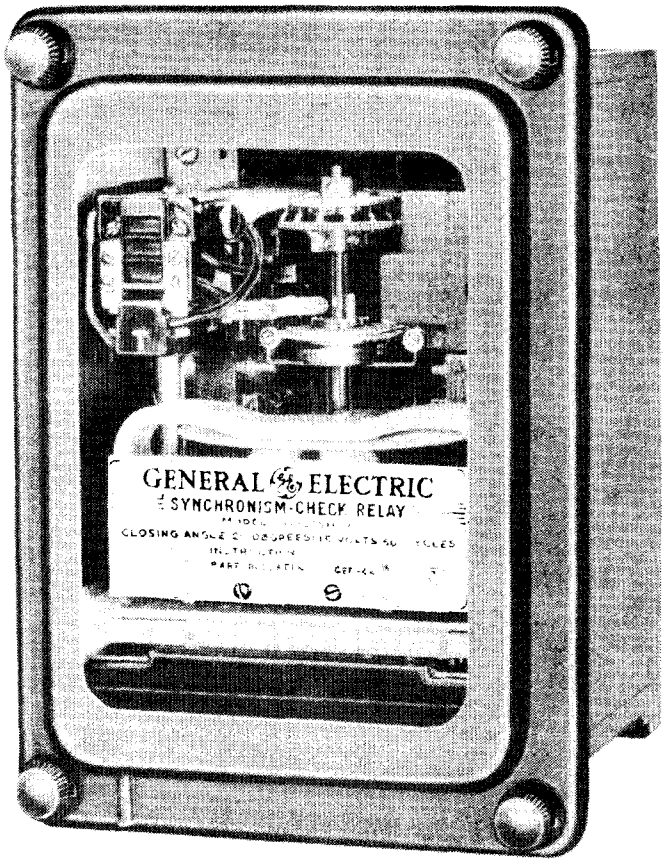
INSTRUCTIONS

SYNCHRONISM-CHECK RELAYS



Types IJS51A
and IJS52A

GE Meter and Control
205 Great Valley Parkway
Malvern, PA 19355-0715

CONTENTS

Cover Photo 8007016

SYNCHRONISM-CHECK RELAYS

TYPE IJS

INTRODUCTION

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

These relays have two shaded-pole U-magnet driving elements acting on opposite sides of a single rotating disk. (See Figure 3.) 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 IJS51A relay has a seal-in unit mounted to the left of the disk shaft, which operates when the main contacts close.

The Type IJS52A relay does not have a seal-in unit, and is used primarily as an auxiliary to the Type GES Synchronizing relay as described below.

APPLICATION

The Type IJS relay is applicable as a synchronism-check relay to permit closure of a circuit breaker only when the frequency difference is negligible or is 0 due to the two sources which energize it being interconnected elsewhere.

The IJS51A should be used where a target-seal-in unit is required; otherwise use the IJS52A.

In such an application, the voltages may be considerably out of phase due to load transfer around the loop that is open at the breaker controlled by the relay. Forms of the relay are available with a rated calibration range up to 60°; but for settings over 20° consideration should be given to the resulting generator stresses at the instant of closure through existing system impedances, as in any other situation involving out-of-phase closure.

On systems where the two sides of a given breaker may or may not be interconnected elsewhere at any given moment when paralleling is desired, the GES or GXS is used for synchronising when a finite frequency difference exists; and the IJS is used at the same location for synchronism check when the frequency difference is negligible or 0 due to the existence of an interconnection elsewhere. In this application, the IJS contacts are connected in parallel with those of the GES or GXS.

The IJS is not adaptable to applications involving continuous loading of the contact circuit, since contact welding may result even with contact loadings that are low in relation to the interrupting capacity of the contacts. The control should be designed to energize the IJS coils when synchronism is to be checked, and to permit the IJS contacts to be the last to complete a closing circuit that is promptly bypassed or interrupted.

Cross feed from the energized side to the de-energized side is very low, because the operating principle of the relay requires the two windings on the operating magnet to be additive while those on the restraining magnet are subtractive, and, therefore, the coupling from the bus side to the line side coil on the operating magnet is practically cancelled by the reverse polarity of the corresponding coupling between the coils on the restraining magnet.

OPERATING CHARACTERISTICS

The operating coils, mounted on the left-hand side, produce a torque tending to close the relay contacts. This torque is proportional to the vector sum of the voltages whose phase positions are being compared. The torque produced the restraint coils is proportional to the vector difference of the voltages. The operating torque is maximum when the systems are in synchronism and is 0 when they are in phase opposition; 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 contacts 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 primariy 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 5 and 6 for 60-cycle relays and in Figure 7 for 25-cycle relays. The model 12IJS51A1 relay has the standard closing angle setting of 20° and has its drag magnet adjusted to provide 20 seconds time delay from 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 the time delay, as shown in Figure 5.

The approximate reset time of the 12IJS51A1A relay with both coils de-energized is 100 seconds at the #10 TDS. The approximate reset time with one coil circuit energized varies from 3 seconds on the 10° setting to 6 seconds on the 60° setting at the No. 10 time-dial setting.

The Model 12IJS51A3 and 12IJS52A7A relays, which are designed for use where the closing angle greater than 20° is required, provides 20 seconds delay at the 40° closing-angle setting, as shown in Figure 6. It may be adjusted to other closing angles between 20° and 60° with corresponding changes in time delay, as shown in Figure 6.

The approximate reset time of the 12IJS51A3A and 12IJS52A7A is 130 seconds at the No. 10 time-dial setting. The approximate reset time with one coil energized varies from 13 seconds on the 20° setting to 20 seconds on the 60° setting at the No 10 time-dial setting.

The 25-cycle Type IJS relay has operating characteristics as shown in Figure 7.

Figure 8 gives the operating time in seconds for various time-dial settings, with 0 phase displacement and with rated voltage at 60 cycles on both circuits. Curves for 25 cycles are similar, except that the operating time from the No. 10 time-dial setting is 32 seconds instead of 20 seconds.

RATINGS

The operating and restraining coils are continuous rated. The tap setting used on the seal-in unit is determined by the current drawn by the contact circuit.

The 0.2-ampere tap is for use with circuits that operate on currents ranging from 0.2 up to 2.0 amperes at the minimum control voltage. If this tap is used with circuits requiring more than 2 amperes, there is a possibility that the 7-ohm resistance will reduce the current to so low a value that the proper current may not be obtained.

The 2.0-ampere tap should be used with circuits that take 2.0 amperes or more at minimum control voltage, provided the current does not exceed 30 amperes at the maximum control voltage. If the current exceeds 30 amperes, an auxiliary relay should be used, the connections being such that the current does not pass through the contacts or the target and seal-in coil of the protective relay.

The current-closing rating of the contacts is 30 amperes for voltages not exceeding 250 volts. The current carrying ratings are affected by the selection of the tap on the seal-in coil, as indicated in the following table:

		Target and Seal-in Coil Amperes, AC or DC	
	Function	2-Amp Tap (0.13 ohm)	0.2-Amp Tap (7 ohms)
	Momentary Duty	30	5
*	Carry Continuously	2.3	0.37

* Revised since last issue

BURDENS

Burdens for the Type IJS relays are listed below. The burden for each circuit varies, depending upon the phase displacement of the two voltages, from a minimum at 0° displacement to a maximum near 180° displacement.

VOLTS	CYCLES	CIRCUIT	PHASE DIFF.	WATTS	VOLTS AMPS	POWER FACTOR
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

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.

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 ensure that proper hardware will be included. For outline and drilling dimensions, see Figure 15.

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 9 and Figure 10, and that the auxiliary brushes are properly adjusted (see Figure 13).

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 0. The contact wipe should be approximately 1/32".

3. Check that the control spring is not deformed, and that the spring convolutions at No. 5 time-dial setting are reasonably concentric.

ELECTRICAL TESTS

Connect the relay as shown in Figure 11 and check the following:

1. Check that with at least 115 volts, 60 cycle single-phase source connected to both operating coils the relay picks up with approximately the time delay shown in Figure 8.

2. Check that the relay picks up at a 20^{o} closing angle (or other closing angle that is used) within $\pm$ 3^{o} when connected to a 115 volt, 60 cycle source with rated voltage in both coils. Check 0 displacement pickup, which should agree with the value in Figure 1 within $\pm$ 10 %.

3. With both coils connected to a 115 volt source with 0 displacement, check that pickup time agrees with values given in Figures 5 or 6 $\pm$ 10%.

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 mechanical inspection described under 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.

A typical elementary diagram of external connections is shown in Figure 12. The "b" contact of 52 in series with only one coil circuit serves to reset the disk and contacts promptly after the circuit breaker closes, so that the normal delay is available as soon as possible in case the breaker trips again. Additional relays (undervoltage or reclosing) may be considered desirable for prevention of unlimited reclosures in case of one wire broken and grounded or crossed with another phase.

The relay closing angle should be set as required for its permanent location, which would normally be 20^{o}. Connect the relay as shown in Figure 11 and check that the relay picks up at the proper phase angle $\pm$ 3^{o}.

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 14. 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 14 for the phase angle used (i.e. 24 volts for 20^{o} closing).

When using connections shown in either Figure 11 or Figure 13, check the operating time at 0 displacement with 115 volts on each coil, using the time dial setting of the permanent location. (See Figure 8 for nominal time delay values.)

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. It is recognized that 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 points listed below be checked at an interval of from one to two years.

MECHANICAL

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

ELECTRICAL

Using connections in Figure 11,

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 7.

2. Check the closing time with the potentiometer set to provide 115 volts on both circuits. The time should agree with values given in Figure 8 $\pm$ 10%.

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 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 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 disc 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.

ELECTRICAL ADJUSTMENTS

Closing Angle Adjustment

Connect the relay as shown in Figure 11. 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 11, set V_1 at 115 volts. If a 20° closing angle is desired, set V_2 at 115 volts, leading V_1 by 20°. Adjust the left-hand resistor until the contacts just close. Now, with 115 volts in both circuits, determine the angle at which the contact closes with V_2 lagging V_1. If the two angles are unequal, equalize then 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 setting.

Time Characteristics

If it is necessary to adjust the time characteristics, impose the chosen conditions on the relay, using the connections shown in Figure 11, 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.

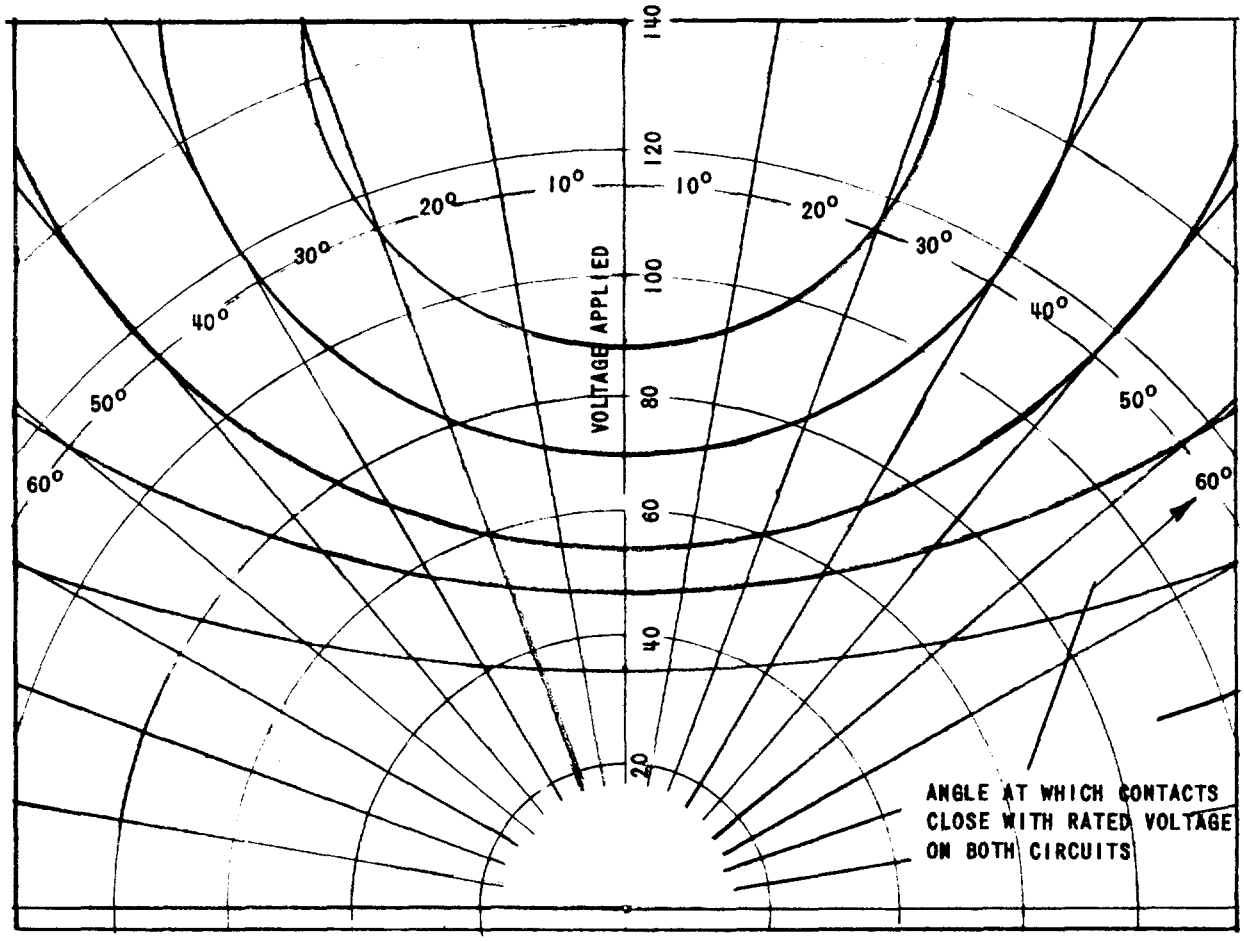
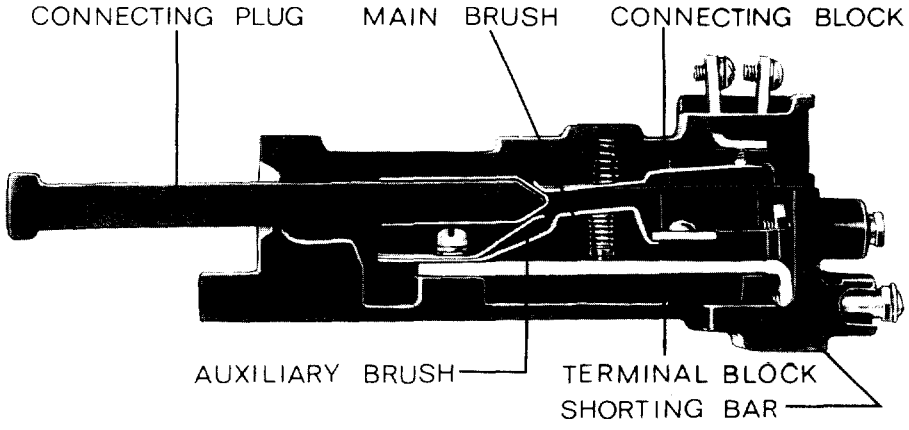


Figure 1 (0165A7535-0) Typical Voltage-Phase Angle Characteristic of 115 Volt 50/60 Cycle IJS Relay for various Closing Angle Adjustments with Rated Voltage Maintained on One Circuit



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

Figure 2 (8025039) Cross Section of Drawout Case Showing Position of Auxiliary Brush and Shorting Brush

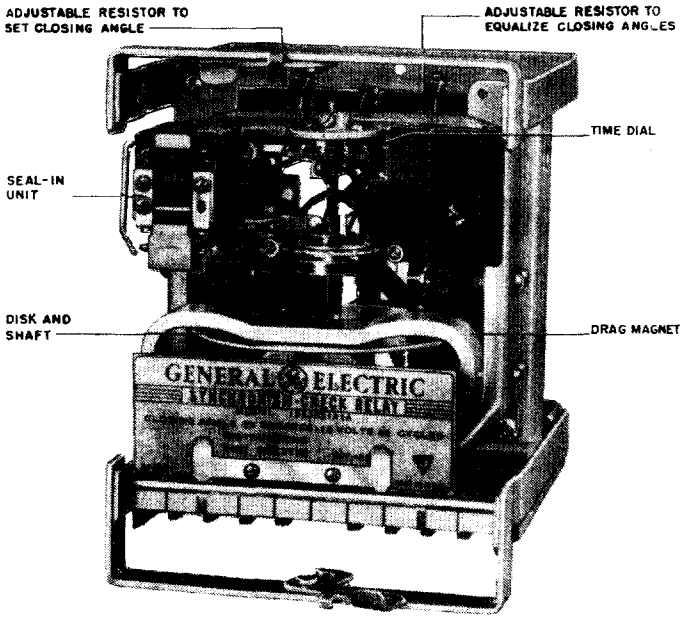


Figure 3 (8007014) Type IJS51A Relay Unit in Cradle (Front View)

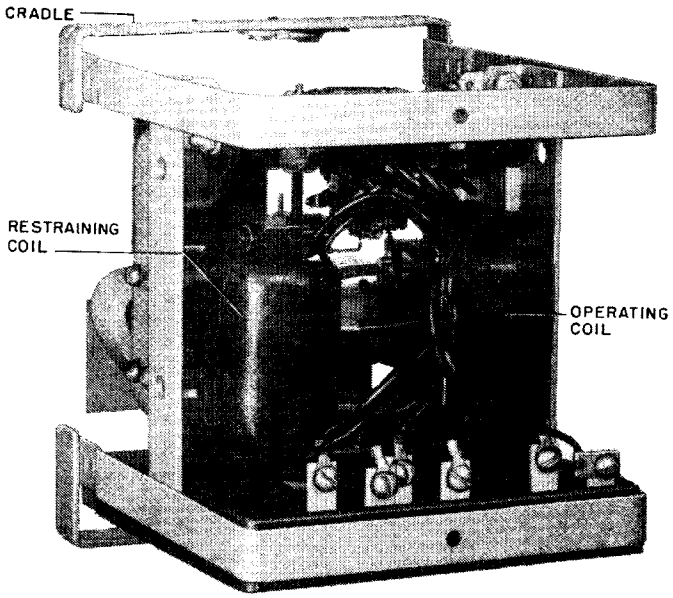


Figure 4 (8007013) Type IJS51A Relay Unit in Cradle (Rear View)

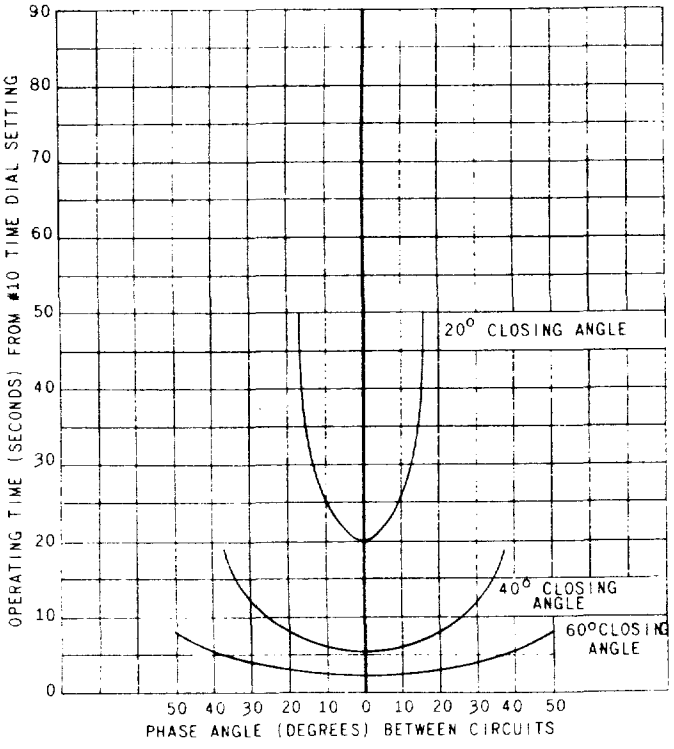


Figure 5 (6400151-3) Typical Time-Phase-Angle Characteristic of 60-Cycle Relay 12IJS51A1 With Rated Voltage On Both Circuits With #10 Time-Dial Settings

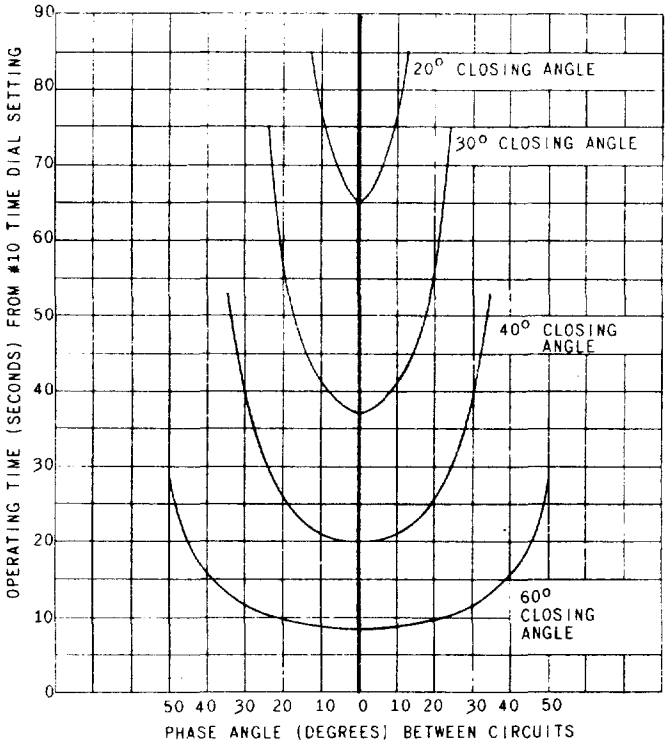


Figure 6 (0376A964-1) Typical Time-Phase-Angle Characteristic of 60-Cycle Relay 12IJS51A3 With Rated Voltage on Both Circuits With #10 Time-Dial Settings.

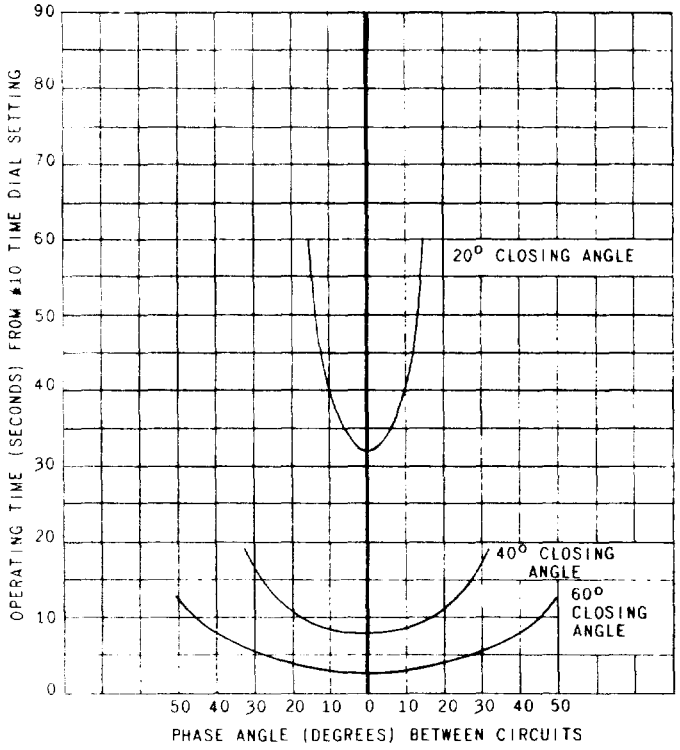


Figure 7 (6400496-1) Typical Time-Phase Angle Characteristic of 25-Cycle Type IJS Relay With Rated Voltage on Both Circuits With #10 Time-Dial Settings

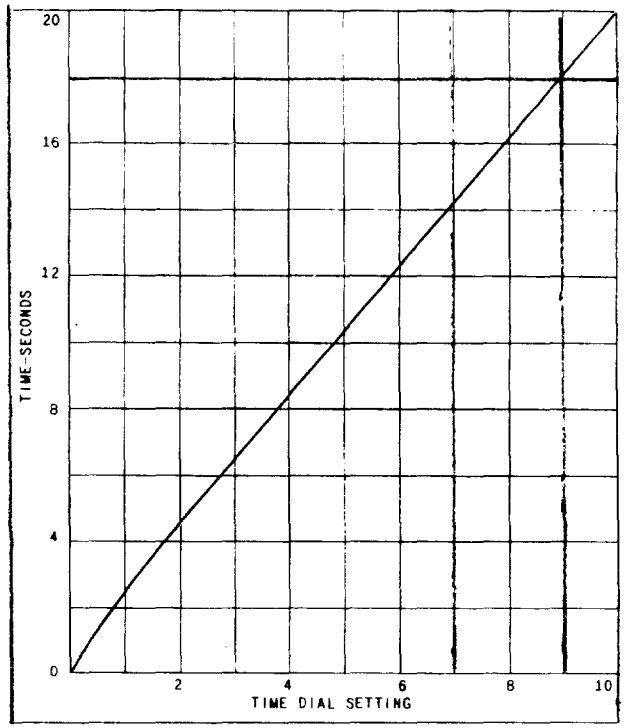


Figure 8 (6400150-2) Operating Time of Type IJS Relay With 20° Closing-Angle-Time at 0°, 115 Volts, 60 Cycles on Both Cycles

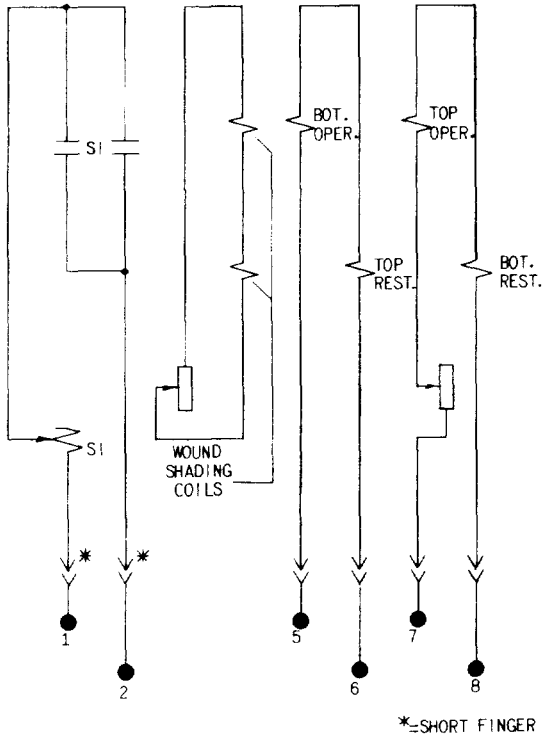


Figure 9 (6305898-3) Internal Connections For Type IJS51A Relay (Front View)

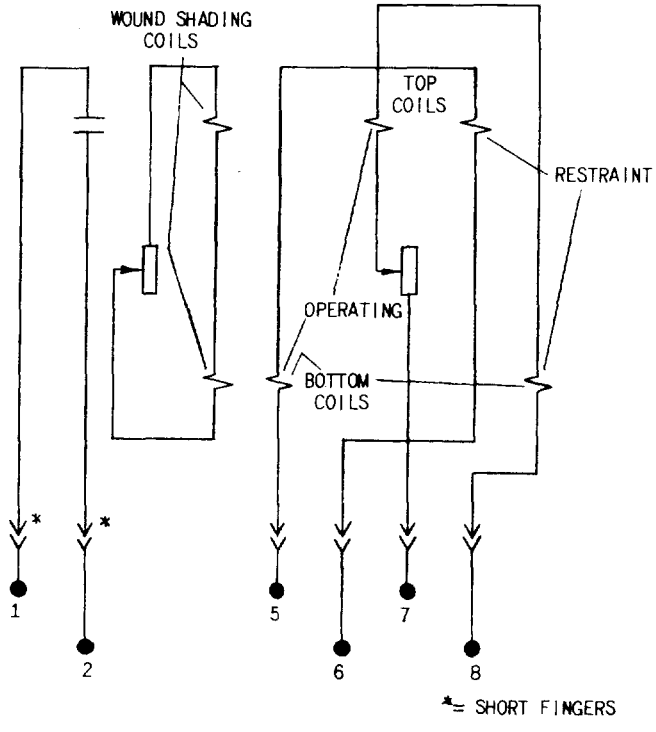


Figure 10 (6400419-3) Internal Connections for Type IJS52A Relay (Front View)

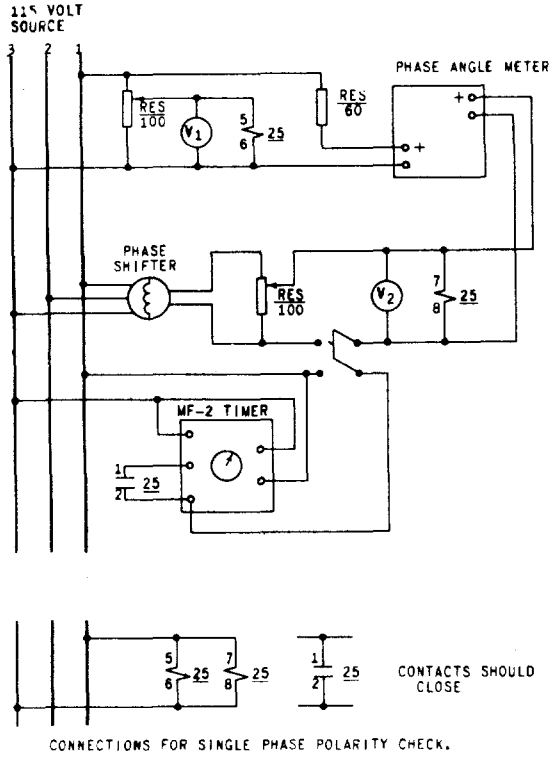
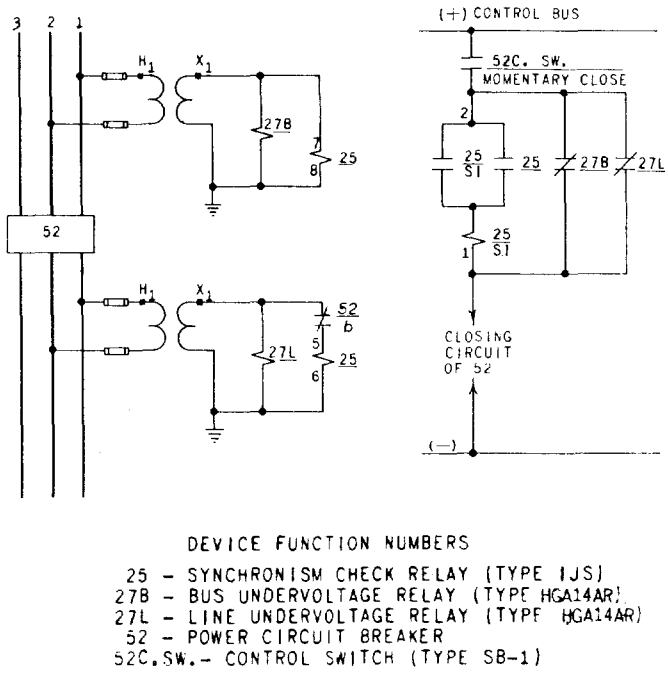


Figure 11 (6154272-1) Testing Connections for Type IJS Relays



DEVICE FUNCTION NUMBERS

25 - SYNCHRONISM CHECK RELAY (TYPE IJS)
27B - BUS UNDERVOLTAGE RELAY (TYPE HGA14AR)
27L - LINE UNDERVOLTAGE RELAY (TYPE HGA14AR)
52 - POWER CIRCUIT BREAKER
52C.SW.- CONTROL SWITCH (TYPE SB-1)

*Figure 12 (6209561-5) Typical Elementary Diagram of External Connections Type IJS Relays

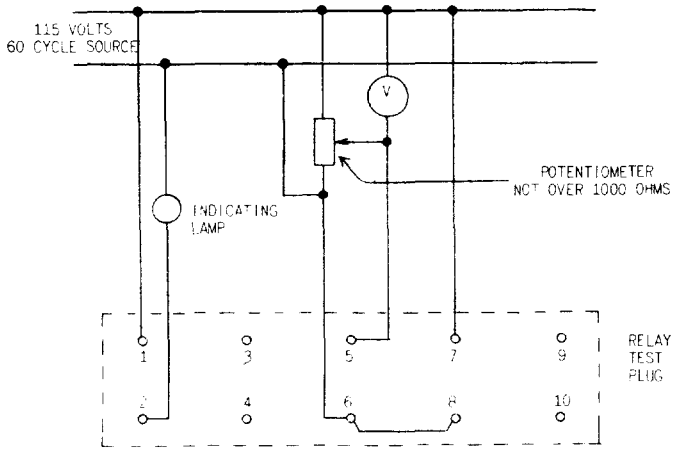


Figure 13 (0178A9112-0) Test Connections for Single-Phase Closing-Angle Check, Type IJS51A & IJS52A Relays

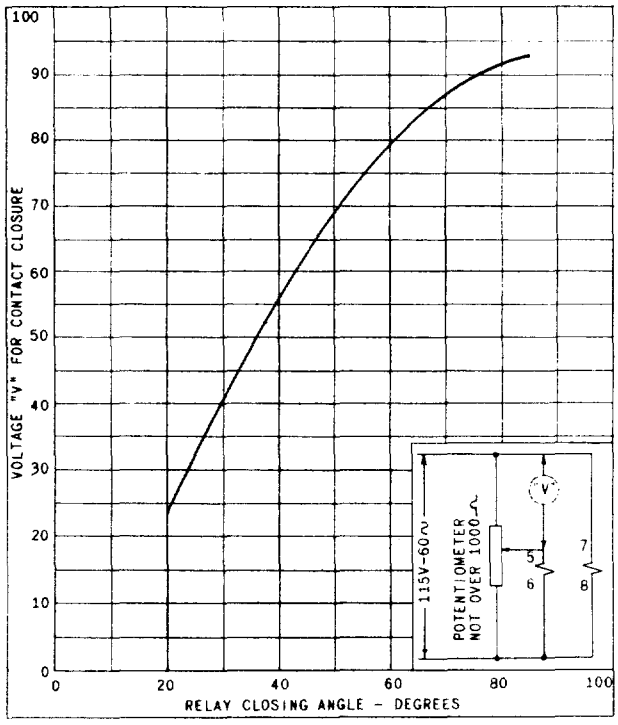


Figure 14 (6400145-1) Connections and Curve to Make Approximate Closing-Angle Adjustment Without Phase Shifter on 115 Volt, 60-Cycle Relay Type IJS

* "Revised since last issue

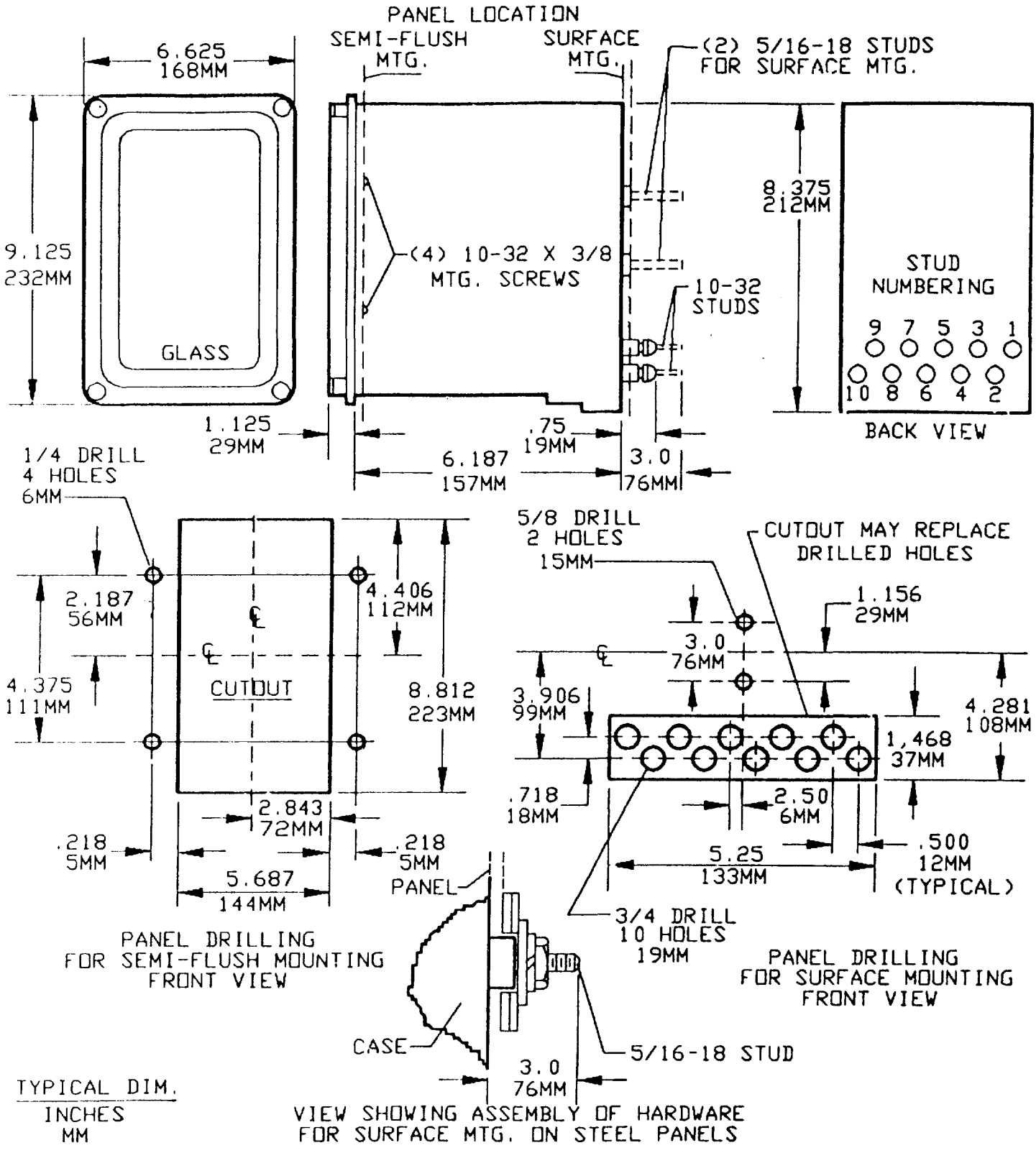


*Figure 15 (6209271-8) Outline and Panel Drilling Dimensions for Type IJS Relay

* Revised since last issue

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