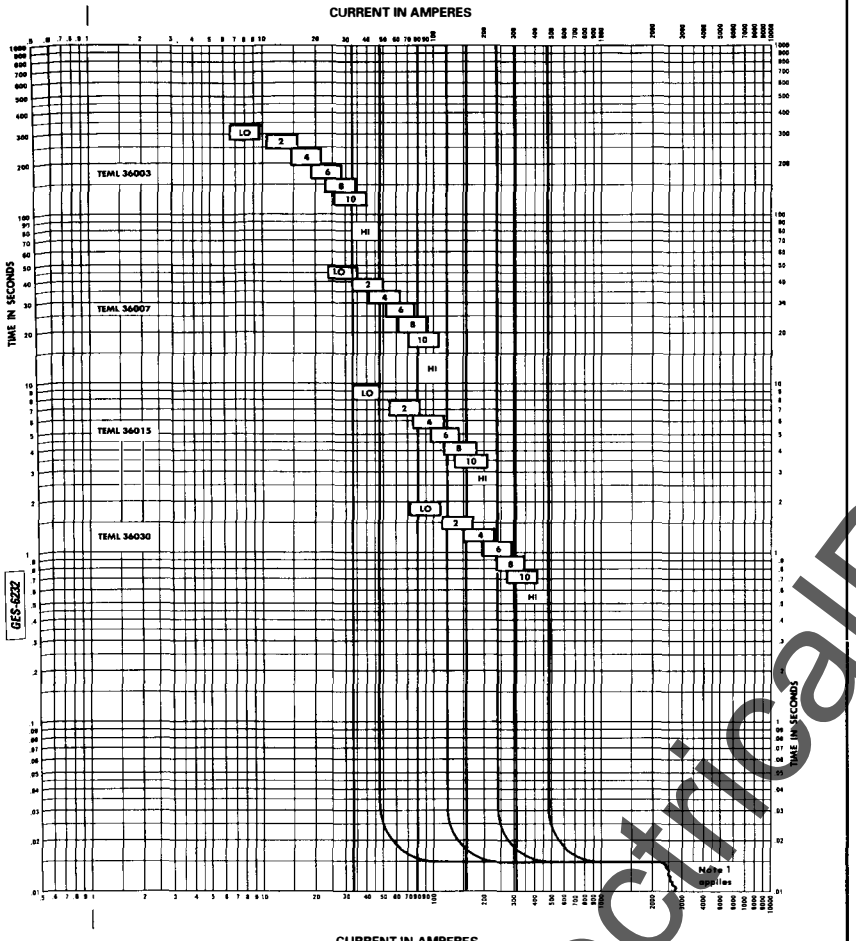
Type TEC With TECL Current Limiter

Peak Let-Thru-Available Current Curves

Note: Curves based on 0.15 power factor current through 4 feet, 10 inches of rated wire per phase

GENERAL ELECTRIC CO, DISTRIBUTION EQUIPMENT DIVISION, PLAINVILLE, CONN. 06062

TEML 3–30



GE Electrical Distribution & Control

General Electric Company
Plainville, CT06062

Current Ratings
3, 7, 15 and 30 Amperes

Voltage Ratings
240, 480, 600Volts ac

Frequency Rating
50/60 Hertz

Current-Limiting Mag-Break® Motor Circuit Protector

Type TEML

Instantaneous Time-current Curves

GES-6232

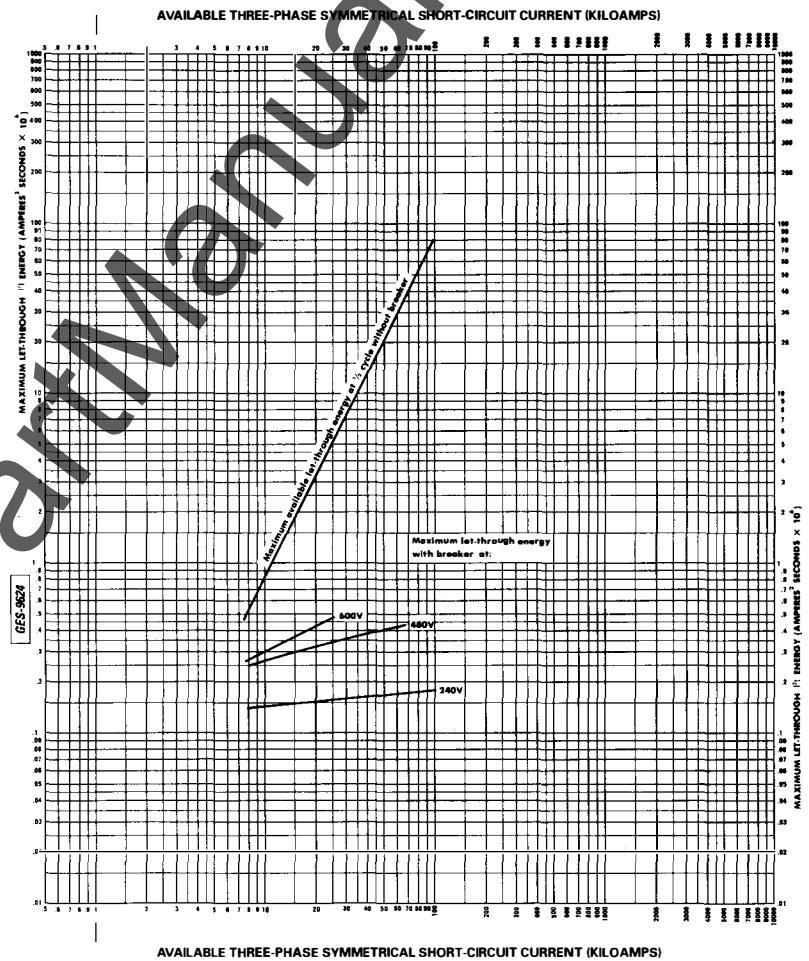
Adjustments

Instantaneous magnetic trip continuously adjustable

Note 1: Current limiting range, breaker totally clears prior to 0.01 sec. For additional data refer to Ip and I^2T curves

12/89 (3M)

TEML 3–30 i^2t MAXIMUM LET-THRU ENERGY



GE Electrical Distribution & Control

General Electric Company
Plainville, CT06062

Current Ratings
3, 7, 15 and 30 Amperes

Voltage Ratings
240, 480, 600 Volts ac

Frequency Rating
50/60 Hertz

Current-Limiting Mag-Break® Motor Circuit Protector

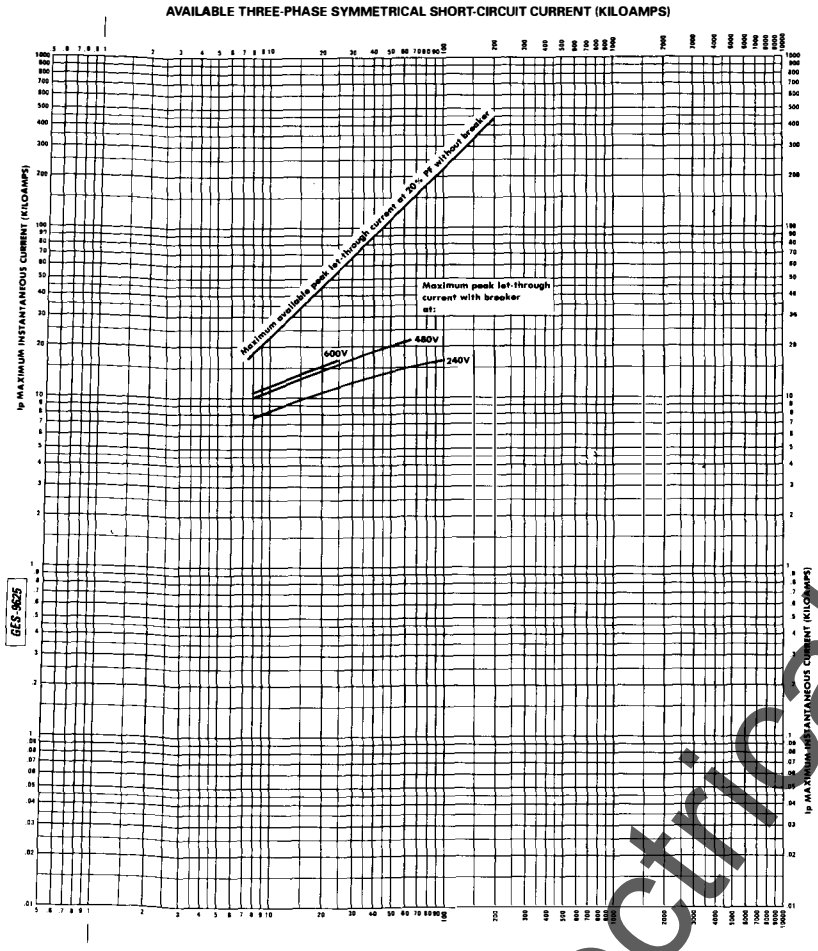
Type TEML

Let-through Energy Curves

GES-9624

12/89 (3M)

TEML 3–30 Ip–MAXIMUM INSTANTANEOUS CURRENT



GE Electrical Distribution & Control
General Electric Company
Plainville, CT06062

Current-Limiting Mag-Break® Motor Circuit Protector

GES-9625

Type TEML

Peak Let-through Current Curves

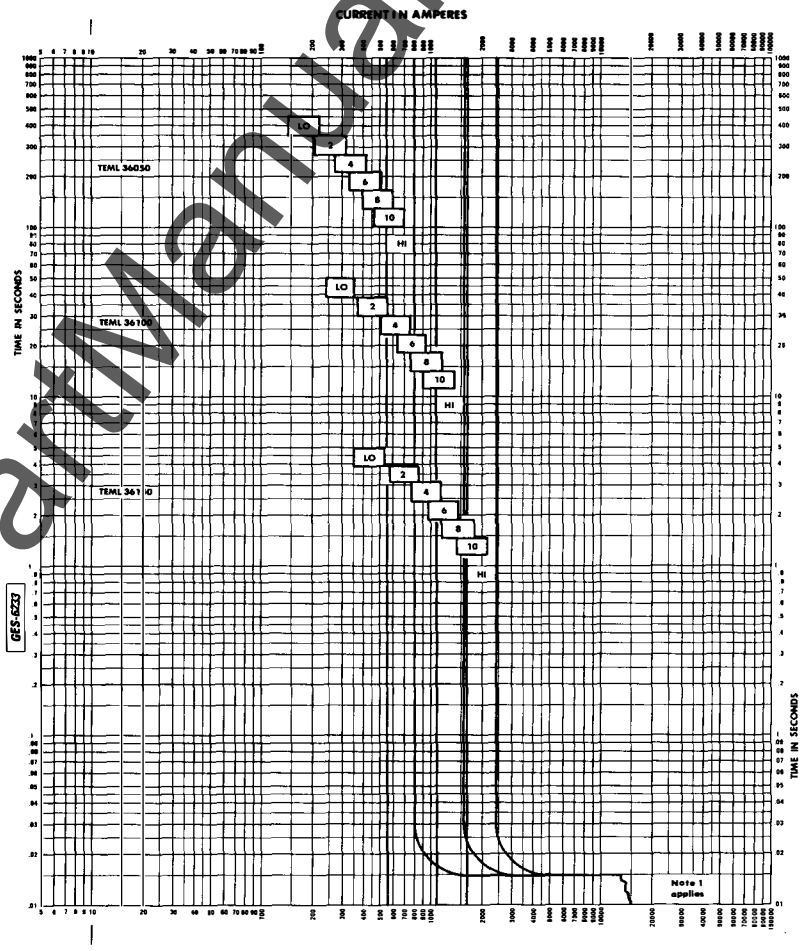
Current Ratings
3, 7, 15 and 30 Amperes

Voltage Ratings
240, 480, 600Volts ac

Frequency Rating
50/60 Hertz

12/89(3M)

TEML 50–150



GE Electrical Distribution & Control
General Electric Company
Plainville, CT06062

Current-Limiting Mag Break® Motor Circuit Protector

GES-6233

Type TEML

Instantaneous Time-current Curves

Adjustments

Instantaneous magnetic trip continuously adjustable

Note 1: Current limiting range, total clear prior to 0.01 sec. For additional data refer trip and I²T curves.

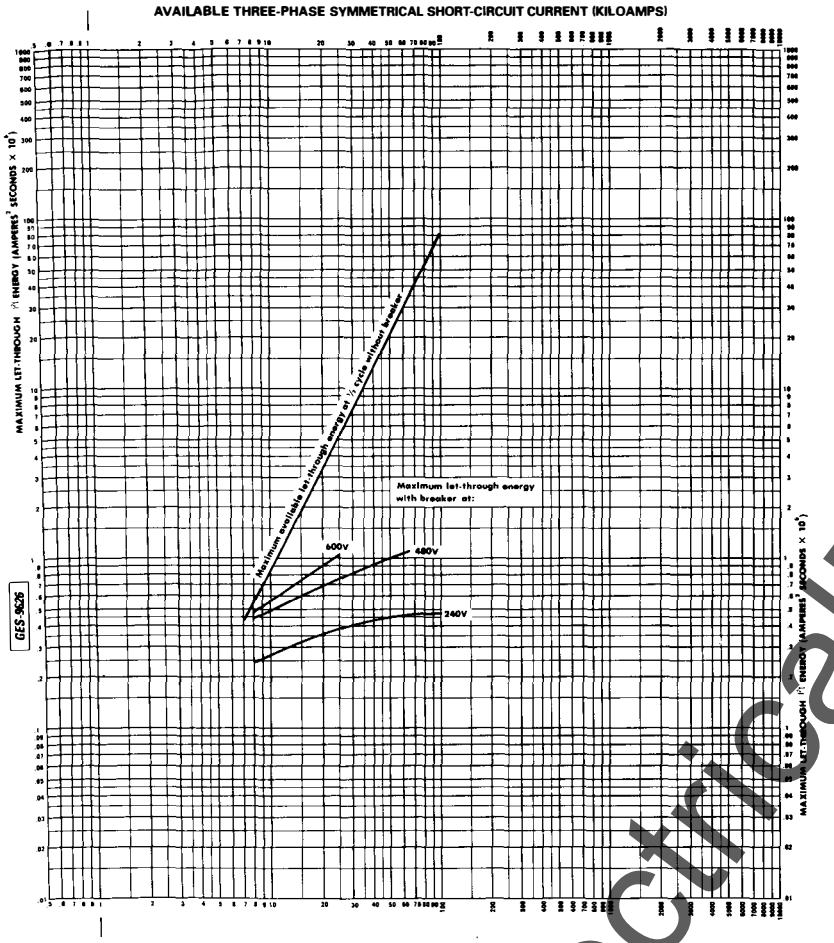
Current Ratings
50, 100 and 150 Amperes

Voltage Ratings
240, 480,600Volts ac

Frequency Rating
50/60Hertz

12/89 (3M)

TEML 50–150 i^2t MAXIMUM LET-THRU ENERGY



GE Electrical Distribution & Control
General Electric Company
Plainville, CT 06062

Current-Limiting Mag-Break® Motor Circuit Protector

GES-9626

Type TEML

Let-through Energy Curves

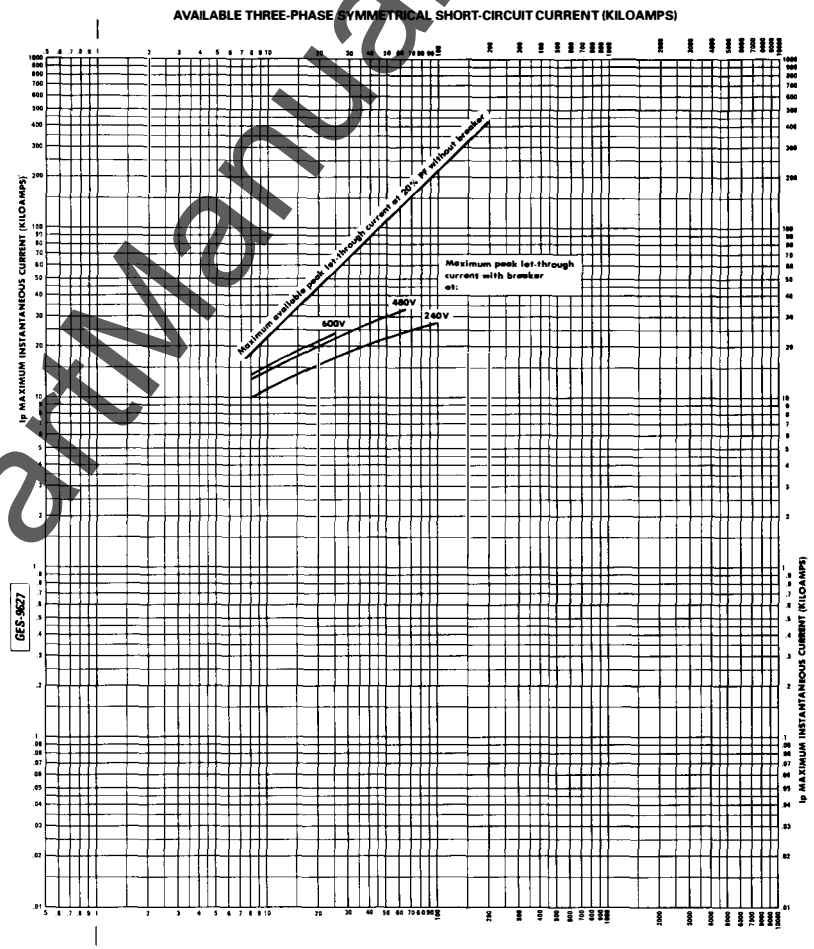
Current Ratings
50, 100 and 150 Amperes

Voltage Ratings
240, 480, 600 Volts ac

Frequency Rating
50/60 Hertz

12/89 (3M)

TEML 50–150 Ip–MAXIMUM INSTANTANEOUS CURRENT



GE Electrical Distribution & Control
General Electric Company
Plainville, CT 06062

Current-Limiting Mag-Break® Motor Circuit Protector

GES-9627

Type TEML

Peak Let-through Current Curves

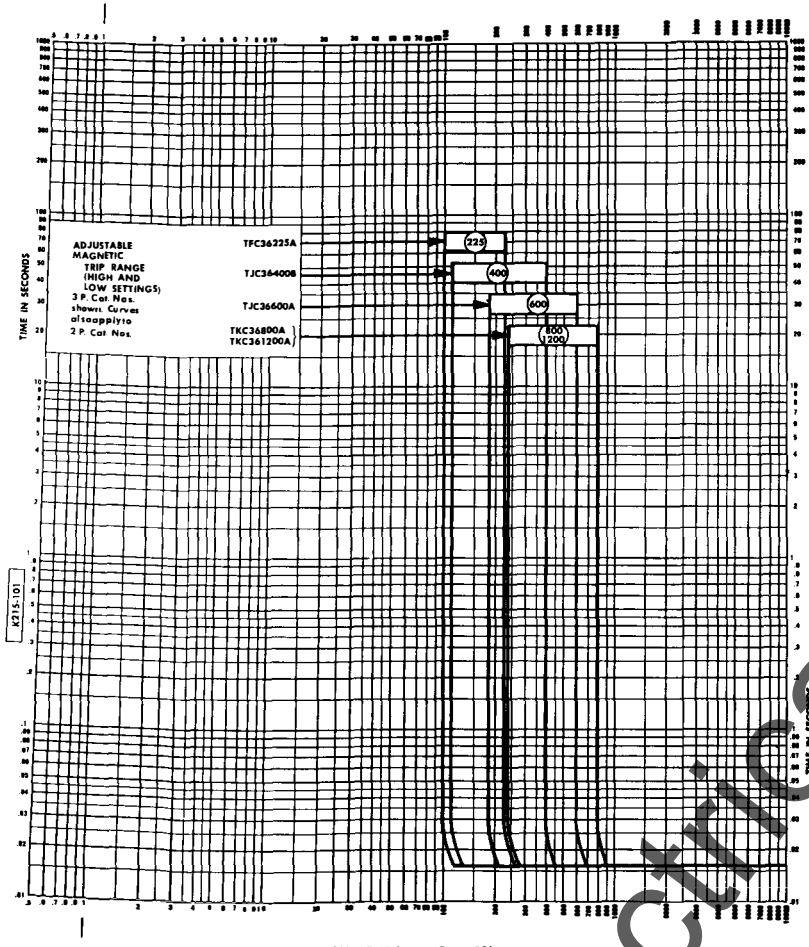
Current Ratings
50, 100, and 150 Amperes

Voltage Ratings
240, 480, 600 Volts ac

Frequency Rating
50/60 Hertz

12/89 (3M)

TFC



GENERAL ELECTRIC

"MAG-BREAK" MOTOR CIRCUIT PROTECTOR

Types TFC, TJC (400 and 600 A), TKC

K215-101

Continuous Current Ratings 225, 400, 600, 800 and 1200 Amperes

Voltage Rating 600 Volts A-c

Frequency Rating 50-60 Hz.

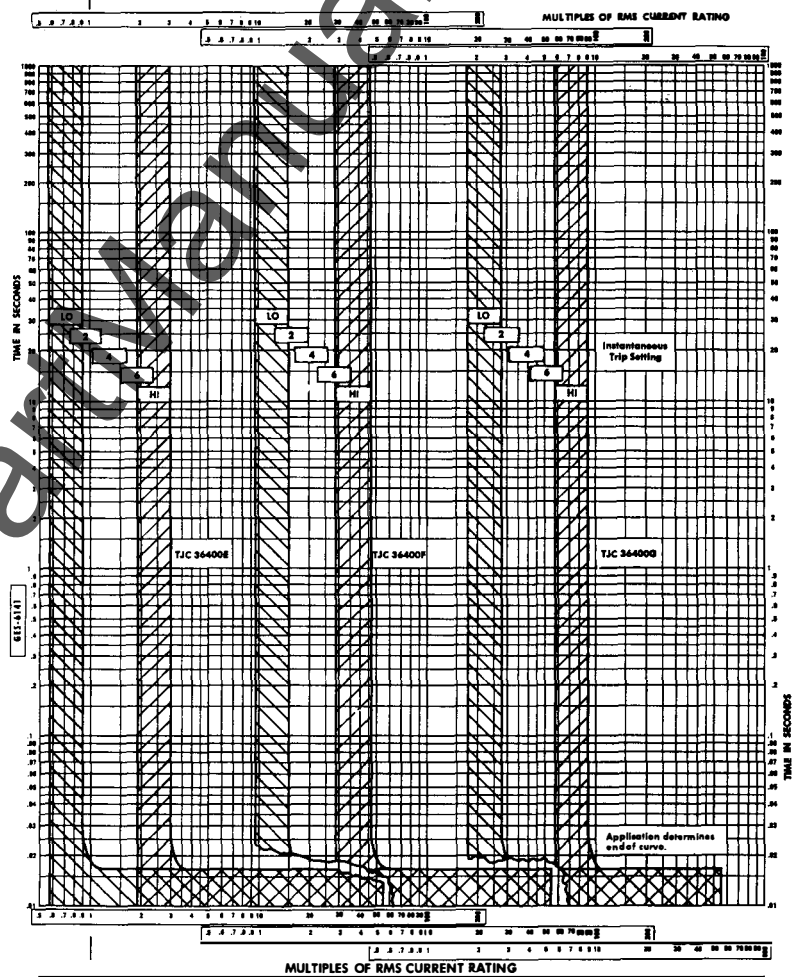
Magnetic Trip Characteristics Time vs. RMS Current

Instantaneous magnetic trip, continuously adjustable.

6-78 (1.2M)

GENERAL ELECTRIC CO., CIRCUIT PROTECTIVE DEVICES DEPT., PLAINVILLE, CONN. 06062

TJC 400 AMPERES



GENERAL ELECTRIC

MOLDED-CASE CIRCUIT PROTECTOR

MAG-BREAK™

Type TJC 400 Amperes

Instantaneous Time-current Curves

GES-6141

Continuous Current Rating 400 amperes

Voltage Rating 600 volts a-c

Frequency Rating 50-60 Hertz

Adjustments

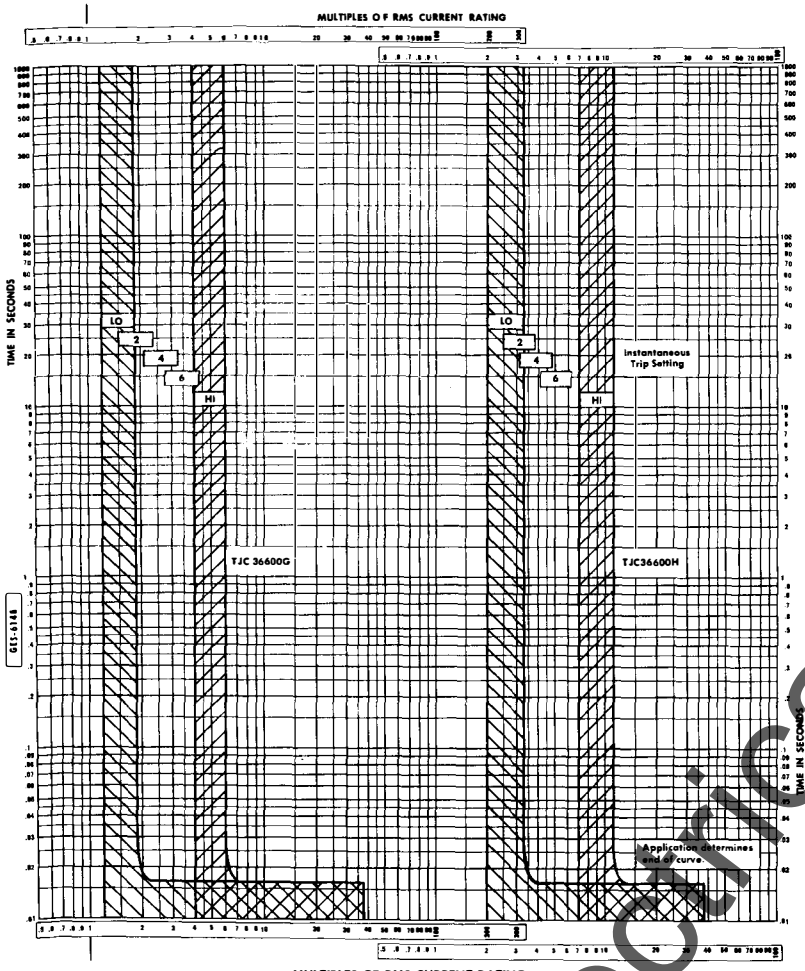
Instantaneous Unit: Continuously adjustable between LO and HI.

NOTE: U/L component recognition for use in combination motor controllers.

1-79PS2

GENERAL ELECTRIC CO., CIRCUIT PROTECTIVE DEVICES DEPT., PLAINVILLE, CONN.

TJC 600 AMPERES



MULTIPLES OF RMS CURRENT RATING

GENERAL ELECTRIC

MOLDED-CASE CIRCUIT PROTECTOR

MAG-BREAK™

Type TJC 600 Amperes

Instantaneous Time-current Curves

GES-6142

Continuous Current Rating
600 amperes
Voltage Rating
600 volts a-c
Frequency Rating
50-60 Hertz

Adjustments
Instantaneous Unit. Continuously adjustable between LO and HI.

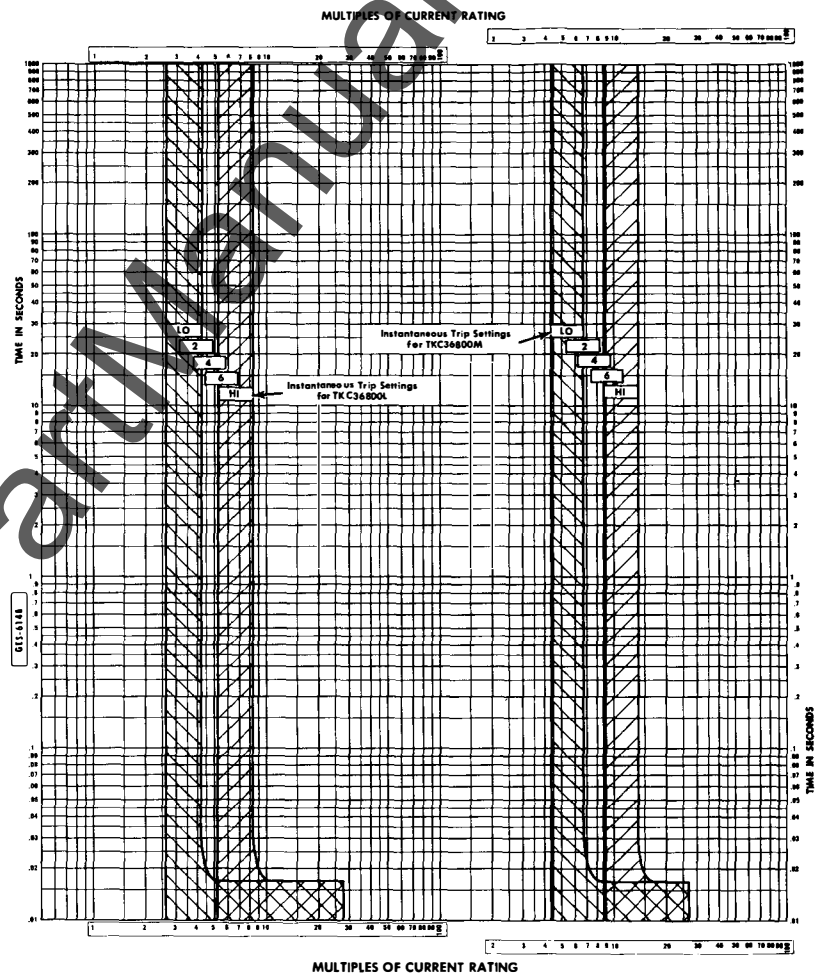
NOTE: U/L component recognition for use in combination motor controllers.

12-74 (3M)

GENERAL ELECTRIC CO., CIRCUIT PROTECTIVE DEVICES DEPT., PLAINVILLE, CONN.

K215-135

TKC 800 AMPERES



MULTIPLES OF CURRENT RATING

GENERAL ELECTRIC

MOLDED-CASE MOTOR CIRCUIT PROTECTOR

MAG-BREAK™

Type TKC 800 Amperes

Magnetic Trip Time-current Curves

GES-6146

Continuous Current Rating
800 amperes
Voltage Rating
600 volts a-c
Frequency Rating
50-60 Hertz

Adjustments
Instantaneous Unit. Continuously adjustable between LO and HI.

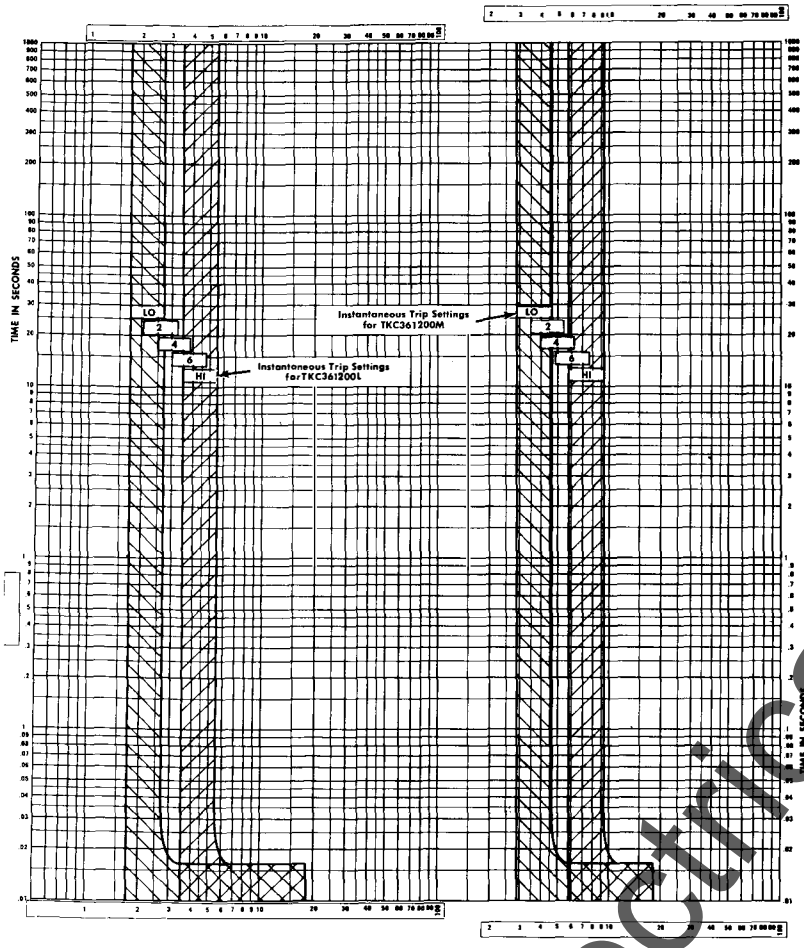
NOTE: UL component recognition for use in combination motor controllers.

7-85 (1M)

GENERAL ELECTRIC CO., CONTRACTOR EQUIPMENT BUSINESS OPERATIONS, PLAINVILLE, CONN. 06062

K213-331

TKC 1200 AMPERES



GENERAL ELECTRIC

MOLDED-CASE MOTOR CIRCUIT PROTECTOR

MAG-BREAK™

Type TKC 1200 Amperes

Magnetic Trip Time-current Curves

GES-6147

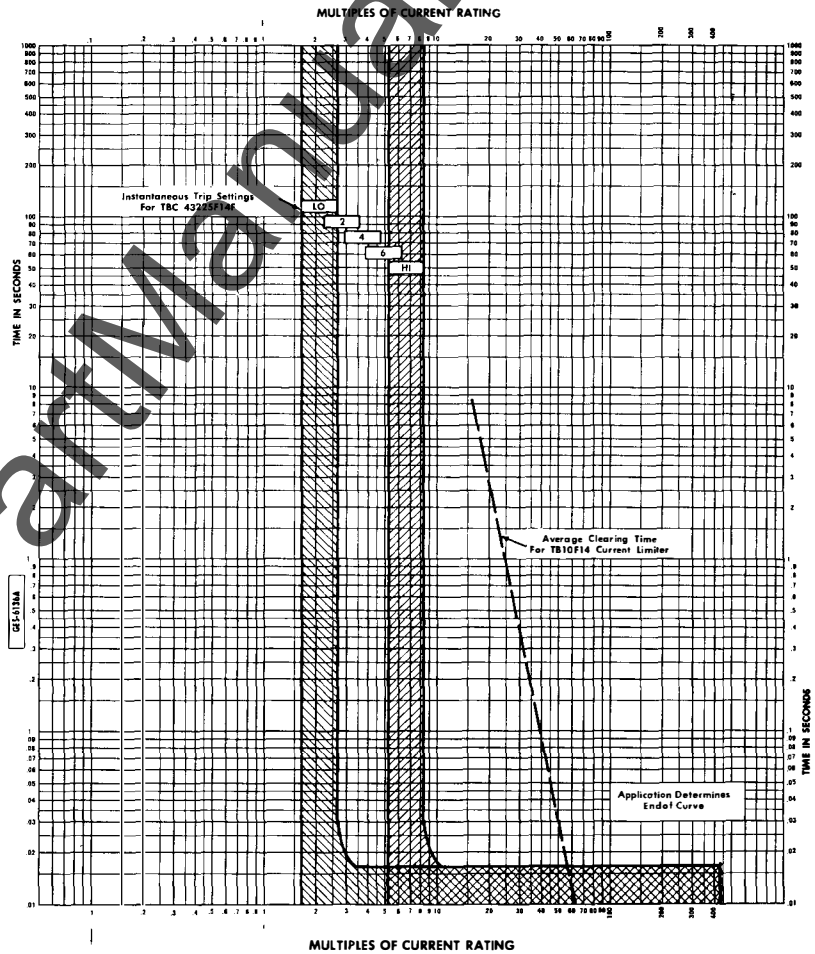
Continuous Current Rating
1200 amperes
Voltage Rating
600 volts a.c.
Frequency Rating
50-60 Hertz

Adjustments
Instantaneous Unit: Continuously adjustable between LO and HI.

NOTE: UL component recognition for use in combination motor controllers.

GENERAL ELECTRIC CO., CONSTRUCTION EQUIPMENT BUSINESS OPERATIONS, PLAINVILLE, CONN. 06062 K215-140

TBC 225 AMPERES



GENERAL ELECTRIC

MOLDED-CASE MOTOR CIRCUIT PROTECTOR

MAG-BREAK™

Type TBC 225 Amperes

Magnetic Trip and Limiter Time-current Curves

GES-6136A

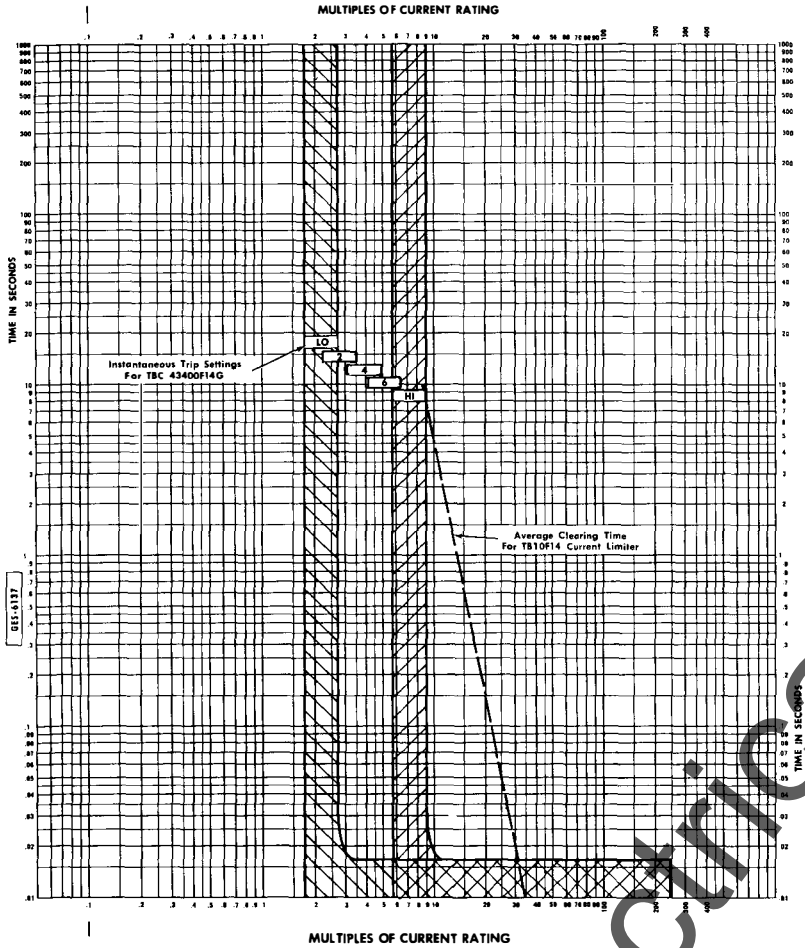
Continuous Current Rating
225 amperes
Voltage Rating
600 volts a.c.
Frequency Rating
50-60 Hertz

Adjustments
Instantaneous Unit: Continuously adjustable between LO and HI.

NOTE: UL component recognition for use in combination motor controllers.

GENERAL ELECTRIC CO., DISTRIBUTION EQUIPMENT DIVISION, PLAINVILLE, CONN. 06062 K215-139

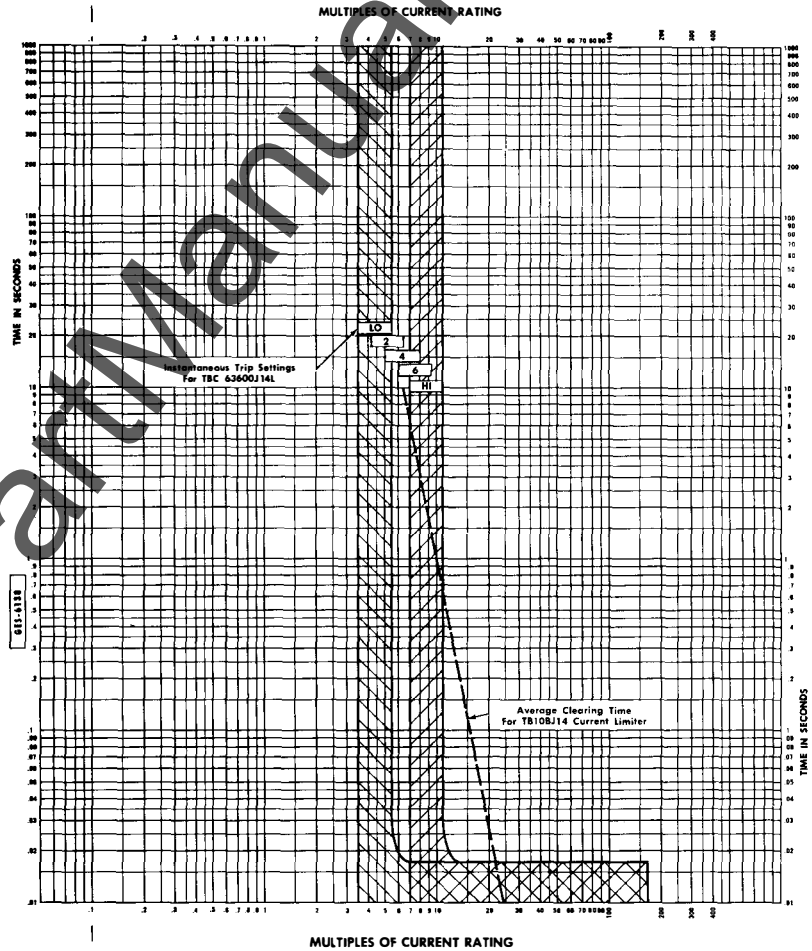
TBC 400 AMPERES



GENERAL ELECTRIC	MOLDED-CASE MOTOR CIRCUIT PROTECTOR MAG-BREAK™	GES-6137
Continuous Current Rating 400 amperes Voltage Rating 600 volts a-c Frequency Rating 50-60 Hertz	Type TBC 400 Amperes Magnetic Trip and Limiter Time-current Curves	Adjustments Instantaneous Unit: Continuously adjustable between LO and HI. NOTE: UL component recognition for use in combination motor controllers.

8-78 (1.2M) GENERAL ELECTRIC CO., CIRCUIT PROTECTIVE DEVICES DEPT., PLAINVILLE, CONN. 06062 K215 131

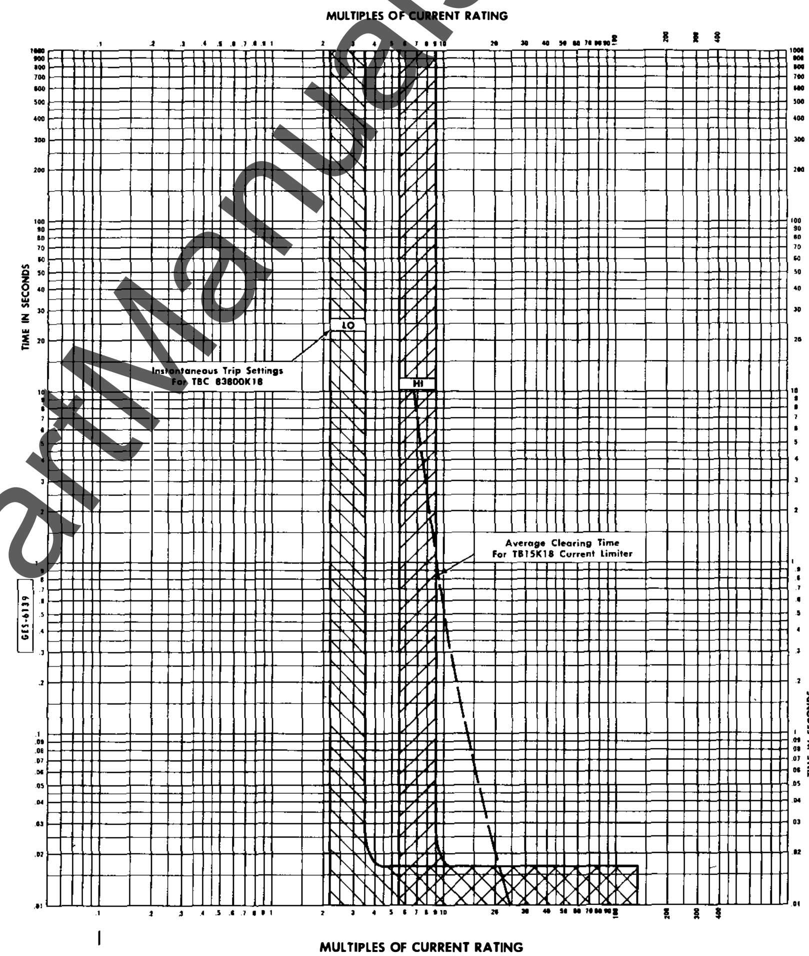
TBC 600 AMPERES



GENERAL ELECTRIC	MOLDED-CASE MOTOR CIRCUIT PROTECTOR MAG-BREAK™	GES-6138
Continuous Current Rating 600 amperes Voltage Rating 600 volts a-c Frequency Rating 50-60 Hertz	Type TBC 600 Amperes Magnetic Trip and Limiter Time-current Curves	Adjustments Instantaneous Unit: Continuously adjustable between LO and HI. NOTE: UL component recognition for use in combination motor controllers.

3-83 (1M) GENERAL ELECTRIC CO., CONTRACTORS EQUIPMENT BUSINESS OPERATIONS, PLAINVILLE, CONN. 06062 K215 132

TBC 800 AMPERES



GENERAL ELECTRIC	MOLDED-CASE MOTOR CIRCUIT PROTECTOR **MAG-BREAK™**	GES-6139
Continuous Current Rating 800 amperes **Voltage Rating** 600 volts a-c **Frequency Rating** 50-60 Hertz	Type TBC 800 Amperes Magnetic Trip and Limiter Time-current Curves	**Adjustments** Instantaneous Unit: Continuously adjustable between LO and HI.

8-76 (1.2M) GENERAL ELECTRIC CO., CIRCUIT PROTECTIVE DEVICES DEPT., PLAINVILLE, CONN. 06062 K215-133

Inspection and Testing

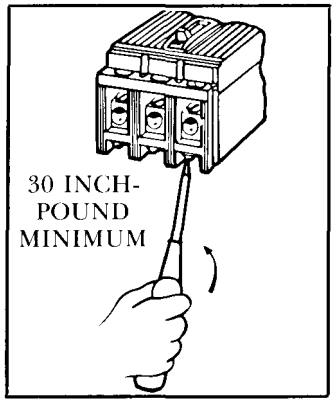
The need for preventive maintenance on molded case circuit breakers will vary depending on operating conditions. Suggested inspection and testing is defined in GET-2963 entitled testing and maintenance of molded case circuit breakers.

IN MAKING CONNECTIONS WITH ALUMINUM WIRE REFER TO GEH3445.

GEJ-4654
TCAL12, 12A, 15, TCO12
Mounting Lugs for E150 Line

Lugs must be securely fastened to terminal straps. Lugs are mounted at the factory with a torque wrench set at 30 inch-pounds minimum.

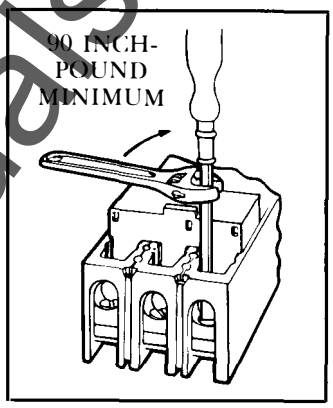
Suggested method for attachment or removal is illustrated.



GEJ-4639
TCAL24, TCO 24, TCAL26, TCO26, TCAL27
Mounting Lugs for F225 Line

Lugs must be securely fastened to terminal straps. Lugs are mounted at the factory with a *high-torque wrench* set at 90 inch-pound minimum.

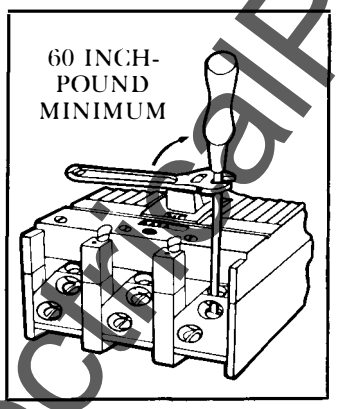
Suggested method for attachment or removal is illustrated.



GEJ-4655
TCAL43, TCAL63, TCO43, TCO63, TCAL47,
Mounting Lugs for J600 Line

Lugs must be securely fastened to terminal straps. Lugs are mounted at the factory with a *high-torque wrench* set at 60 inch-pounds minimum.

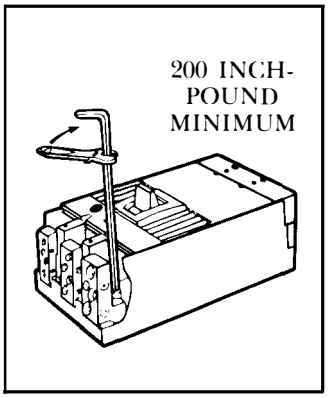
Suggested method for attachment or removal is illustrated.



GEJ-4656
TCAL41, TCAL61, TCAL81, TCAL91, TCAL121, TCAL131, TCAL122, TCO41, TCO61, TCO81A, TCO121, TCO131, TCO91
Mounting Lugs for K1200 Line

Lugs must be securely fastened to terminal straps. Lugs are mounted at the factory with a *high-torque wrench* set at 200 inch-pounds minimum.

Suggested method for attachment or removal is illustrated.



CABLE CONNECTOR (WIRING LUG) TORQUE VALUES

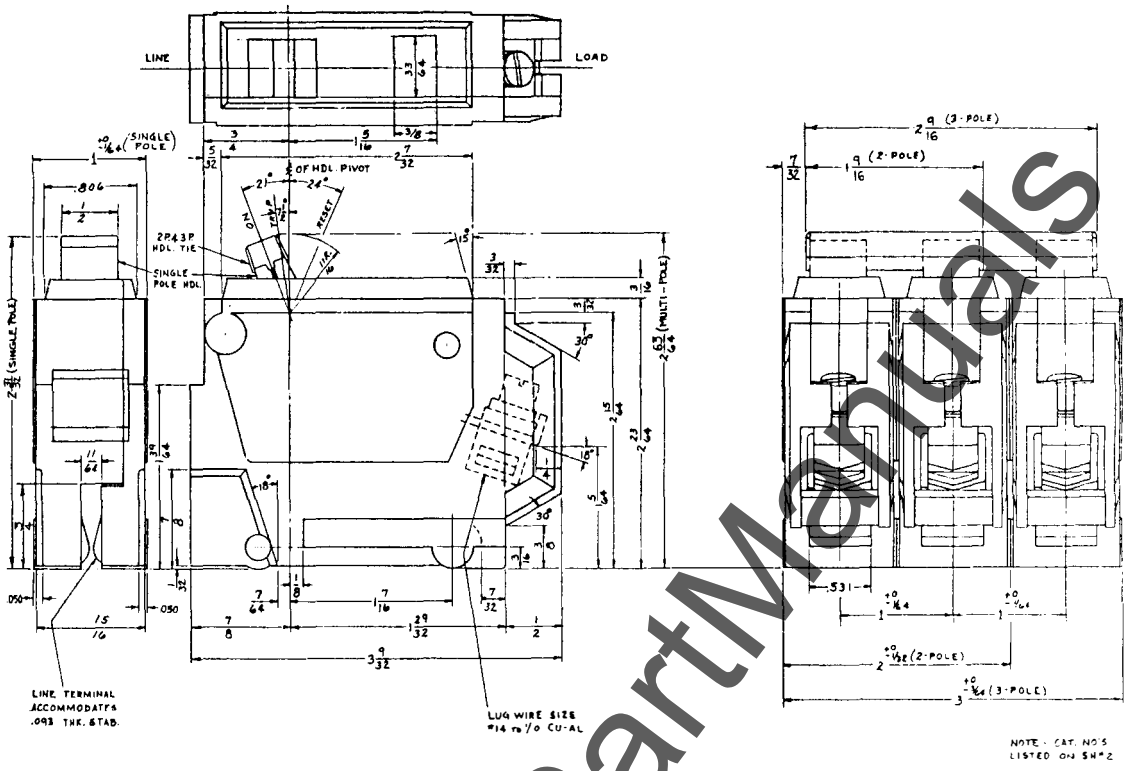
All Type THQP, THQL, THQB, THQC (including ground fault circuit breakers) and all TEB, TEC, TED, THED and TB1 circuit breakers and molded case switches are marked with the appropriate lug tightening torque values.

All other circuit breakers employ lugs with screws having an internal hexagonal socket with dimension "across the flats" of ¼, 5⁄16 or ⅜ inch. The following table gives the recommended cable tightening torque for these lugs.

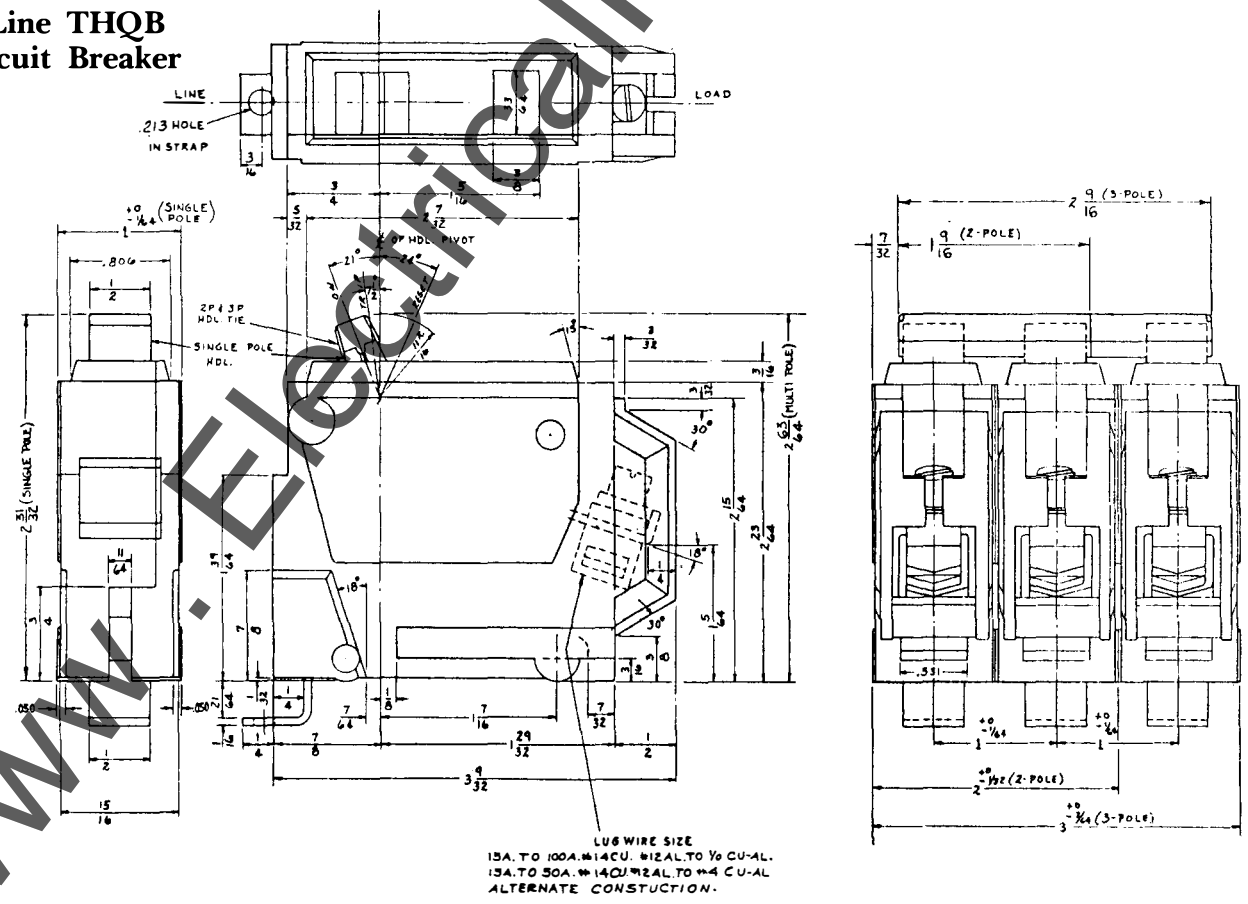
Socket Size (across flats)	Recommended Tightening Torque, (lb.-in.)	Circuit Breaker Types
¼	200	TQD, TQDL
5⁄16	275	TFJ/K, TJJ/K/D/C, TJ-V, TB4
⅜	375	TKM/C, TK-V, TB6/TB8

Outline Drawings

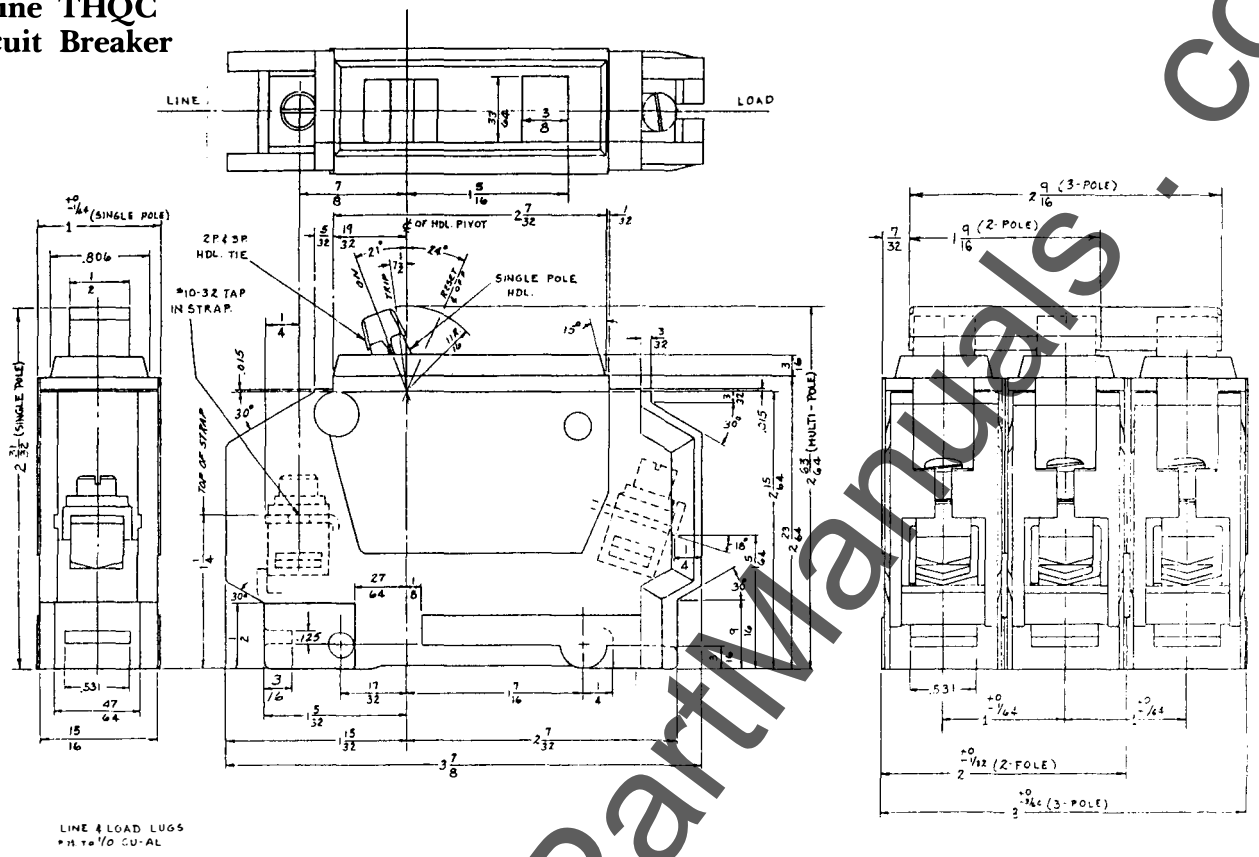
Q-Line THQL Circuit Breaker



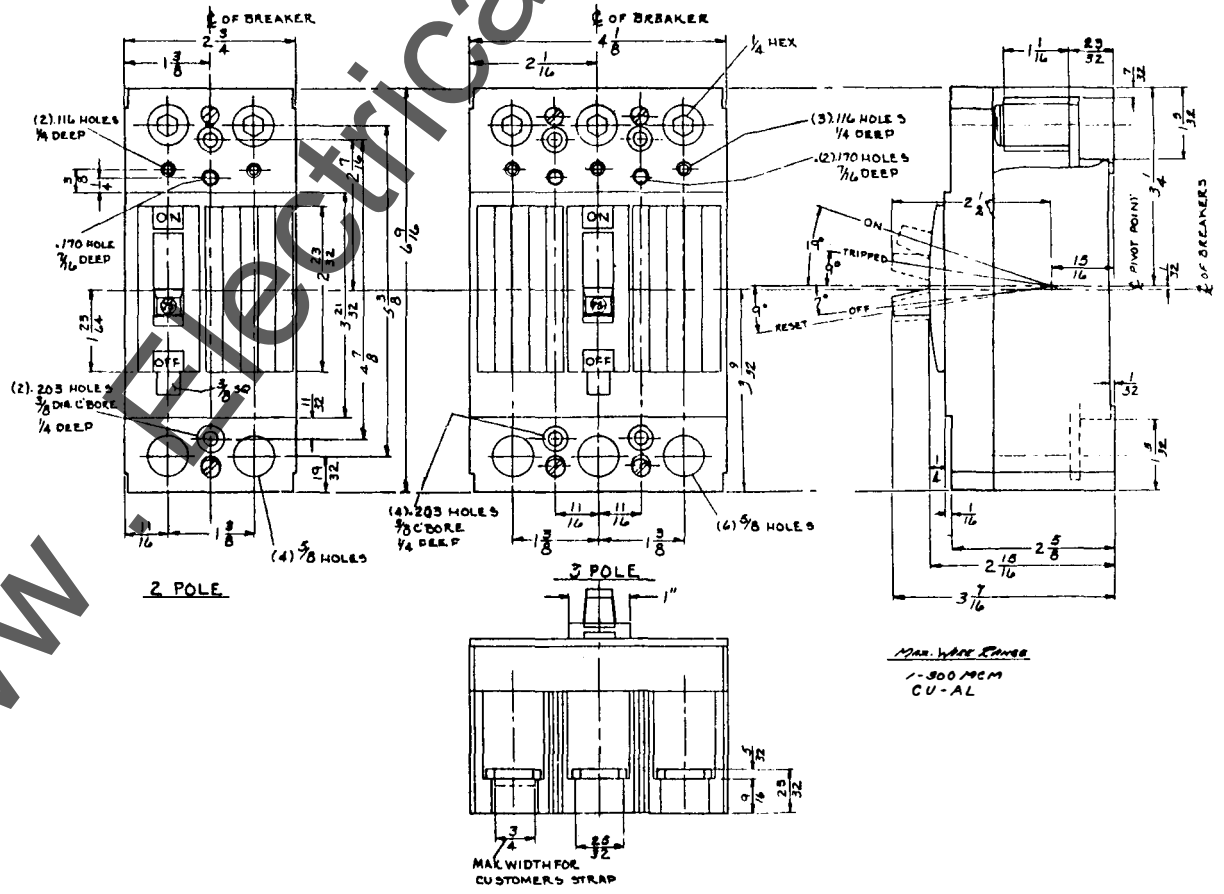
Q-Line THQB Circuit Breaker



Q-Line THQC Circuit Breaker

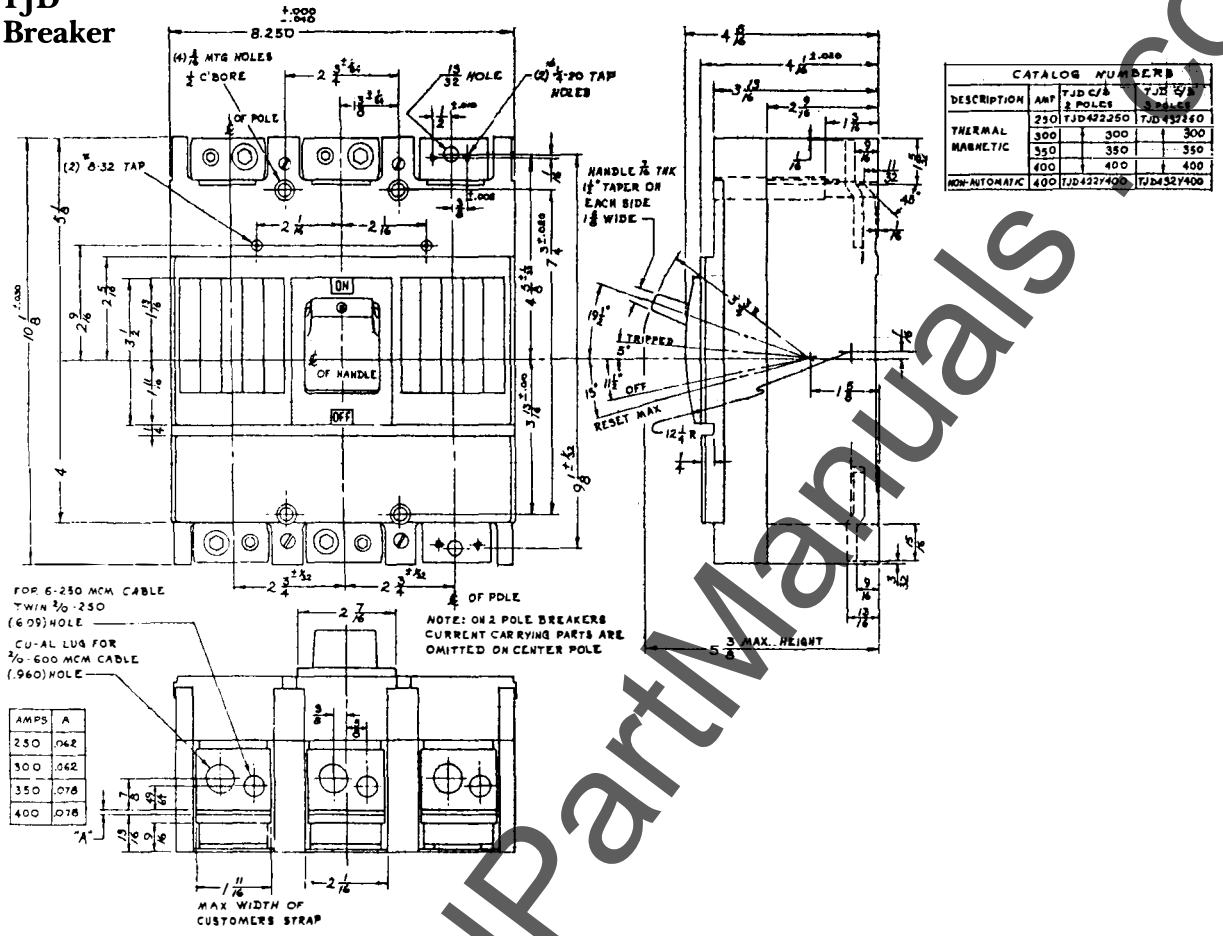


Q-Line TQD Circuit Breaker



Outline Drawings

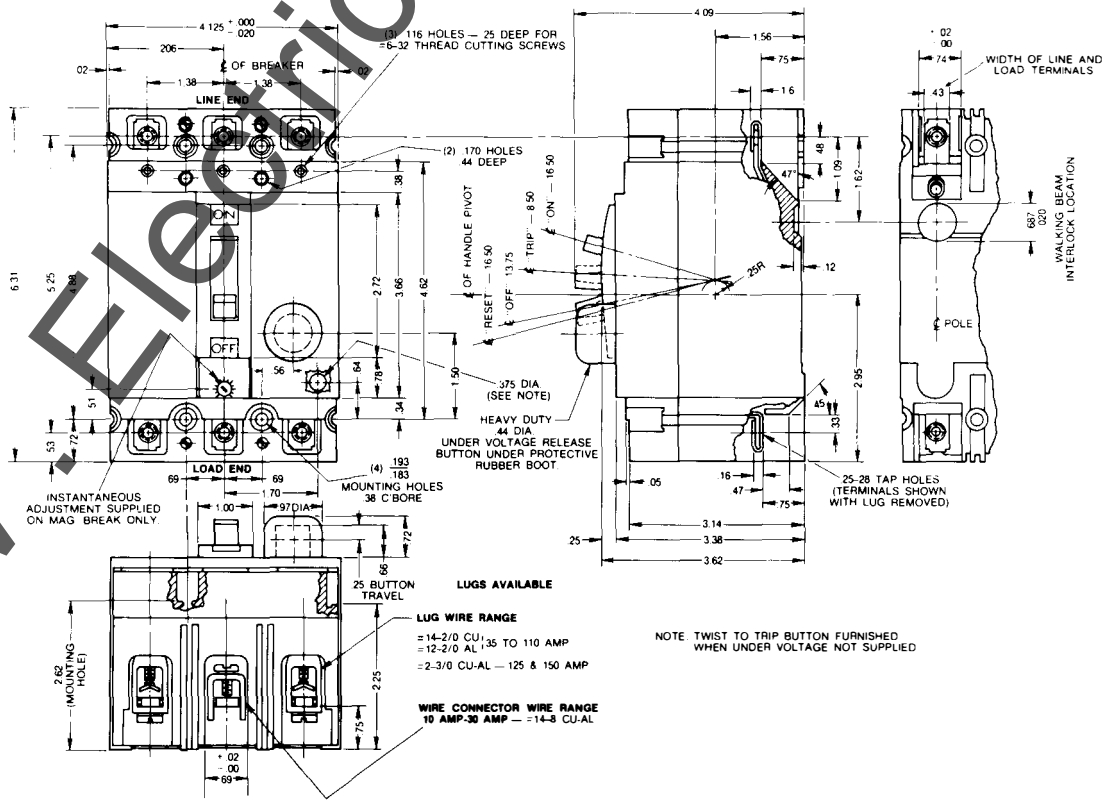
Q-Line TJD Circuit Breaker



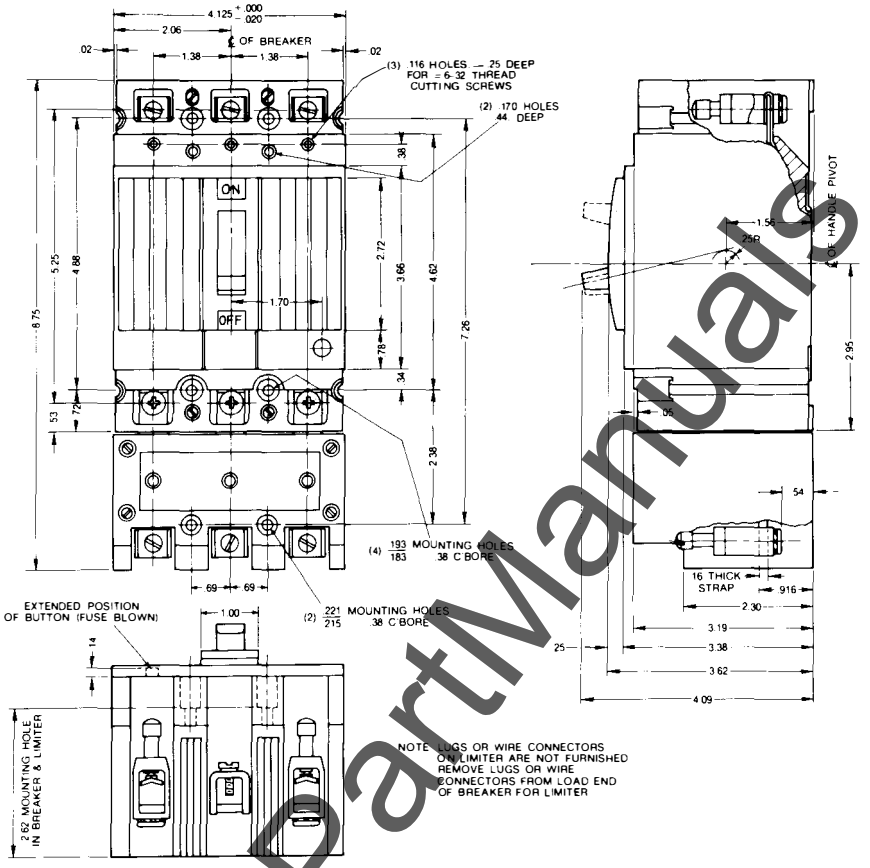
AMPS	A
250	.062
300	.062
350	.078
400	.078

CATALOG NUMBERS			
DESCRIPTION	AMP	TJD C/B 2 POLES	TJD C/B 3 POLES
THERMAL MAGNETIC	250	TJD422250	TJD432250
	300	300	300
	350	350	350
	400	400	400
NON-AUTOMATIC	400	TJD422Y400	TJD432Y400

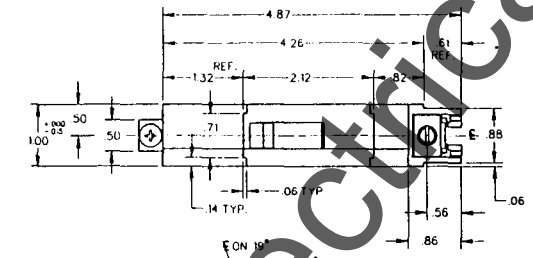
E150 Line-E Frame Circuit Breaker



E150 Line-E Frame Circuit Breaker Plus Current Limiter

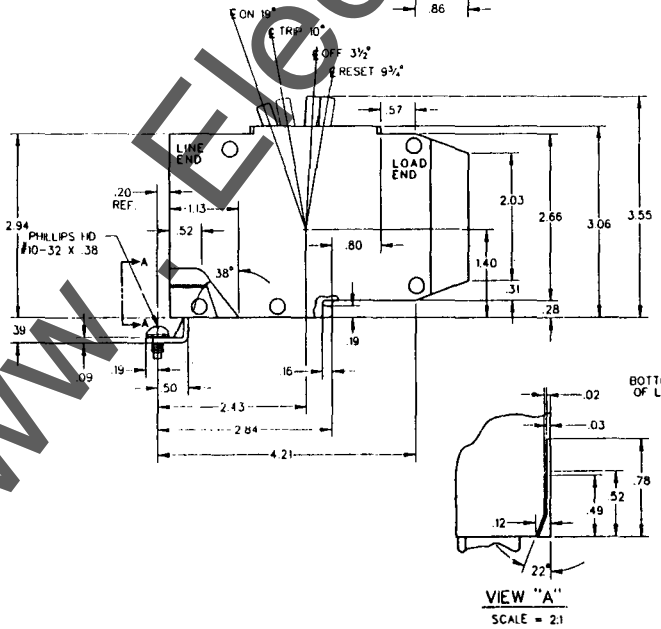


TEY Line- One Pole Circuit Breaker



WIRE CONNECTOR	USED ON	WIRE RANGE CU	WIRE RANGE AL	LOAD END LUG TORQUE TO WIRE	LINE END MOUNTING SCREW TORQUE
A (SADDLE CLAMP)	15A-20A	#12-#14	#10-#12	#10 #12 -35LB-IN #14	25-32LB-IN
B (LUG)	30A-60A	#10-#6	#8-#4	#10-35LB-IN #8 -40LB-IN #6,#4-45LB-IN	
	70A-100A	#4-#1	#2-1/0	#4-#1/0-45LB-IN	

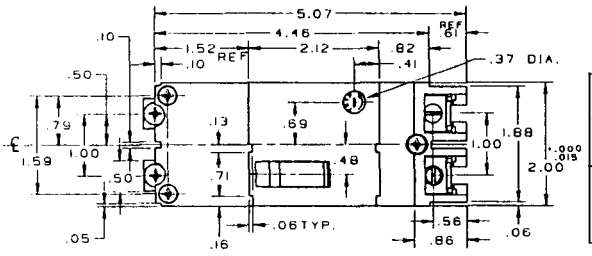
NOMINAL HANDLE OPERATING FORCES (LBS)	
ON TO OFF	16.5
TRIP TO RESET	17.5
OFF TO ON	12.2



NOTE: BREAKER IS SUITABLE FOR REVERSE FEEDING

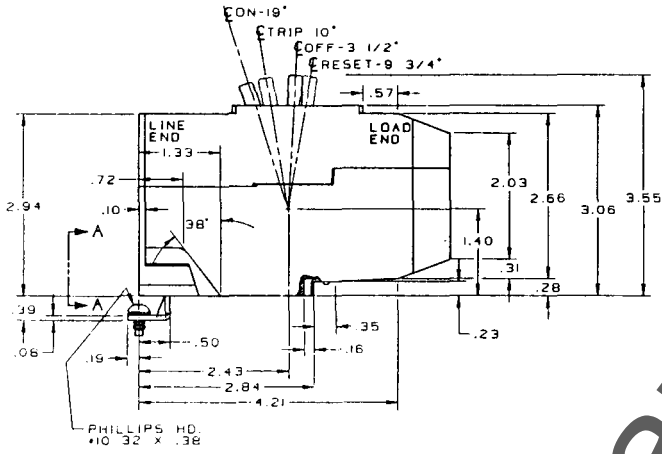
Outline Drawings

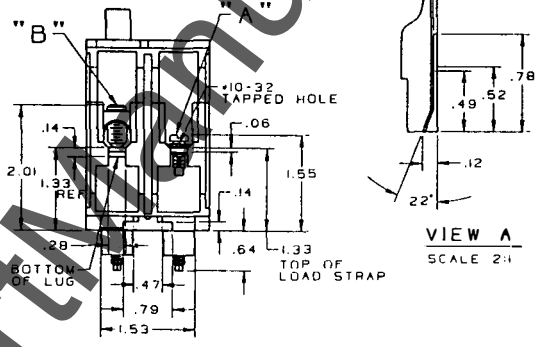
TEY Line- Two Pole Circuit Breaker



WIRE CONNECTOR	USED ON	WIRE RANGE CU	WIRE RANGE AL	LOAD END LUG TORQUE TO WIRE	LINE END MOUNTING SCREW TORQUE
A (SADDLE CLAMP)	15A-20A	#12-#14	#10-#12	#10 #12 -35LB-IN #14	25-32LB-IN
B (LUG)	30A-60A	#10-#6	#8-#4	#10-35LB-IN #8 -40LB-IN #6,#4-45LB-IN	
	70A-100A	#4-#1	#2-1/0	#4-1/0 45LB-IN	

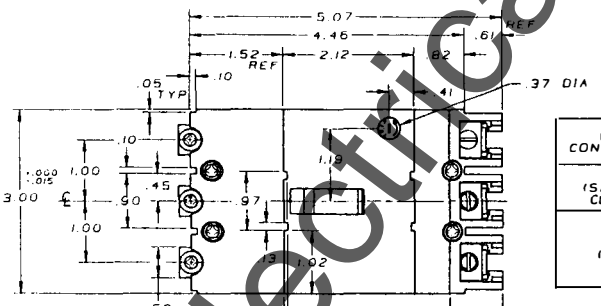
NOMINAL HANDLE OPERATING FORCES (LBS)	
ON TO OFF	16.5
TRIP TO RESET	17.5
OFF TO ON	12.2





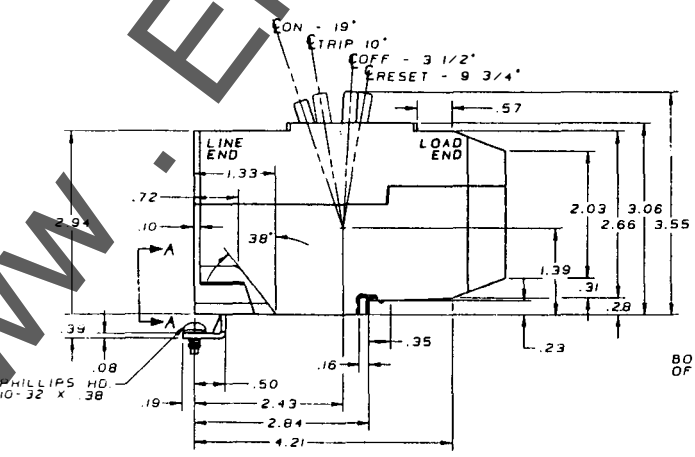
NOTE: BREAKER IS SUITABLE FOR REVERSE FEEDING

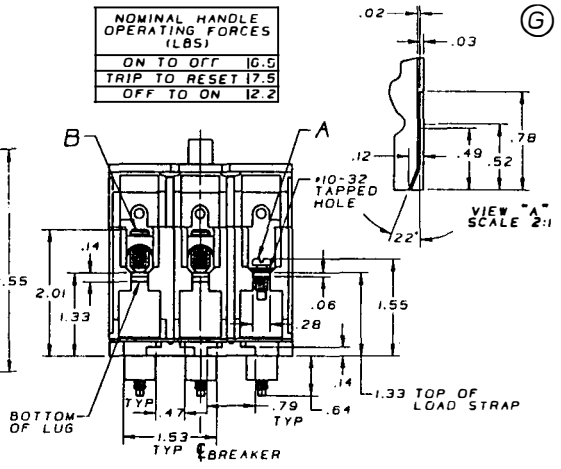
TEY Line- Three Pole Circuit Breaker



WIRE CONNECTOR	USED ON	WIRE RANGE CU	WIRE RANGE AL	LOAD END LUG TORQUE TO WIRE	LINE END MOUNTING SCREW TORQUE
A (SADDLE CLAMP)	15A-20A	#12-#14	#10-#12	#10 #12 -35LB-IN #14	25-32LB-IN
B (LUG)	30A-60A	#10-#6	#8-#4	#10-35LB-IN #8 -40LB-IN #6,#4-45LB-IN	
	70A-100A	#4-#1	#2-1/0	#4-1/0 45LB-IN	

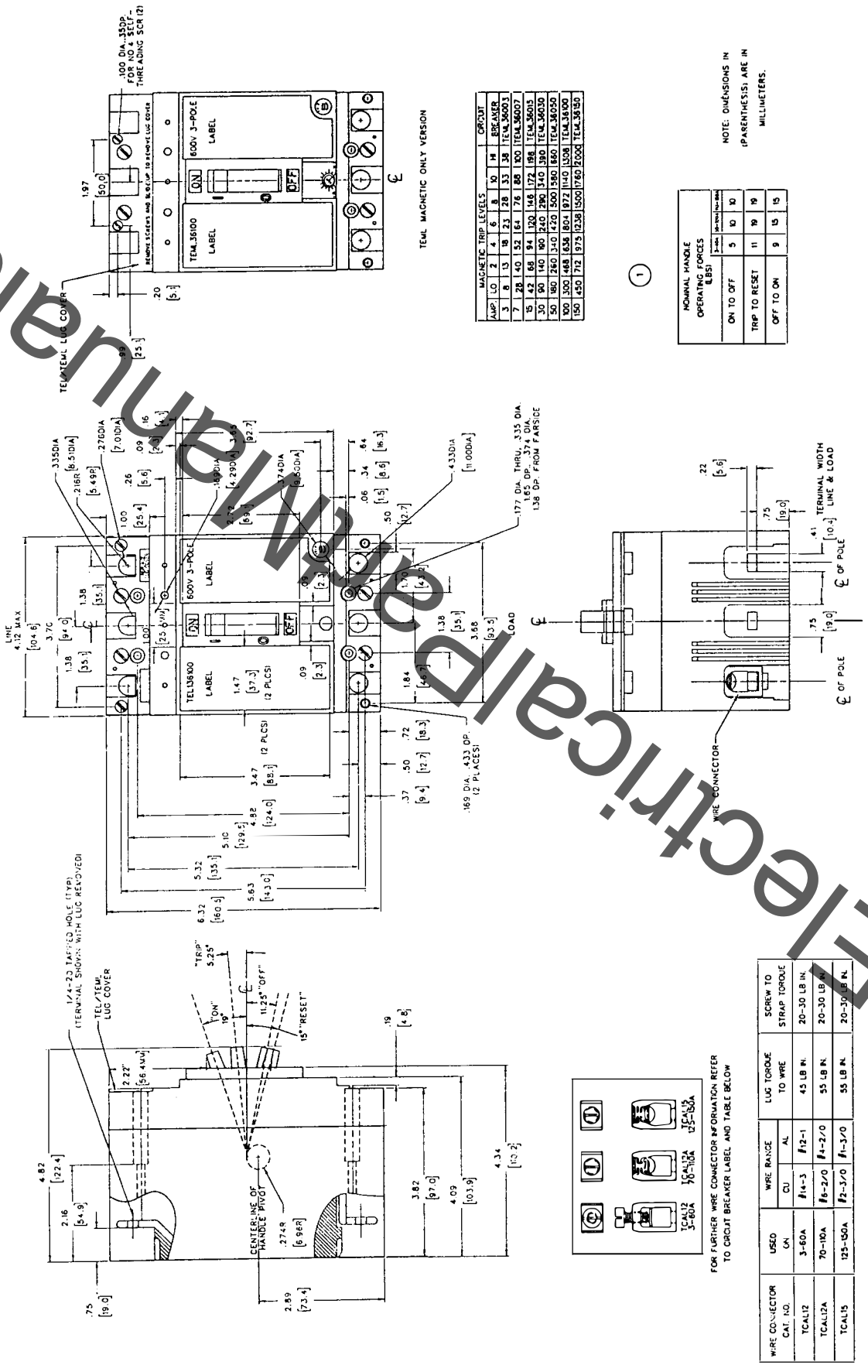
NOMINAL HANDLE OPERATING FORCES (LBS)	
ON TO OFF	16.5
TRIP TO RESET	17.5
OFF TO ON	12.2





NOTE: BREAKER IS SUITABLE FOR REVERSE FEEDING

E150 Line—TEL—CIRCUIT BREAKER



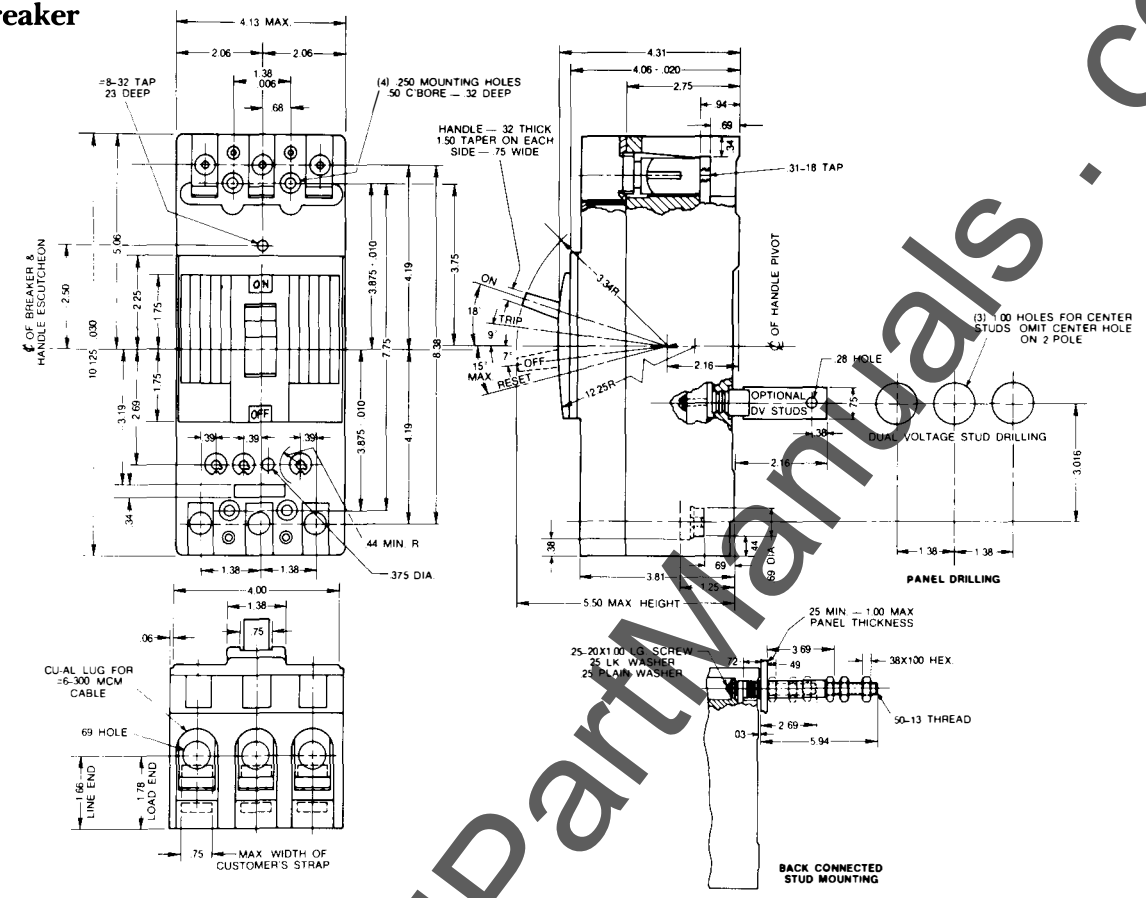
MAGNETIC TRIP LEVELS							CIRCUIT
AMP	LO	2	4	6	8	10	HI	BREAKER
3	8	13	18	23	28	33	38	TEM_36003
7	28	40	52	64	76	88	100	TEM_36007
15	42	68	94	120	146	172	198	TEM_36015
30	90	140	190	240	290	340	390	TEM_36030
50	180	260	340	420	500	580	660	TEM_36050
100	300	488	636	804	972	1140	1308	TEM_36100
150	450	712	975	1238	1500	1760	2000	TEM_36150

NOMINAL HANDLE OPERATING FORCES (LBS)	3-POLE	4-POLE & 4-POLE NEUTRAL
ON TO OFF	5	10
TRIP TO RESET	11	19
OFF TO ON	9	15

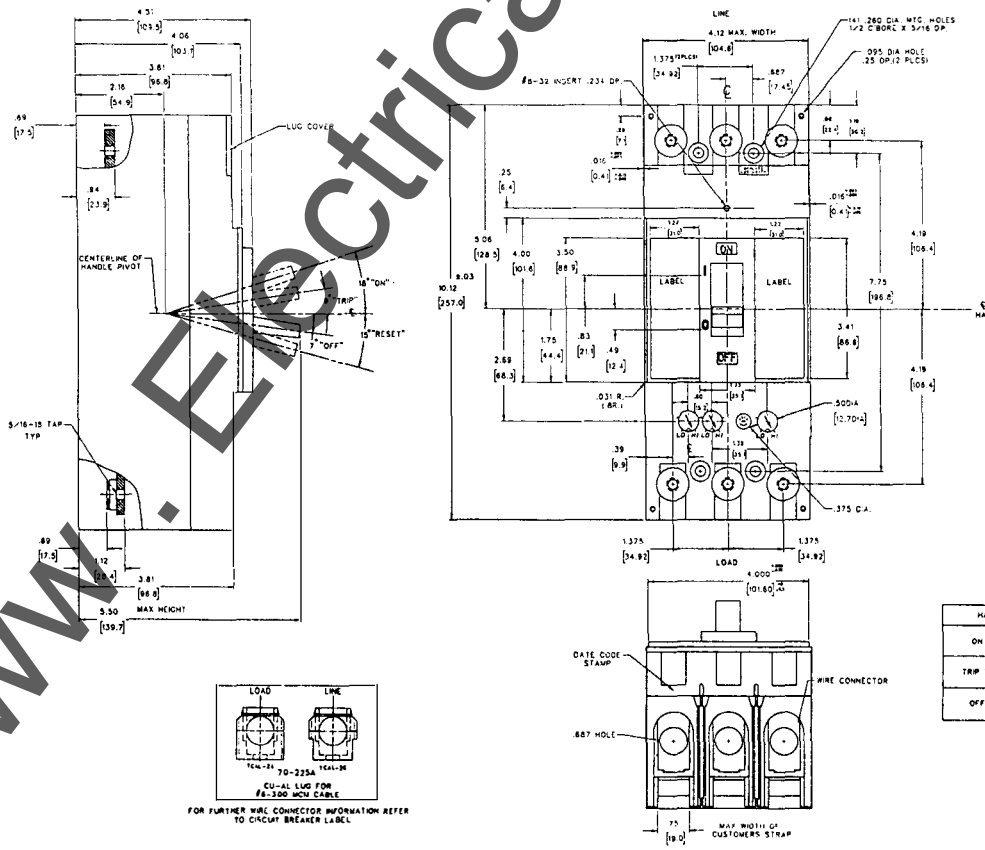
WIRE CONNECTOR CAT. NO.	USED ON	WIRE RANGE CU	WIRE RANGE AL	LUG TORQUE TO WIRE	SCREW TO STRAP TORQUE
TCAL12	3-60A	#14-3	#12-1	45 LB IN.	20-30 LB IN.
TCAL12A	70-110A	#6-2/0	#4-2/0	55 LB IN.	20-30 LB IN.
TCAL15	125-150A	#2-3/0	#1-3/0	55 LB IN.	20-30 LB IN.

Outline Drawings

F225 Line-F Frame Circuit Breaker



F225 Line-TFL Circuit Breaker

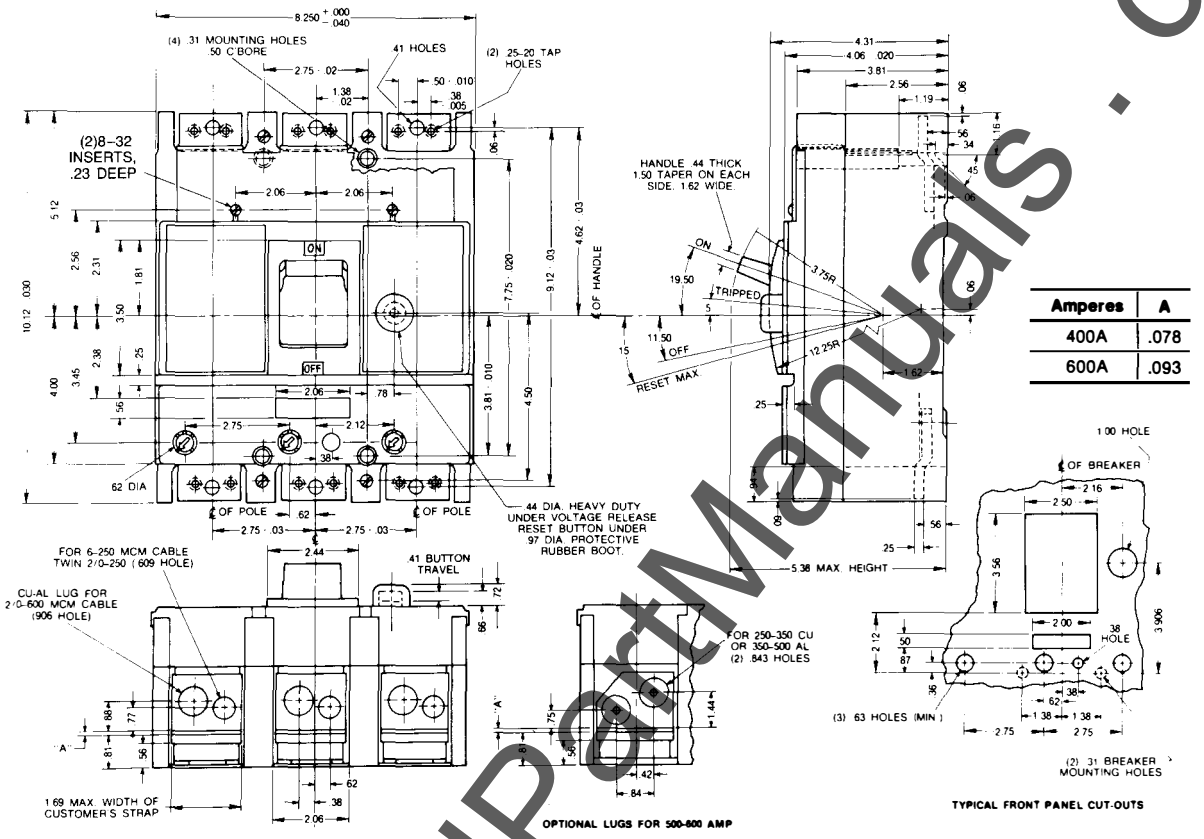


Magnetic Trip Levels			Circuit Breaker
Amps	Lo	Hi	
70	600	900	TFL236070WL
80	600	900	TFL236080WL
90	600	900	TFL236090WL
100	600	1250	TFL236100WL
125	600	1250	TFL236125WL
150	700	1500	TFL236150WL
175	800	1750	TFL236175WL
200	900	2000	TFL236200WL
225	1000	2250	TFL236225WL

HANDLE FORCE (LBS.)	
ON TO OFF	8
TRIP TO RESET	20
OFF TO ON	20

NOTE: DIMENSIONS IN (PARENTHESES) ARE IN MILLIMETERS

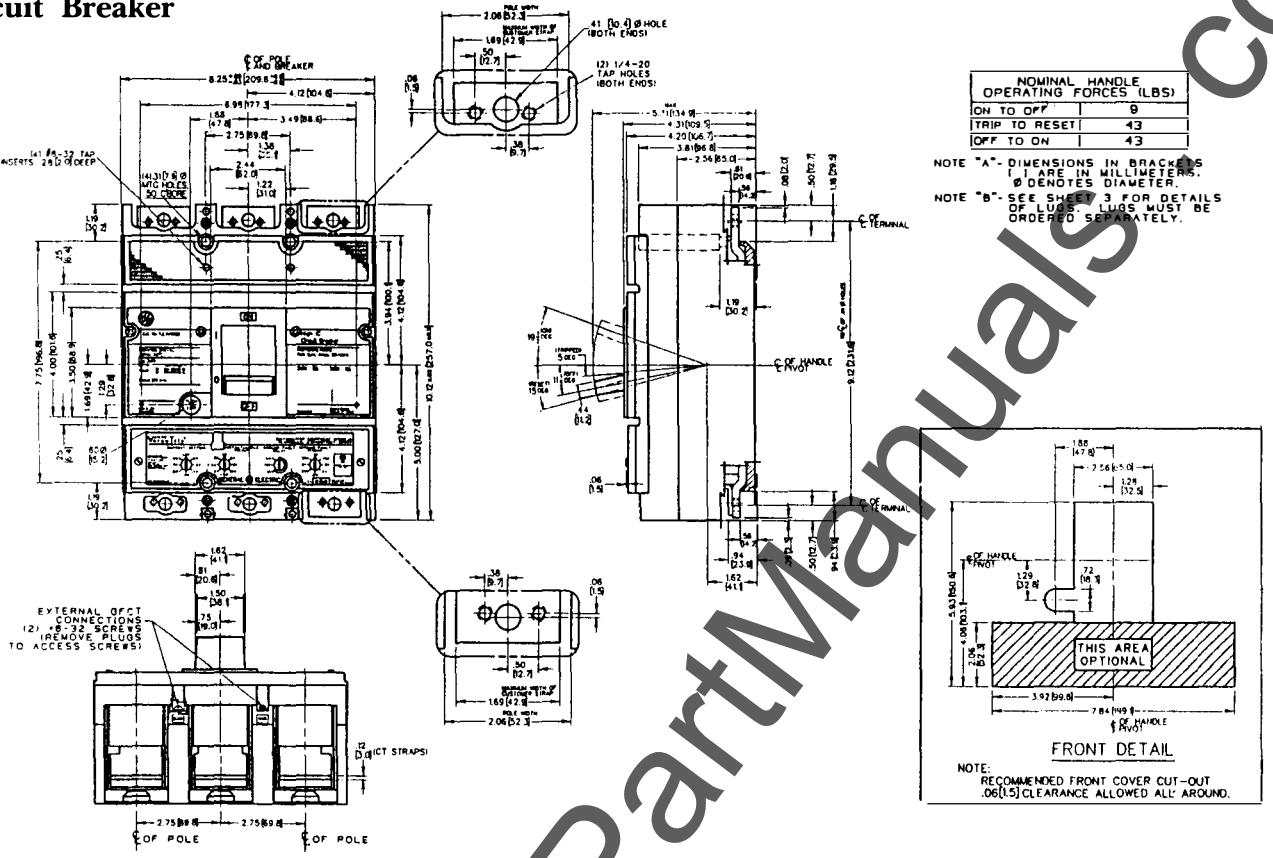
J600 Line-J Frame
Circuit Breaker



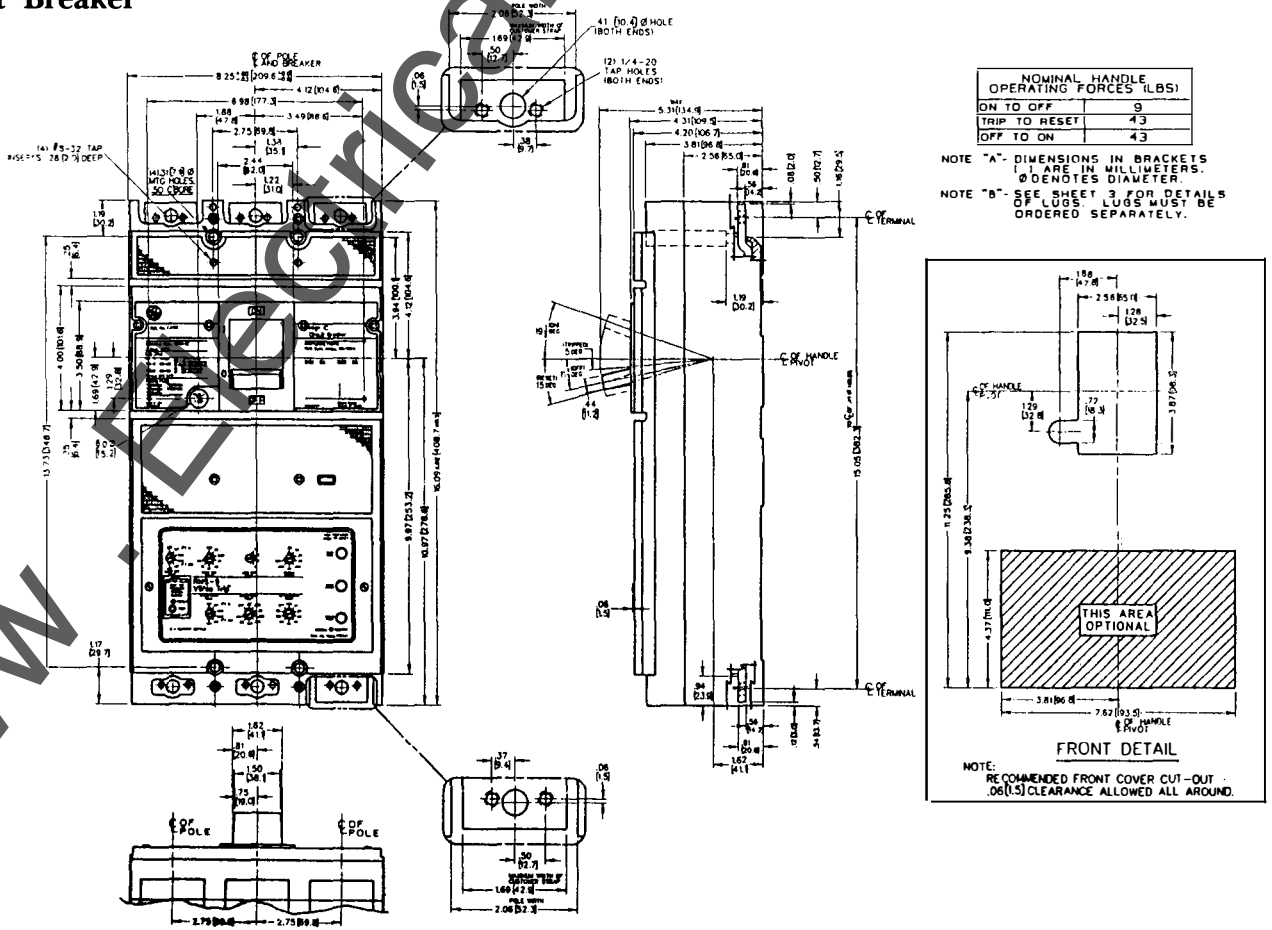
Amperes	A
400A	.078
600A	.093

Outline Drawings

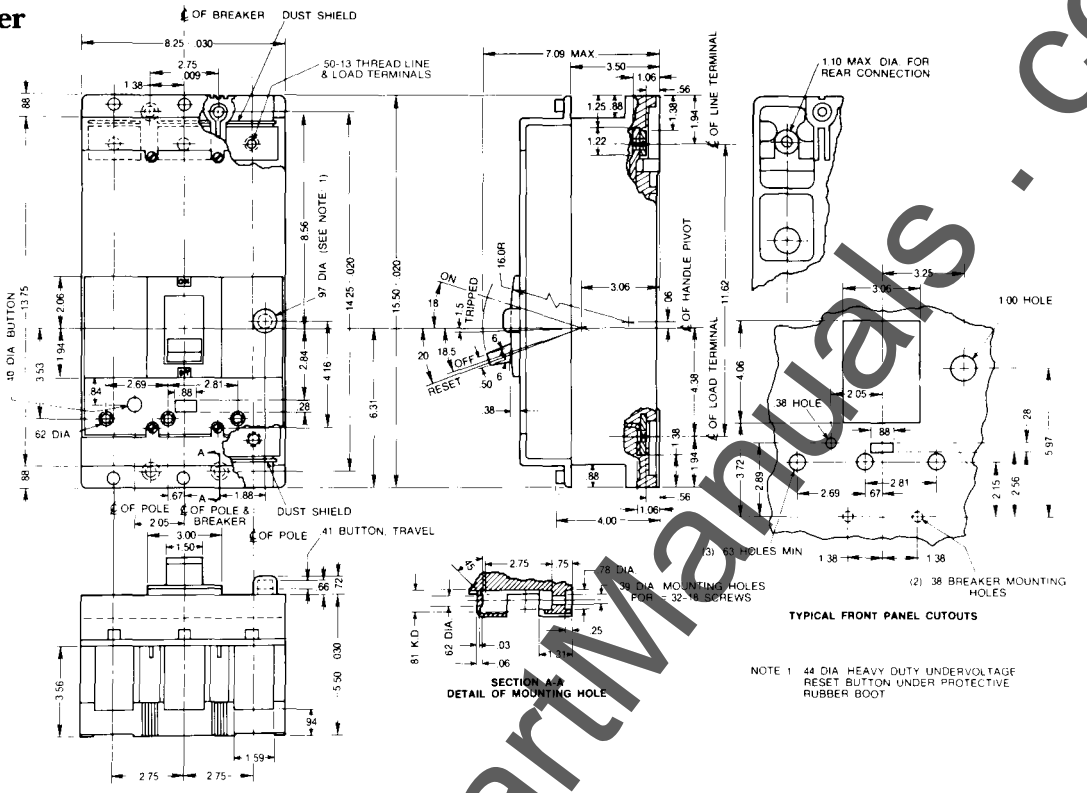
J400 Line-MicroVersaTrip® 4 Circuit Breaker



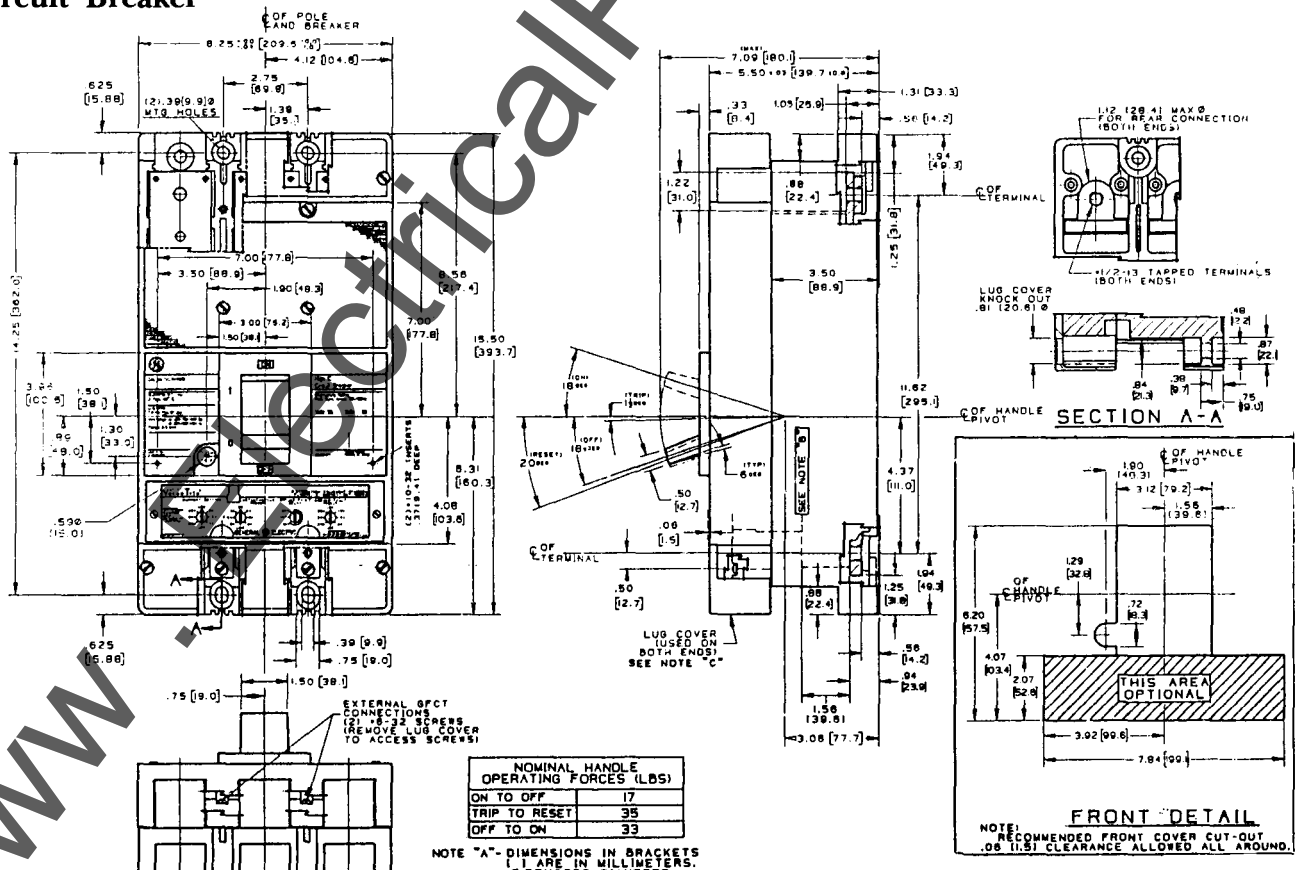
J600 Line-MicroVersaTrip® RMS-9 Circuit Breaker



K1200 Line-K Frame Circuit Breaker



K1200 Line-MicroVersaTrip® 4 Circuit Breaker



NOMINAL HANDLE OPERATING FORCES (LBS)	
ON TO OFF	17
TRIP TO RESET	35
OFF TO ON	33

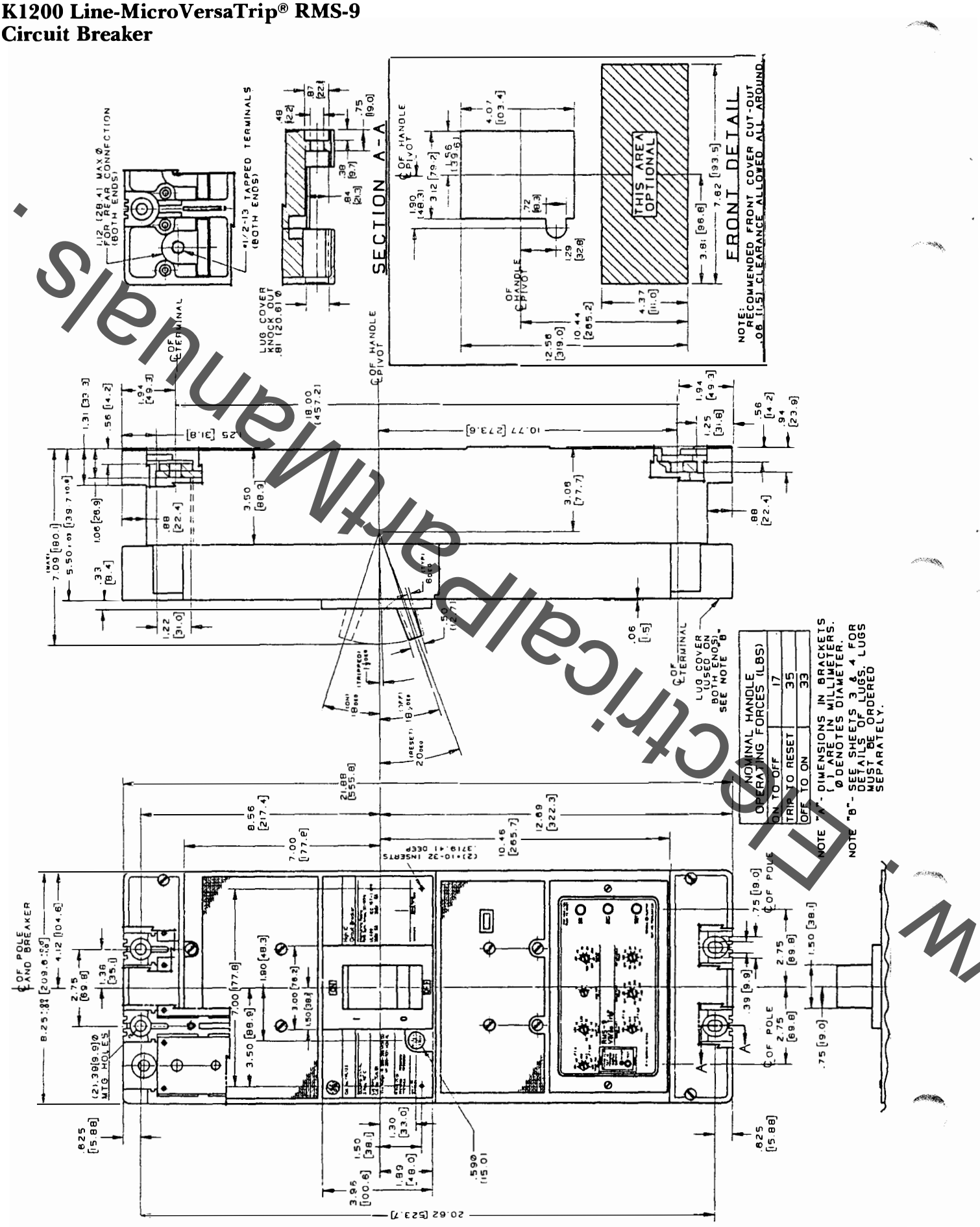
NOTE "A"- DIMENSIONS IN BRACKETS [ ] ARE IN MILLIMETERS. Ø DENOTES DIAMETER.

NOTE "B"- BUSS CONNECTIONS TO BE MADE AT THIS LEVEL. *(PROGRAMMER END ONLY)*

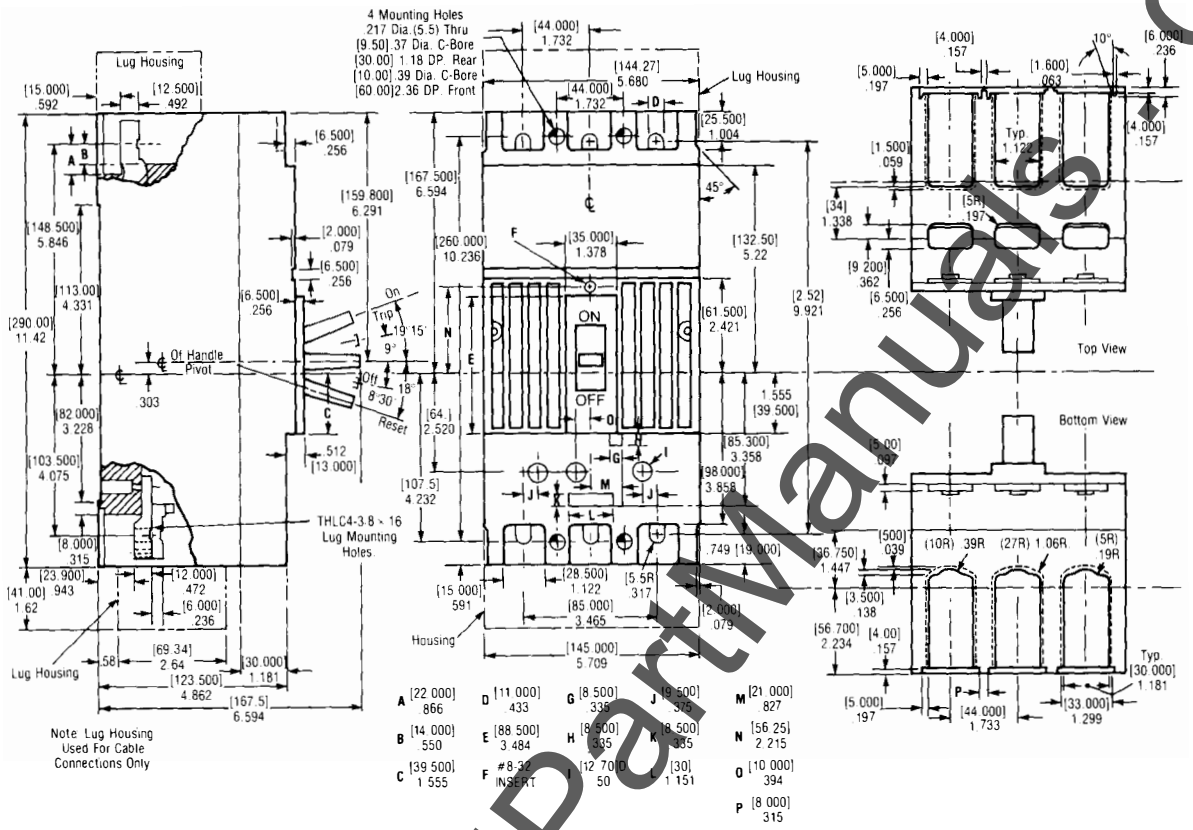
NOTE "C"- SEE SHEETS 3 & 4 FOR DETAILS OF LUGS. LUGS MUST BE ORDERED SEPARATELY.

Outline Drawings

K1200 Line-MicroVersaTrip® RMS-9 Circuit Breaker

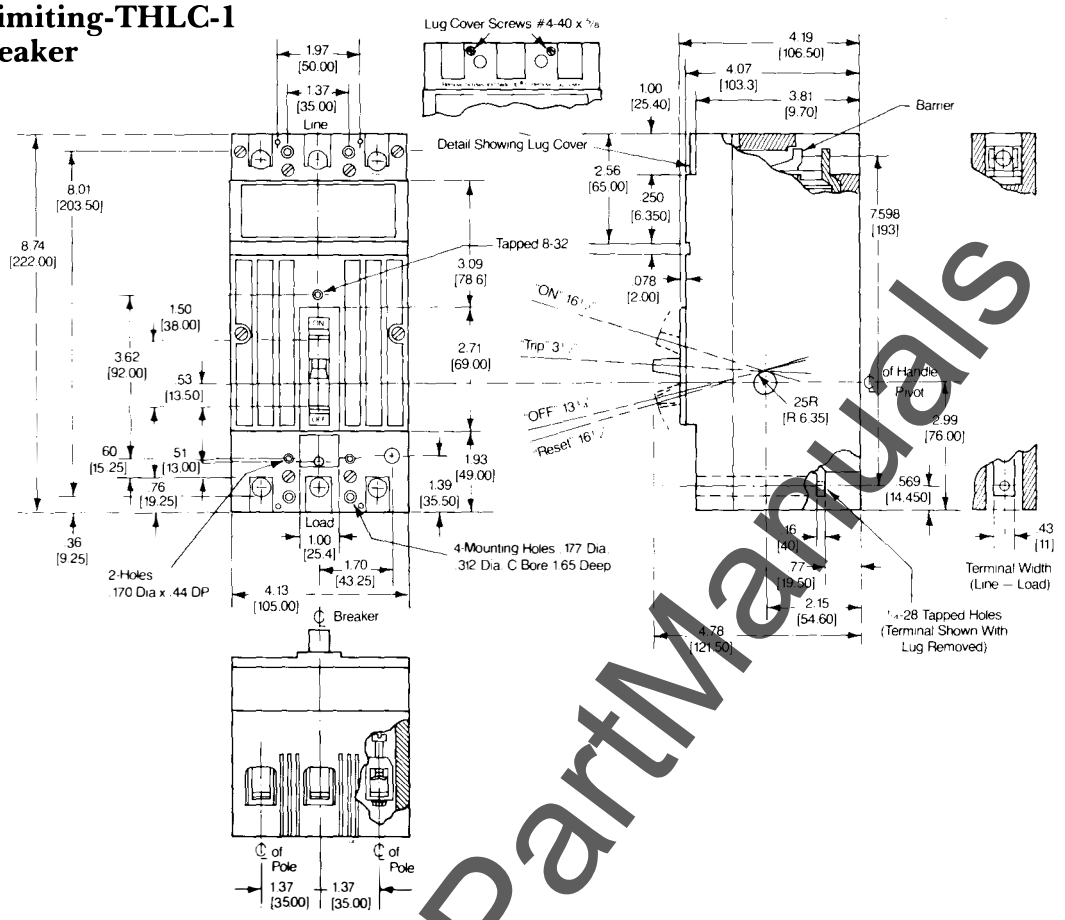


TLB4—65KAIC
Circuit Breaker

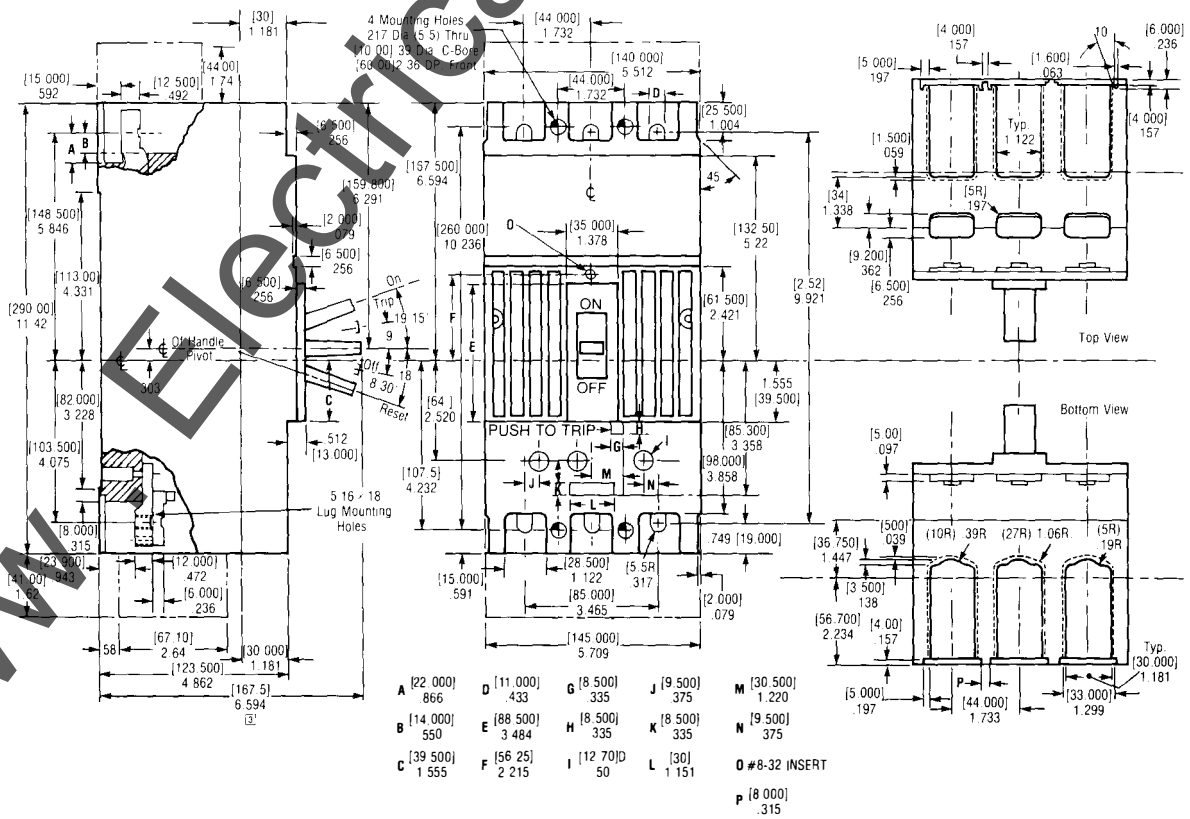


Outline Drawings

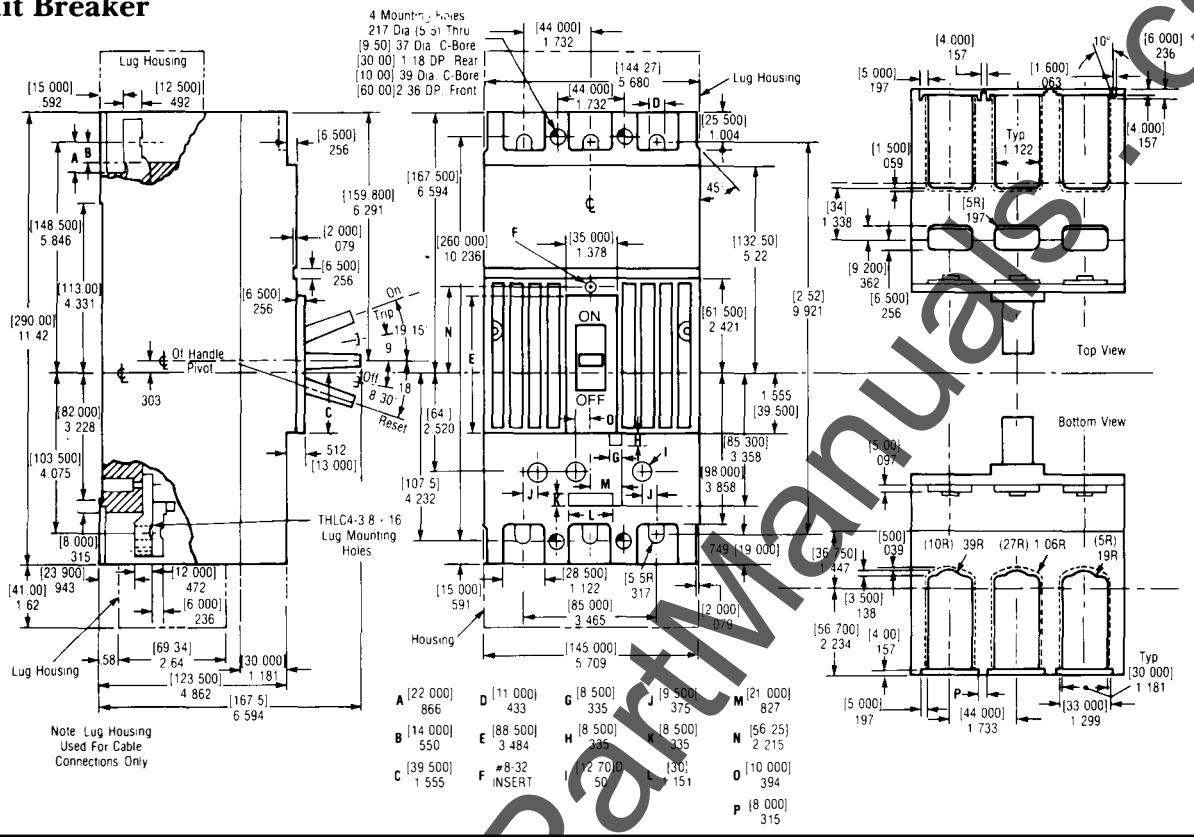
Current Limiting-THLC-1 Circuit Breaker



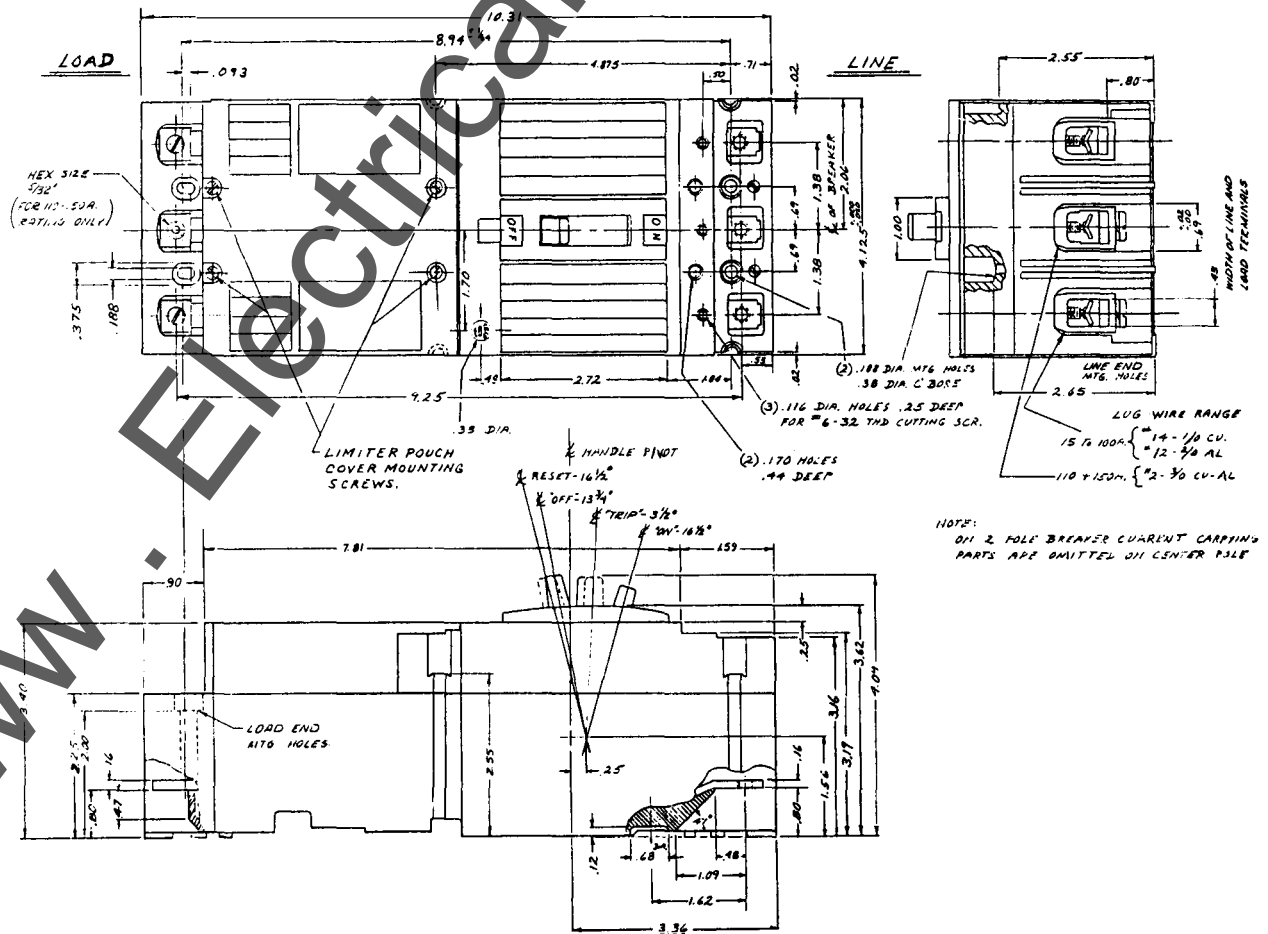
Current Limiting-THLC-2 Circuit Breaker



Current Limiting-THLC-4 Circuit Breaker

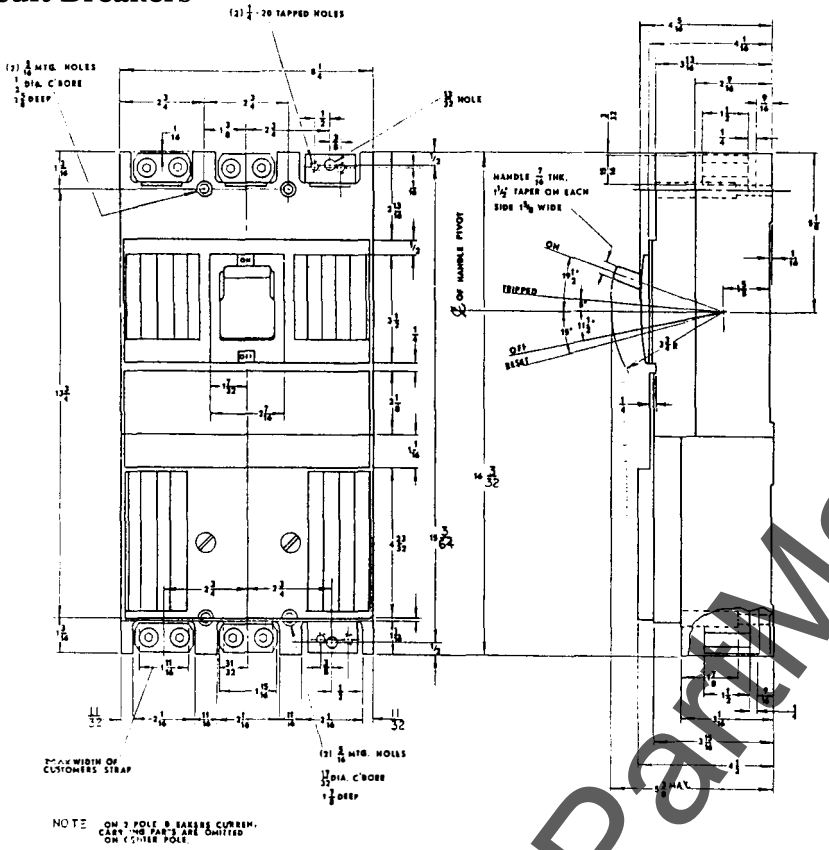


Tri-Break® TB-1 Circuit Breaker

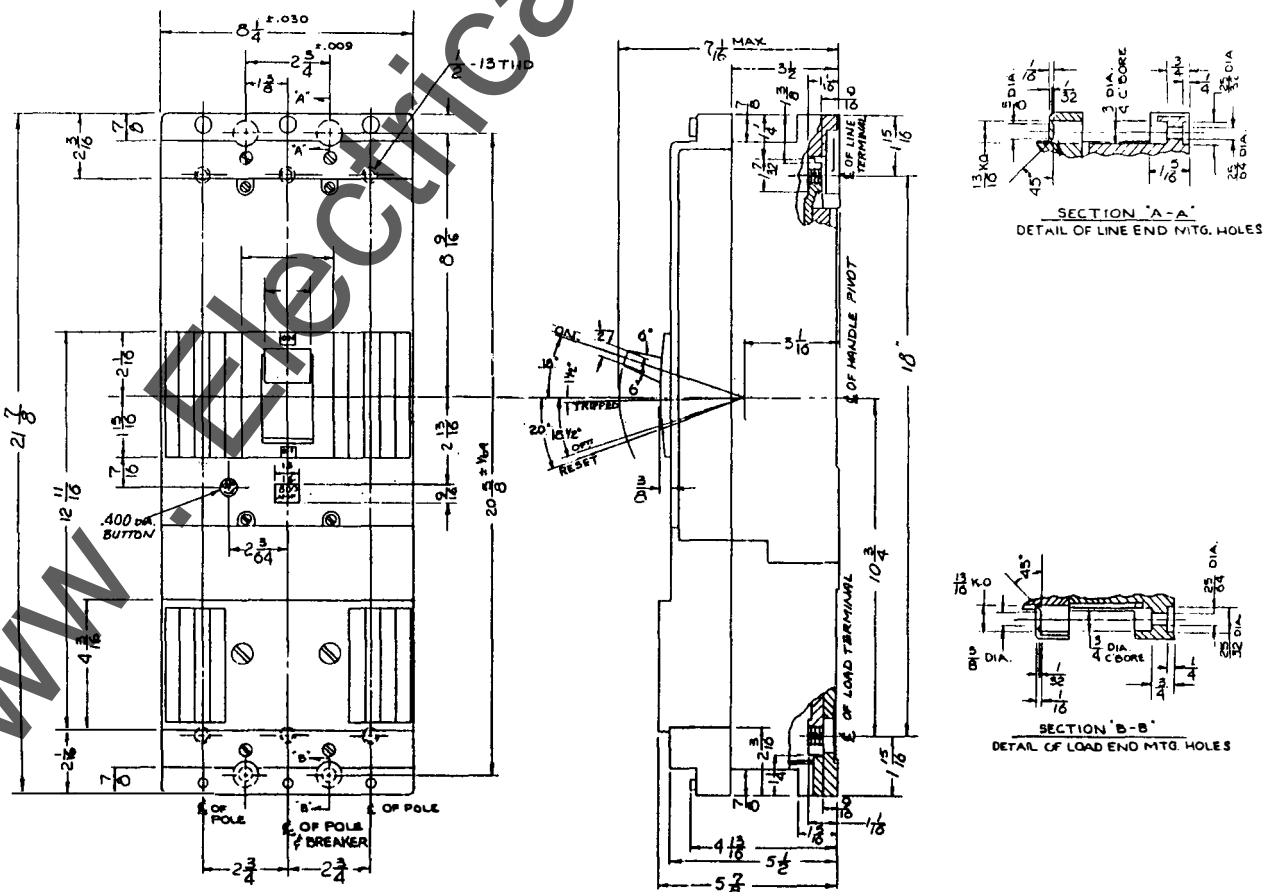


Outline Drawings

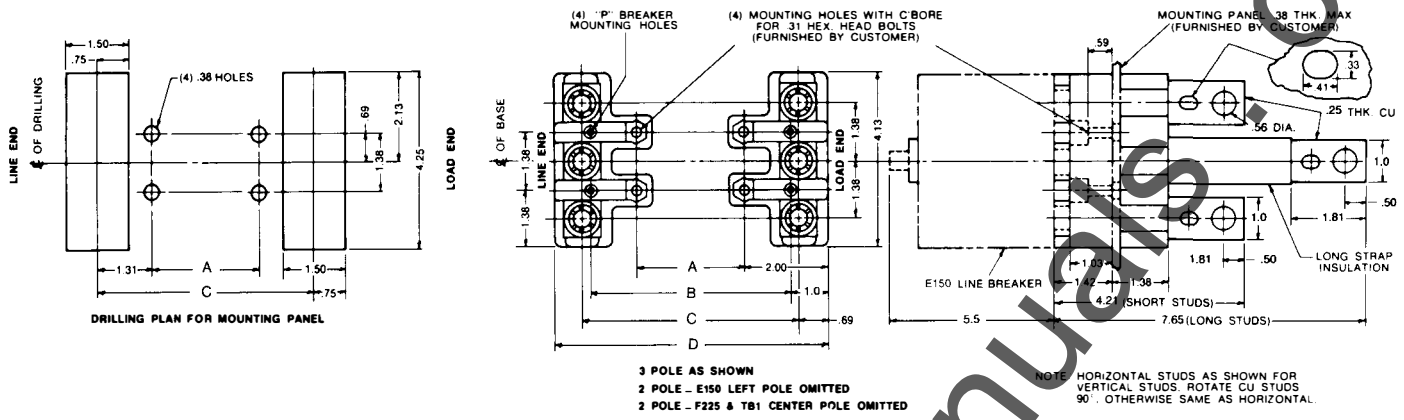
Tri-Break® TB-4, TBC-4 Circuit Breakers



Tri-Break® TB-6, TBC-6, TB-8, TBC-8 Circuit Breakers



Plug-In Bases

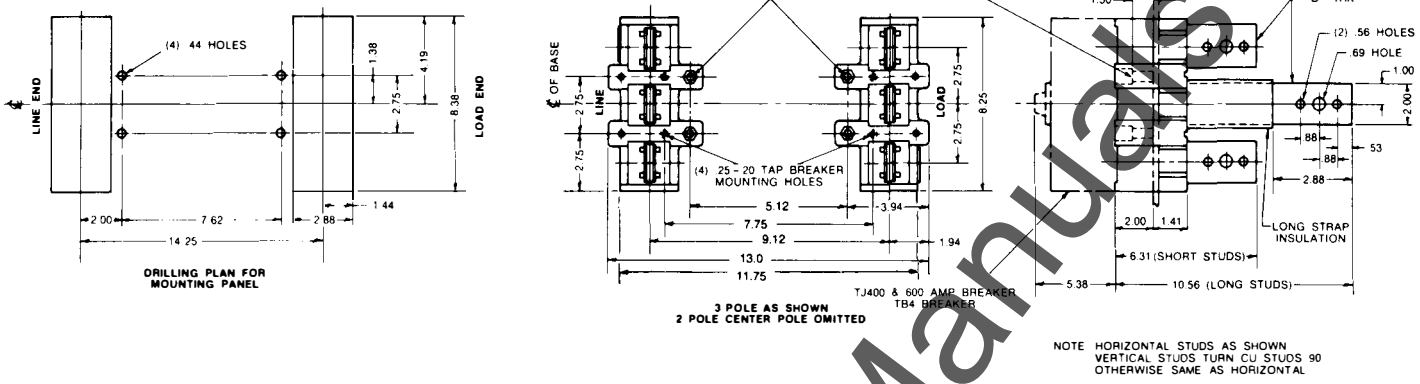


Breaker Type	Dimensions in inches						
	A	B	C	D	E	F	G
E150	2.63	4.88	5.25	6.63	4.14	4.16	6.84
F225	5.75	7.25	8.09	9.47	4.69	4.16	6.84
TB-1	6.66	8.91	9.28	10.66	4.25	4.16	6.84

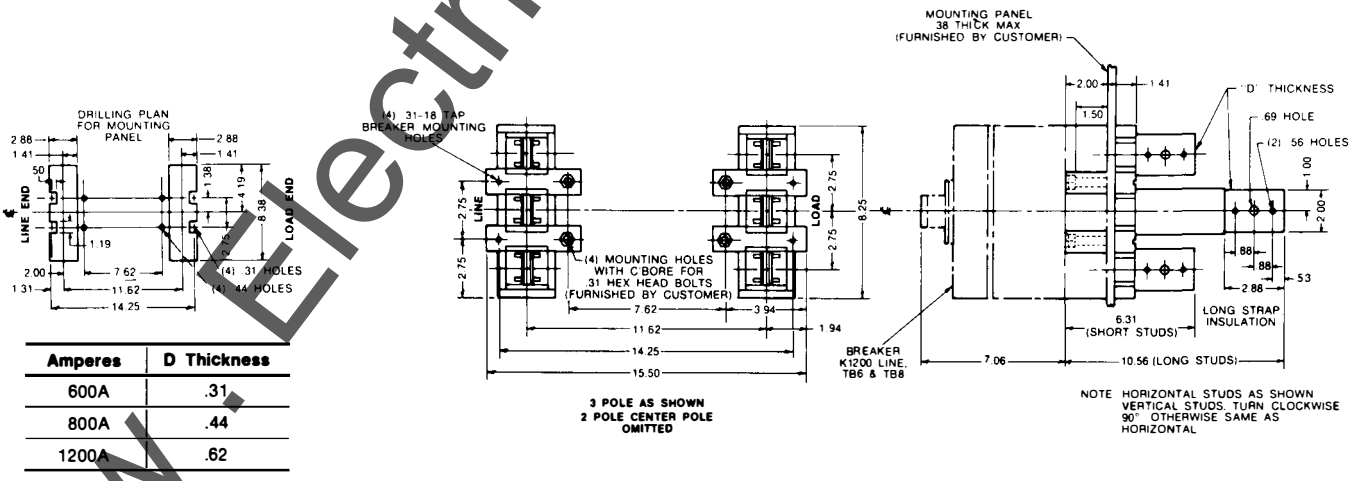
E150 and F225 Line

Outline Drawings

Plug-In Bases



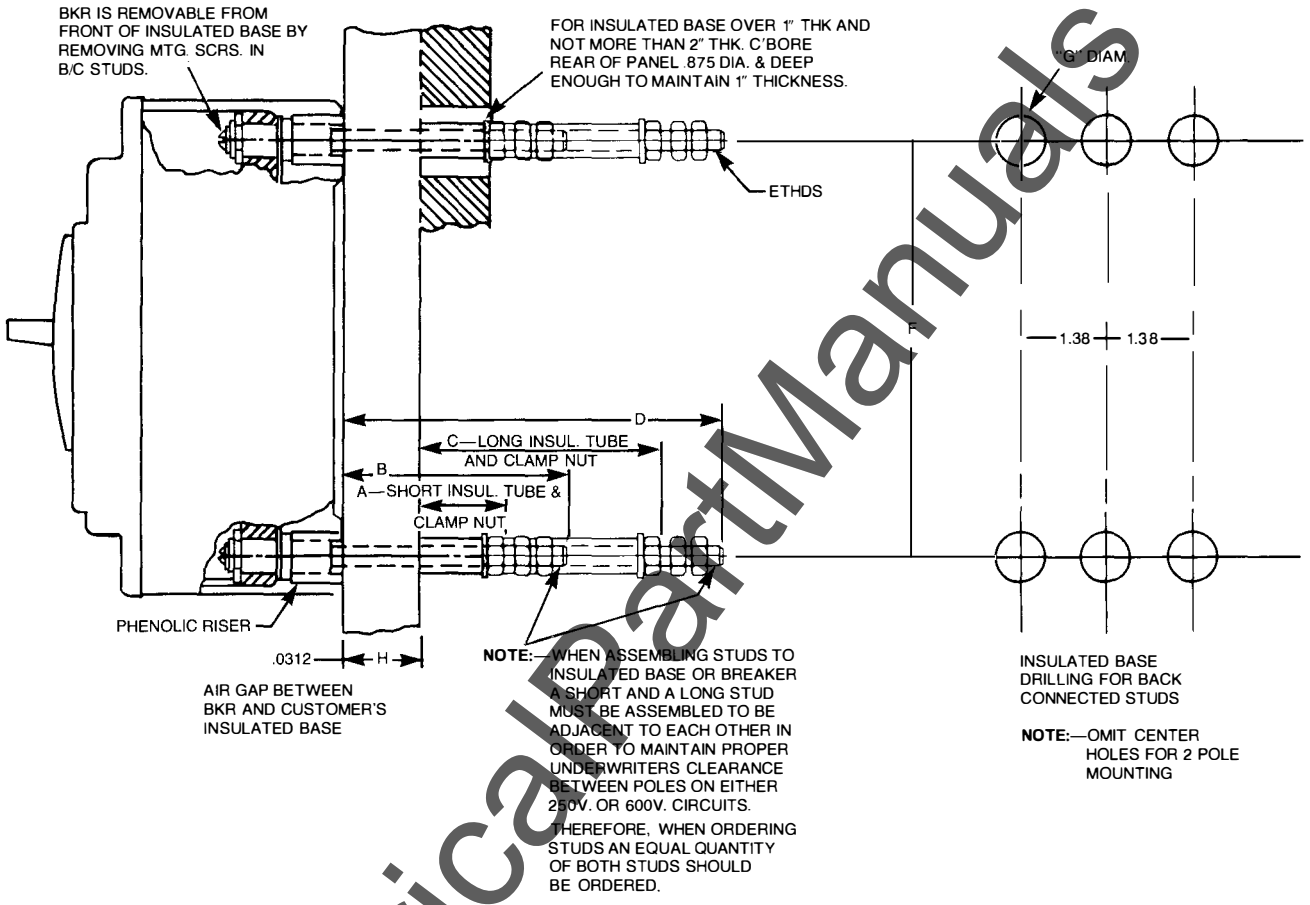
J600 Line



Amperes	D Thickness
600A	.31
800A	.44
1200A	.62

K1200 Line

Back Connected Studs

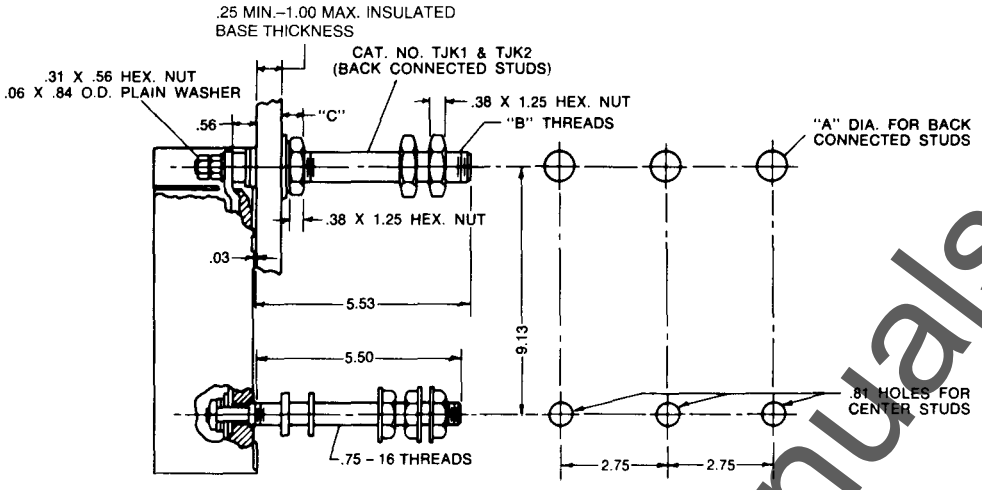


										H	
Breaker	**Stud Cat.**	**Rating & Length**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**Min**	**Max**
E-150	TEF 1	15-50A Short	1.06	2.75			.25-20	5.25	.32	.5	1
	TEF 2	15-50A Long			2.56	4.38	.25-20	5.25	.32	.5	1
	TEF 3	60-150A Short	1.25	3.375			.375-16	5.25	.44	.5	1
	TEF 4	60-150A Long			3.62	5.75	.375-16	5.25	.44	.5	1
F-225	TFK 1	225A Short	.44	2.69			.5-13	8.38	.56	.25	1
	TFK 2	225A Long			3.69	5.94	.5-13	8.38	.56	.25	1

E150 and F225 Line

Outline Drawings

Back Connected Studs

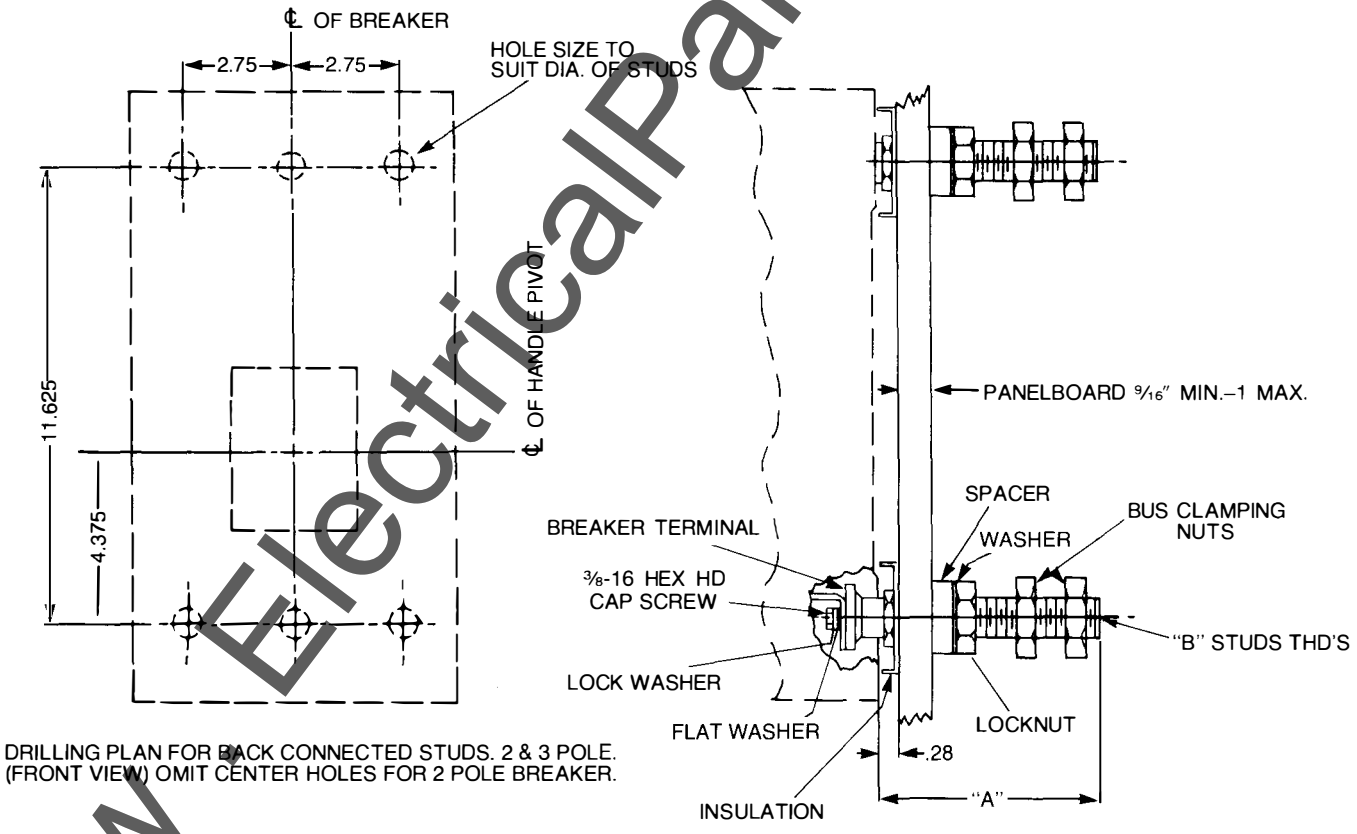


Catalog No.	A	B	C
TJK1	.81	.75-16.00	.63
TJK2	1.00	.94-16.00	.88

INSULATED BASE DRILLING FOR BACK CONNECTED STUDS & CENTER STUDS

NOTE: OMIT CENTER HOLES FOR 2 POLE MOUNTING

J600 Line



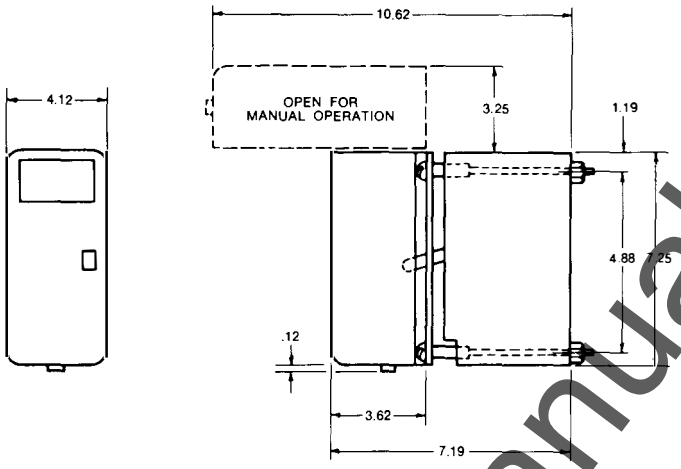
DRILLING PLAN FOR BACK CONNECTED STUDS. 2 & 3 POLE. (FRONT VIEW) OMIT CENTER HOLES FOR 2 POLE BREAKER.

Cat. No.	Amp. Max.	"A"	"B" Stud THD'S
TKM9*	400	5.5	.75 × 16
TKM10*	600	5.5	.9375 × 16
TKM11	800 to 1200	5.5	1.125 × 16
TKM12		8	1.125 × 16

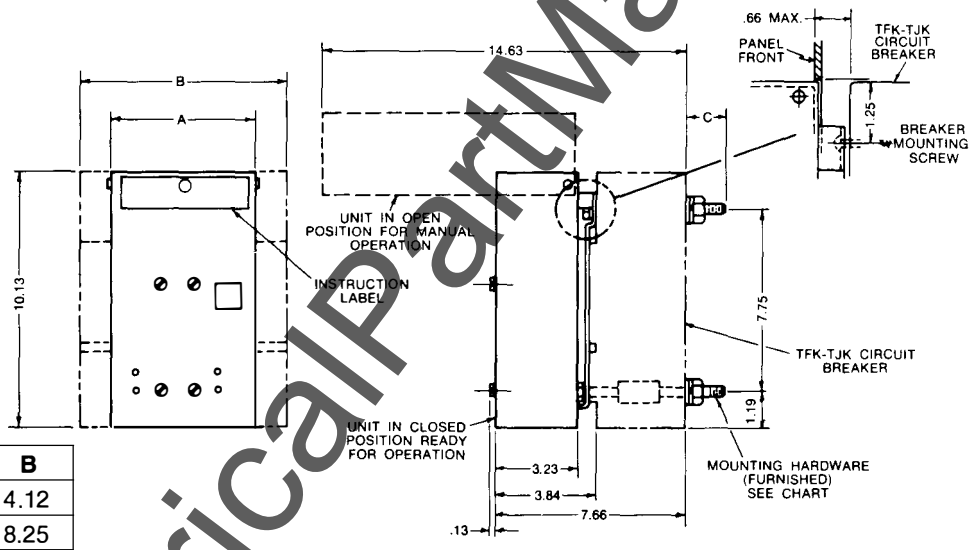
*Discontinued

K1200 Line

Motor Operated Mechanisms

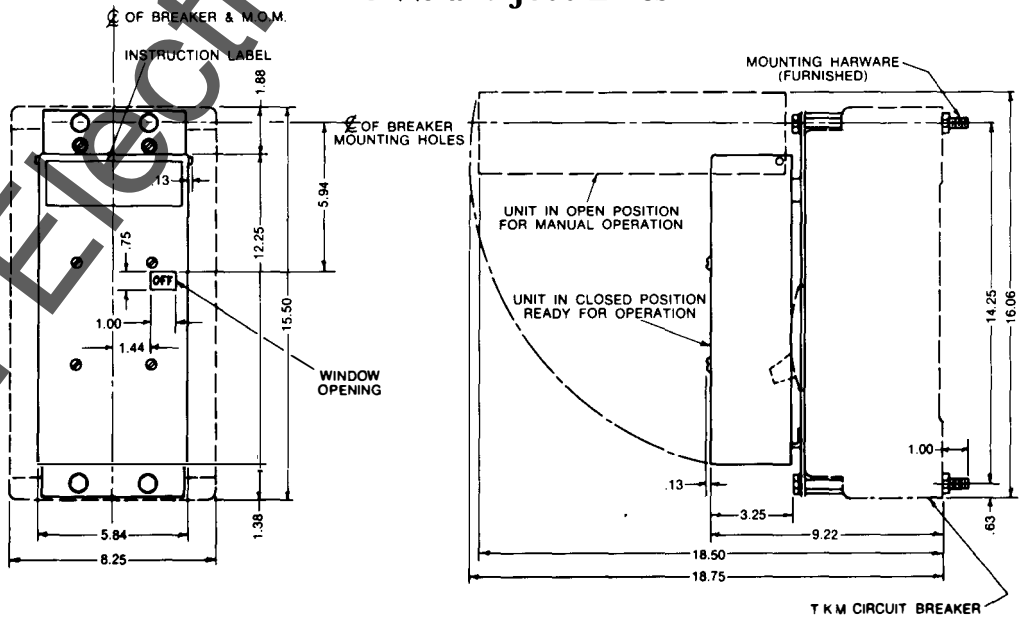


E150 Line



	A	B
F225	3.97	4.12
J600	5.85	8.25

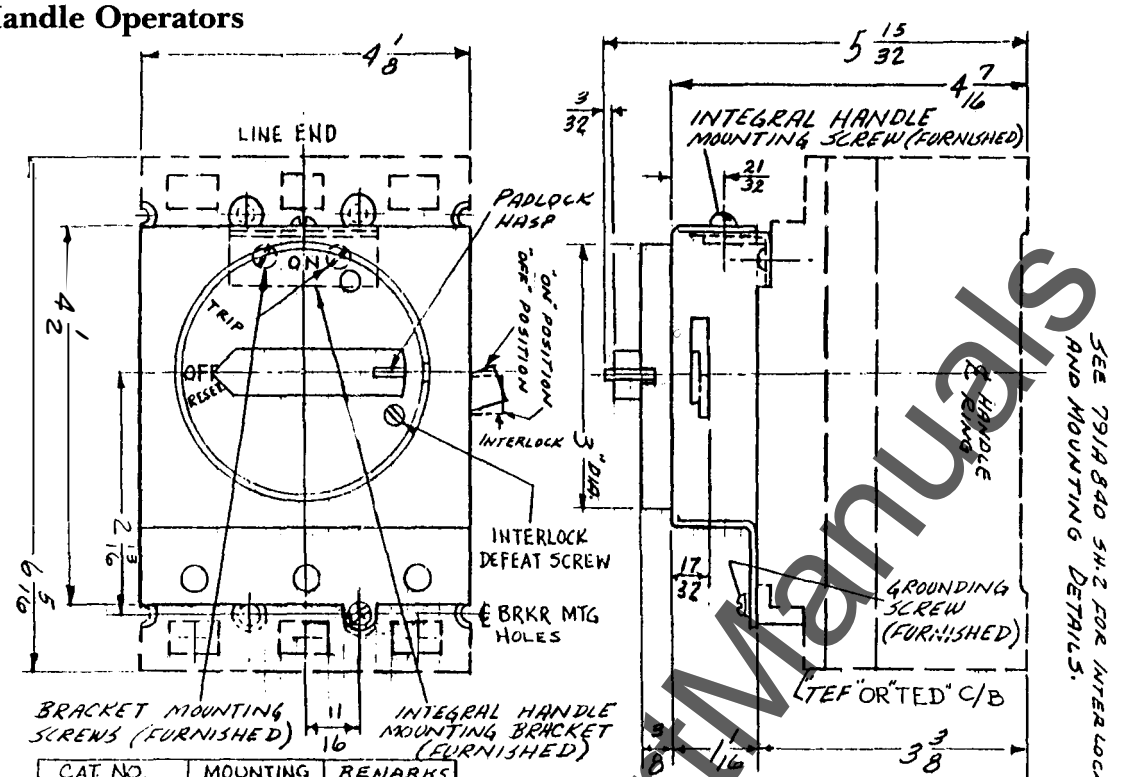
F225 and J600 Lines



K1200 Line

Outline Drawings

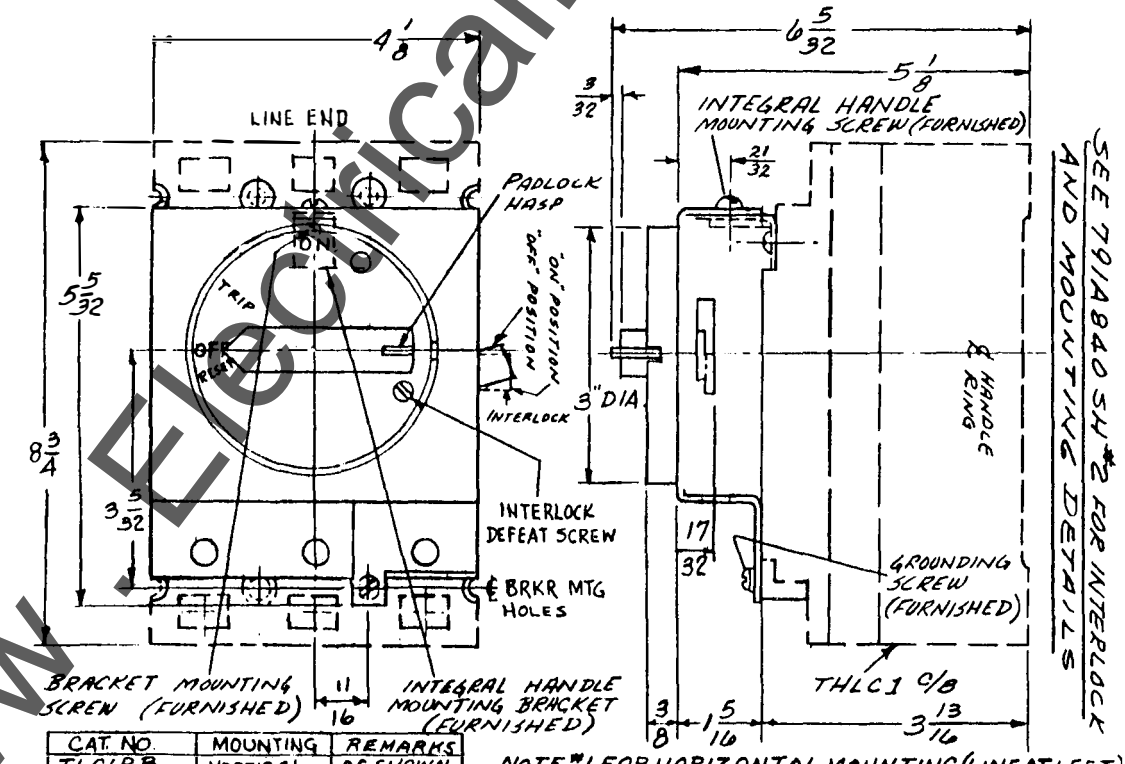
TDR Handle Operators



CAT. NO.	MOUNTING	REMARKS
TEFKIB	VERTICAL	AS SHOWN
TEFRIHB	HORIZONTAL	SEE NOTE "1

NOTE "1 FOR HORIZONTAL MOUNTING (LINE AT LEFT) THE HANDLE ESCUTCHEON AND INDICATING PLATE ARE ROTATED CLOCKWISE 90° FROM SHOWN POSITION. MOUNTING POSITION VARIATIONS MUST BE ORDERED FROM FACTORY. (SEE TABLE)

E150 Line

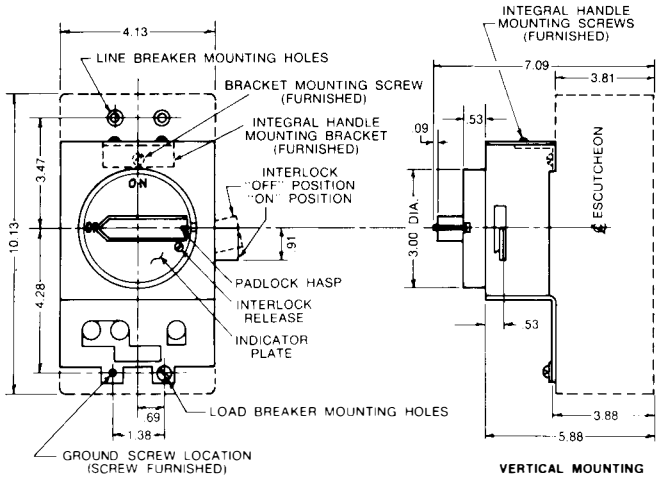


CAT. NO.	MOUNTING	REMARKS
TLCIRB	VERTICAL	AS SHOWN
TLCIRHB	HORIZONTAL	SEE NOTE "1

NOTE "1 FOR HORIZONTAL MOUNTING (LINE AT LEFT) THE HANDLE ESCUTCHEON AND INDICATING PLATE ARE ROTATED CLOCKWISE 90° FROM SHOWN POSITION. MOUNTING POSITION VARIATIONS MUST BE ORDERED FROM FACTORY. (SEE TABLE)

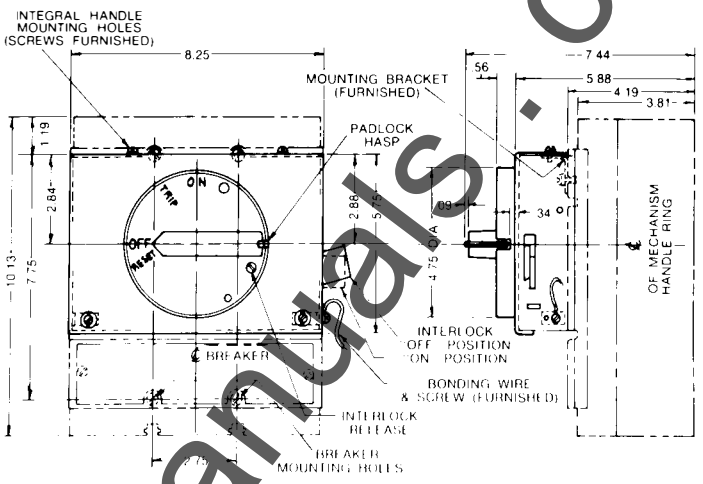
THLC-1

TDR Handle Operators (cont.)



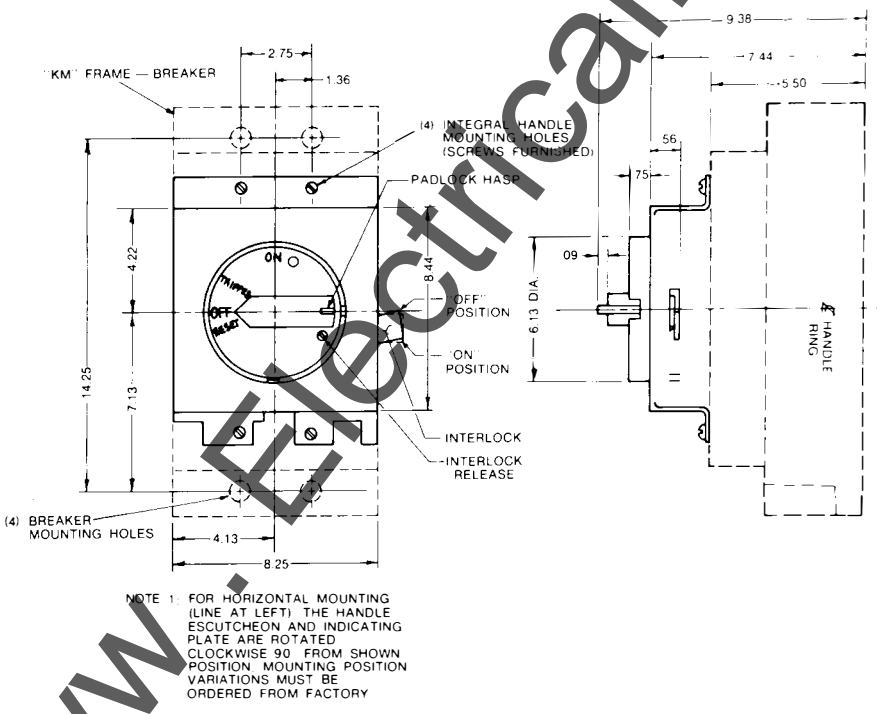
NOTE 1 FOR HORIZONTAL MOUNTING (LINE AT LEFT) THE HANDLE ESCUTCHEON AND INDICATING PLATE ARE ROTATED CLOCKWISE 90 FROM SHOWN POSITION MOUNTING POSITION VARIATIONS MUST BE ORDERED FROM FACTORY

F225 Line



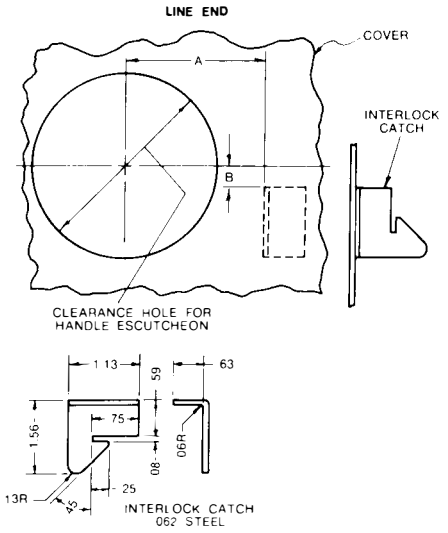
NOTE 1 FOR HORIZONTAL MOUNTING (LINE AT LEFT) THE HANDLE ESCUTCHEON AND INDICATING PLATE ARE ROTATED CLOCKWISE 90 FROM SHOWN POSITION MOUNTING POSITION VARIATIONS MUST BE ORDERED FROM FACTORY

J600 Line



NOTE 1 FOR HORIZONTAL MOUNTING (LINE AT LEFT) THE HANDLE ESCUTCHEON AND INDICATING PLATE ARE ROTATED CLOCKWISE 90 FROM SHOWN POSITION MOUNTING POSITION VARIATIONS MUST BE ORDERED FROM FACTORY

K1200 Line



DOOR INTERLOCK BRACKET

Catalog No.	A	B
TJR1HB TJVR1B TJR1B TJVR1HB	4.50	.69
TEFR1HB TEFR1B TFKR1B TFKR1HB	2.25	.31
TKMR1B TKMR1HB TKVR1B TKVR1HB	4.63	.91

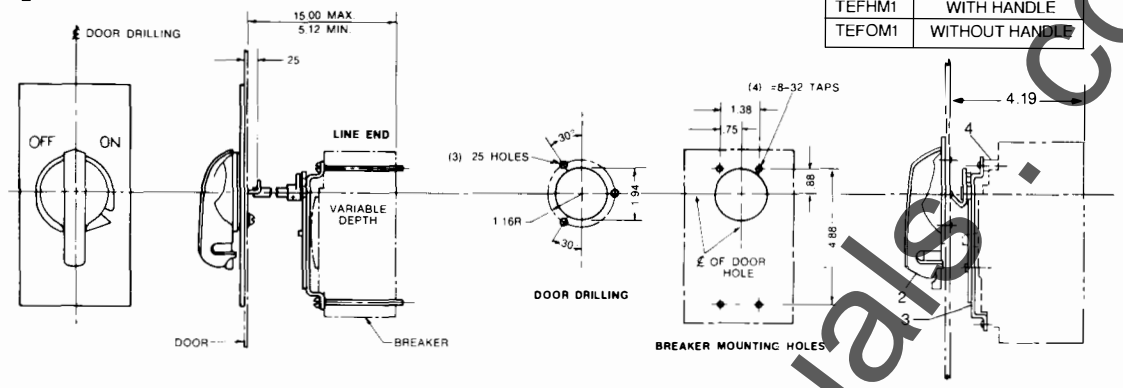
Door Interlock Bracket

Outline Drawings

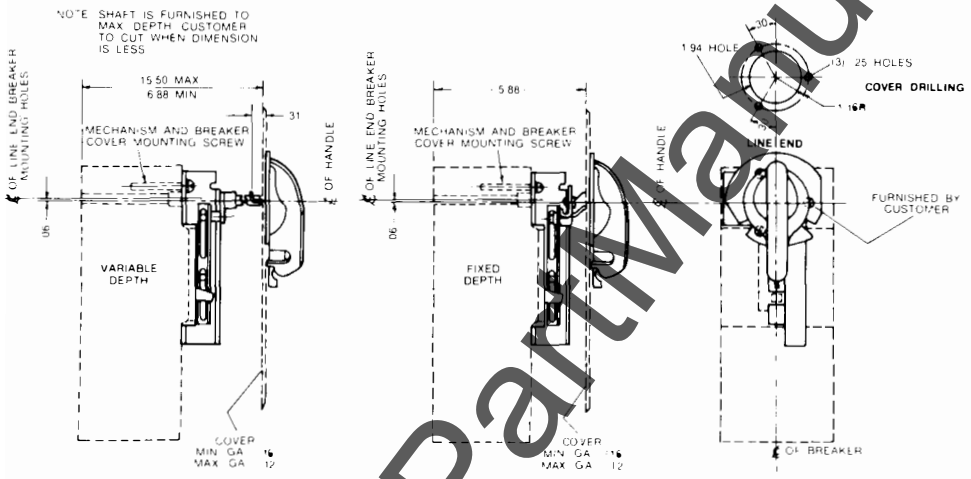
TDM Handle Operators

CAT. NO.	REMARKS
TEFHM1	WITH HANDLE
TEFOM1	WITHOUT HANDLE

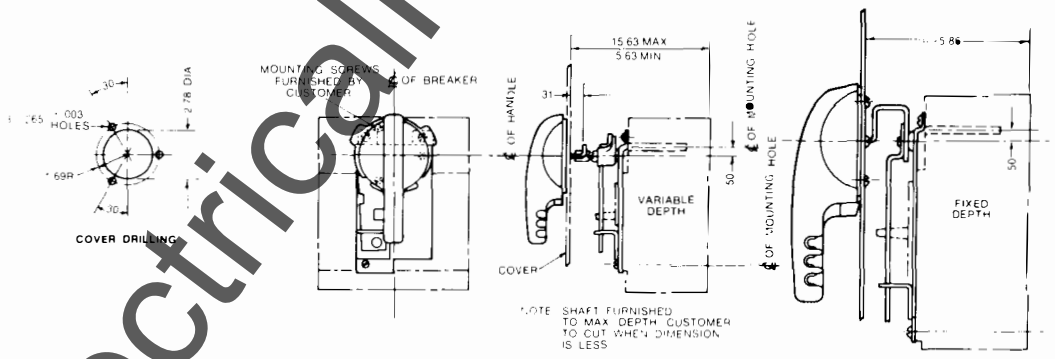
E150 Line



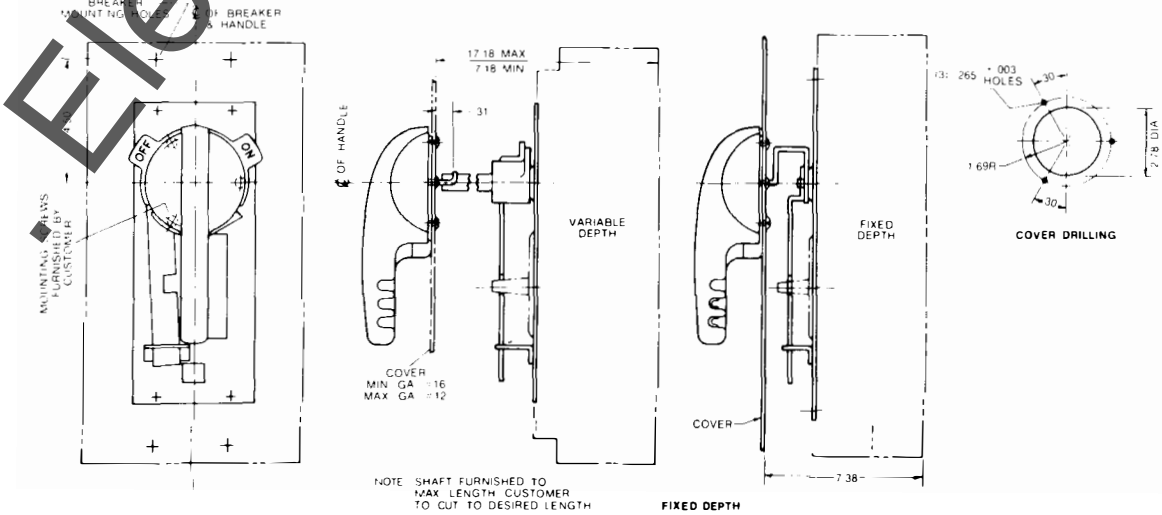
F225 Line



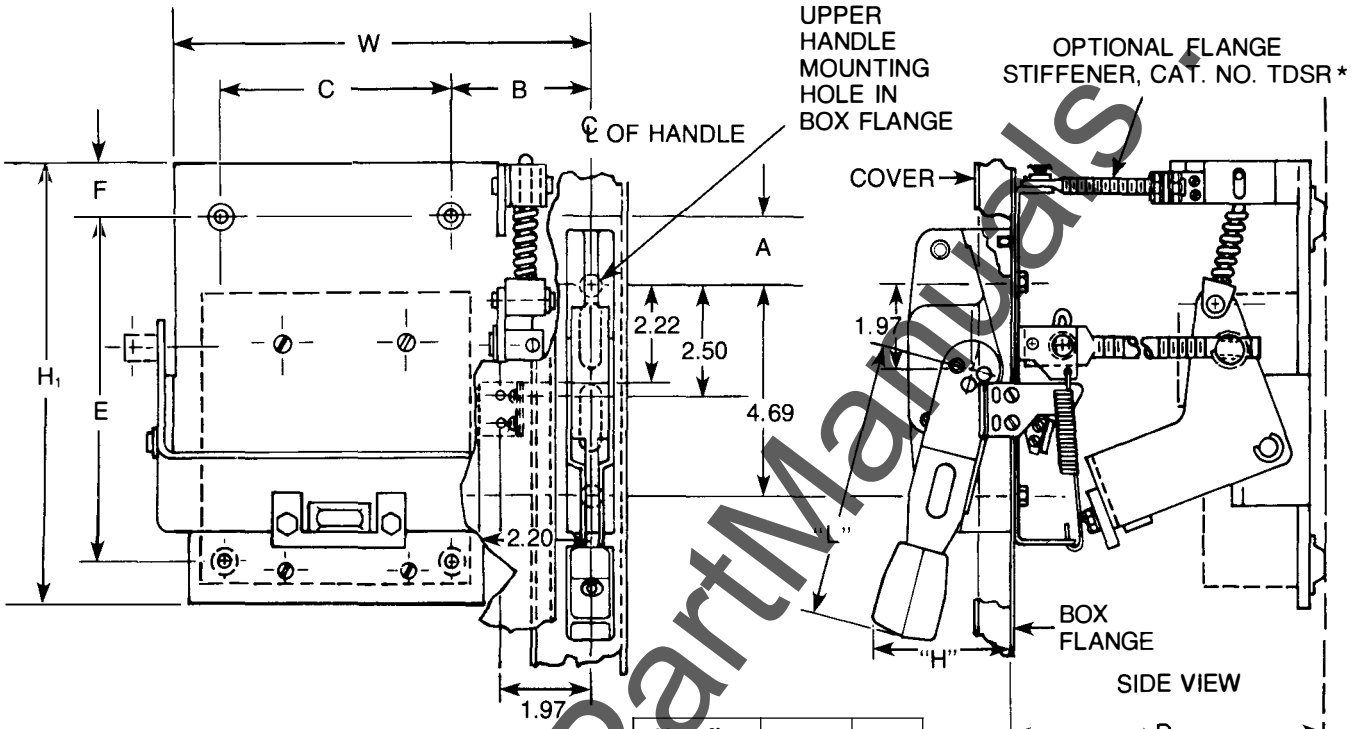
J600 Line



K1200 Line



TDA Handle Operators



Handle Cat. No.	"L"	"H"
TDA1	6.22	3.12
TDA2	10.22	4.09

* Flange stiffener provided with operating mechanisms Cat. No. TDOM4-TDOM7

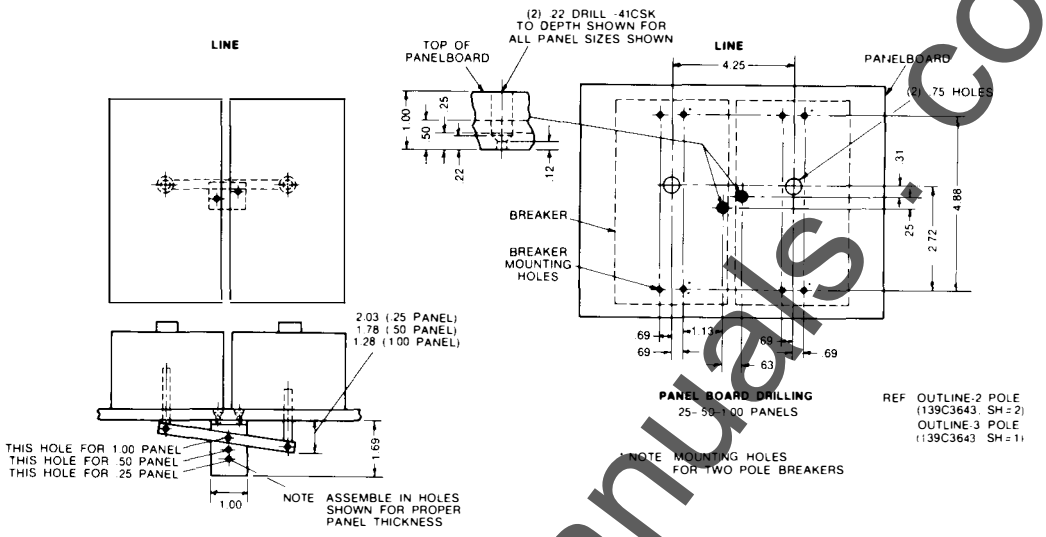
Circuit Breaker Type	Operating Mechanism Cat. No.	A	B	C	D	E	F	H_1	W
E-150	TDOM1A	1.62	1.78	3.00	6.50	6.75	1.20	9.69	6.25
TEL, TEML	TDOM1C								
THLC1	TDOM1D								
TB1	TDOM1B		1.78	3.00	6.50	6.75	1.20	14.23	6.25
②	TDOM3		2.72	2.75	6.75	10.88	1.38	13.38	6.75
J-600	TDOM4	2.25	2.66	5.50	8.00	8.62	1.30	11.81	10.33
TB4	TDOM5	2.25			8.00	14.62	1.30	17.75	
①	TDOM6	6.00			9.00	10.50	1.00	18.75	
TB6, TB8	TDOM7	6.00			9.00	23.12	1.00	25.12	

①K-1200, THLC2, TLB2, THLC4, TB4
②F225, TFL

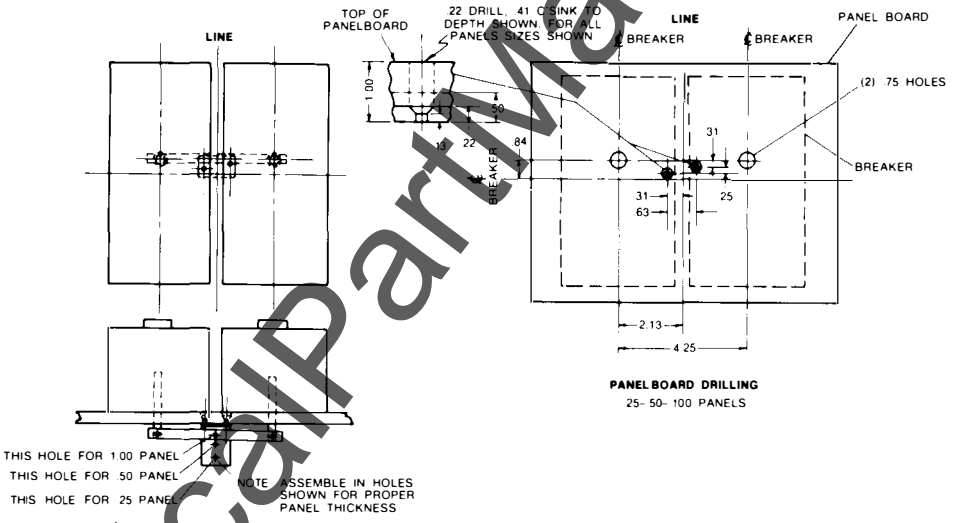
Outline Drawings

Mechanical Interlocks

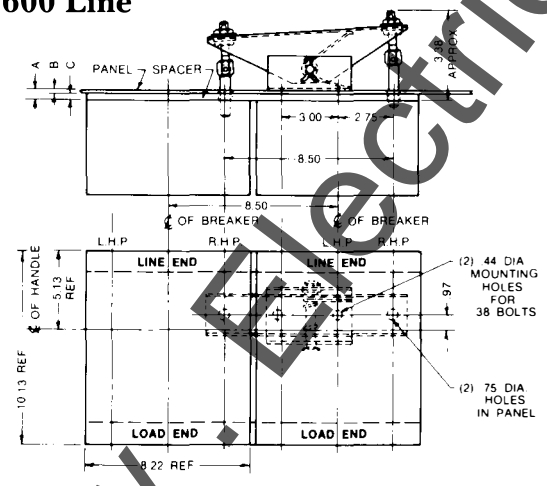
E150 Line



F225 Line



J600 Line



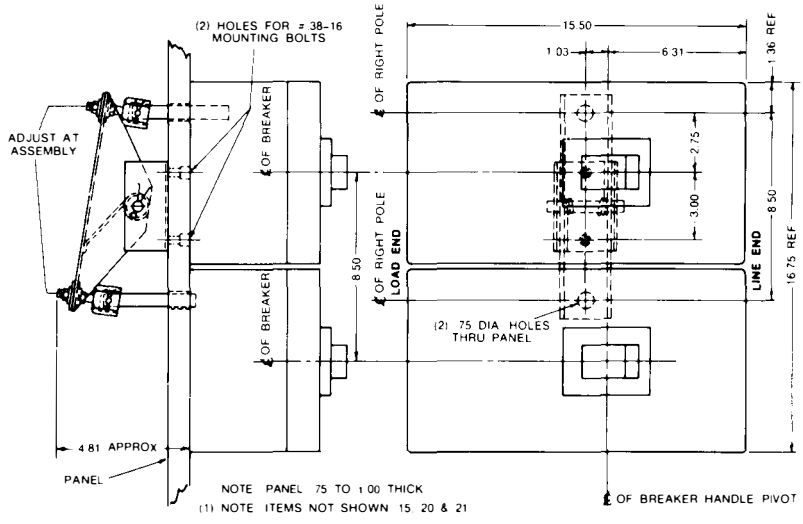
NOTE "A" RISERS ARE NEEDED TO CLEAR BREAKERS OF BOLT HEADS USED TO MOUNT SUPPORT TO PANELS

NOTE "B" 1.00 THK. PANEL NEEDS NO RISERS. C'BORE .44 MOUNTING HOLES TO RECESS MOUNTING BOLT HEADS

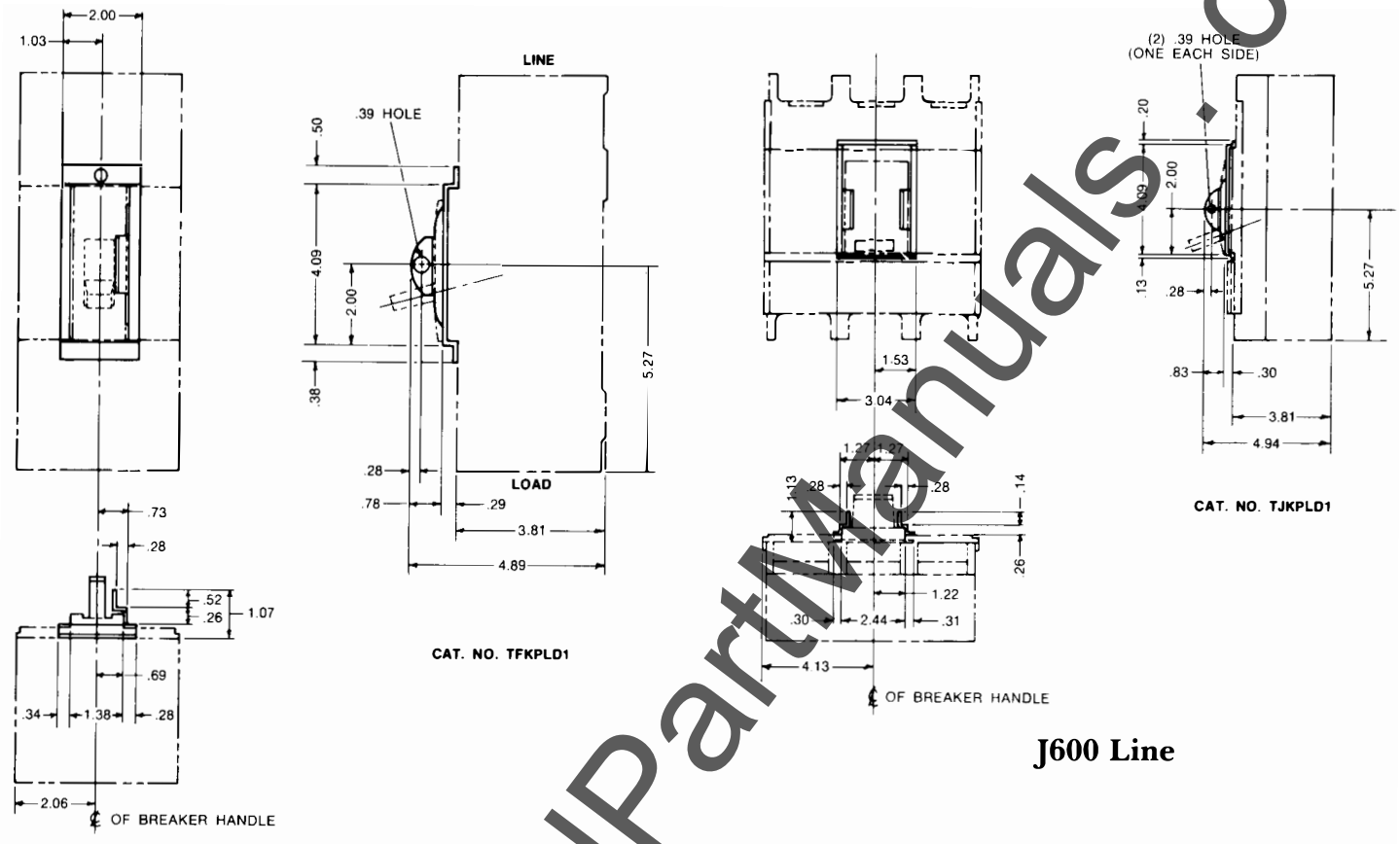
NOTE "C" PANEL & SPACERS (SUPPLIED BY CUSTOMER)

Catalog No.	A	B	C	Remarks
TJKMIB	.38	.13	.25	See Note "A"
TJKMIE	1.00	None	None	See Note "B"

K1200 Line

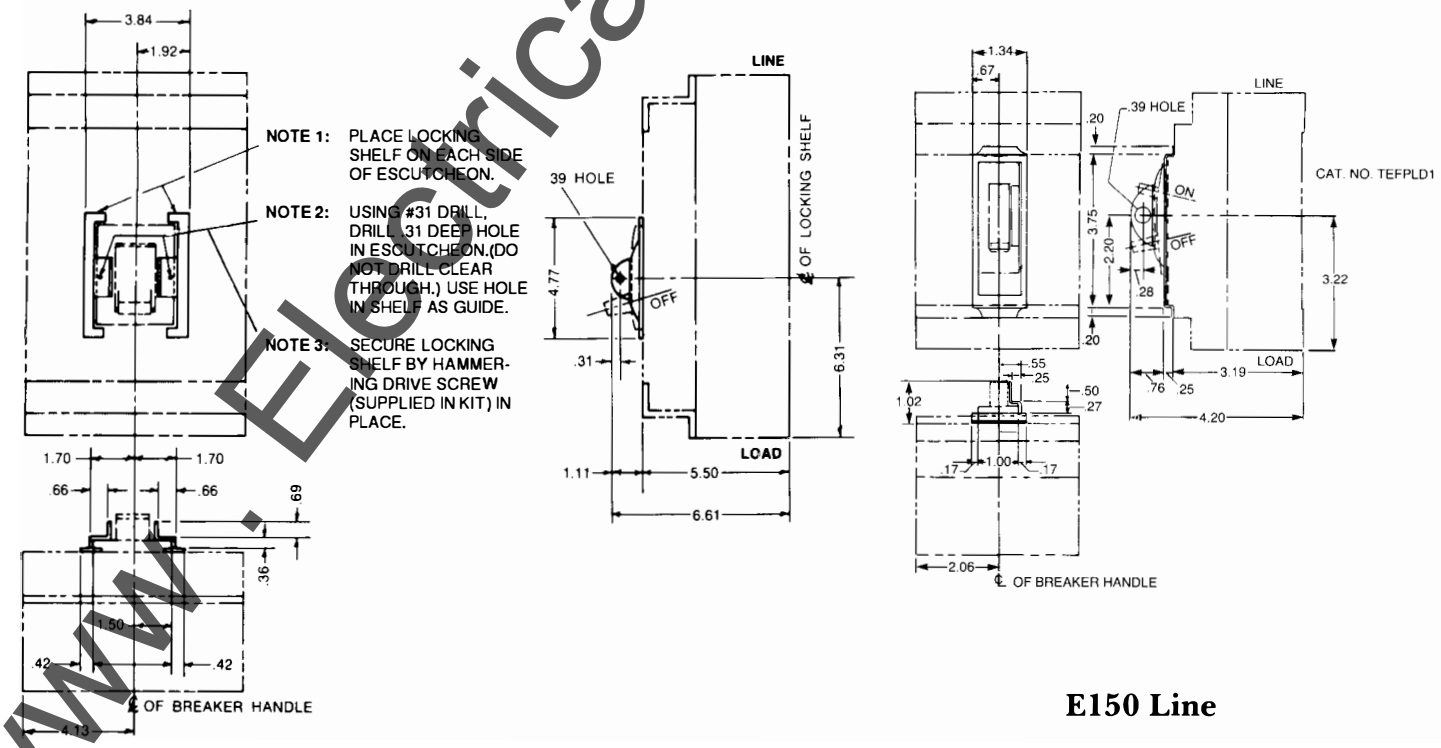


Handle Locking Plates



F225 Line

J600 Line

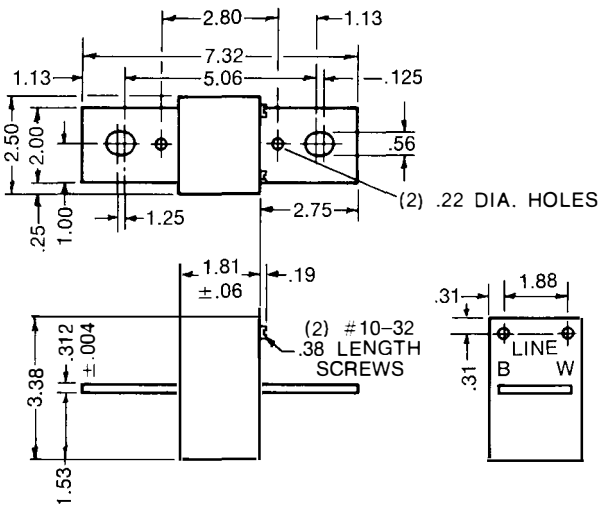


K1200 Line

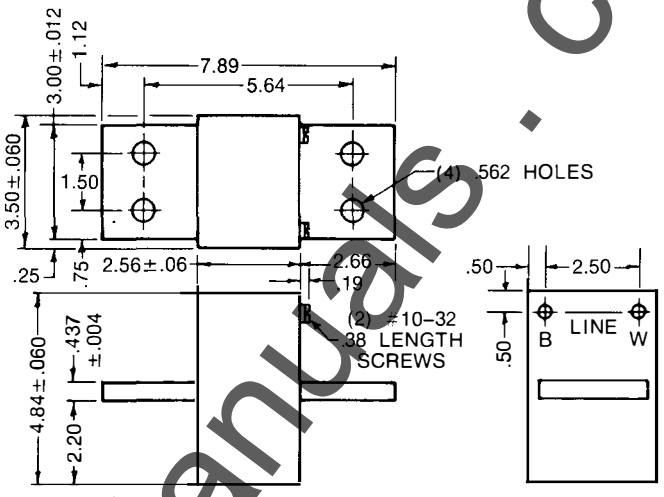
E150 Line

Outline Drawings

Neutral Current Transformers

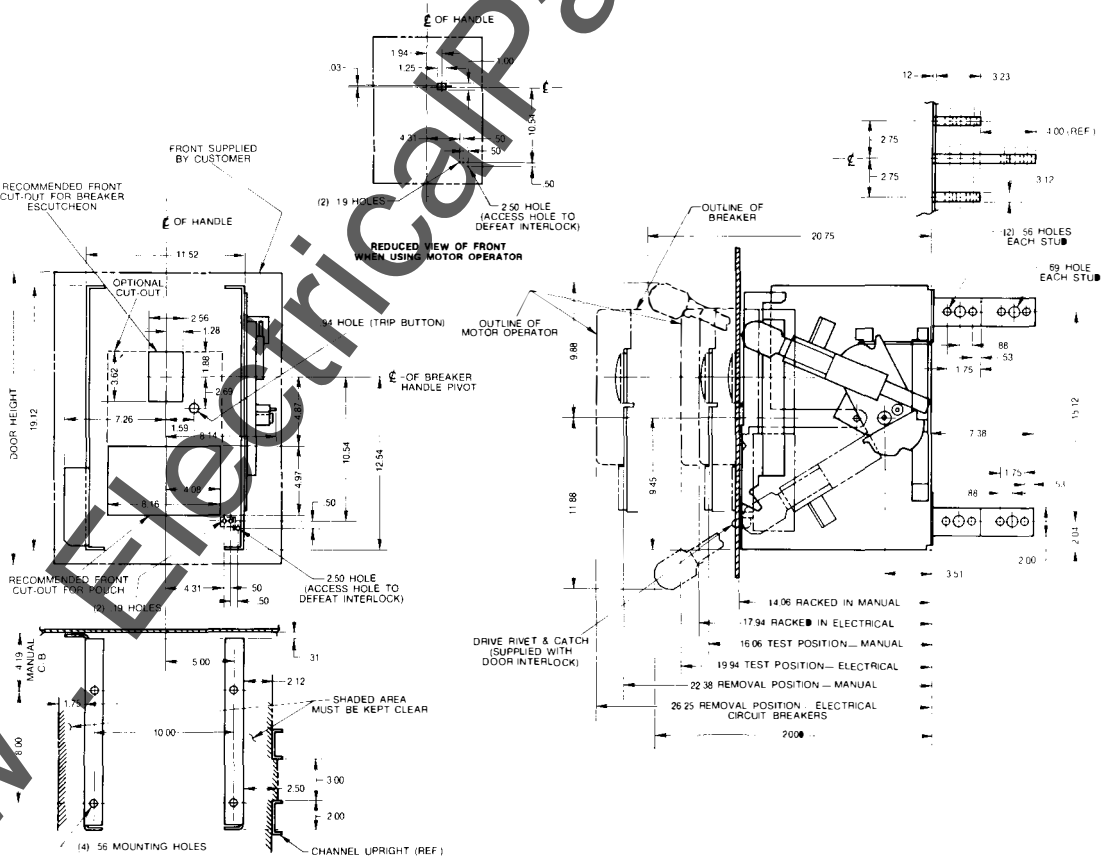


J600 Line



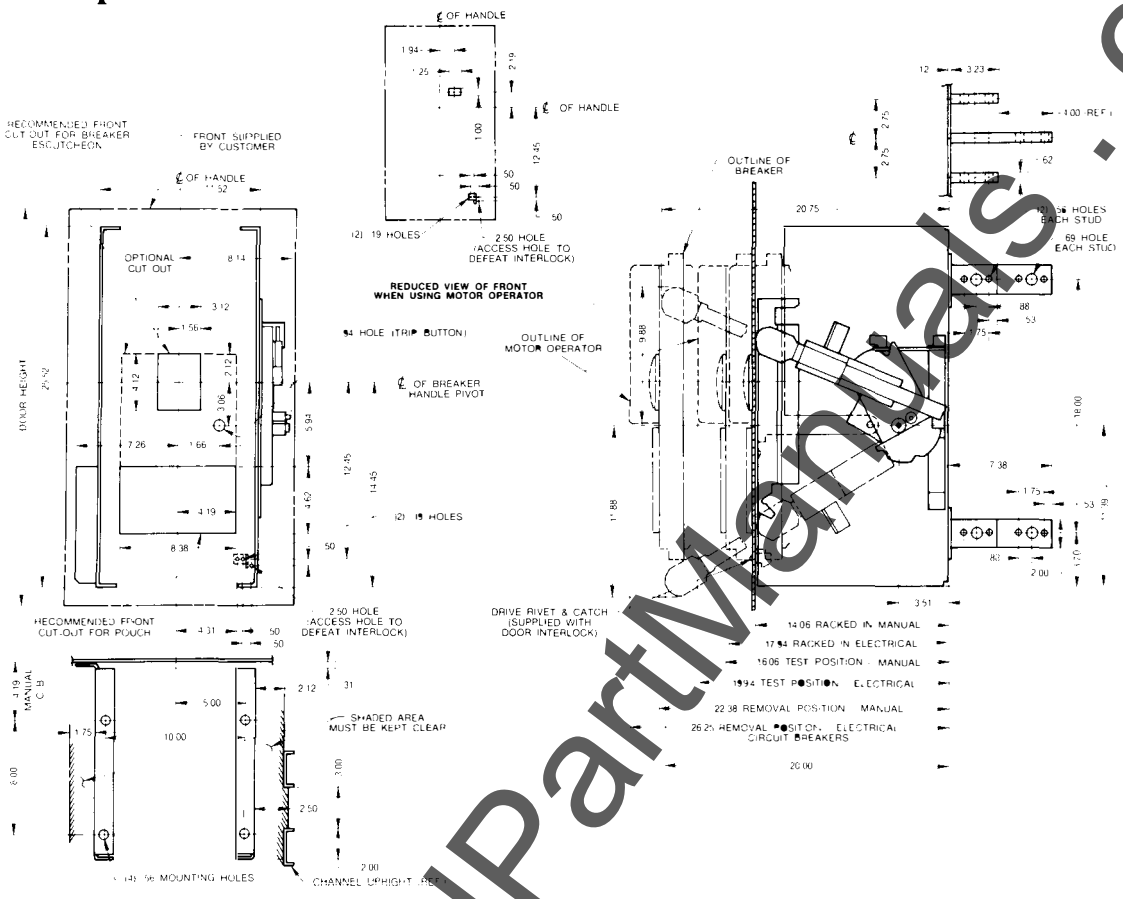
K1200 Line

Drawout Mechanism
MicroVersaTrip® RMS-9



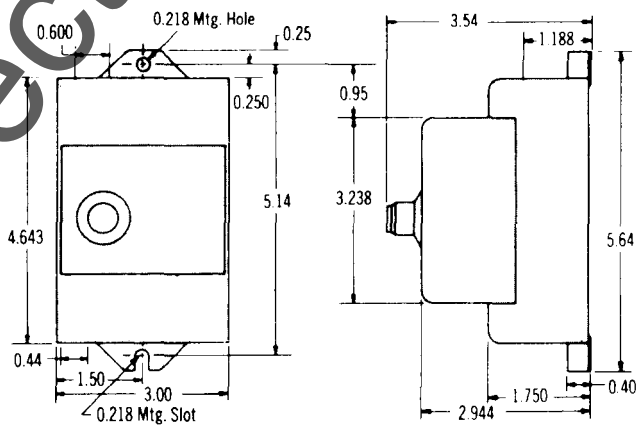
J600 Line

Drawout Mechanism
MicroVersaTrip® RMS-9



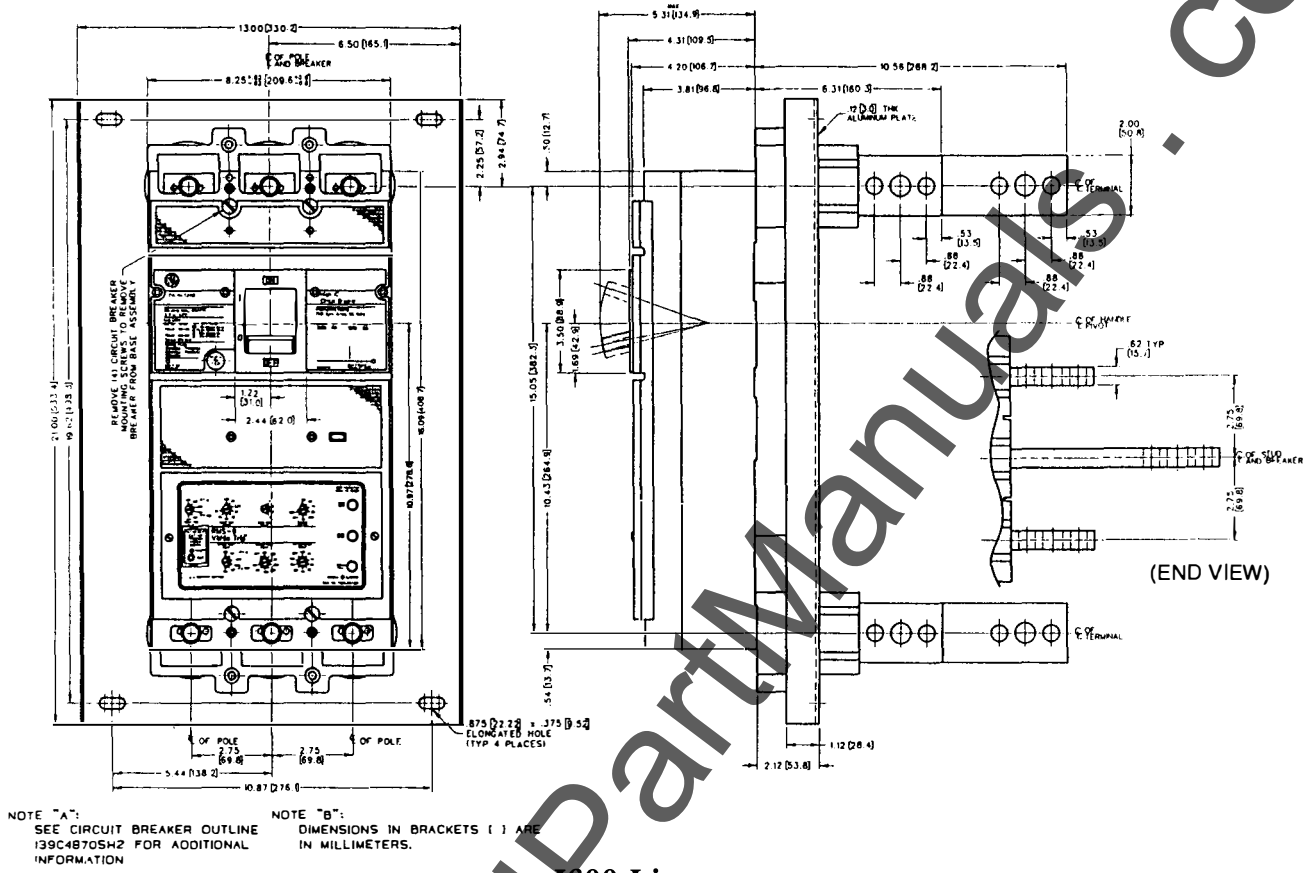
K1200 Line

Time Delay Modules (Cat. Nos. TD1000, TD110A530)

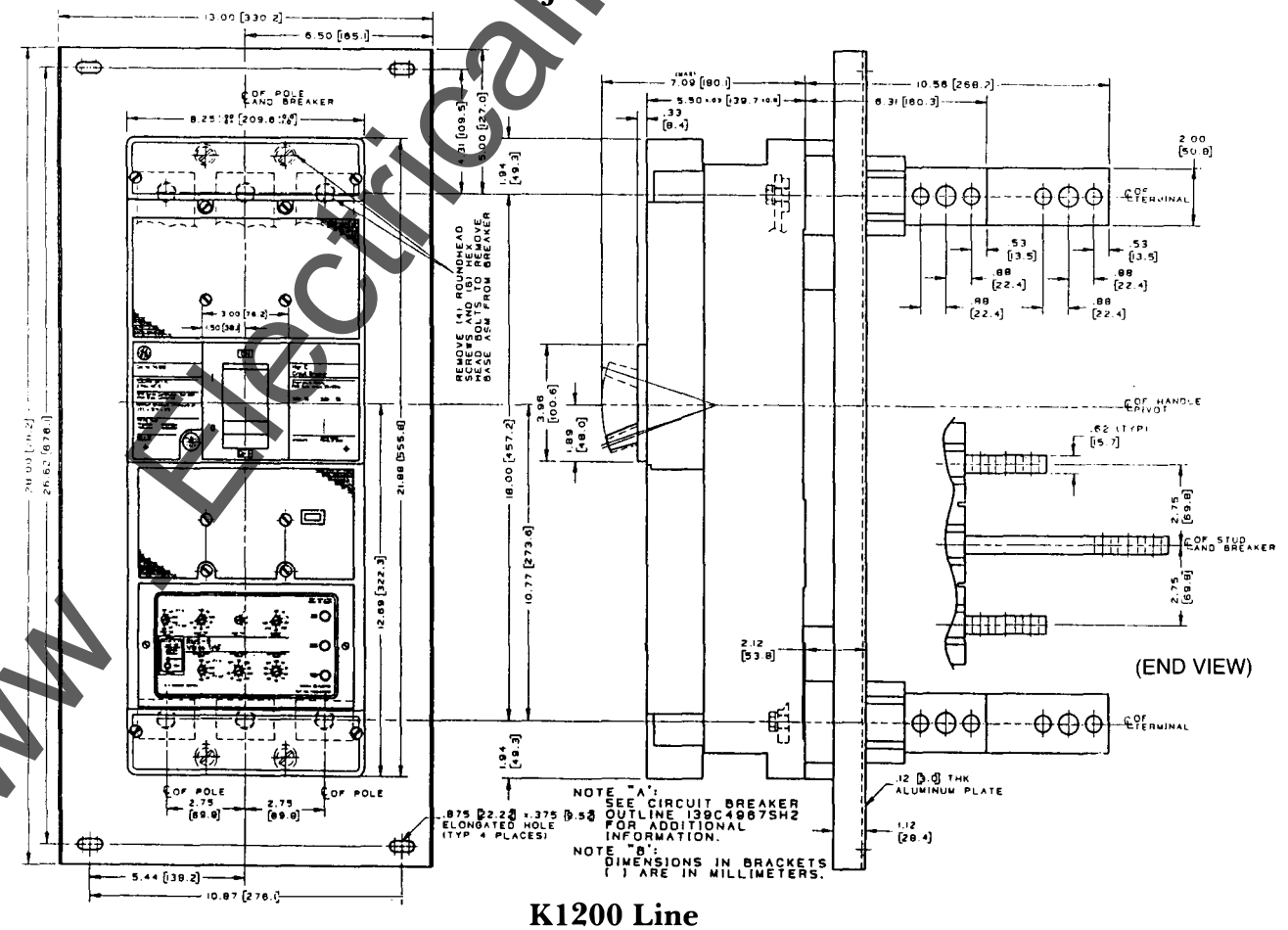


Outline Drawings

100% Equipment Rated Mounting
MicroVersaTrip® RMS-9



J600 Line



K1200 Line

GE Electrical Distribution & Control

General Electric Company
41 Woodford Ave., Plainville, CT 06062

GET-2775H 0191 MMJ

GET-2779C

application & selection ■ molded case circuit breakers

GENERAL ELECTRIC

application & selection molded case circuit breakers

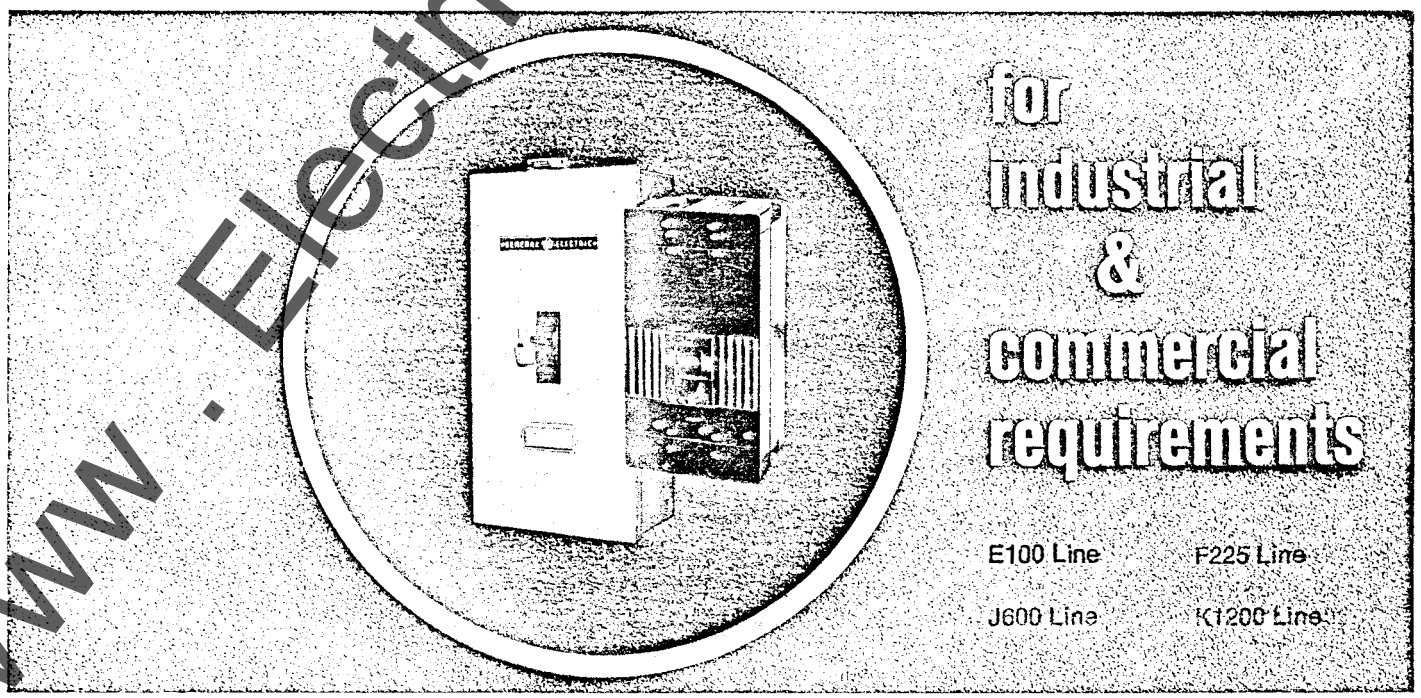
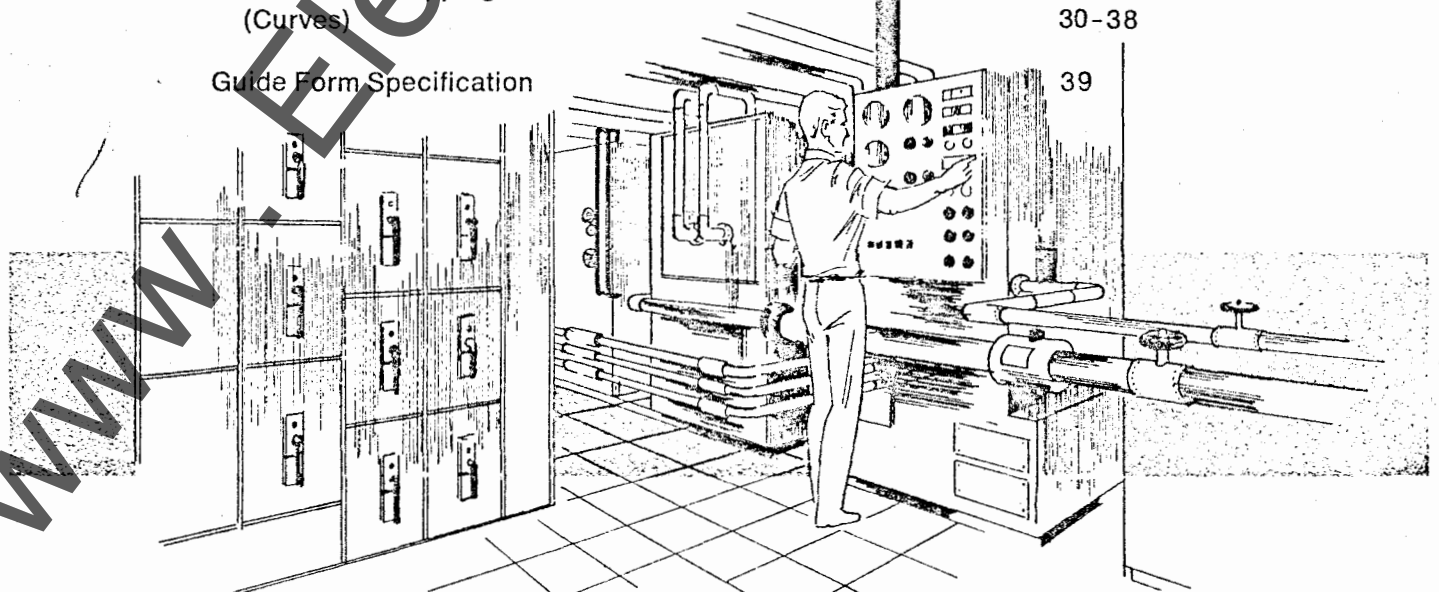


Table of Contents



GE Molded Case Circuit Breakers

APPLICATION FLEXIBILITY

In switchboards, in motor control centers, in lighting and distribution panelboards, and in other applications to 600 volts AC or 250 volts DC, more and more often, GE Molded Case Circuit Breakers are being used for circuit protection. The molded case breaker in an individual enclosure is also being used in an increasing number of applications, too.

MINIMUM DOWNTIME

Downtime is reduced—fuse replacement is eliminated with the circuit breaker. It is designed for continuous operation and fault interruption without damage to itself. In case of overload or short circuit the breaker trips, opening the circuit and protecting the conductors. When normal current is restored, the breaker can be closed ("ON") again.

TRIP-FREE MECHANISM

The breaker's *trip-free* mechanism opens the breaker contacts under overload or short-circuit conditions, even though the breaker handle is held in ON position.

ELIMINATE SINGLE-PHASING

The circuit breaker eliminates single-phasing. When an overload or short-circuit occurs on any one conductor, a common trip bar disconnects all three conductors of a 3-phase circuit simultaneously.

EASY SYSTEM UPGRADING

With a GE breaker, the circuit can be up-rated, even after the breaker has been installed. Interchangeable trips provide a wide range of ratings within the same frame.

ACCESSORY FUNCTIONS

Application flexibility of the molded case breaker is complemented by a breaker accessory line. Remote closing or opening, voltage-drop protection, indication of "tripped" condition at a remote location, electrical or mechanical interlocking, automatic reclosing, and primary or sequential operation are some of the functions practical with accessories.

SPACE SAVINGS

Space savings can be an important factor in selecting GE Molded Case Breakers as equipment components. Breakers in higher ratings, in particular, offer major space economies over fused switches.

INTERRUPTING ABILITY

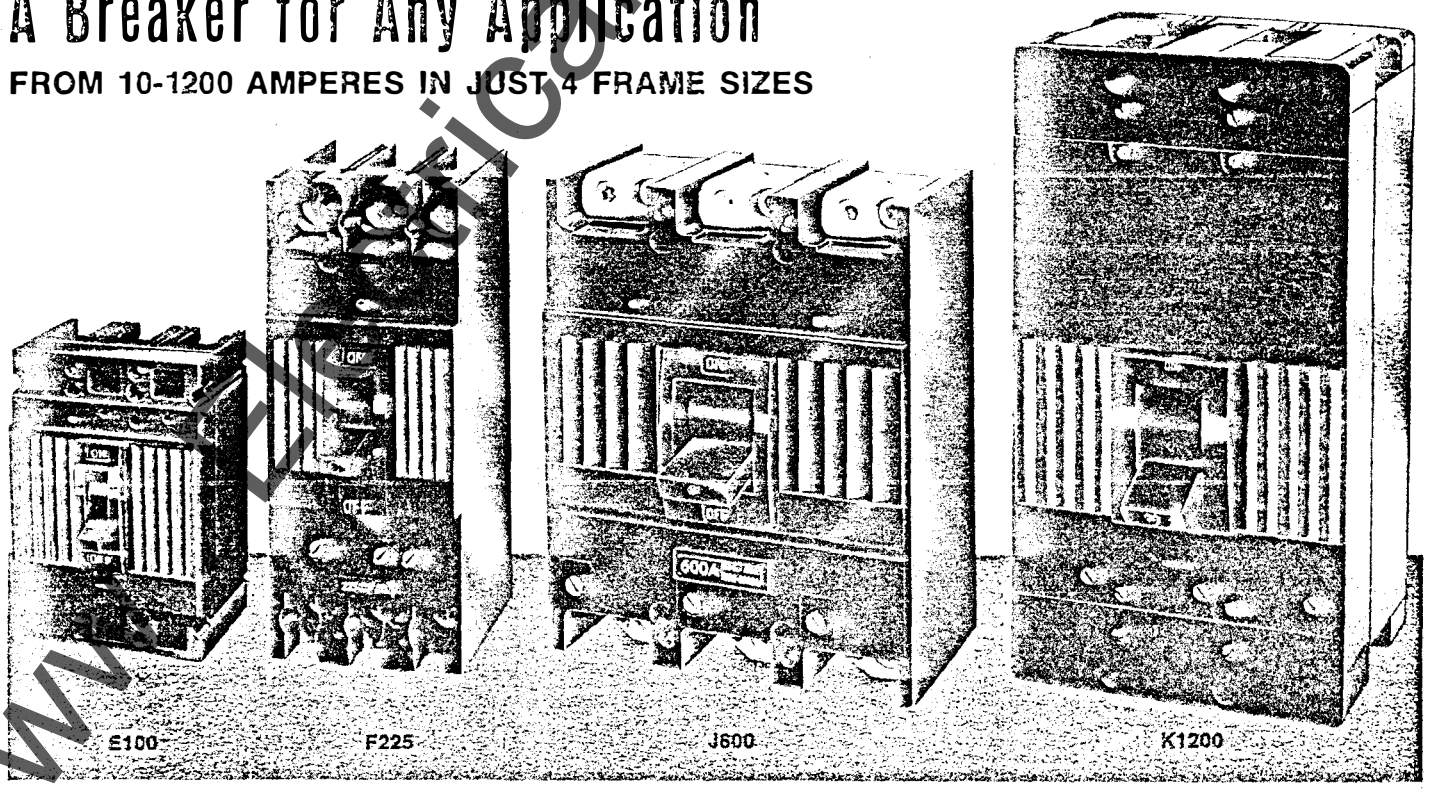
Interrupting ratings of GE Molded Case Breakers are based on actual short circuit tests. Breakers are rated for RMS symmetrical and asymmetrical amperes AC and for maximum amperes DC.

STANDARDS & SPECIFICATIONS

GE Molded Case Circuit Breakers meet standards established by Underwriters' Laboratories, National Electrical Manufacturers Association, Federal Specifications, Institute of Electrical and Electronic Engineers, National Electrical Code and General Electric Company's own quality standards.

A Breaker for Any Application

FROM 10-1200 AMPERES IN JUST 4 FRAME SIZES



A Breaker for Any Application

5 BREAKER TYPES WITHIN EACH FRAME SIZE

Conventional thermal-magnetic circuit breakers employ a thermal bimetallic element for an inverse time-current relationship to protect against sustained overloads, and an instantaneous magnetic trip element for short-circuit protection.

Magnetic-trip-only breakers have no thermal elements; they utilize a magnetic tripping arrangement to trip instantaneously (no purposely introduced time delay) at currents equal to, or above, the trip setting. They are principally used for *short-circuit protection only* of motor branch circuits, where motor overload or running protection is provided by other elements.

Non-automatic circuit interrupters have no automatic overload or short-circuit trip elements; they are used for manual switching and isolation. Short-circuit and overload protection must be provided by other devices.

Hi-Break® breakers provide higher interrupting ratings in the same physical frame size as conventional breakers. Hi-Break breakers have the same time-current tripping characteristics, but they are specially constructed so that they will interrupt a higher available short-circuit current.

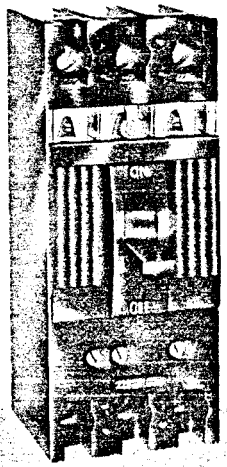
Vu-Break® incorporates a transparent insert in the face of the breaker which permits visual inspection of the breaker contact position.

Conventional Thermal—
Magnetic Breaker

Magnetic-Trip Only

Non-Automatic
Circuit Interrupter

Hi-Break® Breaker



Vu-Break® Breaker

Trip Units

Ambient Temperature Compensated

The thermal action of the bimetal provides a time-delay which prevents service interruptions on normal in-rush currents or temporary overloads. Continuous overloads will cause the bimetal to deflect sufficiently to release the trip latch and open the contacts.

Trip units in each of the four frame sizes are ambient compensated as a standard feature.* They are designed to carry rated current in open air ambients from 10 to 50°C. At temperatures above 50°C, they derate themselves to protect conductors (and the breaker) against dangerously high temperatures, as well as fault currents.

Ambient compensated breakers mounted in individual enclosures can normally carry rated current in room ambients of 25 to 35°C.

*E100 Line Types TE 240-volts, TED/TEF 277-volt, TED/TEF 480-volt and TED 600-volt ratings‡ will carry rated trip current in open air ambient of 40°C. These breakers in individual enclosures can normally carry rated current in room ambients of 20-25°C.

Refer to Table 6, page 18, for requirements of NEC covering ratings of breakers for continuous current loads.

Adjustable Magnetic Trip

An electromagnet which partially surrounds the bimetal is used to provide instantaneous trip in the event of a short circuit. The high current creates a strong magnetic field attracting the armature and releasing the trip latch in the same manner as the bimetal does on overload.

For short circuit protection, the adjustable magnetic trip provides **high, low** and **intermediate** trip settings.* Tolerance on any setting is ±10% for F225, J600 and K1200 Line; ±25% for E100 Line breakers.

Note: E100 Line breakers have adjustable magnetic trip on *magnetic only* breakers.

*Adjustable magnetic trip only circuit breaker. Refer to curves pages 30-35 for tolerances of conventional circuit breakers.

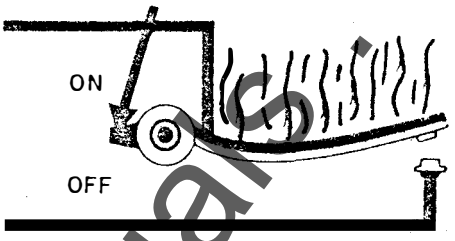
Interchangeable and Fixed Trips

Interchangeable trips for F225, J600 and K1200 Line Breakers make it practical to carry a full inventory with minimum stock. Three basic frame sizes with interchangeable trips in various ratings cover application requirements from 70 through 1200 amperes.

Interchangeable trips provide flexibility in the field, too. Even after the breaker has been installed and is in operation, its rating can be easily changed.

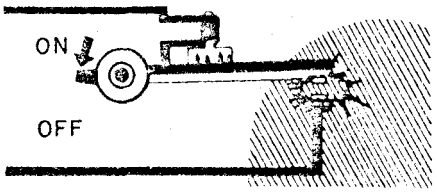
Where lower first cost is the prime consideration, or where future up-rating of circuits is unlikely, non-interchangeable-trip breakers are available in F225 and J600 Lines (to 400 amperes.) E100 Line Breakers are available with non-interchangeable (fixed) trips *only*.

Overload Protection



NOTE: K1200 Line breakers with 1000 and 1200 ampere trip units, utilize a specially designed current-transformer trip unit.

Short-Circuit Protection



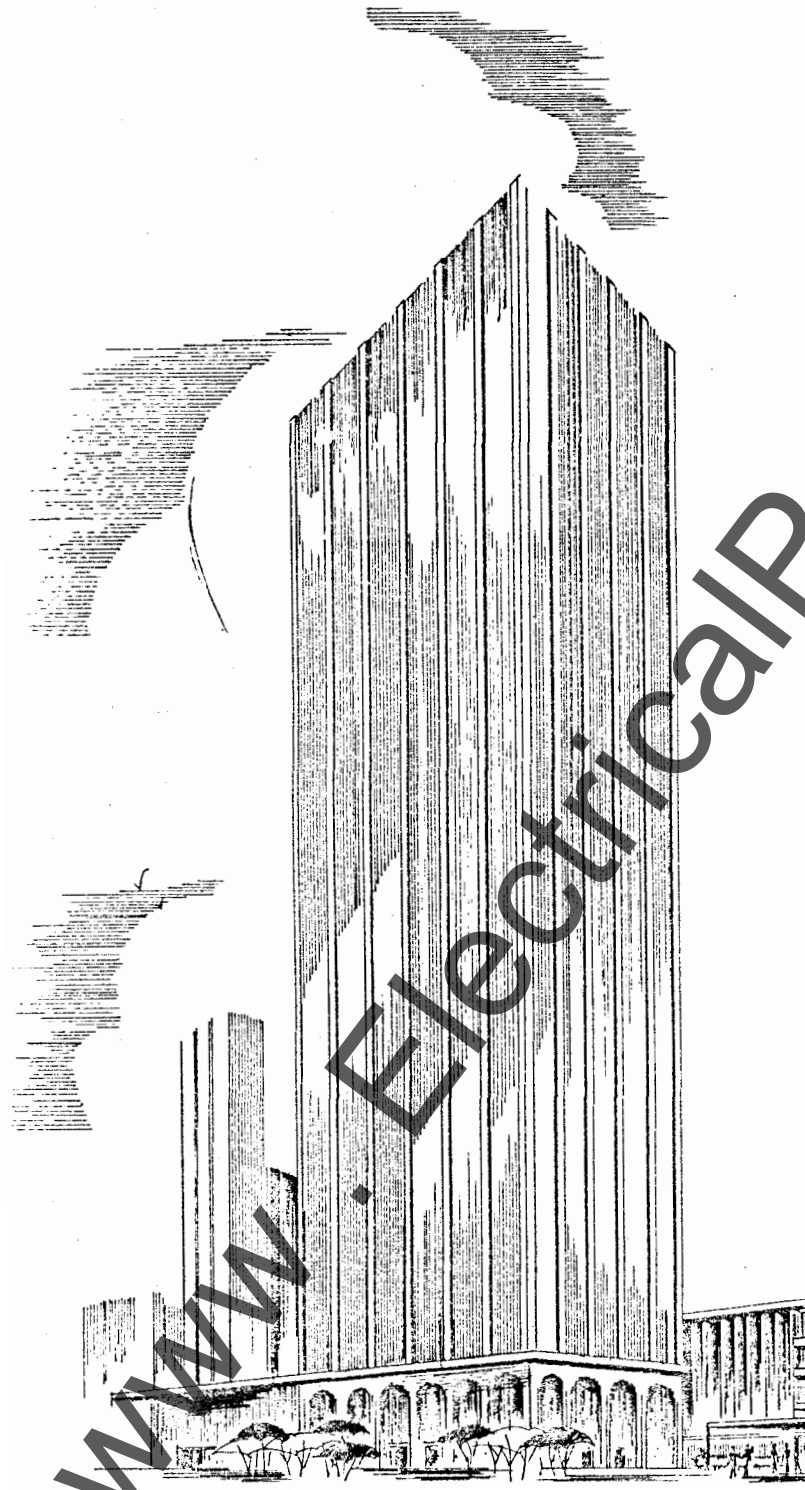
E100		F225	
Type	Trip	Type	Trip
TE	Non-Inter.	TFJ	Non-Inter.
TED and TEF†	Non-Inter.	TFK	Inter.
THED and THEF† Hi-Break	Non-Inter.	THFK Hi-Break	Inter.

J600		K1200	
Type	Trip	Type	Trip
TJJ	Non-Inter. (400 amps max.)	TKM-800	Inter.
TJK	Inter.	TKM-1200	Inter.
THJK Hi-Break (400 amps max.)	Inter.	THKM-1200	Inter.

†TEF being superseded by TED.
THEF being superseded by THED.

‡TED/THED 600-volt series will be ambient compensated 4th Qtr. 1970.

Here Is The Inside Story



1. Just four basic frame sizes for 10 to 1200 amps. Easy to identify, easy to apply.

2. Molded case. Ruggedly constructed insulating material.

3. Trip indication is by handle position midway between ON and OFF. To reset the trip mechanism, move the handle to extreme OFF, then to ON position.

4. Quick-make, quick-break, trip-free mechanism minimizes arcing during breaker operation. Contacts cannot be "teased" into position. Trip-free mechanism is independent of manual handle control. The breaker trips under short-circuit or overload, even though the operating handle is held in ON position.

5. Front-adjustable magnetic trip. Magnetic trip element provides instantaneous trip in event of short-circuit. Any current surge above the trip setting produces a magnetic field which instantly actuates the trip mechanism and opens the circuit.

6. Thermal trip provides protection against sustained overloads. A bi-metallic element reacts time-wise in inverse proportion to the current. If a circuit is overloaded, heat resulting from excessive current flow causes the bi-metal to bend, actuating the trip mechanism to open the circuit.

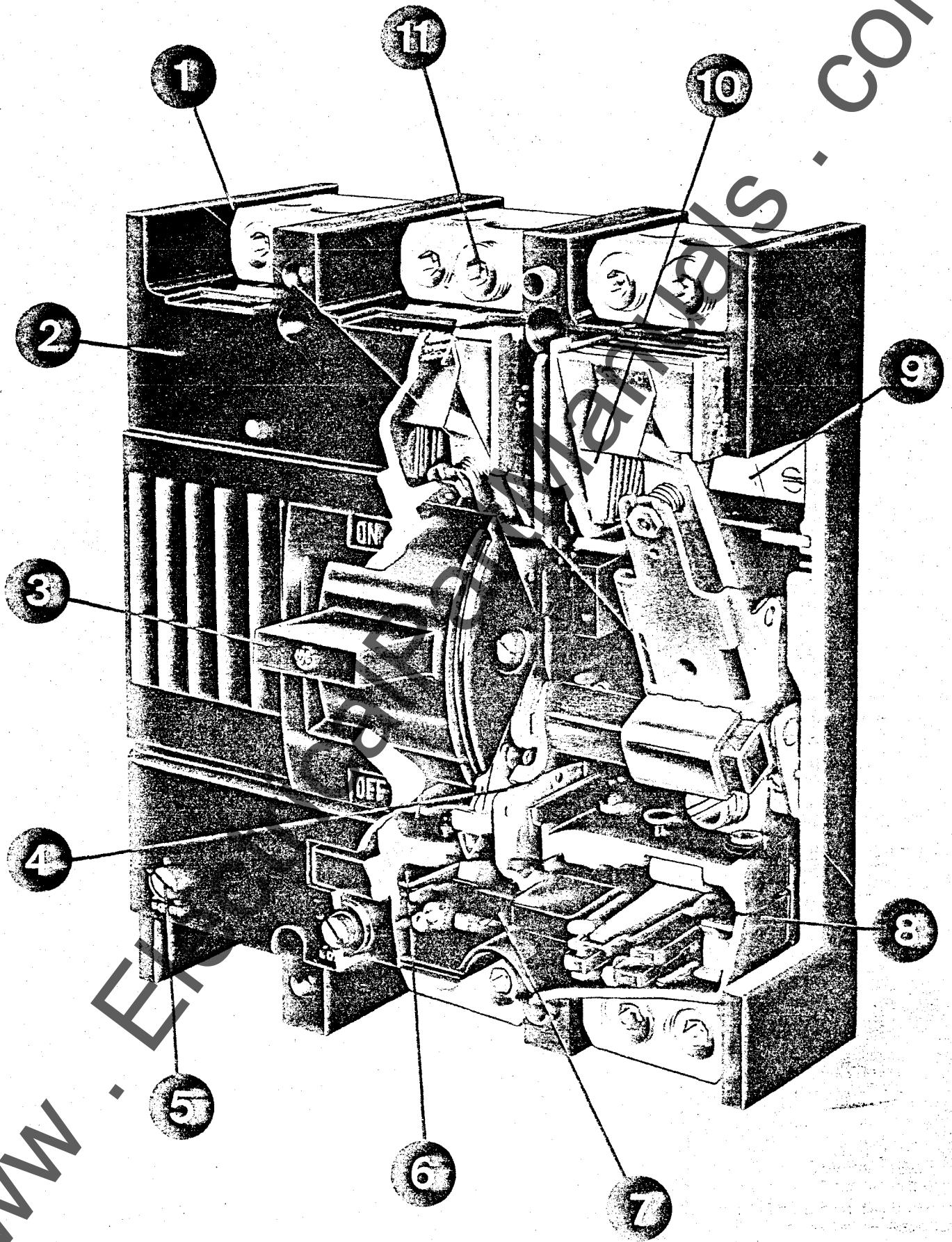
7. Common-trip bar assures instant disconnect of all conductors when an overload or short-circuit occurs on any one conductor in the circuit.

8. Interchangeable trip units (for frames over 100-amp rating) simplify stocking and reduce inventory requirements. Field interchangeability assures maximum flexibility.

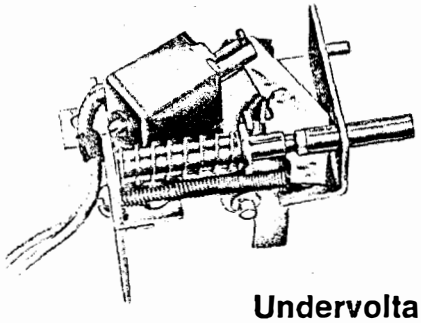
9. Silver alloy contacts combine the conductive properties of silver with other elements for clean, positive electrical contacting. Pitting and burning are minimized for longer contact life.

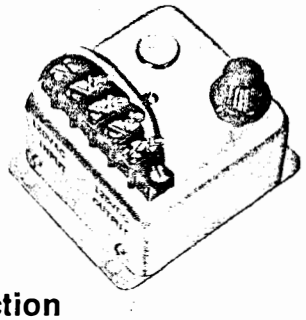
10. Arc chute of heat-absorbing insulating material and metal grid plates quickly "snuffs" arcs.

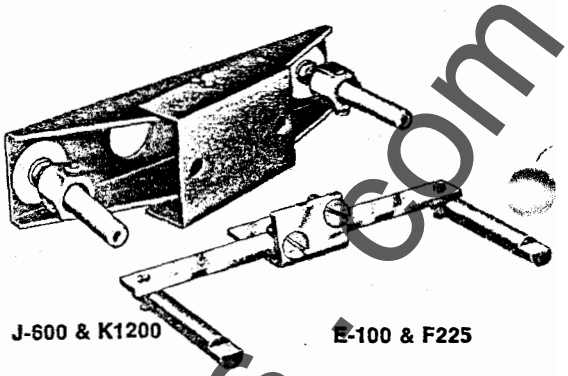
11. U.L. listed lugs for copper or aluminum cable, at full frame rating. Easy access, and simple straight-in wiring.



Accessories







J-600 & K1200 E-100 & F225

Undervoltage Protection

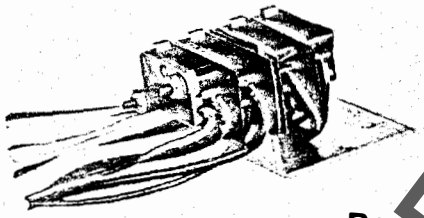
The Undervoltage Release instantaneously trips the breaker when voltage drops to 30-60% of normal rating. The device re-trips the breaker if it is closed before normal voltage is restored.

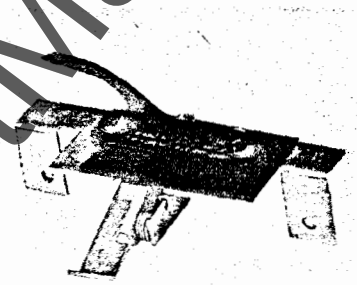
Time-delay Unit—For use with UVR
Prevents nuisance tripping due to momentary loss of voltage.

Separate externally mounted unit has 120 volt a-c input and 125 volt d-c output with delay adjustable from 5 to 30 Hertz. Used in conjunction with 125 volt d-c undervoltage release, which must be ordered separately.

Mechanical Interlocking

The Mechanical Interlock is a walking beam type external link between two breakers mounted in a switchboard structure. The interlock permits only one breaker to be on at a time; however, both breakers can be OFF at the same time.

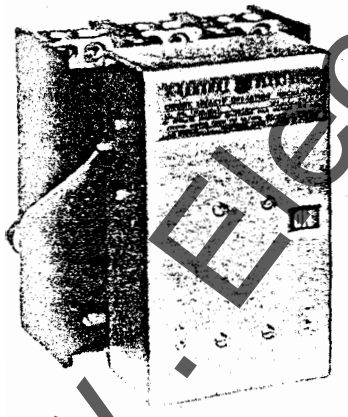




Remote Indication

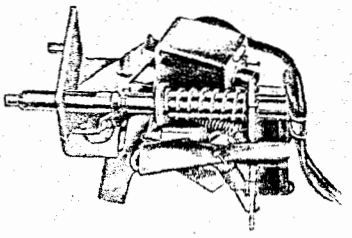
An Auxiliary Switch can be used to operate other accessories, indicating lights, relays, for automatic re-set, etc. Available with one to four SPDT elements for flexibility. Switches open and close as the breaker is either manually or remotely operated.

An Alarm Switch actuates a warning signal or other circuitry when the breaker is tripped under over-load or short-circuit conditions. Not actuated during normal ON-OFF operation.



Remote "On-Off" Operation, Push-button Control

A motor-operated mechanism can open, close or reset a breaker, remotely. This convenient attachment mounts integrally with the breaker, without modification to the breaker or its handle. Just lift the cover of the accessory mechanism to operate the breaker manually. Breaker ON-OFF is indicated in the operating mechanism cover.



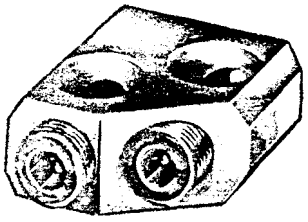
Remote Tripping

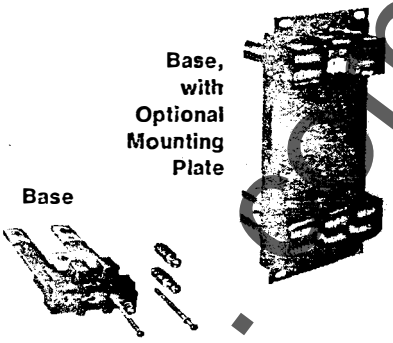
Standard Shunt Trip
A Shunt Trip Device can be used to trip and open a breaker by remote control. When the breaker opens, the shunt trip coil circuit is de-energized by means of an auxiliary switch.

Three-coil Shunt Trip (not illustrated)
Provides single-phase protection for fused circuit-breaker combinations, factory installed only.

Mounts in right pole for TEF, TED, and in left pole for TFK, TJK, TKM. Installed internally similar to standard shunt trip with leads connected across the fuses. Trips breaker when a fuse blows or if the breaker is closed under load with a fuse open. Fits all breaker types including nonautomatic. Suitable for system voltages 208 to 600 volts a-c.

A Full Line of Mounting Hardware





Front Connections

Front-connected Cu-Al Lugs allow easy cable feed. The Lug mounts directly to the mounting surface with screws and lockwashers.

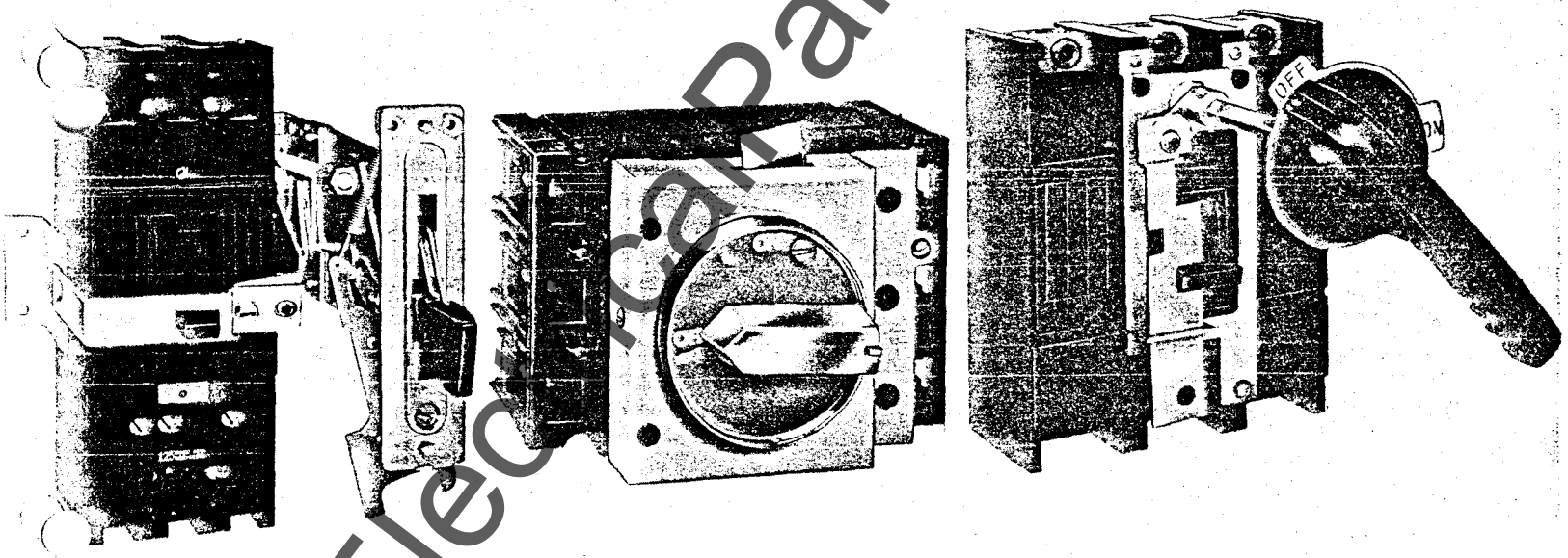
Back Connections

Back-connected Studs are supported by a sub-base, but make positive contact with each line and load terminal. Studs stay in place while the breaker can be removed or installed.

Plug-in Mounting

A Plug-in Base Assembly provides for quick changeout of breakers. The assembly backplate mounts angle-iron cross-pieces. Breaker plug-in terminals align with one-piece backplate assembly.

Handles and Operating Mechanisms



TDF Safety Handle

TDF Safety Handle Mechanisms are designed to meet automotive and machine tool manufacturers' and control panel builders' requirements. Interlock prevents enclosure opening with handle ON. Available for thru-door or thru-flange operation, right- or left-hand mounting. Vault-type hardware available. For mounting in enclosure depths through 19½ inches. Simple assembly.

See Bulletin GET-2954.

TDR Rotary Operating Handle

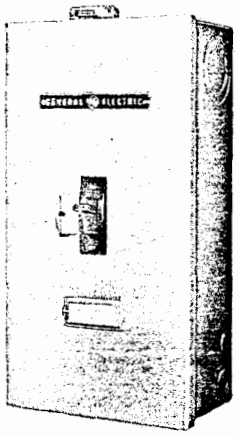
The Rotary-Operating Integral Handle mounts directly to the breaker, and operates through the door of the enclosure. A mechanical interlock prevents unauthorized opening of the enclosure when the handle is in the ON position. The locking hasp accommodates up to three padlocks. Suitable for horizontally or vertically mounted breakers. For NEMA 1A and NEMA 12 enclosures.

TDM Adjustable Depth Handles

TDM Door-Mounting Handles are available in shallow mounting types and extended shaft type for vertical or horizontal breaker mounting. Mechanism provides interlocking. The door-mounted handle accommodates up to three padlocks. Suitable for NEMA 1A and NEMA 12 enclosures.

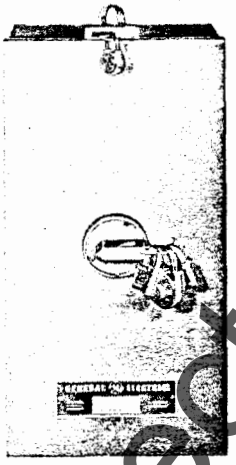
NOTE: A pendulum-type handle designated Cat. No. THCH45 is also available for NEMA 4 and 5 enclosures.

Enclosures For Individual Breakers



NEMA Type 1—Handle-thru-cover Surface or Flush Mounting

An enclosure cover cut-out which fits the breaker escutcheon gives direct access to the handle and makes OFF-ON or tripped position apparent. The breaker mounts conveniently in the enclosure, and the hinged cover is easily removed for installation. Knock-outs on top, bottom, back and sides for wiring and nail knock-outs for stud mounting. Locking shelf permits breaker to be locked in either ON or OFF position.



NEMA Types 1A and 12 Rotary Handle Integral with Breaker

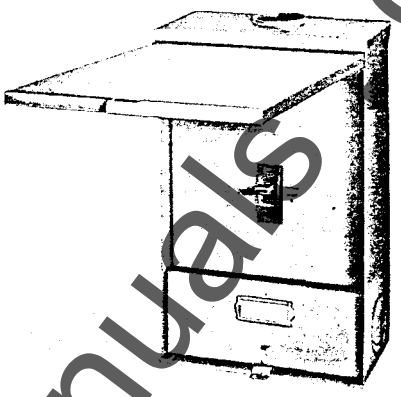
Both NEMA Type 1A (semi-dust-tight, general purpose, with gasket) and NEMA Type 12 (industrial use) enclosures utilize the TDR integral handle mechanism. A mechanical interlock prevents unauthorized opening of the enclosure when the handle is in the ON position.

Type 12 enclosure has external mounting feet. NEMA 1A enclosures for E100, F225 and J600 breakers; NEMA Type 12 enclosures for all four frames.

Enclosures For Individual Breakers

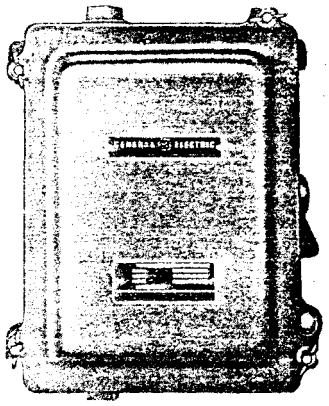
NEMA Type 3R—Raintight, Splashproof, Moisture Resistant

NEMA Type 3R enclosures meet all requirements for raintight enclosures, with maximum resistance to rust. The top-hinged cover is easily removed to speed wiring. Smaller enclosures use versatile interchangeable conduit hubs; large enclosures have blank end-walls for Meyers-type hubs. Cover catch can be padlocked for safety.



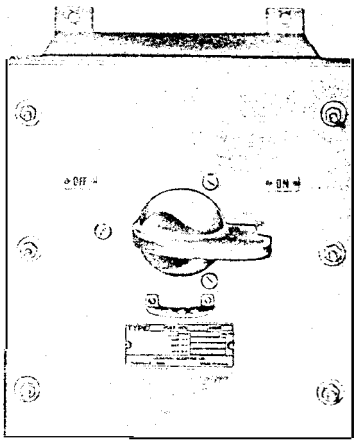
NEMA Types 4 and 5 Cast Iron, Water-tight, Dust-tight

Two pipe-tap conduit openings—one at the top of the enclosure, one at the bottom—are shipped with standard pipe plugs for optional line and load wiring. Wing nuts clamp the cover against the neoprene rubber gasket and the box to insure a dust-tight enclosure. Rugged side-operating die cast handle can be padlocked ON or OFF. Breakers shipped assembled in cast iron enclosures.



NEMA Types 4 and 5 Stainless Steel, Water-tight, Dust-tight

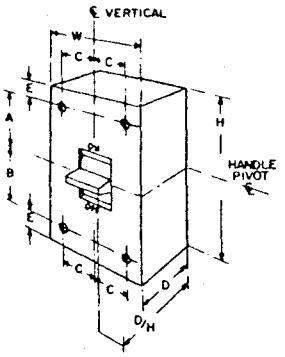
High quality stainless steel throughout assures corrosion resistance and attractive appearance. Pendulum-type breaker operating handle and two Meyers-type chrome-plated conduit hubs supplied. Enclosures for E100, F225 and J600 Lines.



Dimensions (FOR ESTIMATING ONLY)

MOLDED-CASE CIRCUIT BREAKERS

OUTLINE DIMENSIONS



Breaker Type	Poles	Dimensions in Inches W	H	D	D/H Max	A	B	C	E
E 100 TED, THED① TE, TEF, THEF①	1 2 3	1⅜ 2¾ 4⅛	6 5/16	3 3/16	4 3/32	2 41/64	2 15/64	— — 11/16	23/32
F 225 TFJ, TFK, THFK	2, 3	4⅛	10⅛	3 3/16	5½	3⅞	3⅞	11/16	1 3/16
J 600 TJJ, TJK4, TJK6, THJK	2, 3	8¼	10⅛	3 13/16	5½	3 15/16	3 13/16	1⅜	1 3/16
K 1200 TKM8, THKMB, TKM12, THKM12	2, 3	8¼	15½	5½	7⅛	8 9/16	5 11/16	1⅜	⅝

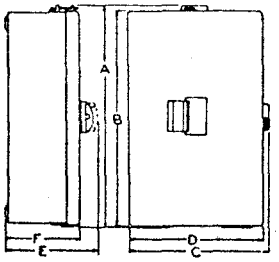
① 2-pole THED and THEF is in a 3-pole frame.

OUTLINE DRAWINGS

Breaker	Outline Dimensional Drawing
E 100 Line	TE/TEF 455C200 TED/THED 139C3643
F 225 Line	455C561
J 600 Line	455C564
K 1200 Line	455C840

ENCLOSURE DIMENSIONS HANDLE-THRU-COVER STYLE

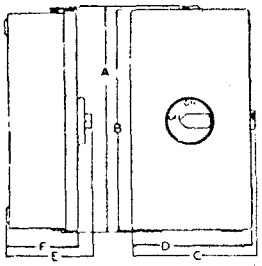
NEMA 1



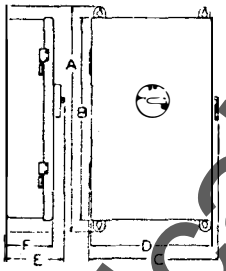
Cat. No.	Dimensions in Inches A	B	C	D	E	F
TE100F	16⅛	16⅛	9	9	4 13/16	4⅛
TE100S	15⅜	14 11/16	8	8	5½	4¾
TF100F	21¾	21¾	11½	11½	7	6 5/16
TF100S	21⅜	20 11/16	10½	10½	7	6 5/16
TF225F	21¾	21¾	11½	11½	7	6 5/16
TF225S	21⅜	20 11/16	10½	10½	7	6 5/16
TJ400F	23⅜	23⅜	16⅝	16⅝	7¼	6⅜
TJ400S	22⅞	22⅞	15¼	15½	7¼	6⅜
TJ600F	28 3/16	28 3/16	18⅜	18⅜	8 15/16	8¼
TJ600S	26¾	26¾	17 13/16	17 13/16	8 15/16	8¼
TK1200F	47¾	47¾	23 5/16	23 5/16	9½	8⅝
TK1200S	46⅞	46½	21 15/16	21 7/16	9½	8⅝

INTEGRAL HANDLE STYLE

NEMA 1A (D Suffix)



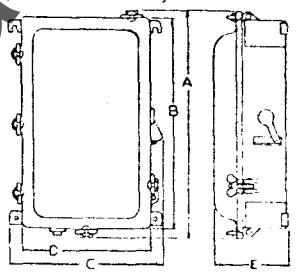
NEMA 12 (J Suffix)



Cat. No.	Dimensions in Inches A	B	C	D	E	F
TE100D	15⅜	14 11/16	8	8	5 13/16	4¾
TF100D	21⅜	20 11/16	10½	10½	7½	6 5/16
TF225D	21 7/16	20 11/16	10½	10½	7½	6 5/16
TJ400D	22⅞	22⅛	16¼	15½	7 13/16	6⅜
TJ600D	26¾	26¾	17 13/16	17 13/16	9 11/16	8¼
TB100J	20⅜	18⅝		8	5 11/16	4 11/16
TB400J	34¼	32¾	17 3/16	17 3/16	9 13/16	8 7/16
TB400MJ	34¼	32¾	17 3/16	17 3/16		8 7/16
TB800J	54½	52	22 9/16	21⅞	10 15/16	9⅞
TB800MJ	54½	52 13/16	22 9/16	21⅞		9⅞
TE100J	16 7/16	14 11/16	8	8	5 13/16	4 13/16
TF100J	22 7/16	20 11/16	10½	10½	7 5/16	6 5/16
TF225J	22 7/16	20 11/16	10½	10½	7 5/16	6 5/16
TF225MJ	22 7/16	20 11/16		10½		8⅜
TJ400J	24 13/16	22⅞	16¼	15½	7¾	6 5/16
TJ600J	28¼	26¾	17 13/16	17 3/16	9⅝	8 5/16
TJ600MJ	34¼	32¾	17 13/16	17 3/16		8 7/16
TK1200J	42⅛	40¼	22 9/16	21 7/16	9⅝	8 9/16
TK1200MJ	54½	52 13/16	22 9/16	21⅞		9⅞

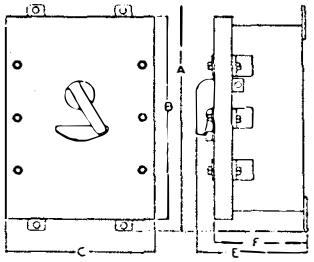
CAST IRON

NEMA 4, 5



STAINLESS STEEL

NEMA 4, 5

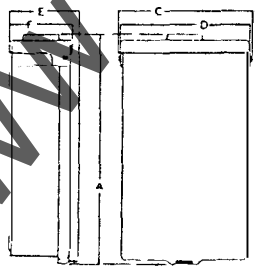


Cat. No. Cast Iron	Dimensions in Inches A	B	C	D	E
15-70A					
"E" 90-100A	15⅛	14 9/16	12 1/16	10⅜	6¾
"F" 15-70A	15⅓	14 9/16	12 1/16	10⅜	6¾
"F" 90-100A	20	19 1/16	14 3/16	12 7/16	8⅛
TF225C	25 3/16	24 1/16	16 7/16	14 11/16	8¼
TJ400C	25 13/16	24 1/16	16 7/16	14 11/16	8¼
TJ600C	33 5/16	31 9/16	19 5/16	17 9/16	8 13/16
TK1200C	42⅛	40⅜	23 13/16	21 5/8	11⅝

Stainless Steel	A	B	C	D	E	F
"E" 90-100A	15	13 5/16	11⅞		8¼	6¼
TF225CS	20½	18 13/16	14½		9 5/16	7⅛
TJ400CS	24½	22 13/16	17⅜		9⅛	7⅛
TJ600CS	28½	26 13/16	19		9⅛	7⅛

RAINTIGHT ENCLOSURES

NEMA 3R



Universal Raintight Hubs	
Nominal Pipe Size	Use with Cat. No. Suffix RH
¾	TC75
1	TC100
1¼	TC125
1½	TC150
2	TC200
2½	TC250
Closing Cap	TCCP

Cat. No.	Dimensions in Inches A	B	C	D	E	F
TE100RH	12 13/16		7⅝	7⅜	5 5/16	5 13/16
TF100RH	16 3/16		7¾	7¾	7 1/16	6 13/16
TF225R	20 9/16		12 13/16	12 9/16	7	6⅜
TF225RH	20 13/16		12 13/16	12 9/16	7	6⅜
TJ400R	28⅞		18⅛	18⅛	8⅜	8 1/16
TJ600R	28 11/16		18 5/16	18 1/16	9¼	9 3/16
TK1200R	46⅛		22 13/16	22 9/16	10 9/16	9 3/16
TRP210RH	13		7⅝	7⅜	5 11/16	5⅛
TQD225RH	17⅝		10 3/16	9 15/16	6⅛	5⅞
TQL70R2	9 7/16		7	7	5 1/16	4 7/16
TQL100RH	12 13/16		7⅝	7⅜	5 13/16	5 3/16

Functions and Application

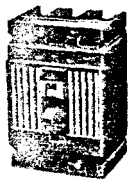
Molded case circuit breakers are circuit protective devices that primarily perform two functions: (1) manual switching operation to open and close circuit by means of toggle handle (2) automatic opening of the circuit under sustained overload and/or short circuit conditions. Circuit breakers inherently provide the automatic protective function of opening the circuit under abnormal sustained overload or short circuit conditions without the use of fuses. When a circuit breaker opens to clear a fault, the toggle handle goes to a TRIPPED position mid-way between the ON and OFF positions thus clearly indicating that a circuit breaker has opened. When the cause of the fault has been removed, the circuit breaker can again be closed simply by moving the toggle handle to the RESET position and then moving the handle to the ON position.

Circuit breakers have an advantage over fusible elements in that a fault on one pole of a multi-pole breaker actuates a common trip bar that opens all poles simultaneously . . . thus avoiding single phasing a motor circuit such as could occur in a fusible device. Molded case circuit breakers are "trip free" in construction. This means that unless the cause of the abnormal condition has been removed, the circuit breaker cannot be held closed against a fault condition. Molded case circuit breakers are principally designed to protect insulated conductors against unsafe over-heating that would ultimately damage the insulation and conductor. They are not designed to provide motor running current overload protection. This function is normally performed by over-load relays supplied in manual or magnetic motor starters.

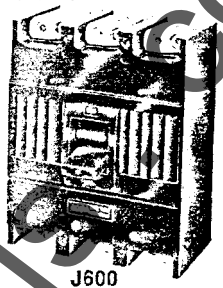
Molded case circuit breakers meet applicable U/L Standard 489 covering "Branch Circuit and Service Circuit Breakers" and meet Nema Standards AB1-1969—Molded Case Circuit Breakers.

Standards and References

Molded-case Circuit Breakers



E100
15 thru
100 Amperes



J600
125 thru
600 Amperes

F225
70 thru
225 Amperes

K1200
300 thru
1200 Amperes

Underwriters' Laboratories
U/L 489 Branch Circuit and Service Circuit Breakers

National Electrical Manufacturers Association (NEMA)
AB-1-1969 Standards Publication—Molded Case Circuit Breakers

Federal Specifications
WC-375A Circuit Breaker, Molded Case; Branch Circuit and Service

Institute of Electrical and Electronics Engineers (IEEE)
No. 45 Recommended Practice for Electrical Installation on Shipboard

National Electrical Code (NEC)
1968 Issue

General Electric Publications

GEA-7402	E 100 Line Breakers
GEA-7403	F 225 Line Breakers
GEA-7404	J 600 Line Breakers
GEA-7405	K 1200 Line Breakers
GEA-7438	TQD 225-Ampere Circuit Breakers and Enclosures
GEA-7441	TQD Circuit Breaker Technical Specification
GEA-7477	TRI-BREAK® Fused Circuit Breakers
GEA-7486	CLB® Current Limiting Circuit Breakers
GEA-8481	"Q" Line Breakers and Accessories
GEA-7479	S-2500 Molded-case Circuit Breakers
GEC-1067	Circuit Protective Components for the OEM
GET-2954	Fusible Disconnects, Operating Mechanisms and Accessories
GEA-7490	Fusible Panelboard Units
GET-2951	CPDD Short Circuit Laboratory

Application Information

Time-Current Tripping Characteristics

General Electric thermal-magnetic molded case circuit breakers utilize a bimetallic element to provide an inverse time-current tripping characteristic to protect insulated circuit conductors against harmful sustained overloads, and an instantaneous magnetic trip element for short circuit protection. In addition, they have interrupting capacity to open and clear short circuit currents up to the rated interrupting capacity of the circuit breaker.

Time-current tripping characteristics of General Electric molded case circuit breakers are shown on curves reproduced on pages 30 through 35.

Time-Current Curves

Curves show the maximum and minimum time limits to be expected from a group of breaker ratings in a given frame size. Tripping characteristics meet National Electrical Manufacturers Association and Underwriters' Laboratory, Inc. standards for rating and calibration.

Breaker	10½" x 15" Translucent Paper for System Coordination Studies	8½" x 11" Size
E 100 (TE)	GES-6107	K215-47C
E 100 (TEF, THEF)	GES-6102	K215-38C
E 100 (TEF, THEF, Amb Comp) ⊙	GES-6109	K215-49C
E 100 (TED, THED)		
(15-45 amp)	GES-6113	K215-87C
(50, 60, 70, 80 amp)	GES-6114	K215-88C
(90, 100 amp)	GES-6115	K215-89C
F 225 (TFJ, TFK, THFK)	GES-6103	K215-44C
J 600 (TJJ, TJK, THJK)	GES-6104	K215-45C
K 1200 (300 to 1200 amperes)	GES-6111	K215-77C

Ambient Compensated Circuit Breakers

Circuit breakers in the E100 (TEF ⊙ 600-volts a-c series), F225, J600 and K1200 frames are ambient compensated. They are designed to carry rated current in open air ambients from 10 to 50°C. At temperatures above 50°C, they derate themselves to protect against dangerously high temperatures, in addition to protecting against fault current.

They need no derating‡ in enclosures at normal room temperatures (20-35°C). If room temperatures rise higher, the enclosure temperatures will increase correspondingly and the breakers will derate themselves.

Enclosure Compensated Circuit Breakers

E100 breakers (TE 240-volt, TEF 277-volt, and TEF 480-all volt TED series†) of ratings through 100 amperes are *enclosure compensated.* These breakers are calibrated to carry rated current in a 40°C ambient in open air, and respond to ambient temperature as well as to current. The higher the current, and the higher the ambient temperature, the shorter will be the tripping time. They need no derating‡ in enclosures when the enclosure does not exceed a temperature rise 15°C over normal room ambient (25°C).

Underwriters' Laboratories Calibration Requirements

Ambient Compensated Breakers in Open Air

U.L. requirements include:

1. Carry 100% rating in 40°C ambient.
2. Trip at 135% rating in specified time in 25°C ambient.
3. Trip at 125% rating in specified time in 40°C ambient from hot start.
4. Trip at 200% rating in specified time in 25°C ambient.

40°C Calibrated Breakers in Open Air

U.L. requirements include:

1. Carry 100% rating in 40°C ambient.
2. Trip at 135% rating in specified time in 25°C ambient.
3. Trip at 200% rating in specified time in 25°C ambient.

Note that (3) calls for tripping at 125% rating in 40°C ambient from "hot start"—that is, after carrying rated current to constant temperature. This is to insure that the breaker is not over-compensated.

†TED/THED 600-volt series will be ambient compensated 4th Qtr. 1970.

‡Refer to Table 6, page 18, for requirements of NEC covering ratings of breakers for continuous current loads.

⊙Obsolete. For reference only. To be superseded by TED/THED 4th Qtr. 1970.

Application Information

Interrupting Ratings

Circuit breakers must not only carry the circuit current at all times under normal conditions, and trip open under overload conditions, but must have sufficient interrupting capacity to successfully interrupt the short circuit current that will flow under the worst fault conditions that can occur, when the breaker is applied within its rating.

The interrupting ratings of GE breakers are determined from tests based on NEMA Standard AB1-1969 "Molded-case Circuit Breakers". These interrupting ratings are listed in Table 1. The basic rating is given in RMS symmetrical amperes, which is the preferred basis for selection and application. The corresponding asymmetrical rating is also given, for reference. Values for D-c are maximum amperes.

TABLE 1

Quick Selection Guide

Circuit Breaker Type		Cont Amp Rating	No. Poles	Volts A-c	Volts D-c	RMS	Interrupting Ratings Based on NEMA Test Procedure — A-c Rating Volts 120	120/240	240	277	480	600	D-c Rating Volts 125	D-c Rating Volts 250
E 100	TE	10-100	1	120	125	Sym	10,000						5,000	
						Asym	10,000							
		10-100	2, 3	240	250	Sym			10,000					5,000
						Asym			10,000					
	TEF	10-100	1	277	125	Sym				14,000			10,000	
						Asym				15,000				
		10-100	2	480	250	Sym			18,000		14,000			10,000
						Asym			20,000		15,000			
	TED	15-100	3	480		Sym			18,000		14,000			
						Asym			20,000		15,000			
		15-100	3	600		Sym			18,000		14,000	14,000		
						Asym			20,000		15,000	15,000		
	THEF	15-30	1	277	125	Sym				65,000			20,000	
						Asym				75,000				
	THED	15-100	2	600	250	Sym			65,000		25,000	18,000		20,000
						Asym			75,000		30,000	20,000		
		15-100	3	600		Sym			65,000		25,000	18,000		
						Asym			75,000		30,000	20,000		
F 225	TFJ, TFK	70-225	2	600	250	Sym			25,000		22,000	22,000		10,000
						Asym			30,000		25,000	25,000		
		70-225	3	600		Sym			25,000		22,000	22,000		
						Asym			30,000		25,000	25,000		
	THFK ①	70-225	2	600	250	Sym			42,000		25,000	22,000		20,000
						Asym			50,000		30,000	25,000		
		70-225	3	600		Sym			42,000		25,000	22,000		
						Asym			50,000		30,000	25,000		
J 600	TJJ, TJK4	125-400	2	600	250	Sym			42,000		30,000	22,000		10,000
						Asym			50,000		35,000	25,000		
		125-400	3	600		Sym			42,000		30,000	22,000		
						Asym			50,000		35,000	25,000		
	TJK6	250-600	2	600	250	Sym			42,000		30,000	22,000		10,000
						Asym			50,000		35,000	25,000		
		250-600	3	600		Sym			42,000		30,000	22,000		
						Asym			50,000		35,000	25,000		
	THJK	125-400	2	600	250	Sym			65,000		35,000	25,000		20,000
						Asym			75,000		40,000	30,000		
		125-400	3	600		Sym			65,000		35,000	25,000		
						Asym			75,000		40,000	30,000		
K 1200	TKM8	300-800	2	600	250	Sym			42,000		30,000	22,000		10,000
						Asym			50,000		35,000	25,000		
		300-800	3	600		Sym			42,000		30,000	22,000		
						Asym			50,000		35,000	25,000		
	TKM12	600-1200	2, 3	600		Sym			42,000		30,000	22,000		
						Asym			50,000		35,000	25,000		
	THKM8	300-800	2	600	250	Sym			65,000		35,000	25,000		20,000
						Asym			75,000		40,000	30,000		
		300-800	3	600		Sym			65,000		35,000	25,000		
						Asym			75,000		40,000	30,000		
	THKM12	600-1200	2, 3	600		Sym			65,000		35,000	25,000		
						Asym			75,000		40,000	30,000		

① Consult the Company for special types when higher IC ratings are required.

Application Information

Circuit Breaker/Fuse Coordination

For systems having available short-circuit current up to 200,000 symmetrical amperes.

Introduction

Molded-case circuit breakers can be applied where the available short circuit current exceeds the breaker's established interrupting rating by using suitable current limiting fuses in series with the breaker. The ratings of breaker and fuse must be carefully selected to prevent damage to the breaker itself, to eliminate needless fuse melting, and to secure the high short circuit protection required. *See Tables 2 and 3 for coordination based on laboratory tests.*

Explanation of Terms Used

Maximum Fuse-Line Side is the maximum fuse rating that can be used with the circuit breaker. The fuse must be connected on the line side of the circuit breaker.

Maximum Fuse-Load Side is the largest size fuse that can be used on the load side of the circuit breaker. These ratings are lower line-side-mounted fuse ratings, because the high transient-arcing voltage created across the fuse is impressed across the trip and internal parts of the circuit breaker during a fault interruption. Higher ratings may cause flash-over within the circuit breaker during an interruption.

Minimum Fuse Rating—HI or LO is the smallest fuse rating that may be used that will clear the knee of the circuit breaker curve. This takes full advantage of the thermal overload protection provided by the circuit breaker, thus eliminating nuisance fuse blowing at these ratings.

TABLE 2
Coordination Table—Circuit Breakers and Current-Limiting Fuses

The following fuse-breaker coordination data is based on the use of Class J or L fuses on systems having a maximum available short-circuit current of 200,000 symmetrical amperes, 600 volts a-c. The data also applies to Class K-1 fuses on systems with maximum available short circuit current of 100,000 symmetrical amperes, 600 volts a-c. Coordination table applies to both conventional and HI-Break types. Does not apply to non-automatic types.

Circuit Breaker Amp. Rating	Class J, L or K-1 Current-limiting Fuse Rating—Amperes																Circuit Breaker Rating—Amperes
	E 100			ED and EF 100			F 225				J 600				K 1200		
	Min. Fuse	Max. Fuse Load Side	Max. Fuse Line Side	Min. Fuse	Max. Fuse Load Side	Max. Fuse Line Side	Min. Fuse Mag. Trip LO	Min. Fuse Mag. Trip HI	Max. Fuse Load Side	Max. Fuse Line Side	Min. Fuse Mag. Trip LO	Min. Fuse Mag. Trip HI	Max. Fuse Load Side	Max. Fuse Line Side	Min. Fuse Mag. Trip LO	Min. Fuse Mag. Trip HI	Max. Fuse Load Side	Max. Fuse Line Side	
15	70	200	300	70	200	400													15
20	100	200	300	70	200	400													20
25	100	200	300	100	200	400													25
30	100	200	300	100	200	400													30
35	100	200	300	100	300	400													35
40	100	200	300	100	300	400													40
45	100	200	300	200	300	400													45
50	100	200	300	200	300	400													50
60	200	200	300	300	300	400													60
70	200	200	300	300	300	400	200	400	800	1200									70
80	200	200	300	300	300	400	200	400	800	1200									80
90	200	200	300	300	300	400	200	400	800	1200									90
100	200	200	300	300	300	400	300	400	800	1200									100
110							300	400	800	1200									110
125							300	400	800	1200	300	400	1000	1200					125
150							300	400	800	1200	300	400	1000	1200					150
175							300	400	800	1200	300	400	1000	1200					175
200							400	600	1000	1200	400	600	1000	1200					200
225							400	600	1000	1200	400	600	1000	1200					225
250											400	600	1000	1200					250
300											600	800	1000	1200	400	800	800	1600	300
350											600	800	1200	1600	600	800	800	1600	350
400											600	1000	1200	1600	600	800	800	1600	400
450											600	1000	1200	1600	600	800	800	1600	450
500											800	1200	1200	1600	800	1200	1200	1600	500
600											800	1200	1200	1600	1000	1200	1200	1600	600
700															1200	1600	1600	2000	700
800															1200	1600	1600	2000	800
1000															1600	1600	1600	2000	1000
1200															1600	1600	1600	2000	1200

NOTE: Current-limiting fuses must be NEMA Class "J" or "L." For systems having available short-circuit current above 100,000 amperes. Current-limiting fuses can be NEMA Class J, K-I, or L for systems having available short circuit currents up to 100,000 symmetrical amperes.

TABLE 3
Coordination Table—Maximum Size Current Limiting Fuses—Circuit Breakers Frame Size

Fuse Amp Rating	Circuit-breaker Rating—Amperes										
	E 100	ED and EF 100	F 225	J 600	K 1200	E 100	ED and EF 100	F 225	J 600	K 1200
	FOR LINE-SIDE CURRENT-LIMITING FUSES—Class J, L or K-1					FOR LOAD-SIDE CURRENT LIMITING FUSES—Class J, L or K-1				
2000					700-1200					
1600				350-600	300-1200					700-1200
1200			70-225	250-600	300-800				350-600	500-800
1000			70-225	125-600	300-600			200-225	250-600	500-700
800			70-225	125-600	300-500			70-225	125-600	300-500
600			70-225	125-400	300-400			70-225	125-400	300-400
400		15-100	70-225	125-250	300			70-200	125-200	300
300	15-100	15-100	70-175	125-175			40-100	70-175	125-175	
200	15-100	15-50	70-90			70-100	30-50	70-90		
100	15-50	15-40				15-50	15-40			

Application Information

Equivalent Ratings—Breakers in Open Air at Various Ambient Temperatures

Circuit Breakers Equivalent Current Ratings

Tables 4 and 5 show the equivalent current ratings of General Electric molded case circuit breakers for various ambient temperatures in open air and in customary applications. For special applications such as frequencies above 60 cycle, high altitudes, unusual duty cycles etc., see "Selection of Circuit Breaker Rating."

TABLE 4
Breakers in Open Air
Equivalent Average Current Ratings at Various Ambient Temperatures

Breaker Frame and Type	Standard Ampere Ratings within Frame	Temperature (Degrees C) 25°C	40°C	50°C	60°C
		Percent of Standard Rating			
E100 Line (Cal. 40°C) TE, TEF: 240, 277 and 480V TED/THED:† All Voltage Ratings	15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100	111	100	91	81
E100 Line ⊙ TEF, THEF 600V Ambient Compensated	15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100	123	115	100	94
F225 Line TFJ, TFK, THFK Ambient Compensated	70, 90, 100, 110, 125, 150, 175, 200, 225	117	107	100	90
J600 Line TJJ, TJK, THJK 600A Frame Ambient Compensated	125, 150, 175, 200, 225, 250, 300, 350, 400	117	107	100	90
K1200 Line TKM, THKM Ambient Compensated	300, 350, 400, 450, 500, 600, 700, 800 1000, 1200	117 115	107 105	100 100	90 88

TABLE 5
Enclosed Breakers
Equivalent Average Current Ratings at Various Ambient Temperatures

Breaker Frame and Type	Standard Ampere Ratings within Frame	Continuous Current Capacity (See Note 1) Individual Enclosures, Busway Plugs, Switchboards, and Panelboards, Except as Listed in Right Column. Room Ambient 25 C	40 C	50 C	In Upper Half of: 1. Lighting Panelboards with more than 20 breakers. 2. Power Panelboard over four feet high. Room Ambient 25 C	40 C	50 C
		Percent of Standard Rating					
E100 Line (Cal. 40°C) TE, TEF: 240, 277 and 480V TED/THED:† All Voltage Ratings	15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100	96	87	79	87	80	72
E100 Line ⊙ TEF, THEF 600V Ambient Compensated	15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100	108	100	87	100	93	80
F225 Line TFJ, TFK, THFK Ambient Compensated	70, 90, 100, 110, 125, 150, 175, 200, 225	102	93	87	93	86	80
J600 Line TJJ, TJK, THJK 600A Frame Ambient Compensated	125, 150, 175, 200, 225, 250, 300, 350, 400	102	93	87	93	86	80
K1200 Line TKMA, THKMA Ambient Compensated	300, 350, 400, 450, 500, 600, 700, 800	102	93	87	93	83	76
	1000, 1200	100	77	67	91	71	71

NOTE 1: The NEC requires that in circuits where continuous current loads are involved—3 hours duration or more—the ampacity rating of the circuit conductors and the rating of the circuit breaker protecting the conductors shall be 25% greater than the continuous load. Therefore, for continuous loads a breaker whose standard rating is 125% of the load must be used.

†TED/THED 600-volt series will be ambient compensated 4th Qtr. 1970.

⊙Obsolete. For reference only. To be superseded by TED/THED 4th Qtr. 1970.

Overload and Short Circuit Protection for Motor and Non-motor Circuits

Selection of Circuit Breaker Rating

Circuit breakers are primarily used to provide overload and short circuit protection for insulated conductors. In this regard the National Electrical Code Article 240-5 requires that Conductors be protected in accordance with their Ampacities, as given in NEC Tables 310-12 through 310-15. Exceptions are listed in the Article for certain specific applications or conditions including protection for conductors in motor circuits.

The size and type of conductors required for a given circuit is usually calculated by the consulting engineer or other specifying authority and specified on the job plans. It is, therefore, in these instances, relatively simple to select a standard circuit breaker rating that matches the Ampacity of the conductor. Where standard circuit breaker ratings do not correspond to the Ampacity of the conductor the NEC allows the next higher rating to be used where rating is 800 amperes or less.

For applications where only load currents are known, motor circuits are involved, and ambient temperature, special duty cycles, frequency and altitude are involved, the following simple formula for selection of standard circuit breaker rating is available.

This formula is as follows:

Breaker Ampere Rating = Actual Load Current x A x B x C x D. The procedure for using this formula is explained in the following steps.

Step 1—Determine the ACTUAL CURRENT of the circuit by adding the continuous load amperes for each load on the circuit.

If the load includes motors as well as other equipments, Table 7 will provide the breaker rating for branch circuit protection for the motor portion; add to it the current obtained from Steps 2 through 4 for the non-motor load. If the load equipments consist only of motors for average duty-cycle conditions, disregard Steps 2, 3, and 4 and select the proper ampere rating from Table 7. If the room temperature should be above 40°C or severe duty cycle is possible, special consideration should be given to using higher-rated breakers.

Step 2—Using the ACTUAL CURRENT determined in Step 1, estimate the breaker frame size required by your application. Jot down this "estimated" frame size—you'll need it to complete Step 3.

Step 3—Select the appropriate multiplying factors A to D from Table 6 for the application conditions involved, and substitute in the formula. For applications under the jurisdiction of the National Electrical Code, the product of factors A and B must equal at least 1.25 in the case of continuously loaded circuits. The breaker rating must be at least 25% greater than the actual load current.

Step 4—You can now compute the proper ampere rating and the proper General Electric circuit breaker for your application by multiplying the "ACTUAL CURRENT" by each of the four factors you have selected from the table shown under "STEP 3":

Ampere Rating = ACTUAL CURRENT x A x B x C x D = Amperes. Select a General Electric breaker having a rating equal to or next above your answer.

Examples

To illustrate: Assume a Type TED 480-volt circuit breaker satisfies all other circuit conditions and its continuous current rating is to be determined when mounted in a switchboard in a 40°C ambient. The circuit load current is 50 amperes and located at sea level on a 60-cycle system. The continuous current rating is determined as follows:

Continuous Current = 50 x Factor A x Factor B x Factor C x Factor D = 50 x 1.15 x 1.00 x 1.00 x 1.00 = 57.5 amperes. Use the next larger trip device above 57.5 amperes which is 60 amperes for the Type TED breaker.

This selection complies with the National Electrical Code, as the breaker trip selected is at least 25% greater than actual load current.

Assume everything but the load current remains the same and select a TFJ breaker for a load current of 71 amperes.

Continuous Current = 71 x 1.08 x 1.00 x 1.00 = 76.7 amperes. Use the next larger trip device which is 80 amperes.

TABLE 6
Factor A—For Enclosed Breakers at Various Room Temperatures

Room Ambient Temperature		Molded-case Circuit Breakers; Multiplying Factor A				
Degrees		E100 Line TED/THED: All Voltage Ratings† TE, TEF 240 and 480 Volts Cal. 40°C	E100 Line ⊙ TEF, THEF 600V Ambient Comp.	F225, J500, CLB™ TFJ, TFK, THFK TJJ, TJK, THJK Ambient Comp.	K1200 Line TKMA, THKMA Ambient Comp.	K1200 Line TKMA, THKMA Ambient Comp.
C	F					
		10-100 Amp		70-60 Amp	125-800 Amp	1000-1200 Amp
In Individual Enclosures, Small Panelboards, Switchboards, Motor-control Centers, Power Dist. Panelboards, Busway Plugs						
25	77	1.04	.93	.98	.98	1.00
40	104	1.15	1.00	1.08	1.08	1.30
50	122	1.27	1.15	1.15	1.15	1.49
In large Panelboards (over 20 circuits) and Distribution Panelboards (over 4" high)						
25	77	1.15	1.00	1.07	1.07	1.10
40	104	1.25	1.08	1.10	1.20	1.40
50	122	1.39	1.25	1.25	1.31	1.63

†TED/THED 600-volt series will be ambient compensated 4th Qtr. 1970.

⊙Obsolete. For reference only. To be superseded by TED/THED 4th Qtr. 1970.

TABLE 6 (continued)
Factor B—Load Classification or Duty Cycle

Load or Duty Cycle	Factor B
Continuous Steady Loads (including lighting) (see NEC Sections 210-23, 220-2, 220-3, 384-16)	1.00△
Capacitors (NEC 460-8)	1.35 (min)
Resistance Welders (NEC 630)	3.00 (max)
Two or More Motors (NEC 430-62; 670-4)	▪
Motors and Lights (NEC 430-61, 430-62, 430-63)	†

△ To comply with NEC requirements (Section 210-23), the standard breaker trip rating must be 25% greater than actual load current. For applications where the NEC applies, the product of Factors A and B must be 1.25, otherwise Factor B must be sufficient to make the product 1.25.

▪ Rating of feeder circuit-protective-device trip shall not be greater than the largest rating as determined from NEC Tables 430-152, -153, plus the sum of the full-load currents of the other motors in the group.

† Rating of feeder circuit-protective-device trip is determined by adding trip device ratings for motor and lighting load individually.

Factor C—Effect of Frequency

Frequency in Cycles**	Multiplying Factor C‡				
	E100 LINE	F225 LINE	J600 LINE	K1200 LINE	
	TED/THED TE, TEF and THEF 15–100 Amp	TFJ, TFK and THFK 70–225 Amp	TJJ, TJK and THJK 125–400 Amp	TKM and THKM 125–400	TKM and THKM 450–1200
D-c or 60 Cycles	1.00	1.00	1.00	1.00	Refer to Factory
120	1.02	1.02	1.02	1.02	
180	1.05	1.05	1.04	1.04	
240	1.10	1.09	1.06	1.06	
300	1.14	1.11	1.10	1.10	
400	1.22	1.18	1.15	1.15	

Factor D—Effect of Altitude

Altitude	Multiplying Factor D
Sea Level to 6000 feet	1.00
6000 to 10,000 feet	1.04

** For frequencies above 400 cycles and breakers above 400A. refer to Company.

‡ Frequency factors apply to current-carrying capacity only. Do not apply to magnetic trip. Above 200 cycles, magnetic trip is affected in some breakers.

TABLE 7
Selection of Thermal-Magnetic Molded-case Circuit Breakers for Individual Induction Motor Branch Circuit Protection

Suitable to perform the combined functions of: 1. Branch circuit protection. 2. Disconnecting means.

Motor Hp	Three-phase Full-load Amperes of Motor □				Full-voltage, Resistor, or Reactor Starting—Three-phase Squirrel-cage Motors		
					Recommended 40 or 50 C Calibrated Breaker Rating in Amperes		
	208 Volts	230 Volts	460 Volts	575 Volts	208/ 230 Volts	460 Volts	575 Volts
1½	5.7	5.2	2.6	2.1	15	15	15
2	7.5	6.8	3.4	2.7	15	15	15
3	10.6	9.6	4.8	3.9	20	15	15
5	16.7	15.2	7.6	6.1	40	15	15
7½	25	22	11	9	50	30	20
10	31	28	14	11	50	40	30
15	46	42	21	17	70	50	40
20	59	54	27	22	100	50	50
25	75	68	34	27	100	70	70
30	88	80	40	32	125	70	70
40	110	104	52	41	150	100	100
50	143	130	65	52	200	100	100
60	169	154	77	62	225	125	100
75	210	192	96	77	300	150	125
100	272	248	124	99	300	200	150
125	342	312	156	125	400	225	225
150	396	360	180	144	500	300	225
200	528	480	240	192	600	300	300
250		626	313	250	800	400	300
300		750	375	300	1000	500	400
350		878	438	350	1200	600	500
400		1000	500	400	1200	600	500
450		1126	563	450		700	600
500		1250	625	500		800	600
600		1500	750	600		1000	800

Recommended breaker ratings are those that experience has shown to be satisfactory for average standard motor and duty-cycle conditions. In general, they are the breakers furnished in combination starters or motor control centers unless special load or ambient temperature conditions are specified.

If the control center or enclosed combination starter is in a room ambient above 40°C, or if the duty-cycle conditions may be severe, special consideration should be given to using breakers with higher ratings than the recommended breaker rating listed.

See National Electrical Code Tables 430-152, 430-153 (page 22) for *maximum* breaker ratings permitted by the Code.

□ These selections are based on 1968 National Electrical Code requirements for squirrel-cage motors without code letters or with code letters B to E. Lower trip ratings may be required for motors with code letter A and higher trip ratings for motors with code letters F to V. Local code or specific application requirements may necessitate special selection.

Short Circuit Protection Only—for Motor Circuits
TABLE 8
Selection of GE Instantaneous Trip Only Breakers For Use with AC Combination Motor Starters—Short Circuit Protection Only

Three Phase Induction Type Motors

Motor Horse Power			Circuit Breaker Data			Adjustable Instantaneous Trip Range*						Trip Setting Position		
208/230	460V	575V	Frame	Catalog No.	Cont. Amps.	Lo	2	3	4	5	Hi	208/230	460V	575V
½	1	1½	E—100	TEF 136M1005	5	15	19	23	27	31	35	4	3	4
¾	1½	2	E—100	TEF 136M1005	5							5	5	5
1	2	3	E—100	TEF 136M1010	10	28	36	44	52	60	68	3	3	4
1½	3		E—100	TEF 136M1010	10							Hi	5	
2	5	5	E—100	TEF 136M1025	25	65	85	105	125	145	165	2	Lo	Lo
3	7½	7½	E—100	TEF 136M1025	25							4	4	3
		10	E—100	TEF 136M1025	25									5
5	10	15	E—100	TEF 136M1050	50	156	196	237	278	319	360	2	2	2
7½	15	20	E—100	TEF 136M1050	50							4	3	3
10	20	25	E—100	TEF 136M1050	50							Hi	5	5
	25	30	E—100	TEF 136M2050	50	250	314	378	442	506	570		3	3
15			E—100	TEF 136M2050	50							Hi		
	30	40	E—100	TEF 136M2050	50								5	5
20	40	50	E—100	TEF 136M1100	100	480	584	688	792	896	1000	3	3	3
25	50	60	E—100	TEF 136M2100	100	800	944	1088	1232	1376	1520	2	Lo	Lo
30	60	75	E—100	TEF 136M2100	100							4	3	3
40	75	100	F—225	TFJ/FK 236M1225	225	600	830	1075	1250		1400	Hi	4	4
50	100	125	F—225	TFJ/FK 236M2225	225	1000	1325	1650	1950		2250	3	3	3
60	125	150	F—225	TFJ/FK 236M2225	225							4	4	4
75	150	200	J—400	TJJ/JK 436M2400	400	1200	1400	1880	2500		4000	4	4	4
100	200	250	J—400	TJJ/JK 436M2400	400							Hi	Hi	Hi
125	250	300	J—400	TJJ/JK 436M2400	400							Hi	Hi	Hi
150	300	400	J—600	TJK 636M2600	600	1800	2400	3300	4500		6000	Hi	Hi	Hi
200	400	500	J—600	TJK 636M2600	600							Hi	Hi	Hi
250	500	600	KM—800	TKMA 836M6000	800	2400	3200	4400	6000		8000			
Other circuit breakers that are available for specific applications			E—100	TEF 136M1003	3	8	10.5	13	15.5	18	20			
			J—600	TJJ/JK 436M1400	400	600	800	1100	1500		2000			
			J—600	TJJ/JK 636M1600	600	600	800	1100	1500		2000			
			KM—800	TKMA 836M4400	600	1100	1600	2200	3000		4000			
			KM—1200	TKMA 3M51200	1200	1500	2400	3300	4500		8000			
			KM—1200	TKMA 3M61200	1200	2400	3200	4400	6000		8000			

*E-100 Frame—within ±25% of ampere values listed.
All other frames—within ±10% of ampere values listed.

Application Information

TABLE 8 (continued)

Single Phase Induction Type Motors

Motor Horse Power			Circuit Breaker Data			Adjustable Instantaneous Trip Range*						Trip Setting Position		
115V	230V	440V	Frame	Catalog No.	Cont. Amps.	Lo	2	3	4	5	Hi	115V	230V	440V
⅓			E—100	TEF 126M1025	25	65	85	105	125	145	165	2		
½	1		E—100	TEF 126M1025	25	65	85	105	125	145	165	4	3	
¾	1½		E—100	TEF 126M1050	50	156	196	237	278	319	360	2	Lo	
1	2		E—100	TEF 126M1050	50	156	196	237	278	319	360	2	Lo	
1½	3		E—100	TEF 126M1050	50	156	196	237	278	319	360	4	3	
2		7½	E—100	TEF 126M1050	50	156	196	237	278	319	360	5		4
	5	10	E—100	TEF 126M2050	50	250	314	378	442	506	570		3	3
3	7½		E—100	TEF 126M2050	50	250	314	378	442	506	570	4	5	
5	10		E—100	TEF 126M1100	100	480	584	688	792	896	1000	3	3	
7½			E—100	TEF 126M2100	100	800	944	1088	1232	1376	1520	3		
4			F—225	TFJ/K 226M1225	225	600	830	1075	1250		1400	10		

*E-100 Frame—within ±25% of ampere values listed. All other frames—within ±10% of ampere values listed.

The recommended trip setting is based on 12 to 14 times motor full load current to assure motor starting without breaker tripping on transient inrush starting current.

It is assumed that the available short circuit current does not exceed the interrupting rating of the breaker. In case of doubt, check for available short circuit current.

Allowable Ampacities of Insulated Copper and Aluminum Conductors from National Electrical Code 1968 Edition

Not more than three conductors in raceway or cable or direct burial. (Based on room temperature of 30°C, 86°F.)

*From National Electrical Code, 1968 Edition, Tables 310-312** and 310-314***

Size AWG MCM	Copper			Aluminum		
	60 C (140 F)	75 C (167 F)	85-90 C (185 F)	60 C (140 F)	75 C (167 F)	85-90 C (185 F)
14	15	15	25			
12	20	20	30	15	15	25
10	30	30	40	25	25	30
8	40	45	50	30	40	40
6	55	65	70	40	50	55
4	70	85	90	55	65	70
3	80	100	105	65	75	80
2	95	115	120	75	90	95
1	110	130	140	85	100	110
0	125	150	155	100	120	125
00	145	175	185	115	135	145
000	165	200	210	130	155	165
0000	195	230	235	155	100	185
250	215	255	270	170	205	215
300	240	285	300	190	230	240
350	260	310	325	210	250	260
400	280	335	360	225	270	290
500	320	380	405	260	310	330
600	355	420	455	285	340	370
700	385	460	490	310	375	395
750	400	475	500	320	385	405
800	410	490	515	330	395	415
900	435	520	555	355	425	455
1000	455	545	585	375	445	480
1250	495	590	645	405	485	530
1500	520	625	700	435	520	580
1750	545	650	735	455	545	615
2000	560	665	775	470	560	650

CORRECTION FACTORS, ROOM TEMPERATURES OVER 30 C 86

C.	F.						
40	104	0.82	0.88	0.90	0.82	0.88	0.90
45	113	.71	.82	.85	.71	.82	.85
50	122	.58	.75	.80	.58	.75	.80
55	131	.41	.67	.74	.41	.67	.74
60	140		.58	.67		.58	.67
70	158		.35	.52		.35	.52
75	167			.43			.43
80	176			.30			.30

See National Electrical Code, 1968 Edition for notes to Tables 310-12 and 310-14. For conductor application see Table 310-2(a).

**The following branch circuit conductor insulations are rated for:
60 C—Types RUW, T, TW
75 C—Types RH, RHW, RUH, THW, THWN, THHW
85 C—Types V, MI
90 C—Types TA, TBS, SA, AVB, SIS, RHH, THHN, XHHW

General Application Data

Full-load Currents, Single-phase, A-c Motors †

From National Electrical Code, 1968 Edition, Table 430-148

Hp	115V	230V
1/6	4.4	2.2
1/4	5.8	2.9
1/3	7.2	3.6
1/2	9.8	4.9
3/4	13.8	6.9
1	16	8
1 1/2	20	10
2	24	12
3	34	17
5	56	28
7 1/2	80	40
10	100	50

†These values of full-load currents are for motors running at usual speeds and motors with normal torque characteristics. Motors built for especially low speeds or high torques may have higher full-load currents, and multispeed motors will have full load current varying with speed, in which case the nameplate current ratings should be used.

To obtain full-load currents of 208- and 200-volt motors, increase corresponding 230-volt motor full-load currents by 10- and 15-per cent respectively.

The voltages listed are rated motor voltages. Corresponding nominal system voltages are 110 to 120 and 220 to 240.

Full-load Current, Direct-current Motors

From National Electrical Code, 1968 Edition, Table 430-147

The following values of full-load currents are for motors running at base speed.

Hp	120V	240V	Hp	120V	240V
1/4	2.9	1.5	15		55
1/3	3.6	1.8	20		72
1/2	5.2	2.6	25		89
3/4	7.4	3.7	30		106
1	9.4	4.7	40		140
1 1/2	13.2	6.6	50		173
2	17	8.5	60		206
3	25	12.2	75		255
5	40	20	100		341
7 1/2	58	29	125		425
10	76	38	150		506
			200		675

Full-load Current, Three-phase A-c Motors

From National Electrical Code, 1968 Edition, Table 430-150

Hp	Induction Type Squirrel-Cage and Wound Rotor Amperes					Synchronous Type †Unity Power Factor Amperes			
	115V	230V	460V	575V	2300V	220V	440V	550V	2300V
1/2	4	2	1	.8					
3/4	5.6	2.8	1.4	1.1					
1	7.2	3.6	1.8	1.4					
1 1/2	10.4	5.2	2.6	2.1					
2	13.6	6.8	3.4	2.7					
3		9.6	4.8	3.9					
5		15.2	7.6	6.1					
7 1/2		22	11	9					
10		28	14	11					
15		42	21	17					
20		54	27	22					
25		68	34	27		54	27	22	
30		80	40	32		65	33	26	
40		104	52	41		86	43	35	
50		130	65	52		108	54	44	
60		154	77	62	16	128	64	51	12
75		192	96	77	20	161	81	65	15
100		248	124	99	26	211	106	85	20
125		312	156	125	31	274	132	106	25
150		360	180	144	37		158	127	30
200		480	240	192	49		210	168	40

For full-load currents of 208- and 200-volt motors, increase the corresponding 230 volt motor full-load current by 10 and 15 per cent, respectively.

*These values of full-load current are for motors running at speeds usual for belted motors and motors with normal torque characteristics. Motors built for especially low speeds or high torques may require more running current, and multispeed motors will have full load current varying with speed, in which case the nameplate current rating shall be used.

† For 90 and 80 per cent P. F. the above figures shall be multiplied by 1.1. and 1.25 respectively.

The voltages listed are rated motor voltages. Corresponding nominal system voltages are 110 to 120, 220 to 240, 440 to 480 and 550 to 600 volts.

NEC TABLE 430-7(b) *From National Electrical Code, 1968 Edition*

Code letters are marked on most motor nameplates to show the motor input with locked rotor as follows:

Code Letters	Kva per Hp with Locked Rotor	Code Letters	Kva per Hp with Locked Rotor	Code Letters	Kva per Hp with Locked Rotor	Code Letters	Kva per Hp with Locked Rotor
A	Up to 3.14	F	5.0 to 5.59	L	9.0 to 9.99	S	16.0 to 17.99
B	3.15 to 3.54	G	5.6 to 6.29	M	10.0 to 11.19	T	18.0 to 19.99
C	3.55 to 3.99	H	6.3 to 7.09	N	11.2 to 12.49	U	20.0 to 22.39
D	4.0 to 4.49	J	7.1 to 7.99	P	12.5 to 13.99	V	22.4 and up
E	4.5 to 4.99	K	8.0 to 8.99	R	14.0 to 15.99		

Electrical Formula—For Obtaining Kw, Kva, Hp, and Amperes

Wanted	Single-Phase	Alternating Current Two-Phase Four-Wire	Three-Phase	Direct Current
Kilowatts	$\frac{I \times E \times PF}{1000}$	$\frac{I \times E \times 2 \times PF}{1000}$	$\frac{I \times E \times 1.73 \times PF}{1000}$	$\frac{I \times E}{1000}$
Kva	$\frac{I \times E}{1000}$	$\frac{I \times E \times 2}{1000}$	$\frac{I \times E \times 1.73}{1000}$	$\frac{I \times E}{1000}$
Horsepower	$\frac{I \times E \times \% \text{ Eff.} \times PF}{746}$	$\frac{I \times E \times 2 \times \% \text{ Eff.} \times PF}{746}$	$\frac{I \times E \times 1.73 \times \% \text{ Eff.} \times PF}{746}$	$\frac{I \times E \times \% \text{ Eff.}}{746}$
Amperes from Kva	$\frac{KVA. \times 1000}{E}$	$\frac{KVA. \times 1000}{2 \times E}$	$\frac{KVA. \times 1000}{1.73 \times E}$	$\frac{KVA. \times 1000}{E}$
Amperes from Kw	$\frac{K.W. \times 1000}{E \times PF}$	$\frac{K.W. \times 1000}{2 \times E \times PF}$	$\frac{K.W. \times 1000}{1.73 \times E \times PF}$	$\frac{K.W. \times 1000}{E}$
Amperes from Hp	$\frac{H.P. \times 746}{E \times \% \text{ Eff.} \times PF}$	$\frac{H.P. \times 746}{2 \times E \times \% \text{ Eff.} \times PF}$	$\frac{H.P. \times 746}{1.73 \times E \times \% \text{ Eff.} \times PF}$	$\frac{H.P. \times 746}{E \times \% \text{ Eff.}}$

E = Volts I = Amperes % Eff. = Percent Efficiency PF = Power Factor

Overcurrent Protection for Motors

TABLE 430-152

Maximum Rating or Setting of Motor Branch Circuit Protective Devices for Motors Marked with a Code Letter Indicating Locked Rotor KVA

Type of Motor	Percent of Full-Load Current Circuit Breaker Setting		
	Fuse Rating	Instantaneous Type	Time Limit Type
All AC single-phase and polyphase squirrel cage and synchronous motors with full-voltage, resistor or reactor starting:			
Code Letter A	150	700	150
Code Letter B to E	250	700	200
Code Letter F to V	300	700	250
All AC squirrel cage and synchronous motors with auto-transformer starting:			
Code Letter A	150	700	150
Code Letter B to E	200	700	200
Code Letter F to V	250	700	200

For certain exceptions to the values specified see Sections 430-52 and 430-54. The values given in the last column also cover the ratings of nonadjustable, time-limit types of circuit breakers which may also be modified as in Section 430-52.

Synchronous motors of the low-torque, low-speed type (usually 450 RPM or lower), such as are used to drive reciprocating compressors, pumps, etc., which start up unloaded, do not require a fuse rating or circuit breaker setting in excess of 200% of full-load current.

For motors not marked with a Code Letter, see Table 430-153.

TABLE 430-153

Maximum Rating or Setting of Motor Branch Circuit Protective Devices for Motors not Marked with a Code Letter Indicating Locked Rotor KVA

Type of Motor	Percent of Full-Load Current Circuit Breaker Setting		
	Fuse Rating	Instantaneous Type	Time Limit Type
Single-phase, all types	300	700	250
Squirrel-cage and synchronous (full-voltage, resistor and reactor starting)	300	700	250
Squirrel-cage and synchronous (auto-transformer starting):			
Not more than 30 amperes	250	700	200
More than 30 amperes	200	700	200
High-reactance squirrel-cage:			
Not more than 30 amperes	250	700	250
More than 30 amperes	200	700	200
Wound-rotor	150	700	150
Direct-current:			
Not more than 50 H.P.	150	250	150
More than 50 H.P.	150	175	150
Sealed (Hermetic Type): Refrigeration Compressor* 400 KVA locked-rotor or less	†175		†175

For certain exceptions to the values specified see Sections 430-52, and 430-59. The values given in the last column also cover the ratings of nonadjustable, time-limit types of circuit breakers which may also be modified as in Section 430-52.

Synchronous motors of the low-torque low-speed type (usually 450 RPM or lower) such as are used to drive reciprocating compressors, pumps, etc., which start up unloaded, do not require a fuse rating or circuit breaker setting in excess of 200% of full-load current.

For motors marked with a Code Letter, see Table 430-152.

*The locked rotor KVA is the product of the motor voltage and the motor locked rotor current (LRA) given on the motor nameplate divided by 1,000 for single-phase motors, or divided by 580 for 3-phase motors.

†This value may be increased to 225 per cent if necessary to permit starting.

Application Information

SHORT CIRCUIT DETERMINATION

Short-Circuit Currents In Low-Voltage Systems

The accurate determination of the maximum available short circuit current at a given point in a circuit may require complex calculations. A simplified method for determining this, for a wide range of voltage systems and transformer sizes, has been developed.

This method for determining short circuit currents in low-voltage systems is based on one applied by the NEMA Joint Sections Committee on Air Circuit Breakers. The Committee's report was recommended by the AIEE Committee on Industrial Power Systems, and published as AIEE Transactions Paper No. 55-442, "Short-circuit Currents in Low-voltage Systems."

Description of Method

The method is based on the use of curves showing symmetrical short-circuit currents available at various distances from the transformer. Curves are included for five insulated copper conductor types.

Conductor Size—	Conductor Temperature Rating	Ampacities of Conductors
No. 4	60°C	70
No. 1/0	60°C	125
250 MCM	75°C	255
2—500 MCM	75°C	760
4—750 MCM	75°C	1900

These curves are plotted from calculations based on methods described in AIEE-ASA Publication C37.5 and in the supplement to AIEE-ASA Publication C37.13. All calculations, based on bolted faults, involve the following assumptions:

A 3-phase radial system of 208, 240, 480, or 600 volts 60 cycles, supplied from transformers of 150 to 2000 kva inclusive. The fault is a bolted 3-phase short circuit.

1. A typical circuit, as shown in Fig. 1, in which the short circuit occurs at point "X"—a known distance from the secondary of the transformer.

2. A 500,000-kva short-circuit duty is available at the primary of the transformer.

3. The nominal transformer impedance is 4.5% for 150-, 225-, 300- and 500-kva transformers, 5.75% for 750-kva transformers and above. There are also included curves for 150- and 225-kva transformers presently available with lower impedances (2%) on which the short-circuit current is higher.

4. The short-circuit current includes contributions from a group of motors connected to the transformer secondary bus. The total kva of the motors is equal to the transformer kva for 240-, 480- and 600-volt systems and one-half the transformer kva for 208-volt systems.

The curves plotted from these calculations are reproduced on pages 22-6. They permit the determination, at any point in a given low-voltage system, of the magnitude of the AC (RMS) symmetrical short-circuit current.

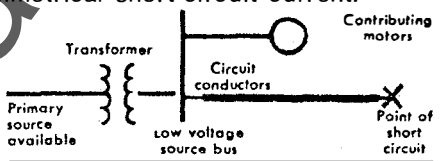


Fig. 1. Typical circuit investigated to obtain data for curves showing reduction in short-circuit duty with distance from transformer to point of fault.

Equivalent feeder arrangements having short circuit currents equal to or less than that read from the curves include:

Original Conductor Arrangement	Equivalent Feeder Arrangement
2—500 MCM	3—No. 4/0 Cables 4—No. 2/0 Cables LVD3 (Copper) 600 Amp Busway FVK (Copper) 1000 Amp Busway FVA (Aluminum) 800 Amp Busway DE Busway 600 Amps
4—750 MCM	3—2000 MCM Cables 5—400 MCM Cables 6—300 MCM Cables LVD (Copper) 1600 Amp Busway LVD (Aluminum) 1600 Amp Busway

Transformer Short Circuit Curves

Use the curves directly to determine the available short-circuit current at the end of a given-size feeder originating at the low-voltage bus of a given transformer. Choose the graph for the correct transformer kva and system voltage. The graphs apply only to transformers with nominal impedances equal to or greater than the values assumed.

Select the curve corresponding to the feeder size used. Find the point on the horizontal scale corresponding to the length of the feeder. Then, find the corresponding short-circuit current on the vertical scale.

Where the circuit from the substation low-voltage bus includes two sections of different wire size an estimate of the duty can be obtained considering only one wire size. First, find the short-circuit current corresponding to the length and size of the section having the smaller wire. Then, find the short-circuit current corresponding to the wire size of the other section but using a length equal to the sum of the two section lengths. Since the actual duty is less than either of the two short-circuit currents thus determined, use the smaller current value.

After the short-circuit current has been determined in this manner, choose a circuit breaker from Table 1 (Interrupting Current Ratings—page 14) . . . that has an interrupting rating equal to or higher than the short-circuit current. This General Electric molded-case circuit breaker will be adequate to provide short-circuit protection at this point in the circuit.

Cable sizes and lengths selected from the included curves to obtain a given reduction in short-circuit duty should also be separately checked to see that the cable meets other necessary requirements.

Sample Problem—Determine the short-circuit current available on a 480-volt system connected to a 1500-kva transformer with the circuit breaker connection 300-feet from the transformer on a feeder having 2—500-MCM conductors per phase. A circuit breaker of 600-amp continuous current rating is to be applied.

In Fig. 28, enter at 300 feet on the horizontal scale and read 22,000 symmetrical amperes.

The interrupting ratings of General Electric circuit breakers on page 14 show that the TJK6 or TKM-frame molded-case circuit breaker with a continuous current rating of 600 amperes, and an interrupting rating of 30,000 amperes symmetrical at 480 volts is satisfactory for application at this point.

Application Information

SHORT-CIRCUIT CURRENT CURVES

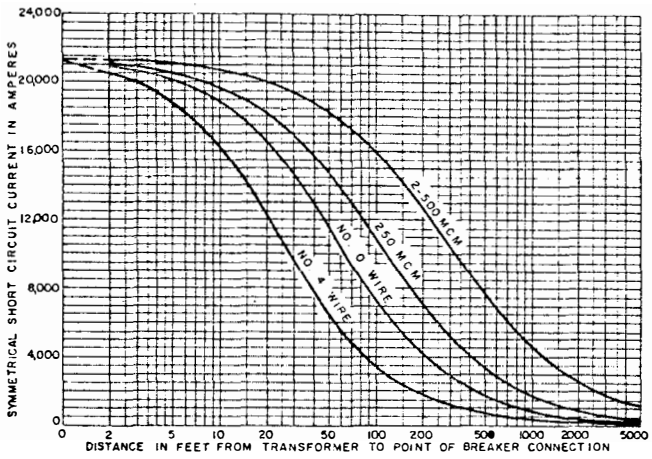


Fig. 2 Transf: 150 kva, 208 v, 2.0% z

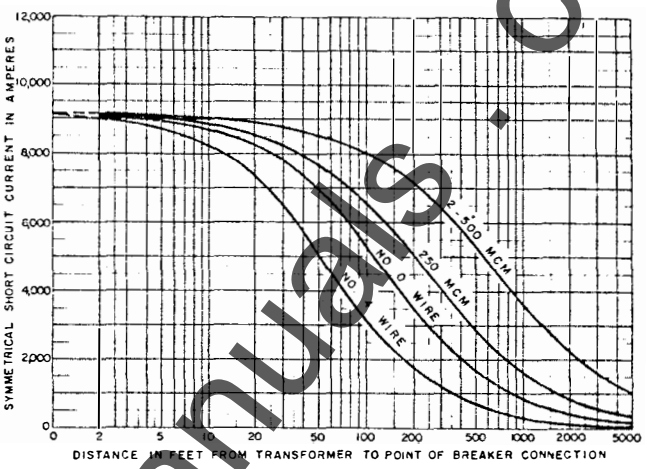


Fig. 3 Transf: 150 kva, 208 v, 4.5% z

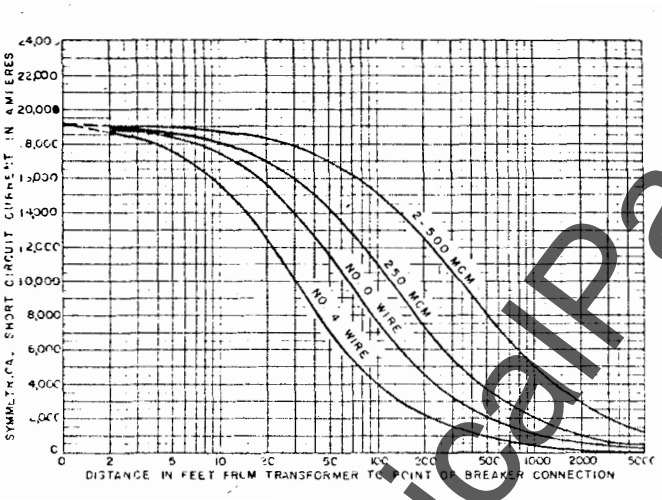


Fig. 4 Transf: 150 kva, 240 v, 2.0% z

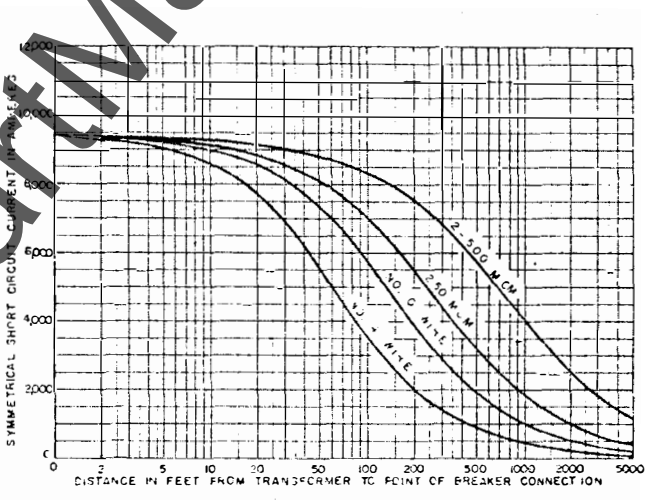


Fig. 5 Transf: 150 kva, 240 v, 4.5% z

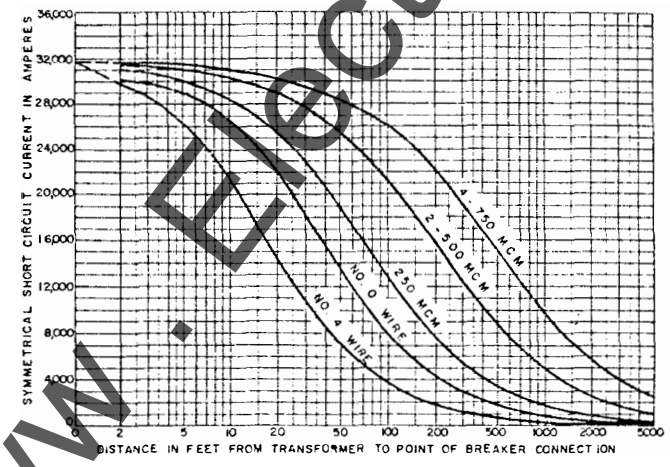


Fig. 6 Transf: 225 kva, 208 v, 2.0% z

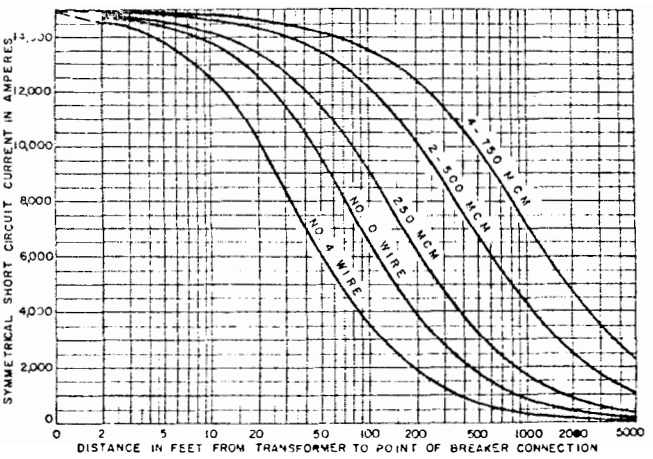


Fig. 7 Transf: 225 kva, 208 v, 4.5% z

Application Information

SHORT-CIRCUIT CURRENT CURVES

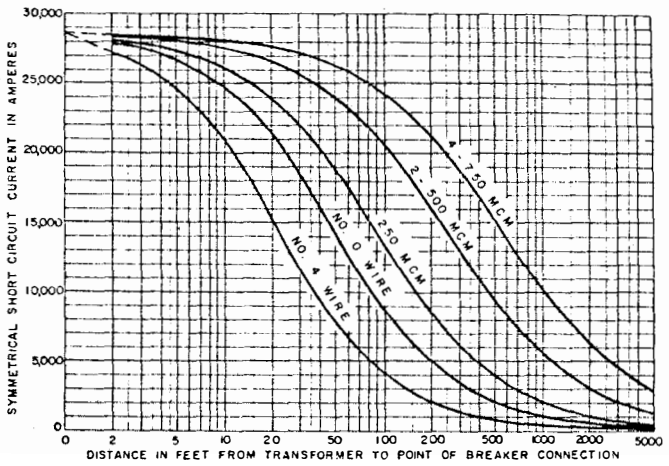


Fig. 8 Transf: 225 kva, 240 v, 2.0% z

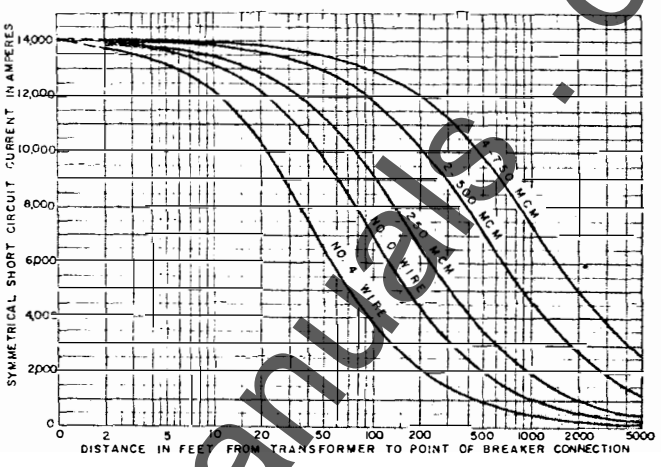


Fig. 9 Transf: 225 kva, 240 v, 4.5% z

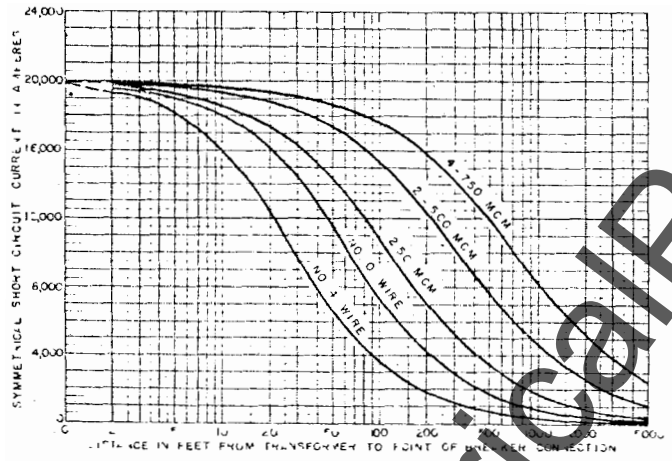


Fig. 10 Transf: 300 kva, 208 v, 4.5% z

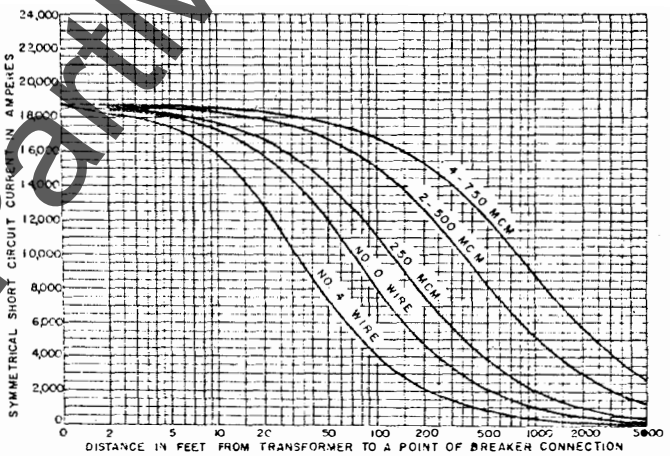


Fig. 11 Transf: 300 kva, 240 v, 4.5% z

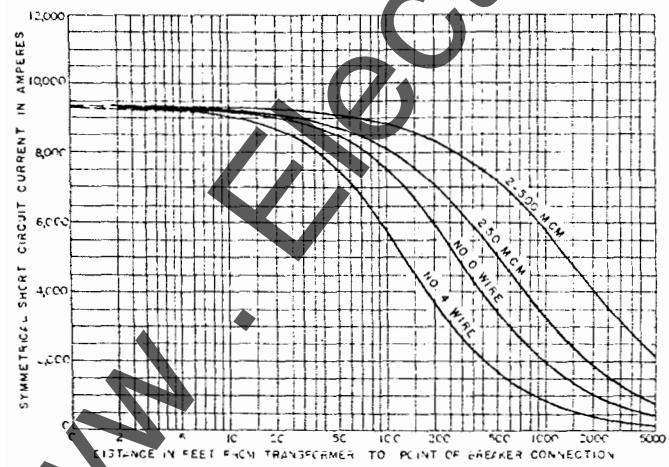


Fig. 12 Transf: 300 kva, 480 v, 4.5% z

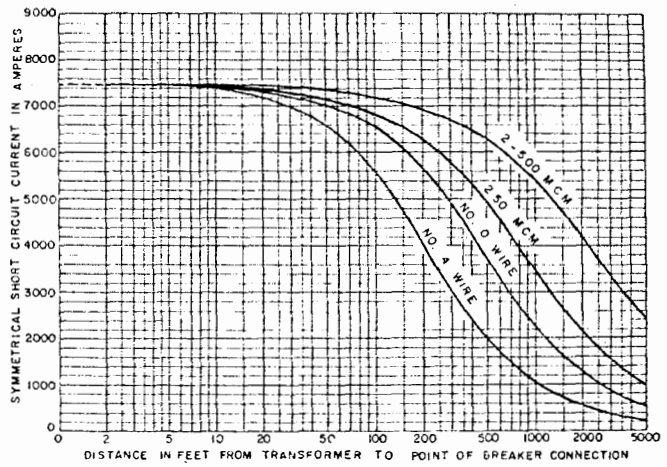


Fig. 13 Transf: 300 kva, 600 v, 4.5% z

Application Information

SHORT-CIRCUIT CURRENT CURVES

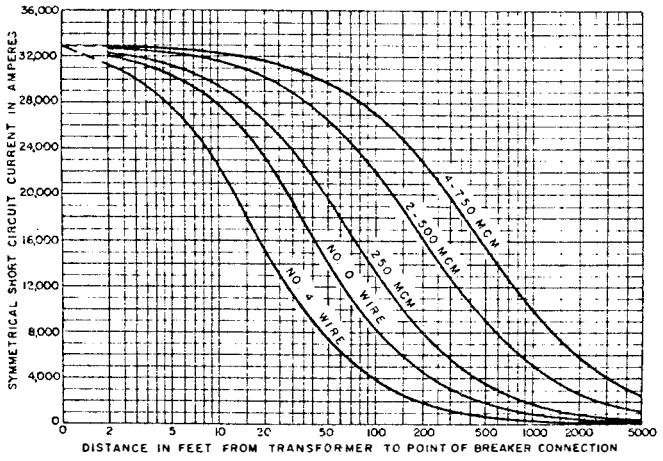


Fig. 14 Transf: 500 kva, 208 v, 4.5% z

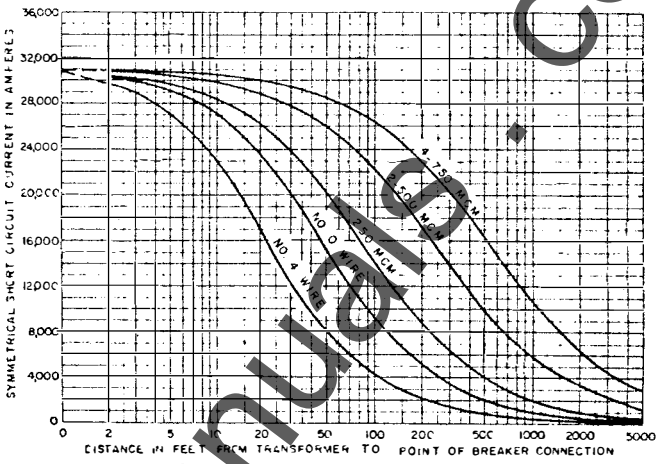


Fig. 15 Transf: 500 kva, 240 v, 4.5% z

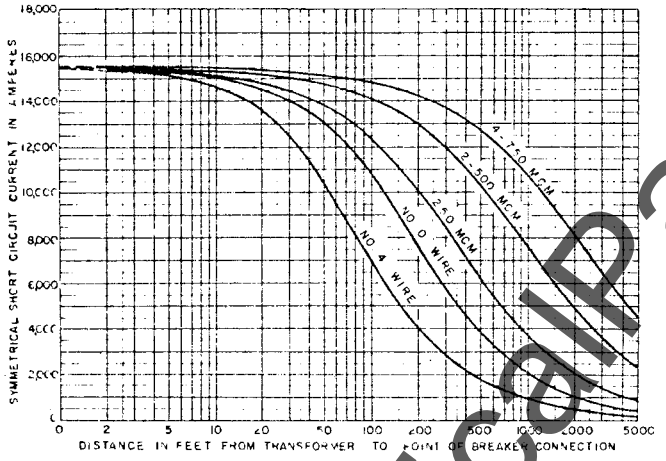


Fig. 16 Transf: 500 kva, 480 v, 4.5% z

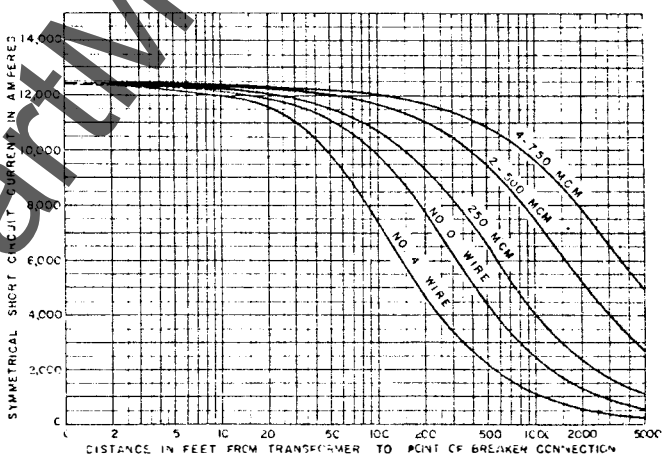


Fig. 17 Transf: 500 kva, 600 v, 4.5% z

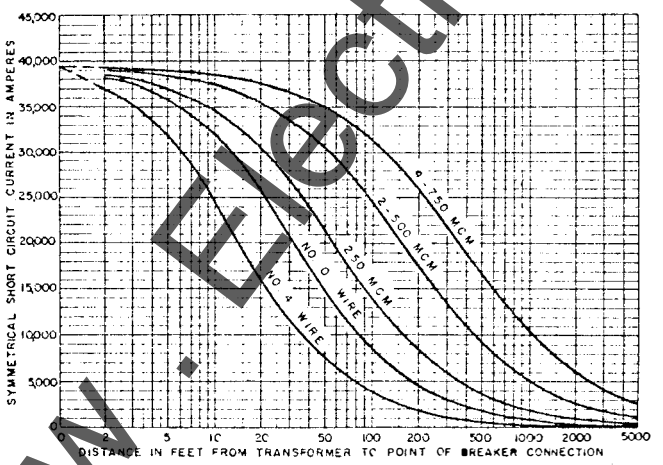


Fig. 18 Transf: 750 kva, 208 v, 5.75% z

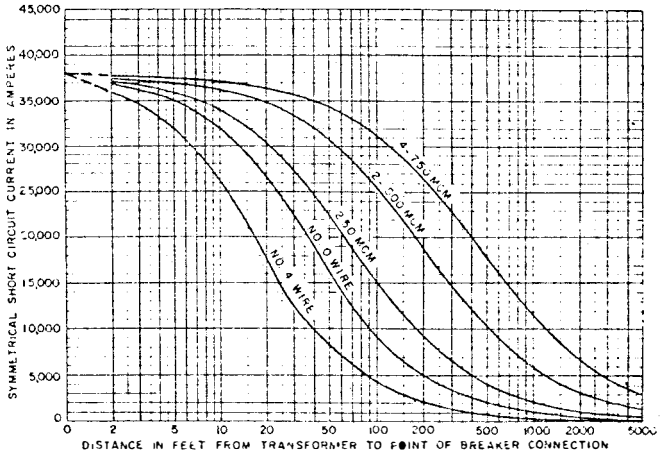


Fig. 19 Transf: 750 kva, 240 v, 5.75% z

SHORT-CIRCUIT CURRENT CURVES

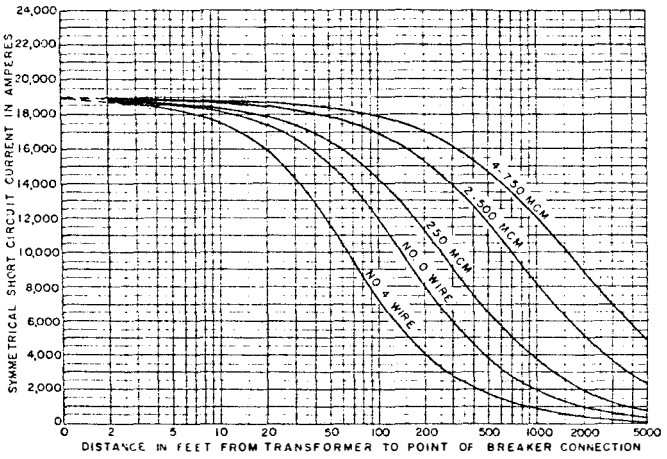


Fig. 20 Transf: 750 kva, 480 v, 5.75% z

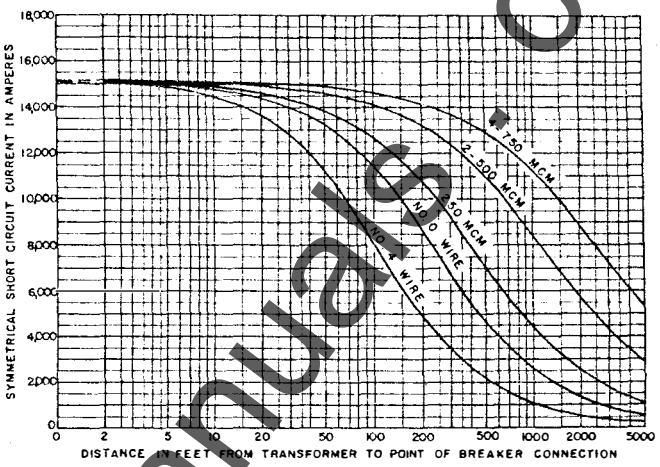


Fig. 21 Transf: 750 kva, 600 v, 5.75% z

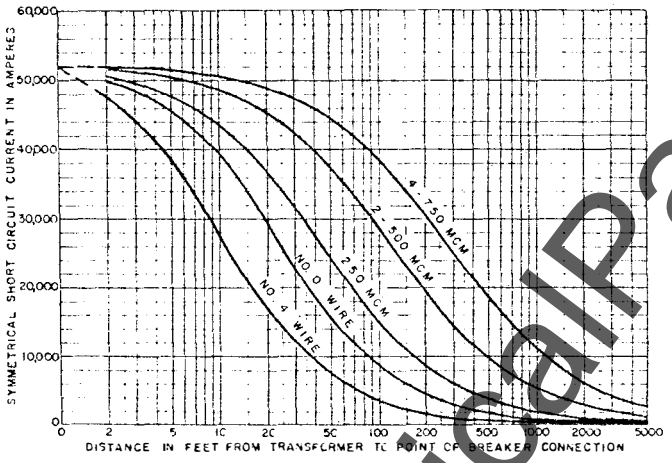


Fig. 22 Transf: 1000 kva, 208 v, 5.75% z

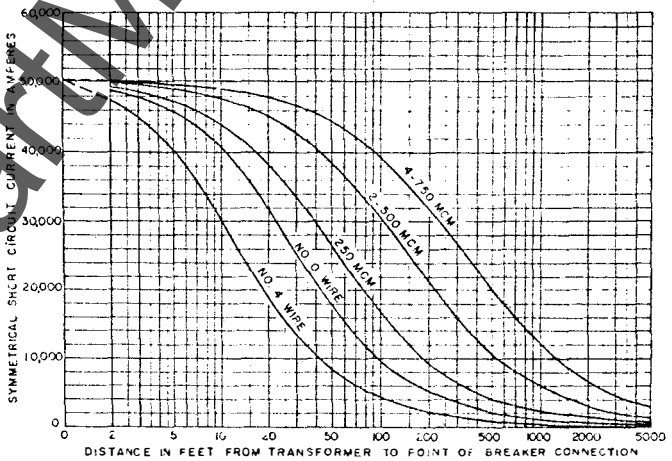


Fig. 23 Transf: 1000 kva, 240 v, 5.75% z

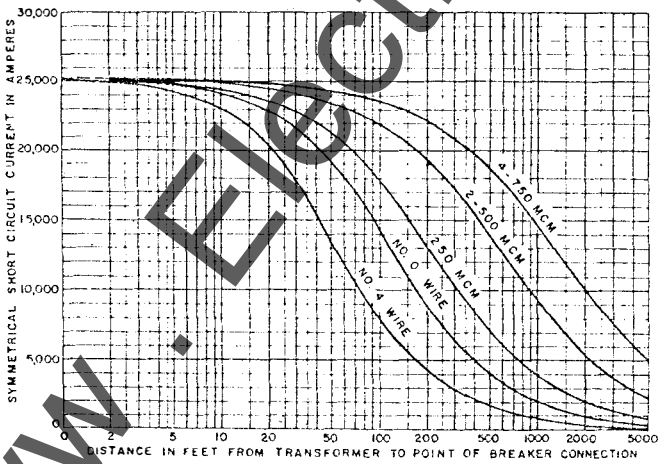


Fig. 24 Transf: 1000 kva, 480 v, 5.75% z

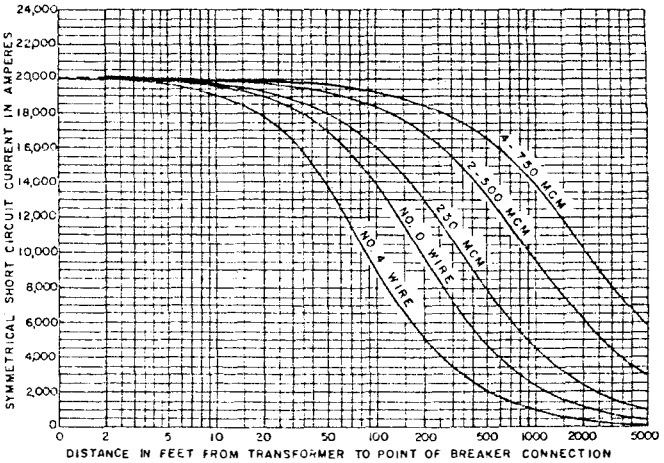


Fig. 25 Transf: 1000 kva, 600 v, 5.75% z

Application Information

SHORT-CIRCUIT CURRENT CURVES

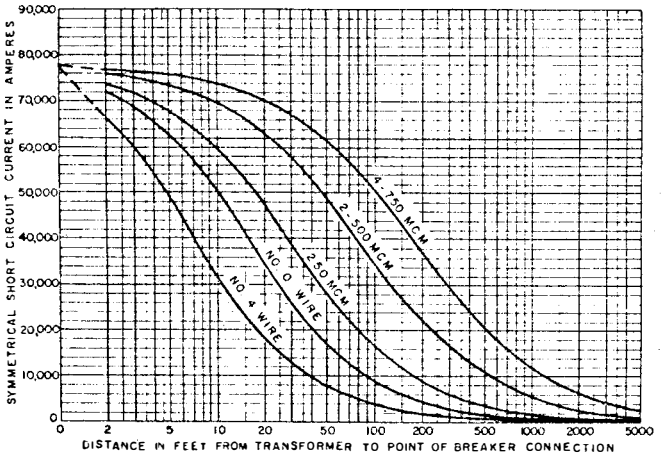


Fig. 26 Transf: 1500 kva, 208 v, 5.75% z

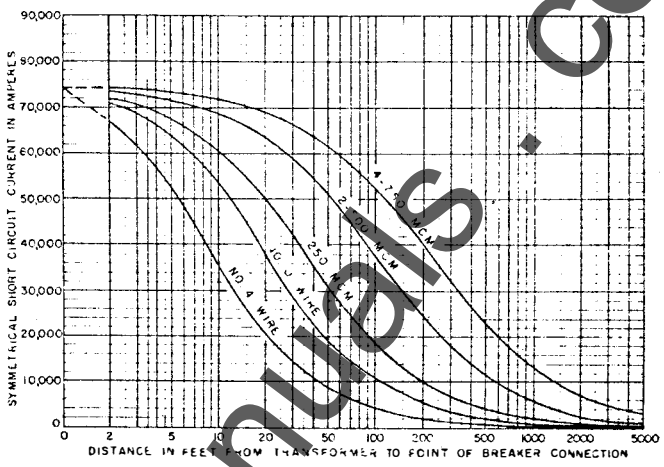


Fig. 27 Transf: 1500 kva, 240 v, 5.75% z

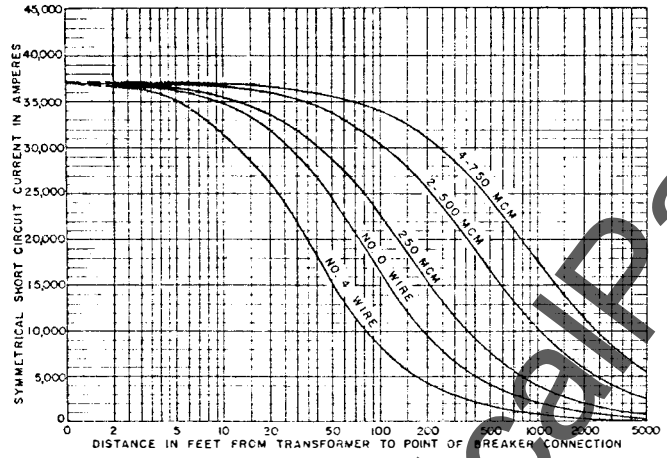


Fig. 28 Transf: 1500 kva, 480 v, 5.75% z

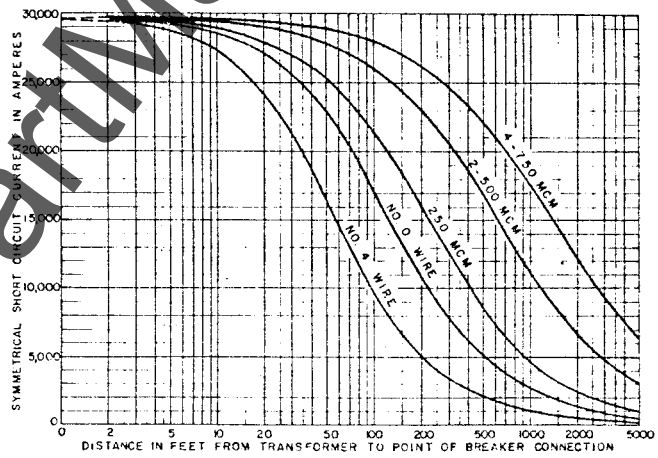


Fig. 29 Transf: 1500 kva, 600 v, 5.75% z

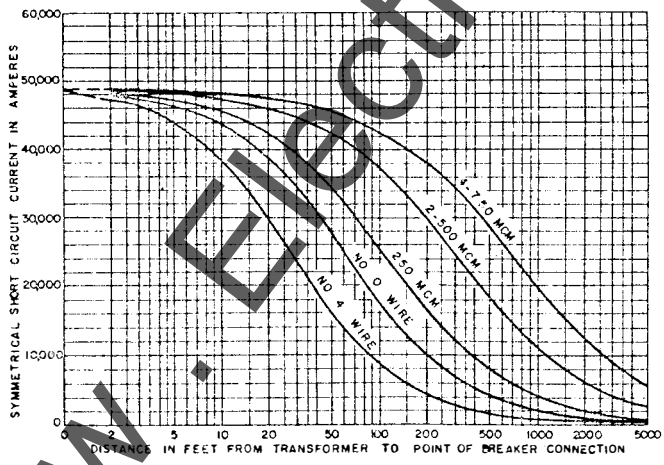


Fig. 30 Transf: 2000 kva, 480 v, 5.75% z

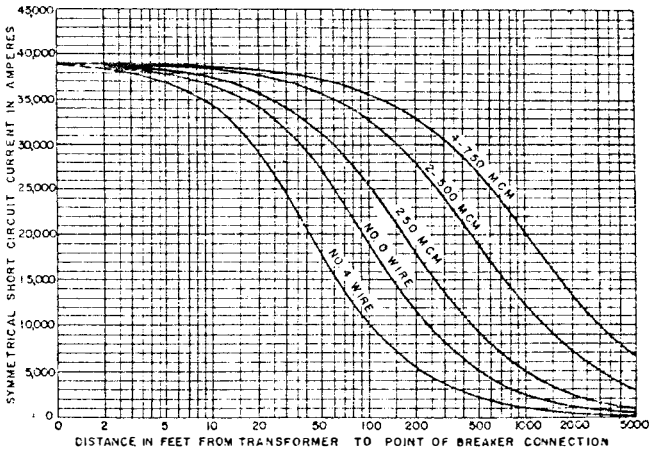
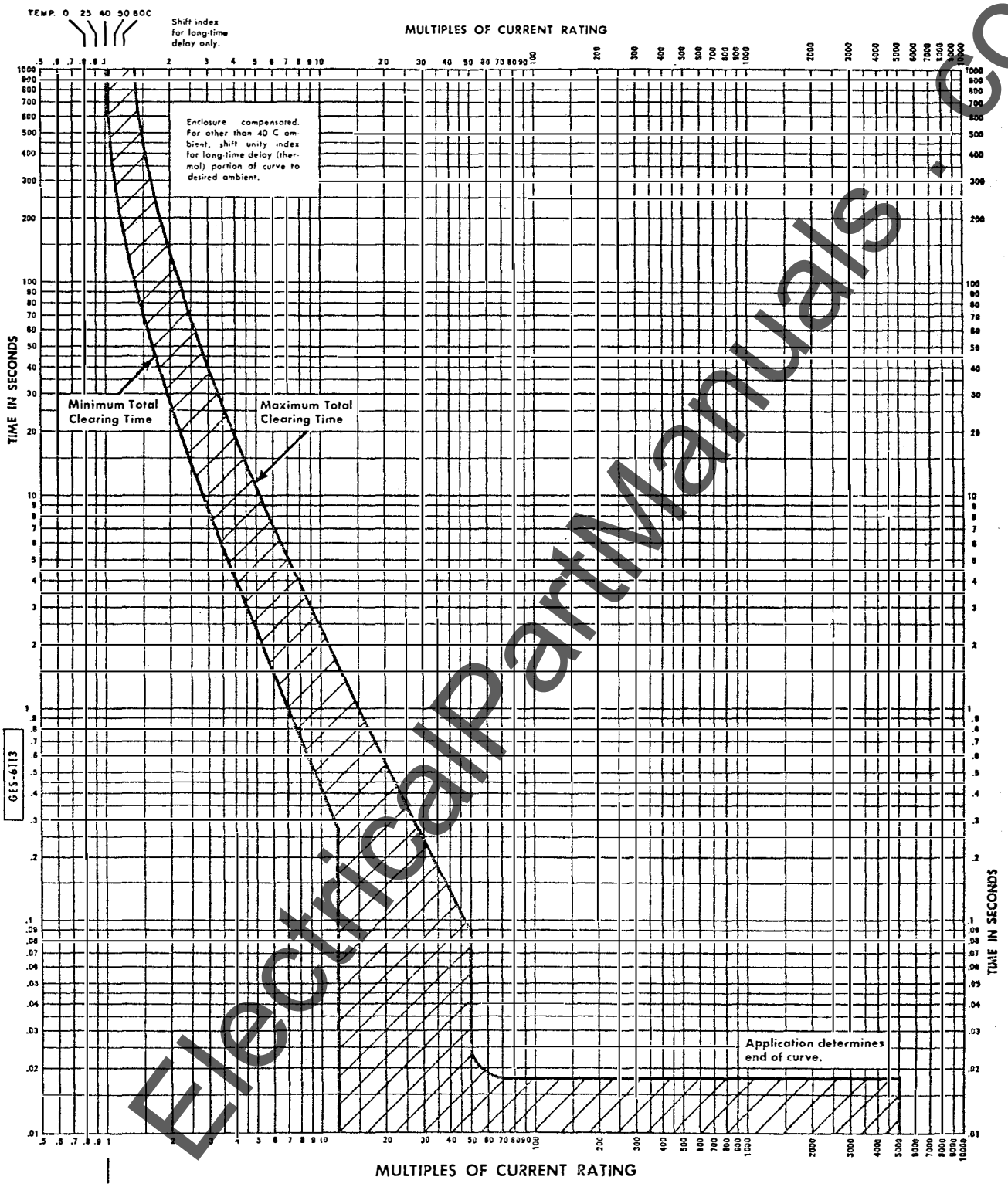


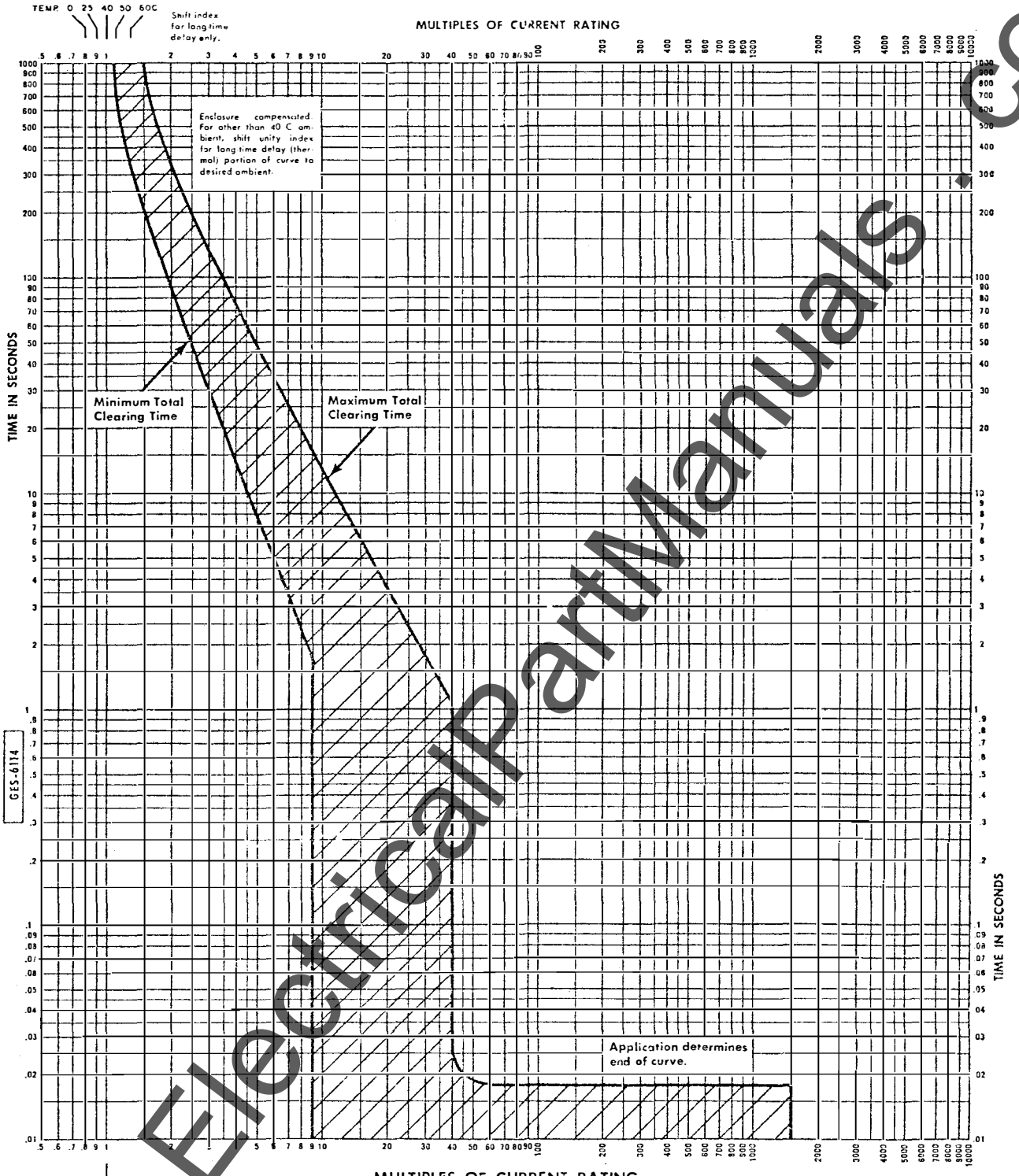
Fig. 31 Transf: 2000 kva, 600 v, 5.75% z

Time Current Curves



GENERAL ELECTRIC	MOLDED-CASE CIRCUIT BREAKER **E 100 LINE** ENCLOSURE COMPENSATED Types TED and THED, 15–45 Amperes Long-time Delay and Instantaneous Time-current Curves (Curves show enclosure-compensated circuit breaker in open air, 40 C ambient, wired with conductors of corresponding rating, no prior load. For all other ambients, use shift index at top of sheet.)	GES-6113
Current Ratings 15, 20, 25, 30, 35, 40 and 45 amperes **Voltage Ratings** 480 and 600 volts a-c **Frequency Rating** 60 Hertz		**Adjustments** Long-time delay thermal trip: not adjustable. Instantaneous magnetic trip: not adjustable.

Time Current Curves



GENERAL ELECTRIC

MOLDED-CASE CIRCUIT BREAKER

E 100 LINE

ENCLOSURE COMPENSATED

Types TED and THED, 50–80 amperes

Long-time Delay and Instantaneous

Time-current Curves

(Curves show enclosure-compensated circuit breaker in open air, 40 C ambient, wired with conductors of corresponding rating, no prior load. For all other ambients, use shift index at top of sheet.)

GES-6114

Current Ratings
50, 60, 70 and 80 amperes

Voltage Ratings
480 and 600 volts a-c

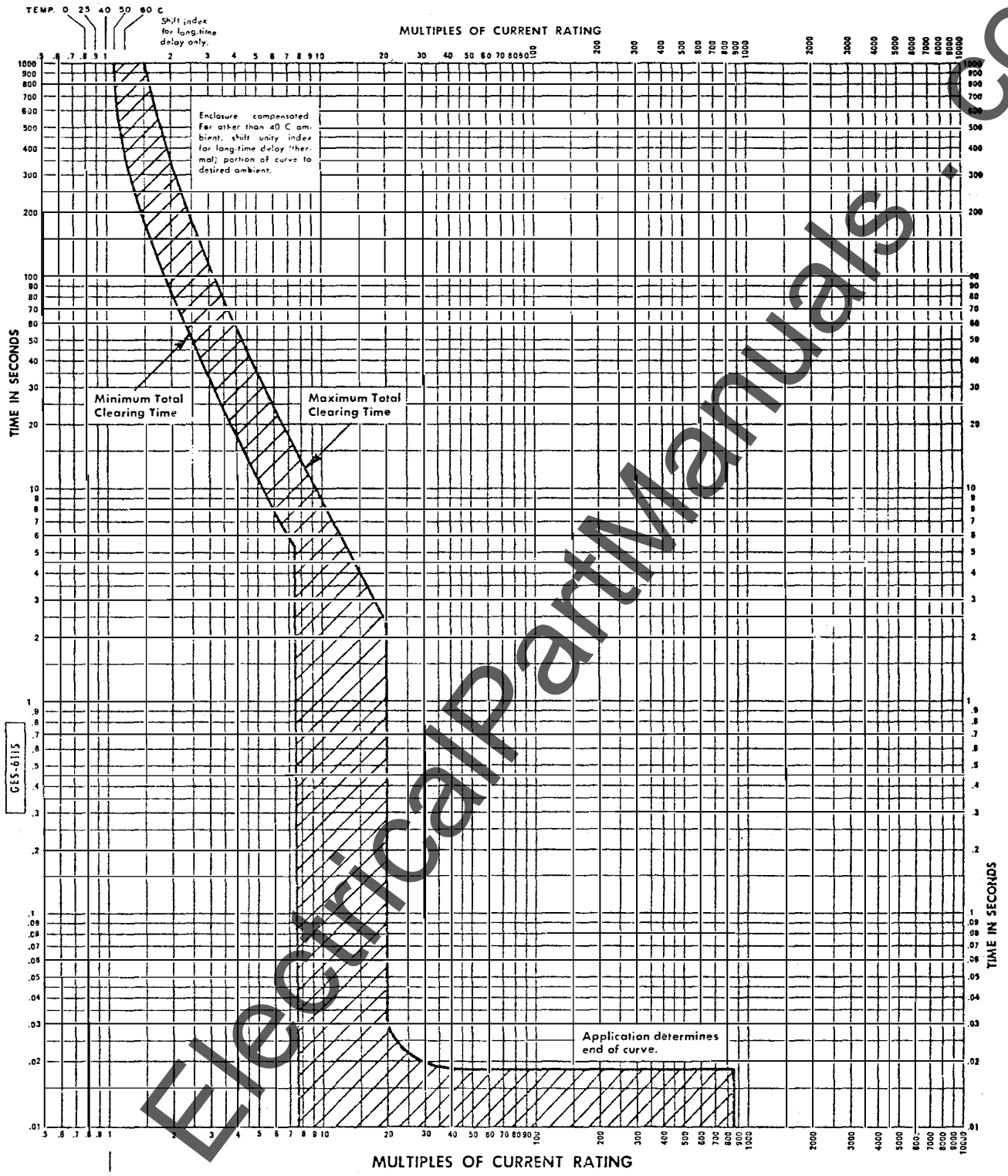
Frequency Ratings
60 Hertz

Adjustments

Long-time delay thermal trip: not adjustable.

Instantaneous magnetic trip: not adjustable.

Time Current Curves



GENERAL ELECTRIC

Current Ratings
90 and 100 amperes

Voltage Ratings
480 and 600 volts a-c

Frequency Rating
60 Hertz

MOLDED-CASE CIRCUIT BREAKER

E 100 LINE

ENCLOSURE COMPENSATED

Types TED and THED, 90 and 100 amperes

Long-time Delay and Instantaneous

Time-current Curves

(Curves show enclosure compensated circuit breaker in open air, 40 C ambient, wired with conductors of corresponding rating, no prior load. For all other ambients, use shift index at top of sheet.)

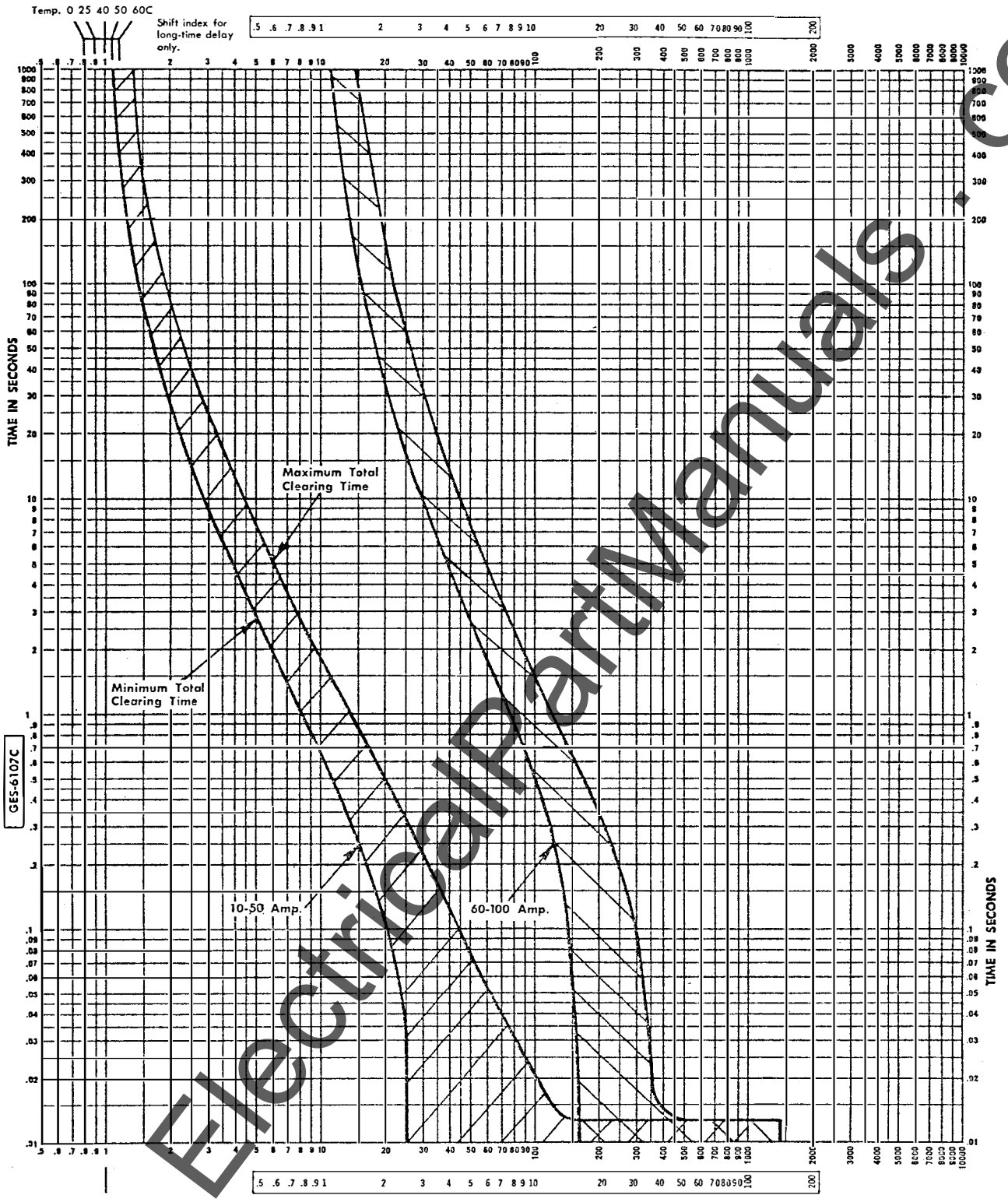
GES-6115

Adjustments

Long-time delay thermal trip: not adjustable.

Instantaneous magnetic trip: not adjustable.

Time Current Curves



GENERAL ELECTRIC

Current Ratings
10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90 and 100 Amperes

Voltage Ratings
240 Volts, A-c (125/250 Volts, D-c)

Frequency Ratings
60 Hertz

MOLDED-CASE CIRCUIT BREAKER

E-100 LINE

ENCLOSURE COMPENSATED

Type TE

Long-time Delay and Instantaneous Time-current Curves

(Curves show circuit breaker in open air, 40C ambient, wired with conductors of corresponding rating, no prior load. For all other ambients use rating shift index at top of sheet.)

GES-6107C

Adjustments

Long-time delay thermal trip: not adjustable

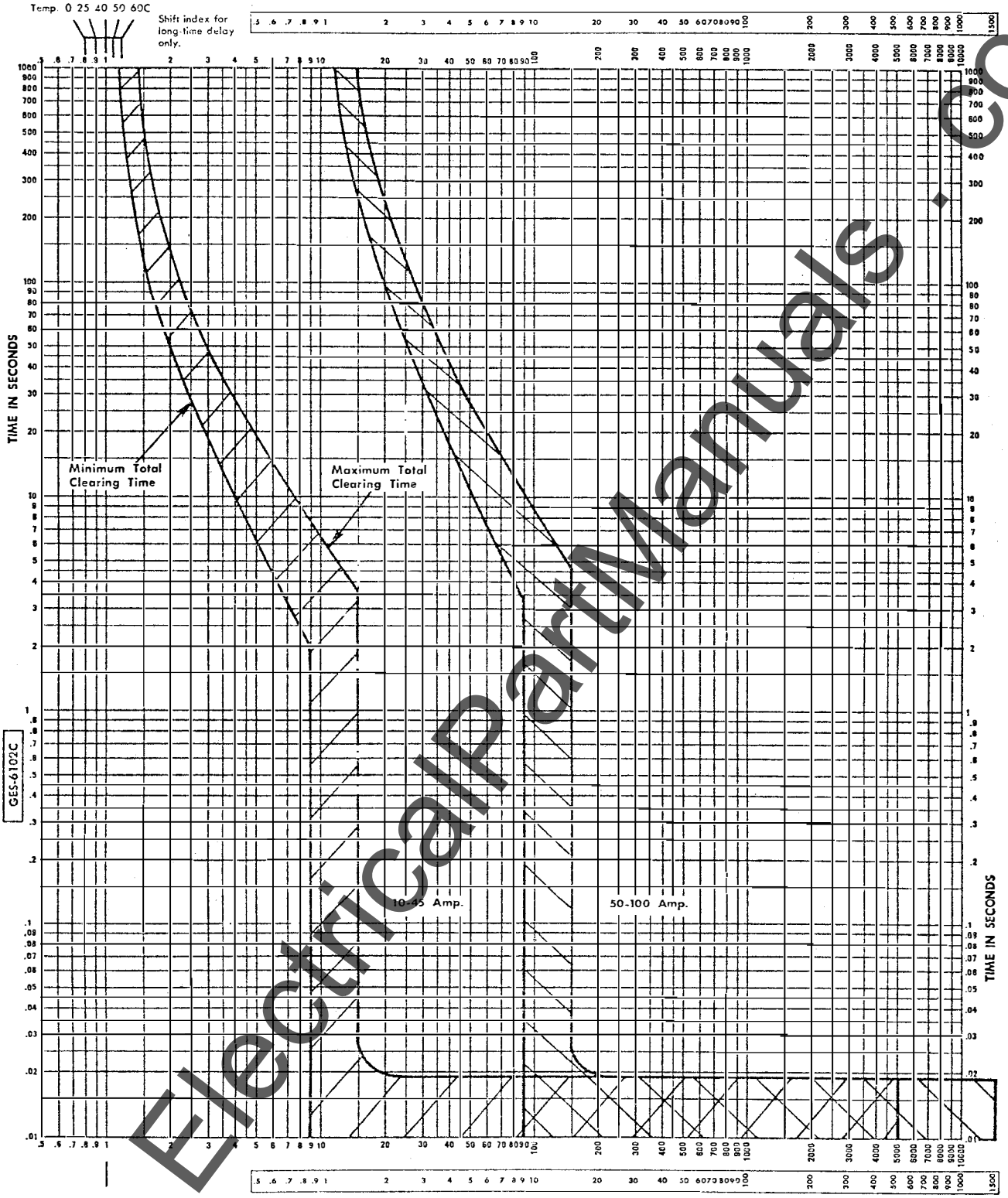
Instantaneous magnetic trip: not adjustable

REV. 6-19-69

CIRCUIT PROTECTIVE DEVICES DEPARTMENT, PLAINVILLE, CONNECTICUT

K215-47C

Time Current Curves



GENERAL ELECTRIC

MOLDED-CASE CIRCUIT BREAKER

E-100 LINE

ENCLOSURE COMPENSATED

Types TEF & THEF ●

Long-time Delay and Instantaneous Time-current Curves

(Curves show circuit breaker in open air, 40C ambient, wired with conductors of corresponding rating, no prior load. For all other ambients use rating shift index at top of sheet.)

GES-6102C

Current Ratings
10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90 and 100 Amperes

Voltage Ratings
480 Volts, A-c (250 Volts D-c)
277 Volts A-c (125 Volts D-c)

Frequency Ratings
60 Hertz

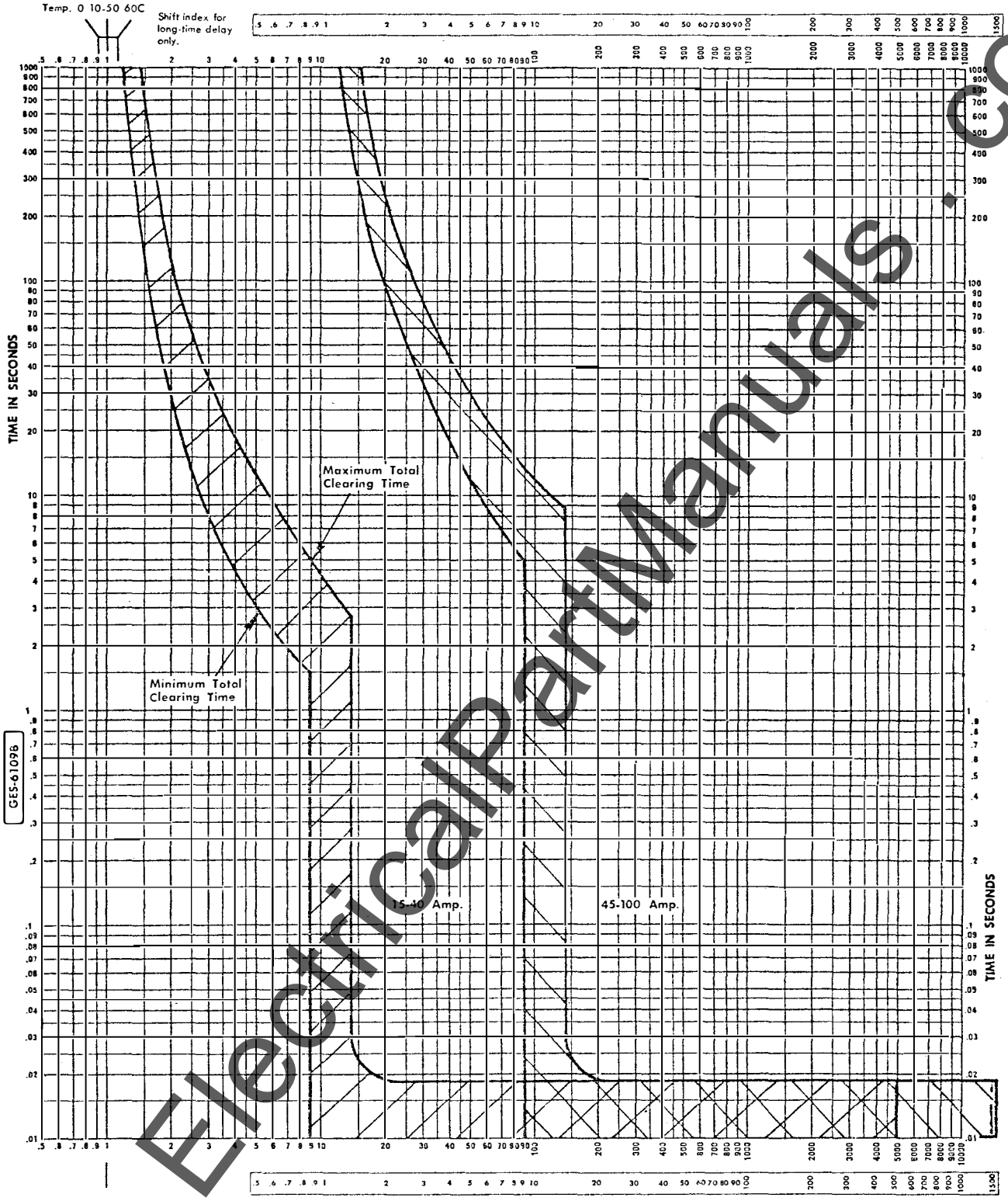
Adjustments
Long-time delay thermal trip: not adjustable
Instantaneous magnetic trip: not adjustable

REV. 6-18-69

CIRCUIT PROTECTIVE DEVICES DEPARTMENT, PLAINVILLE, CONNECTICUT

● 3-pole breakers superseded by TED/THED.

Time Current Curves



GENERAL ELECTRIC

Current Ratings
15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90 and 100 Amperes

Voltage Ratings
600 Volts A-c (250 Volts D-c)

Frequency Ratings
60 Hertz

MOLDED-CASE CIRCUIT BREAKER

E-100 LINE

AMBIENT COMPENSATED

Types TEF & THEF ⊙

Long-time Delay and Instantaneous Time-current Curves

(Curves show circuit breaker in open air, 10-50C ambient, wired with conductors of corresponding rating, no prior load. For all other ambients use rating shift index at top of sheet.

GES-6109B

Adjustments

Long-time delay thermal trip: not adjustable

Instantaneous magnetic trip: not adjustable

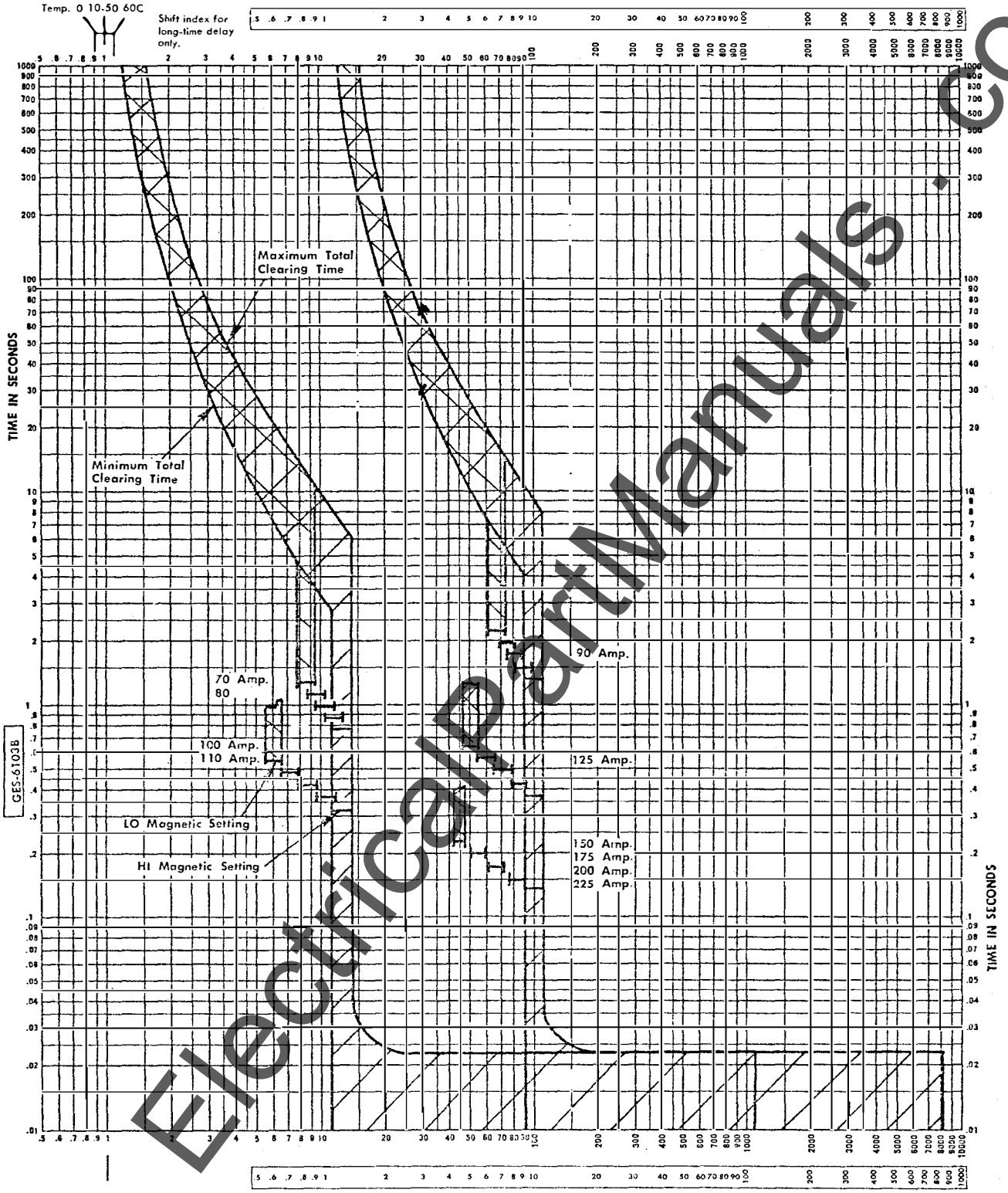
REV. 6-20-69

CIRCUIT PROTECTIVE DEVICES DEPARTMENT, PLAINVILLE, CONNECTICUT

K215-4X

⊙ Obsolete. For reference only. To be superseded by TED/THED 4th Qtr. 1970.

Time Current Curves



GENERAL ELECTRIC

Current Ratings
70, 80, 90, 100, 110, 125, 150 175, 200 and 225 Amperes

Voltage Ratings
600 Volts A-c (250 Volts D-c)

Frequency Ratings
60 Hertz

MOLDED-CASE CIRCUIT BREAKERS

F-225 LINE

AMBIENT COMPENSATED

Types TFJ, THFJ (150 Amp. Max.), TFK & THFK

Long-time Delay and Instantaneous

Time-current Curves

(Curves show circuit breaker in open air, 10-50C ambient, wired with conductors of corresponding rating, no prior load. For all other ambients use rating shift index at top of sheet.)

GES-6103B

Adjustments

Long-time delay thermal trip: not adjustable

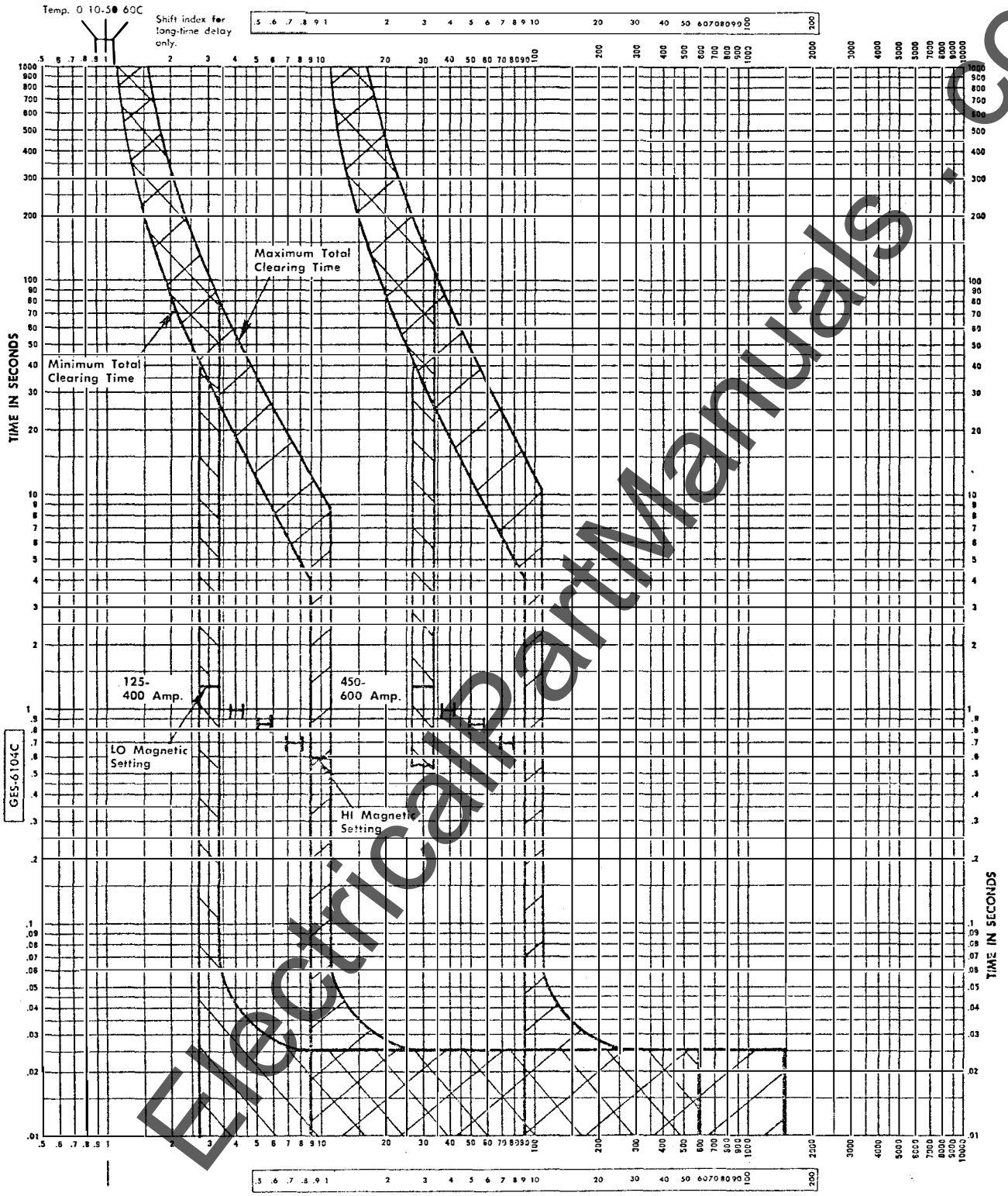
Instantaneous magnetic trip, continuously adjustable, factory set on HI. Blocks show trip range at marked points on instantaneous dials.

REV. 6-19-69

CIRCUIT PROTECTIVE DEVICES DEPARTMENT, PLAINVILLE, CONNECTICUT

K215-441

Time Current Curves



GENERAL ELECTRIC

Current Ratings
125, 150, 175, 200, 225, 250, 300, 350, 400, 450, 500 and 600 Amperes

Voltage Ratings
600 Volts A-c (250 Volts D-c)

Frequency Ratings
60 Hertz

MOLDED-CASE CIRCUIT BREAKER

J-600 LINE

AMBIENT COMPENSATED

Types TJJ (400 Amp. Max.), TJK, THJK & THJK2 (225 Amp. Max.)

Long-time Delay and Instantaneous Time-current Curves

(Curves show circuit breaker in open air, 10-50C ambient, wired with conductors of corresponding rating, no prior load. For all other ambients use rating shift index at top of sheet.)

GES-6104C

Adjustments

Long-time delay thermal trip: not adjustable

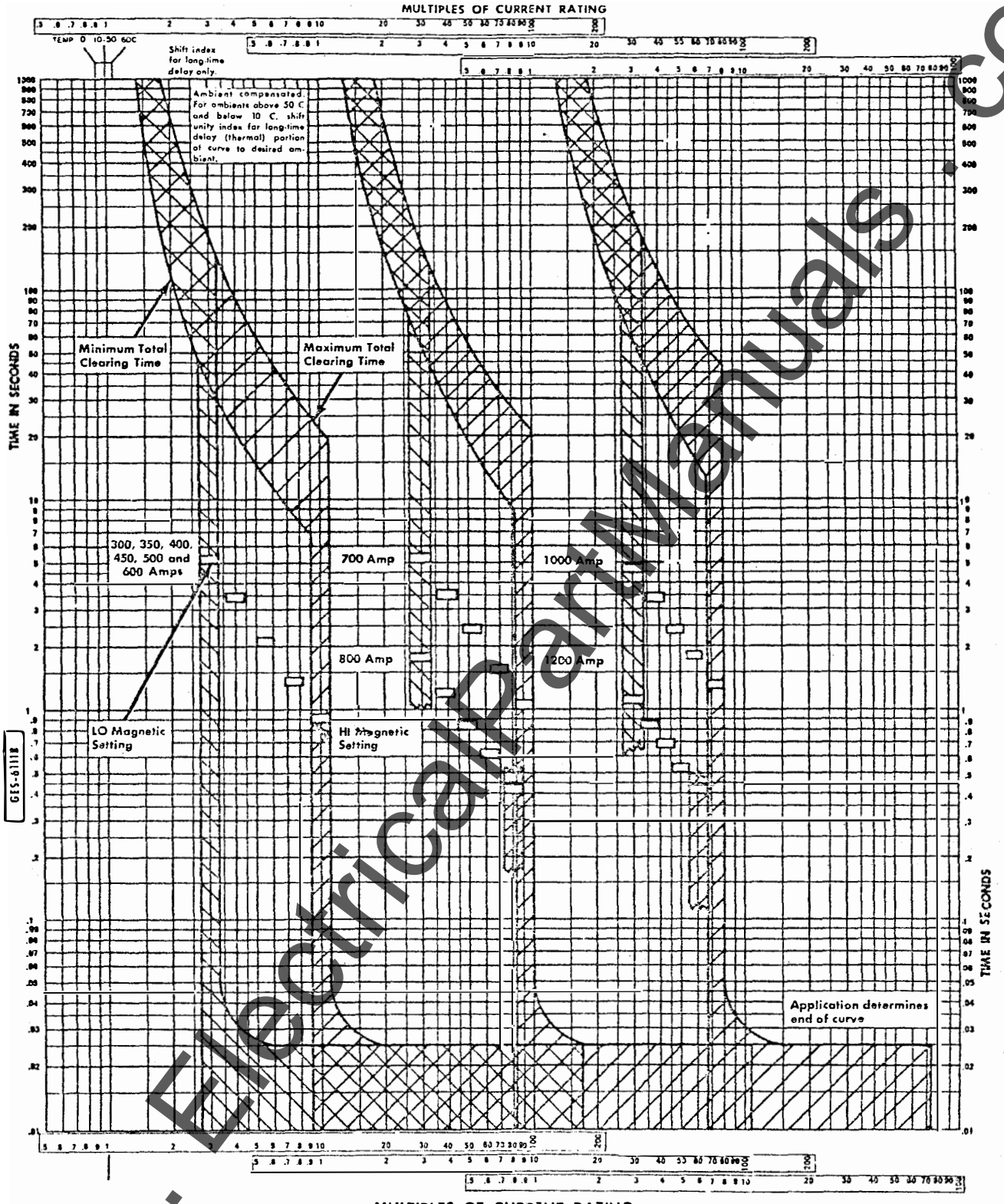
Instantaneous magnetic trip, continuously adjustable, factory set on HI. Blocks show trip range at marked points on instantaneous dials.

REV. 6-19-69

CIRCUIT PROTECTIVE DEVICES DEPARTMENT, PLAINVILLE, CONNECTICUT

K215-45C

Time Current Curves



GENERAL ELECTRIC

Current Ratings
300, 350, 400, 450, 500, 600, 700, 800, 1000 and 1200 amperes

Voltage Ratings
600 volts a-c (250 volts d-c)

Frequency Ratings
D-c or 60 Hertz for 300-800 amperes
60 Hertz for 1000-1200 amperes

MOLDED-CASE CIRCUIT BREAKER

K-1200 LINE

AMBIENT COMPENSATED

Types TKMA and THKMA (300–1200 Amperes)
Long-time Delay and Instantaneous
Time-current Curves

(Curves show ambient compensated circuit breaker in open air, 10 to 50 C ambient, wired with conductors of corresponding rating, no prior load. For all other ambients, use rating shift index at top of sheet.)

GES-6111B
Supersedes GES-6110A and GES-6111A

Adjustments

Long-time delay thermal trip: not adjustable.
Instantaneous magnetic trip: continuously adjustable, factory set on HI.
Blocks show trip range at marked points on instantaneous dials.

CIRCUIT PROTECTIVE DEVICES DEPT., PLAINVILLE, CONN.

Guide Form Specification

Molded case circuit breaker shall be a circuit interrupting device which will operate both manually for normal switching functions and automatically under overload and short circuit conditions. It is to provide circuit and self protection when applied in its rating. Control and signalling function may be incorporated by the use of accessories.

The operating mechanism shall be entirely trip-free so that the contacts cannot be held closed against an abnormal overcurrent or short circuit condition.

The operating handle of the circuit breaker shall open and close all poles of a multi pole breaker simultaneously. These breakers shall meet applicable Nema AB-1-1964 and/or U/L Laboratories, Inc. specifications. Each circuit breaker shall have a trip unit to provide overload and short circuit protection. The trip unit for each pole shall have elements providing inverse time delay under overload conditions and instantaneous magnetic tripping for short circuit protection. The trip element shall operate a common trip bar which shall open all poles in case of an overload or short circuit through any one pole.

The circuit breakers to be used in (lighting panelboards), (power distribution panelboards), (combination motor starters), (motor control centers), (switchboards) and on a system capable of delivering_____(symmetrical)_____ (asymmetrical) RMS amperes at _____volts shall be (1) (2) (3) pole, (E-100) (F225) (J600) (K1200).

General Electric Company Type_____.

The circuit breakers shall be individually mounted in one of the following enclosures:

NEMA 1

Handle through cover (surface) or (flush) mounting.

NEMA 1A

Gasketed cover enclosure with external operating handle.

NEMA 3R

Raintight Construction.

NEMA 4-5

Cast Iron Water and Dust tight.

NEMA 4-5

Stainless Steel, Corrosion Resistant.

NEMA 12

Industrial use enclosure with external operating handle.

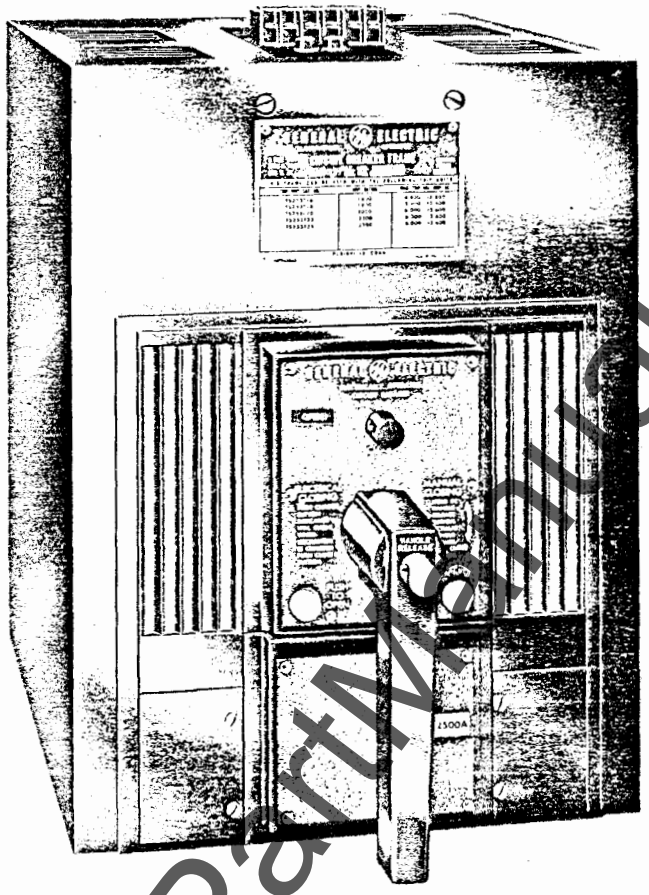
GENERAL ELECTRIC'S PREMIUM PROTECTION PACKAGE OF MOLDED CASE CIRCUIT BREAKERS

TQD

2 and 3 pole, fixed trip.
10,000 amperes IC U/L Listed.
125 to 225 amperes, 240 volt A-c.
Bulletin GEA-8481

TJD

2 and 3 pole, fixed trip.
22,000 amperes IC U/L Listed.
250 to 400 amperes, 240 volt, A-c and 250 volt, D-c.
Bulletin GEC-1637



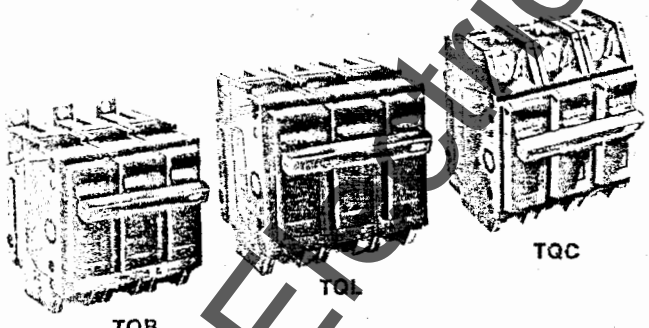
S-2500

600 to 2500 Amperes
240, 480, 600 Volts AC
U/L Listed

Manual or Electrical Operation . . . Stationary or drawout

Interrupting capacity to 150,000 Amperes (Asymmetrical) at 240 Volts AC

Bulletin GEA-7479



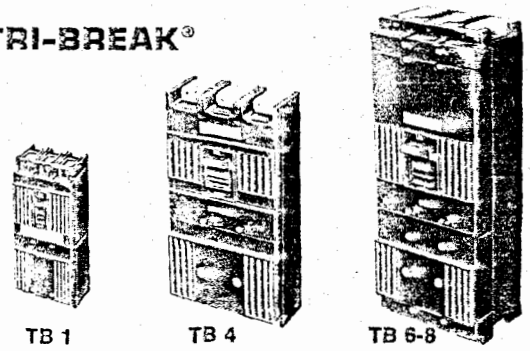
Q LINE

1, 2 or 3 Pole

Interrupting Capacities To 10,000 Amperes (Symmetrical) at 240 Volts XQ to 75,000 Amps Interrupting Capacity (Asymmetrical).

Bulletin GEA-8481

TRI-BREAK®



TRI-BREAK fused circuit breaker combines a conventional molded-case circuit breaker with fuse-type current limiters. It is available in three physical frame sizes with frame ratings of 100, 400, 600 and 800 amperes and covers current ratings of 15 to 800 amperes. 200,000 amps interrupting capacity (symmetrical) at 600 volts.

Bulletin GEA-7477

GENERAL ELECTRIC

CIRCUIT PROTECTIVE DEVICES DEPT., PLAINVILLE, CONN. 06062

4-70