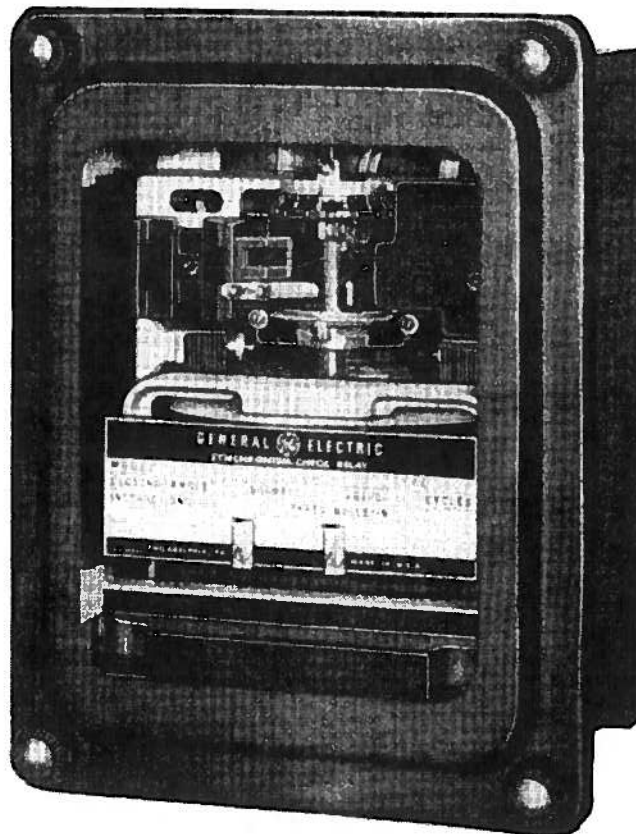




INSTRUCTIONS

SYNCHRONISM CHECK RELAY



TYPE IJ552D

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GEI-90802

CONTENTS

	PAGE
INTRODUCTION	3
APPLICATION.....	3
RATINGS.....	4
CHARACTERISTICS.....	4
Operating Principles	4
BURDENS.....	5
CONSTRUCTION.....	6
RECEIVING, HANDLING AND STORAGE.....	6
ACCEPTANCE TESTS.....	6
Visual Inspection	6
Mechanical Inspection	7
Electrical Tests	7
INSTALLATION PROCEDURE	7
Electrical Tests	8
PERIODIC CHECKS AND ROUTINE MAINTENANCE.....	8
Contact Cleaning	8
Mechanical	9
Electrical	9
SERVICING.....	9
Mechanical Adjustments	9
Electrical Adjustments	9
RENEWAL PARTS.....	10
LIST OF FIGURES	11

Cover Photo (8038824)

SYNCHRONISM-CHECK RELAY

TYPE IJS52D

INTRODUCTION

The Type IJS52D relays are of the induction-disk construction, and are intended for use as synchronism-check relays.

The synchronism-check unit has two shaded-pole U-magnet driving elements acting on opposite sides of a single rotating disk (see Figure 2). One of these, the operating element, drives the disk in the contact-closing direction, and the other, the restraining element, drives the disk in the opposite direction. The disk shaft is restrained by a spiral spring, the purpose being to hold the contacts open when the relay is de-energized. The motion of the disk is retarded by permanent magnets (drag magnets) acting on the disk to give a time delay.

The Type IJS52D relay has two telephone-type undervoltage units. These are designated as "B" and "L" on Figure 7.

The Type IJS52D relay does not have a seal-in unit, since one is not required in its normal application.

APPLICATION

The IJS relay is applicable as a synchronism-check relay to permit closure of a circuit breaker only when the two sources connected to it are correctly synchronized elsewhere. It determines that synchronism is being maintained by other interconnections, and then permits closure of the circuit breaker. See Figure 9 for a typical elementary diagram.

In such an application, the voltages may be slightly out of phase with each other because of different line and load characteristics. This condition may exist, for example, where one line is supplying a lagging load through a transformer bank, and the second is unloaded. The relay, however, can be calibrated to permit closure of the breaker under these conditions if the voltage and the phase-angle differences are not excessive.

However, the IJS relay cannot discriminate between a very low slip frequency between systems, and systems in synchronism. Figures 13 and 14 illustrate that the slip frequency with which the IJS will permit closing increases with increasing closing-angle settings, and decreases with increasing time-dial settings. In general, the closing-angle setting is fixed by the maximum angular separation of the systems for which the IJS must operate, and the slip frequency for which the IJS will operate is reduced to an acceptable maximum by increasing the time-dial setting.

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 General Electric Company.

To the extent required the products described herein meet applicable ANSI, IEEE and NEMA standards; but no such assurance is given with respect to local codes and ordinances because they vary greatly.

On systems where lines may or may not be tied together elsewhere, the IJS relay is used in parallel with the Type GES relay to permit closure of a breaker with zero frequency difference.

Depending on the external connections used (see Figure 9), the telephone relays "B" and "L", mentioned above, serve to reclose the breaker under conditions of (1) dead bus or line, (2) live bus, dead line, (3) dead bus, live line, (4) dead bus, live line, or live bus, dead line (5) dead line, bus live or dead (6) dead bus, line live or dead.

RATINGS

The operating and restraining coils of the synchronism-check unit are continuously rated. The contact of this unit will make and carry momentarily 30 amperes, but it has no interrupting rating.

The telephone-type voltage relay contacts will make and carry 30 amperes momentarily for normal duty, but the circuit must be opened by a breaker auxiliary unit or other suitable means.

The telephone-type relays have operation coils rated at either 67 or 115 volts.

CHARACTERISTICS

OPERATING PRINCIPLES

The operating coils, mounted on the left-hand side, produce a torque tending to close the synchronism-check contact. This torque is proportional to the vector sum of the voltages whose phase positions are being compared. The torque produced by the restraint coils is proportional to the vector difference of the voltages. The operating torque is maximum when they are in phase; the reverse is true of the restraining torque.

The closing angle of the relay is defined as the maximum phase displacement of the two voltages at which the relay will close its synchronism-check contact when the voltages are at rated value. The 20° closing angle is considered standard; however, other settings may be made, as indicated by the voltage-phase angle characteristics shown in Figure 1.

The time-delay characteristics of the Type IJS relay are obtained primarily by the time-dial setting. The time dial controls the distance the contacts must travel before closure, and hence controls the time delay. At No. 10 time-dial setting, the travel is maximum, whereas at No. 0 the contacts are just closed. A certain amount of adjustment may be made by changing the position of the drag magnet on its shelf. Moving it toward the disk shaft decreases the time delay, while moving it away from the disk shaft increases the time delay.

Typical time vs. phase-angle curves are shown in Figures 4 and 5 for 60 cycle relays. The Model 12IJS52D1 relay has a standard closing angle setting of 20°, and has its drag magnet adjusted to provide 20 seconds time delay from the No. 10 time-dial setting for voltages in phase. The closing angle on this relay can be adjusted to angles greater than 20°, but with a corresponding decrease in time delay, as

shown in Figure 4. The approximate reset time with both coils de-energized is about 40 seconds. The approximate reset time with one coil energized at rated voltage varies from 3 seconds on the 20° setting to 6 seconds on the 60° setting with the No. 10 time-dial setting.

The Model 12IJS5203 relay, which is designed for use where a closing angle greater than 20° is required, provides 20 seconds delay at the 40° closing-angle setting, as shown in Figure 5. It may be adjusted to other closing angles between 20° and 60° with corresponding changes in time delay, as shown in Figure 5. The approximate reset time with both coils de-energized is about 130 seconds at the No. 10 time-dial setting. The approximate reset time with one coil energized at rated voltage varies from 13 seconds on the 20° setting to 20 seconds on the 60° setting at the No. 10 time-dial setting.

Figure 6 gives the operating time in seconds for various time-dial settings with zero phase displacement and with rated voltage at 60 cycles on both circuits. Curves for 50 cycles are similar. The telephone-type undervoltage units are calibrated to pick up at 50% or less of rated voltage and to drop out at 15% or more of rated voltage.

BURDENS

The burdens for the synchronism-check unit are given in Table I. The burden varies with the phase displacement of the two voltages, with a minimum at 0° to a maximum at 180°.

TABLE I

Volts	Cycles	Circuit	Phase Difference	Watts	Volt Amps	Power Factor
67*	60	5-6	0°	1.00	3.86	0.258
		5-6	180°	1.25	4.00	0.312
		7-8	0°	1.10	3.63	0.300
		7-8	180°	1.36	3.77	0.360
67*	50	5-6	0°	1.45	4.73	0.306
		5-6	180°	1.75	4.87	0.359
		7-8	0°	1.58	4.45	0.357
		7-8	180°	1.87	4.63	0.403
115	60	5-6	0°	3.00	11.6	0.258
		5-6	180°	3.76	12.0	0.313
		7-8	0°	3.30	10.9	0.300
		7-8	180°	4.07	11.3	0.360
115	50	5-6	0°	4.35	14.2	0.306
		5-6	180°	5.25	14.6	0.359
		7-8	0°	4.75	13.3	0.357
		7-8	180°	5.60	13.9	0.403

* The burden of telephone-relay units is 10 volt-amperes and 6 watts for each unit rated at 67 volts, 60 cycles, and 13 volt-amperes and 8 watts for each unit rated at 115 volts, 60 cycles.

CONSTRUCTION

The relay components are mounted in a cradle assembly that is latched into a drawout case when the relay is in operation, but they can be easily removed when desired. To do this, the relay is first disconnected by removing the connection plug that completes the electrical connections between the case blocks and the cradle block. To test the relay in its case, this connection block can be replaced by a test plug. The cover, which is attached to the front of the relay case, contains an interlock arm that prevents the cover from being replaced until the connection plugs have been inserted.

Every circuit in the drawout case has an auxiliary brush, as shown in Figure 12, to provide adequate overlap when the connecting plug is withdrawn or inserted.

The relay case is suitable for either semi-flush or surface mounting, on all panels up to 2 inches thick, and appropriate hardware is available. However, panel thickness must be indicated on the relay order to insure that proper hardware will be included. For outline and drilling dimensions, see Figure 15.

Internal connections for the IJS52D are shown in Figure 7. Note that the connections to terminal 10 are arranged so that the normally-closed contact of "B" or "L" can be used separately, as shown in the typical external connections in Figure 9.

RECEIVING, HANDLING AND STORAGE

These relays, when not included as part of a control panel, will be shipped in cartons designed to protect them against damage. Immediately upon receipt of a relay, examine it for any damage sustained in transit. If injury or damage resulting from rough handling is evident, file a damage claim at once with the transportation company and promptly notify the nearest General Electric Sales Office.

Reasonable care should be exercised in unpacking the relay in order that none of the parts are injured or the adjustments disturbed.

If the relays are not to be installed immediately, they should be stored in their original cartons in a place that is free from moisture, dust and metallic chips. Foreign matter collected on the outside of the case may find its way inside when the cover is removed, and cause trouble in the operation of the relay.

ACCEPTANCE TESTS

Immediately upon receipt of the relay, an inspection and acceptance test should be made to make sure that no damage has been sustained in shipment and that the relay calibrations have not been disturbed. If the examination or tests indicate that readjustment is necessary, refer to the section on **SERVICING**.

VISUAL INSPECTION

Check the nameplate stamping to make sure that the Model Number and rating of the relay agree with the requisition.

Remove the relay from its case and check that there are no broken or cracked molded parts or other signs of physical damage, and that all screws are tight.

Check that the short fingers are in the correct location, as indicated in Figure 7, and that the auxiliary brushes are properly adjusted (see Figure 12).

MECHANICAL INSPECTION

1. Check that the rotating element moves without noticeable friction.
2. Remove the time-dial locking screws and check that the moving contact just touches the stationary contact when the time dial is set at zero (0). The contact wipe should be approximately 1/32". Put locking screws back in place.
3. Check that the control spring is not deformed and that the spring convolutions at the No. 5 time-dial setting are reasonably concentric.
4. Check that the armatures of the telephone relays move freely. Also, with the telephone relays in the de-energized position, all circuit-closing contacts should have a gap of 0.015" and all circuit-opening contacts should have a wipe of 0.005". Gap may be checked by inserting a feeler gage, and wipe can be checked by observing the amount of deflection on the stationary contact before parting the contacts. The armature should then be operated by hand and the gap and wipe again checked as described above.

ELECTRICAL TESTS

Connect the relay as shown in Figure 10 and check the following:

1. Check that the relay picks up with approximately the time delay shown in Figure 6 when a single-phase source of at least rated voltage is connected to both operating coils.
2. Check that the relay picks up at a 20° closing angle (or other closing angle if used) within ± 30 when connected to a source with rated voltages on both coils. Check zero-displacement pickup, which should agree with the value in Figure 1 within $\pm 10\%$.
3. With both coils connected to a rated voltage source with zero displacement, check that pickup time agrees with the values given in Figures 4 or 5 $\pm 10\%$.
4. With an adjustable 115 volt source of rated frequency, check that the telephone-type units pick up at 50% or less of rated voltage and drop out at 15% or more of rated voltage. To check the "L" relay, connect the voltage source to studs 5 and 6. To check "B" relay, connect voltage to studs 8 and 9.

INSTALLATION PROCEDURE

If, after acceptance tests, the relay is held in storage before shipment to the job site, it is recommended that the visual and manual inspections described in the section on ACCEPTANCE TESTS be repeated before installation.

ELECTRICAL TESTS

Before the following electrical tests are made, the relay should be in its case, preferably mounted in its permanent location.

The relay closing angle should be set as required for its permanent location, which would normally be 20°. Connect the relay as shown in Figure 10, and check that the relay picks up at the proper phase angle $\pm 30^\circ$.

If a phase angle meter or a phase shifter is not available, it is possible to adjust the relay to approximately the closing angle desired by means of the connections and curve shown in Figure 11. In this test, rated voltage is held on one circuit (studs 7-8) and a reduced voltage is applied to the other circuit (studs 5-6). The voltage connected to studs 5-6 is adjusted until the synchronizing-check unit just closes its contact. The difference between the two voltages should agree approximately with the voltage given on the curve shown in Figure 11 for the phase angle used (e.g. 24 volts for 20° closing).

When using the connections shown in either Figure 10 or Figure 11, check the operating time at 0 displacement with rated voltage on each coil, using the time-dial setting of the permanent location. See Figure 6 for nominal time-delay values.

Pickup and dropout of the telephone-type undervoltage relays should be checked as described in the section on **ACCEPTANCE TESTS**.

PERIODIC CHECKS AND ROUTINE MAINTENANCE

In view of the vital role of protective relays in the operation of a power system, it is important that a periodic test program be followed. The interval between periodic checks will vary depending upon environment, type of relay and the user's experience with periodic testing. Until the user has accumulated enough experience to select the test interval best suited to his individual requirements, it is suggested that the following points be checked once a year.

CONTACT CLEANING

A flexible burnishing tool should be used for cleaning relay contacts. This is a flexible strip of metal with an etched-roughened surface, which in effect resembles a superfine file. The polishing action of this file is so delicate that no scratches are left on the contacts, yet it cleans off any corrosion thoroughly and rapidly. The flexibility of the tool insures the cleaning of the actual points of contact.

Relay contacts should not be cleaned with knives, files, or abrasive paper or cloth. Knives or files may leave scratches, which increase arcing and deterioration of the contacts. Abrasive paper or cloth may leave minute particles of insulating abrasive material in the contacts, and thus prevent closing.

The burnishing tool described above can be obtained from the factory.

MECHANICAL

The mechanical checks described in the section on **ACCEPTANCE TESTS** should be repeated.

ELECTRICAL

Using the connections in Figure 8:

1. Check that the maximum closing angle for pickup of the synchronizing-check unit agrees approximately with the value shown on the curve in Figure 11.
2. Check the closing time with the potentiometer set to provide rated voltage on both circuits. The time should agree with the values given in Figure 6, $\pm 10\%$.

Check the pickup and dropout of the telephone-type undervoltage units (27B and 27L).

SERVICING

If recalibration of the relay is necessary, the following should be considered when making adjustments.

MECHANICAL ADJUSTMENTS

1. The moving contact should just touch the secondary contact when the time dial is set at the zero (0) position. If readjustment is necessary, loosen the two clamping screws which fasten the stop arm to the shaft and change the position of the stop arm relative to the moving contact until the contacts just touch with the time dial set at 0. A fine adjustment can be obtained by moving the stationary contact brush in or out by means of its adjusting screw. However, in the final adjustment, the contact brush must be positioned so that there is 1/64" to 1/32" wipe with the contact fully closed. Be sure that the screws are securely tightened after the adjustment is made.
2. The stop-arm leaf spring should deflect at least 1/64" when the synchronism-check unit is de-energized.
3. The disk and shaft assembly should have a vertical end play of 1/16" to 1/32" and both bearing screws should be tight. The disk should be approximately centered between the poles of the U-magnet and drag magnet.
4. Telephone-type relay contact gaps may be adjusted by bending the stationary contact brush to obtain 0.015 inch gap. When the adjustment is made, the wipe must be rechecked to make sure there is a minimum of 0.005" wipe.

ELECTRICAL ADJUSTMENTS

Closing Angle Adjustment

Connect the relay as shown in Figure 10. To make an accurate adjustment of the closing angle, a phase shifter and phase angle meter are required, along with a means for voltage control.

Two adjustments are necessary for obtaining a desired closing angle. The right-hand adjustable resistor at the top of the frame permits equalizing the closing angle. That is, the closing angle will be the same, whether one voltage is leading or lagging the other voltage.

The left-hand adjusting resistor is for obtaining the correct closing-angle setting. Simultaneous adjustments of the two resistors are necessary.

Using the connections shown in Figure 10, set V_1 at rated voltage. If a 20° closing angle is desired, set V_2 at rated voltage, leading V_1 by 20° . Adjust the left-hand resistor until the contacts just close. Now, with rated voltage on both circuits, determine the angle at which the contact closes with V_2 lagging V_1 . If the two angles are unequal, equalize them at 20° by adjusting the right-hand resistor. Then check the closing angle with V_2 leading V_1 , and readjust if necessary. Continue this procedure until the relay contacts just close for V_1 leading or lagging V_2 by 20° . Use the same procedure for other closing-angle settings.

Pickup and Dropout

The pickup and dropout of the telephone-type relay may be changed by adjusting the gap between the armature and the pole face by bending the contact operating arm stop. After this adjustment is made, the contact wipe and gap must be rechecked.

Operating Time

If it is necessary to adjust the time characteristics, impose the chosen conditions on the relay, using connections shown in Figure 10, and adjust the time dial and, if necessary, the drag magnet until the correct operating time is obtained.

RENEWAL PARTS

Sufficient quantities of renewal parts should be kept in stock for the prompt replacement of any that are worn, broken or damaged.

When ordering renewal parts, address the nearest Sales Office of the General Electric Company. Specify the name of the part wanted, quantity required, and complete nameplate data, including the serial number, of the relay. If possible, give the General Electric requisition number on which the relay was furnished.

Since the last edition, changes have been made in the final step of ELECTRICAL TESTS, ON PAGE 7.

			<u>Page</u>
			<u>Cover</u>
Figure 1	(8038824) (0165A7535-0)	IJS Relay in its Case, Front View Typical Voltage/Phase-Angle Characteristic of 50/60 Cycle Relay for Various Closing-Angle Adjust- ments with Rated Voltage Maintained on One Circuit.	12
Figure 2	(8038825)	Type IJS52D Relay Unit in Cradle (Front View)	12
Figure 3	(8038823)	Type IJS52D Relay Unit in Cradle (Rear View)	12
Figure 4	(K-6400151-3)	Typical Time/Phase-Angle Curve of Relay Type IJS52D1 with Rated Voltage	13
Figure 5	(0376A0964-1)	Typical Time/Phase-Angle Characteristic of 50/60 Cycle Relay IJS52D3 with Rated Voltage on Both Circuits	13
Figure 6	(K-6400150-2)	Operating Time of Type IJS Relay with 200° Closing Angle at 0° Phase Displacement, Rated Voltage, 50/60 Cycles on Both Circuits	13
Figure 7	(0165A6040-4)	Internal Connection Diagram for IJS52D Relay	13
Figure 8	(0165A7532-1)	Pickup Test Connections (Front View) for IJS52D Relay	14
Figure 9	(0264B0496-1)	Elementary Diagram of External Connections of Type IJS Relays	14
Figure 10	(0165A7533-0)	Time Test Connections for Relay Type IJS52D	14
Figure 11	(0165A7534-0)	Connections and Curve to Make Approximate Closing-Angle Adjustment without Phase Shifter on 50/60 Cycle Type IJS52D Relay at Rated Voltage	15
Figure 12	(8025039)	Cross Section of Drawout Case Showing Position of Auxiliary Brush	15
Figure 13	(0208A2314-0)	IJS52D3A Cutoff Slip vs. Time-Dial Settings for Closing-Angle Settings of 200°, 400° and 600°	16
Figure 14	(0208A2315-0)	IJS52D1A Cutoff Slip vs. Time-Dial Settings for Closing-Angle Settings of 200°, 400° and 600°	17
Figure 15	(K-6209271-5)	Outline and Panel Drilling Dimensions for Type IJS Relay	18

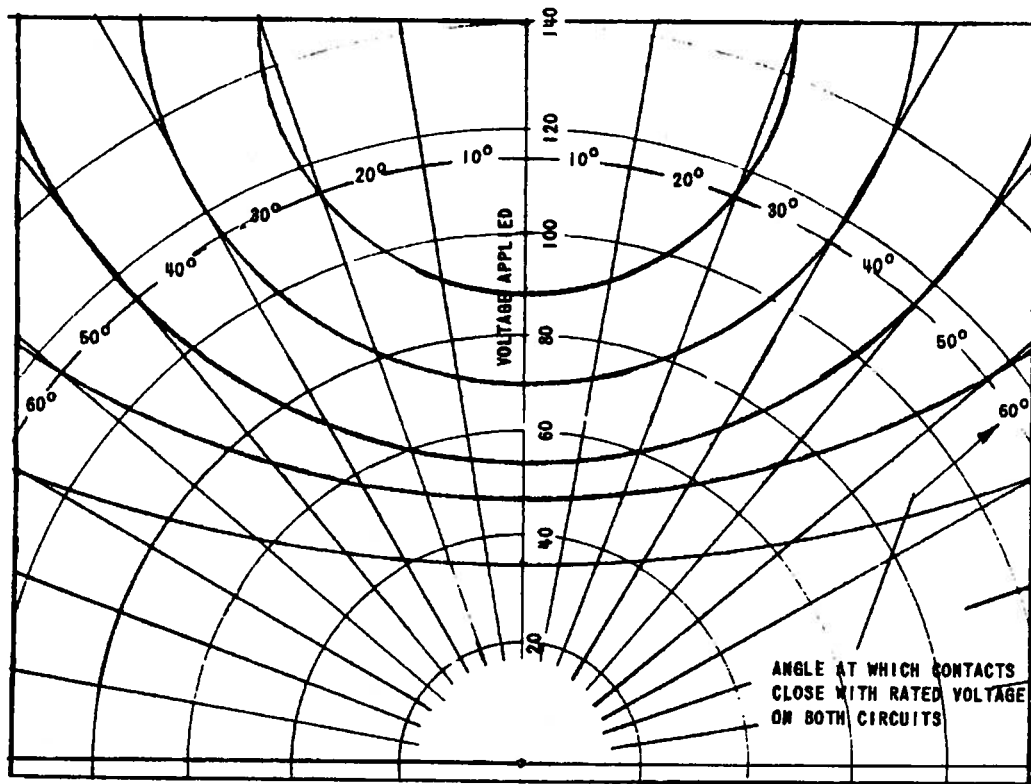


Figure 1 (0165A7535-0) Typical Voltage/Phase-Angle Characteristic of 50/60 Cycle Relay for Various Closing-Angle Adjustments with Rated Voltage Maintained on One Circuit

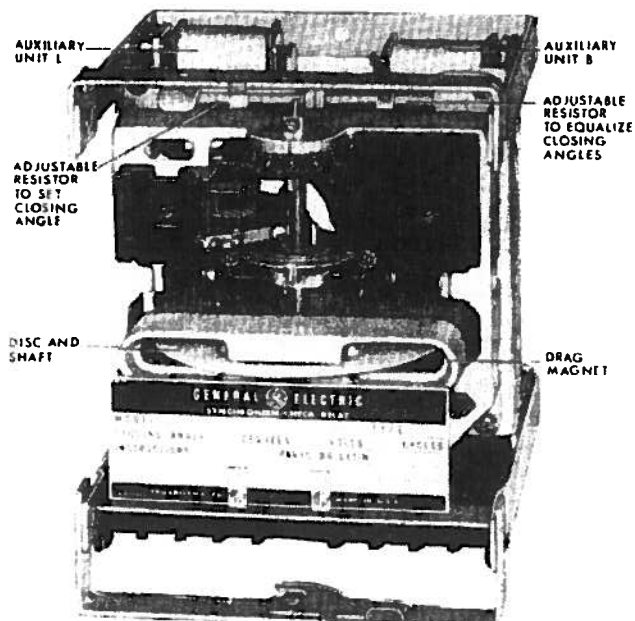


Figure 2 (8038825) Type IJS52D Relay Unit in Cradle (Front View)

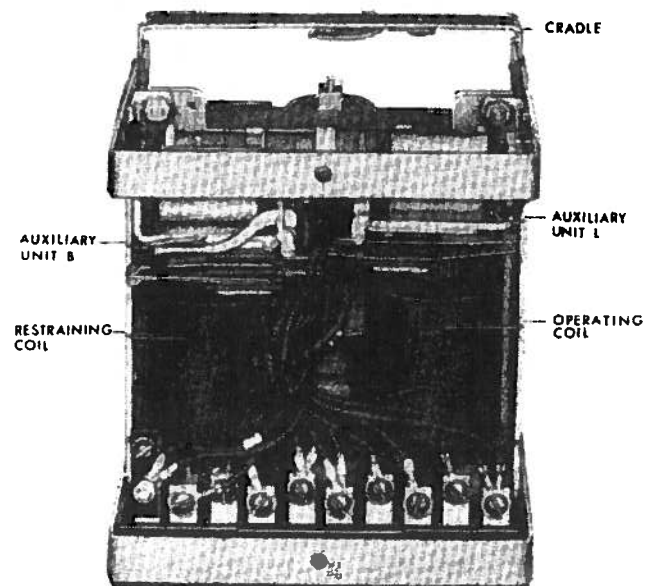


Figure 3 (8038823) Type IJS52D Relay Unit in Cradle (Rear View)

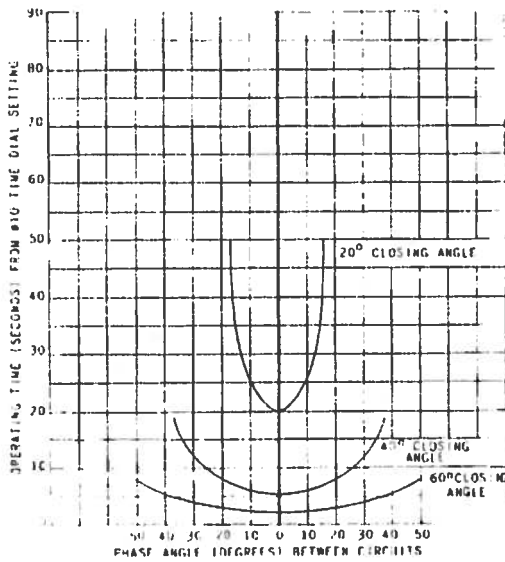


Figure 4 (K-6400151-3) Typical Time/Phase Angle Curve of Relay Type IJS52D1 with Rated Voltage

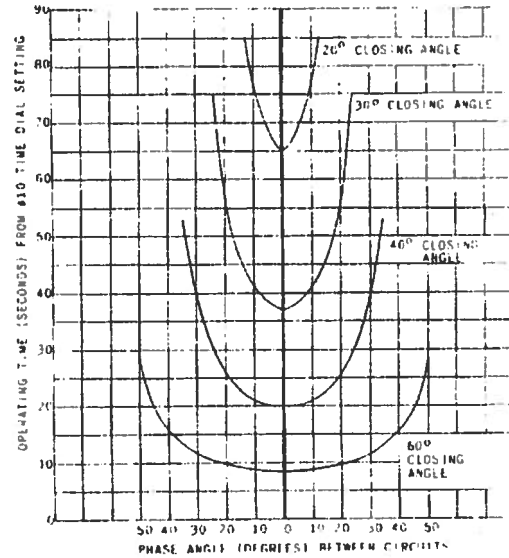


Figure 5 (0376A0964-1) Typical Time/Phase Angle Characteristic of 50/60 Cycle Relay IJS52D3 with Rated Voltage on Both Circuits

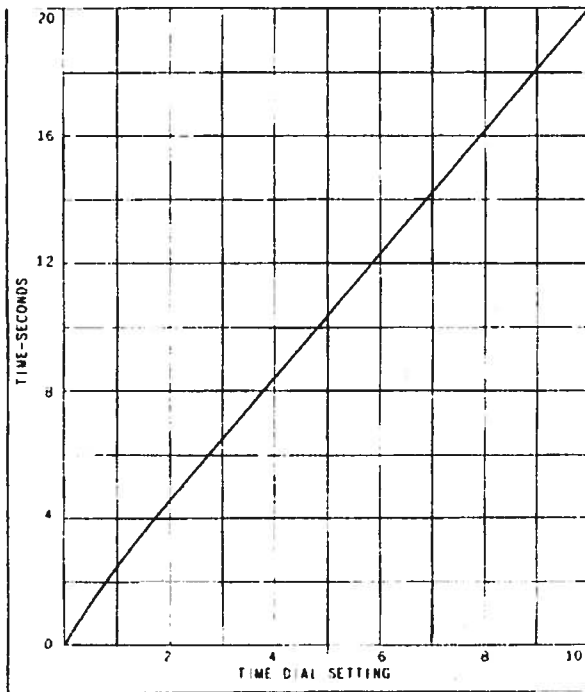


Figure 6 (K-6400150-2) Operating Time of Type IJS Relay with 20° Closing Angle at 0° Phase Displacement, Rated Voltage, 50/60 Cycles on Both Circuits

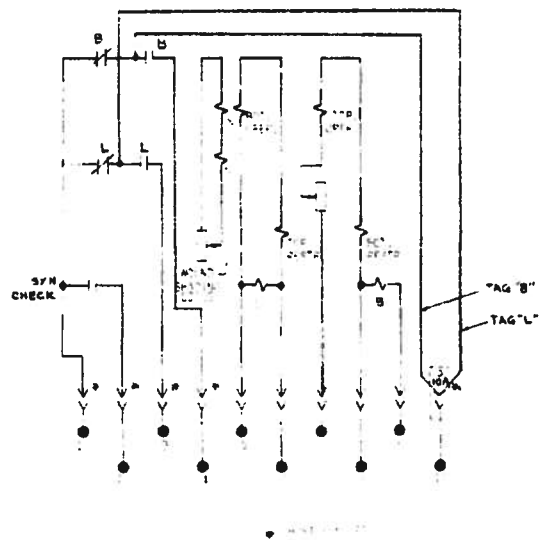


Figure 7 (0165A6040-4) Internal Connection Diagram for IJS52D Relay

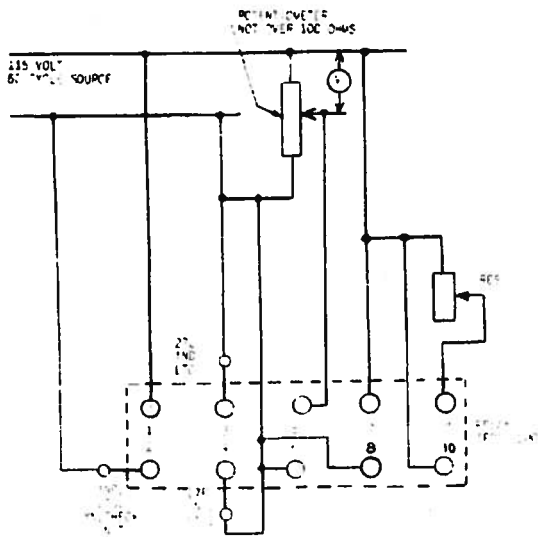


Figure 8 (0165A7532-1) Pickup Test Connections (Front View) for IJS52D Relay

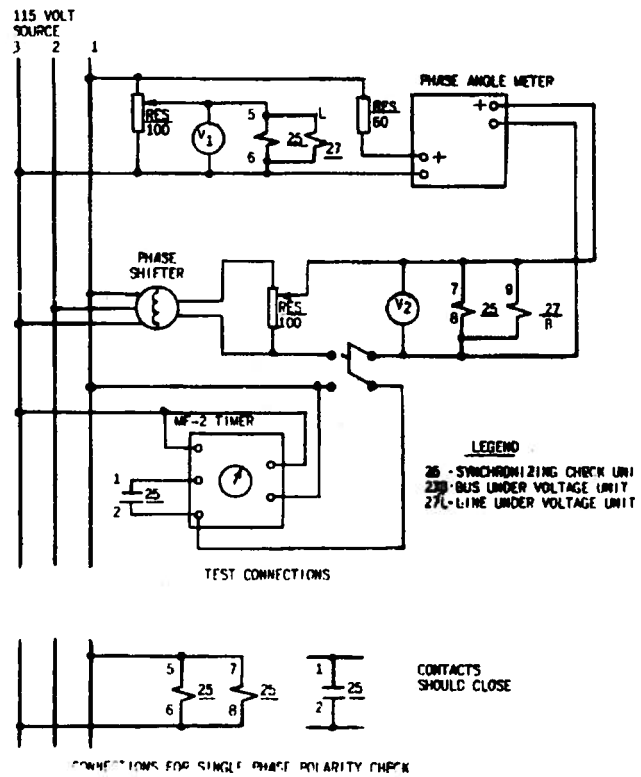


Figure 10 (0165A7533-0) Time Test Connections for Relay Type IJS52D

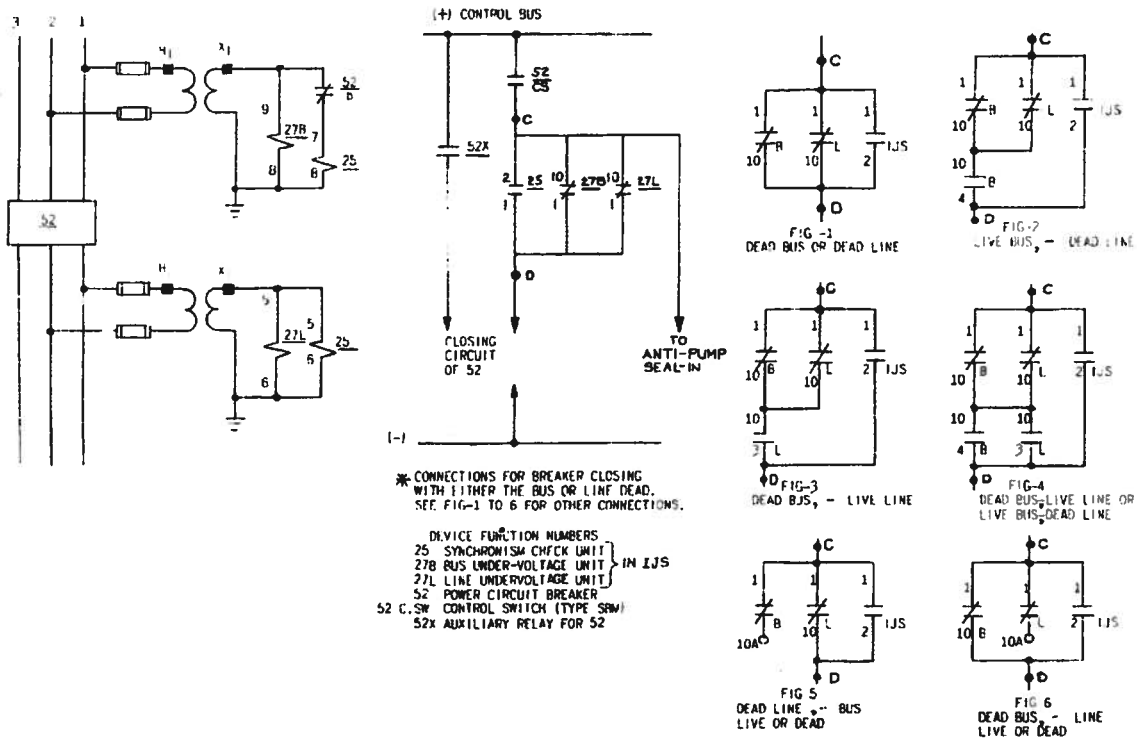


Figure 9 (0264B0496-1) Elementary Diagram of External Connections of Type IJS Relays

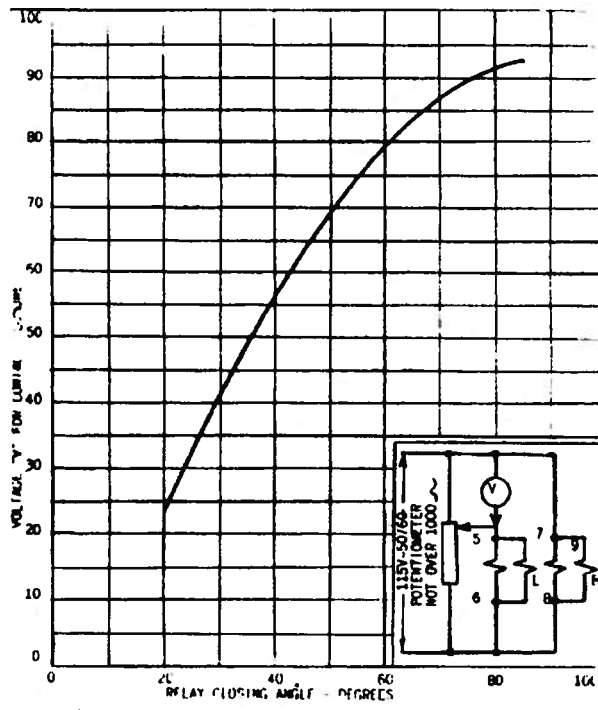
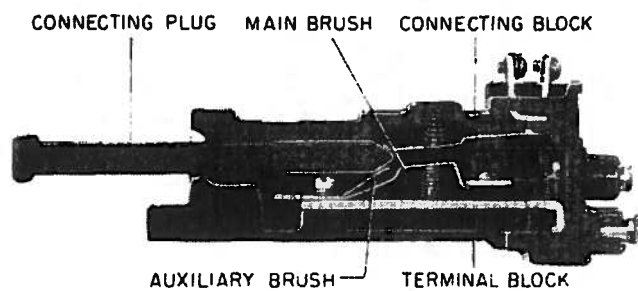


Figure 11 (0165A7534-0) Connections and Curve to Make Approximate Closing-Angle Adjustment without Phase Shifter on 50/60 Cycle Type IJS52D Relay at Rated Voltage



NOTE AFTER ENGAGING AUXILIARY BRUSH, CONNECTING PLUG TRAVELS 1/4 INCH BEFORE ENGAGING THE MAIN BRUSH ON THE TERMINAL BLOCK.

Figure 12 (8025039) Cross Section of Drawout Case Showing Position of Auxiliary Brush

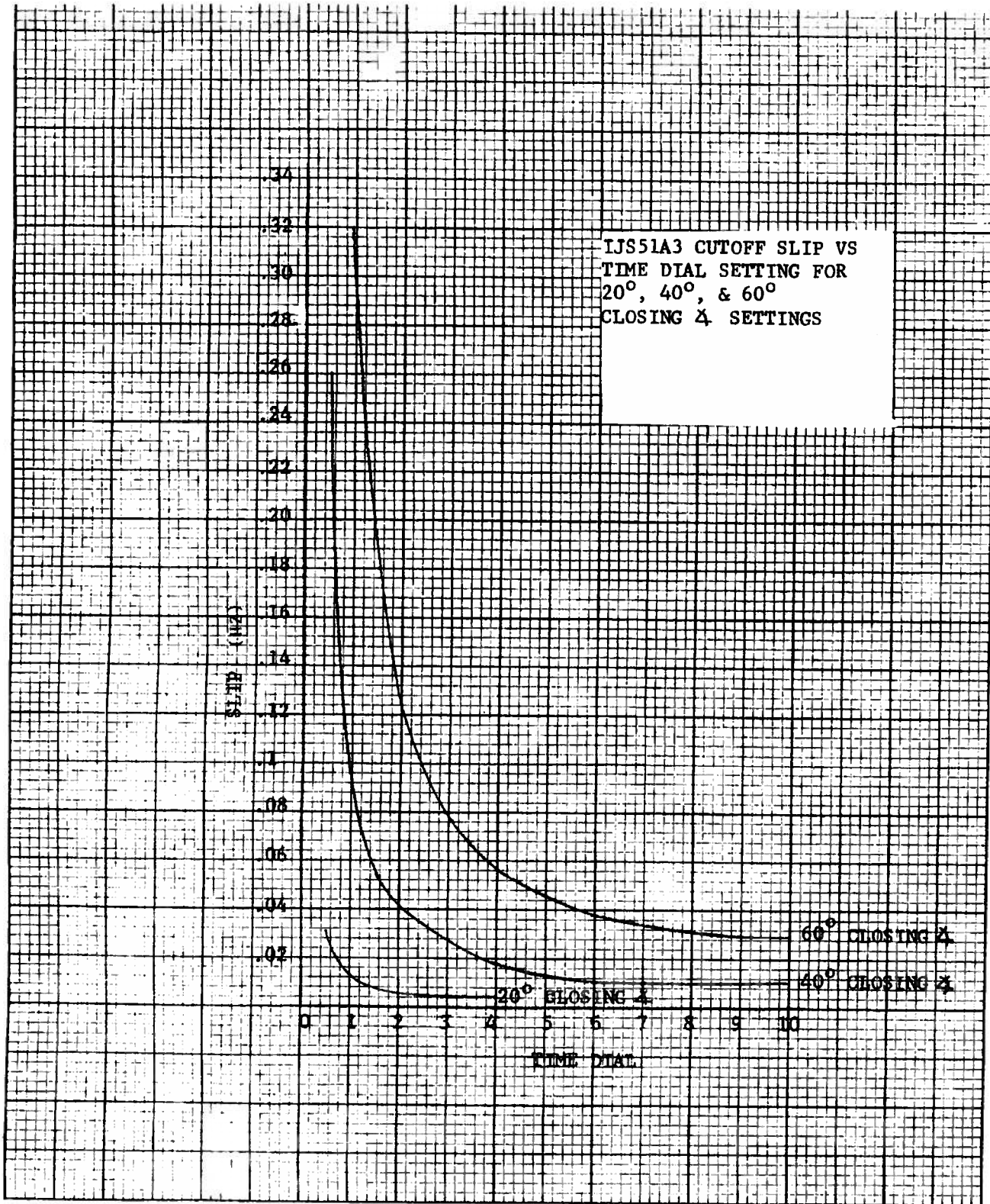


Figure 13 (0208A2314-0) IJS52D3A Cutoff Slip vs. Time-Dial Settings for Closing-Angle Settings of 20°, 40° and 60°

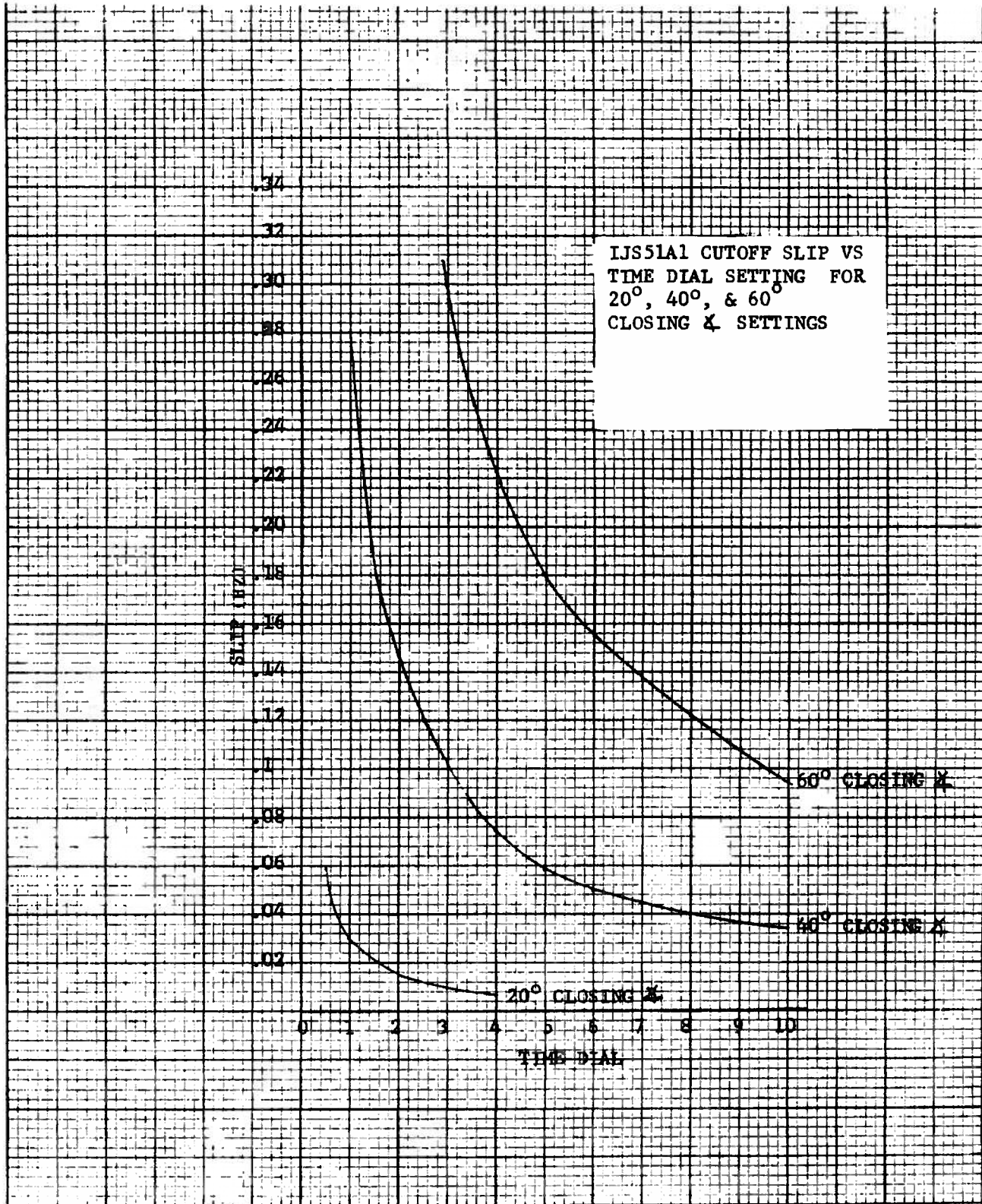


Figure 14 (0208A2315-0) IJS52D1A Cutoff Slip vs. Time-Dial Settings
for Closing-Angle Settings of 20°, 40° and 60°

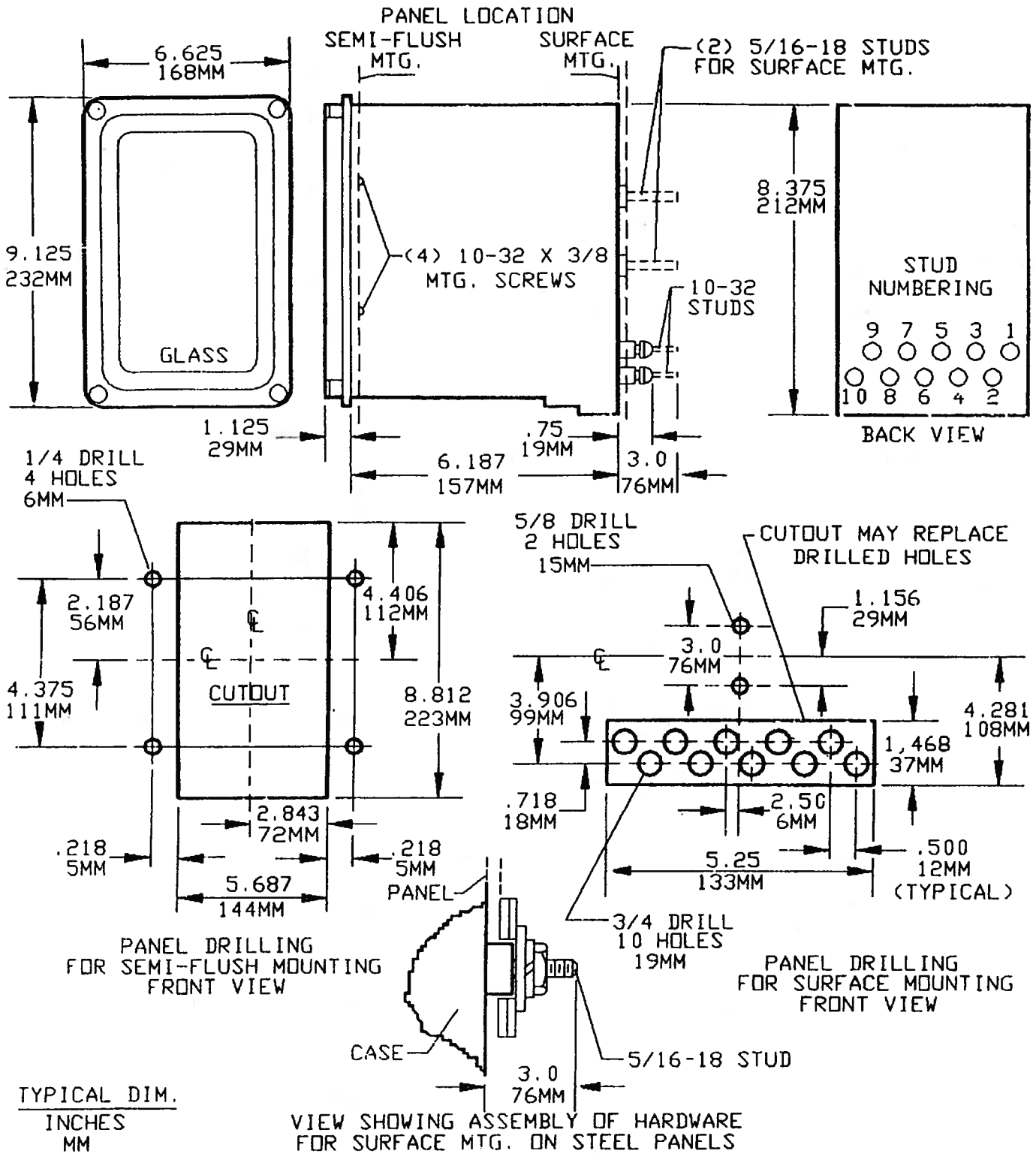


Figure 15 (K-6209271 [8]) Outline and Panel Drilling Dimensions for Type IJS Relay



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