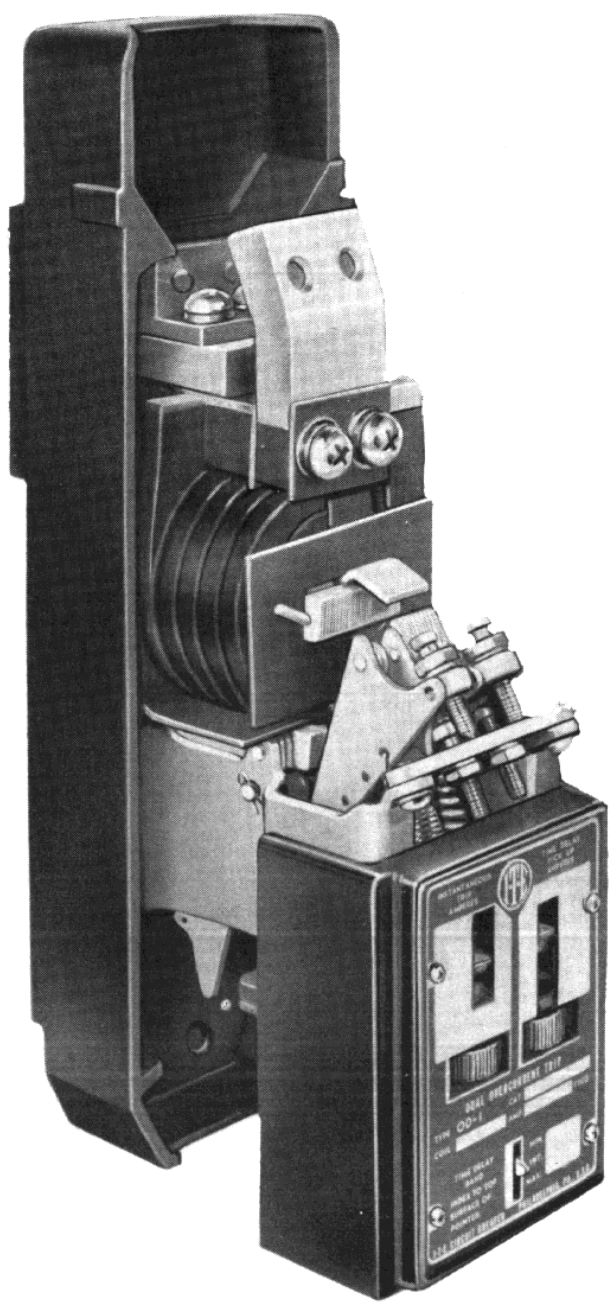
IB-5413A

# LOW VOLTAGE SWITCHGEAR

# INSTRUCTIONS

## OVERCURRENT TRIP DEVICES TYPE OD-1 AND TYPE OD-2



I-T-E CIRCUIT BREAKER COMPANY • PHILADELPHIA 30, PENNSYLVANIA

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DATED 2-55

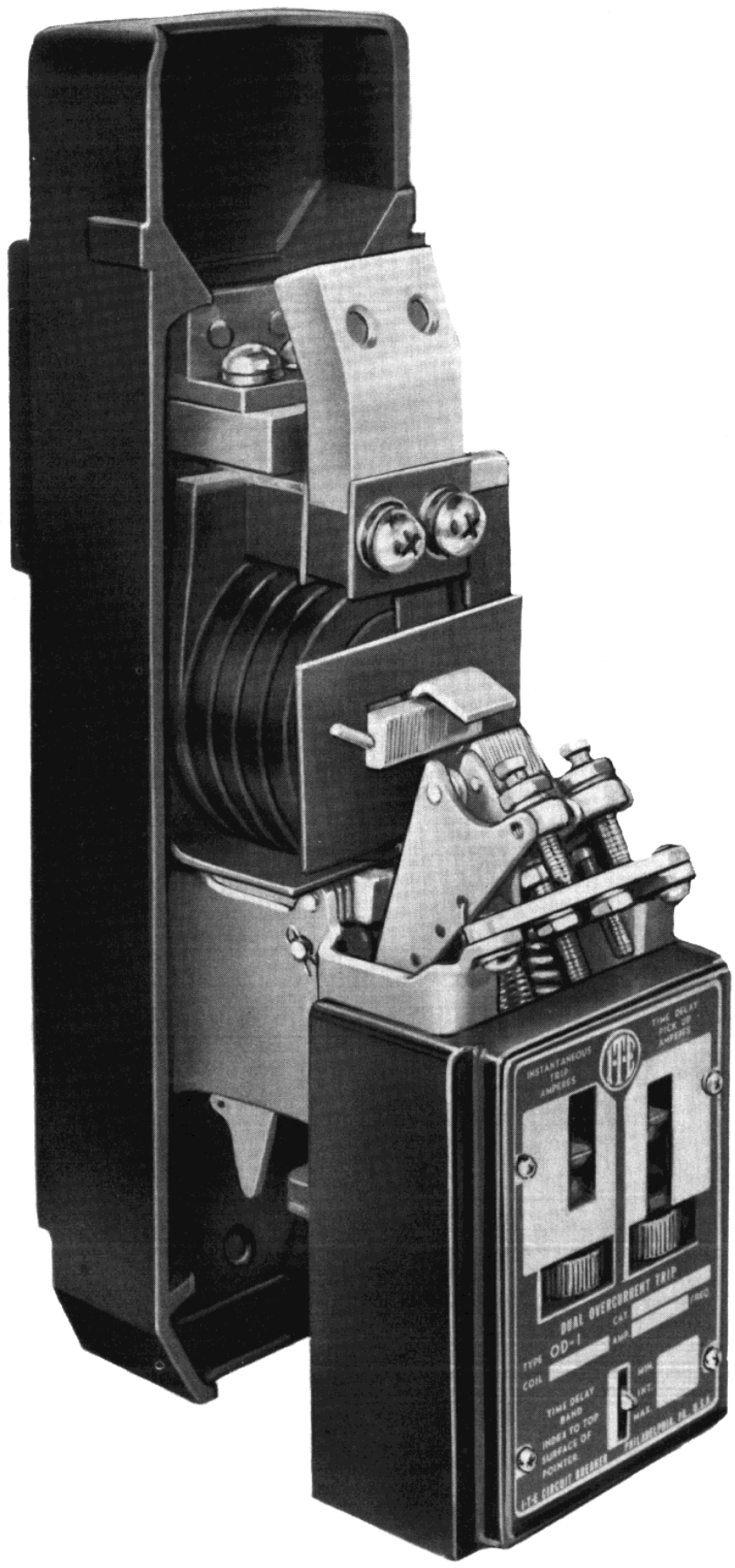



Photo 21055-R

***Fig. 1—Type OD-1 Dual Overcurrent Trip Device, For One Pole, Mounted on Insulated Molding***

# INSTRUCTIONS FOR OVERCURRENT TRIP DEVICES TYPE OD-1 AND TYPE OD-2

## INTRODUCTION

The Type OD-1 dual overcurrent trip device and Type OD-2 dual selective overcurrent trip device each consist of two of the following basic elements in different combinations.

1. A long-time delay trip element using a fluid-displacement dashpot for time delays measurable in seconds, minutes, and hours.
2. A short-time delay trip element using a mechanical timer for time delays measurable in cycles.
3. An instantaneous trip element which operates with no intentional time delay.

The Type OD-1 dual overcurrent trip device is comprised of a long-time delay element and an instantaneous element.

The Type OD-2 dual selective overcurrent trip device is comprised of a long-time delay element and a short-time delay element.

## APPLICATION

The Type OD-1 and Type OD-2 overcurrent trip devices are applicable to a-c and d-c circuit breakers having a continuous-current rating up to 1600 amperes with series overcurrent tripping; and to a-c circuit breakers having continuous-current ratings from 2000 to 6000 amperes with transformer overcurrent tripping.

## ELECTRICAL CHARACTERISTICS

The long-time delay trip element is calibrated at the factory and adjustable in the field to minimum pick-up currents of 80 to 160 per cent of the continuous-current rating of the circuit breaker.

Type OD-1 long-time delay trip elements will be calibrated at the factory for the minimum operating band.

Type OD-2 long-time delay trip elements are calibrated at the factory for the three NEMA long-time operating bands; minimum, intermediate, and maximum. The long-time delay is adjustable in the field to any one of the three bands as described under section ADJUSTMENTS.

The short-time delay trip element is calibrated at the factory and adjustable in the field to minimum pick-up currents of 500, 750, and 1000 per cent of the continuous-current rating of the circuit breaker. The short-time delay is calibrated at the factory for the three NEMA short-time operating bands; minimum, intermediate, and maximum. The short-time delay is adjustable in the field as described under section ADJUSTMENTS.

The instantaneous trip element is calibrated at the factory and adjustable in the field to minimum pick-up currents of 500, 1000, and 1500 per cent of the continuous-current rating of the circuit breaker.

## DESCRIPTION AND OPERATION

The Type OD-1 dual overcurrent trip device and Type OD-2 dual selective overcurrent trip device are shown in Fig. 1 and Fig. 2 respectively. The devices are similar and vary only in the constructional and operational differences of the individual elements. The elements, rather than the complete devices, are described in the following sections.

## LONG-TIME DELAY TRIP ELEMENT

The long-time delay armature has a fixed air gap and a tensioning spring for current pick-up calibration. The armature is connected through a linkage and crank shaft to a piston which is suspended in a fluid-displacement dashpot. The time delay is obtained by the displacement of the fluid from one side of the piston to the other side of the piston. The magnitude of the delay is a function of the distance that the piston moves in the restrained portion of the cylinder.

After the armature has completed not more than half its total operating stroke, the piston enters an unrestrained portion of the cylinder. This allows the armature trip screw to strike the circuit breaker tripper bar tripper with impact. This rotates the tripper bar, releases the mechanism latch, and results in the opening of the circuit breaker.

NOTE: CIRCUIT BREAKERS FURNISHED WITH EITHER TYPE OD-1 OR OD-2 OVERCURRENT TRIP DEVICES SHOULD HAVE THE LONG-TIME DELAY ARMATURE ON EACH POLE OPERATED MANUALLY A FEW TIMES UNTIL THE ARMATURE IS RESTRAINED DURING THE CLOSING STROKE. THIS IS DONE TO MAKE SURE THAT ALL OF THE FLUID IS IN THE LOWER (PRESSURE) SIDE OF THE TIME-DELAY DASHPOT.

A highly responsive check valve allows the armature to reset rapidly in less than one second, after a full or partial tripping stroke. Therefore, in any successive tripping attempts, both the current and time delay are in accordance with the calibrated values.

On alternating current applications, a resonant silencer is added to the armature assembly to reduce the vibrations which cause noise and, in time, undue wear on the bearings and stops. The resonant silencer minimizes the vibrations by absorbing the slightest resonant pulsations of the armature.

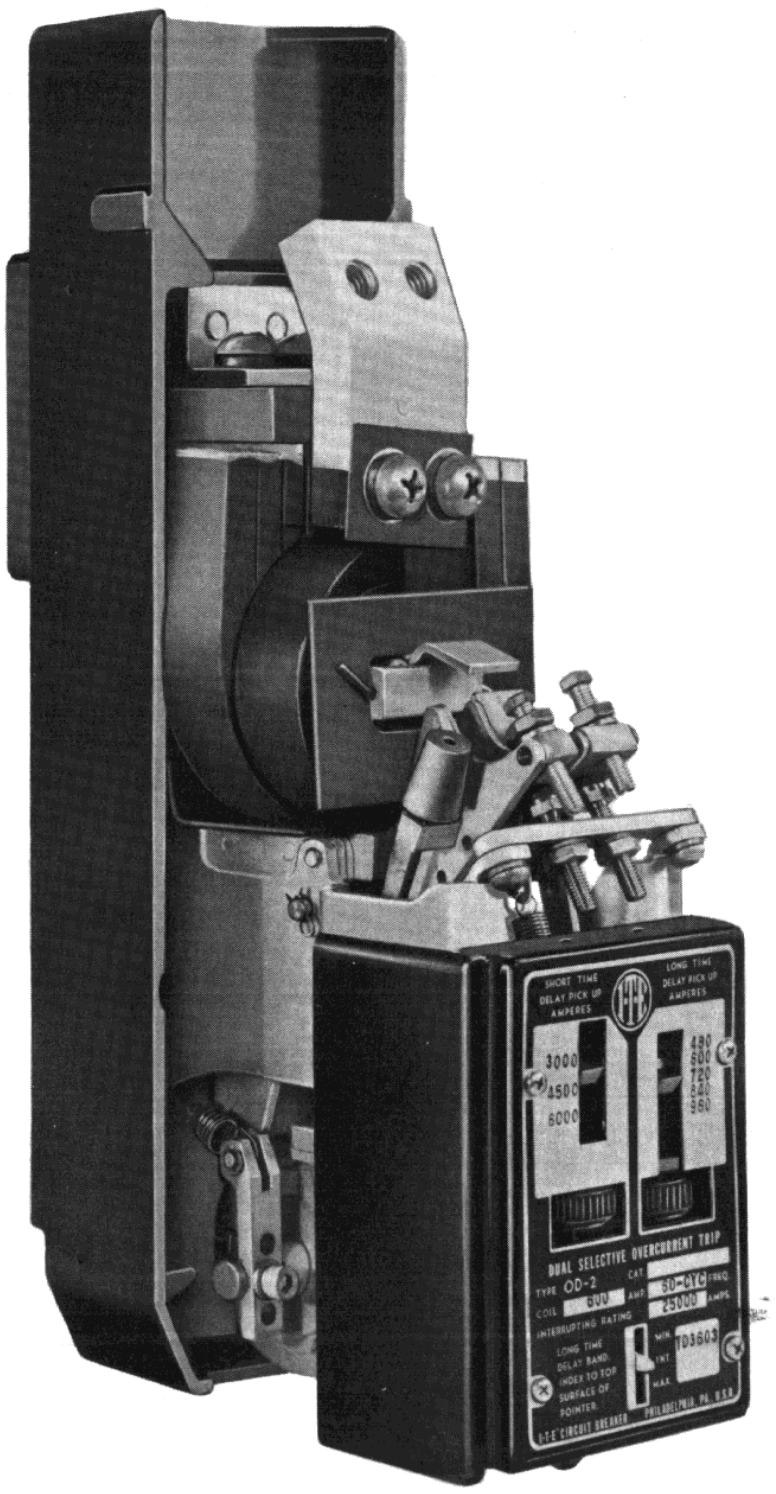



Photo 20247-R

***Fig. 2—Type OD-2 Dual Selective Overcurrent Trip Device, For One Pole, Mounted On Insulated Molding***

## SHORT-TIME DELAY TRIP ELEMENT

The short-time delay armature has a fixed air gap and a tensioning spring for current pick-up calibration. The armature is direct acting against the lever arm of a mechanical timer. The torque supplied by the lever arm actuates a toothed wheel which ultimately actuates an oscillating member. Timing is obtained from the inertia of this oscillating member while the magnitude of the delay is a function of the torque applied by the lever arm. The amount of torque supplied depends upon which of the three holes are used when bolting the lever arm to the shaft of the mechanical timer. At the end of the time-delay period, using not more than the first half of the armature stroke, the restraint is removed automatically. This allows the armature to move freely so that its trip screw strikes the circuit breaker tripper bar tripper with impact. This rotates the tripper bar, releases the mechanism latch, and results in the opening of the circuit breaker.

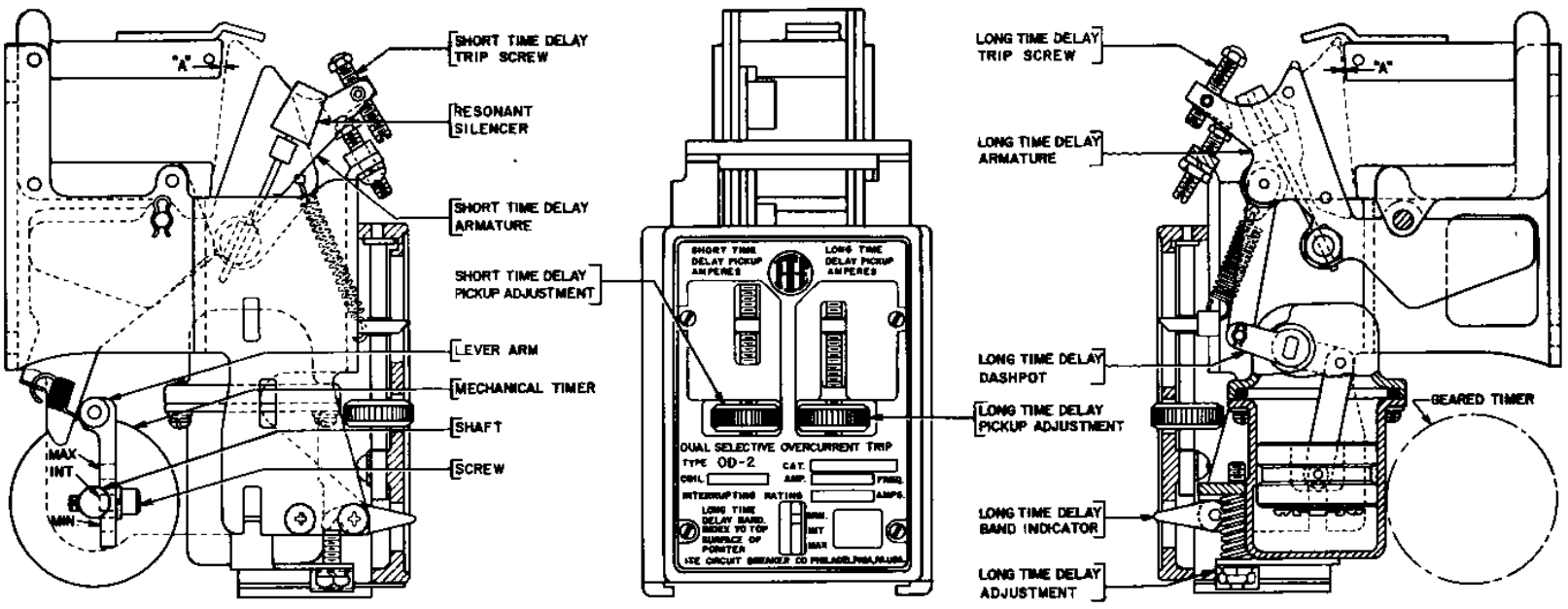
After a full or partial tripping stroke, the armature is free to return to its open position and is retarded only by a light drag spring which causes the timer to reset more slowly. Therefore, the full pick-up current is required to start armature motion for successive tripping attempts.

On alternating current applications, a resonant silencer is added to the armature assembly to reduce the vibrations which cause noise and, in time, undue wear on the bearings and stops. This resonant silencer minimizes the vibrations by absorbing the slightest resonant pulsations of the armature.

## INSTANTANEOUS TRIP ELEMENT

The instantaneous trip element is similar to the short-time delay element except that the mechanical timer is omitted and that the corresponding armature is calibrated to trip instantaneously at the desired current value.

When two of the above basic elements are assembled to make one of the complete devices described under INTRODUCTION, their individual armatures pivot on a common pin. The current flowing through a series coil surrounding the upper leg of the magnet supplies the force necessary to operate the device. The armature of either element is attracted toward this electromagnet when the current reaches, or exceeds, a pre-determined value. Which armature actually moves depends upon the current values and the particular time-delay characteristics of the elements involved. The circuit breaker will trip when either of the armature trip screws strike the tripper bar tripper.




LEFT SECTION VIEW — FRONT VIEW — RIGHT SECTION VIEW

Dwg. S-13869

***Fig. 3—Overcurrent Trip Device—Displacement Type Typical of Type OD-1 or Type OD-2***

## MAINTENANCE

It is recommended that no attempt be made to repair or replace individual parts of the elements due to the sensitivity and accuracy expected of the overcurrent trip devices. Instead, the Type OD-1 or OD-2 overcurrent trip device should be replaced as a complete device.

If repairs or adjustments other than those described under section ADJUSTMENTS are necessary, contact the nearest Sales Office of the I-T-E Circuit Breaker Company for specific instructions.

## ADJUSTMENTS

The Type OD-1 and OD-2 overcurrent trip devices are calibrated and adjusted before leaving the factory.

CAUTION: DE-ENERGIZE THE PRIMARY AND CONTROL CIRCUITS BEFORE INSPECTING, ADJUSTING, OR REPLACING THE OVERCURRENT TRIP DEVICES.

## MINIMUM PICK-UP CURRENT

The minimum current at which the instantaneous, short-time delay, or long-time delay armature will pickup can be adjusted by turning the appropriate calibration knob on the front of the device. The setting of the minimum pick-up current value is indicated by the position of the indicator relative to the line indicating the corresponding numerical value.

CAUTION: THE INDICATOR MUST BE SET OPPOSITE THE LINE ENGRAVED ON THE CALIBRATION PLATE CORRESPONDING TO THE PICK-UP VALUE REQUIRED. THE LINES MAY OR MAY NOT LINE-UP WITH THE NUMERALS ON THE PLATE.

## LONG-TIME DELAY

The long-time delay is set and locked at the factory to the time-band setting requested in the customer's order.

### Type OD-1 Devices

The long-time delay is not adjustable in the field.

### Type OD-2 Devices

The long-time delay is adjustable in the field from one time-delay band to one of the other time-delay bands by flattening the corner of the lock-plate and turning the long-time delay adjusting screw (Fig. 3). Turn the screw in the direction required to line up the ***upper edge*** of the long-time delay indicator (Fig. 3) with the desired time-delay band mark. Be sure and bend the corners of the locking plate around the head of the adjusting screw when the setting is correct.

The characteristic curves for the three long-time delay bands are represented by TD-3604-A, B, C and TD-3605-A, B, C for Type OD-1 devices; and by TD-3603-A, B, C and TD-3608-A, B, C for Type OD-2 devices.

## SHORT-TIME DELAY

The short-time delay band is factory set to the time band setting requested in the customer's order.

The short-time delay is adjustable in the field to any one of the three short-time delay bands; minimum, intermediate, and maximum. Before changing the band setting, refer to Table I which shows the NEMA standards limiting the size overcurrent coils which may be used for any of the three NEMA short-time delay bands for any given circuit breaker interrupting rating. If the trip coil rating is lower than shown, the maximum interrupting rating of the circuit breaker is derated and the circuit breaker can not be applied safely to a circuit with greater interrupting current available than the derated value.

To change from one short-time delay band to one of the other short-time delay bands, proceed as follows:

Refer to Fig. 4 and,

1. Remove socket head screw (6) fastening lever arm (3) to the shaft (5).

2. Select the proper hole in lever arm (3) corresponding to the short-time delay band setting required. Starting with the lower hole, the holes in the lever are marked MIN, INT, and MAX. Refer to the corresponding short-time delay band characteristic curves represented by TD-3603-A, B, C and TD-3608-A, B, and C.

3. Replace lever arm (3) on shaft (5) making sure the socket head screw (6) passes through the hole corresponding to the time-delay band setting required.

4. Inspect for proper operation by manually pushing on the short-time armature and examining the timing stroke and reset stroke.

NOTE: DO NOT, UNDER ANY CIRCUMSTANCES, LOOSEN BOLT (2) FASTENING THE MECHANICAL TIMER (4) TO ITS SUPPORT PLATE (1).

## INSTANTANEOUS

The instantaneous trip is factory set as specified in the customer's request. The pick-up current values may be adjusted as described under section MINIMUM PICK-UP CURRENT.

## ARMATURE AIR GAP

The armature air gap is adjusted and factory set. It must not be changed.

## ARMATURE TRIPPING TRAVEL

When checking or adjusting the armature tripping travel, insert feeler gauge at point "A" parallel to the magnet face as shown in Fig. 3. The circuit breaker should trip, when the armatures are operated by hand, with a 0.020 inch feeler gauge inserted at "A". It should not trip when a 0.030 inch gauge is inserted.

If adjustments are not as stated above, loosen the set screw and turn the trip adjustment screw in or out as may be required. Be sure and tighten the set screw after making any adjustment, and operate the circuit breaker a few times to insure correct adjustment.

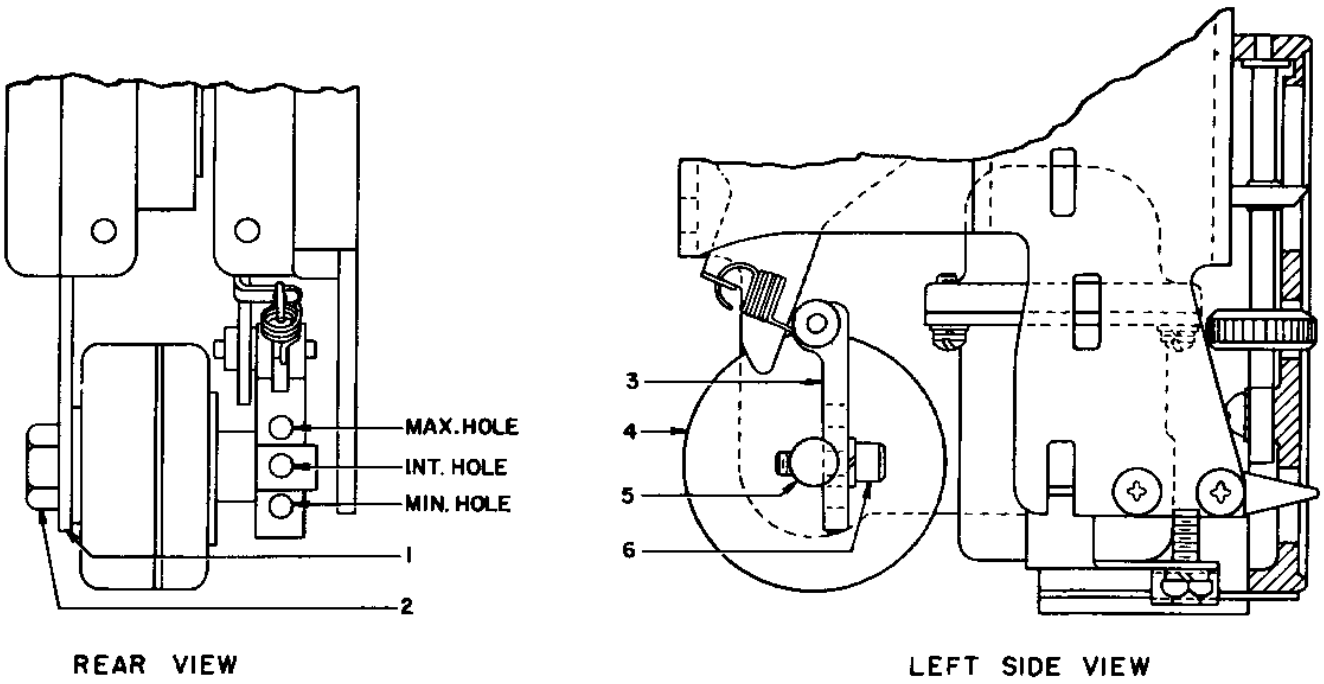
## RENEWAL PARTS

It is recommended that one complete overcurrent trip device of each type and rating in use be stocked as a replacement unit for each 25 units in service.

When ordering replacement units, address the nearest Sales Office of the I-T-E Circuit Breaker Company. Specify the quantity required, type of device, continuous current rating, specific calibrations and settings required, and the complete nameplate data of the circuit breaker.

**TABLE I**

| Interrupting Rating in RMS Total Amperes at all Voltages up to and Including Rated Voltage | RANGE OF TRIP COIL RATINGS, AMPERES | | |
|---|---|---|---|
| | Short-Time Delay Operating Bands | | |
| | Minimum | Intermediate | Maximum |
| 15000 | 100– 225 | 125– 225 | 150– 225 |
| 25000 | 175– 600 | 200– 600 | 250– 600 |
| 50000 | 350–1600 | 400–1600 | 500–1600 |
| 75000 | 2000–3000 | 2000–3000 | 2000–3000 |
| 100000 | 4000–6000 | 4000–6000 | 4000–6000 |

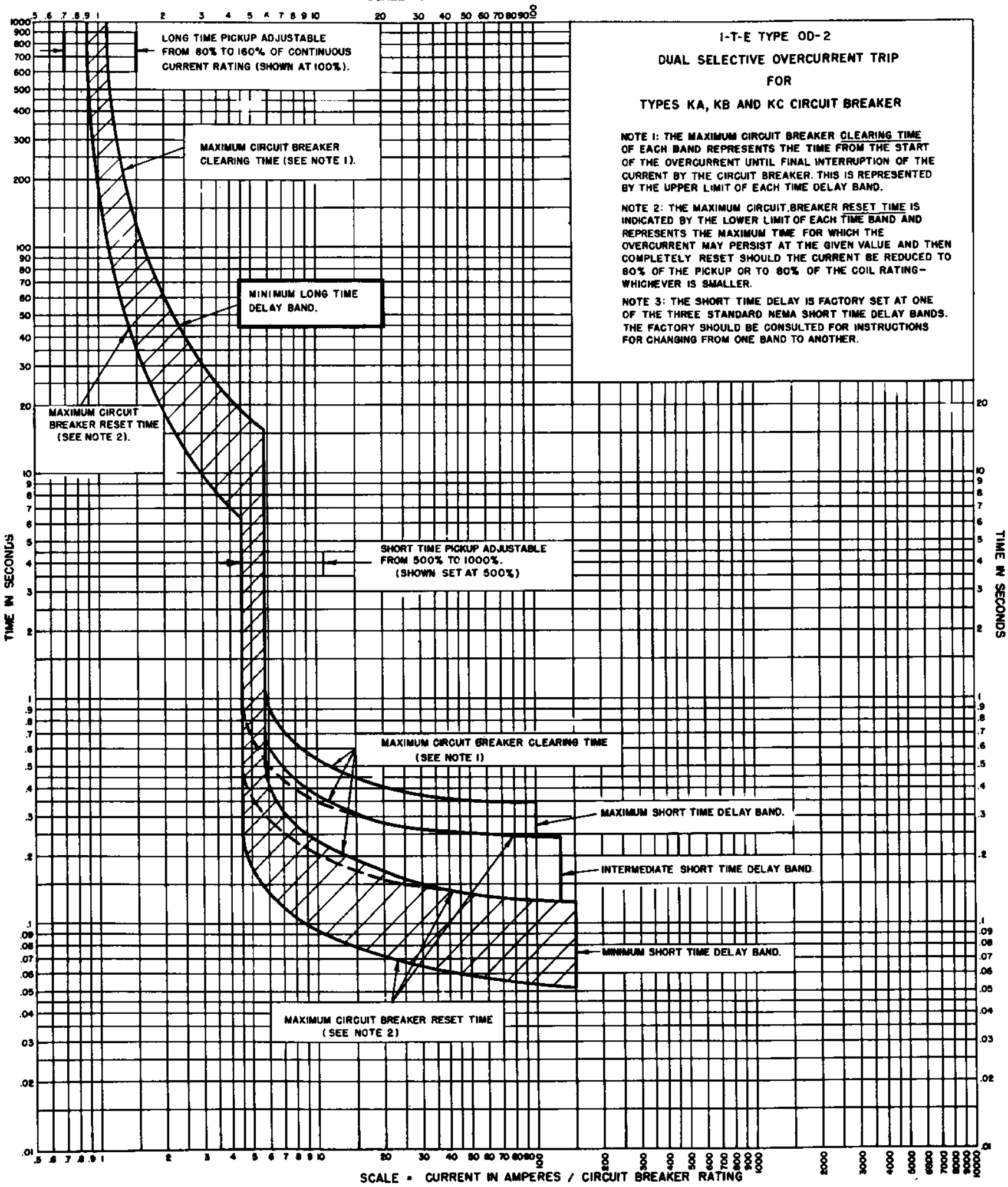



1. Support Plate
2. Bolt
3. Lever Arm
4. Mechanical Timer
5. Shaft
6. Screw

Dwg. S-13874

*Fig. 4—OD-2 Overcurrent Trip Device*

***These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the I-T-E Circuit Breaker Company.***




I-T-E TYPE OD-2

DUAL SELECTIVE OVERCURRENT TRIP

FOR

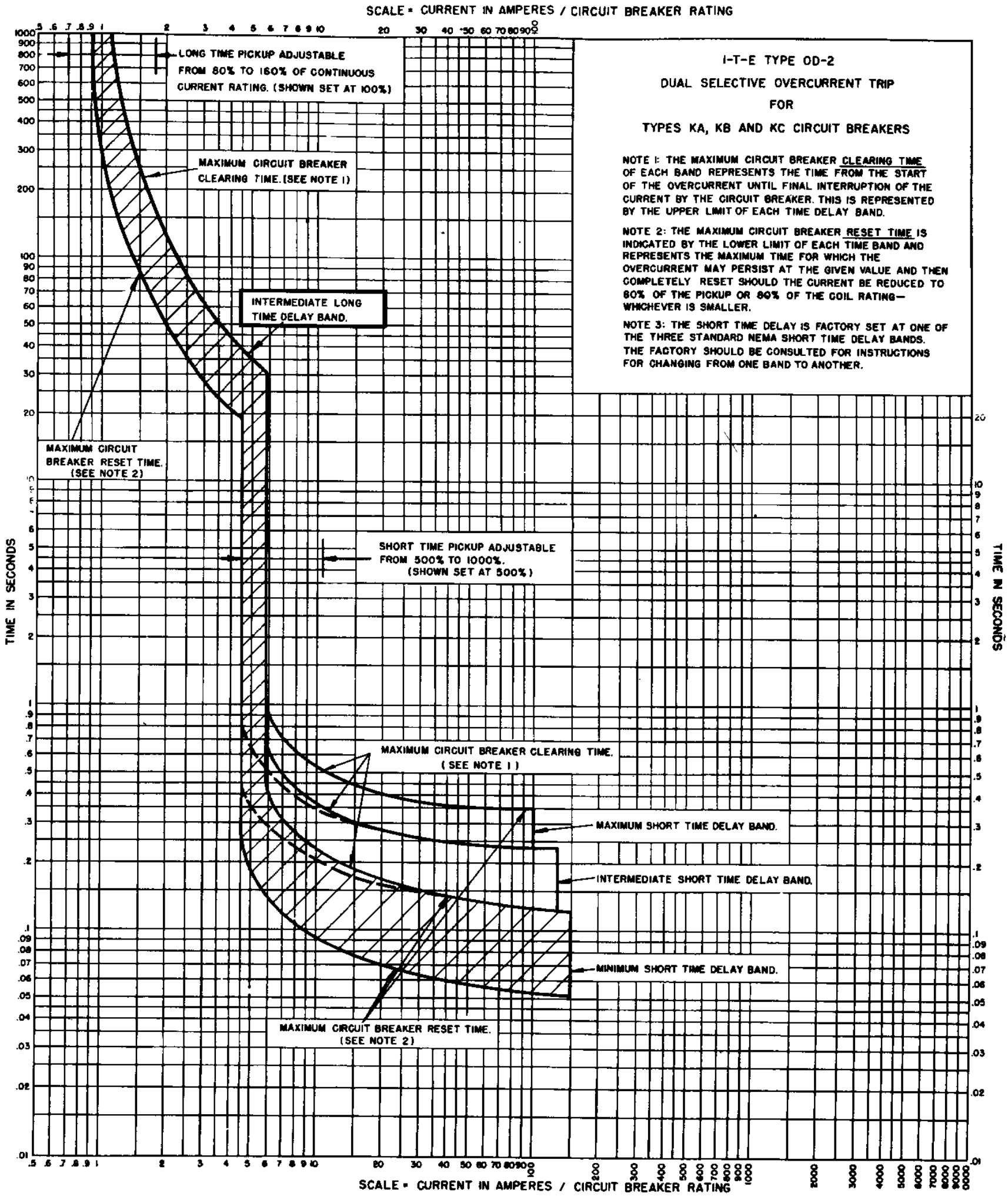
TYPES KA, KB AND KC CIRCUIT BREAKER

NOTE 1: THE MAXIMUM CIRCUIT BREAKER CLEARING TIME OF EACH BAND REPRESENTS THE TIME FROM THE START OF THE OVERCURRENT UNTIL FINAL INTERRUPTION OF THE CURRENT BY THE CIRCUIT BREAKER. THIS IS REPRESENTED BY THE UPPER LIMIT OF EACH TIME DELAY BAND.

NOTE 2: THE MAXIMUM CIRCUIT BREAKER RESET TIME IS INDICATED BY THE LOWER LIMIT OF EACH TIME BAND AND REPRESENTS THE MAXIMUM TIME FOR WHICH THE OVERCURRENT MAY PERSIST AT THE GIVEN VALUE AND THEN COMPLETELY RESET SHOULD THE CURRENT BE REDUCED TO 80% OF THE PICKUP OR TO 80% OF THE COIL RATING— WHICHEVER IS SMALLER.

NOTE 3: THE SHORT TIME DELAY IS FACTORY SET AT ONE OF THE THREE STANDARD NEMA SHORT TIME DELAY BANDS. THE FACTORY SHOULD BE CONSULTED FOR INSTRUCTIONS FOR CHANGING FROM ONE BAND TO ANOTHER.

TD-3603-A




I-T-E TYPE OD-2

DUAL SELECTIVE OVERCURRENT TRIP

FOR

TYPES KA, KB AND KC CIRCUIT BREAKERS

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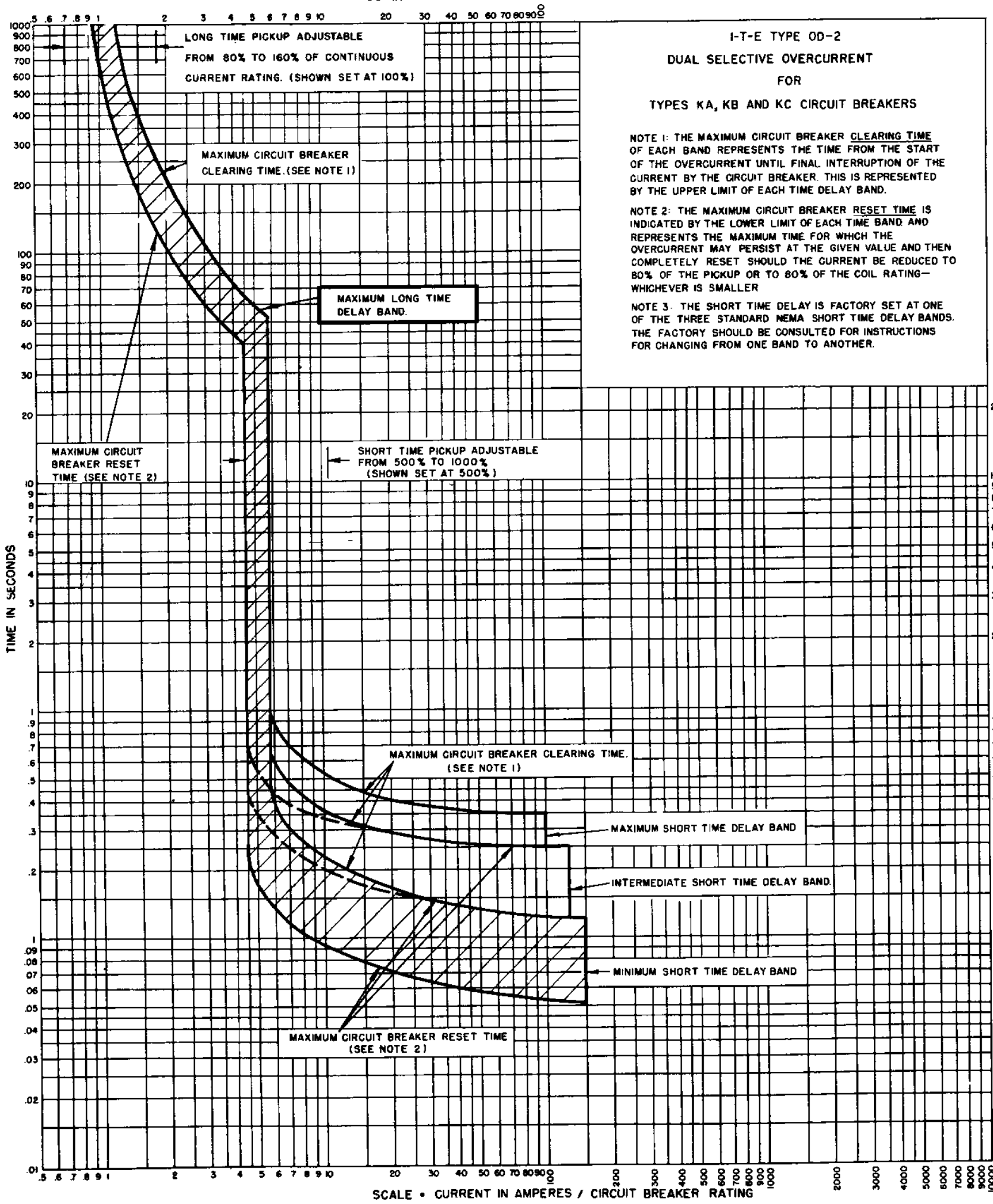
NOTE 3: THE SHORT TIME DELAY IS FACTORY SET AT ONE OF THE THREE STANDARD NEMA SHORT TIME DELAY BANDS. THE FACTORY SHOULD BE CONSULTED FOR INSTRUCTIONS FOR CHANGING FROM ONE BAND TO ANOTHER.

TD-3603-B




I-T-E TYPE OD-2

DUAL SELECTIVE OVERCURRENT

FOR

TYPES KA, KB AND KC CIRCUIT BREAKERS

NOTE 1: THE MAXIMUM CIRCUIT BREAKER CLEARING TIME OF EACH BAND REPRESENTS THE TIME FROM THE START OF THE OVERCURRENT UNTIL FINAL INTERRUPTION OF THE CURRENT BY THE CIRCUIT BREAKER. THIS IS REPRESENTED BY THE UPPER LIMIT OF EACH TIME DELAY BAND.

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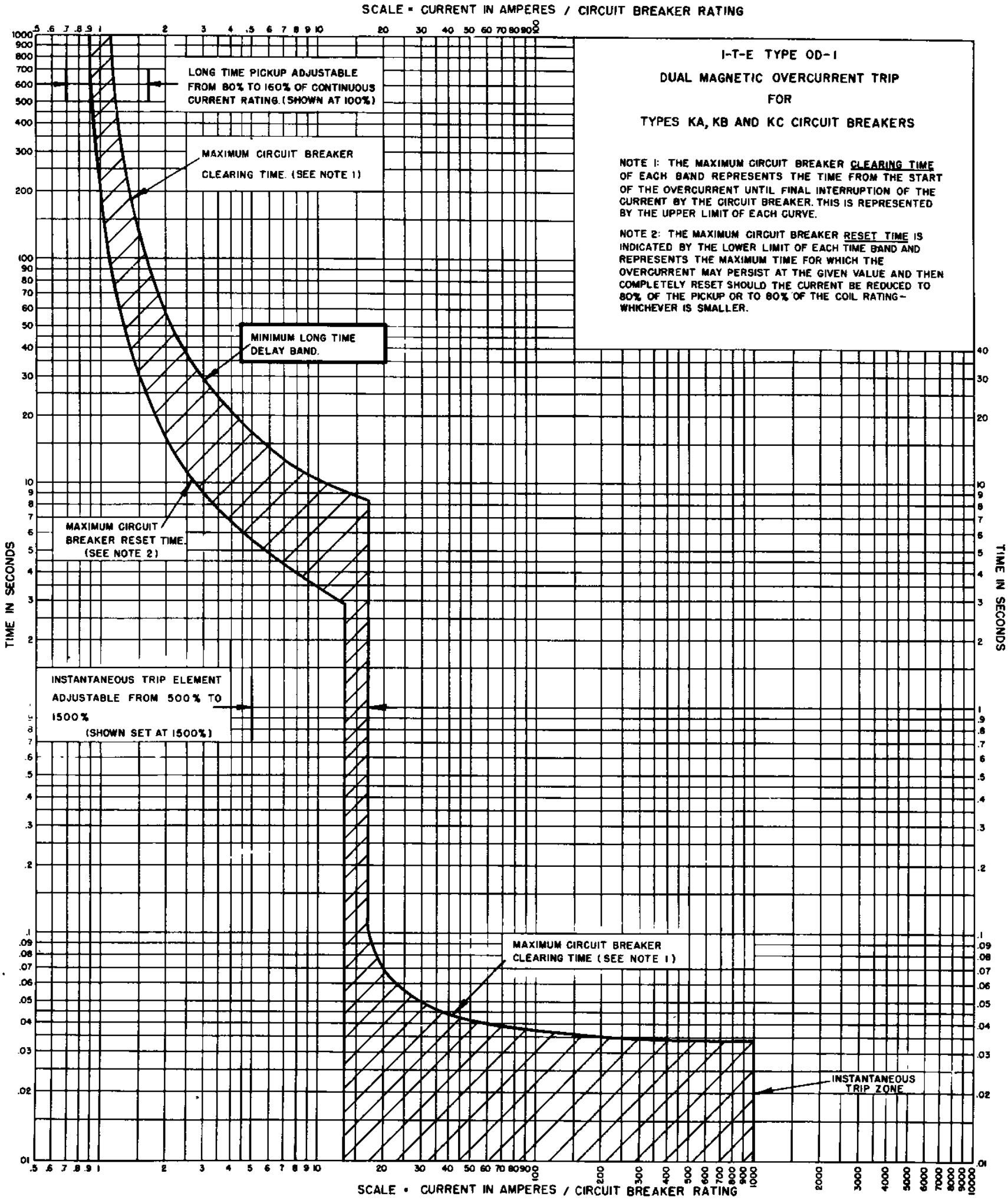
TD-3603-C


SCALE = CURRENT IN AMPERES / CIRCUIT BREAKER RATING
I-T-E TYPE OD-1
DUAL MAGNETIC OVERCURRENT TRIP
FOR
TYPES KA, KB AND KC CIRCUIT BREAKERS
NOTE 1: THE MAXIMUM CIRCUIT BREAKER CLEARING TIME OF EACH BAND REPRESENTS THE TIME FROM THE START OF THE OVERCURRENT UNTIL FINAL INTERRUPTION OF THE CURRENT BY THE CIRCUIT BREAKER. THIS IS REPRESENTED BY THE UPPER LIMIT OF EACH CURVE.
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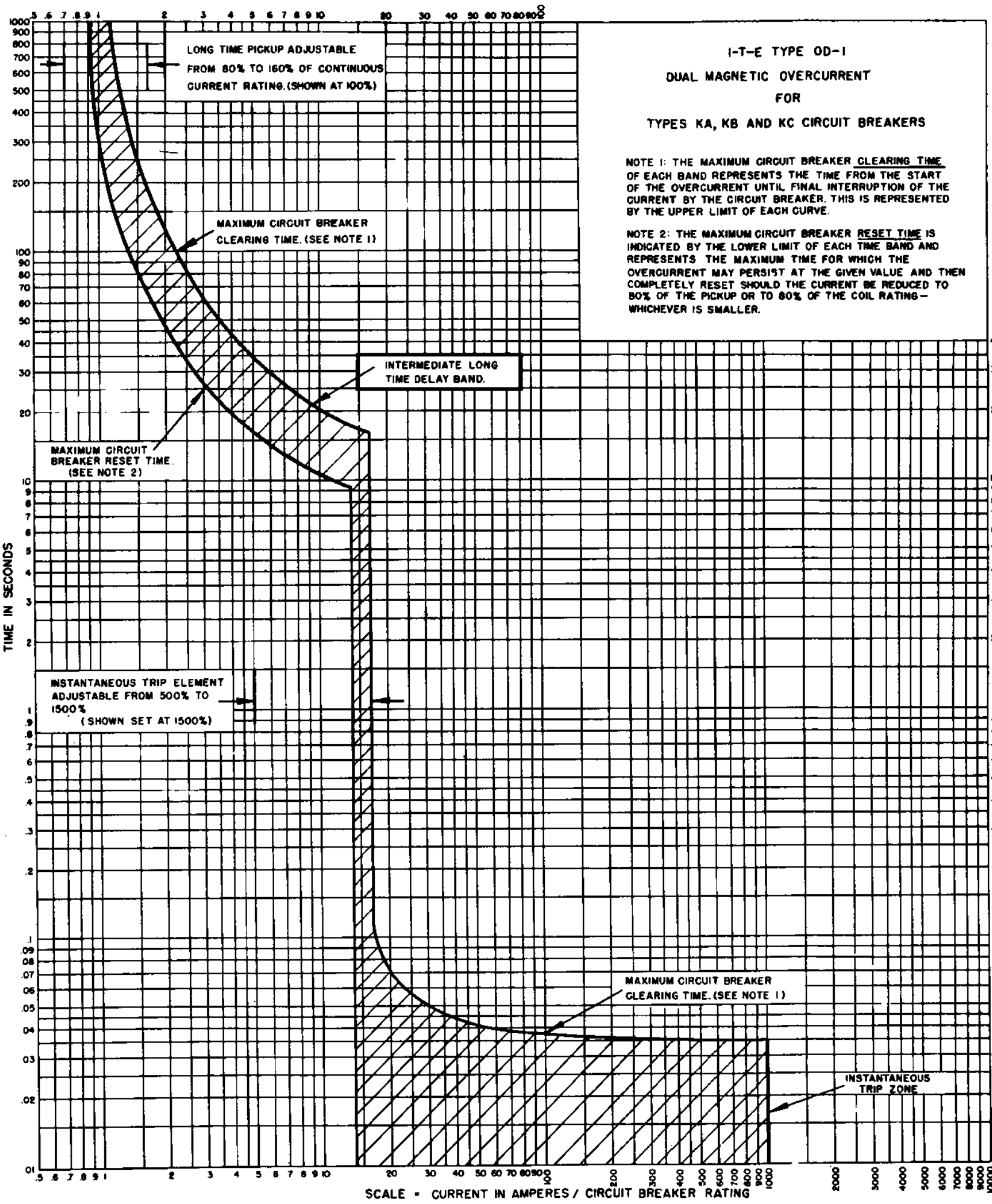
LONG TIME PICKUP ADJUSTABLE FROM 80% TO 160% OF CONTINUOUS CURRENT RATING. (SHOWN AT 100%)
MAXIMUM CIRCUIT BREAKER CLEARING TIME. (SEE NOTE 1)
MINIMUM LONG TIME DELAY BAND.
MAXIMUM CIRCUIT BREAKER RESET TIME. (SEE NOTE 2)
INSTANTANEOUS TRIP ELEMENT ADJUSTABLE FROM 500% TO 1500%
(SHOWN SET AT 1500%)
MAXIMUM CIRCUIT BREAKER CLEARING TIME (SEE NOTE 1)
INSTANTANEOUS TRIP ZONE
TIME IN SECONDS
TIME IN SECONDS
SCALE • CURRENT IN AMPERES / CIRCUIT BREAKER RATING

TD-3604-A




I-T-E TYPE OD-1

DUAL MAGNETIC OVERCURRENT

FOR

TYPES KA, KB AND KC CIRCUIT BREAKERS

NOTE 1: THE MAXIMUM CIRCUIT BREAKER CLEARING TIME OF EACH BAND REPRESENTS THE TIME FROM THE START OF THE OVERCURRENT UNTIL FINAL INTERRUPTION OF THE CURRENT BY THE CIRCUIT BREAKER. THIS IS REPRESENTED BY THE UPPER LIMIT OF EACH CURVE.

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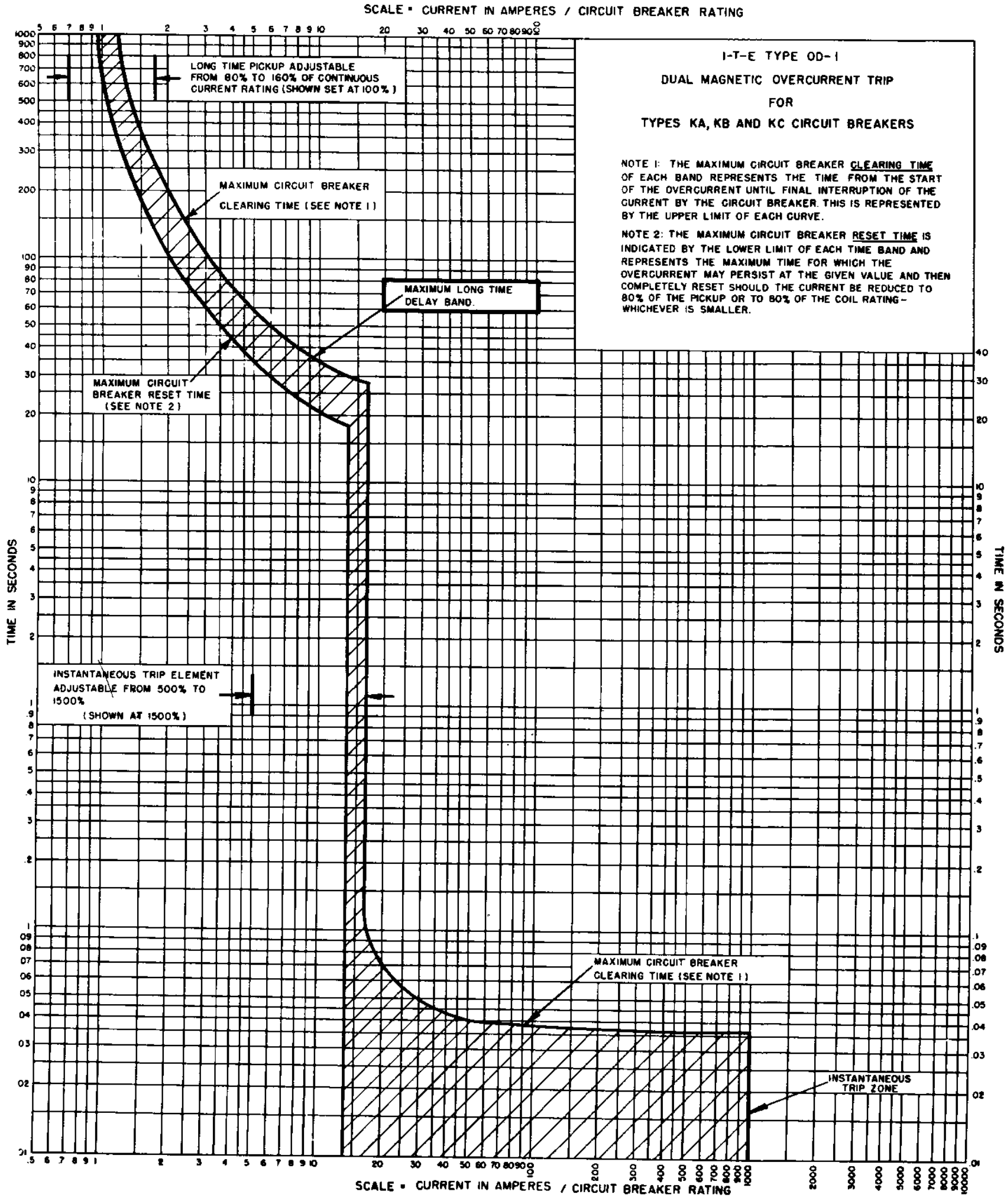
TD-3604-B




I-T-E TYPE OD-1

DUAL MAGNETIC OVERCURRENT TRIP

FOR

TYPES KA, KB AND KC CIRCUIT BREAKERS

NOTE 1: THE MAXIMUM CIRCUIT BREAKER CLEARING TIME OF EACH BAND REPRESENTS THE TIME FROM THE START OF THE OVERCURRENT UNTIL FINAL INTERRUPTION OF THE CURRENT BY THE CIRCUIT BREAKER. THIS IS REPRESENTED BY THE UPPER LIMIT OF EACH CURVE.

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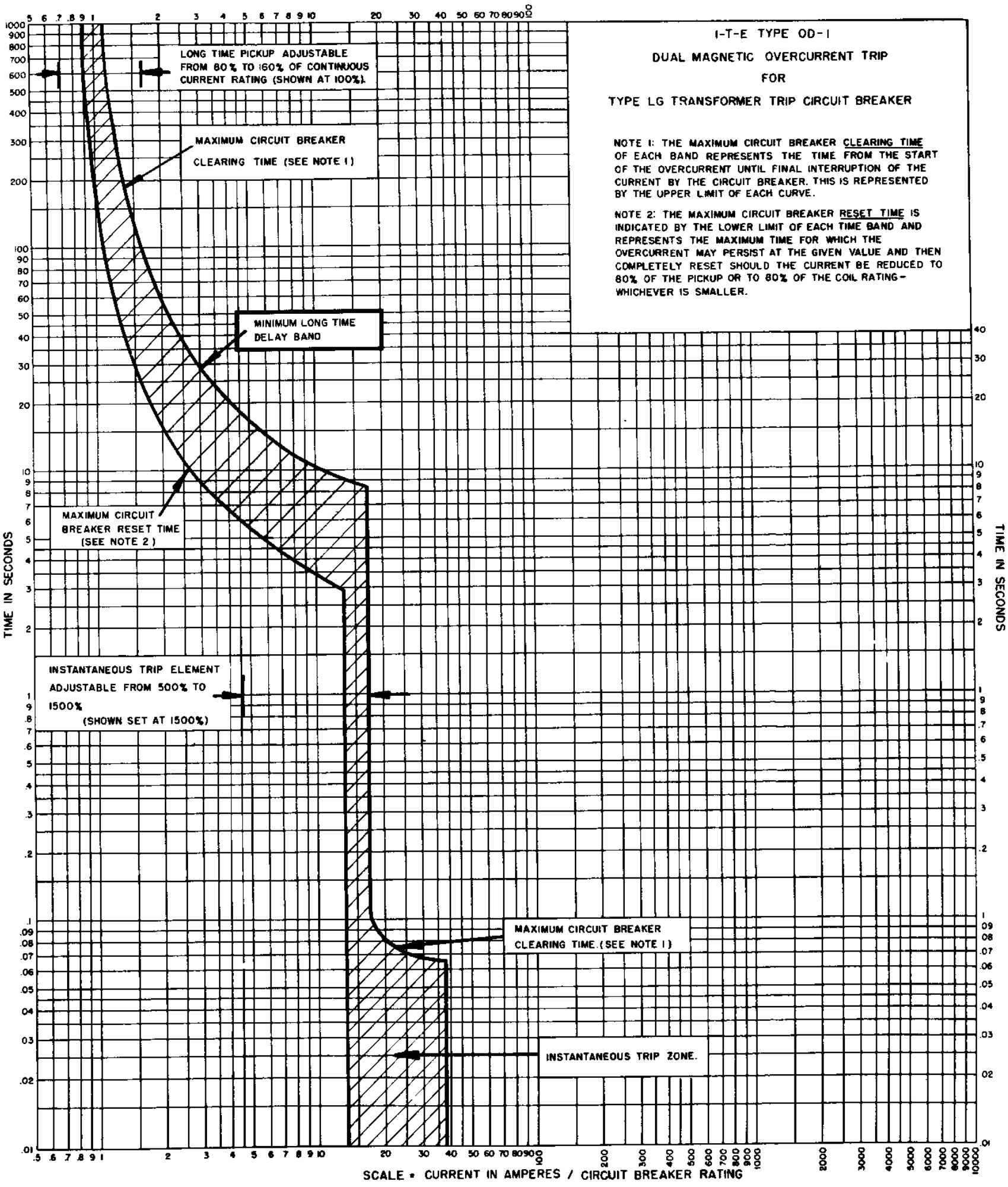
TD-3604-C

SCALE = CURRENT IN AMPERES / CIRCUIT BREAKER RATING




I-T-E TYPE OD-1

DUAL MAGNETIC OVERCURRENT TRIP

FOR

TYPE LG TRANSFORMER TRIP CIRCUIT BREAKER

NOTE 1: THE MAXIMUM CIRCUIT BREAKER CLEARING TIME OF EACH BAND REPRESENTS THE TIME FROM THE START OF THE OVERCURRENT UNTIL FINAL INTERRUPTION OF THE CURRENT BY THE CIRCUIT BREAKER. THIS IS REPRESENTED BY THE UPPER LIMIT OF EACH CURVE.

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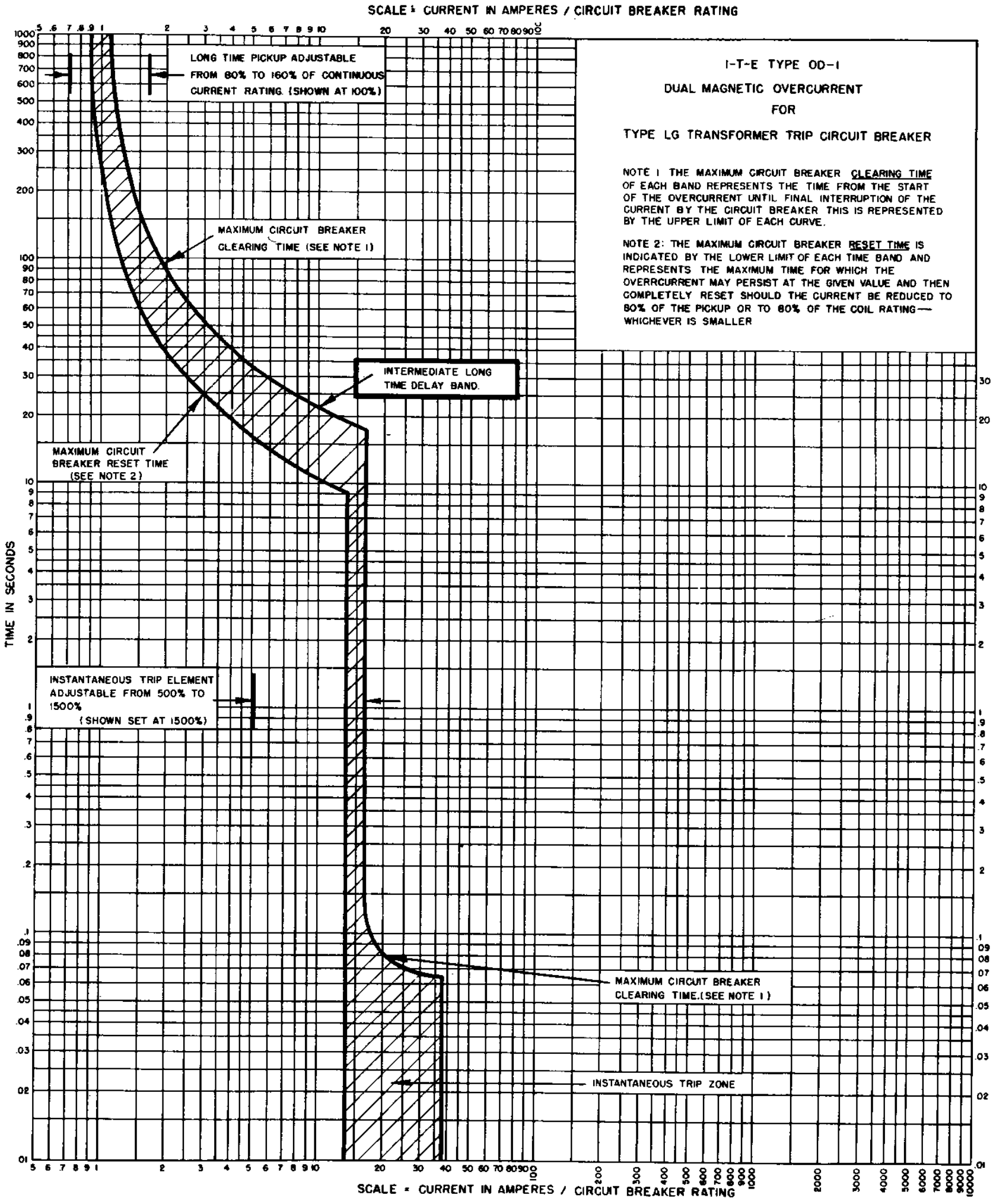
SCALE = CURRENT IN AMPERES / CIRCUIT BREAKER RATING

TD-3605-A




I-T-E TYPE OD-1

DUAL MAGNETIC OVERCURRENT

FOR

TYPE LG TRANSFORMER TRIP CIRCUIT BREAKER

NOTE 1 THE MAXIMUM CIRCUIT BREAKER CLEARING TIME OF EACH BAND REPRESENTS THE TIME FROM THE START OF THE OVERCURRENT UNTIL FINAL INTERRUPTION OF THE CURRENT BY THE CIRCUIT BREAKER. THIS IS REPRESENTED BY THE UPPER LIMIT OF EACH CURVE.

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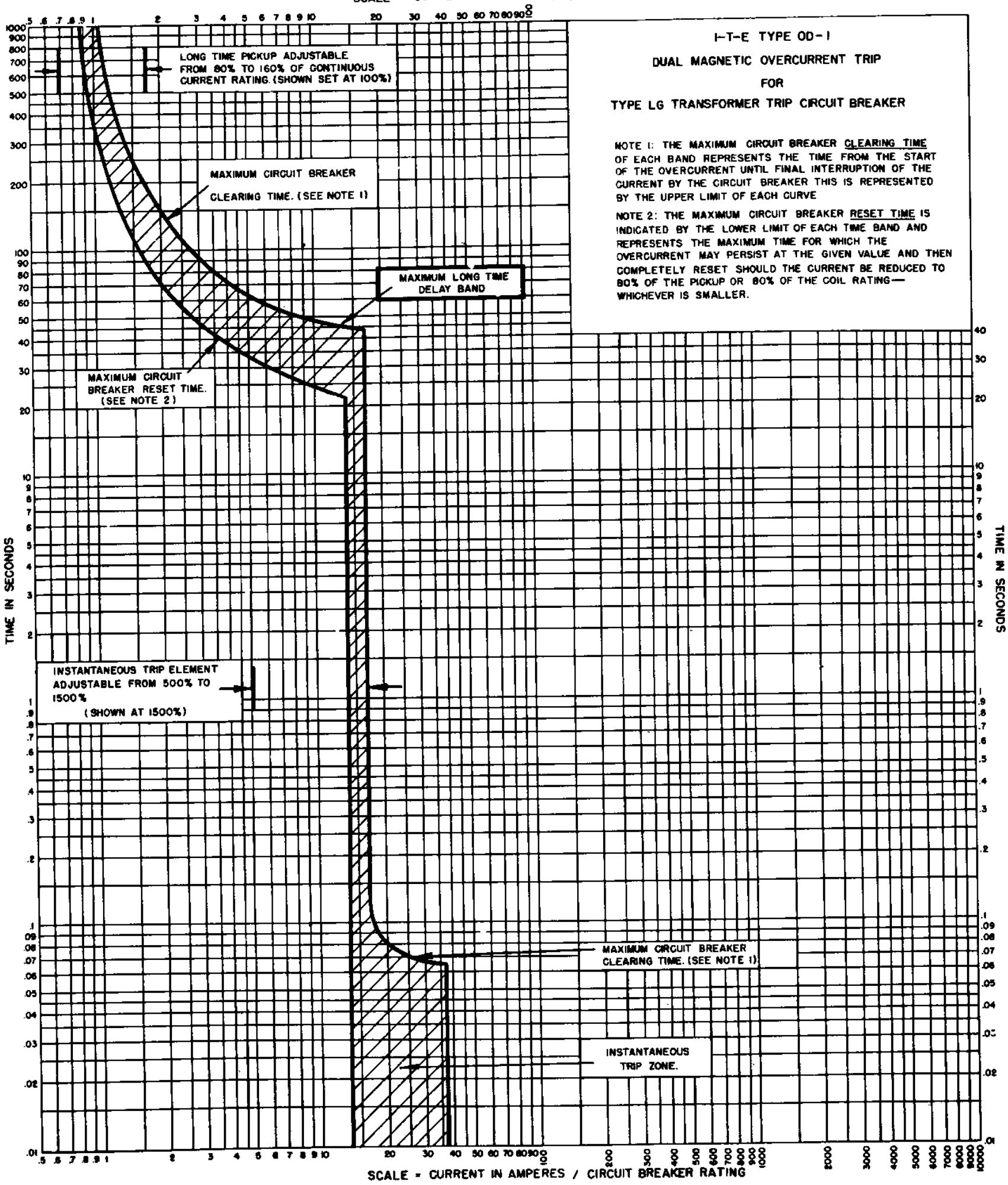
TD-3605-B

SCALE = CURRENT IN AMPERES / CIRCUIT BREAKER RATING




SCALE = CURRENT IN AMPERES / CIRCUIT BREAKER RATING

I-T-E TYPE OD-1

DUAL MAGNETIC OVERCURRENT TRIP

FOR

TYPE LG TRANSFORMER TRIP CIRCUIT BREAKER

NOTE 1: THE MAXIMUM CIRCUIT BREAKER CLEARING TIME OF EACH BAND REPRESENTS THE TIME FROM THE START OF THE OVERCURRENT UNTIL FINAL INTERRUPTION OF THE CURRENT BY THE CIRCUIT BREAKER THIS IS REPRESENTED BY THE UPPER LIMIT OF EACH CURVE

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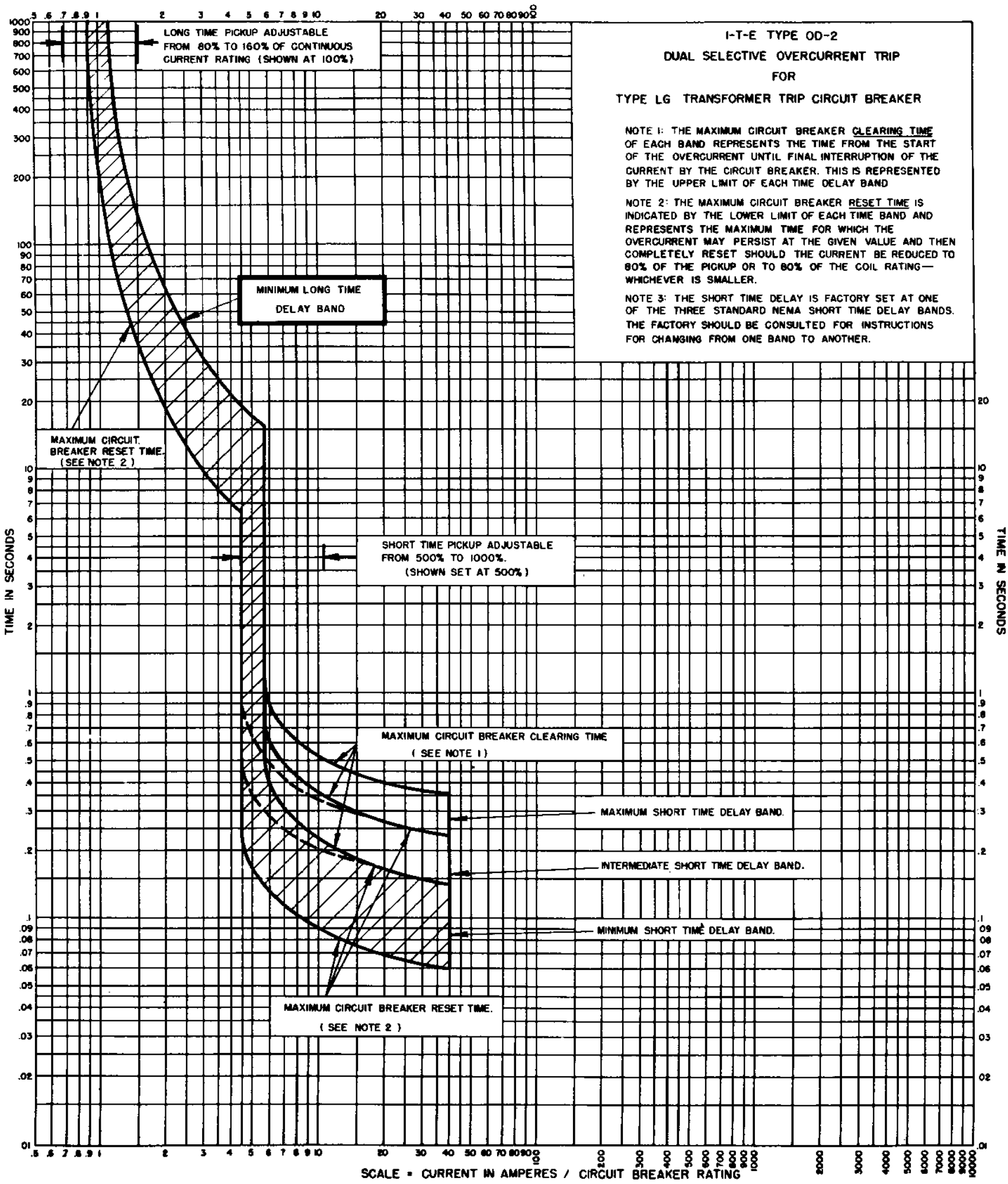
TD-3605-C

SCALE = CURRENT IN AMPERES / CIRCUIT BREAKER RATING




SCALE = CURRENT IN AMPERES / CIRCUIT BREAKER RATING

I-T-E TYPE OD-2

DUAL SELECTIVE OVERCURRENT TRIP

FOR

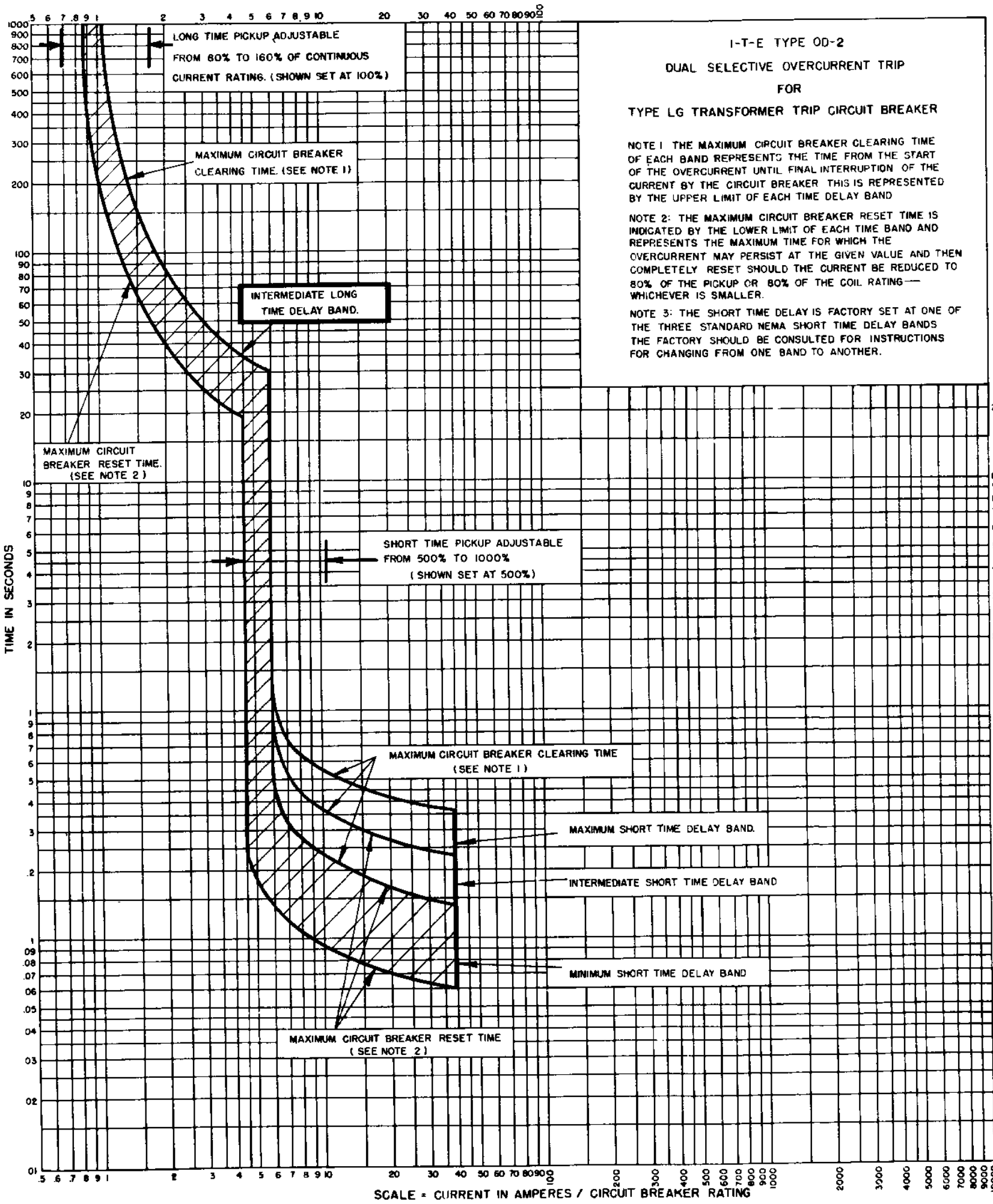
TYPE LG TRANSFORMER TRIP CIRCUIT BREAKER

NOTE 1: THE MAXIMUM CIRCUIT BREAKER CLEARING TIME OF EACH BAND REPRESENTS THE TIME FROM THE START OF THE OVERCURRENT UNTIL FINAL INTERRUPTION OF THE CURRENT BY THE CIRCUIT BREAKER. THIS IS REPRESENTED BY THE UPPER LIMIT OF EACH TIME DELAY BAND

NOTE 2: THE MAXIMUM CIRCUIT BREAKER RESET TIME IS INDICATED BY THE LOWER LIMIT OF EACH TIME BAND AND REPRESENTS THE MAXIMUM TIME FOR WHICH THE OVERCURRENT MAY PERSIST AT THE GIVEN VALUE AND THEN COMPLETELY RESET SHOULD THE CURRENT BE REDUCED TO 80% OF THE PICKUP OR TO 80% OF THE COIL RATING— WHICHEVER IS SMALLER.

NOTE 3: THE SHORT TIME DELAY IS FACTORY SET AT ONE OF THE THREE STANDARD NEMA SHORT TIME DELAY BANDS. THE FACTORY SHOULD BE CONSULTED FOR INSTRUCTIONS FOR CHANGING FROM ONE BAND TO ANOTHER.

TD-3608-A




I-T-E TYPE OD-2

DUAL SELECTIVE OVERCURRENT TRIP

FOR

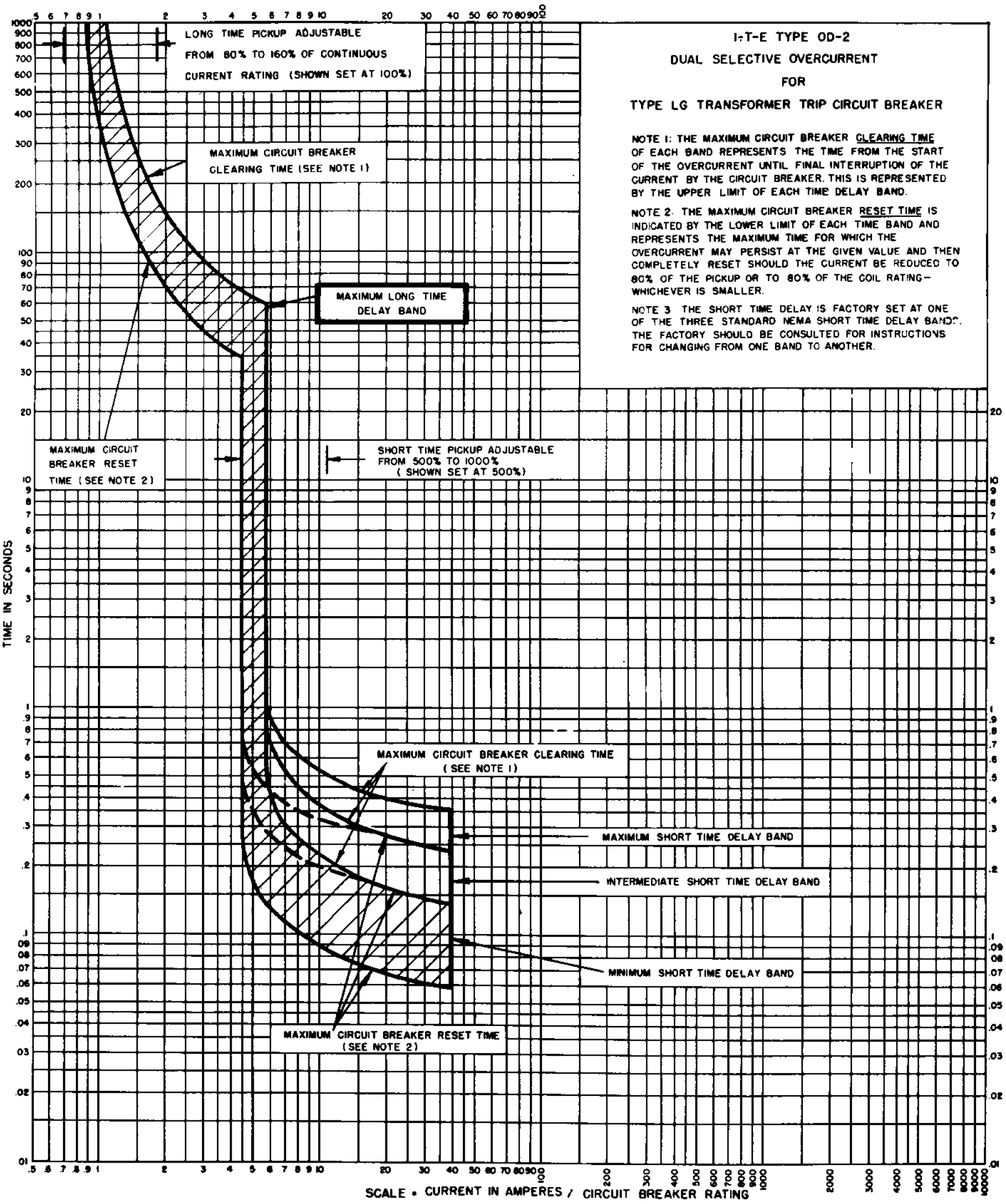
TYPE LG TRANSFORMER TRIP CIRCUIT BREAKER

NOTE 1 THE MAXIMUM CIRCUIT BREAKER CLEARING TIME OF EACH BAND REPRESENTS THE TIME FROM THE START OF THE OVERCURRENT UNTIL FINAL INTERRUPTION OF THE CURRENT BY THE CIRCUIT BREAKER THIS IS REPRESENTED BY THE UPPER LIMIT OF EACH TIME DELAY BAND

NOTE 2: THE MAXIMUM CIRCUIT BREAKER RESET TIME IS INDICATED BY THE LOWER LIMIT OF EACH TIME BAND AND REPRESENTS THE MAXIMUM TIME FOR WHICH THE OVERCURRENT MAY PERSIST AT THE GIVEN VALUE AND THEN COMPLETELY RESET SHOULD THE CURRENT BE REDUCED TO 80% OF THE PICKUP OR 80% OF THE COIL RATING— WHICHEVER IS SMALLER.

NOTE 3: THE SHORT TIME DELAY IS FACTORY SET AT ONE OF THE THREE STANDARD NEMA SHORT TIME DELAY BANDS THE FACTORY SHOULD BE CONSULTED FOR INSTRUCTIONS FOR CHANGING FROM ONE BAND TO ANOTHER.

TD-3608-B




I-T-E TYPE OD-2

DUAL SELECTIVE OVERCURRENT

FOR

TYPE LG TRANSFORMER TRIP CIRCUIT BREAKER

NOTE 1: THE MAXIMUM CIRCUIT BREAKER CLEARING TIME OF EACH BAND REPRESENTS THE TIME FROM THE START OF THE OVERCURRENT UNTIL FINAL INTERRUPTION OF THE CURRENT BY THE CIRCUIT BREAKER. THIS IS REPRESENTED BY THE UPPER LIMIT OF EACH TIME DELAY BAND.

NOTE 2: THE MAXIMUM CIRCUIT BREAKER RESET TIME IS INDICATED BY THE LOWER LIMIT OF EACH TIME BAND AND REPRESENTS THE MAXIMUM TIME FOR WHICH THE OVERCURRENT MAY PERSIST AT THE GIVEN VALUE AND THEN COMPLETELY RESET SHOULD THE CURRENT BE REDUCED TO 80% OF THE PICKUP OR TO 80% OF THE COIL RATING— WHICHEVER IS SMALLER.

NOTE 3: THE SHORT TIME DELAY IS FACTORY SET AT ONE OF THE THREE STANDARD NEMA SHORT TIME DELAY BANDS. THE FACTORY SHOULD BE CONSULTED FOR INSTRUCTIONS FOR CHANGING FROM ONE BAND TO ANOTHER.

TD-3608-C