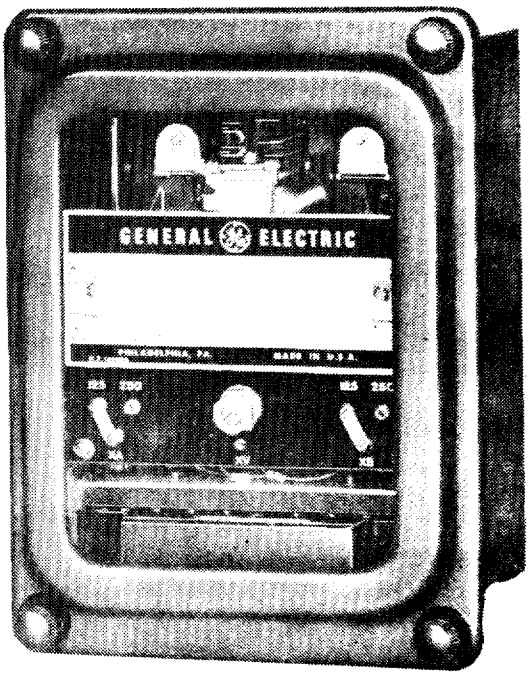
INSTRUCTIONS

GEK-33927B
Supersedes GEK-33927A

AUXILIARY RELAY

TYPE NAA30A



GENERAL ELECTRIC

CONTENTS

Cover Photo 8041545

NAA30A

DESCRIPTION

The NAA30A (Figure 1) is an auxiliary relay designed for use in a scheme where synchronization is performed manually by a GXS11B synchronizing relay, but relay supervision is desired.

Included in the NAA30A are three telephone relays that operate in combination with the GXS, and allow the operator to synchronize only if: 1) permission is received from the GXS11B, 2) the bus and machine voltage have **not** passed the in-phase condition, and 3) the machine is running faster than the system. By reconnecting, the relay can be set to permit synchronization only if the machine is running slower than the system. The NAA30A is mounted in an S1 case, the outline and drilling dimensions for which are given in Figure 3. The internal connections for the relay are shown in Figure 4.

One NAA30A and one GXS11B are required to perform the above functions. In some cases an auxiliary potential transformer (PT) may be required. The scheme and equipment requirements are further described in the **APPLICATION** section.

APPLICATION

The NAA30A is used in combination with a GXS11B synchronizing relay, to provide relay supervision when synchronizing is to be performed manually. Figure 10 illustrates the external AC connections for the scheme. Figure 11 illustrates the DC connections for the scheme when a CS/NOR contact is available on the control switch. In this connection, only the 25X/A and 25X/V units of the NAA30A are used. If it is desired not to use the CS/NOR contact, or if one is not available, the DC connections illustrated in Figure 12 can be used. In this type of connection the 25X/B unit is used in place of the CS/NOR contact. Functionally, both schemes perform in a like manner.

With the auto-manual switch in the auto position, breaker closing can be initiated by the operator only after the GXS has operated and before the machine reaches an in-phase condition with the system. The machine must also be running faster (or slower, by re-connection) than the system. Synchronization will be blocked if the control switch is thrown before the GXS has operated. Synchronization cannot be performed by holding the control switch in the closed position and waiting for the machine to swing into position (because the 25X/A unit is blocked by the operation of the CS/NOR contact in one scheme and by the operation of the 25X/B in the other). See GEI-33858B for details of GXS11B operation. In both schemes the 25X/V unit is set to drop out at the in-phase condition of the machine and system, and so block any attempts at synchronizing once that opportunity has been passed.

The 25X/V unit is connected to measure the vector difference between the machine and system voltages. See Figure 10. Note that there is a phase shift introduced before the measurement is made; e.g., it measures the difference between the phase 2-1 voltage at the machine terminals and the phase 2-1 voltage of the system. Thus, when the machine and system are in phase, the 25X/V will be measuring a voltage difference, due to the 30° phase shift. The dropout setting of the 25X/V unit is based on this difference. If the system and generator-PT-secondary voltages are equal, of rated value, and in phase, this difference is:

$$V = 2E \sin 15°$$

where: V = voltage difference

E = rated value = system and generator voltage, assumed equal

Variation from normal in either voltage will cause some change in the dropout of the 25X/V unit. Consequently, the angle at dropout will not be exactly zero degrees (0°). The extent of the change may be noted in Table I. An auxiliary PT, as shown in Figure 10, may be required to balance the voltages between the machine and system PTs.

The connections illustrated in Figure 10 allow the machine to be synchronized only if it is running fast with respect to the system. Noted on the figure is the change that should be made if it is desired to synchronize a machine running slower than the system. In either case, if the machine is running opposite to the direction for which the connections are made, the 25X/V unit will drop out approximately 60° before the in-phase condition and will not pick up until some time after the in-phase condition. Thus, synchronizing can be initiated only if the machine is running in the selected relationship with respect to the system.

The operating times and characteristics of the telephone units incorporated in the NAA30A relay are given in the **CHARACTERISTICS** section.

SETTINGS

The only setting that must be made in the NAA30A is the dropout setting of the 25X/V unit. As noted in the section under **APPLICATION**, this unit should drop out when the machine and system voltage are in phase. At that instant the 25X/V unit will be measuring a voltage difference due to a 30° phase shift. Its dropout should be set at:

$$V = 2E \sin 15°$$

where: V = dropout setting

E = rated value = system and generator voltage, assumed equal

Any variation from normal in either voltage will cause some change in the dropout of the 25X/V unit. As a consequence, cutoff will not occur exactly at the in-phase position. The extent of the change in dropout, and hence the need for an auxiliary PT, can be determined from Table I.

TABLE I

INCOMING VOLTAGE †	RUNNING VOLTAGE †	OPERATING ANGLE Δ
0.9	0.9	– 3.5°
1.0	0.9	– 1.0°
1.1	0.9	+ 2.0°
0.9	1.0	– 1.0°
1.0	1.0	0
1.1	1.0	+ 2.0°
0.9	1.1	+ 2.0°
1.0	1.1	+ 2.0°
1.1	1.1	+ 2.5°

† In per-unit of 25X/V calibration voltage.
Δ Positive angle indicates drop out beyond the in-phase position.
Δ Negative angle indicates drop out in advance of the in-phase position.

RATINGS

*The 12NAA30A(–)A relay consists of 3 telephone-relay circuits contained in an S1 case. The two auxiliary circuits, 25XA and 25XB, are continuously rated at 110/220 volts or 125/250 volts DC, depending upon the relay model chosen. The voltage selection is made with two links (one per telephone-relay unit) located and clearly identified on the front of the relay. The voltage circuit, 25XV, which is energized from an input transformer (T1), is designed to carry 240 volts continuously and is available for either 50 or 60 hertz. Transformer T1 is applied in the machine and bus PT circuits, each of which are rated for 120 V. However, since it is the vector difference of these voltages that is applied to T1, the transformer must be rated for 240 V, which occurs when the two voltages are 180° apart.

The primary winding of the 25XV input transformer, T1, has a tap that can be connected for a Phase-to-Neutral Potential Transformer connection by reversing the leads on studs 5 and 5A. The telephone-relay contacts will make and carry 30 amperes momentarily, and can carry 3 amperes continuously. The interrupting capability for each contact is listed in Table II.

TABLE II

	INTERRUPTING CURRENT (AMPS)	
VOLTAGE	INDUCTIVE	NON-INDUCTIVE
125 VDC	0.5	1.5
250 VDC	0.25	0.75

CHARACTERISTICS

25XA
*

1. The 25XA telephone relay is adjusted to pick up when a voltage equal to or less than 80% of rated voltage is applied.

*Revised since last issue.

2. The pickup time with rated voltage suddenly applied is adjusted for 8 milliseconds or less.

3. The dropout time with rated voltage suddenly reduced to zero (0) is adjusted for 16 milliseconds or less.

25XB

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1. The 25XB telephone relay is adjusted to pick up when a voltage equal to or less than 80% of rated voltage is applied.

2. The pickup time with rated voltage suddenly applied is adjusted to be in the range of 4 to 8 milliseconds.

25XV

1. The 25XV telephone relay can be continuously adjusted for a dropout voltage of 30 to 70 volts by means of rheostat R1, which is located on the front of the relay between the 25XV and 25XB DC links. Final adjustment is set at 62.1-63.5 volts dropout for a 120-volt secondary system.

2. Pickup voltage is not adjustable but the dropout-to-pickup ratio is in the range of 50 to 70%.

ENVIRONMENTAL CHARACTERISTICS

1. Figure 6 is a curve for the 25XA unit illustrating the change in pickup and dropout time over an ambient temperature of – 20°C to + 60°C.

2. Figure 7 is the curve for the 25XB unit showing the change in pickup time versus ambient temperature from – 20°C to + 60°C.

3. Figure 8 illustrates the change in dropout over a range of – 20°C to + 60°C for a dropout setting of 80 volts on the 25XV unit.

BURDENS

*

UNIT	STUDS	110 VDC 125 VDC	220 VDC	250 VDC	240 VAC
25XA	8 - 9	2000 ohms	4000 ohms	4500 ohms	---
25XB	2 - 10	2000 ohms	4000 ohms	4500 ohms	---
25XV	4 - 5	---	4000 ohms	---	13.1 VA

The burden given for the 25XV circuit is the maximum burden, and will be less for voltages below 240V.

CONSTRUCTION

BASIC RELAY UNIT

These relays are assembled with telephone-relay units of hinged-armature construction (see Figure 1A) mounted in a drawout case.

*Revised since last issue.

CASE

The units of each relay are mounted on a cradle assembly that can be easily removed from the relay case. The cradle is locked in the case by means of latches at the top and bottom. The electrical connections between the case and cradle block are completed through a removable connecting plug. A separate testing plug can be inserted in place of the connection plug to permit testing of the relay in its case. The cover attaches to the case from the front, and includes the target reset mechanism and an interlock arm to prevent the cover from being replaced until the connection plug has been inserted.

The case is suitable for either semi-flush or surface mounting on panels up to two inches (2") thick.Hardware is available for all panel thicknesses up to two inches, but panel thickness must be specified on the order to make sure that the proper hardware will be provided. Outline and panel-drilling dimensions are shown in Figure 3.

RECEIVING, HANDLING, AND STORAGE

These relays, when not included as a 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. 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 test indicates 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 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 of the screws are tight.

MECHANICAL INSPECTION

It is recommended that the following mechanical adjustments be checked:

1. With 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". The gap may be checked by inserting a feeler gage, and the 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 (0.015" gap, 0.005" wipe).

2. Check the positions of the connection brushes on the cradle block and the case block against the internal-connection diagram for the relay. Be sure that the shorting bars are in the proper positions on the case block, and that the long and short brushes on the cradle block agree with the internal-connection diagram in Figure 4. Figure 2 shows a sectional view of the case and cradle blocks in place. Note that there is an auxiliary brush in each position on the case block. This brush should be bent high enough so that, when the connection plug is inserted, its contact strips engage the auxiliary brushes before striking the main brush. This is especially important in current circuits and other circuits with shorting bars, since an improper adjustment of the auxiliary brush may result in a momentary open circuit.

ELECTRICAL TESTS

It is recommended that the following electrical tests be made immediately upon receipt of the relay. Note that all tests should be made with the relay in its case and the connection plug inserted.

1. Check the pickup and dropout time of the 25XA and pickup time of the 25XB units. This can be accomplished by making the electrical connections shown in Figure 5 and stud connections of Table III.

*

TABLE III

UNIT AND VOLTAGE	CONNECT TO STUD A	B	C	D	TIME PICKUP	DROPOUT
25XA 110/220 VDC 125/250 VDC	8	9	"a" Contact That Is Not Used On 25XA		8 ms or less	16 ms or less
25XB 110/220 VDC 125/250 VDC	2	10	6	7	4 to 8 ms	----
25XV 240V, 50/60 HZ	4	5	1	2	----	25 ms or less †

† Time from point of 1 volt above [illegible]e-dropout to zero volts.

The dropout voltage of the 25XV can be checked with connections for the timing as given in Table III, except connect the 25XV contact of studs 1 and 3 to an indicating light. Normally, for a 120-volt system this would be 62 - 63.5 volts and is adjusted with the R1 rheostat. For a system that is not a 120-volt system but is still within the rating of the circuit, the following formula can be used to calculate the 25XV setting:

Voltage dropout setting = 2(sin 15° × relay voltage)

where:

Relay voltage = maximum voltage that the relay will see at its studs (4 and 5) from the secondary of the Potential Transformer on the bus side.

*Revised since last issue

Pickup time is defined as the time elapsed from the application of rated voltage to the coil until an "a" contact closes.

Dropout time is the elapsed time from the removal of rated voltage from the coil until an "a" contact opens.

INSTALLATION PROCEDURE

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

Before any of the following electrical tests are made the relay should be in its case and, preferably, mounted in its permanent location. Repeat pickup tests described in the **ACCEPTANCE TESTS** section using a ten-point plug as shown in Figure 5.

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, 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 at an interval of from one to two years.

MECHANICAL CHECKS

Check the telephone relay contacts for 0.015" gaps and 0.005" wipe, as described in the **ACCEPTANCE TESTS** section.

ELECTRICAL CHECKS

Connect the relay as shown in Figure 5 and repeat the tests described in the **ACCEPTANCE TESTS** section.

SERVICING

If any of the mechanical or electrical check points described in the previous sections are found to be out of limits, the following points should be observed in restoring them:

ELECTRICAL

1. To decrease the voltage or current at which the telephone relay will pick up, decrease the gap between the armature and the pole face, by bending the contact-operating-arm stop. To increase the pickup, reverse the above procedure. After this adjustment is made, it will be necessary to readjust the contacts to obtain a wipe of 0.005" and a gap of 0.015". Resetting the circuit-opening-contact pressure can also alter the percentage pickup.

2. To decrease pickup time, reduce the pressure of the circuit-opening contacts by bending the moving flexible contact. To increase the pickup time, reverse the above procedure.

RENEWAL PARTS

It is recommended that sufficient quantities of renewal parts be carried in stock to enable 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 quantity required and name of part wanted, and give complete nameplate data, including serial number. If possible, give the General Electric Company number on which the relay was furnished.

LIST OF ILLUSTRATIONS

*Revised since last issue

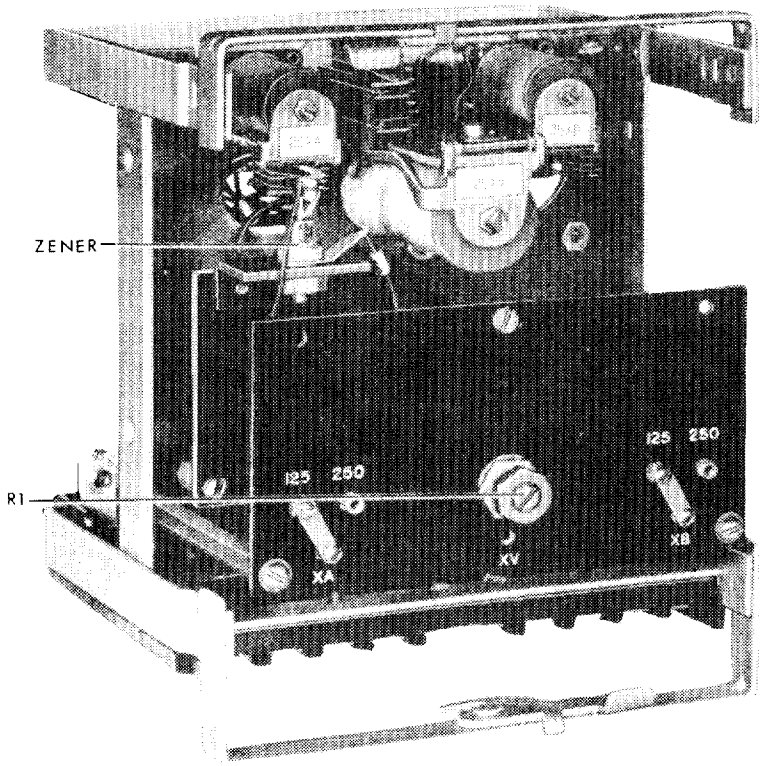


Figure 1A (8041547) Front View

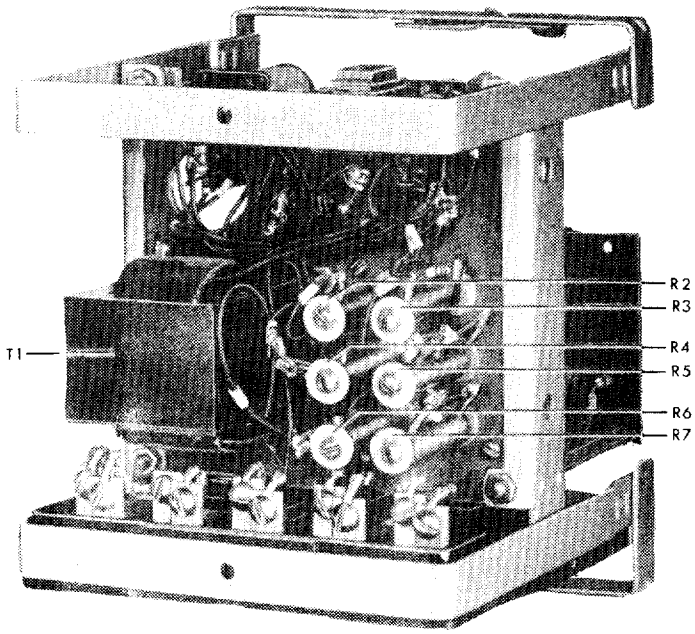
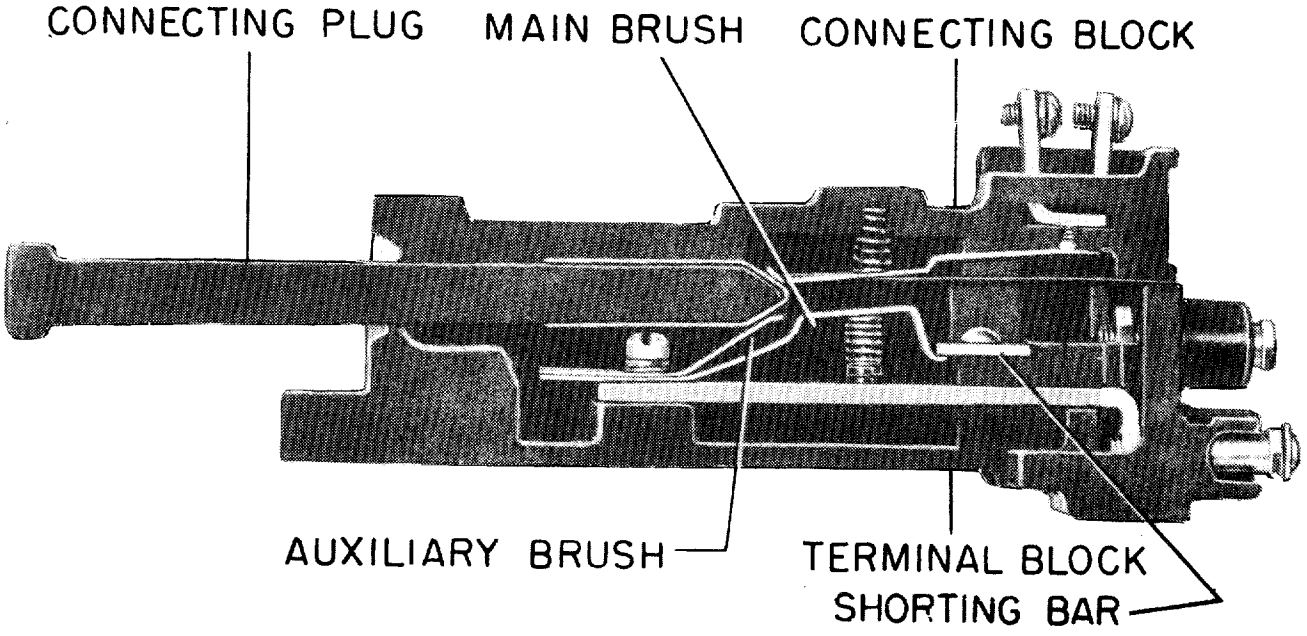


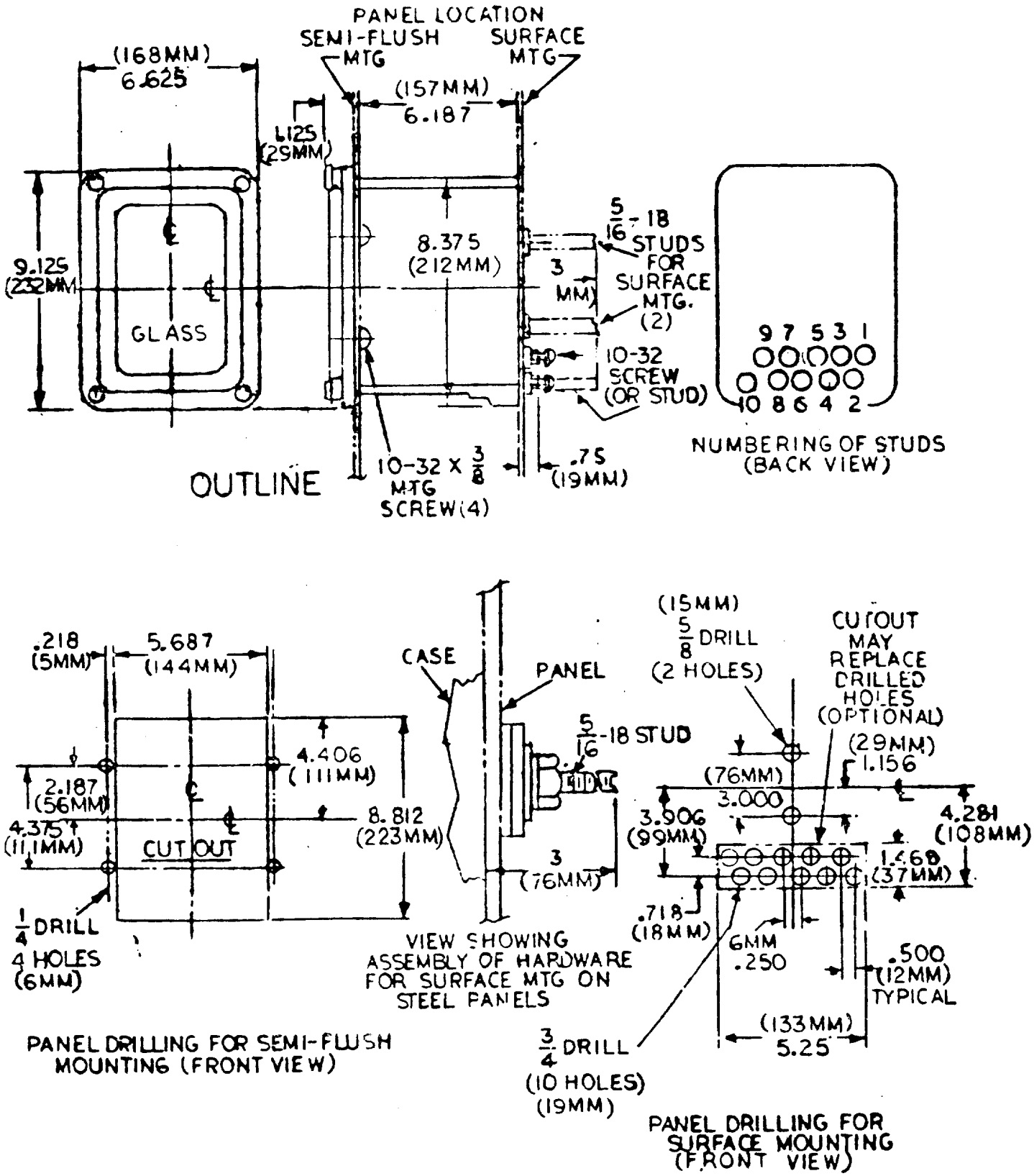
Figure 1B (8041546) Rear View

Figure 1 Type NAA30A Relay, Removed from Case



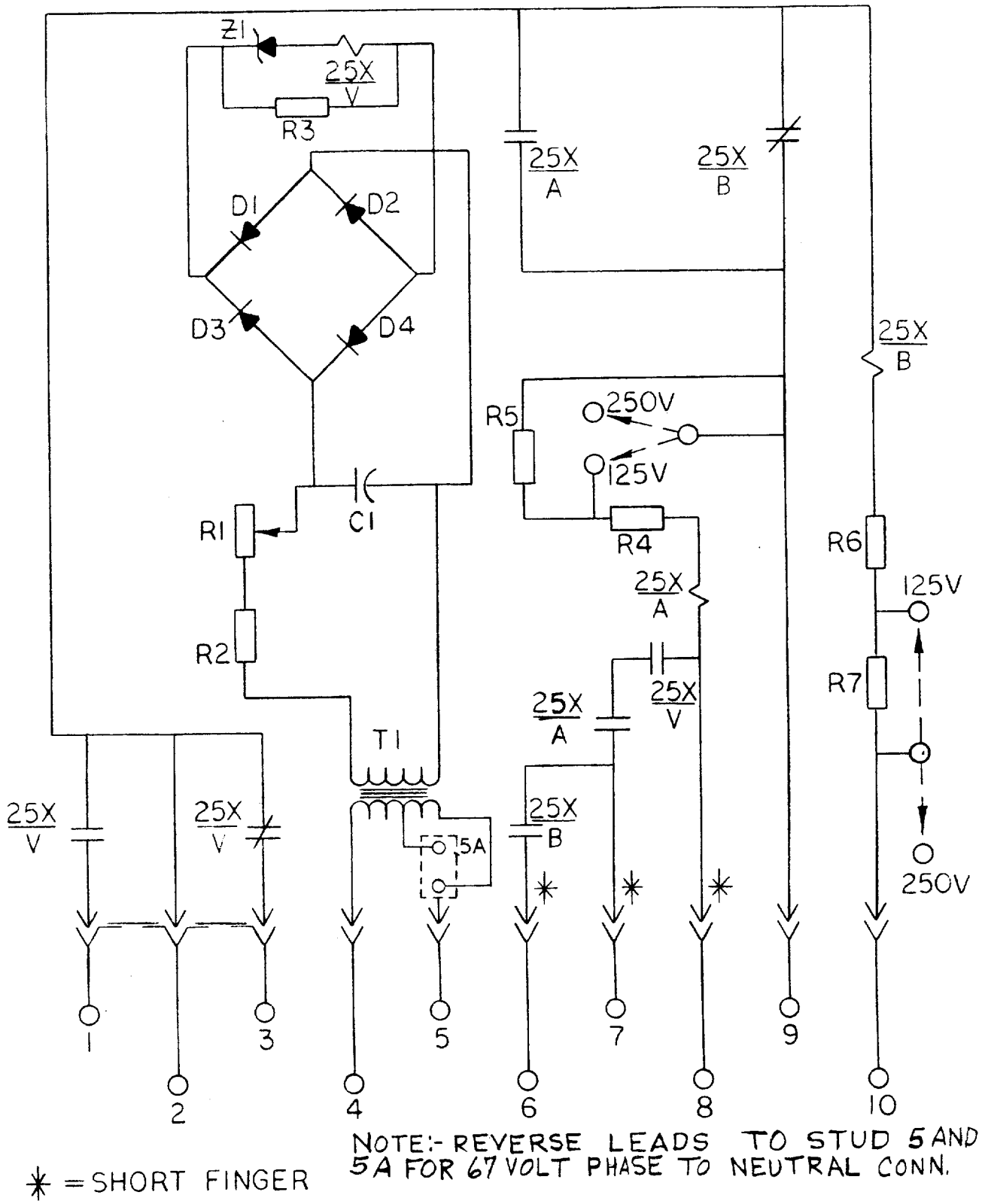
NOTE: AFTER ENGAGING AUXILIARY BRUSH, CONNECTING PLUG TRAVELS 1/4 INCH BEFORE ENGAGING THE MAIN BRUSH ON THE TERMINAL BLOCK

Figure 2 (8025039) Cross Section of Drawout, Showing Positions of Auxiliary Brush and Shorting Bar



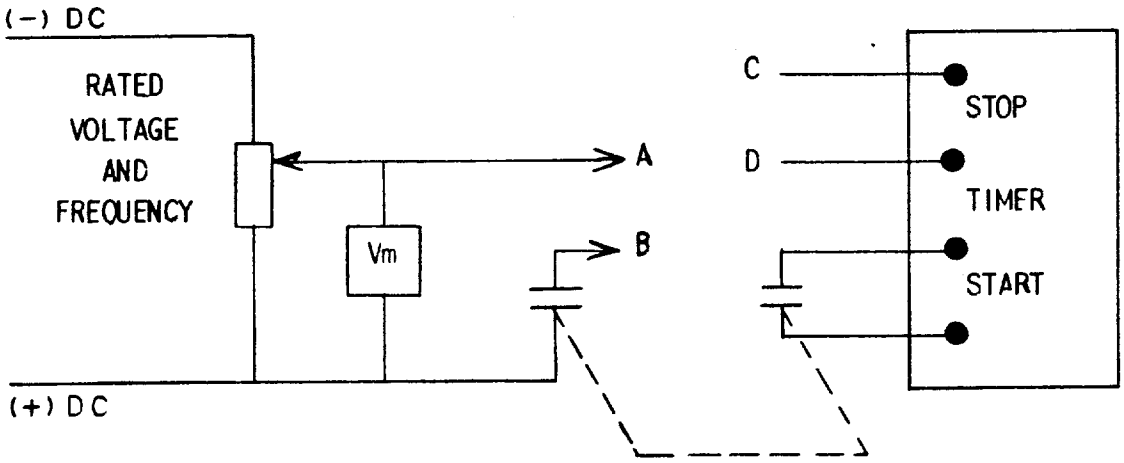
* Figure 3 (K-6209271-7) Outline and Panel Drilling for 12NAA30A(–)A Relay Case

*Revised since last issue.



* Figure 4 (0227A7111-5) Internal-Connections Diagram

*Revised since last issue.



* Figure 5 (0246A3787-1) Electrical Test Diagram

*Revised since last issue.

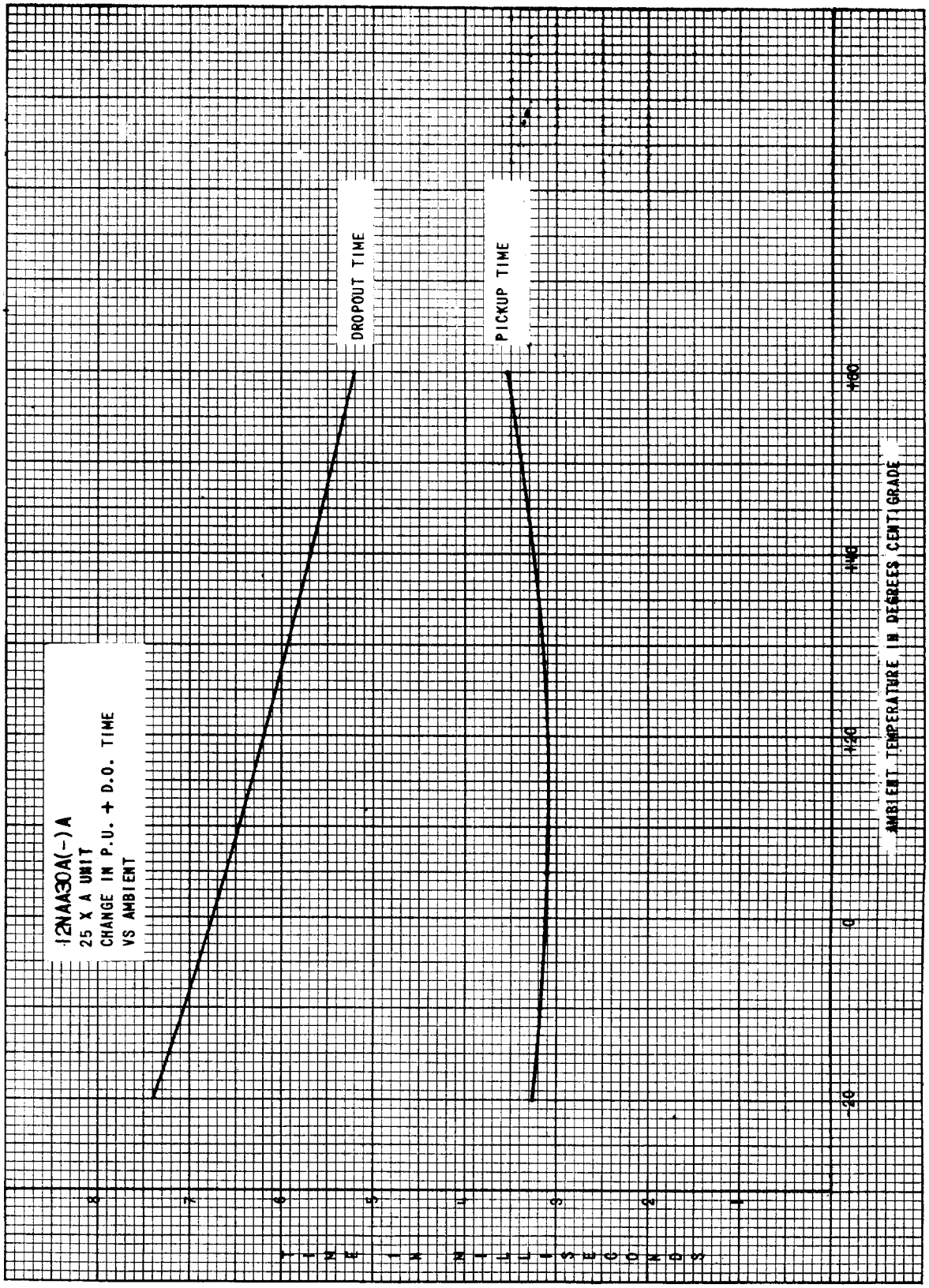


Figure 6 (0246A3807) 25XA Characteristic Curve

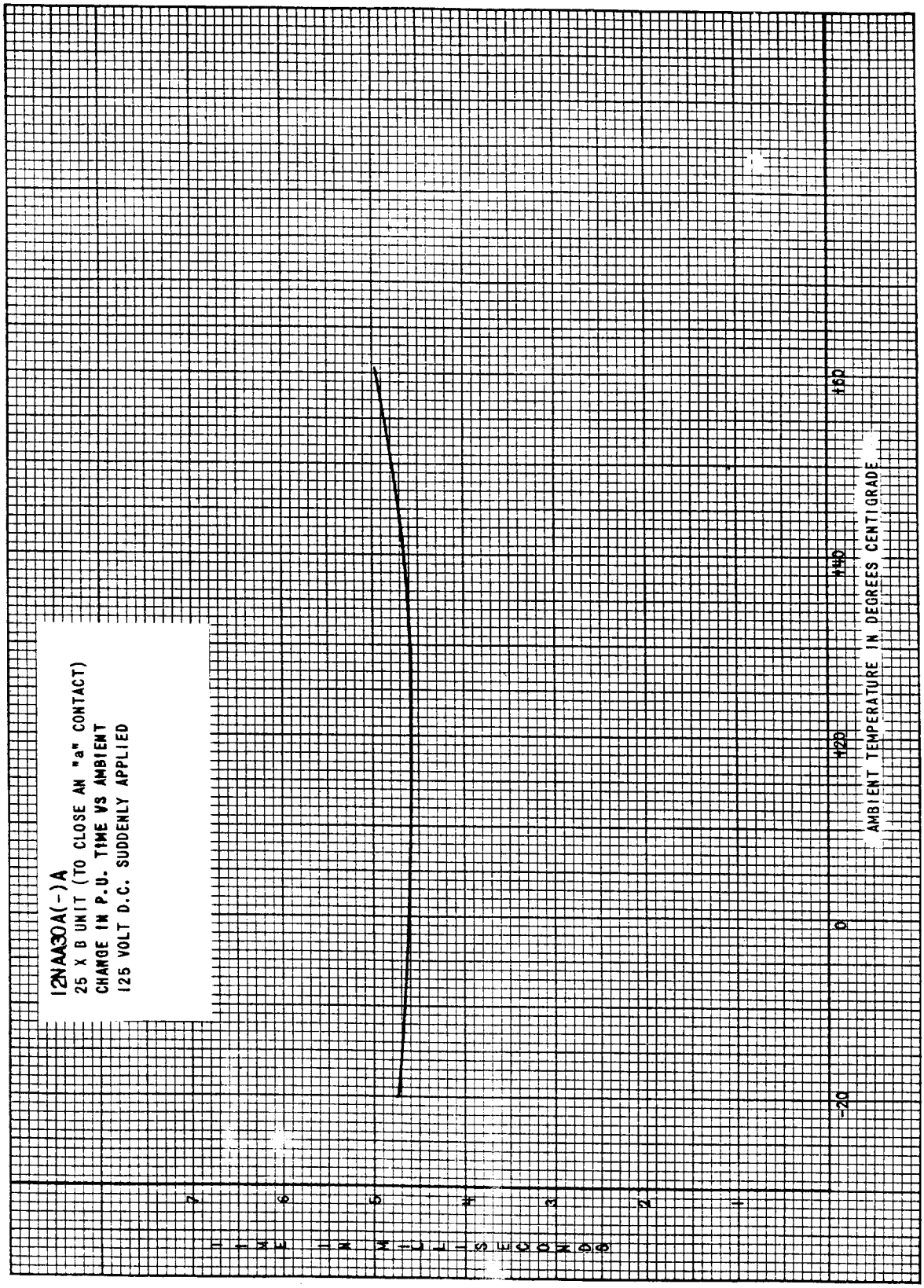


Figure 7 (0246A3806) 25XB Characteristic Curve

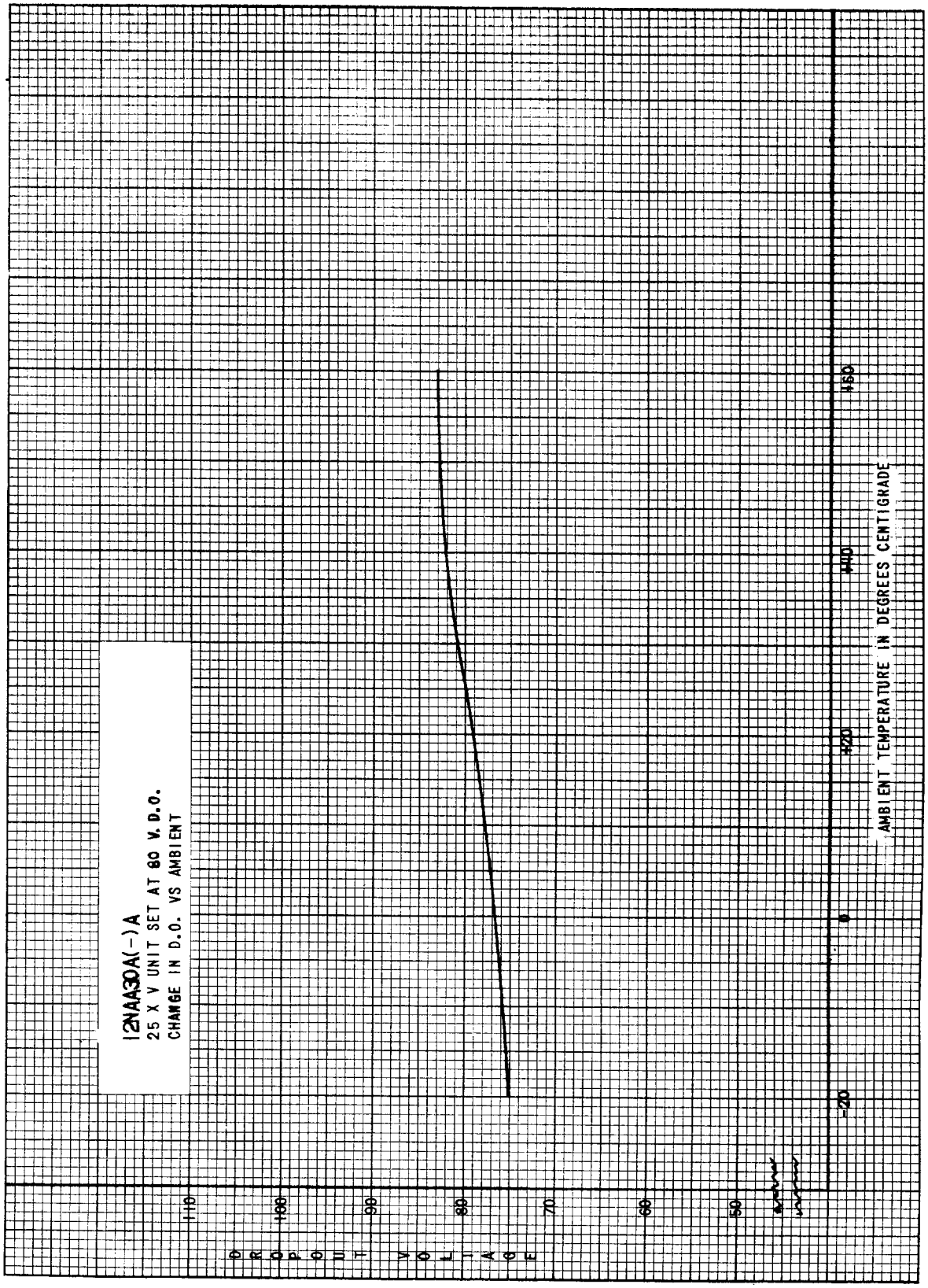
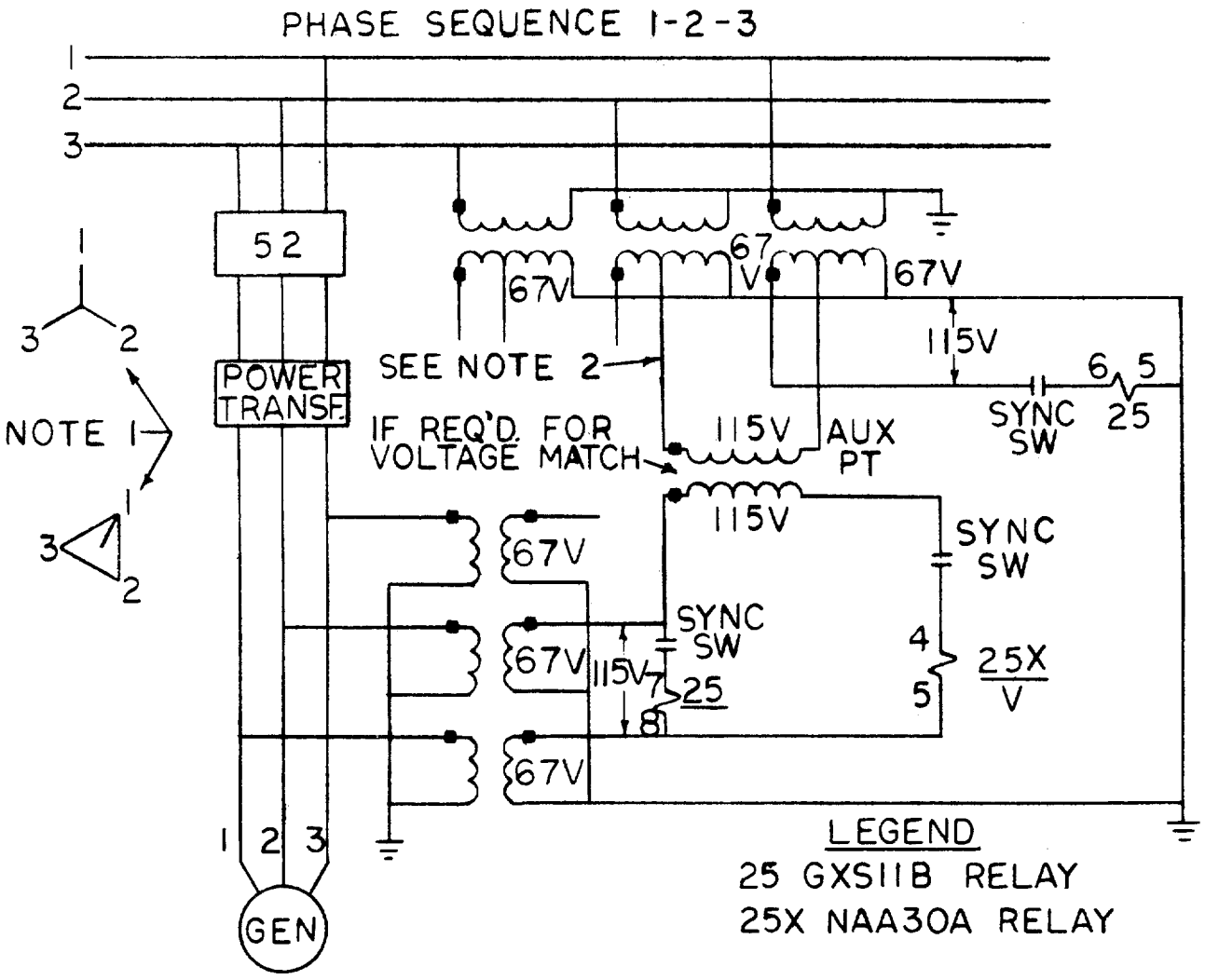


Figure 8 (0246A3805) 25XV Characteristic Curve

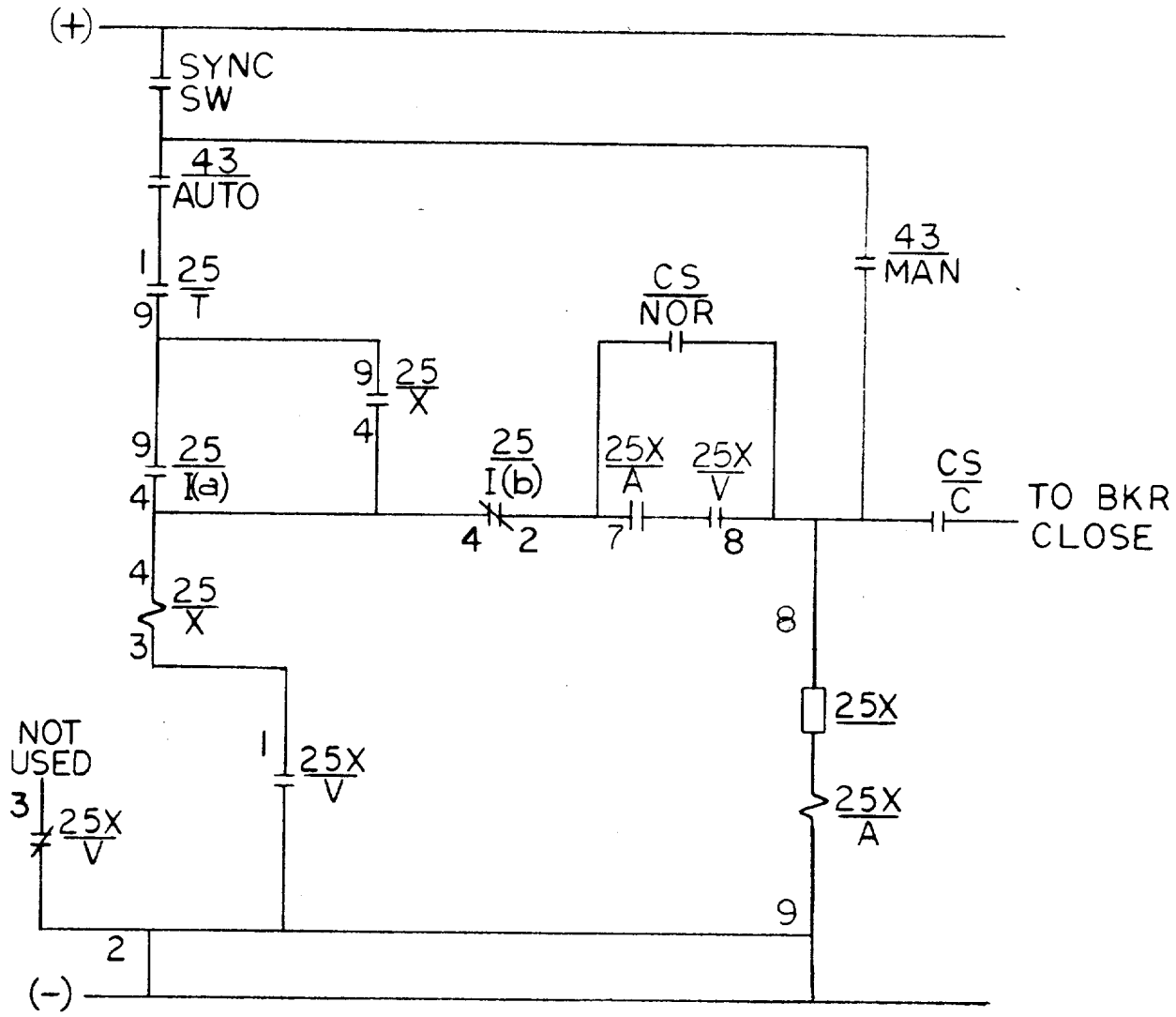
FIGURE 9 NOT AVAILABLE



NOTE 1 - HIGH SIDE ASSUMED TO LEAD LOW SIDE BY 30° UNDER NORMAL SYNCHRONIZING CONDITIONS THE VOLTAGES SUPPLIED TO THE RELAYS FROM THE BUS & MACHINE PT'S. SHOULD BE NEAR EQUAL.

NOTE 2 - SCHEME AS SHOWN IS FOR CLOSING ON FAST SCOPE FOR CLOSING ON SLOW SCOPE, CONNECT THIS LEAD TO PHASE 3.

Figure 10 (0246A3380 Sh.1) External AC Connections for NAA30A and GXS11B to Supervise the Operator when Synchronizing a Generator onto a System, Zero-Degree (0°) Cutoff.



LEGEND

25-GXSIIB RELAY
25/T-TIME DELAY UNIT
25/I-INSTANTANEOUS UNIT
25/X AUXILIARY UNIT

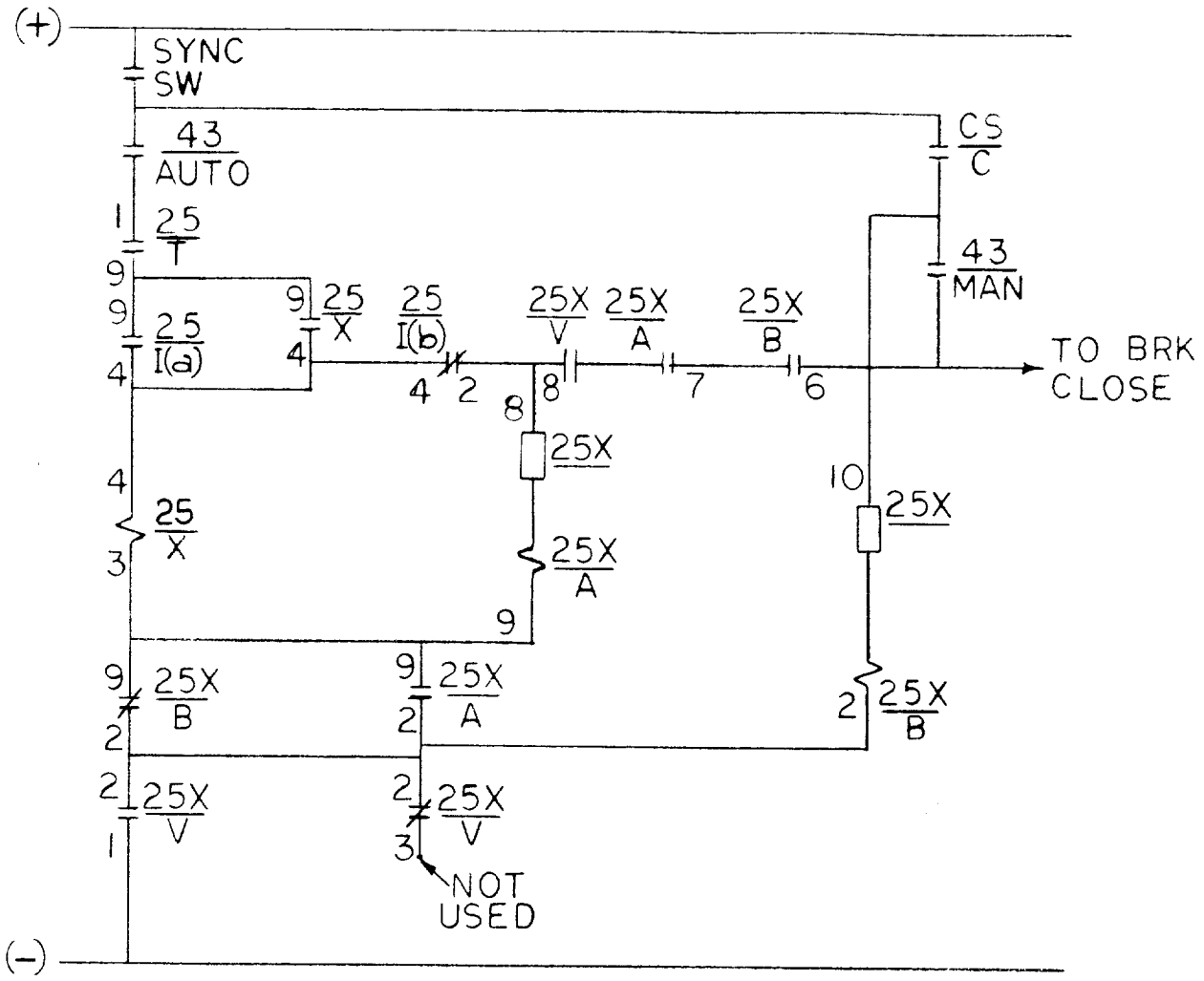
25X-NAA 30A RELAY
25X/V-VOLTAGE UNIT
25X/A AUXILIARY UNIT

43-AUTO-MANUAL SWITCH
AUTO-CLOSED IN AUTOMATIC
MAN-CLOSED IN MANUAL

CS-BREAKER CONTROL SWITCH
C-CLOSED IN CLOSE
NOR-CLOSED IN NORMAL
AFTER CLOSE AFTER TRIP

* Figure 11 (0246A3380 Sh.2 [2]) External DC Connections for NAA30A and GXS11B to Supervise the Operator when Synchronizing a Generator onto a System, Zero-Degree (0°) Cutoff

*Revised since last issue.



LEGEND

25-GXS11B RELAY
25/T-TIME DELAY UNIT
25/I-INSTANTANEOUS UNIT
25/X-AUXILIARY UNIT

25X-NAA30A RELAY
25X/V-VOLTAGE UNIT
25X/A-AUXILIARY UNIT
25X/B-AUXILIARY UNIT

43-AUTO-MANUAL SWITCH
AUTO-CLOSED IN AUTOMATIC
MAN-CLOSED IN MANUAL

CS-BREAKER CONTROL SWITCH
C-CLOSED IN CLOSE

* Figure 12 (0246A3380 Sh.3 [2]) External DC Connections for NAA30A and GXS11B to Supervise the Operator when Synchronizing a Generator onto a System, Zero-Degree (0°) Cutoff

* Revised since last issue

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