INSTRUCTIONS FOR OPERATION AND MAINTENANCE OF TYPE KA CIRCUIT BREAKERS

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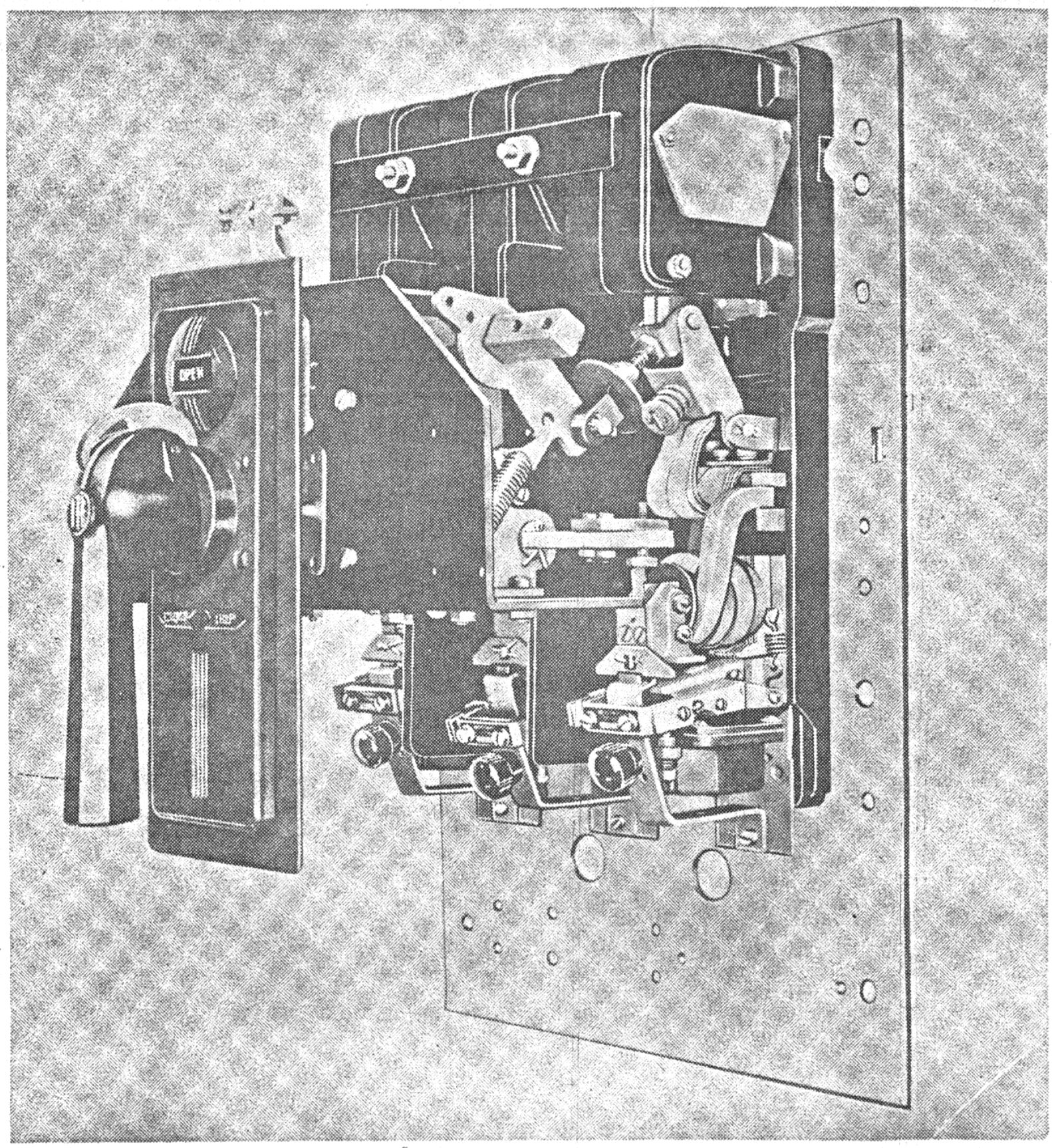

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FIG. 1—TYPE KA CIRCUIT BREAKER MANUALLY OPERATED WITH THREE DUAL MAGNETIC OVERCURRENT TRIP DEVICES

INTRODUCTION

Instructions for operation and maintenance of type KA Circuit Breakers are usually furnished with each shipment.

These instructions may not cover all details or applications in connection with this equipment. Should further information be desired, or some specific problem arise which is not covered sufficiently for the purchaser's purpose, the matter should be referred to the I-T-E Circuit Breaker Company.

Filing these instructions in a readily accessible place, together with any drawings or descriptive switchgear data, will facilitate proper maintenance of the equipment and prolong its life and usefulness.

INSTRUCTIONS FOR OPERATION AND MAINTENANCE OF TYPE KA CIRCUIT BREAKERS

SCOPE OF INSTRUCTIONS

These instructions cover requirements for installation as applied to feeder circuits and also as main circuit breakers on medium capacity systems, particularly where frequent operations may be expected.

GENERAL MOUNTING CONSTRUCTION

Switchboard Mounting. Generally consists of mounting circuit breaker in a switchboard frame work. A flat steel sheet or formed door is then placed over the front of the breaker compartment.

U-Re-Lite. This term applies to a circuit breaker individually enclosed within a steel box. The contacts may be closed or opened by an operating handle on the outside of the enclosure. The box cover may be easily removed for inspection of the apparatus. The breaker may be removed from the box leaving cable connections undisturbed.

The enclosure also serves as a pull box which can be secured to a wall or column, and is provided with knockouts for standard wiring conduits. The breakers are pushed and then bolted into place. A shallow front cover with standard escutcheon cutout is bolted to flanges.

Panel Mounted U-Re-Lite. This is an individually enclosed breaker in which the cover surrounds only the front of the breaker leaving the rear connection studs exposed.

GENERAL CIRCUIT BREAKER CONSTRUCTION

The type KA circuit breaker shown in Figure 1 is a standard 3 pole manually operated construction. For 2 pole construction, the center pole is omitted.

Each pole unit (Fig. 1) is mounted on individual insulated moldings. These moldings isolate the main current carrying structure from the metal supporting base of the circuit breaker.

Each moving contact structure is mounted independently on its own pivot and supported by a bracket fastened to the molding and connected to the respective series overcurrent coil.

The moving contacts in turn are actuated by a common contact jack-shaft which is linked to the operating mechanism. Adjustable insulation couplings isolate each contact structure of each pole and assure that all poles will open and close at the same time. Direct connection to the lower terminal series coil from each moving contact is provided by laminated flexible conductors.

The arc chutes which surround the contact structures may be removed as complete units. Simply remove two nuts and a support bar from the two studs anchored to the circuit breaker panel. The contacts are then readily exposed for inspection or replacement.

Interphase barriers extending below the arc chutes provide additional insulation for the operating mechanism and adjacent poles.

The operating mechanism is centrally mounted on a shelf. If necessary the operating mechanism may be removed as a complete assembled unit.

The operating mechanism consists of a system of toggles and latches supported by two side supports bolted to the breaker base. These side supports with the front shelf form a housing for the operating mechanism.

The circuit breaker may be operated manually or electrically, or a combination of both. For manual operation, the operating handle transmits the closing force through a series of, toggles and latches thereby completing a closing sequence. In turn the contact structure is actuated by individual linkage to the rotable jack-shaft.

For electrical operation, the closing force originates from an energized solenoid cpil.

Protective devices, such as dual overcurrent trip with time delay, thermomagnetic dual overcurrent trip, and reverse current trip are usually mounted on their respective base moldings.

Any of these protective devices will cause the circuit breaker to open by direct action on the tripper bar. As the circuit breaker is mechanically trip free, it is impossible to hold it closed on fault.

The shunt and undervoltage trip devices when used are mounted above the shelf.

The breaker interrupting rating is 15,000 rms amperes and the maximum continuous rating is 225 amperes. Voltage ratings are 600 volts a-c and 250 volts d-c.

SAFETY PRECAUTIONS

Before making any inspection, adjustments, or replacements, make certain all control circuits have been "DE-ENERGIZED". If the circuit breakers are mounted on pantograph mechanism, withdraw breakers completely or rack out to test position. If circuit breakers are rigidly mounted "DE-ENERGIZE" bus. Disconnect cables from leads if there is a power source on the load side.

CONTACT STRUCTURE

The moving contact (Fig. 2) consists of a silver composition block brazed to the upper portion of the contact lever. A laminated flexible conductor extends down towards a lower terminal series coil.

Each moving contact lever pivots within an individual contact arm. The contact arm in turn pivots on a support fastened to a base molding. A compression type contact spring rests against the contact arm and transmits its force to the lower end of the contact lever by means of a cap, link, and pin. When the breaker closes, the contact lever rotates about its pivot, and the spring force presses the moving contact against the stationary contact.

Each contact lever with its attached conductor may be removed from the circuit breaker as a complete unit.

The stationary contact also has a silver composition block brazed to an arc horn. This arc horn extends upwards and aids the movement of the arc up into the arc chute area. The stationary contact is readily detached by removing two attaching screws.

MAINTENANCE

The contacts as shown in Fig. 2 should be inspected at least every six months, and especially after any short circuit.

The arc chutes must be removed before making any examination or replacement of contacts.

If the contacts show excessive burning, erosion, and loss of contact overlap beyond adjustment, they should be replaced. Too frequent replacement may indicate circuit conditions that may require correction. A slight burning or pitting does no harm.

The flexible conductors fastened to the lower end of the contact levers should be replaced if they show severe distortion, damage, or breakage.

OVERHEATING

A cause of overheating is often a loose connection between the circuit breaker and the bus, or a loosely bolted joint at the cable terminal. It is important not to let loose joints or undersize copper feed heat into the circuit breaker.

If a circuit breaker has not been operated for long periods of time, a high resistance oxide or sulphide may form on the contact surfaces which may result in overheating. At regular inspection periods, this high resistance film can sometimes be removed by simply opening and closing the circuit breaker several times under load. Very light dressing with a fine file may be required under severe conditions.

CONTACT PRESSURE ADJUSTMENT

Should the operating mechanism be removed for any reason it may be necesary to make adjustments for proper contact pressure.

1. Slowly close the breaker until the moving contacts just touch the stationary contacts. Measure the gap between the center of contact pivot pin and base molding at "A". See Fig. 2.

2. Continue closing breaker to fully latched position. Repeat measurement at "A". There should be 3/32 inch less gap than before.

3. Should adjustments be needed, loosen locknut (front) on adjusting screw (5) Fig. 2. Adjusting screw can be turned at hex shoulder (rear). To decrease gap at "A" Fig. 2 turn adjusting screw counter-clockwise. Tighten locknut while holding adjusting screw after making adjustments.

ARC CHUTE

DESCRIPTION

The arc chute confines the arc within a limited insulated space. Magnetic blowout irons placed on the outside of the insulating barriers are magnetized as the circuit breaker opens. The magnetic field thus set up forces the arc into an extinguishing chamber.

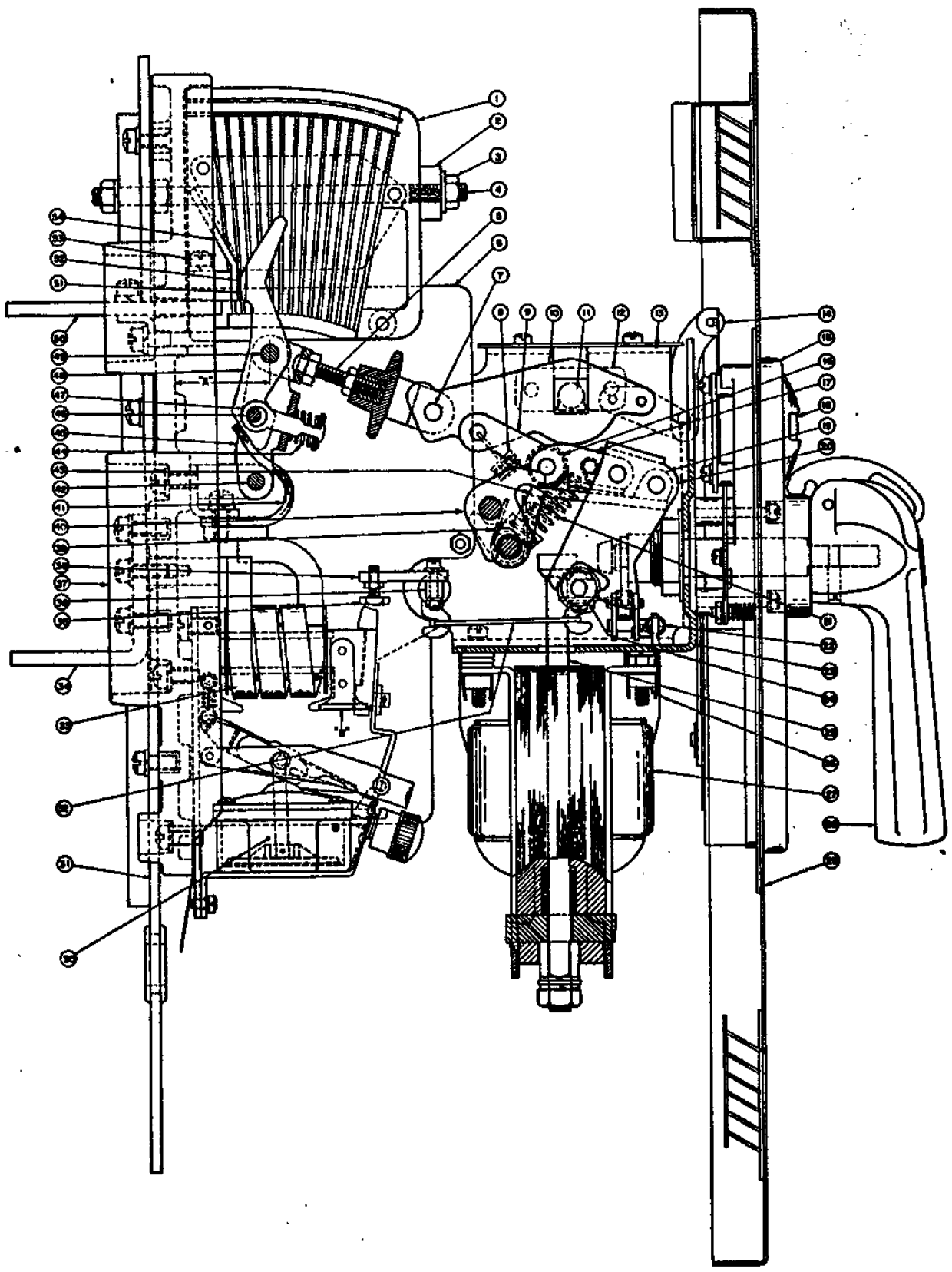
The arc chutes are held to the base by a support bar and two mounting studs. Before removing the arc chutes, it will be necessary to remove two holding nuts from both mounting studs to release the support bar.

Before installing any arc chute after making an inspection, adjustments or replacements, inspect the arc chute for any loose, broken or burned parts. Liners and side plates burned away in severe service, particularly on d-c currents, would require new arc chute replacement. When installing arc chutes after removal, be sure they are securely held in place by their attaching members.

OPERATING MECHANISM

DESCRIPTION

The operating mechanism is centrally located directly in front of the contact bar assembly. The mechanism is supported by two side supports which are fastened to the breaker base. The shelf is attached at the front and bottom of these supports. The tripper bar and contact bar are also supported by these side supports.



1 ARC CHUTE
2 SUPPORT BAR
3 NUT (SUPPORT BAR)
4 SUPPORT STUD (ARC CHUTE)
5 ADJUSTING SCREW
6 INTERPHASE BARRIER
7 PIN (CONTACT ARM BAR)
8 OPENING SPRING
9 TOGGLE LINK
10 CONTACT ARM BAR
11 CONTACT BAR
12 BEARING
13 MECHANISM SUPPORT (R.H.)
14 SLIDER CONNECTING LINK (VISUAL)
15 ESCUTCHEON
16 MAIN LATCH ROLLER
17 TOGGLE LINK
18 VISUAL FLAG
19 HAND CLOSING LEVER
20 LATCH LEVER
21 RESET SPRING (MECHANISM)
22 SPRING (HANDLE CENTERING)
23 SHELF ASSEMBLY
24 LATCH BAR
25 PLUNGER ROD (SOLENOID)
26 SOLENOID ATTACHING NUTS
27 SOLENOID COIL
28 OPERATING HANDLE
29 FRONT PANEL (FORMED DOOR)
30 DUAL OVERCURRENT TRIP DEVICE
31 PANEL (CIRCUIT BREAKER)
32 TRIP LINK
33 SERIES COIL
34 LOWER CURRENT STUD
35 ADJUSTING STUD (O.C.TRIP DEVICE)
36 TRIPPER BAR
37 BASE MOLDING
38 TRIP LEVER
39 MAIN LATCH SPRING
40 HAND CLOSING LEVER STOP
41 FLEXIBLE CONDUCTOR
42 PIN (CONTACT LEVER)
43 MAIN LATCH
44 SPRING (CONTACT)
45 CONTACT ARM
46 PIN (SPRING LINK)
47 SPRING LINK
48 CONTACT LEVER
49 PIN
50 UPPER CURRENT STUD
51 MOVING CONTACT
52 STATIONARY CONTACT
53 STATIONARY CONTACT SCREW
54 STATIONARY ARCING HORN

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FIG. 2—TYPE KA CIRCUIT BREAKER DEAD FRONT MOUNTING, FORMED FRONT DOOR ELECTRICALLY OPERATED

The mechanism consists of a simple system of toggles and levers employing a trip free latch and a main latch. The closing and latching of the contacts is accomplished through linkage.

TRIP FREE OPERATION

The mechanism is mechanically trip free so that it is impossible to hold the circuit breaker closed on a fault above which the overcurrent protective device is designed to operate. As soon as the contacts touch under such conditions, the trip coil energizes the tripping mechanism. In turn a toggle is released and the partly stressed opening springs return the contacts to fully open position.

Circuit breakers equipped with undervoltage or reverse current trip devices when used, are trip free under the conditions against which these devices give protection.

LATCH ADJUSTMENT

The circuit breaker latching and tripping mechanism are adjusted at the factory. However, failure of the breaker to close (slipping latch) under normal operation or replacement of parts may require re-adjustment of latch bite.

Should adjustments be necessary proceed as follows:

1. Check freedom of latch with circuit breaker in open position. Latch bar spring should return latch bar tripper against stop screw as shown in Fig. 3.
2. Adjust the latch bar stop screw so that the breaker will trip with 0.060 inch feeler gauge, and close with 0.050 inch. The stop screw is friction locked by its supporting bracket.
3. After making any latch adjustment, or replacement of the operating mechanism, check the overcurrent trip travel by placing feeler gauge between overcurrent armature and magnet at point "B" Fig. 2. When the overcurrent armature (long time) Fig. 6 is pushed up, the breaker should trip with 0.020 inch feeler gauge and not trip with 0.040. The instantaneous armature Fig 6 should be set to trip at 0.030 and not trip at 0.050.

MANUAL OPERATION

TO CLOSE: The operating handle Fig. 2 is turned clockwise until the operating mechanism latch remains closed. Visual indicator shows "CLOSED". The operating handle when released will resume normal vertical position.

TO TRIP: The operating handle is turned counter-clockwise until the operating mechanism latch releases and visual indicator shows "OPEN". The operating handle when released will resume normay vertical position. The proper motions for operating the circuit breaker are clearly shown on the nameplate beneath the operating handle.

ELECTRICAL OPERATION

GENERAL

The solenoid assembly as shown in Fig. 2 is suspended below the shelf assembly supporting the operating mechanism. Basically the solenoid consists of a magnet, closing coil and plunger rod. The plunger is limited in its upward travel when the closing coil is energized. An adjustable rod carried by this plunger extends up into the operating mechanism. It is possible to remove the solenoid assembly as a complete unit by simply removing four locked nuts.

As an integral part of the solenoid, the control relay operates in conjunction with the closing coil. The relay is designed with a latching arrangement to prevent pumping or repetition of the solenoid closing stroke. Either maintained or momentary control closing switch may be used to operate the relay. The relay operating coil is designed for continuous service. A resistor is inserted in series with the coil on certain control voltages.

Wiring of the control circuit should be in accordance with the diagram specified for the circuit breaker. A typical electrical diagram is shown in Fig. 4.

ADJUSTMENTS

Should the solenoid fail to reset the latch, adjustments will be required. Manually close the breaker and hold the operating handle (28) Fig. 2 in the extreme closed position. Hold the plunger rod (25) up against magnet stop. Turn in four nuts (26) until plunger rod just engages the main latch roller (16). Then turn in the four nuts (26) one extra full turn to compress plunger rod spring. Release operating handle (28) and recheck breaker electrical operation for proper latch resetting. If the latch still does not reset, back out the four nuts (26) a quarter turn each. Check solenoid operation before locking nuts (26).

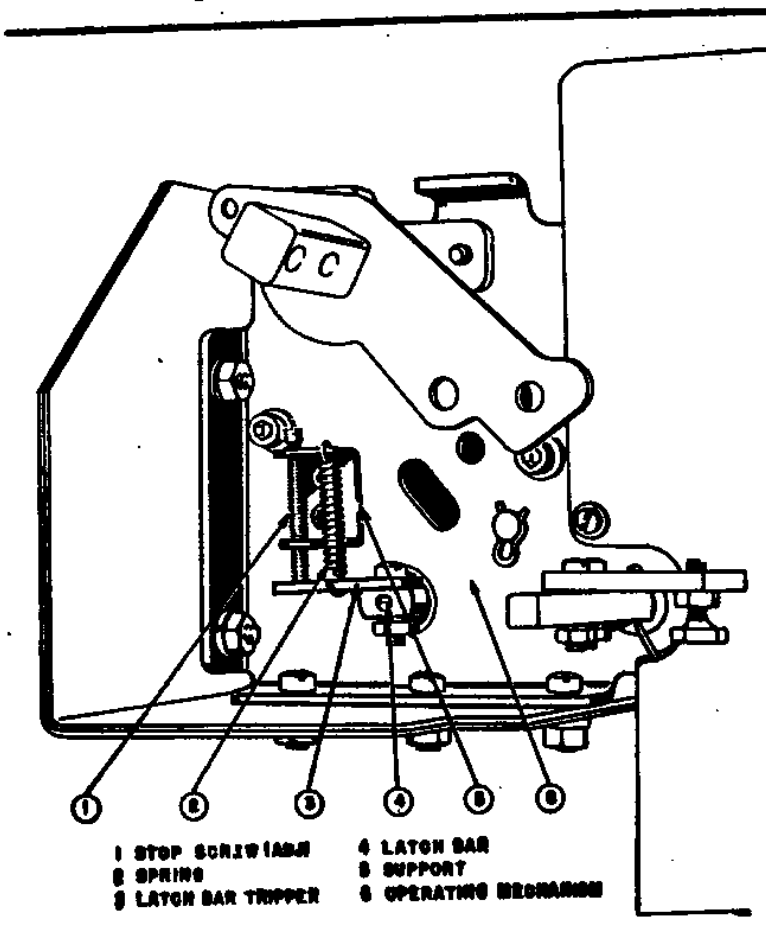
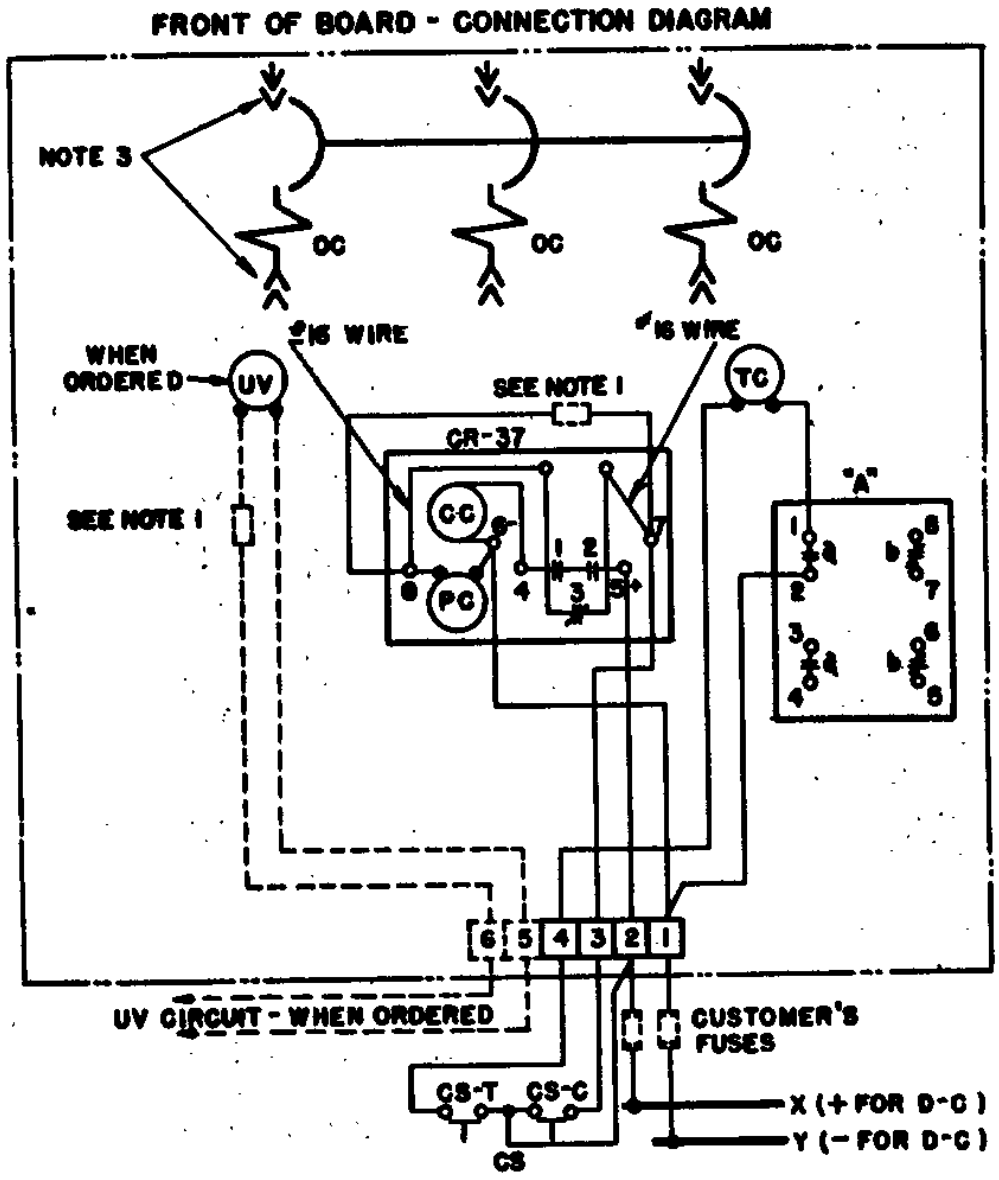


FIG. 3—TYPE KA CIRCUIT BREAKER OPERATING MECHANISM—LATCH ADJUSTMENT

ELECTRICAL DIAGRAMS

FRONT OF BOARD - CONNECTION DIAGRAM



LEGEND

a—Contact closed when circuit breaker is closed.
b—Contact closed when circuit breaker is open.
CC—Closing coil.
CR-37—Closing control relay (Trip free.)
CR-37/1, CR-37/2—Contacts close when pickup coil is energized, contacts opened mechanically at end of solenoid plunger closing stroke.
CR-37/3—Contact normally closed.
CS—Control Switch.
CS-C—Control switch close contact—maintained or momentary.
CS-T—Control switch trip contact.
OC—Overcurrent trip coil (omit for non-automatic.)
PC—Pickup coil of closing control relay.
TC—Shunt trip coil.
UV—Undervoltage trip coil.

Notes:
1. Resistor requirements per #175081. Resistors omitted on certain voltages.
2. Pole positions reading left to right:
   One pole breaker uses #2 pole only.
   Two pole breaker uses #1 & #3 poles.
   Three pole breaker uses #1, #2 & #3 poles.
   Four pole breaker uses #1, #2 & #3 poles as shown & #4 pole in addition.
3. Disconnect devices on individually enclosed pull out breakers only.
4. Switch "A" is mounted on back of position indicator housing standard arrangement of contacts shown. Customer to wire directly to extra contacts of switch.
5. Use AWG #14 stranded wire (except as noted).

SCHEMATIC DIAGRAM

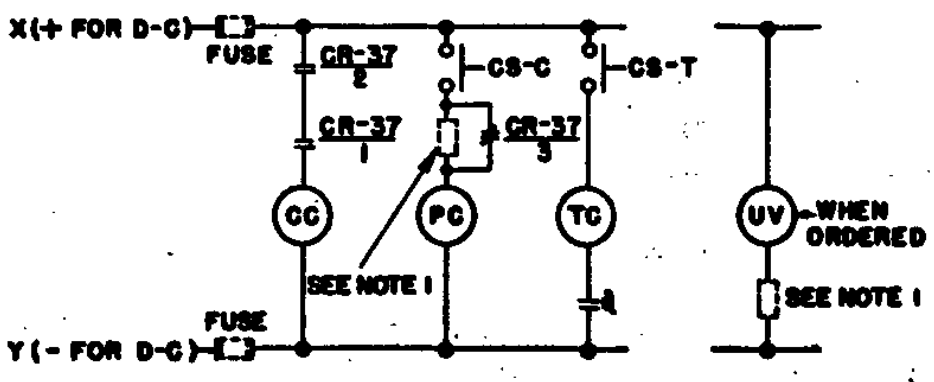


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FIG. 4—TYPICAL ELECTRICAL DIAGRAMS FOR TYPE KA CIRCUIT BREAKERS

TYPE R37 CONTROL RELAY

DESCRIPTION

For electrically operated circuit breakers, a control relay with heavy duty contacts is supplied to control the current drawn by the solenoid closing coil. Standard control switch contacts may be used to control the relatively small current drawn by the control relay operating coil.

The control relay (Fig. 5) is a single pole double break type whose magnet is structurally part of the solenoid magnet. The relay isolates one side of the control power only and is equipped with permanent magnet blowout on d-c circuits.

A control switch is closed to energize the relay operating coil. The relay armature is attracted by the magnet to cause the relay main contacts to "make" while a secondary contact inserts a resistor (when required) in series with the relay operating coil. As the main relay contacts "make" the solenoid plunger operates the closing mechanism of the circuit breaker.

At the end of the solenoid plunger closing stroke, a trip lever attached to the plunger, strikes a latch bar in the relay which disengages the relay main contacts. When the latch bar is rotated by the plunger lever it releases the contact latch lever permitting the lever to slide backwards under tension of the contact arm spring. In moving backwards as far as the slot will permit, the contact latch lever rotates the contact arm about a fixed pin to the open contact position. When a de-energized relay coil permits the armature to open under the force of the independent armature spring, the latch bar moves backward so that the adjusting screw carried by the latch bar, may drop in place behind the engaging pin on the contact arm latch lever.

The lower position of the latch bar, the proper position of the armature, and the backward position of the contact arm latch lever are all determined by the same pin.

When the solenoid coil is de-energized, the plunger drops and releases the relay latch bar.

Should the circuit breaker trip free during the solenoid closing stroke the plunger will continue its stroke to complete the relay contact releasing sequence.

The relay trip lever will cause the relay contacts to open even though the control switch is maintained. The circuit through the relay operating coil will also be maintained which prevents resetting of the latch bar. Therefore the circuit through the blowout contacts for energizing the solenoid closing coil cannot be re-established without releasing the control switch.

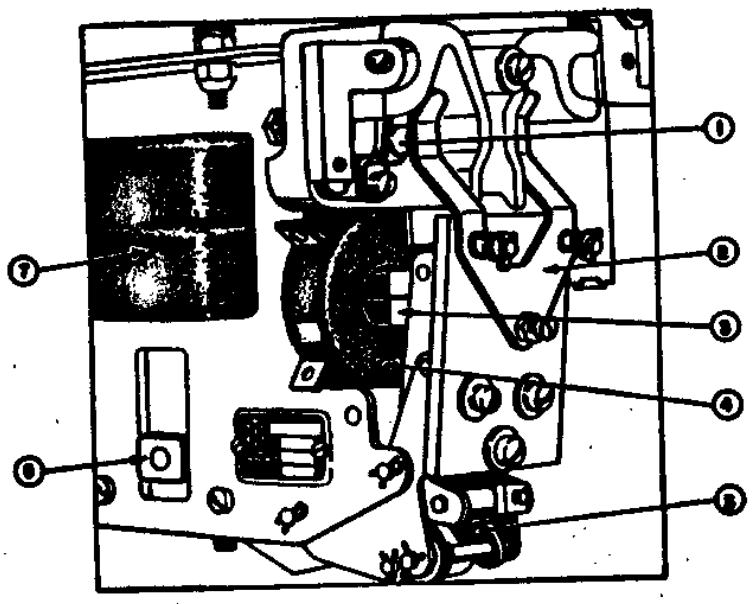


FIG. 5—TYPE R-37 CONTROL RELAY AND SOLENOID FOR TYPE KA CIRCUIT BREAKERS

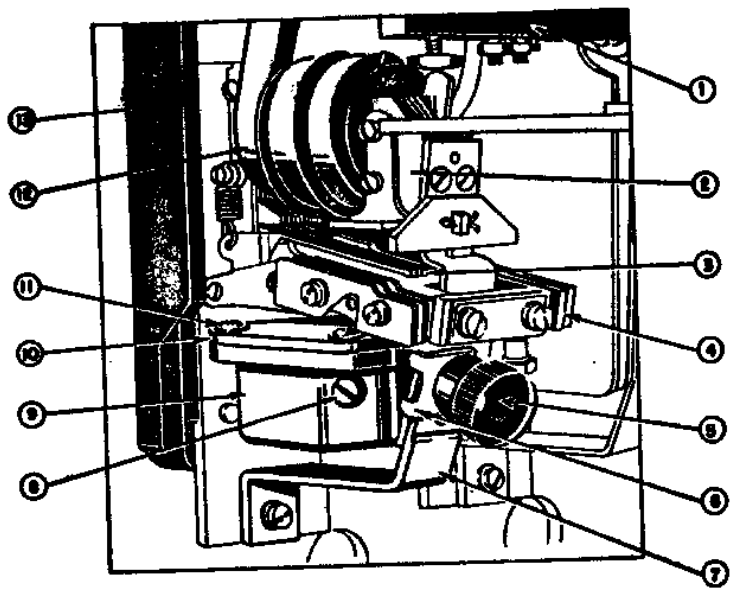
DUAL MAGNETIC OVERCURRENT TRIP DEVICE

DESCRIPTION

The dual overcurrent trip device as shown in Fig. 6 combines short period overcurrent protection with short circuit value interruption. Short circuits or excessive overcurrents will be cleared instantly.

The device may be found mounted directly under the pole with which it is associated, and is attached to an insulation molding supported by the breaker base. Two laminated iron armatures per series coil pivot about a common pin and are one within the other. The inside armature when restrained by the oil film time delay will prevent tripping of the circuit breaker during starting periods overcurrents. Should overcurrents persist beyond pre-calibrated limits, the time delay oil film will rupture and allow the armature to trip the breaker. Calibration range of tripping adjustment is 80 to 160 percent of the ampere rating of the circuit breaker. The outside armature provides a fixed instantaneous trip which is set to trip approximately 8 times the ampere rating for a-c breakers.

The tripping response of one overcurrent trip device will cause the opening of the circuit breaker contacts for all poles.



1 TRIPPER BAR
2 MAGNET
3 ARMATURE (LONG TIME)
4 ARMATURE (INSTANTANEOUS)
5 KNOB (LONG TIME CALIBRATION
6 CLAMP
7 SUPPORT BRACKET
8 SCREW (OIL INSERT)
9 OIL CUP
10 COVER (OIL CUP)
11 SCREW (COVER)
12 SERIES COIL
13 MOLDING

FIG. 6—DUAL MAGNETIC OVERCURRENT TRIP DEVICE FOR TYPE KA CIRCUIT BREAKERS

ADJUSTMENTS

The device should be set for a value of current slightly above the maximum rating of the equipment. If the circuit breaker trips under normal working conditions, lower the oil cup slightly after loosening the calibration knob.

Location of the armature pointer relative to the graduations on the support bracket indicate the current value at which the circuit breaker will trip (without oil in the time delay cup). For the proper amount of overcurrent trip time delay refer to typical characteristic curve Fig. 7.

MAINTENANCE

Initial Service. Remove screw (side of oil cup) and insert ½ ounce of oil from tube supplied.

Inspection. Clean oil cup at least once a year to insure efficient service. Any indication of the time delay not performing as it should, may be due to not enough oil or some foreign matter has settled in the cup.

Servicing Oil Cup (Refer to Fig. 6).

1. Remove knob and clamp.
2. Remove pin connecting upper end of time delay link to inside armature. Pin may be reached by raising outside (instantaneous) armature.
3. Lift up both armatures to slide out oil cup.

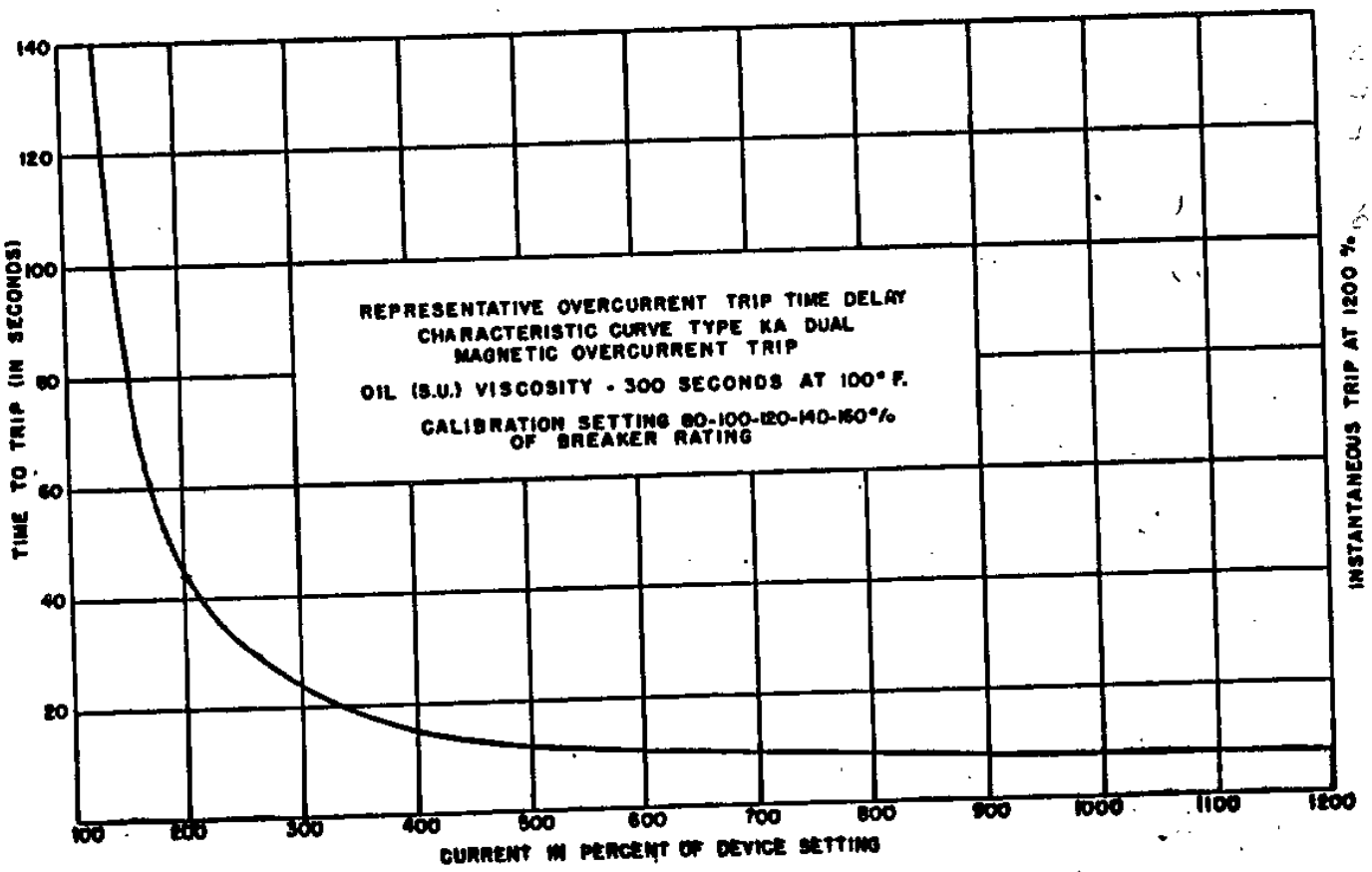


FIG. 7—REPRESENTATIVE OVERCURRENT TRIP TIME DELAY CHARACTERISTIC CURVES—TYPE KA DUAL MAGNETIC OVERCURRENT TRIP

4. Remove four screws to remove cup cover then lift out movable adhesive disc. Caution. Do not interchange oil cups or mar adhesive surfaces of discs.
5. Flush oil cup and adhesive discs with carbon tetrachloride and wipe clean.
6. Insert fresh time delay oil. For this application ½ ounce of oil is required for each cup, or a depth of ⅛ inch above cup adhesive disc. Replace moving disc and cover. Assemble time delay cup to support bracket.
7. Reset time delay device at pre-determined calibration point. Refer to adjustments should any calibration change be necessary.

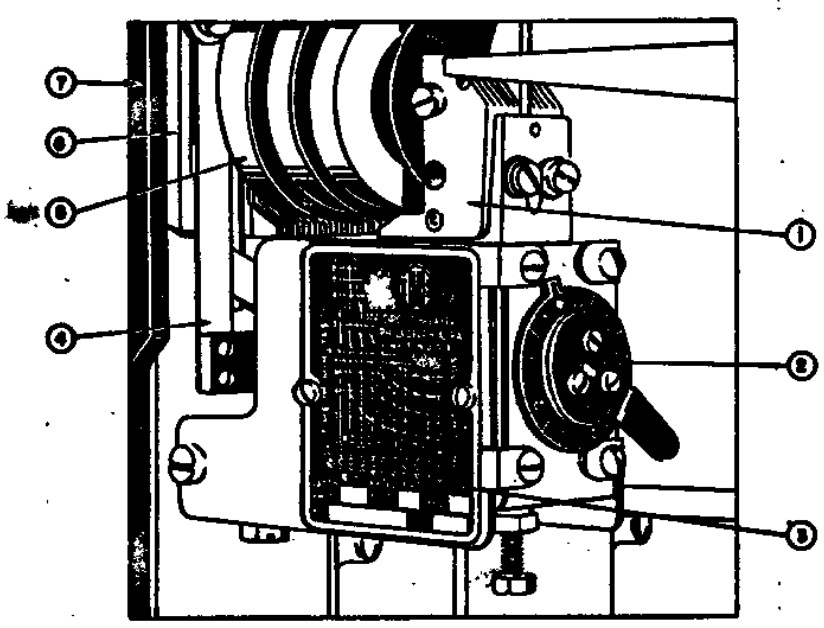
When re-ordering time delay oil, specify the type circuit breaker oil is intended for and amount required. Time delay oil supplied by the I-T-E Circuit Breaker Company is recommended.

DUAL THERMAL MAGNETIC OVERCURRENT TRIP DEVICE

DESCRIPTION

The dual thermal magnetic overcurrent trip device (Fig. 8) is direct acting and series connected for use on a-c breakers supplying individual motor circuits. Adjustable long time delay is provided by a thermal element inductively heated to prevent burn out regardless of overcurrent. Instantaneous trip occurs in the current ranges well above starting inrush currents.

The device is mounted to an insulated base molding as a complete sub-assembly and consists of an electro-magnet excited by current flowing in the series coil. A bimetal thermal element mounted at the back of the magnet is heated by the current induced in a short circuited turn of metal adjacent to it. A hinged laminated iron armature is attracted by the magnet and is normally restrained by a latch.



1 MAGNET
2 CALIBRATION INDICATOR
3 NAMEPLATE
4 THERMAL ELEMENT
5 SERIES COIL
6 HEATER
7 INSULATING MOLDING

FIG. 8—DUAL THERMAL MAGNETIC OVERCURRENT TRIP DEVICE FOR TYPE KA CIRCUIT BREAKERS

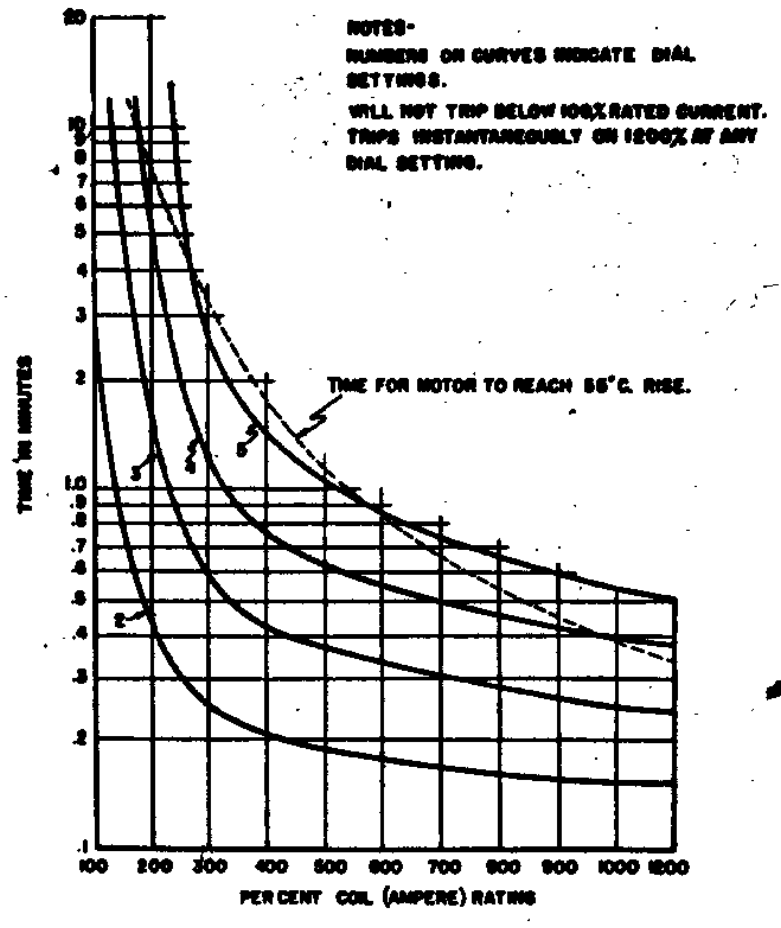


FIG. 9—TIME LOAD CHARACTERISTICS OF DUAL THERMAL MAGNETIC OVERCURRENT TRIP DEVICE, 25 AND 60 CYCLES A-C

Heating of the thermal element causes an attached rod to move, which in turn actuates a latch to release an armature. The armature free to move, is drawn up by the electro-magnet and imparts a "hammer blow" to trip the circuit breaker.

When a short circuit or heavy overload occurs the entire frame is lifted. At the end of the armature stroke the latch is released so that the restraining instantaneous spring force does not substract from the force available to trip the breaker.

The instantaneous trip setting is approximately 12 times the ampere rating of the circuit breaker.

Turning the calibration indicator moves a latch release nut forward and backward along a threaded part of a shaft, so that it can disengage the latch at different percent load temperatures of the bimetal strips. The indicator is spring locked to prevent accidental turning. The index plate is graduated and numbered. For each number, the device has a different current-time tripping characteristic. A family of these curves is shown on Fig. 9

in comparison with corresponding curve for the maximum safe motor temperature.

Additional points are provided between the numbers to permit close adjustment for individual applications.

SHUNT TRIP DEVICE

DESCRIPTION

The shunt trip device as shown in Fig. 10 is used to affect remote tripping without regard to load conditions in the circuit, and is used with a normally open control contact.

The device may be found mounted to the shelf at the right hand side of the operating mechanism. It is similar in construction to that of the undervoltage trip. Adjustable linkage from the armature to the tripper bar provides tripping of the circuit breaker.

An auxiliary contact disconnects the shunt trip coil from the circuit as the circuit breaker opens, which prevents the coil from burning out after the breaker opens. The shunt trip device may be operated by any convenient source of potential, such as a storage battery or control transformer. Note. As the shunt trip device operates only by completing a normally open circuit, any grounds or faults in the control wiring would not be evident until the device failed to work when required to open the circuit breaker. Where hazards to control power exist, an undervoltage trip device is recommended because it operates upon opening of a normally closed circuit.

COIL REPLACEMENT. (Refer to Fig. 10.)

Should the operating coil need to be removed:

1. Unhook spring (not shown) from armature (2).
2. Remove link head pin (5) and armature pivot pin (10).
3. Disconnect leads for operating coil (7).
4. Pry off shading ring (6) from magnet (9).
5. Remove coil retainers (8) to remove coil (7) from magnet (9).
6. Replace coil by reverse operations.

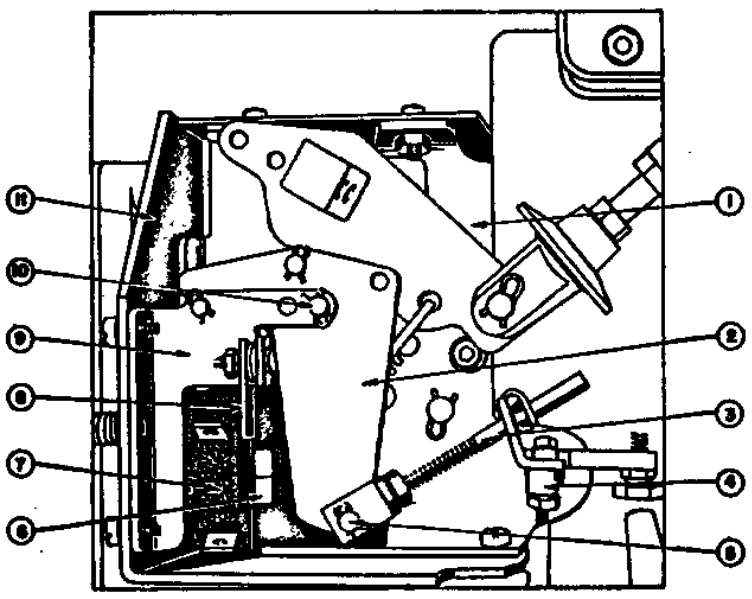
UNDERVOLTAGE TRIP DEVICE

DESCRIPTION

The undervoltage trip device (Fig. 11) will trip the circuit breaker instantly on or after a time on loss of voltage.

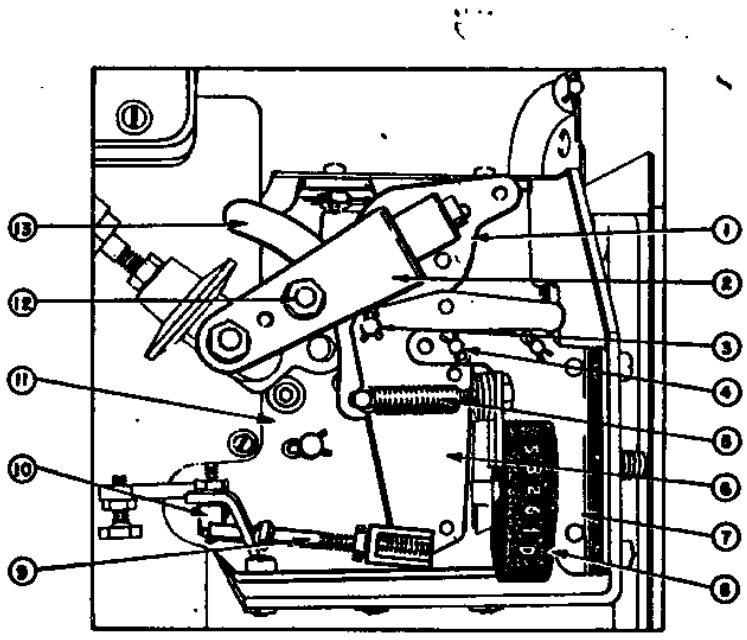
The device has a coil surrounding an electromagnet connected directly to the line and attracts a pivoted armature. (For this application the time delay feature is omitted.)

Under normal operating conditions the armature is sealed against the magnet pole face. When the operating voltage drops to approximately 20-60% of the normal circuit voltage, the magnet will release the armature. The armature rotating about its pivot pin, moves clockwise to trip the circuit breaker by means of a force applied to the circuit breaker tripper bar through a connecting trip link. This force is accelerated by two springs, which



1 OPERATING MECHANISM
2 ARMATURE
3 TRIP LINK
4 TRIPPER BAR
5 PIN
6 SHADING RING
7 OPERATING COIL
8 COIL RETAINER
9 MAGNET
10 PIN
11 SHELF

FIG. 10—SHUNT TRIP DEVICE FOR TYPE KA CIRCUIT BREAKERS



1 JACK SHAFT
2 GUIDE
3 PIN (SPRING LEVER)
4 PIN (ARMATURE)
5 SPRING
6 ARMATURE
7 MAGNET
8 OPERATING COIL
9 TRIP LINK
10 TRIPPER BAR
11 OPERATING MECHANISM
12 ECCENTRIC
13 SPRING LEVER

FIG. 11—UNDERVOLTAGE TRIP DEVICE FOR TYPE KA CIRCUIT BREAKERS

have initial tension when the breaker is open and further tension applied by rotation of a rotable spring lever when the breaker is closed. The spring lever is actuated by a caming operation of an adjustable eccentric carried by a guide attached to the breaker contact arm bar or jack-shaft.

TIME DELAY

When it is required for the circuit breaker to remain closed for momentary voltage dips, the oil film delay feature (not shown) may be added, which delays the tripping operation for a definite predetermined time interval. The time delay is approximately 3 seconds at no voltage. If normal circuit conditions do not restore during this interval, the circuit breaker will open by normal tripping sequence described in preceding third paragraph.

MAINTENANCE—TIME DELAY

The device may be removed as a complete unit, and is readily accessible for inspection. For initial service, remove screw (side of oil cup) and insert ½ ounce of oil from tube supplied.

Clean oil cup at least once a year to insure proper service. Any indication of improper time delay action, may indicate insufficient amount of oil or some foreign deposits in the oil cup.

The oil cup may be detached by removing four mounting screws. Be careful not to mar the adhesive disc surfaces. Clean the cup and adhesive disc with carbon tetrachloride or similar oil solvent, then dry thoroughly. Replace oil cup, then remove cup screw and insert ½ ounce of time delay oil. Oil supplied by the I-T-E Circuit Breaker Company is recommended.

REVERSE CURRENT TRIP DEVICE

DESCRIPTION

A reverse current trip device is used to trip the circuit breaker upon any reversal of current flow or power feed-back. Generators operated in parallel or those used to charge batteries should be protected with a device as shown in Fig. 12. If one generator were to lose its terminal voltage, the other generator or storage batteries would feed power into the disabled machine and tend to operate it as a motor.

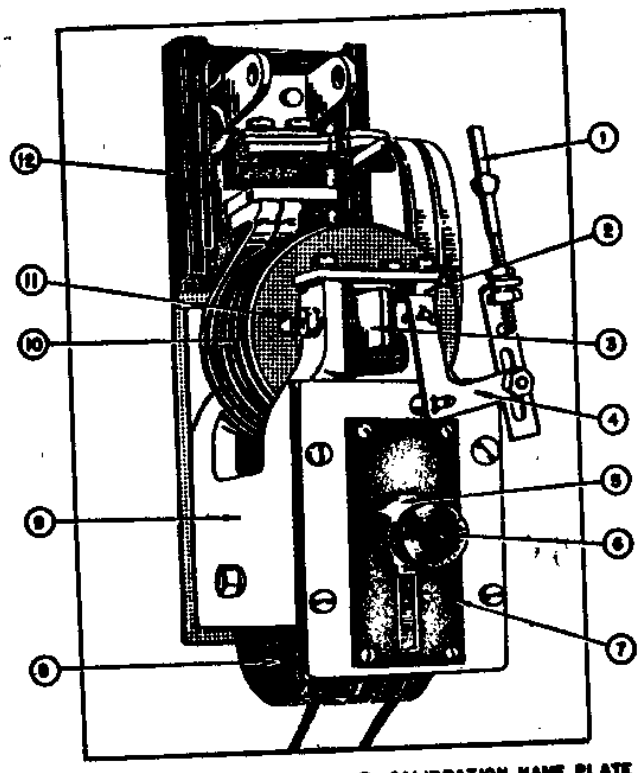


FIG. 12—REVERSE CURRENT TRIP FOR TYPE KA CIRCUIT BREAKERS

The device consists of two magnetic systems, one energized by a series coil carrying the main current, the other by a shunt coil upon which the circuit potential is impressed. These two systems interact in much the same manner as that of the field and armature in a direct current motor. The polarity of the shunt coil system remains constant. The magnetic field of the series coil causes the armature to press against a stop screw when current is flowing in the normal direction.

Upon current reversal, the action of the series magnetic field is reversed, which causes the armature to rotate in the opposite direction and trip the breaker through mechanical connection to the breaker tripper bar.

This device will trip on any reverse current in excess of the calibration setting. Calibration range of tripping adjustment is 5-25 percent of the ampere rating of the circuit breaker. Tripping action requires that 70 percent voltage be maintained.

TYPE OD-1 AND OD-2 OVERCURRENT TRIP DEVICES

INTRODUCTION

The dual overcurrent device consists of the following basic elements in two combinations.

ELEMENT 1. Long time delay of dual or selective trip using a silicone oil displacement dash pot.

ELEMENT 2. Short time delay of selective trip using a geared timer.

ELEMENT 3. Instantaneous trip of dual overcurrent trip.

Type OD1 is comprised of elements 1 and 3.
Type OD2 is comprised of elements 1 and 2.

APPLICATION

The type OD1 and OD2 overcurrent trip devices are applicable to a-c circuit breakers up to and including 6000 amperes and to d-c breakers up to and including 1600 amperes with either series or transformer tripping as design warrants.

FUNCTIONS

The delay of element 1 is measurable in seconds, minutes and hours, and that of element 2 in cycles. Element 3 operates with no intentional delay.

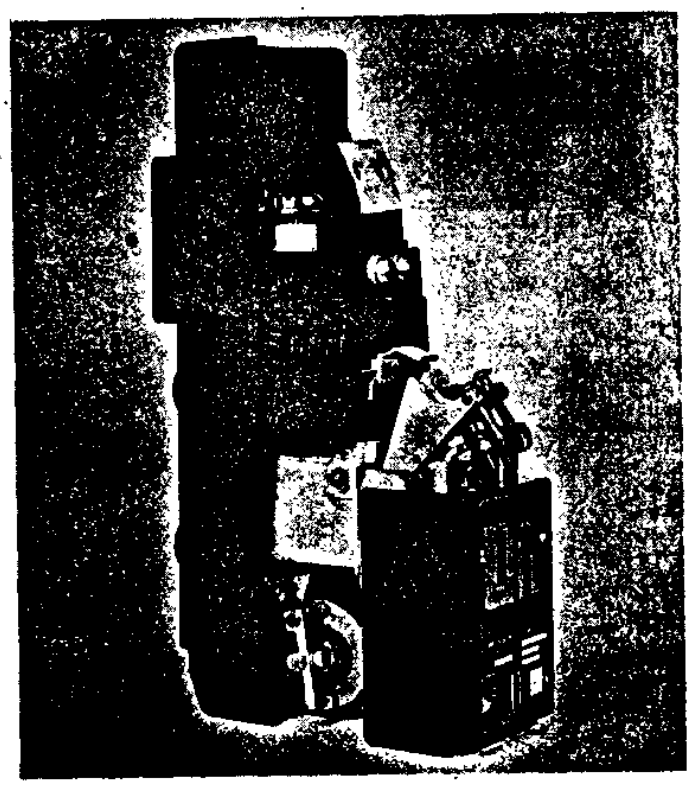


Photo. 17457

FIG. 13—TYPE OD-2 OVERCURRENT TRIP DEVICE

MECHANICAL DESCRIPTION

The device is shown in Fig. 13. Tripping current flows through the coil surrounding the upper leg of the magnet and supplies the tripping force. The two armatures pivot on a common pin and are attracted to the magnet with a force, the value of which depends upon the current and the number of turns in the coil. Tripping of the circuit breaker is obtained by having either armature trip screw strike the breaker trip finger. A resonant silencer is incorporated on the long time delay armature for alternating current application. Both armatures have fixed air gaps and use tension springs for calibration of pick up values. The long time delay dashpot is linked to one armature. Delay is obtained by the displacement of the silicone oil from one side of the piston to the other. After the armature has completed not more than half its stroke, the piston enters an unrestrained portion of the cylinder, allowing the armature to strike the trip finger with impact. The magnitude of time delay is a function of the distance that the piston moves in the restrained portion of the cylinder. Due to a highly responsive check valve, the armature resets rapidly (in less than 1 second) and, therefore, successive tripping attempts both current and time delay, are in accordance with calibrated values.

The short time delay timer is also constructed in a manner that permits impact trip, since time delay is concluded in the first half of the armature stroke. Due to instantaneous reset of the armature after a partial tripping stroke, minimum operating current is required on successive tripping attempts.

ELECTRICAL CHARACTERISTICS

Element 1 is calibrated and adjustable for minimum operating currents of 80 to 160% of the ampere rating of the circuit breaker with time delay adjustments to any of the three standard NEMA operating bands.

Element 2 is calibrated and adjustable for minimum operating currents of 500%, 750%, and 1000% of the ampere rating of the circuit breaker with time delay adjustments to any of the three standard NEMA short time operating bands.

Element 3 is calibrated and adjustable for minimum operating currents of 800%, 1200%, and 1500% of circuit breaker rating.

ADJUSTMENTS

Minimum operating current adjustments are made by turning the appropriate calibration knob on the front of the device.

Long time delay adjustment has been factory set and locked. Should adjustment be required, flatten corner of lock plate and turn spring loaded screw so that the long time delay indicator moves in the required direction. Refer to applicable characteristic curves TD-3304C, TD-3305C, or TD-3306C for setting the long time band indicator.

Short time delay is factory set according to one of the three NEMA bands and the coil rating of the breaker. The factory should be consulted for instructions for changing from one band to another. These bands are represented by TD-3307C, TD-3308C, and TD-3309C.

Armature air gap adjustment is factory set and must not be changed.

Armature tripping travel. When checking or making this adjustment, insert feeler shims at point "A" Fig. 14 parallel armature face. Breakers should trip with 0.020 inch gauge and not trip with 0.030 inch gauge. Make sure set screws are tightened after making this adjustment and operate breaker a few times to insure correct adjustment.

SPARE PARTS

Due to the high precision expected of this device, assembly and calibration must be extremely accurate. It is, therefore, recommended that no attempt be made to repair or replace parts of the unit. A replacement unit may be obtained from the factory.

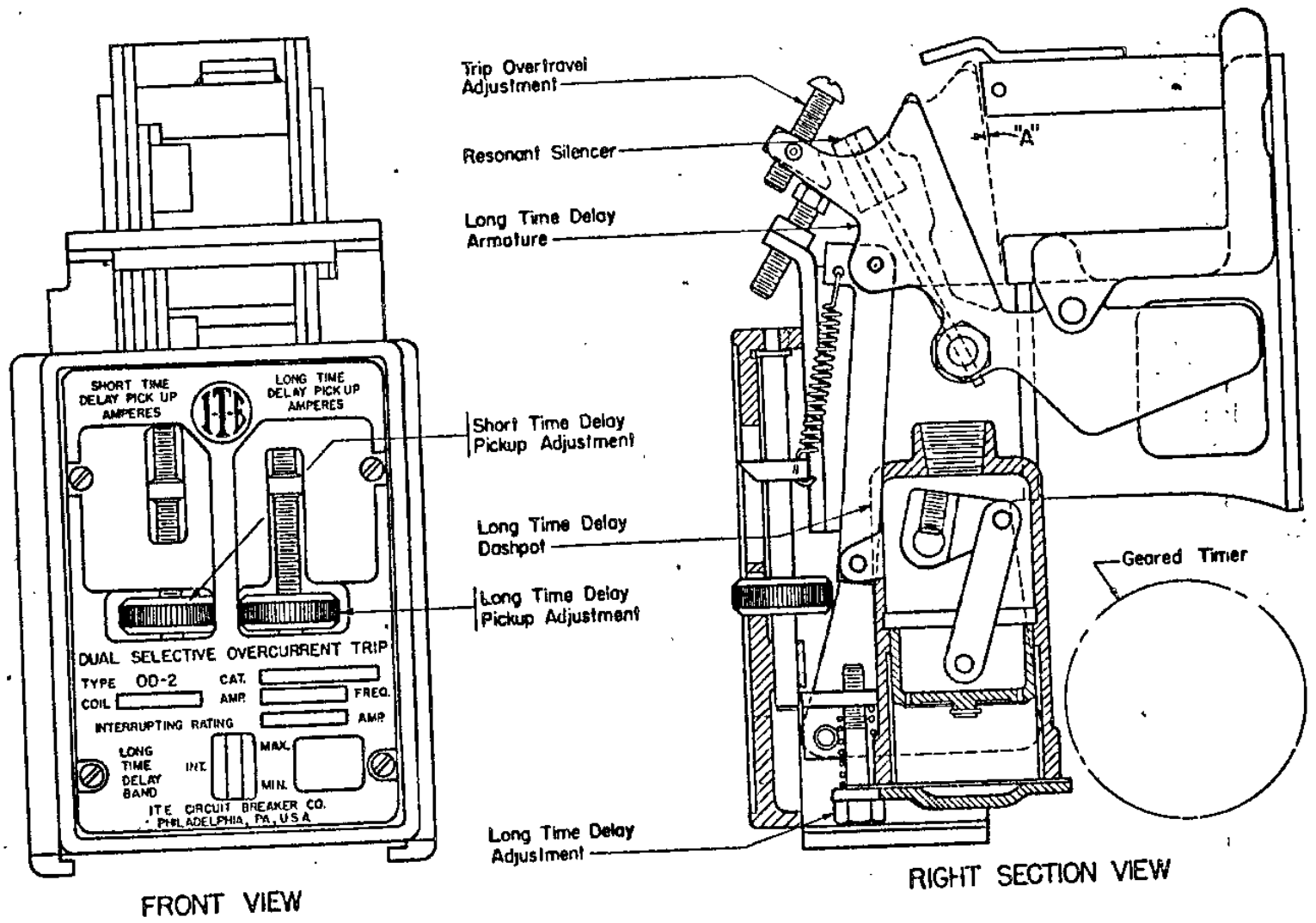


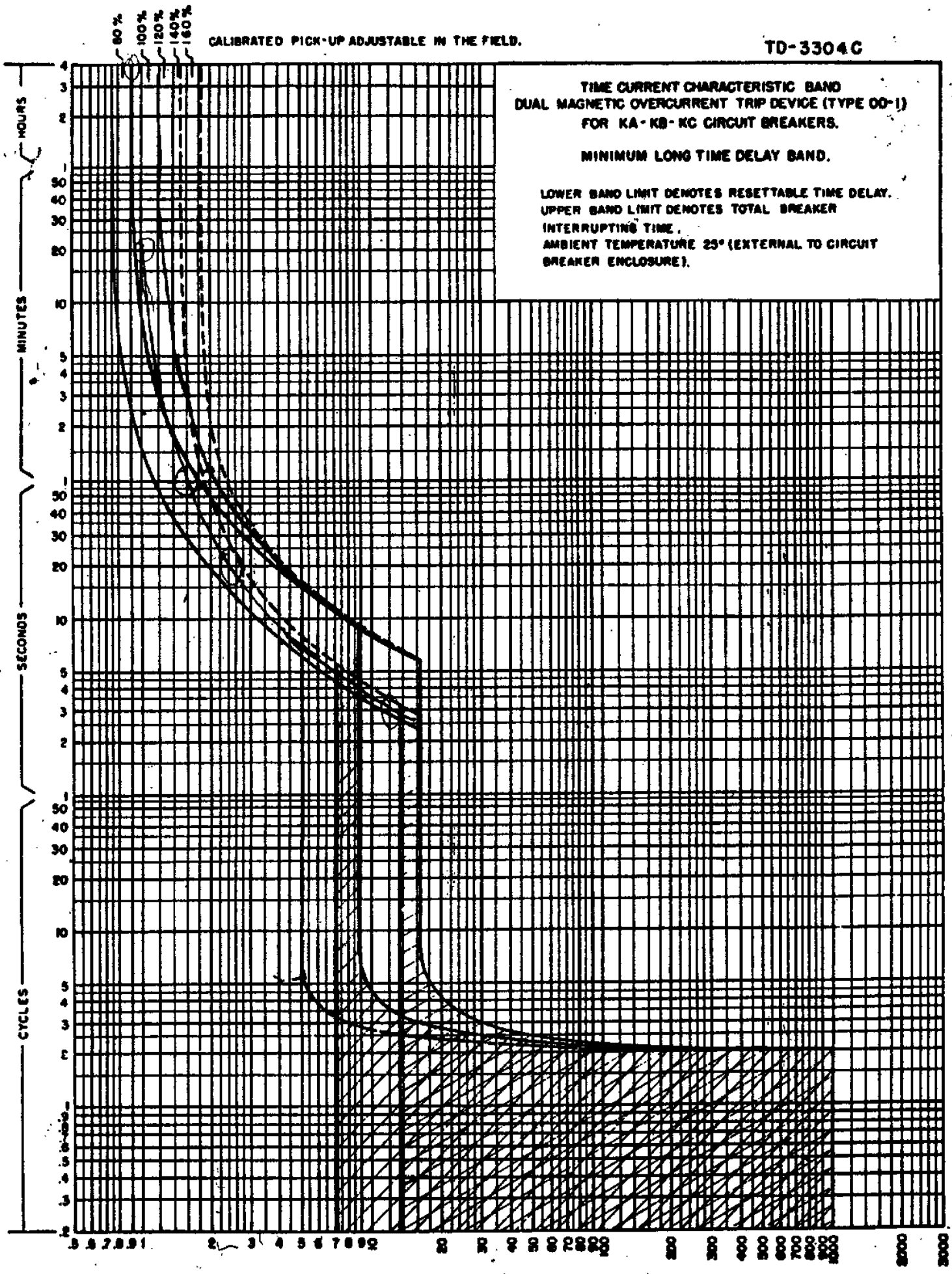
FIG. 14—Type OD-1, OR OD-2 OVERCURRENT TRIP DEVICE

SPARE PARTS

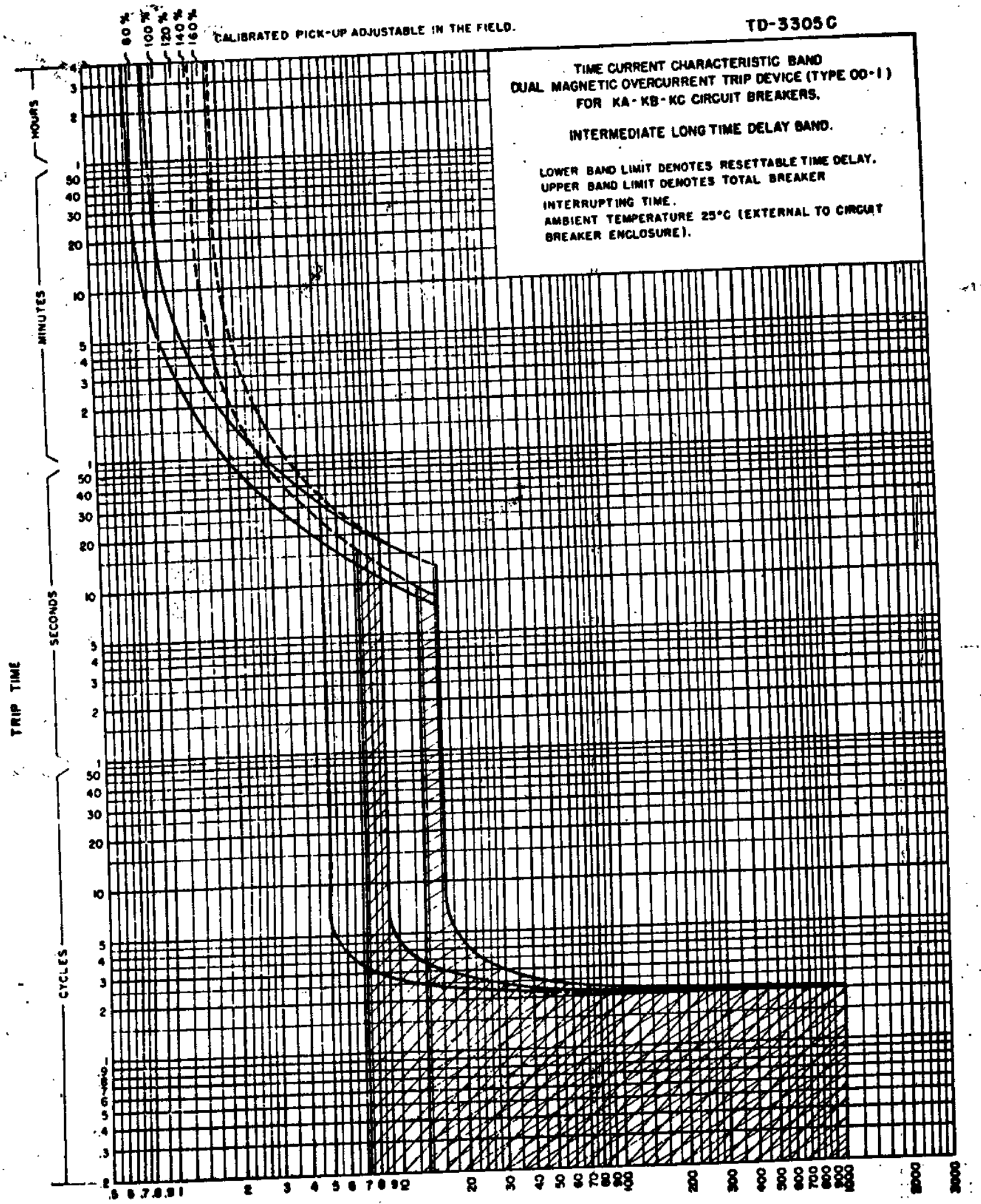
It is recommended that sufficient spare parts be carried in stock to enable the operators of circuit breakers to promptly replace any worn, broken or damaged parts. Should renewal parts be required, refer to Bulletin RP-1500-KA. The figure indexes in this bulletin are for instruction description only.

In conclusion it is again strongly urged that the manufacturer's instructions for each circuit breaker be carefully read and followed.

Portions of this Instruction Bulletin as to text and calibration ratings are in accordance with the National Electrical Manufacturers Association Standards, dated April 1951.


80 %
100 %
120 %
140 %
160 %
CALIBRATED PICK-UP ADJUSTABLE IN THE FIELD.
TD-3304C
TIME CURRENT CHARACTERISTIC BAND
DUAL MAGNETIC OVERCURRENT TRIP DEVICE (TYPE 00-1)
FOR KA-KB-KC CIRCUIT BREAKERS.
MINIMUM LONG TIME DELAY BAND.
LOWER BAND LIMIT DENOTES RESETTABLE TIME DELAY.
UPPER BAND LIMIT DENOTES TOTAL BREAKER INTERRUPTING TIME.
AMBIENT TEMPERATURE 25° (EXTERNAL TO CIRCUIT BREAKER ENCLOSURE).
TRIP TIME
HOURS
MINUTES
SECONDS
CYCLES
BREAKER RATING TIMES SCALE EQUALS CURRENT IN AMPERES.

TD-3305C

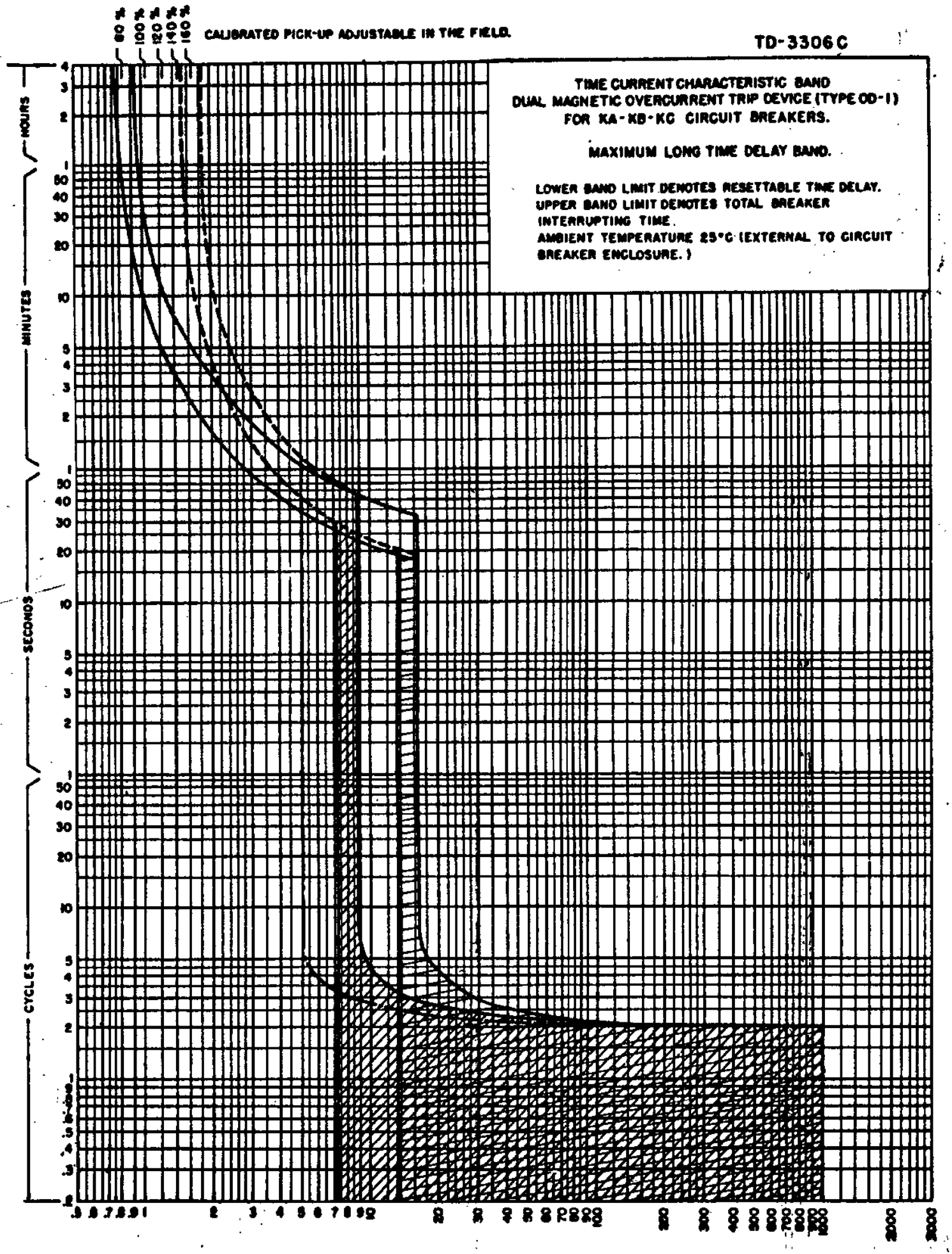


TIME CURRENT CHARACTERISTIC BAND
DUAL MAGNETIC OVERCURRENT TRIP DEVICE (TYPE OD-1)
FOR KA-KB-KC CIRCUIT BREAKERS.

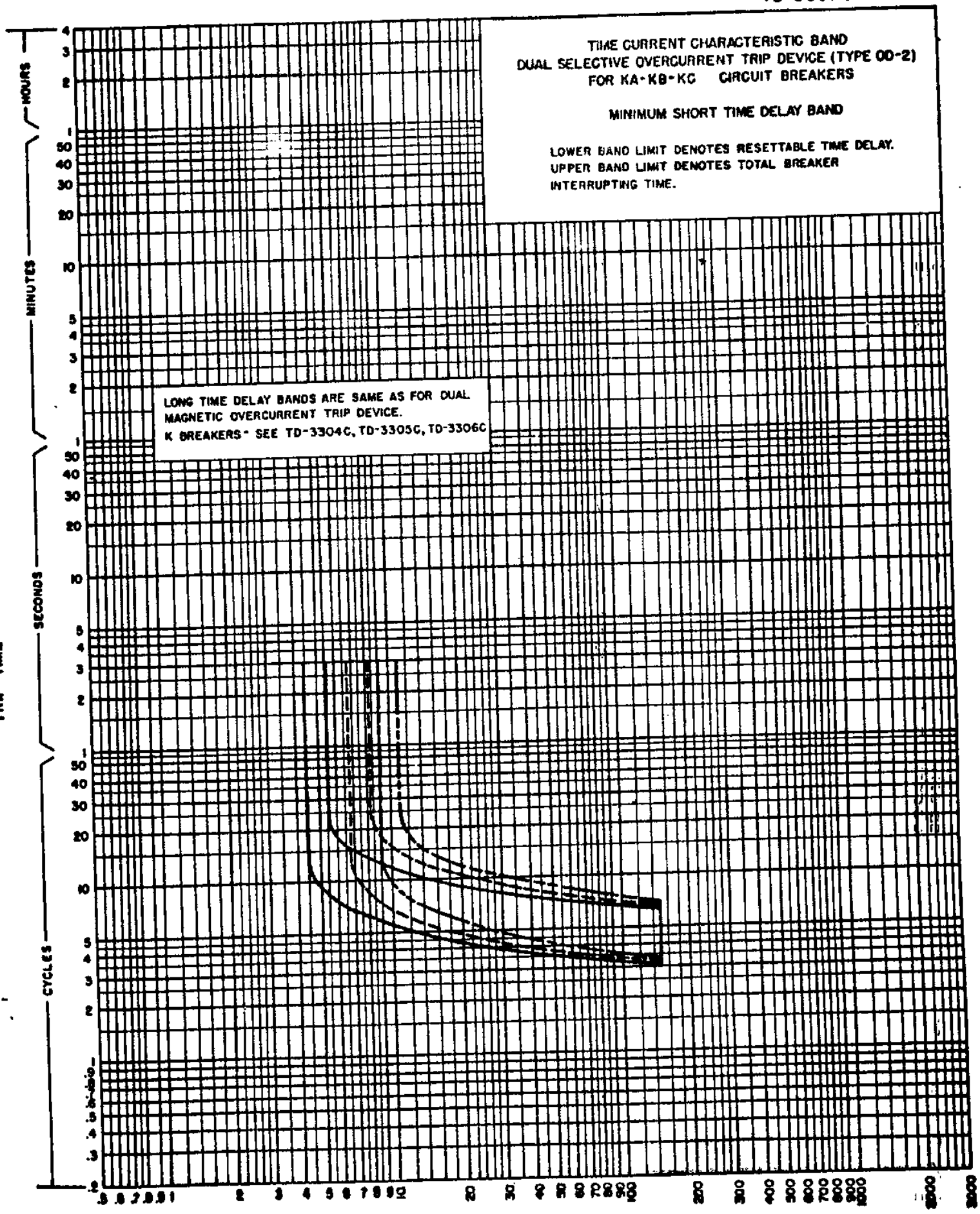
INTERMEDIATE LONG TIME DELAY BAND.

LOWER BAND LIMIT DENOTES RESETTABLE TIME DELAY.
UPPER BAND LIMIT DENOTES TOTAL BREAKER INTERRUPTING TIME.
AMBIENT TEMPERATURE 25°C (EXTERNAL TO CIRCUIT BREAKER ENCLOSURE).

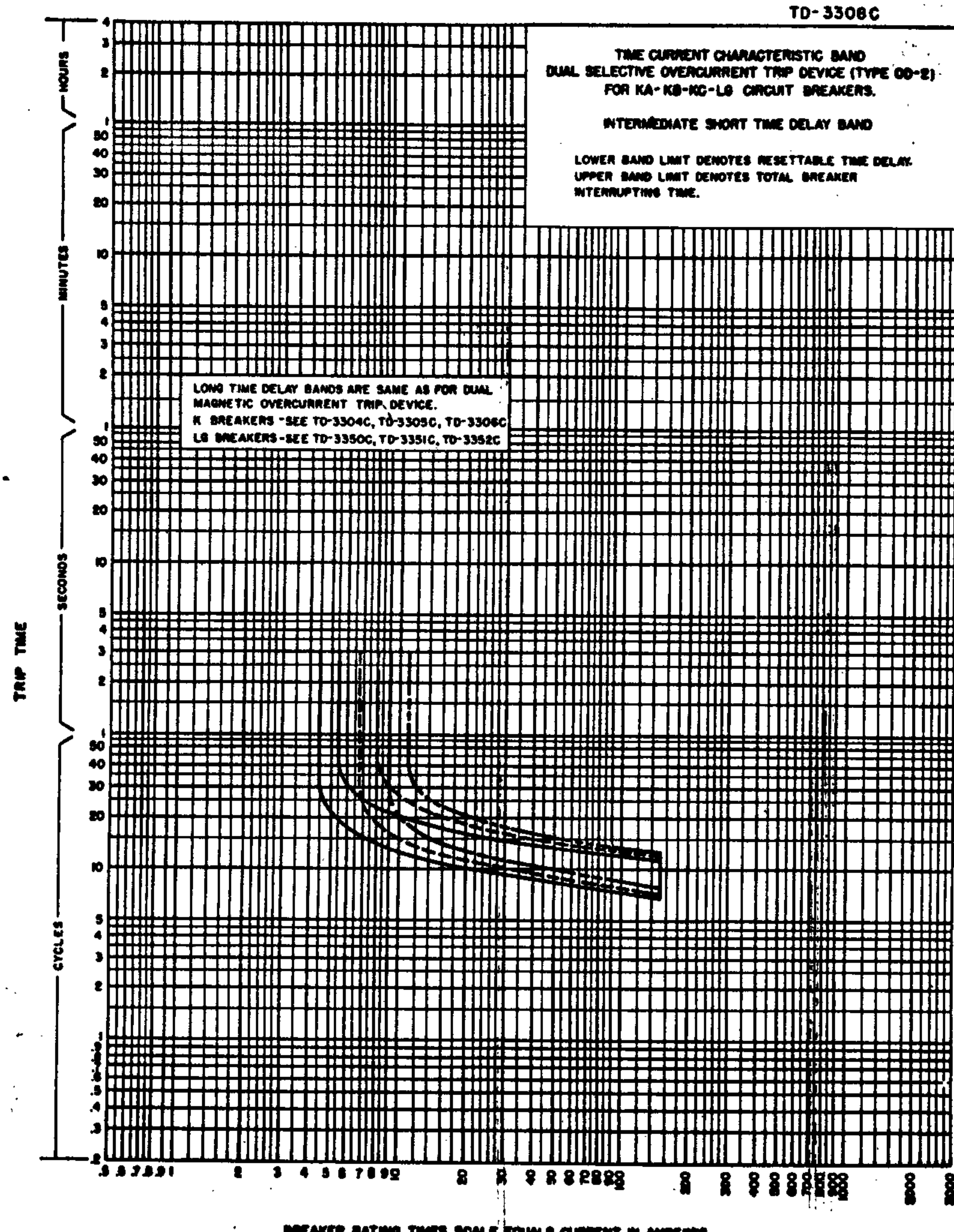
BREAKER RATING TIMES SCALE EQUALS CURRENT IN AMPERES.


CALIBRATED PICK-UP ADJUSTABLE IN THE FIELD.
TD-3306C
TIME CURRENT CHARACTERISTIC BAND
DUAL MAGNETIC OVERCURRENT TRIP DEVICE (TYPE OD-1)
FOR KA-KB-KC CIRCUIT BREAKERS.
MAXIMUM LONG TIME DELAY BAND.
LOWER BAND LIMIT DENOTES RESETTABLE TIME DELAY.
UPPER BAND LIMIT DENOTES TOTAL BREAKER INTERRUPTING TIME.
AMBIENT TEMPERATURE 25°C (EXTERNAL TO CIRCUIT BREAKER ENCLOSURE.)
TRIP TIME
HOURS
MINUTES
SECONDS
CYCLES
BREAKER RATING TIMES SCALE EQUALS CURRENT IN AMPERES.

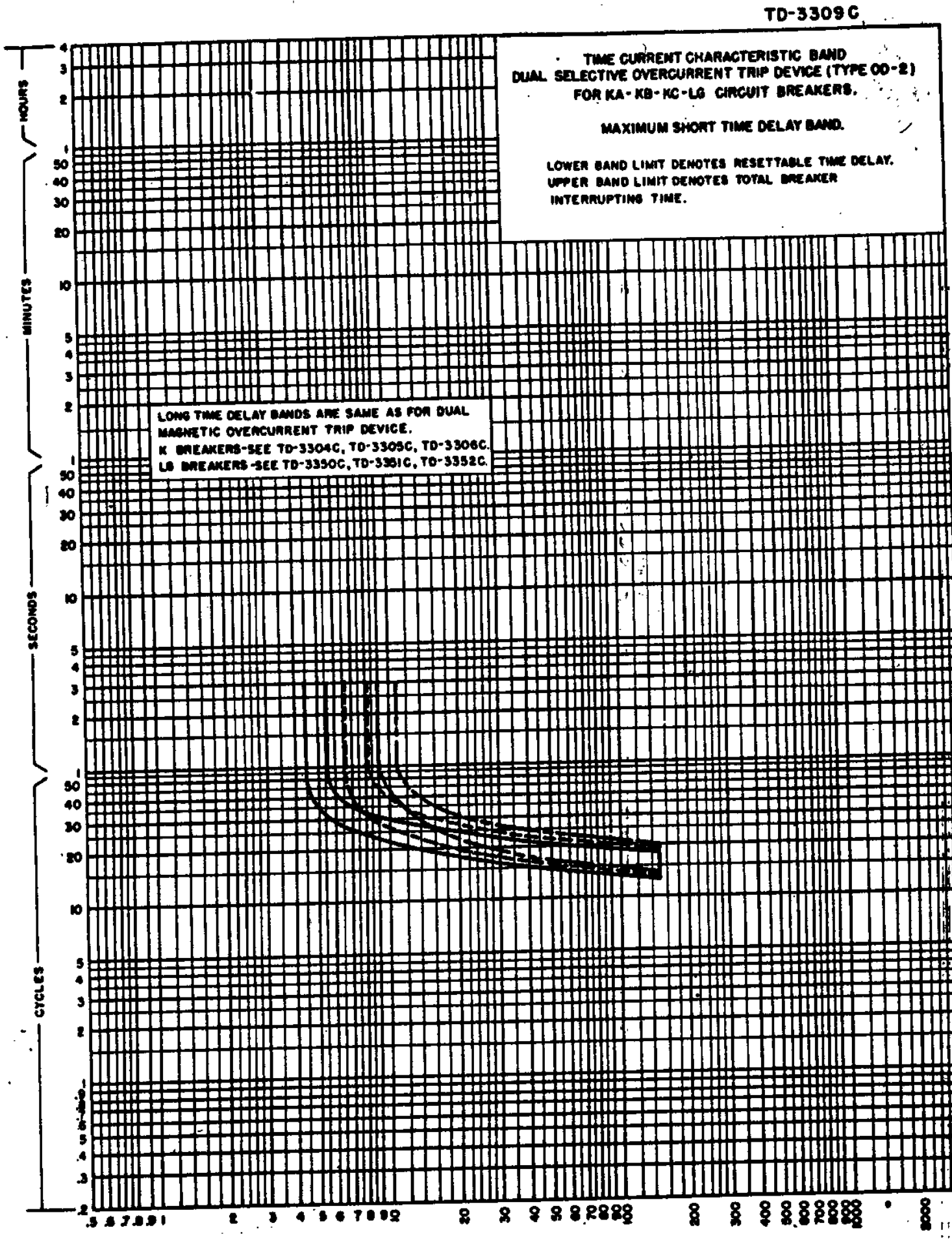
TD-3307C


TIME CURRENT CHARACTERISTIC BAND
DUAL SELECTIVE OVERCURRENT TRIP DEVICE (TYPE OD-2)
FOR KA-KB-KC CIRCUIT BREAKERS
MINIMUM SHORT TIME DELAY BAND
LOWER BAND LIMIT DENOTES RESETTABLE TIME DELAY.
UPPER BAND LIMIT DENOTES TOTAL BREAKER
INTERRUPTING TIME.
LONG TIME DELAY BANDS ARE SAME AS FOR DUAL
MAGNETIC OVERCURRENT TRIP DEVICE.
K BREAKERS - SEE TD-3304C, TD-3305C, TD-3306C
TRIP TIME
HOURS
MINUTES
SECONDS
CYCLES
BREAKER RATING TIMES SCALE EQUALS CURRENT IN AMPERES

TD-3308C


TIME CURRENT CHARACTERISTIC BAND
DUAL SELECTIVE OVERCURRENT TRIP DEVICE (TYPE OD-2)
FOR KA-KB-KC-LG CIRCUIT BREAKERS.
INTERMEDIATE SHORT TIME DELAY BAND
LOWER BAND LIMIT DENOTES RESETTABLE TIME DELAY.
UPPER BAND LIMIT DENOTES TOTAL BREAKER INTERRUPTING TIME.
LONG TIME DELAY BANDS ARE SAME AS FOR DUAL MAGNETIC OVERCURRENT TRIP DEVICE.
K BREAKERS - SEE TD-3304C, TD-3305C, TD-3306C
LG BREAKERS - SEE TD-3350C, TD-3351C, TD-3352C
TRIP TIME
HOURS
MINUTES
SECONDS
CYCLES
BREAKER RATING TIMES SCALE EQUALS CURRENT IN AMPERES

TD-3309C


TIME CURRENT CHARACTERISTIC BAND
DUAL SELECTIVE OVERCURRENT TRIP DEVICE (TYPE CO-2)
FOR KA-KB-KC-LG CIRCUIT BREAKERS.
MAXIMUM SHORT TIME DELAY BAND.
LOWER BAND LIMIT DENOTES RESETTABLE TIME DELAY.
UPPER BAND LIMIT DENOTES TOTAL BREAKER
INTERRUPTING TIME.
LONG TIME DELAY BANDS ARE SAME AS FOR DUAL
MAGNETIC OVERCURRENT TRIP DEVICE.
K BREAKERS-SEE TD-3304C, TD-3305C, TD-3306C.
LG BREAKERS-SEE TD-3350C, TD-3351C, TD-3352C.
TRIP TIME
HOURS
MINUTES
SECONDS
CYCLES
BREAKER RATING TIMES SCALE EQUALS CURRENT IN AMPERES