

TYPE DK-25 AIR CIRCUIT BREAKER  
3 POLE - 600 AMP. - 600 V. AC - 250 V. DC.

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TYPE DK AIR CIRCUIT BREAKER

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ILLUSTRATIONS

3-POLE DK-25 AIR CIRCUIT BREAKER . . . . .	PHOTO 265230
ADJUSTMENTS WITH OIL SUCKER MAGNETIC DUAL OVERLOAD..	DWG. 4-D-2515
ADJUSTMENTS WITH THERMAL-MAGNETIC DUAL OVERLOAD ..	DWG. 4-D-8316
CALIBRATION OF OIL SUCKER-MAGNETIC DUAL OVERLOAD. . .	CURVE 261560
CALIBRATION OF THERMAL-MAGNETIC DUAL OVERLOAD . . .	CURVE 258872
WIRING DIAGRAM. . . . .	DWG. 2-D-9043

TYPE DK AIR CIRCUIT BREAKER

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GENERAL

1. The DK air circuit breaker, complete with all attachments, is a self-contained unit, and has been mounted, adjusted and calibrated on its own permanent panel at the factory. It is designed only to be mounted in a vertical position, and all inspections for proper operation must be made with the breaker main panel held vertically.

UNPACKING

2. Care must be exercised when unpacking to make sure that no parts are broken or damaged, and an inspection should be made immediately to check for any damage in transit. All dust and dirt should be carefully blown out of the complete assembly, especially in the closing toggle linkage, overload attachments and such other attachments as are supplied.

3. It is not advised to lubricate any parts of the breaker. The lubrication supplied during factory assembly, where necessary, is a special form of grease used sparingly, and will be found sufficient for years of service. Additional oil will only promote the accumulation of dust and dirt. In new installations the breaker must be carefully protected from plaster, concrete and other foreign gritty particles that may add friction to the moving parts in the toggle linkage.

INSPECTION

4. Final inspection should preferably be made with the breaker in its permanent mounting, but if this is impossible it can be set up rigidly in a vertical position while the inspection is made.

5. Rotate the manual operating handle slowly in a clockwise direction to move the contacts toward the closed position. Check the movement of each arc tip through the throat of the DEION arc interrupting chamber to make sure that the tips do not rub against



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the ceramic side plates. Continue the closing motion until the moving arc tips just touch the stationary arc tips, and check the main contact separation at approximately  $5/32$  inch, as shown on the two drawings 4-D-2515 and 4-D-8316. The moving arc tips of all poles should touch within  $1/64$  inch of each other. Continue the handle rotation to the fully closed position and watch the main contact overtravel as evidenced by rotary motion away from its stop adjacent to the section where the shunt is attached. In the fully closed position the gap between the main contact stop and the contact arm should be  $3/32$  inch minimum.

6. Return the manually operating handle to the neutral position and rotate counterclockwise to trip the breaker. The toggle linkage should collapse and the moving contact assembly move freely to the full open position, followed immediately by complete resetting of the links in the toggle mechanism. This resetting operation is accomplished entirely by gravity and for this reason the links must always be free to move without friction or binding.

ADJUSTMENT OF CONTACTS

7. The arc tip adjustment should be made as shown on drawings 4-D-2515 and 4-D-8316. There is no adjustment provided for the main contacts and under ordinary circumstances these main contacts will last the life of the breaker without repair other than occasional cleaning. Both main and arcing contacts are a high silver alloy and will neither pit nor weld under any conditions of short circuit.

REPLACEMENT OF CONTACTS

8. The sub-panel, barrier and DEION interrupting assembly may be removed as a unit by taking out two bolts at the outer ends of the sub-panel. This gives access to the contacts for easy inspection or replacement.

9. The moving arc tip can be removed by taking out the wire clip and nut on the threaded rod, removing two small screws that hold the secondary shunt to the main contact, and removing the arc tip pin. The stationary arc tip may be removed by taking out four flat head screws. The new items may be replaced in the reverse

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order, taking care to make proper adjustment as shown on drawings 4-D-2515 and 4-D-8316, setting all poles of the breaker at one time and then securely locking each adjusting nut with a wire clip.

10. The moving main contact may be removed by taking out the bolts at the upper end of the trip unit, removing two bolts from the rear that hold this lower section to the panel, and taking out the pin in the contact arm. The contact and shunt can now be removed intact, and replaced in the reverse order. The stationary main contact can be removed by taking out two bolts from the rear of the panel on the flat stud, or removing the finger cluster, large contact nut and one bolt from the rear of the panel on the drawout type. Replacement is made with a complete new upper stud.

#### ADJUSTMENT OF TOGGLE LINKAGE

11. The toggle linkage in the DK circuit breaker is a series of links so arranged that the closed breaker load is transmitted through successive toggles with a reduction at each step, to the final tripping toggle where a very low but consistent load is maintained with one simple adjustment. This adjusting screw will be found in the front of the main frame behind the molded face plate, as shown on drawings 4-D-2515 and 4-D-8316. This adjustment is set slightly over toggle to produce a tripping load of 2 pounds at the trip rod when the breaker is fully closed. The factory adjustment should not vary in service, but can easily be checked or readjusted by reference to the sketches, using a small spring balance applied to the left pole trip finger on the trip bar at a point in line with the plunger. This 2 pound tripping load must be maintained to insure proper tripping of the breaker by the overload trip units and other calibrated attachments.

#### DUAL OVERLOAD TRIPPING ATTACHMENTS

12. The DK circuit breaker is supplied with either of two distinct types of adjustable inverse time delay trip units; (1) oil sucker-magnetic dual overload, and (2) thermal-magnetic dual overload. Both types are furnished in standard ratings as listed below, and both types are suitable for either AC or DC service. The oil sucker type of time delay is designed for all standard applications where over current tripping is desired with

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time delay that can be adjusted to a minimum, approaching zero time if required. The thermal type of time delay, on the other hand, is for applications requiring unusually long tripping time at relatively large overloads, associated with motor starting conditions and protection. In both cases any current in excess of ten times normal rating produces instantaneous tripping. Standard current ratings are:

600	350	225	100	25
550	325	200	90	20
500	300	175	70	15
450	275	150	50	
400	250	125	35	

CHARACTERISTICS OF OIL SUCKER-MAGNETIC DUAL OVERLOAD

13. Drawing 4-D-2515 shows the arrangement of adjustments on this tripping attachment, and curve 261560 represents the characteristic inverse time delay. The 100% calibration setting by the pointer on the scale plate is the normal rating of the trip unit, and that value of current will just trip the breaker with no oil in the pot. Adjusting the thumb screw toward the 200% calibration setting raises the minimum tripping current in minute steps as desired. Rotating the molded pot properly filled with oil as explained on the drawing, varies the time delay between 0 and 100%. Thus any desired combination of minimum tripping current and time delay can be selected as desired. Drawing 4-D-2515 explains in detail the necessary adjustments for maintaining this overload attachment in service.

CHARACTERISTICS OF THERMAL-MAGNETIC DUAL OVERLOAD

14. The general arrangement of this attachment is shown on Drawing 4-D-8316 with inverse time delay characteristics on curve 258872. The 100% calibration setting of the pointer on the scale plate is the normal rating of the trip unit and that value of current will just trip the breaker in approximately 30 minutes or longer in a normal ambient temperature. Adjusting the thumb screw toward the 150% calibration setting raises the minimum tripping current in minute steps as desired.



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15. Ambient correction is explained on drawing 4-D-8316 as 1% increase in calibration for each 2°C rise in temperature. The attachment is calibrated for 24°C. ambient, but if it is desired to meet the calibration characteristics of Curve 258872 at 40°C., for instance, the calibration adjustment should be set at approximately 108% for minimum tripping at normal current rating.

16. The calibration adjustment can therefore be set as close to the normal running current of the motor as is desired, depending on ambient temperature, frequency of starting, etc., and complete protection is afforded under all conditions of operation.

17. Full details for adjustment and maintenance of the thermal-magnetic trip attachment are explained on drawing 4-D-8316.

#### REPLACEMENT OF OVERLOAD ATTACHMENTS

18. Both types of overload trip units may be easily removed. Take out two screws from the rear that fasten the magnet assembly to the main panel and disconnect the trip unit upper terminal where it is bolted to the main pole unit shunt section. In the case of drawout studs the finger cluster and large nut must also be removed. The trip unit may now be removed. Replacement is simply the reverse of this procedure.

19. After the unit is securely mounted to the panel, only one adjustment is necessary for correct operation with the breaker. This adjustment consists of setting the screw in the outer end of the trip armature lever to properly trip the breaker with a thin spacer between the armature and magnet as explained in both drawings 4-D-2515 and 4-D-8316.

#### ELECTRIC CLOSING MECHANISM

20. Electrically operated DK circuit breakers are equipped with an entirely self-contained motor mechanism mounted on the right side of the breaker frame. Two of the toggle linkage pins serve as dowels to accurately locate the mechanism insulating base. By removing three bolts this complete assembly can be taken off the breaker without disengaging any parts except the wiring.



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21. The closing motor is a single phase commutator type vertical shaft motor with ball bearings sealed with lubricant that will normally last the life of the apparatus. A single reduction of speed between the motor shaft and the mechanism crank is accomplished with a worm mounted on the upper end of the motor shaft engaging a worm gear on the crank shaft. This gear assembly is lubricated on assembly sufficient for several years of normal service. An oil seal on the motor shaft prevents any oil or grease from running down into the motor windings.

22. The motor is designed to develop an exceptionally high torque for its size and therefore is rated for intermittent service. If the breaker is closed more frequently than four times a minute for long periods the motor may overheat. A centrifugal speed limiting device is built into the lower end-bell of the motor to prevent excessive speed at normal and over-voltage, and to prevent coasting of the mechanism after the limit switch has cut off the motor current.

23. The mechanism crank engages a hardened steel cam on the closing lever. The relative motion of the crank roller with respect to this cam surface is to produce the maximum mechanical advantage when the closing load is greatest. A limit switch segment on the mechanism crank shaft positively carries the crank roller past the cam after a closing operation, so that the breaker can be closed either manually or electrically without interference or mechanical disengagement. The only requirement is that the limit switch must be allowed to cut off the motor closing current.

24. One adjustment between the motor mechanism and the breaker closing lever should be checked for proper operation. Close the breaker manually and rotate the motor by hand, by removing the plate at the lower end and rotating the armature in the direction of the arrow, until the crank roller is just passing over the heel of the cam. There should be from  $1/64$  to  $1/32$  inch clearance between the roller surface and the cam surface at this point. If binding occurs, the minimum closing voltage will be unduly high, and if too much clearance is present the mechanism may fail to move the breaker toggle linkage to the completely closed position. This adjustment is maintained by adding or taking out a spacer between the molded tie-bar and the cast closing lever on the right side.

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25. The motor closing current is unusually low for this type of apparatus, and is given in the following table for standard control voltage ratings:

<u>Voltage Rating</u>	<u>Closing Current at Normal Voltage</u>	<u>Locked Rotor Current at Normal Voltage</u>
110 V. AC.	12. Amps.	15. Amps.
220 V. AC.	6 "	8 "
125 V. DC.	6 "	8 "
250 V. DC.	3 "	5 "

#### SHUNT TRIP ATTACHMENT

26. The shunt trip attachment, when supplied, is mounted rigidly to the breaker frame behind the molded face plate. The trip bar bracket is attached to its lower end. When the shunt trip is not supplied, its place is taken by a long trip rod held by a round case identical in outside appearance with the shunt trip case. Both types are interchangeable and can be readily removed and replaced. In replacing the shunt trip assembly, make sure that the moving core and trip rod assembly is free to move without binding against the guide holes or coil.

27. The shunt trip is designed for intermittent duty and the tripping current must always be cut off by an auxiliary switch on the breaker. The normal tripping currents for standard control voltages are:

<u>Voltage Rating</u>	<u>Tripping Current</u>
110 V. AC.	3. Amps.
220 V. AC.	1.5 "
125 V. DC.	1. "
250 V. DC.	0.5 "

#### WIRING DIAGRAM

28. The standard wiring diagram for the motor mechanism and shunt trip attachments are given on Drawing 2-D-9043. The motor control circuit includes a special relay as an integral part of the electrically operated breaker that prevents reclosure until after the external control switch has been opened. This prevents the breaker from pumping, if closed against a high overload or short circuit. A further feature of the control wiring is the prevention of electrically inching the breaker closed after the moving contact assembly has started to close.

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#### UNDERVOLTAGE TRIPPING ATTACHMENT

29. The undervoltage attachment is normally mounted on the main panel to the left of the breaker, and operates to trip the breaker through the trip bar if the control voltage drops to a value of 40% to 60% of rated voltage. To check the adjustment of this attachment, remove the voltage from the holding coils, hold the armature against the magnet by hand and close the breaker. Now slowly allow the armature to move away from the magnet under action of the spring in the flexible link. The breaker should trip by this dead push. Adjustment to provide this operation is made by shortening or lengthening the flexible link detail.

30. When the undervoltage attachment is furnished with a time delay tripping feature, the oil dash pot should be removed by unscrewing the pot when the above adjustment is checked.

#### REVERSE CURRENT ATTACHMENT

31. The reverse current attachment is used to trip the breaker when the direction of current flow in that pole is reversed. The attachment consists of a magnet energized by a voltage coil and an armature energized by a current coil in series with one pole of the breaker. When the series coil current is flowing in the proper direction the armature tends to rotate but is restrained by a stop. When the series current is reversed the armature is rotated in the opposite direction against a spring to trip the breaker. This adjustment is calibrated and marked on the scale plate at 5%, 10%, 15%, 20% and 25% reverse current, based on normal current rating.

32. The reverse current armature is reset after a tripping operation by opening the voltage coil circuit. This can be accomplished by wiring the voltage coil through an auxiliary switch on the breaker.

#### FIELD DISCHARGE SWITCH

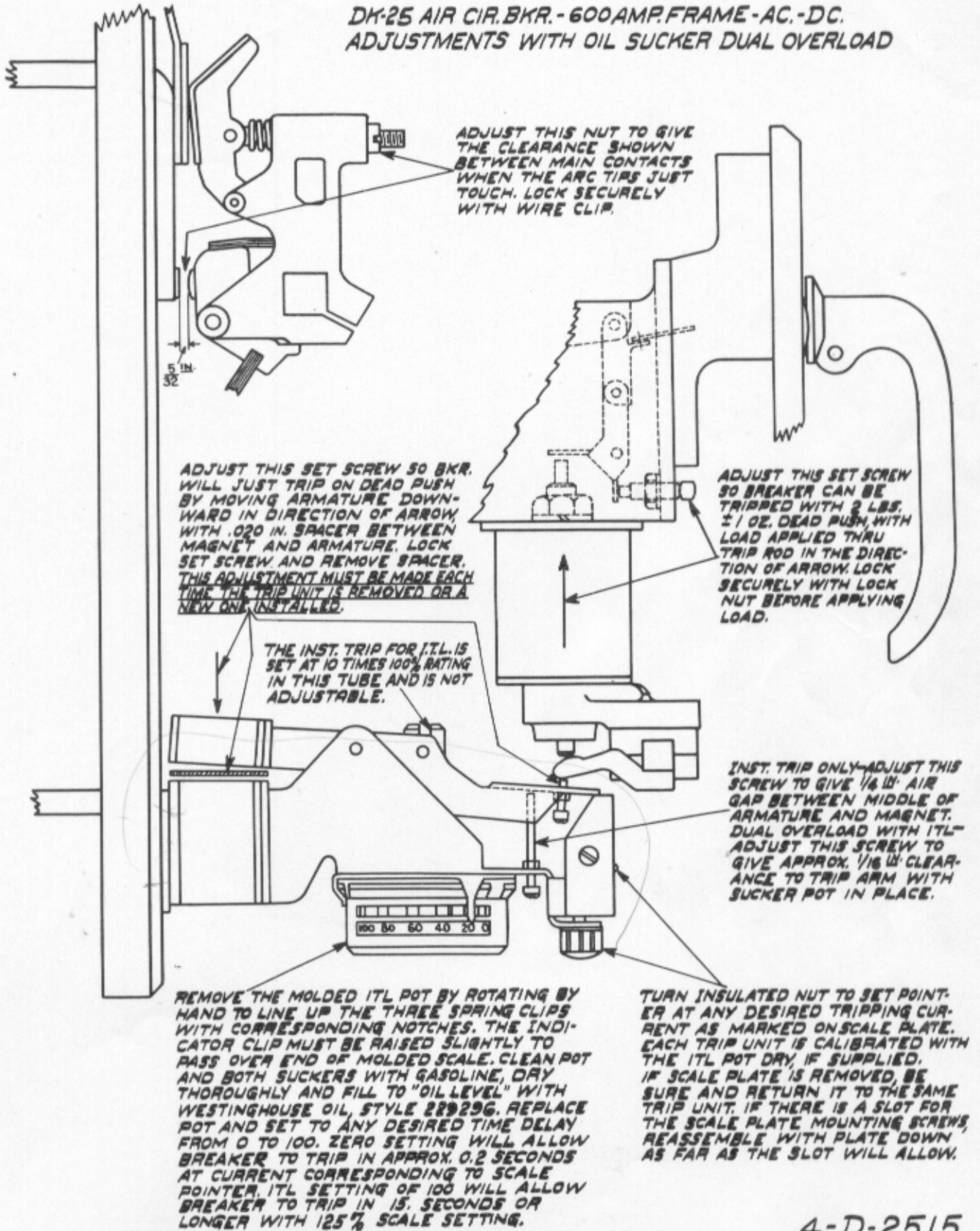
33. The field discharge contact is normally mounted on a two pole breaker in the space left vacant above the breaker toggle linkage. Correct adjustment in one direction is evidenced by opening of the switch contact just prior to the arc tips touching during the breaker closing motion. Similarly, the switch must make contact before the breaker contacts part during the opening motion of the breaker.

4/3/41

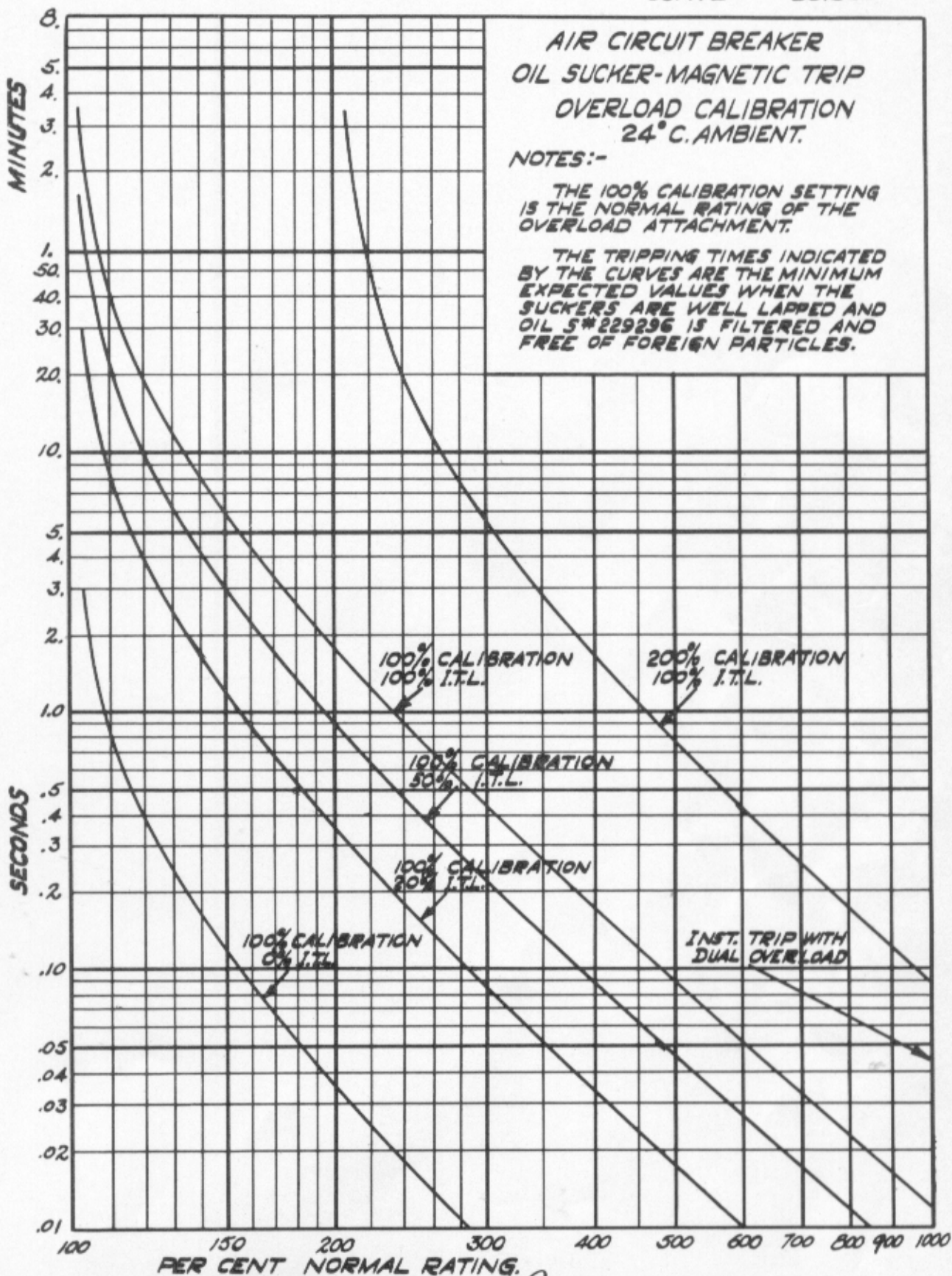
bhh



**DK-25 AIR CIR. BKR. - 600 AMP. FRAME - AC. - DC.  
ADJUSTMENTS WITH OIL SUCKER DUAL OVERLOAD**



4-D-2515



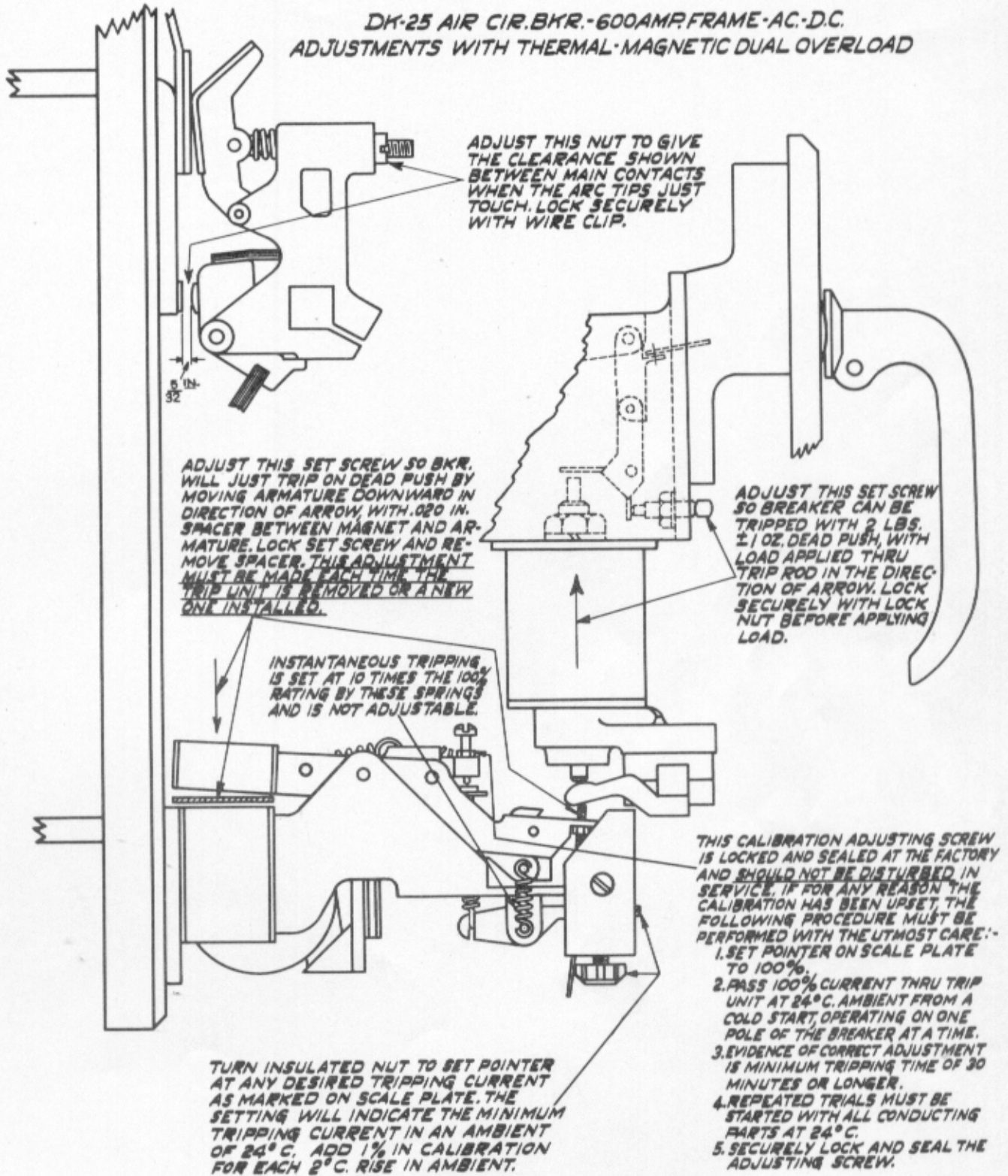
CURVE 261560

SIGNATURE

*J.W. May*

DATE MAR. 27-1941

**DK-25 AIR CIR. BKR. - 600AMP FRAME - AC - D.C.  
ADJUSTMENTS WITH THERMAL - MAGNETIC DUAL OVERLOAD**



ADJUST THIS NUT TO GIVE THE CLEARANCE SHOWN BETWEEN MAIN CONTACTS WHEN THE ARC TIPS JUST TOUCH. LOCK SECURELY WITH WIRE CLIP.

ADJUST THIS SET SCREW SO BKR. WILL JUST TRIP ON DEAD PUSH BY MOVING ARMATURE DOWNWARD IN DIRECTION OF ARROW WITH .020 IN. SPACER BETWEEN MAGNET AND ARMATURE. LOCK SET SCREW AND REMOVE SPACER. THIS ADJUSTMENT MUST BE MADE EACH TIME THE TRIP UNIT IS REMOVED OR A NEW ONE INSTALLED.

INSTANTANEOUS TRIPPING IS SET AT 10 TIMES THE 100% RATING BY THESE SPRINGS AND IS NOT ADJUSTABLE.

ADJUST THIS SET SCREW SO BREAKER CAN BE TRIPPED WITH 2 LBS.  $\pm$  1 OZ. DEAD PUSH, WITH LOAD APPLIED THRU TRIP ROD IN THE DIRECTION OF ARROW. LOCK SECURELY WITH LOCK NUT BEFORE APPLYING LOAD.

THIS CALIBRATION ADJUSTING SCREW IS LOCKED AND SEALED AT THE FACTORY AND SHOULD NOT BE DISTURBED IN SERVICE. IF FOR ANY REASON THE CALIBRATION HAS BEEN UPSET, THE FOLLOWING PROCEDURE MUST BE PERFORMED WITH THE UTMOST CARE:-

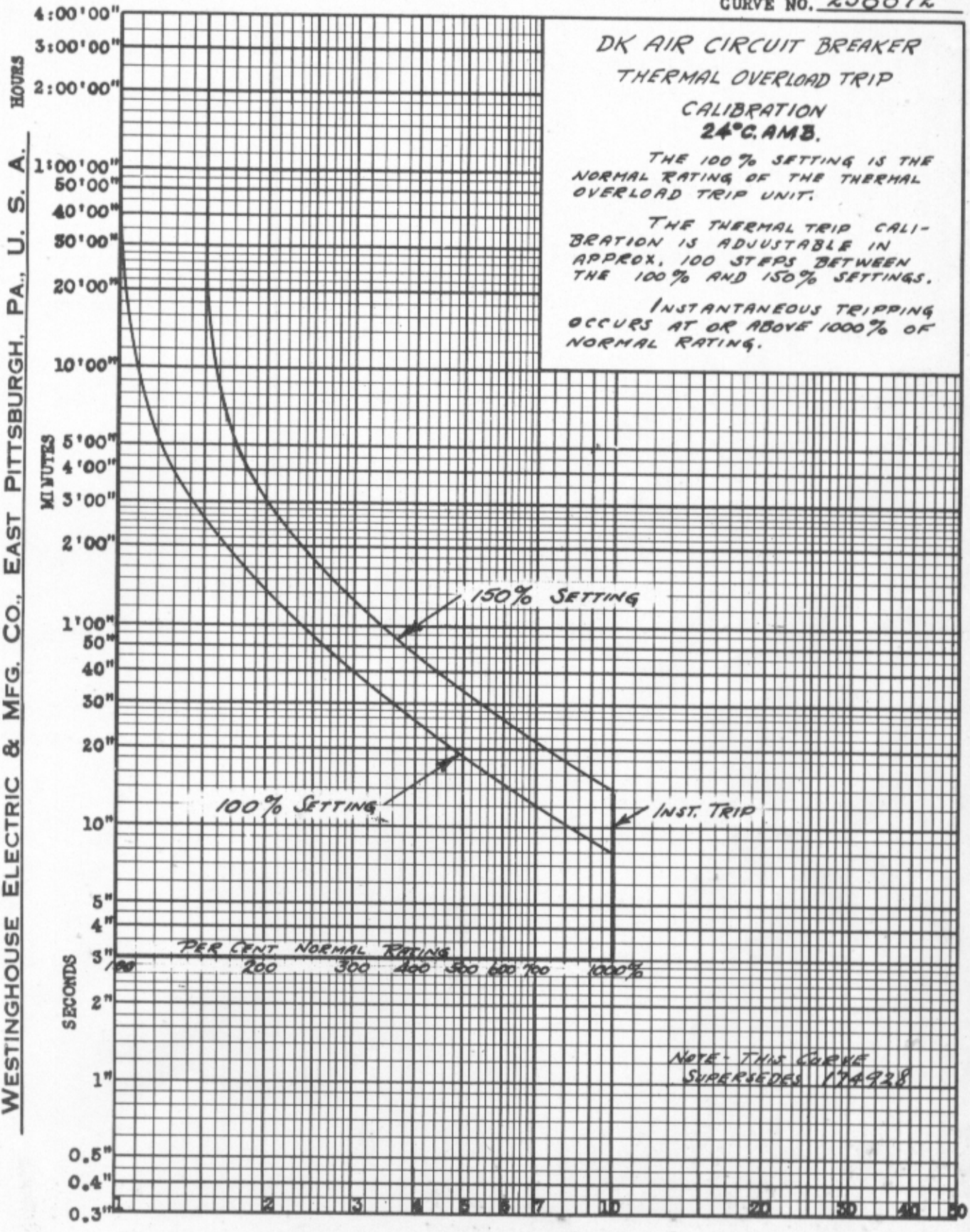
1. SET POINTER ON SCALE PLATE TO 100%.
2. PASS 100% CURRENT THRU TRIP UNIT AT 24°C. AMBIENT FROM A COLD START, OPERATING ON ONE POLE OF THE BREAKER AT A TIME.
3. EVIDENCE OF CORRECT ADJUSTMENT IS MINIMUM TRIPPING TIME OF 30 MINUTES OR LONGER.
4. REPEATED TRIALS MUST BE STARTED WITH ALL CONDUCTING PARTS AT 24°C.
5. SECURELY LOCK AND SEAL THE ADJUSTING SCREW.

TURN INSULATED NUT TO SET POINTER AT ANY DESIRED TRIPPING CURRENT AS MARKED ON SCALE PLATE. THE SETTING WILL INDICATE THE MINIMUM TRIPPING CURRENT IN AN AMBIENT OF 24°C. ADD 1% IN CALIBRATION FOR EACH 2°C. RISE IN AMBIENT.



CURVE NO. 258872

WESTINGHOUSE ELECTRIC & MFG. CO., EAST PITTSBURGH, PA., U. S. A.



NOTE - THIS CURVE SUPERSEDES 174928

CURVE NO. 258872

SIGNATURE *J.W. May*

DATE JAN. 30-1941

