Approval	Vogtle Electric Generating Plant NUCLEAR OPERATIONS	Procedure No. 91704-C
J Beckhold		Revision No. 8
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ACTIONS FOR SECURITY DURING A RADIOLOGICAL EMERGENCY

1.0 PURPOSE

This procedure provides instructions to security personnel during a radiological emergency.

2.0 RESPONSIBILITIES

2.1 The Emergency Director (ED) shall ensure the Supervisor Nuclear Security (SNS) is notified in accordance with Procedure 91002-C, "Emergency Notifications" when an emergency is declared.

NOTE

The SNS shall exercise overall direction of the Security Force prior to activation of the Emergency Operations Facility (EOF). When the EOF becomes activated, the responsibility shifts to the Security Coordinator in the EOF.

2.2 The SNS or the Security Coordinator shall have the following responsibilities:

2.2.1 Manage the overall security of the facility during an emergency.

2.2.2 Conduct assembly and accountability in accordance with Procedure 91401-C, "Assembly And Accountability".

2.2.3 Provide assistance with site evacuation.

2.2.4 Provide assistance for expediting access to emergency vehicles such as ambulances, fire trucks, etc.

2.2.5 Coordinate security response with offsite law enforcement agencies.

2.2.6 Ensure that the ED is transported from the TSC to the EOF upon his request.

3.0 PREREQUISITES

A Notification of Unusual Event (NOUE), Alert, Site Area Emergency or General Emergency has been declared per Procedure 91001-C, "Emergency Classification And Implementing Instructions".

4.0 PRECAUTIONS

4.1 Check with Health Physics (HP) concerning radiological conditions prior to dispatching security officers.

4.2 Early dismissal differs from site evacuation in that normal departure traffic patterns are observed and no radiological monitoring or decontamination is carried out. If during the departure of non-essential personnel, the need for monitoring and possible decontamination arises, a site evacuation can be ordered and exiting personnel will be directed by Security to the selected relocation area.

5.0 PROCEDURE

5.1 NOUE

Actions for Security for a NOUE shall be performed in accordance with Security Checklist During Radiological Emergency.

5.2 ALERT/SITE AREA/GENERAL EMERGENCY

Actions for Security for an Alert/Site Area/General Emergency shall be performed in accordance with Security Checklist During Radiological Emergency.

6.0 REFERENCES

6.1 VEGP Emergency Plan

6.2 PROCEDURES

6.2.1 91001-C, "Emergency Classification And Implementing Instructions"

6.2.2 91002-C, "Emergency Notifications"

6.2.3 91204-C, "Emergency Response Communications"

6.2.4 91401-C, "Assembly And Accountability"

6.2.5 91403-C, "Site Evacuation"

6.2.6 90125-C, "Stand-By Notification And Recall Procedure For Security Personnel"

6.3 NUREG-0654, FEMA-REP-1, Rev 1, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants"

END OF PROCEDURE TEXT

Sheet 1 of 1

DATA SHEET 1

MISSING PERSON ROSTER

Date/Central Time_____

FROM: SNS
TO: EMERGENCY DIRECTOR

Personnel Not Accounted For

Name	Last Known Location

Signature_____

SECURITY CHECKLIST DURING RADIOLOGICAL EMERGENCY

The SNS shall exercise overall direction of the Security Force prior to the activation of the EOF. When the EOF becomes activated, the responsibility shifts to the Security Coordinator.

RESPONSIBILITY

Manage overall security. Conduct assembly and accountability. Provide assistance for expediting access to emergency vehicles. Coordinate response with offsite law agencies. Provide assistance with site evacuation.

NOUE

ACTIONS

1. Maintain a log of the incident.

2. Dispatch a Nuclear Security Officer (NSO) to investigate the event if security degradation is suspected.

3. Notify all posts and patrols of emergency.

4. Evaluate incident and make recommendations to plant management as requested.

5. Dispatch a qualified ENN communicator NSO to the Control Room to assist with notifications. Instruct the NSO to report to the Control Room Shift Supervisor for duty as a communicator.

6. Complete Checklist A, "VEGP Security Department Call Checklist" of this procedure.

7. Augment the on-shift security personnel by initiating emergency recall of off-duty personnel, as needed, in accordance with Procedure 90125-C, "Stand-By Notification And Recall Procedure For Security Personnel".

8. Ensure NSOs are available to escort emergency vehicle(s) and expedite access to site.

9. Ensure NSOs are available to issue and/or assist issuing dosimetry to emergency vehicles(s) personnel.

10. Be prepared to implement Alert, Site Area Emergency or General Emergency procedures.

SECURITY CHECKLIST DURING RADIOLOGICAL EMERGENCY

ALERT/SITE AREA/GENERAL EMERGENCY

ACTIONS

1. Maintain a log of the incident.
2. Activate the Operations Support Center (OSC) and the Technical Support Center (TSC) badge readers to facilitate accountability.
3. Dispatch a NSO to investigate the event if a degradation of security is suspected.
4. Notify all posts and patrols of emergency and ensure all NSO's that are dispatched outside the protected area have dosimetry if appropriate.
5. Evaluate incident and make recommendations to plant management as requested.
6. Dispatch a qualified ENN communicate NSO to the Control Room to assist with notifications if not already done.
7. Complete Checklist A, "VEGP Security Department Call Checklist" of this procedure.
8. After normal working hours notify VEGP Emergency Response Organization personnel in accordance with Checklist B, "Emergency Recall Instructions".
9. Augment the on-shift security personnel by initiating emergency recall of off-duty personnel, as needed, in accordance with Procedure 90125-C, "Stand-By Notification And Recall Procedure For Security Personnel".
10. Ensure that NSOs are available to receive employee, visitor and support personnel badges prior to exiting Plant Entry Security Building (PESB).
11. Ensure NSOs are available to escort emergency vehicle(s) and expedite access to site.
12. Ensure NSOs are available to issue and/or assist issuing dosimetry to emergency vehicles(s) personnel.
13. Dispatch a NSO to the Emergency Operations Facility (EOF) for access control.

    a. The NSO assigned to the EOF shall open the front personnel door, secure the south hallway door to the EOF and assume duty at the North end of the EOF hallway.

    b. The NSO shall control access as indicated below.

SECURITY CHECKLIST DURING RADIOLOGICAL EMERGENCY

ALERT/SITE AREA/GENERAL EMERGENCY

ACTIONS (CONT'D)

1. Access to the EOF shall be restricted to Georgia Power Company, NRC, FEMA, State and County, and Savannah River Site personnel or others authorized by the ED, EOF Manager Security Coordinator or Support Coordinator.

2. Members of the press and general public shall not be allowed access to the EOF. They should be advised to go to the Emergency News Center in Waynesboro for information concerning the emergency.

14. Dispatch a qualified Security Supervisor or higher level to the TSC to act as Security Coordinator and a NSO to act as an Access Control Officer.

15. Dispatch a NSO to the Operations Support Center (OSC) as a field monitoring team member (vehicle driver).

16. NSO's assigned to entrance points to the protected area will restrict access into the protected area to Georgia Power Company members of the Emergency Response Organization and/or NRC personnel.

17. Perform a protected area accountability in accordance with Procedure 91401-C, "Assembly And Accountability" as follows:

    a. The SNS will direct Secondary Alarm Station (SAS) to generate, at approximately 20 minutes after the Alert declaration, a "Badge Accountability Report" from the Security Computer. This report will contain the names of all personnel still listed in the Protected Area (P.A.). Security officers at all permanent or temporary exits will be directed to segregated badges of any personnel that exit after the generation of this report has begun. The exit officers will compile these names and badge numbers (NOT ACAD) and report this information to SAS. SAS will make a cross check of the "Badge Accountability Report" and the segregated badge list to determine accountability.

SECURITY CHECKLIST DURING RADIOLOGICAL EMERGENCY

ALERT/SITE AREA/GENERAL EMERGENCY

ACTIONS (CONT'D)

NOTE

This information maybe obtained by telephone or radio and should be received within 20 minutes of Alert declaration.

b. Obtain accountability lists from the Control Room (CR) and the Security Department of personnel assigned but not in the CR, CAS, or SAS.

c. The following personnel are considered accounted for:

1. Personnel coded as badged in the CR, TSC, OSC, CAS, or SAS on the "Badge Accountability Report".

2. Personnel on the CR or Security Department Accountability lists.

3. Personnel accounted for by other valid authority (OSC Manager, TSC Manager, ED, OSOS, SNS, etc.)

d. Unaccounted personnel should be listed on Data Sheet 1 and the ED informed.

e. The SNS should request that the CR make a plant page announcement requesting the unaccounted personnel to call Security at phone number _____. (insert appropriate phone number)

SECURITY CHECKLIST DURING RADIOLOGICAL EMERGENCY

ALERT/SITE AREA/GENERAL EMERGENCY

ACTIONS (CONT'D)

18. Perform an early dismissal if ordered by the ED as follows:

    a. Contact the assembly area (1st Floor Administration Building) and the Engineering and Construction Department Manager to release personnel to go home.

    b. Direct an NSO to check all public areas and public access and direct all personnel to leave the area(s)and as necessary, ensure all non-essential personnel have departed the owner controlled area outside the protected area.

    c. Report to the ED when all non-essential persons have exited the site.

19. Perform a site evacuation if ordered by the ED in accordance with Procedure 91403-C, "Site Evacuation" as follows:

    a. Notify personnel outside the protected area using the site siren as follows:

        (1) Make an announcement on the site siren public address as follows:

            NOTE

            If this is a drill, the message should be preceded and followed by the statement: "THIS IS A DRILL"

            "ATTENTION ALL PERSONNEL, ATTENTION ALL PERSONNEL - NON-ESSENTIAL PERSONNEL ARE ORDERED TO EVACUATE. REPORT TO THE RELOCATION CENTER AT (relocation center). REMAIN THERE UNTIL CLEARED TO LEAVE."

        (2) Activate the site siren with the Hi-Lo signal for three (3) minutes.

        (3) Repeat announcement on site siren public address.

SECURITY CHECKLIST DURING RADIOLOGICAL EMERGENCY

ALERT/SITE AREA/GENERAL EMERGENCY

ACTIONS (CONT'D)

b. Determine radiological conditions and precautions from the HP Supervisor prior to dispatching Security Officers to verify evacuation.

c. Direct personnel evacuating the site to the designated relocation center(s), VEGP Recreation Area or Plant Wilson.

d. Ensure NSOs are available to receive employee, visitor and support personnel badges prior to exiting.

e. Assign NSOs to stand-by the Plant Entry Security Building (PESB) to assist in evacuation, if needed.

f. Evacuate the Central Alarm Station (CAS), if needed, and transfer control of the security system to the Secondary Alarm Stations (SAS).

g. Direct an NSO to check all public areas and public accesses and direct all personnel to leave the area(s), and as necessary ensure all non-essential personnel have evacuated the areas outside of the Protected Area.

h. Assign NSOs to direct and control traffic to the designated relocation center.

i. Designate a NSO to be the Evacuation Leader for relocation center(s).

j. Contact the relocation center(s) and inform them of impending evacuation.

SECURITY CHECKLIST DURING RADIOLOGICAL EMERGENCY

ALERT/SITE AREA/GENERAL EMERGENCY

ACTIONS (CONT'D)

k. Upon appointment, the Evacuation Leader shall perform the following:

1. Report to their designated relocation centers. (Do not use a designated Field Monitoring Team emergency vehicle for transportation to relocation center).

2. Ensure all personnel and vehicles are surveyed for contamination by an HP Technician before release.

3. Provide periodic progress reports to the SNS or Security Coordinator (EOF activated) via radio or telephone.

20. The SNS will ensure the ED is transported from the TSC to the EOF upon his request.

Sheet 1 of 1

CHECKLIST A

VEGP SECURITY DEPARTMENT CALL CHECKLIST

NOTE

After normal working hours or after an early dismissal or site evacuation, there may not be any personnel at the locations listed below.

Organization or Individual	Person Contacted	Primary Number	Alternate Number	Central Time/Initials
Visitor Center	_____	-3630	-3631	_____/_____
Training Center	_____	-3901	-3903	_____/_____
Recreation Park	_____	-3650	-3494	_____/_____
Engineering and Construction Department	_____	-3580 (days)	-3585 (days)	_____/_____
	_____	beeper # -828-9400	beeper # -828-9510	_____/_____
GPC Vogtle Central Warehouse	_____	-3425	-3297	_____/_____
Corporate Garage	_____	-4205		_____/_____
Nuclear Operations Inprocessing Center	_____	-3352	-3120	_____/_____

NOTE

If an Alert, Site Area Emergency or General Emergency is declared and is after normal working hours, perform the following in accordance with Checklist B "Emergency Recall Instructions"

VEGP Emergency Response Organization Recall	_____/_____

CHECKLIST B

EMERGENCY RECALL INSTRUCTIONS

NOTIFICATION AFTER NORMAL WORKING HOURS

A. EMERGENCY RESPONSE ORGANIZATION (ERO) NOTIFICATION

(1) A Security Officer shall activate the MELITA Autodialer call out and pager/beeper system in accordance with the following:

a. Use only the "B" decks

NOTE

"PLAY" mode is accomplished by depressing the play button ONLY.

b. Place the "B" decks (lower level of recorders) in the "Play" mode on all three Melitas.

c. Close all of the decks

NOTE

All three MELITA computers should be "ON" and remain "ON" at all times. If one or all should be "OFF", push the white switch on the rear of the bottom section to the "ON" position and reboot personal computer (PC). (MELITA display screen should display words "AUTO-DIALING".)

d. Turn the system "ON" if needed.

e. Place "MELITA" telephone switch located beside MELITA system from the "OFF" position to the "ON" position.

NOTE

The PC, monitor and printer should be "ON" at all times and "PASSWORD" will be displayed.

f. Turn the PC "ON" if "OFF".

g. Turn PC monitor "ON" if "OFF".

h. Turn PC printer "ON" if "OFF".

CHECKLIST B

EMERGENCY RECALL INSTRUCTIONS

A. ERO NOTIFICATION (CONT'D)

NOTE

The password is known by the on-shift security officer(s) in the Secondary Alarm Station (SAS).

i. Enter the Password and "RETURN".

j. Enter "D" and "RETURN"

NOTE

Question will come up, "Will this be a weekend dialing?"

k. Enter "Y" and "RETURN"

NOTE

Question may come up, "Do you wish to continue dialing from the last point".

l. Enter "N" and "RETURN"

NOTE

Question will come up, "Do you wish to start a new calling log?"

m. Enter "Y" and "RETURN"

NOTE

Statement will come up, "Ready to dial
Enter emergency level (Enter=1)":

n. Depress "RETURN"

CHECKLIST B

EMERGENCY RECALL INSTRUCTIONS

A. ERO NOTIFICATION (CONT'D)

NOTE

At this time MELITA will make its' calls.

(2) Activate telephone answering machines by placing the power strip switch in the "ON" position.

(3) Initiate an ALL-CALL page and a GROUP-CALL pager in accordance with the following:

a. Obtain ALL-CALL pager code and GROUP-CALL pager codes from the SNS.

b. Call pager/beeper system and enter the appropriate codes and function digits.

(4) To obtain printout of all outgoing calls, perform the following:

NOTE

When all calls have been placed; MELITA will display "dialing complete".

a. Depress "RETURN"

b. To get a print out of all calls placed, enter the letter "O" and "RETURN".

c. Place "MELITA" telephone switch located beside MELITA system from the "ON" position to the "OFF" position.

NOTE

Printer will print out each call that was placed and if the call was acknowledged or busy or didn't answer.

CHECKLIST B

EMERGENCY RECALL INSTRUCTIONS

B. DEPARTMENT NOTIFICATION

(1) Operations, Maintenance and Security personnel required to report after normal working hours shall be contacted by on-shift personnel in their respective departments.

INSTRUCTIONS

GEK-45405B
Supersedes GEK-45405A

2-84

DIFFERENTIAL VOLTAGE RELAYS

TYPES:

PVD21A
PVD 1B
PVD 1C
PVD21D

GENERAL ELECTRIC

CONTENTS

DIFFERENTIAL VOLTAGE RELAYS

TYPES:

PVD21A
PVD21B
PVD21C
PVD21D

DESCRIPTION

All the the Type PVD21 relays are single phase, high speed, high impedance, voltage operated relays that are designed to provide protection in bus differential schemes when used in conjunction with suitable current transformers. Typical operating times are shown in Figure 15. Three PVD relays and a lockout relay are required for combined phase and ground fault protection of a three phase bus. Four models of the relay are available as listed in Table 1.

TABLE 1

	VOLTAGE UNIT (87L)	CURRENT UNIT (87H)	NO. OF THYRITE® STACKS
PVD21A	Yes	No	1
PVD21B	Yes	Yes	1
PVD21C	Yes	No	2
PVD21D	Yes	Yes	2

The PVD21C and PVD21D models of the relay include two paralleled voltage limiting Thyrite® stacks as opposed to the single stack included in the PVD21A and PVD21B models. This feature makes the PVD21C and PVD21D models better suited to those applications where high internal fault currents can be encountered. This is discussed in detail in the section on **APPLICATION** in this instruction book.

The PVD21A and PVD21B models of the relay include a high speed overcurrent unit (87H) in addition to the voltage operated unit (87L). This unit may be used to supplement the high speed voltage unit, and/or when provided with a suitable external timing device and auxiliaries, it may be used to implement breaker failure protection. This is also disccused in detail in the **APPLICATION** section.

The PVD relays are mounted in a single-end M1 size drawout case, and are provided with a single seal-in and separate targets for each unit. Outline and panel drilling dimensions for the relays are illustrated in Figure 1. Internal connections for the various models are illustrated in Figures 2 and 3.

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The external connections for the PVD21A and PVD21C relays are illustrated in Figure 4; those for the PVD21B and PVD21D relays are shown in Figure 5.

APPLICATION

The following comments on the applications of the Types PVD21A, PVD21B, PVD21C and PVD21D relays may be better appreciated if the detailed section on **OPERATING PRINCIPLES** is reviewed before proceeding. The Type PVD21 relays can be applied for bus protection in most cases where CTs having negligible leakage reactance are used. This generally includes any kind of current transformer with a toroidal core if the windings (on the tap used) are completely distributed about the core. The elementary diagram of the external connections for a typical application is shown in Figures 4 and 5.

A bus differential scheme utilizing Type PVD relays has certain advantages that simplify application considerations:

- Standard relaying-type bushing current transformers may be used
- Performance for specific applications is subject to simple calculations
- Protection is easily extended if the number of connections to the bus is increased.

The following points must be considered before a particular application is attempted:

All CTs in the bus differential circuit should have the same ratio. When adding to an existing bus, at least one CT in the new breaker should be ordered with the same ratio as the bus differential CTs in the existing breakers. If the differential circuit unavoidably includes different ratio CTs, the application may still be possible, but special attention must be given to protect against overvoltage conditions during internal faults.

If one or more of the CTs in Figures 4 or 5 are a different ratio than the others, it would appear that the simple solution would be to use the full winding of the lower ratio CTs and a matching tap on the higher ratio CTs. The high peak voltages that occur during an internal fault will be magnified by the autotransformer action of the tapped higher ratio CTs, and the peak voltages across the full winding of the higher ratio CTs may exceed the capability of the insulation in that circuit. Refer applications involving different ratio CTs to the local General Electric Sales office.

When all current transformers are of the same ratio, full windings, instead of taps, should be used. This will insure maximum sensitivity to internal faults in addition to limiting peak voltages. In any case, CT secondary leakage reactance must be negligible.

It may be possible, although not desirable, to use the differential circuit CTs jointly for other functions. The performance of the system under these conditons can be calculated by including the added burden as part of the CT lead resistance.

However, consideration must be given to the hazards of false operation due to extra connections and errors in testing the added devices. Note that the relays may trip if a CT secondary is open circuited during normal operation of the associated bus.

Thyrite®, a non-linear resistance, is used in the relays to limit the voltages that can be developed across the relay during an internal fault to safe values. The magnitude of the voltage that can be developed will be a function of the total internal fault current and the characteristics of the CTs used in the differential circuit. Figure 9 illustrates the safe application limits for the PVD21A and PVD21B relays as a function of the total fault current and the knee point voltage (E_S) of the poorest CT in the circuit. If the fault current and knee point voltage are such that the intersection of these two points plots below the curve, then the application will be safe with respect to the voltage limits. Note that this curve applies for the PVD21A and PVD21B relays which have a single stack of Thyrite®. If the application of these relays does not appear to be permissible on the basis of Figure 9, it may still be permissible if the PVD21C or PVD21D relay is used. These relays have two stacks of Thyrite® connected in parallel so that significantly greater internal fault currents can be accomodated. Figure 10 may be used to determine the safe application limits for the PVD21C and PVD21D relays.

During an internal fault, current will flow in the Thyrite® stack, causing energy to be dissipated. To protect the Thyrite® from thermal damage, a contact of the lockout relay must be connected as shown in Figures 4 and 5 to short out the Thyrite® during an internal fault. The thermal limits of the Thyrite® will not be exceeded provided the relay time, plus lockout relay time, is less than four cycles.

An instantaneous overcurrent unit, 87H, is connected in series with the Thyrite® in PVD21B and PVD21D models. The 87H unit, when set with the proper pickup, may be used to supplement the voltage unit, 87L, and/or implement breaker failure protection when a suitable timing relay and other auxiliary devices are provided by the user. The required setting of the 87H unit is related to the actual setting of the 87L unit.

Figure 8 illustrates the setting to be made on 87H as a function of the 87L setting. Thus, once the voltage unit setting has been calculated, the current unit setting is easily determined.

Figure 5, which applies to the PVD21B and PVD21D relays, shows the contact of the lockout relay connected to short out the Thyrite® only. However, the 87H unit is not shorted so that the relay can continue to operate as an overcurrent function, because it will stay picked up until the fault is cleared. The 87H unit may be used to implement breaker failure protection. Device 62X can be connected as shown in Figure 5A to initiate operation of the breaker failure timer.

The curve of Figure 8, which illustrates the 87H setting as a function of the 87L setting, includes sufficient margin to insure that the overcurrent unit will not operate during an external fault. For this reason, the 87H unit will be less sensitive than the 87L unit, and it may not operate for all internal faults. However, it will pick up as soon as the lockout relay operates, provided the fault current is above the pickup setting. In those cases where the 87H unit does not pick up until the lockout relay oprates, the dropout time of 87L is sufficient to overlap the pickup time of 87H, so that a continuous input will be provided to device 62X.

If any of the bus differential CTs are protected by primary and/or secondary voltage limiting devices, such as vacuum gaps, which might be the case if the bus differential zone included shunt capacitor banks, additional considerations are necessary to ensure a reliable application. Some means must be incorporated to prevent this protective equipment from shorting the operating coils of the PVD during internal faults. Such applications may be referred to the local General Electric Sales Office.

The external connection diagrams of Figures 4 and 5 indicate that the differential junction points for the relays are located in the switchyard. For outdoor installations where there is a great distance between the breaker and the relay panel, it may be desirable to locate the differential junction in the switchyard, since the resistance of the fault CT loop may otherwise be too large (refer to the section, CALCULATION OF SETTINGS). Note that the cable resistance from the junction point to the relay is not included as part of the fault CT loop resistance. It is permissible to locate junction points at the panel, providing that the resulting relay setting gives the desired sensitivity.

The 87L unit should be set no higher than 0.67 times the secondary excitation voltage at ten amperes secondary excitation current (evaluated for the poorest CT in the differential circuit).

When circuit breakers are to be bypassed for maintenance purposes, or when any other atypical setup is to be made, other means than simply opening the PVD contact circuit should be used to avoid incorrect tripping. Voltages that exceed the continuous rating of the PVD may be developed with the high impedance operating coil still connected in the differential circuit. This can be avoided by removing the connection plug, or if external means are required, by short circuiting studs 4 and 5 to stud 6.

The following information must be obtained before settings are determined for a particular application:

- Determine the secondary winding resistance for all the CTs involved
- Obtain the secondary excitation curves for all the CTs involved
- Determine the resistance of the cable leads from the CTs to the differential junction point.

CONSTRUCTION

The Type PVD relays are assembled in the medium size single-end (M1) drawout case having studs at one end in the rear for external connections. The electrical connections between the relay and case studs are through stationary molded inner and outer blocks, between which nests a removable connecting plug. The inner block has the terminals for the internal connections.

Every circuit in the drawout case has an auxiliary brush, as shown in Figure 13, to provide adequate overlap when the connecting plug is withdrawn or inserted. Some circuits are equipped with shorting bars (see internal connections, Figures 2 and 3), and it is especially important that the auxiliary brush make contact on those circuits with adequate pressure to prevent the opening of important interlocking circuits, as indicated in Figure 13.

The relay mechanism is mounted in a steel framework called the cradle and is a complete unit with all leads terminated at the inner block. This cradle is held firmly in the case with a latch at both top and bottom and by a guide pin at the back of the case. The connecting plug, besides making the electrical connections between the respective blocks of the cradle and case, also locks the latch in place. The cover, which is drawn to the case by thumbscrews, holds the connecting plugs in place. The target reset mechanism is a part of the cover assembly.

The relay case is suitable for either semiflush or surface mounting on all panels up to two inches thick, and appropriate hardware is available; however, panel thickness must be indicated on the relay order to insure that the proper hardware will be included. Outline and panel drilling dimensions are shown in Figure 1.

A separate testing plug can be inserted in place of the connecting plug to test the relay in place on the panel, either from its own source of current and voltage, or from other sources. The relay also can be drawn out and replaced by another which has been tested in the laboratory.

The relays covered by these instructions include two hinged armature type operating units: a "low-set" voltage unit, device 87L, and a "high-set" current unit, device 87H.

Device 87L is an instantaneous telephone-type voltage unit having its coil connected across the DC terminal of a full wave rectifier. In turn, the rectifier is connected to a high pass filter through an attenuator network. The 87L unit has two normally open contacts. One set of contacts is connected between terminals 7 and 8, and the other set is connected in parallel with the contacts of the seal-in unit.

Device 87H is an instantaneous overcurrent unit, mounted in the upper right hand corner, with its coil connected in series with Thyrite® resistor discs. A single set of normally open contacts is connected between terminals 9 and 10.

Hi-Seismic Seal-in Unit

A seal-in unit is mounted in the upper left corner of the relay (see Figure 3). The unit has its coil in series and its contacts in parallel with a set of normally open contacts of the 87L unit. When the seal-in unit picks up, it raises a target into view. The target latches up and remains exposed until it is released by manual operation of the reset button, which is located at the lower left corner of the relay.

RANGES

These relays are available for 60 hertz. The standard operating ranges available are given in the table below. Factors which influence the selection of the operating range are covered in the section on **CALCULATION OF SETTINGS**.

TABLE 2

87L UNIT RANGE	LINK POSITION	RANGE VOLTS	CONTINUOUS RATING VOLT
75-500	L H	75 - 200 200 - 500	150 150

TABLE 3

87H HI-SEISMIC INSTANTANEOUS UNIT (AMPS)	LINK POSITION	*RANGE (AMPS)	CONTINUOUS RATING (AMPS)	*ONE SECOND RATING (AMPS)
2-50	L H	2 - 10 10 - 50	3.7 7.5	130

*The range is approximate, which means that the 2-10, 10-50 ampere range may be 2-8, 7-50 amperes. There will always be at least one ampere overlap between the maximum L setting and the minimum H setting. Select the higher range whenever possible, since it has the higher continuous rating.

For other ranges, consult the local General Electric Sales Office.

87L Continuous Rating

The voltage circuit included in the 87L unit has a continuous voltage rating of 150 volts RMS. Refer to the **ACCEPTANCE TESTS** section for precautions that should be taken during testing.

Contacts

The current closing rating of the contacts is 30 amperes for voltages not exceeding 150 volts. The current carrying rating is limited by the seal-in unit rating.

HI-SEISMIC TARGET AND SEAL-IN UNIT

The Type PVD relay is provided with a universal target and seal-in unit having 0.2 and 2.0 ampere taps as indicated in the following tabulations.

If the tripping current exceeds 30 amperes, an auxiliary relay should be used. Its connections should be such that the tripping current does not pass through the contacts or the target and seal-in coils of the protective relay.

TABLE 4

RATINGS OF THE SEAL-IN UNIT COIL

		TAP	
		0.2	2.0
DC Resistance +10%	(ohms)	8.0	0.24
Minimum Operating +0%, -25%	(amperes)	0.2	2.0
Carry Continuous	(amperes)	0.3	3.0
Carry 30 Amperes	(seconds)	0.03	4.0
Carry 10 Amperes	(seconds)	0.25	30.0
60 Hertz Impedance	(ohms)	52	0.53

OPERATING PRINCIPLES

All of the Type PVD relays include a high impedance voltage sensing unit (87L) that operates from the voltage produced by the differentially connected CTs during an internal fault. The relays are also provided with either one or two Thyrite® stacks (see Table 1) connected in parallel with the 87L unit to limit the voltage across the relay to safe values during internal faults. In limiting the voltage, the Thyrite® will pass significant current during internal faults, but very little current during normal operating conditions or external faults. The PVD21B and PVD21D relays are provided with an instantaneous overcurrent unit (87H) connected in series with the Thyrite®. The 87H unit is set so that it will not operate for the maximum external fault, but will operate for heavy internal faults.

The diagrams of Figures 4 and 5 illustrate typical external connections to the relays for use in a bus differential scheme. A conventional differential circuit is utilized, that is, the CTs associated with all of the circuits off the bus are connected in wye and paralleled on a per-phase basis. One PVD relay per phase is required to provide complete protection for the bus.

VOLTAGE UNIT (87L) - PVD21A, PVD21B, PVD21C, PVD21D

If a protection scheme utilizing a PVD relay is to perform satisfactorily, it must not trip for faults external to the zone of protection, such as at F1 in Figure 6. Since the PVD relay is a high impedance device, consider the effect of an external single line to ground fault. Figure 6 illustrates this condition for the faulted phase only. Each of the CTs associated with an infeeding circuit will produce the secondary voltage necessary to drive its secondary current through its winding and leads. The CT in the faulted circuit will produce the voltage necessary to drive the total secondary fault current through its winding and leads. If all of the CTs were to perform ideally, there would be negligible voltage developed across junction points A and D, and hence across the PVD relay. Incidentally, load flow across the bus is similar in effect to an external fault, so there will also be little voltage developed across the relay during normal operating conditions. Unfortunately, during fault conditions CTs do not always perform ideally, because core saturation can cause a breakdown in CT ratio. Such core saturation is generally accentuated by DC transients in the primary current. Any residual flux left in the core may also add to the tendency to saturate.

In the example of Figure 6, the worst condition would be realized if the CT associated with the faulted circuit saturated completely, thus losing its ability to produce a secondary voltage, while the other CTs did not saturate at all. When a CT saturates completely, its secondary impedance approaches the secondary winding resistance, provided the secondary leakage reactance is negligible. This will be the case when CTs wound on a toroidal core with completely distributed windings are used. The CTs in the infeeding circuits would then be unassisted by the fault CT and would have to produce enough voltage to force their secondary currents through their own windings and leads, as well as the windings and leads of the CT associated with the faulted circuit. As a result, a voltage will be developed across the junction points, A and D, and hence across the PVD relay. The magnitude of this voltage will simply be equal to the product of the total resistance in the CT loop circuit and the total fault current in secondary amperes, that is,

$$V_R = (R_S + 2R_L) \frac{I_F}{N} \qquad (1)$$

where: V_R = voltage across PVD relay
R_S = CT secondary winding and lead resistance
R_L = one way cable resistance from junction point to CT
I_F = RMS value of primary fault current
N = CT ratio

Note that the factor of two, appearing with the R_L term, is used to account for the fact that all of the fault current will flow through both the outgoing cable and the return cable for single line to ground faults. If the CTs are connected as shown in Figures 4 or 5, no current will flow in the return lead for three phase faults, thus the maximum voltage developed across the PVD relays for three phase faults can be calculated as follows:

$$V_R = (R_S + R_L) \frac{I_F}{N} \qquad (2)$$

Equations (1) and (2) can be consolidated and written as follows:

$$V_R = (R_S + PR_L) \frac{I_F}{N} \qquad (3)$$

where: P = 1 for three phase faults, and 2 for single line to ground faults.

For the conditions in question, this voltage, V_R, is the maximum voltage that could possibly be developed across the PVD relay. Obviously, the CT in the faulted circuit will not lose all of its ability to produce an assisting voltage, and the CTs in the infeeding circuits may tend to saturate to some degree. In practice, the voltage developed across the relay will be something less than that calculated from equation (3) above. The effect of CT saturation is accounted for by the CT performance factor, K, used in the equation for calculating the actual voltage setting, and it is discussed further in the section **CALCULATION OF SETTINGS**.

Now consider the effect of an internal fault. In this case, all of the infeeding CTs will be operating into the high impedance PVD in parallel with any idle CTs. The voltage developed across the junction points A and D will now approach the open circuit

secondary voltage that the CTs can produce. Even for a moderate internal fault, this voltage will be in excess of the value calculated for the maximum external fault as described above. Therefore, the high impedance voltage sensing unit, 87L, can be set with a pickup setting high enough so that it will not operate as the result of the maximum external fault, but will still pick up for moderate and even slight internal faults. Consequently, the relay will be selective between internal faults and external faults or load flow.

The actual equation for calculating the 87L voltage unit setting, taking CT performance and margin into account, is as follows:

$$V_R = (K)\ (1.6)\ (R_S + PR_L)\ \frac{I_F}{N} \qquad (4)$$

where: K = CT performance factor (see Figure 7)
1.6 = margin factor

All other terms are as described above.

OVERCURRENT UNIT (87H) - PVD21B, PVD21D

The PVD21B and PVD21D relays are similar to the PVD21A and PVD21C relays, respectively, except for the addition of the 87H unit in series with the Thyrite®. The 87H unit is set so that it will not operate on the current passed by the Thyrite® during external faults, but so that it will operate on the current passed during heavy internal faults.

During normal operating conditions, there will be little voltage developed across the PVD relay, and hence across the series combination of the Thyrite® and 87H. During external faults, the same would be true if the CTs did not saturate. Even if the CT in the fault circuit saturated completely, the maximum voltage that could be developed across the relay would be limited to the drop in the CT resistance plus the associated cable resistance. Because 87L is set at some value above the maximum expected drop, it is possible to determine the current through the Thyrite® at the 87L setting, and so determine a suitable setting for 87H to insure that it does not operate for the maximum external fault. Figure 8 illustrates the minimum safe pickup setting to be made as a function of the 87L setting with suitable margin included. Thus, once the 87L setting has been calculated, the 87H setting can be easily determined from Figure 8.

During internal faults, the CTs will attempt to drive all of the fault current through the high impedance PVD relay. As a result, the voltage will build up quite rapidly across the relay. As the voltage builds up, the nonlinear Thyrite® will exhibit a declining resistance characteristic, so that significant current will flow through the Thyrite® and so cause 87H to operate. Because of the margin involved in setting the 87H unit, it will not be quite as sensitive as the 87L unit and it may not operate for some low level faults. It is not possible to predict at exactly what fault level the 87H unit will operate because of the numerous factors involved. However, 87H still may be used to supplement tripping by 87L with the assurance that it will at least operate for heavy internal faults. The 87H unit may also be used to implement breaker failure protection, as described in the APPLICATION section.

CALCULATION OF SETTINGS

The formulas and procedures described in the following paragraphs for determining relay settings assume that the relay is connected to the full windings of differentially connected CTs. Further, they assume that the secondary winding of each CT has negligible leakage reactance, and that all of the CTs have the same ratio. If these are not the conditions that exist in your application, please contact the nearest General Electric District Sales Office.

SETTING OF THE HIGH IMPEDANCE UNIT, 87L

Assuming that an external fault causes complete saturation of the CT in the faulted circuit, the current forced through this secondary by the CTs in the infeeding circuits will be impeded only by the resistance of the winding and leads. The resulting IR drop will be the maximum possible voltage which can appear across the PVD relay for that external fault. The setting of the high impedance 87L unit was described in **OPERATING PRINCIPLES.** It is expressed as follows:

$$V_R = (K)\ (1.6)\ (R_S + PR_L)\ \frac{I_F}{N} \qquad (5)$$

where: V_R = pickup setting of 87L unit
R_S = DC resistance of faulted CT secondary windings and leads to housing terminal
R_L = single conductor DC resistance of CT cable for one way run from CT housing terminal to junction point (at highest expected operating temperature)
P = 1 for three phase faults, 2 for single phase to ground faults
I_F = external fault current, primary RMS value
N = CT ratio
1.6 = margin factor
K = CT performance factor from Figure 6.

The calculations only need to be made with the maximum value of I_F for single phase and three phase faults. If the relay is applicable for these conditions, it will perform satisfactorily for all faults.

As previously noted in **OPERATING PRINCIPLES**, the pessimistic value of voltage determined by equation (5) for any of the methods outlined is never realized in practice. The CT in the faulted circuit will not saturate to the point where it produces no assisting voltage. Furthermore, the condition which caused the faulted CT core to saturate also tends to saturate the cores of the CTs in the infeeding circuits, resulting in a further decrease in voltage across the PVD relay. These effects are not readily calculated; however, extensive testing under simulated fault conditions on bushing CTs similar to those supplied in most circuit breakers manufactured in the United States, has resulted in the establishment of a so-called "performance factor," which can be determined for each application. The performance factor, K, is not a constant for a given bushing CT, but varies for each installation, depending on the value of $(R_S + PR_L)\ I_F/N$. K is readily determined from the curve of Figure 6, which is based on test data. The use of this curve is explained in SAMPLE CALCULATIONS.

* The value of the 87L unit setting established by equation (5) is the minimum safe setting. Higher settings will provide more safety margin, but will result in somewhat reduced sensitivity.

* The methods of utilizing equation (5) are outlined below:

Method I - Exact Method:

(1) Determine the maximum three phase and single phase to ground fault currents for faults just beyond each of the breakers.

(2) The value R_L is the one way cable DC resistance from the junction point to the faulted CT being considered.

(3) For each breaker in turn, calculate V_R separately utilizing the associated maximum external three phase fault current, with P = 1, and the maximum external single phase to ground fault current, with P = 2.

(4) Use the highest of the values of V_R obtained in (3) above.

Method II - Simplified Conservative Method:

(1) Use the maximum interrupting rating of the circuit breaker as the maximum external single phase to ground fault current.

(2) The value R_L is based on the distance from the junction point to the most distant CT.

(3) Calculate a value for V_R using P = 2.

(4) This value of V_R becomes the pickup setting.

Begin with Method II. The calculated value of V_R is determined as outlined in the paragraph, "Minimum Fault to Trip 87L." If the sensitivity resulting from the value calculated is not adequate, then Method I should be used. When the 87L pickup from Method II proves to yield an adequate sensitivity, a unique advantage is realized, since the 87L pickup setting will not require recalculation following changes in system configuration, which would result in higher bus fault magnitudes.

It is desirable for the pickup voltage of the 87L unit to plot below the knee point of the excitation curve (that is, the point on the excitation curve where the slope is 45 degrees) of all the CTs in use. However, it is permissible for the 87L pickup voltage to be higher than the knee point voltage. The maximum setting for the 87L unit is equal to the secondary excitation voltage at ten amperes secondary excitation current (evaluated for the poorest CT in the differential circuit), multiplied by 0.67.

Minimum Fault to Trip 87L Unit

After the pickup setting of the 87L unit has been established for an application, a check should be made to determine the minimum internal fault current which will just cause the unit to operate. If this value is less than the minimum internal fault current expected, the pickup setting is suitable for the application. The following

expression can be used to determine the minimum internal fault current required for a particular 87L unit pickup setting:

$$I_{min} = \left[\sum_{X=1}^{n} (I)_X + I_R + I_1 \right] N \qquad (6)$$

where: I_{min} = minimum internal fault current to trip 87L
n = number of breakers connected to the bus, (i.e., number of CTs per phase)
I = secondary excitation current of individual CT at a voltage equal to the pickup of 87L
I_R = current in 87L unit at pickup voltage = $V_R/1700$
I_1 = current in the Thyrite® unit at 87L pickup voltage (see Figure 11)
N = CT ratio

The values of I_1, I_2, etc., are obtained from the secondary excitation characteristics of the respective CTs. The first term in equation (6) reduces to NI if it is assumed that all CTs have the same excitation characteristic. The relay curent, I_R, can be determined from the impedance of the 87L circuit, assumed to be constant at 1700 ohms. That is:

$$I_R = V_R/1700 \qquad (7)$$

The current drawn by the Thyrite® unit, I_1, can be obtained from that curve in Figure 11 that applies to the relay being used.

SETTING OVERCURRENT UNIT, 87H

The required setting for the overcurrent unit, 87H, is dependent on the actual setting of the voltage unit, 87L. Figure 8, which is a plot of the 87H setting in RMS amperes versus the 87L setting in RMS volts, illustrates the relationship between these two settings. In order to determine the required 87H setting, it is only necessary to calculate the 87L setting and then enter the curve of Figure 8 at that value of voltage to read the 87H setting directly.

SAMPLE CALCULATION

The various steps for determining the settings of the PVD relay in a typical application will be explained with the aid of a worked example. Method II will be used with the following assumed parameters:

Number of breakers: five
Maximum breaker interrupting rating: 40,000 amperes
Cable resistance for longest run: 0.50 ohms at 25°C
CT Ratio: 1200/5

The characteristics for the 1200/5 CT are shown in Figure 12. The value of R_S from this figure is:

$$R_S = (0.0029)\ (240) + 0.113 = 0.809 \text{ ohms}$$

The cable resistance for the longest CT run is given at 25°C. If higher operating temperatures are expected, this must be taken into account in determining the maximum expected resistance. Resistance values of wire at 25°C, or at any temperature, t1, may be corrected to any other temperature, t2, as follows:

$$R_{t2} = \left[1 + P_1 (t2 - t1)\right] R_{t1}$$

where: R_{t1} = resistance in ohms at t1, degrees Centigrade
R_{t2} = resistance in ohms at t2, degrees Centigrade
P_1 = temperature coefficient of resistance at t1

For standard annealed copper, $P_1 = 0.00385$ at t1 = 25°C; therefore the value of R_L at 50°C is:

$$R_L = 1 + 0.00385 (50 - 25) \quad 0.5 = 0.548 \text{ ohms}$$

The CT performance factor, K, must next be determined. To do this, first calculate:

$$\frac{(R_S + PR_L)\ (I_F)}{(E_S)\ (N)}$$

Because Method II was selected, use P = 2. From Figure 12, E_S = 300 volts

$$\frac{[(0.809) + (2)\ (0.548)\ \ (40,000)]}{(300)\ (240)} = 1.06$$

From Figure 7, K = 0.7.

* Using Equation (5), the appropriate relay setting is:

$$V_R = \frac{(1.6)\ (0.7)\ [0.809 + (2)\ (0.548)]\ (40,000)}{240}$$

$$V_R = 355 \text{ volts}$$

This value is just above the knee point (300 volts) of the CT characteristic, and well below 67 percent of the voltage at ten amperes excitation (0.67) (590) so the application is satisfactory in that respect.

Next it is necessary to determine whether the PVD21A or PVD21D, or the PVD21C or PVD21D (one versus two Thyrite® stacks) should be used. First determine the knee point voltage, E_S, for the poorest CT in the circuit. From Figure 12, E_S = 300 volts (all CTs are assumed to be identical). Assume that the maximum internal fault current is 45,000 amperes primary, which is equivalent to 188 amperes secondary. The curve of Figure 10, when entered at these coordinates (300 volts and 188 amperes), shows that the application is safe for either the PVD21C or PVD21D relays (two Thyrite® stacks). If Figure 9 were entered at the same coordinates, it would show that PVD21A or PVD21B would not be applicable.

The next step in the calculation is to determine the sensitivity of the relay to * internal faults. This may be done using equation (6) as follows:

From the excitation curve of Figure 12, I at 355 volts: 0.07 amperes

From the Thyrite® curve of Figure 11, I at 355 volts: 1.1 amperes (use curve for two Thyrite® stacks)

From equation (7):

$$I_R = 355/1700 = 0.209 \text{ amperes}$$

From equation (6):

$$I_{min} = (0.07) + 1.1 + 0.029 \quad 240$$

$$I_{min} = 398 \text{ amperes primary}$$

If the minimum internal primary fault current is above 398 amperes, the pickup setting of 355 volts is adequate.

If the instantaneous overcurrent unit will be included in the relay, then the PVD21D must be used. To determine the 87H setting, enter the curve of Figure 8 at the calculated 87L setting of 355 volts. Read the 87H setting from the scale for the PVD21D relay. For the 355 volt setting of 87L, the appropriate setting for 87H is 11.8 amperes.

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 damage resulting from rough handling is evident, file a damage claim at once with the transportation company and promptly notify the nearest General Electric Apparatus Sales Office.

Reasonable care should be exercised when unpacking the relay in order that none of the parts are damaged nor 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 insure that no damage has been sustained in shipment and that the relay calibrations have not been disturbed. These tests may be performed at the discretion of the user, since most operating companies use different procedures for acceptance and installation tests. The following section includes all applicable tests that may be performed on these relays.

VISUAL INSPECTION

Check the nameplate stamping to insure that the model number, rating and calibration range of the relay received 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.

MECHANICAL INSPECTION

Cradle and Case Blocks

Check that the fingers on the cradle and case agree with the internal connection diagram. Check that the shorting bars are in the correct position, and that each finger with a shorting bar makes contact with the shorting bar. Deflect each contact finger to insure that there is sufficient contact force available, and check that each auxiliary brush is bent high enough to contact the connection plug.

Contact 87L

The following mechanical adjustments must be checked:

1. The armature and contacts of the seal-in unit, as well as the armature and contacts of the instantaneous unit, should move freely when operated by hand. There should be at least 0.015 inch wipe on the seal-in contacts.

2. The targets in the seal-in and the instantaneous unit must come into view and latch when the armatures are operated by hand, and they should unlatch when the target release button is operated.

3. The brushes and shorting bars should agree with the internal connections diagram.

4. With the telephone relays in the de-energized position, all circuit closing contacts should have a gap of 0.015 inch, and all circuit opening contacts should have a wipe of 0.005 inch. The gap may be checked by inserting a feeler gage. 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 SETTING AND INSPECTION

Hi-Seismic Instantaneous Unit, 87H

Make sure the instantaneous unit link is in the correct position for the range in which it is to operate. See internal connections diagram, Figures 3 and 4, and connect as indicated in the test circuit of Figure 14A. Use the higher range whenever possible, since the higher range has a higher continuous rating.

Setting the Hi-Seismic Instantaneous Unit

The instantaneous unit has an adjustable core located at the top of the unit. To set the instantaneous unit to a desired pickup, loosen the locknut and adjust the core. Turning the core clockwise decreases the pickup; turning it counterclockwise increases it. Bring the current up slowly until the unit picks up. It may be necessary to repeat this operation until the desired pickup value is obtained. Once the desired pickup value is reached, tighten the locknut.

CAUTION: Refer to the **RATINGS** section for continuous and one second ratings of the instantaneous unit. Do not exceed these ratings when applying current to the instantaneous unit.

The range of the instantaneous unit must be obtained between one-eighth and 20 turns counterclockwise of the core from the fully clockwise position.

Hi-Seismic Target and Seal-in Unit

The target and seal-in unit has an operating coil tapped at 0.2 and 2.0 amperes. The relay is shipped from the factory with the tap screw in the lower ampere position. The tap screw is the screw holding the right had stationary contact. To change the tap setting, first remove one screw from the left-hand stationary contact and place it in the desired tap. Next remove the screw from the unwanted tap and place it on the left-hand stationary contact where the first screw was removed. This procedure is necessary to prevent the right-hand stationary contact from getting out of adjustment. Screws should never be left in both taps at the same time.

TABLE 5

TAP	PICKUP CURRENT	DROPOUT CURRENT
0.2	0.15 - 0.195	0.05 or more
2.0	1.50 - 1.95	0.50 or more

87L Unit

The 87L unit can be adjusted at any voltage within the range shown on its calibration plate. Four specific calibration values, for both the high and low voltage range are shown on the plate, which correspond to the values stamped on the nameplate. The 87L unit, unless otherwise specified on the requisition, will be set at the factory to operate at its minimum pickup voltage. If the unit is to be set at some other point, the calibration marks should be used as a guide in making a rough adjustment, and the test circut of Figure 14B should then be used to make an exact setting.

When the test plug is inserted in the relay, as depicted in Figure 14B, the current transformer secondaries are shorted by means of the link between the outer terminals 5 and 6. The adjustable test voltage is applied across terminals 5 and 6 of the relay; that is, across the voltage circuit which includes the 87L unit. Since the continuous voltage rating of the resonant circuit is only 150 volts, it is recommended that a hand-reset lockout relay be used in the test setup if the desired 87L setting is to be above this figure.

The following procedure should be followed in checking pickup of the 87L unit. Start with a test voltage considerably higher than the expected operating point. Lower the test voltage by successively smaller increments, closing the test switch at each point. The lockout relay will operate each time, protecting the resonant circuit. Eventually, a point will be reached where the 87L unit will just fail to operate. The preceding voltage value, therefore, is the pickup value of the 87L unit (within reasonable accuracy).

At the point where the 87L unit fails to pick up, the test voltage must be removed at once to prevent damage to the relay.

If the 87L unit setting is to be less than the 150 volt continuous rating, it will not be necessary to use the lockout relay. The voltmeter used must have high internal impedance.

The 87L unit operating time can be checked by using the test circuit shown in Figure 14B and measuring the time elapsed between application of the input voltage and the operation of the 87L output contacts. The times measured should be within plus three and minus seven milliseconds of the time shown in Figure 15.

Thyrite® Unit

Apply 120 volts direct current to studs 3 and 6. The current should be between 0.005 and 0.012 amperes for a single stack, and between 0.010 and 0.024 amperes for a double stack of Thyrite®. The Thyrite® is very voltage sensitive, and should be set carefully. Also, any meter error in the voltmeter will be magnified four to five times, for example, a three percent meter error will have an effect on the current of from 12 to 15 percent.

INSTALLATION PROCEDURE

LOCATION AND MOUNTING

The relay should be mounted on a vertical surface in a location reasonably free from excessive heat, moisture, dust and vibration. The relay case may be grounded using at least #12 AWG gage copper wire. The outline and panel drilling dimensions for Type PVD relays are shown in Figure 1.

CONNECTIONS

Internal connections diagrams for the Type PVD21A and PVD21C, and the Type PVD21B and PVD21D relays, are shown in Figures 2 and 3, respectively. The elementary diagram of the external connections for a typical application is shown in Figure 4.

Note in Figure 4 that when the relay is installed, a connecting jumper should be placed between terminals 4 and 5, and that terminals 5 and 6 are then connected across differential junction points A and B of the several current transformers. A shorting bar is provided between terminals 5 and 6 so that if the connection plug of the relay is withdrawn, the differential circuit will not be opened.

The midpoint between the Thyrite® stack and unit 87H is connected to terminal 3. This makes it possible to test or calibrate unit 87H without the necessity of passing

*Indicates Revision

high current through the Thyrite®, and makes it possible to short out the 87H coil when its operation is not necessary.

The external connections in Figure 4 indicate that the differential junction, points A and B, should be located in the switchyard. This is important in outdoor installations where the distance between the breaker and relay panel may be great, since the resistance through the fault CT loop may otherwise be too large. The junction points can be located at the panel, provided that the necessary relay setting gives the desired sensitivity.

There should be only one ground connection in the secondary circuit. When the junction points are located in the switchyard, the ground connection should be made there rather than at the panel.

The voltage limiting Thyrite® is short-time rated. The contacts of the auxiliary relay device 86 short circuits the differential circuit to protect it.

CAUTION: UNDER NO CIRCUMSTANCES SHOULD THE RELAY BE PLACED IN SERVICE WITHOUT THE THYRITE VOLTAGE LIMITING CIRCUIT CONNECTED; THAT IS, WITHOUT A JUMPER BETWEEN TERMINALS 4 AND 5. OTHERWISE, THE RELAY AND SECONDARY WIRING WILL NOT BE PROTECTED FROM HIGH CREST VOLTAGES WHICH RESULT FROM AN INTERNAL FAULT.

VISUAL INSPECTION

Repeat the items described under **ACCEPTANCE TESTS**, VISUAL INSPECTION.

MECHANICAL INSPECTION AND ADJUSTMENTS

Repeat the items described under **ACCEPTANCE TESTS**, MECHANICAL INSPECTION.

TARGET/SEAL-IN UNIT

Set the target/seal-in unit tap screw in the desired position. The contact adjustment will not be disturbed if a screw is first transferred from the left contact to the desired tap position on the right contact, and then the screw in the undesired tap is removed and transferred to the left contact.

87H AND 87L UNITS

Refer to the appropriate descriptions in **ACCEPTANCE TESTS** for the proper method of setting the 87L and 87H units.

The external trip circuit wiring to the relay, as well as the relay itself, should be checked by operating one of the relay units by hand and allowing it to trip the breaker or lockout relay. Observe that the target operates upon manual operation of the relay unit.

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 points listed under **INSTALLATION PROCEDURE** be checked at an interval of from one to two years.

Check the items described in **ACCEPTANCE TESTS**, both VISUAL and MECHANICAL INSPECTION. Examine each component for signs of overheating, deterioration, or other damage. Check that all connections are tight by observing that the lockwashers are fully collapsed.

CONTACT CLEANING

Examine the contacts for pits, arc or burn marks, corrosion and insulating films. 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 never be cleaned with knives, files, or abrasive paper or cloth.

PERIODIC TEST EQUIPMENT

A test set is available for periodic testing of PVD relays. It is intended to be mounted on the panel adjacent to the relays, and in addition to testing, it can also be used to check current transformers for open or short circuits, and incorrect wiring. This test set is more fully described in instruction book GEI-50290.

ELECTRICAL TESTS

Pickup of the 87L and 87H units should be measured and the results compared against the desired setting. If a measured value is slightly different from that measured previously, it is not necessarily an indication that the relay needs readjustment. The errors in all the test equipment are additive, and the total error of the present setup may be of opposite sign from the error present during the previous periodic test. Instead of readjusting the relay, if the test results are acceptable, no adjustment should be made. Note the deviation on the relay test record. After sufficient test data has been accumulated, it will become apparent whether the measured deviations in the setting are due to random variations in the test conditions, or are due to a drift in the relay characteristics.

THYRITE® UNIT

Repeat the test described in **ACCEPTANCE TESTS**, ELECTRICAL INSPECTION.

HI-SEISMIC INSTANTANEOUS UNIT, 87H

Check for the following:

1. Both contacts should close at the same time.

2. The backing should be so formed that the forked end (front) bears against the molded strip under the armature.

3. With the armature against the pole piece, the cross member of the "T" spring should be in a horizontal plane, and there should be at least 0.015 inch wipe on the contacts. Check by inserting a 0.010 inch feeler gage between the front half of the shaded pole with the armature held closed. The contacts should close with the feeler gage in place.

HI-SEISMIC TARGET AND SEAL-IN UNIT

Check steps 1 and 2 as described in the paragraph above for the instantaneous unit. To check the wipe of the seal-in unit, insert a 0.010 inch feeler gage between the plastic residual bump of the armature and the pole piece with the armature held closed. The contacts should close with the feeler gage in place.

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 catalog numbers as shown in Renewal Parts Bulletin GEF-4543.

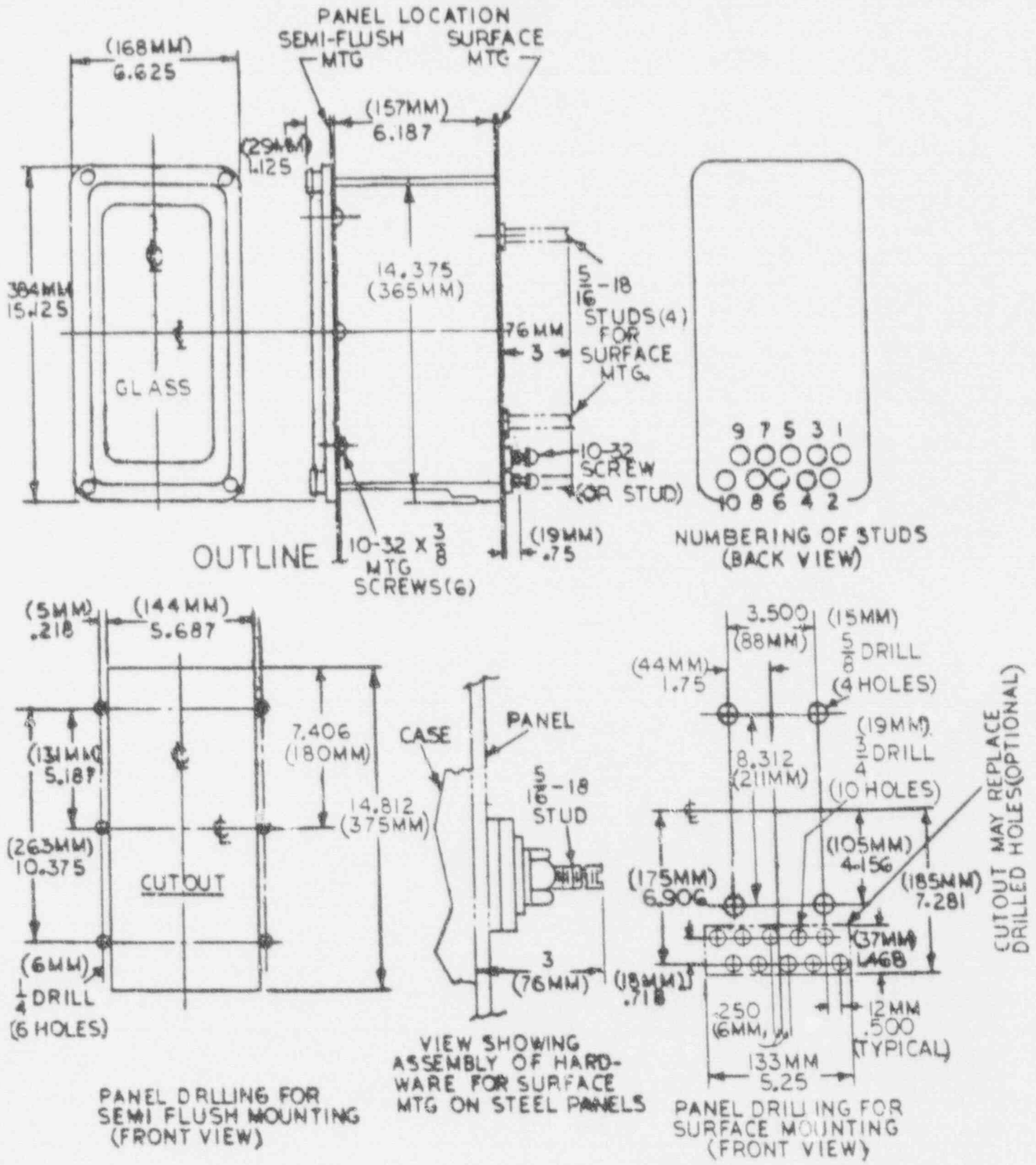


Figure 1 (K-6209273-3) Outline and Panell Drilling Dimensions for an M1 Case

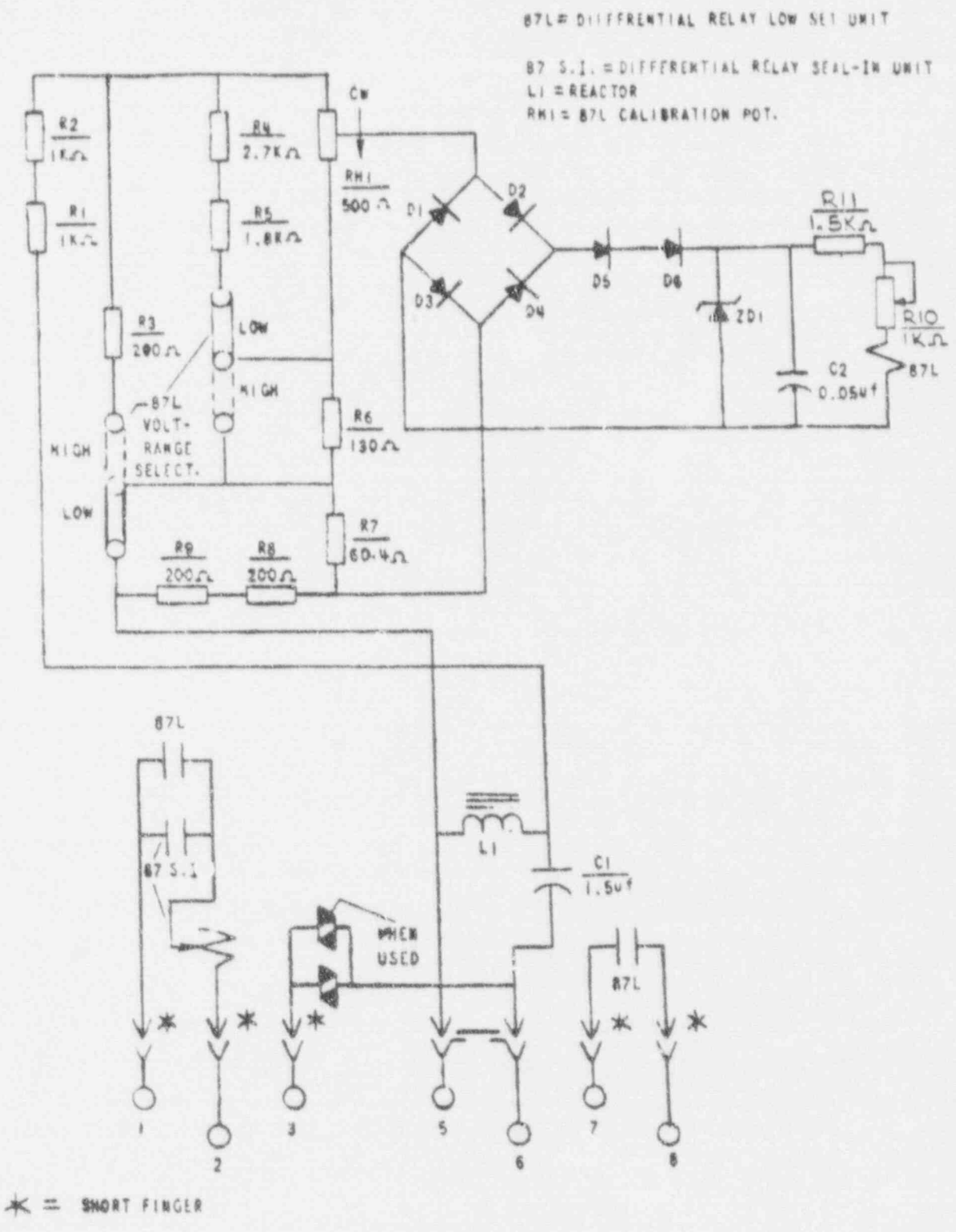


Figure 2 (0257A8374-2) Internal Connections for Type PVD21A and Type PVD21C Relays

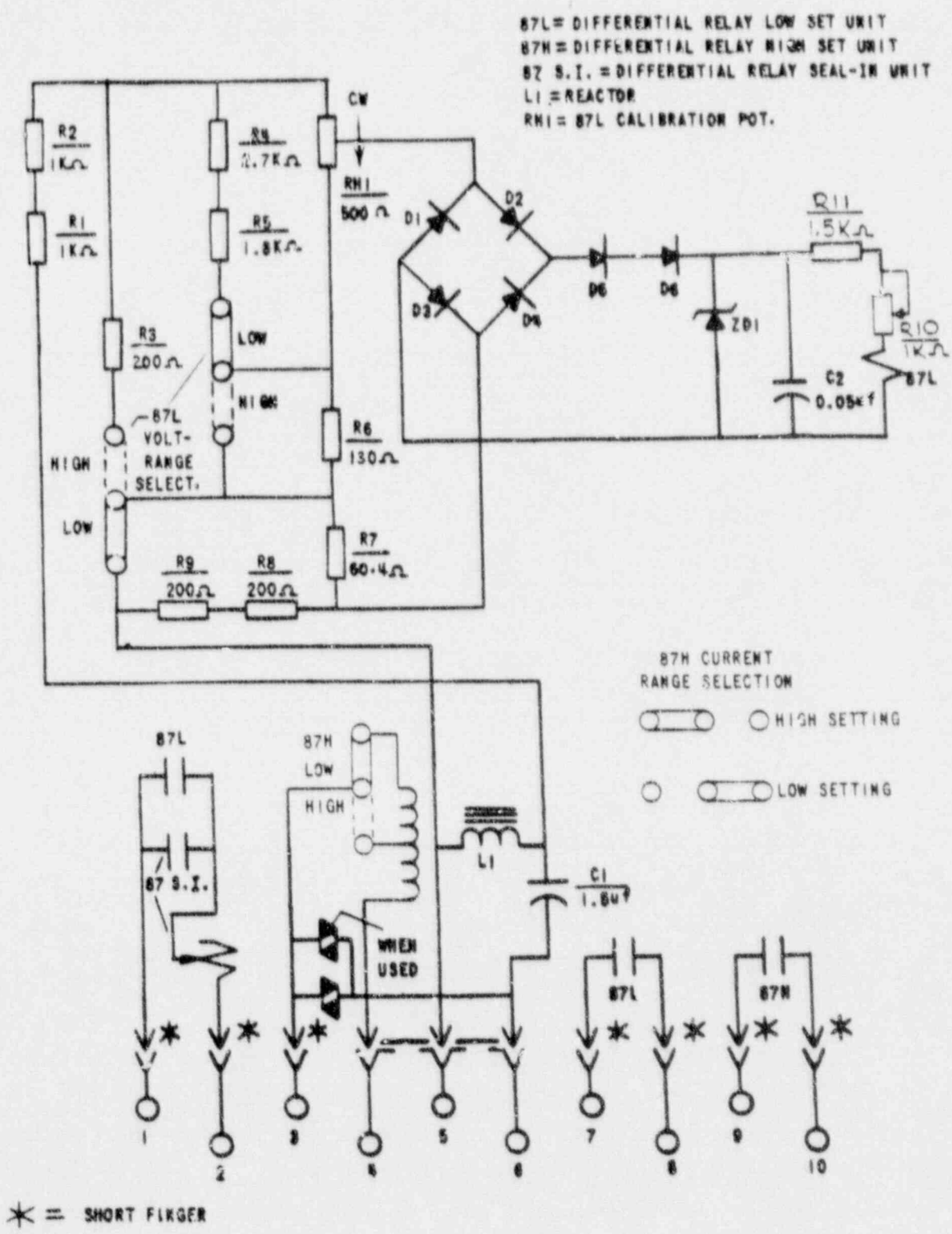


Figure 3 (0257A8387-2) Internal Connections for Type PVD21B and Type PVD21D Relays

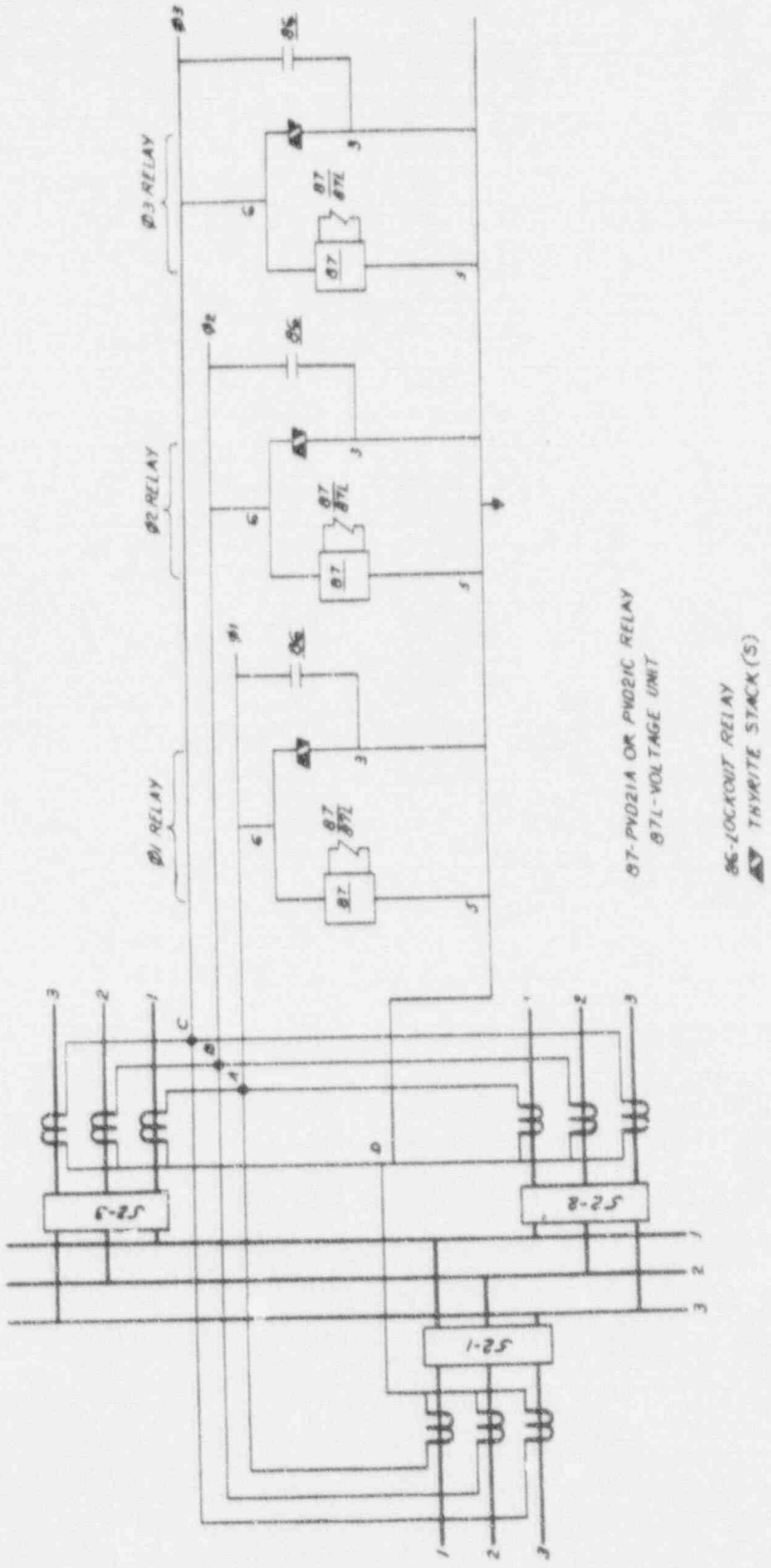


Figure 4 (0108B8928-0, Sh. 1) External AC Connections for Type PVD21A or Type PVD21C Relays

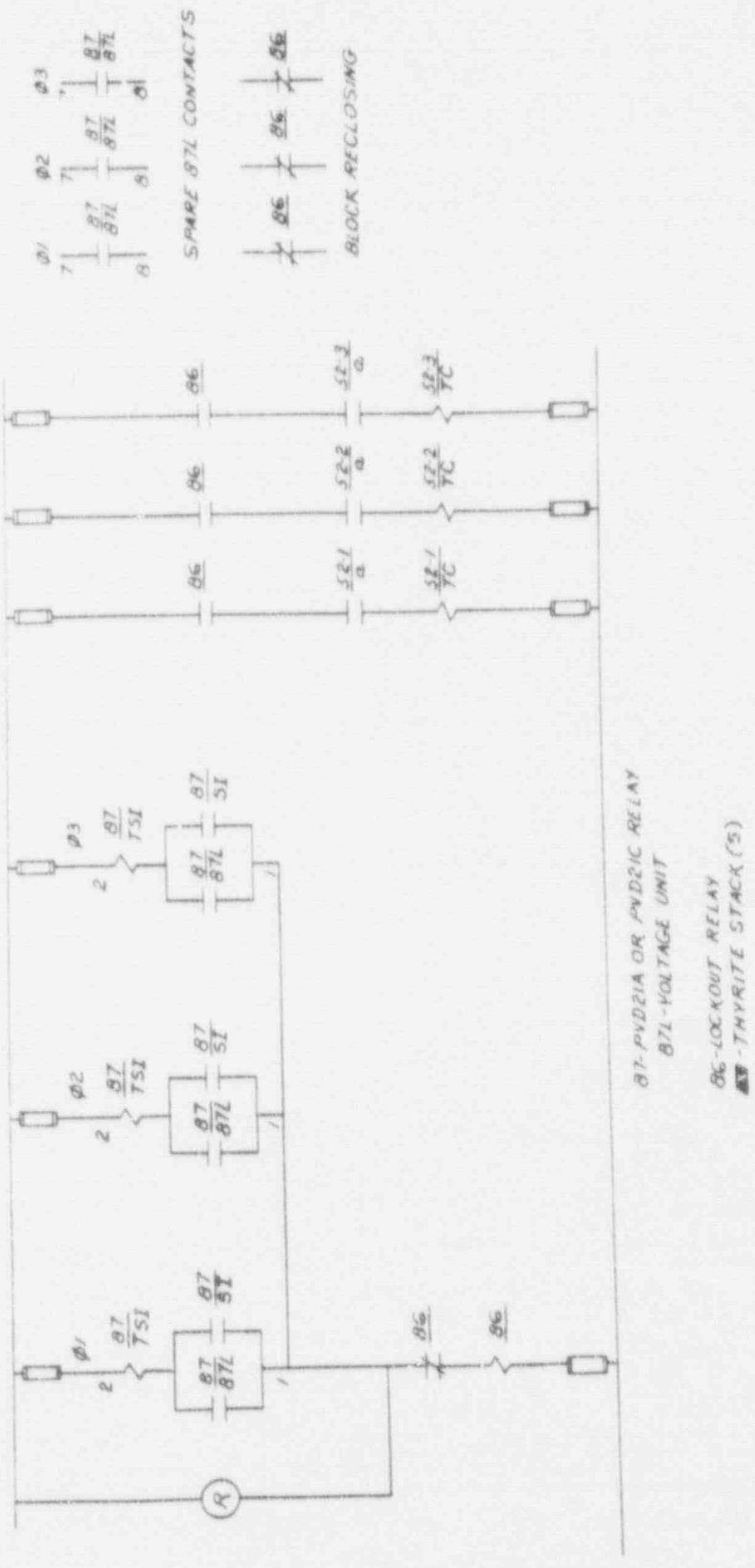


Figure 4A (0108B8928-0, Sh. 2) External DC Connections for Type PVD21A or Type PVD21C Relays

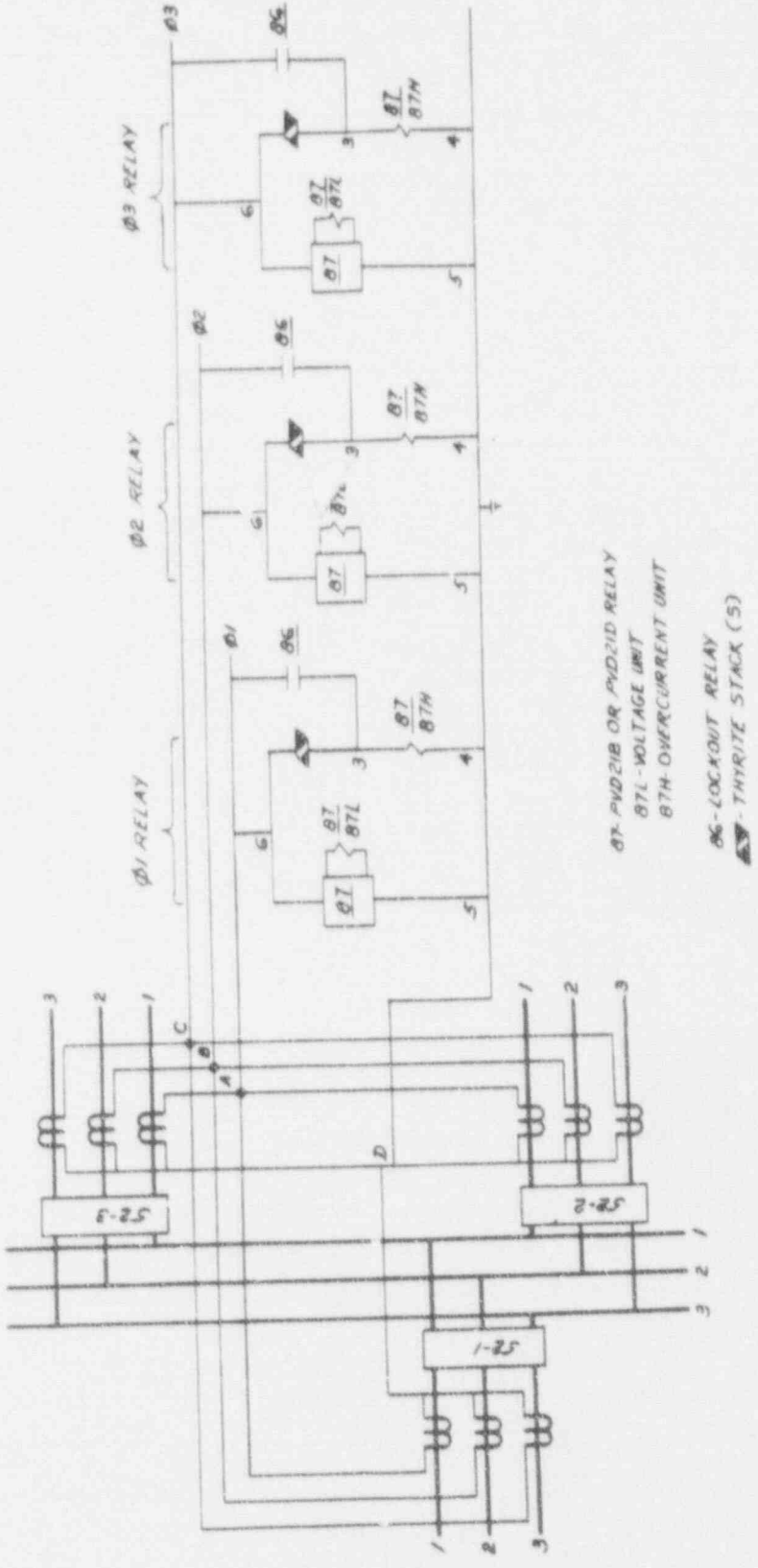


Figure 5 (0108B8929-0, Sh. 1) External AC Connections for Type PVD21B or Type PVD21D Relays

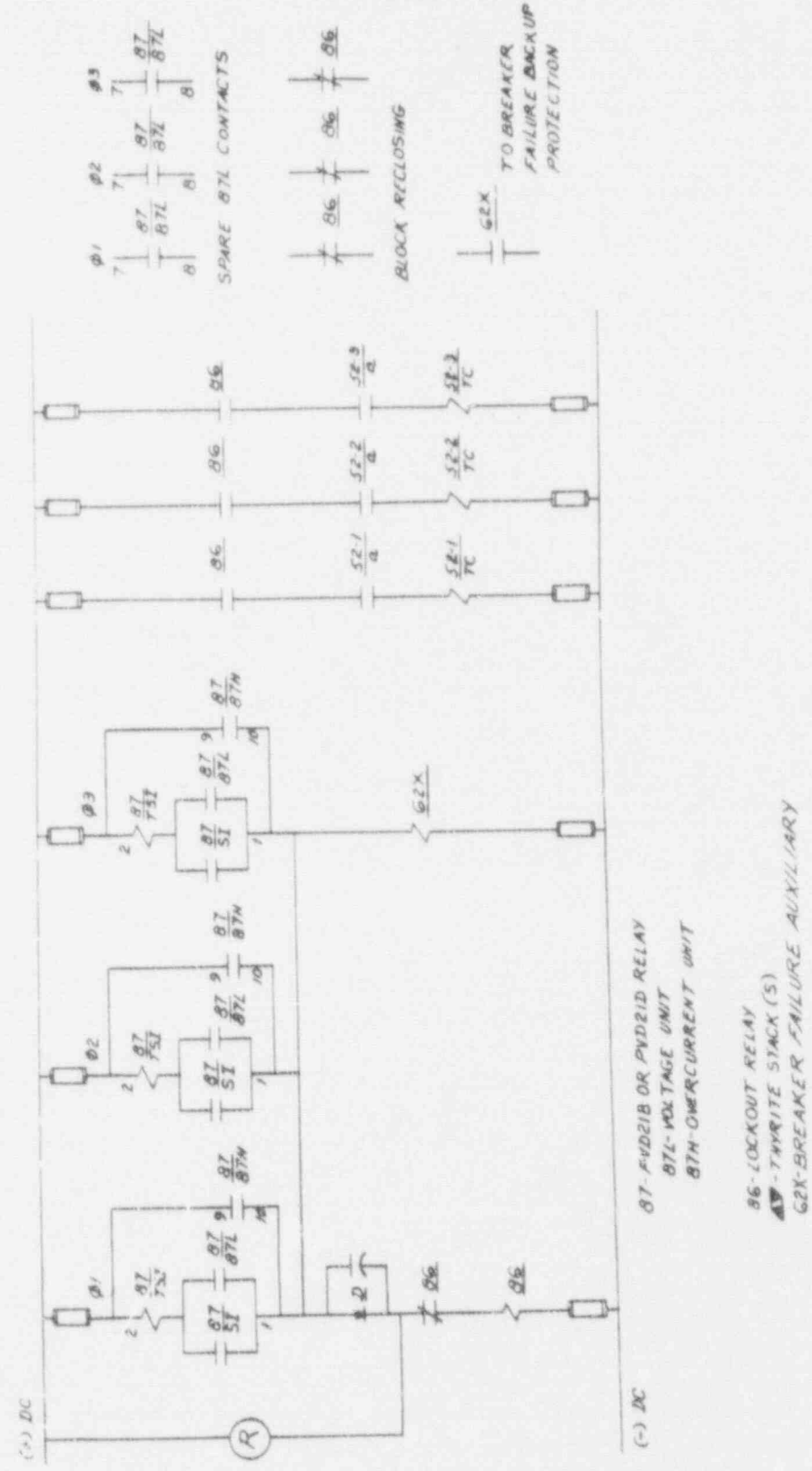
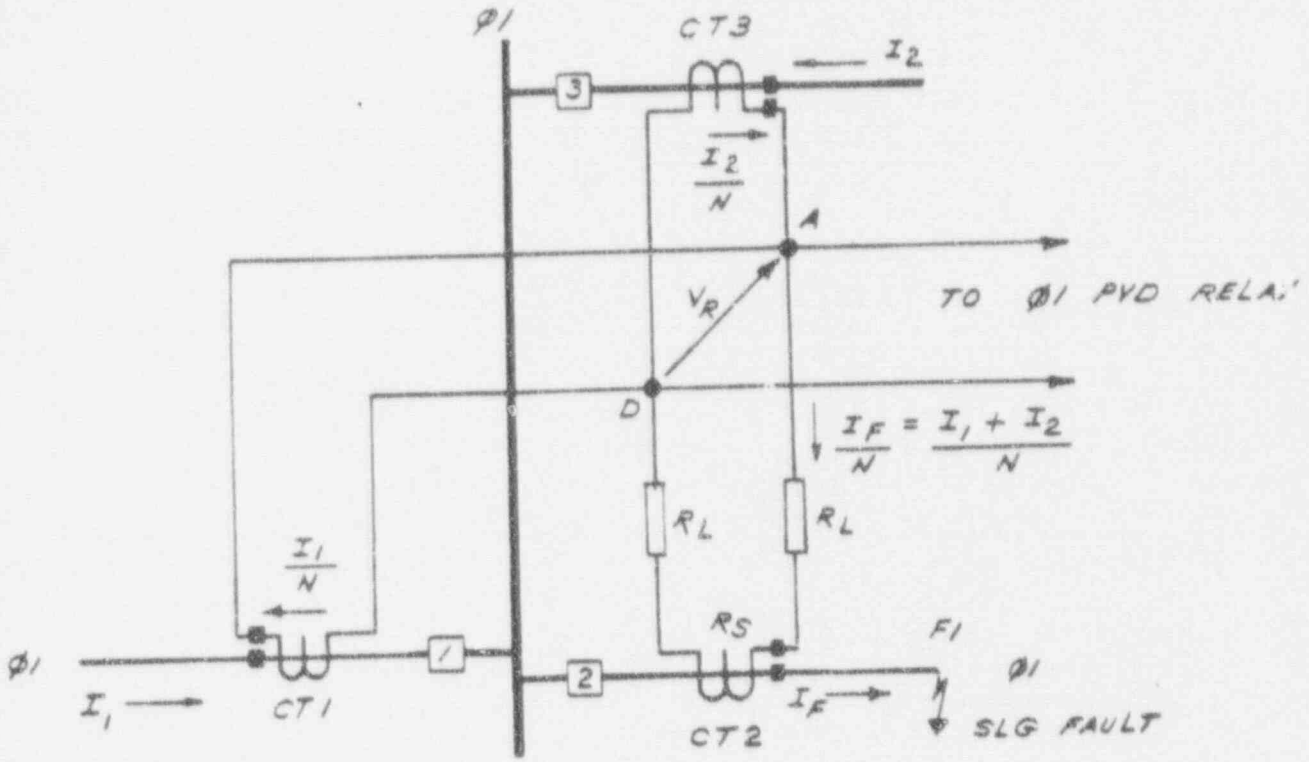


Figure 5A (010B8929-0, Sh. 2) External DC Connections for Type PVD21B or Type PVD21D Relays



NOTE: CT2 ASSUMED TO BE COMPLETELY SATURATED

R_S = CT SEC. WINDING RESISTANCE PLUS ANY LEAD RESISTANCE

R_L = CABLE RESISTANCE FROM JUNCTION POINT TO CT

I_F = RMS VALUE OF PRIMARY CURRENT

N = CT RATIO

V_R = VOLTAGE ACROSS PVD

Figure 6 (0257A8389-0) Simplified Circuit Illustrating the Effect of Single Line to Ground Faults on the Type PVD Relay

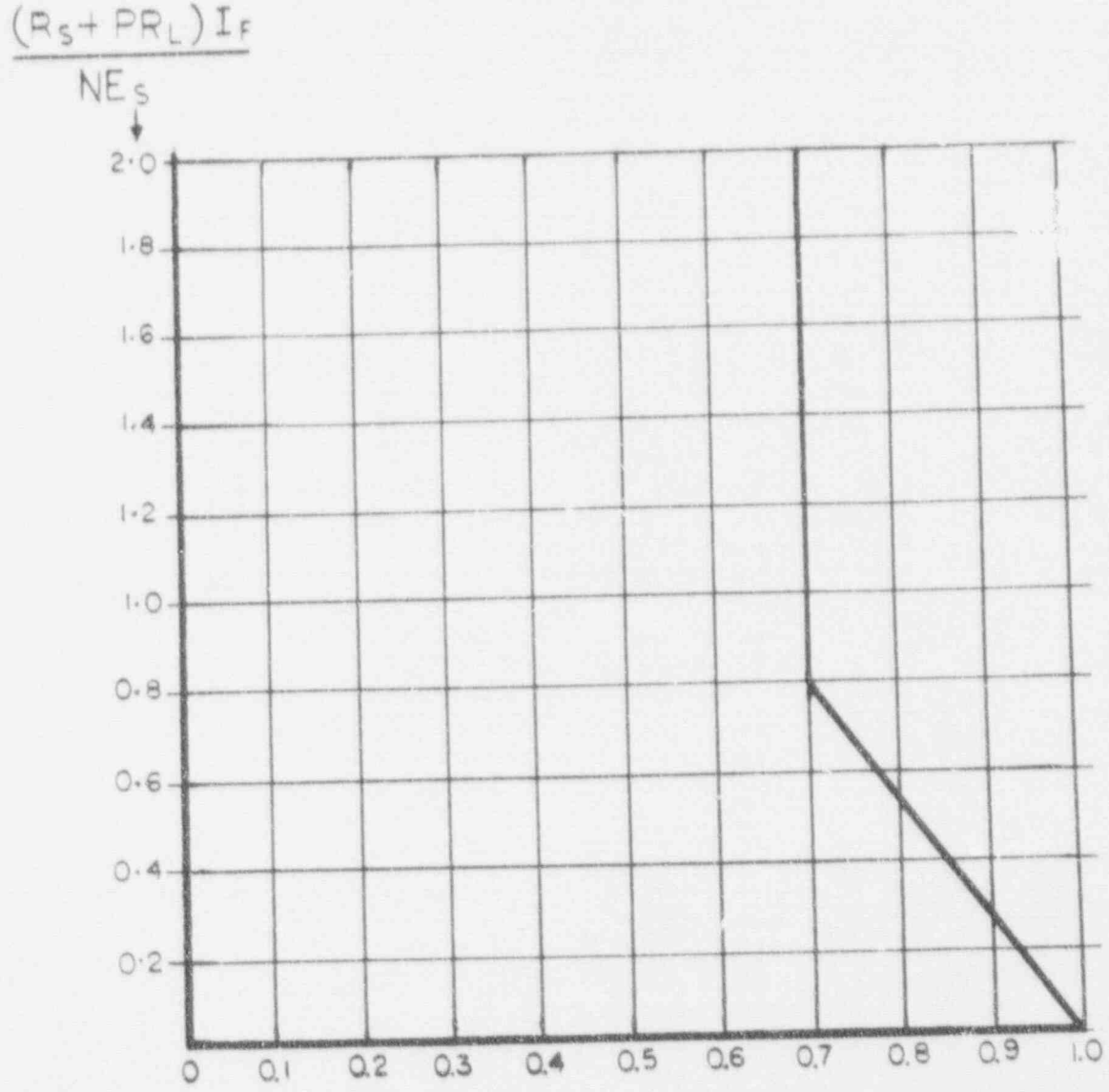


Figure 7 (0257A8586-1) CT Performance Factor, K,
for Type PVD21 Relays

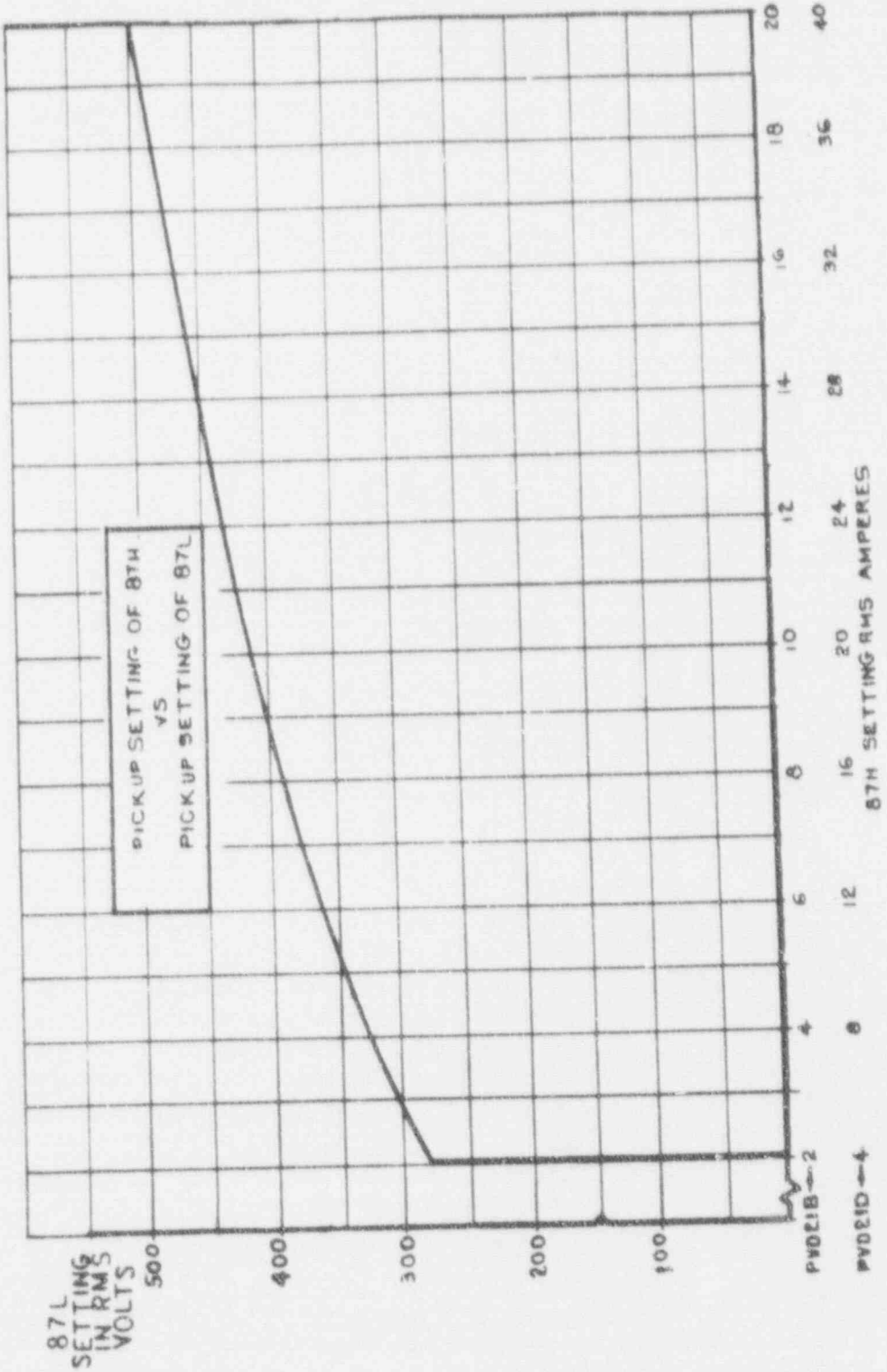


Figure 8 (0257A8587-1) Curve for Obtaining 87H Setting as a Function of 87L Setting

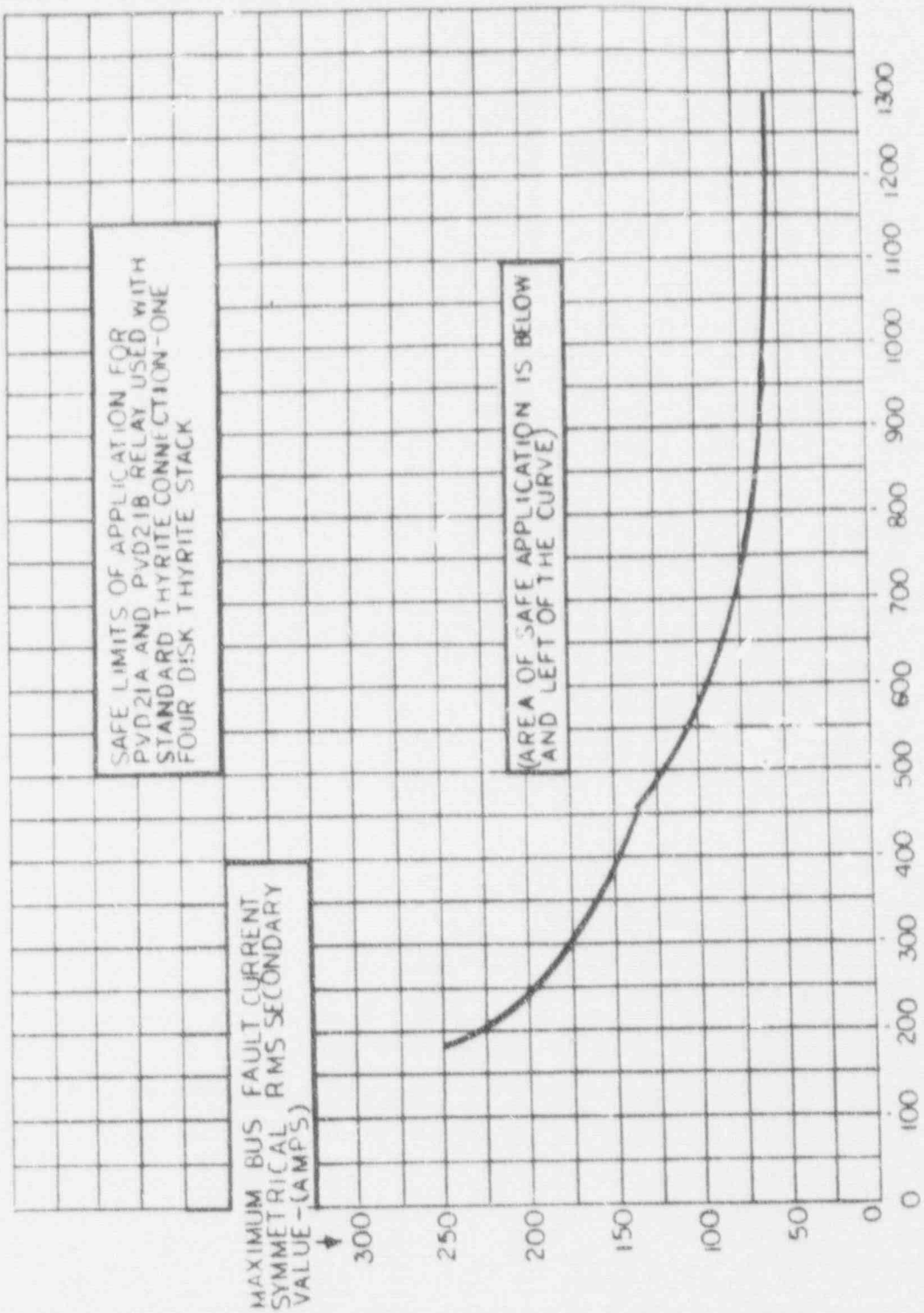


Figure 9 (0257A8588-1) Safe Application Limits for Type PVD21A or Type PVD21B Relays (One Thyrite® Stack)

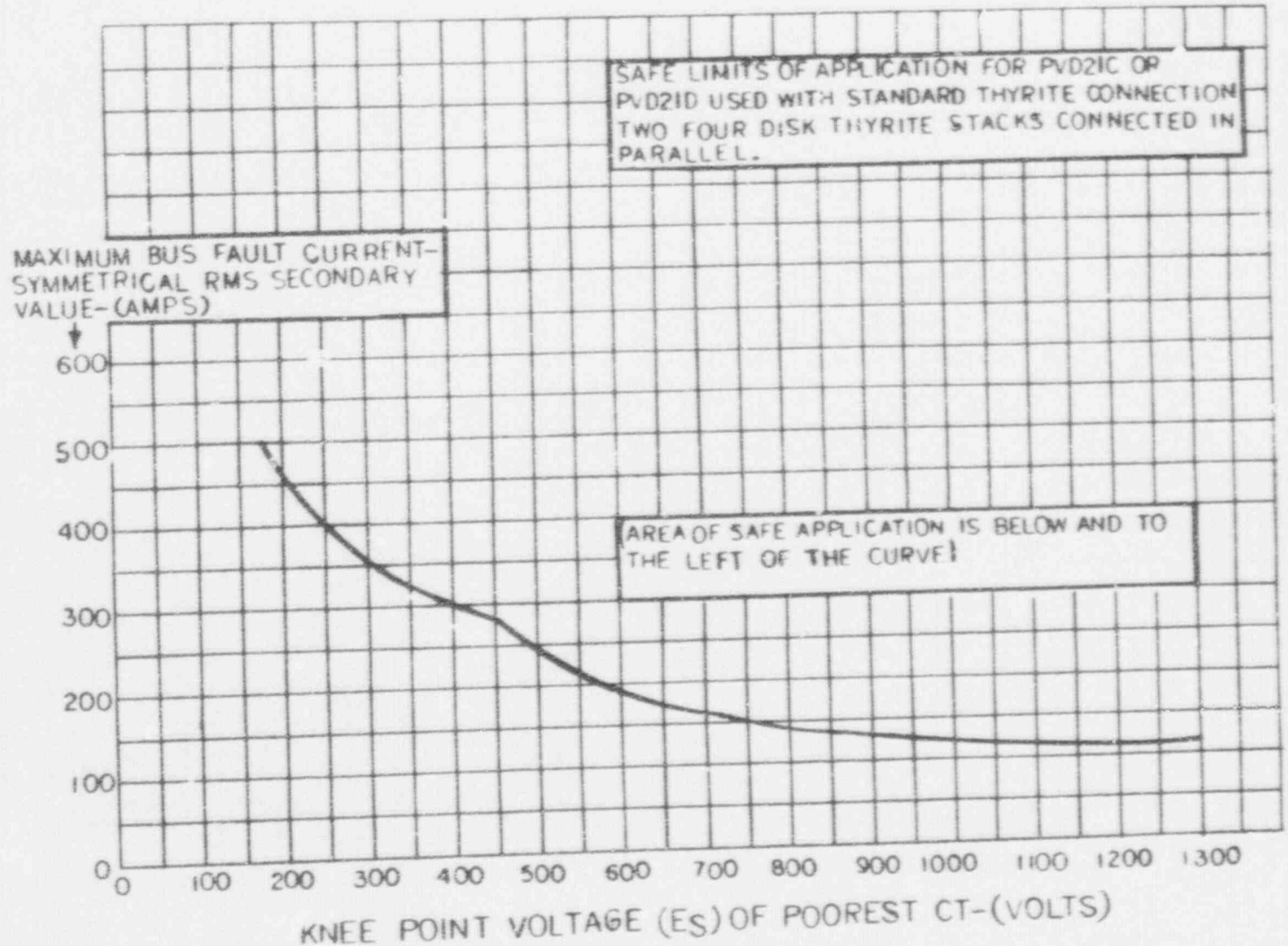


Figure 10 (0257A8590-1) Safe Application Limits for Type PVD21C or Type PVD21D Relays (Two Thyrite® Stacks)

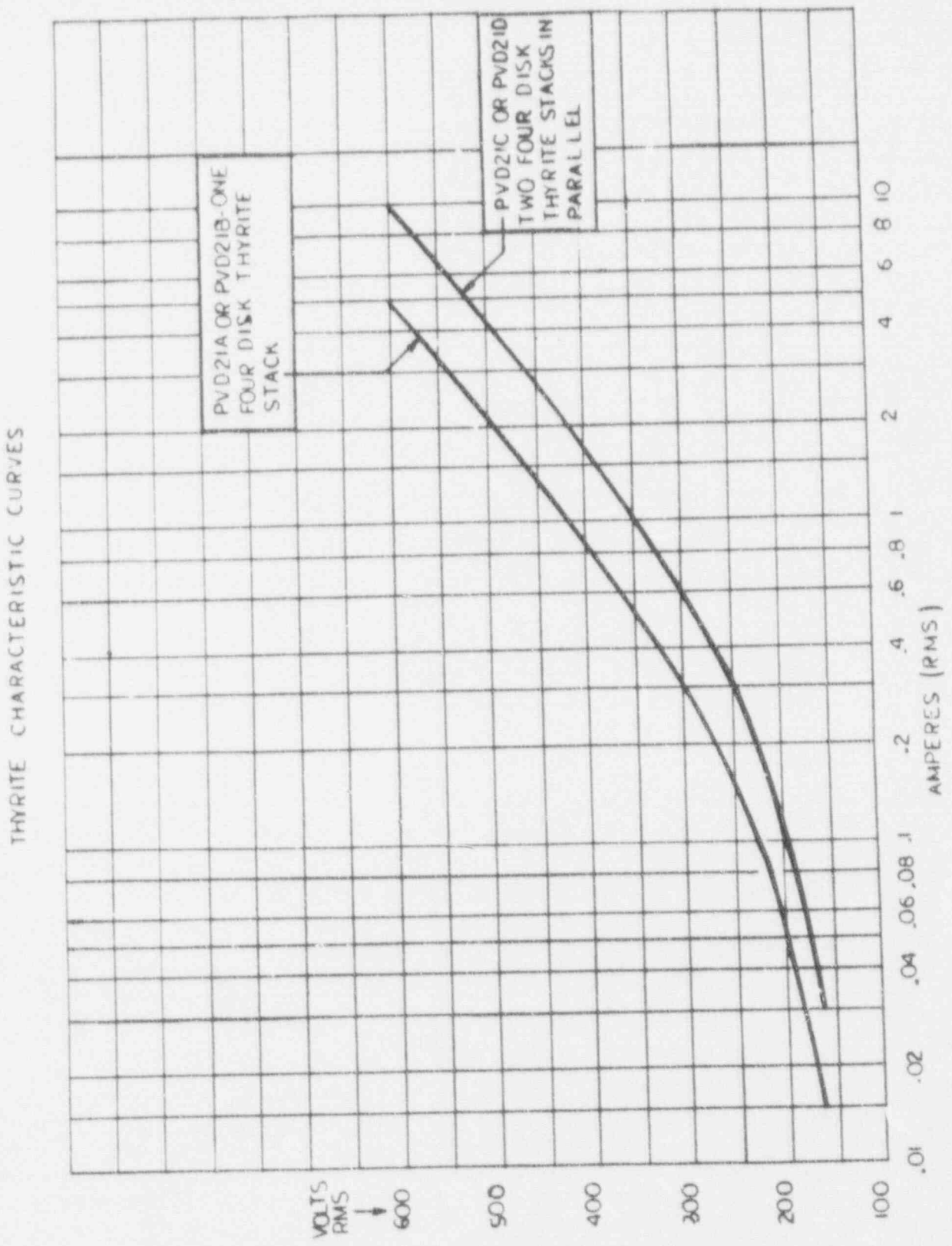


Figure 11 (0257A8589-1) Thyrite® Volt-Ampere Characteristics

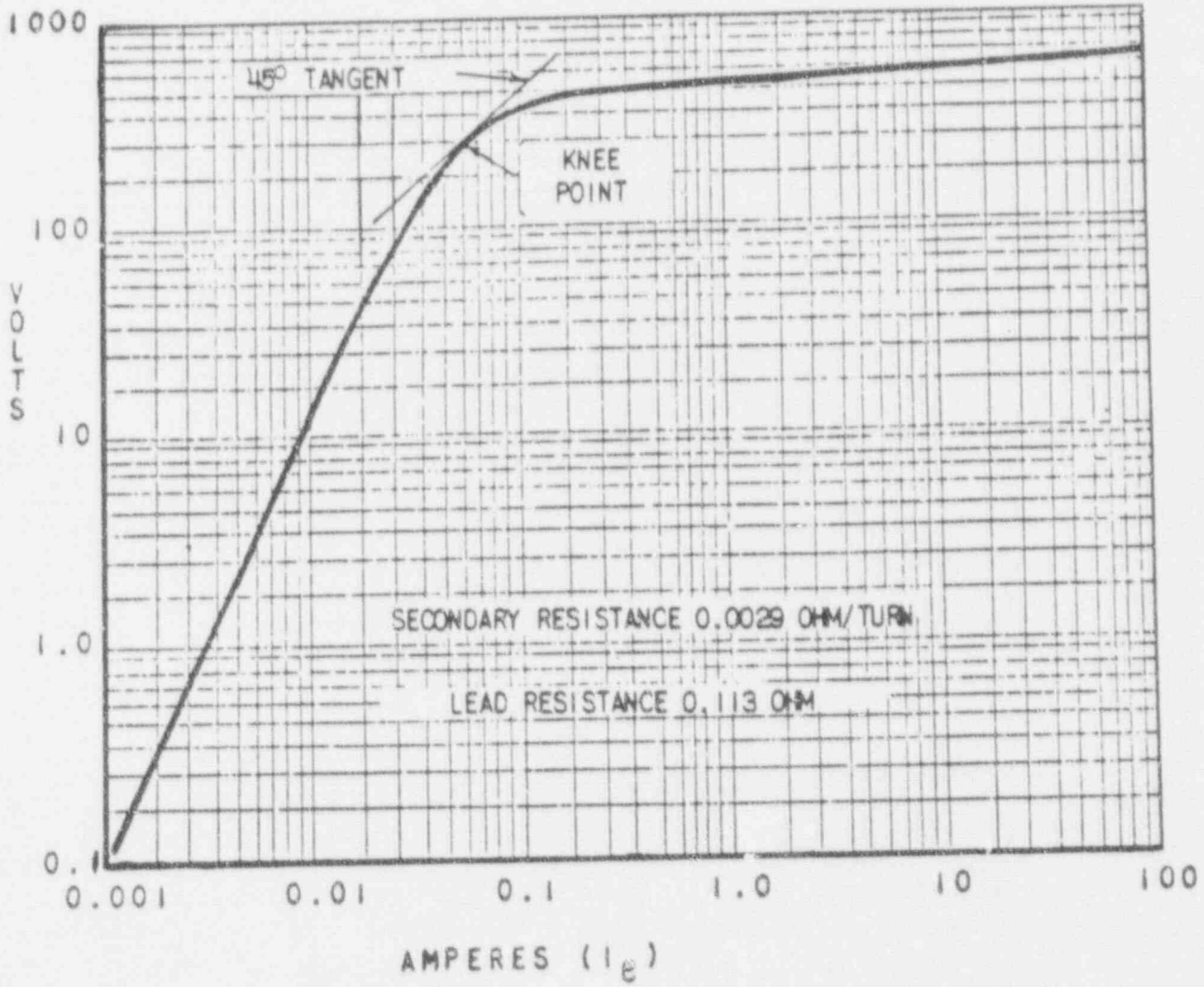
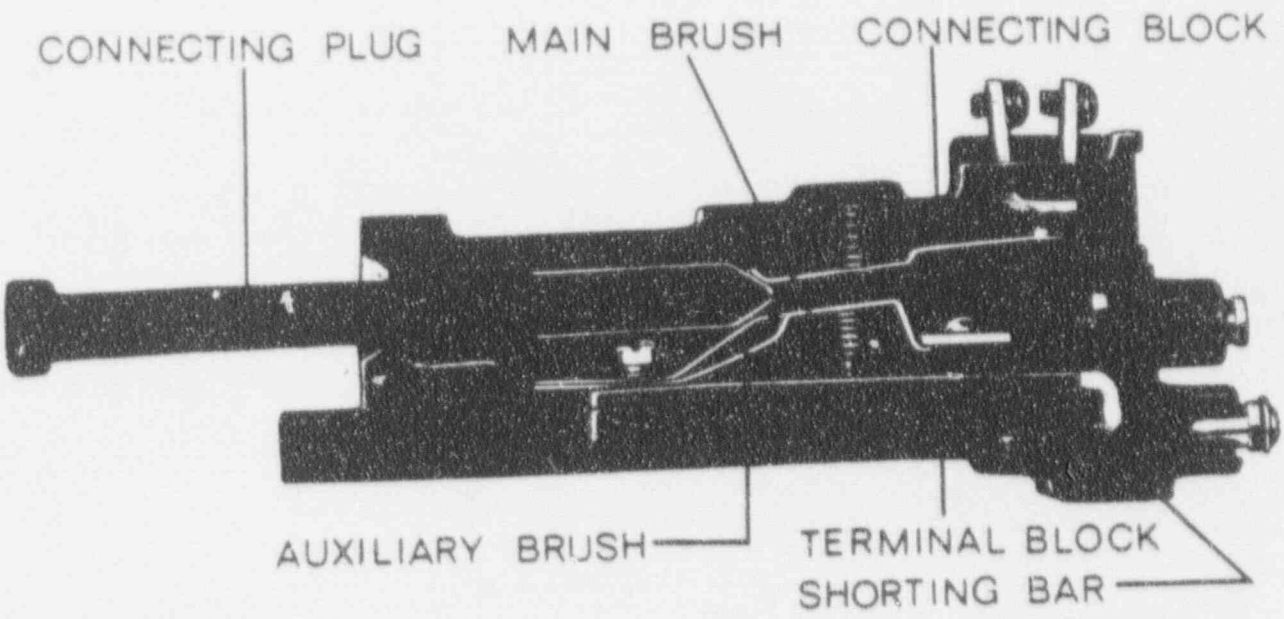
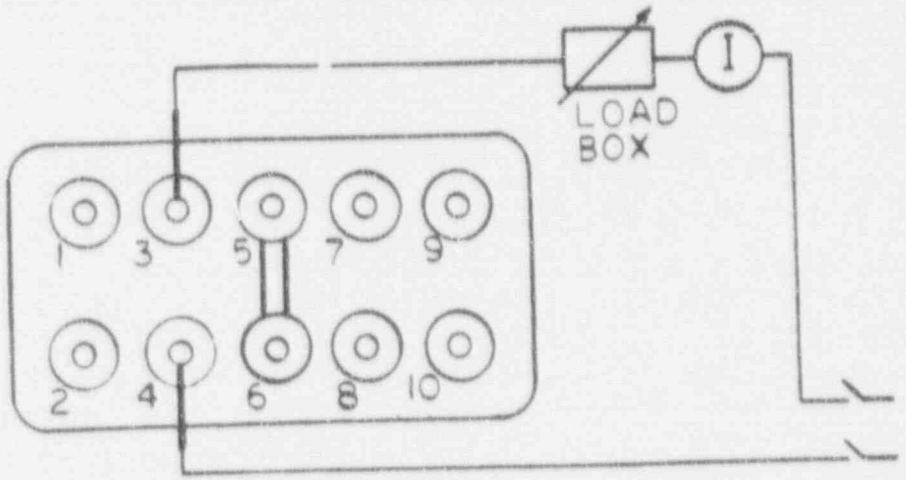


Figure 12 (0246A3799-1) Typical Secondary Excitation Characteristic for Bushing Type Current Transformer

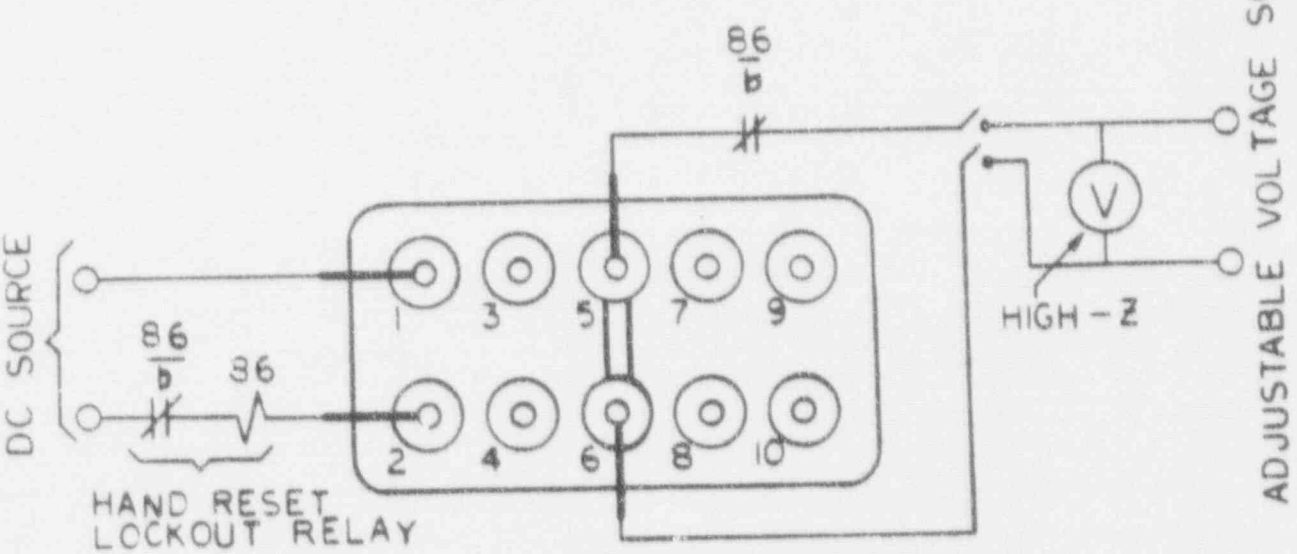


NOTE: AFTER ENGAGING AUXILIARY BRUSH CONNECTING PLUG TRAVELS 1/4 INCH BEFORE ENGAGING THE MAIN BRUSH ON THE TERMINAL BLOCK

Figure 13 (8025039) Cross Section of Drawout Case Showing Position of Auxiliary Brush and Shorting Bar



TEST CIRCUIT FOR SETTING 87H



TEST CIRCUIT FOR SETTING 87L

WARNING — WHEN USING A XLA12A TEST PLUG, INSTALL SHORTING BAR ACROSS TERMINALS 5 AND 6 BEFORE INSERTING TEST PLUG.

NOTE — ABOVE TEST FIGURES SHOW XLA12 TEST PLUG

Figure 14 (0269A3025-0) Test Circuit Connections

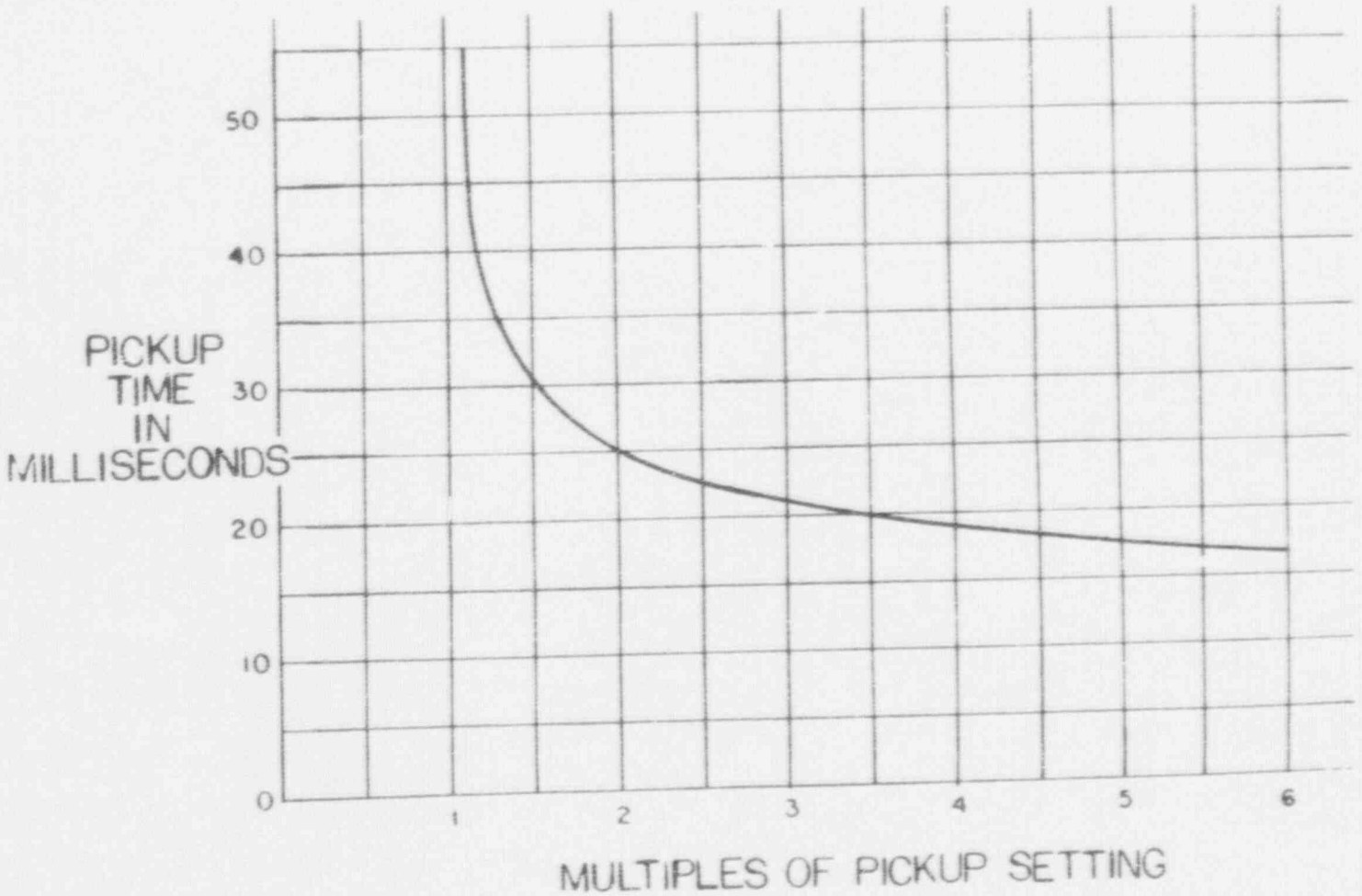


Figure 15 (0269A1798-1) Typical Operating Times for the Type PVD21 Relay, 87L Unit

GENERAL ELECTRIC COMPANY
POWER SYSTEMS MANAGEMENT BUSINESS DEPT.
MALVERN, PA 19355

GENERAL ELECTRIC

6-83 1-77

June 1, 1989

TO ALL PERSONS INVOLVED WITH NUCLEAR PLANT VOGTLE:

You are important to our success because you have special talents, skills, and experience which allow you to make a positive contribution to the Vogtle Project. An important part of the service which we expect you to render is to notify us of any condition that you see or suspect which may be detrimental to either quality or safe operation. In return, you have the right to be heard, you deserve considered response, and you can be assured you will not be retaliated against, in any way, for raising quality concerns.

Please notify your immediate supervisor if you know of any work or other operations that are not in accordance with approved procedures, or which are contrary to established quality, safety, or engineering practices or to regulatory requirements. If you are hesitant to contact your immediate Supervisor, you may and should contact the next higher level of management, or the Quality Concern Program. On site, you can contact the Quality Concern Coordinator, W.C. Lyon at ext. 3294. Mr. Lyon can also be reached, toll free, at 1-800-225-2055. Contacts can be made anonymously if your prefer.

You should feel an obligation to provide Georgia Power with the first opportunity to address any concern you may have. However, you may also feel free to bring nuclear safety and quality matters to the attention of the U.S. Nuclear Regulatory Commission (USNRC). The USNRC's Region II Office of Inspection and Enforcement, located in Atlanta, Ga. (404-331-4503), will accept collect calls twenty-four hours a day. Of course, you may also contact the resident USNRC Inspector on site (404-554-9901) or (404-554-9902), ext. 4249.

If, at any time, you feel that you have been harassed, intimidated, discriminated or retaliated against for having raised a quality issue, you should report this to the Quality Concern Program. You should also be aware of your options of reporting acts of retaliation to the NRC and/or to the Department of Labor, which are described on "NRC Form 3" posters located throughout the site.

Georgia Power Company is committed to operating Vogtle in compliance with all safety and quality requirements. As a part of the Vogtle team, it is your responsibility and obligation to assist Georgia Power in meeting that commitment by informing us of any and all conditions which might prevent such compliance.

G. Bockhold, Jr.
General Manager
Nuclear Plant Vogtle

FIGURE 1
(Example)

Plant Vogtle
Post Office Box 1600
Waynesboro, Georgia 30830
Telephone (404) 724-8114
(404) 554-9961

Nuclear Plant Vogtle

Georgia Power
A subsidiary of Southern Electric System

August 31, 1989

TO: Employees

RE: General Work Policies
Log: NOG-742

The following general work policies are applicable to all employees and visitors at Plant Vogtle and are to be strictly enforced. These policies outline the basic guidelines necessary at the jobsite to ensure safe and productive work activities as well as protecting the assets of Georgia Power Company. Good conduct and proper respect for the rights and safety of other employees at the jobsite are essential and the responsibility of each individual. No conduct will be tolerated if it is inconsistent with local, state, or federal law, federal regulations, or Company regulations.

Policy 1 — Safety on the job is of the utmost importance. You are responsible for your safety and the safety of those working with you.

Policy 2 — Quality is everyone's responsibility. Intentional disregard of quality requirements is strictly prohibited.

Policy 3 — The badge issued to you by the Georgia Power Company at Plant Vogtle is to be used only by you when entering or leaving the plant site. No one is to gain entrance or leave the plant in any way other than by use of the access badge. Further, site personnel should produce their identification upon request.

Policy 4 — Possession, use or distribution of drugs or alcoholic beverages will not be allowed on site.

Policy 5 — All personnel are responsible for the safe operation and proper parking of vehicles.

Policy 6 — An employee must telephone the plant site and inform his immediate supervisor if an unavoidable hardship should occur such as illness, accident, or automobile failure which would prevent or delay his reporting to work. All employees must inform their supervisor of any time that they will be absent from work.

Policy 7 — Theft or dishonesty in any form will be cause for dismissal and may subject the individual to criminal prosecution.

Policy 8 — Telephones, intercoms, and radios are provided as a service for business use only. Employees guilty of telephone misuse subject themselves to the same disciplinary actions as for theft.

Policy 9 — Eating, drinking, smoking, or chewing tobacco or gum in restricted areas, especially radiologically controlled areas, is prohibited and may result in termination.

Policy 10 — Gambling, lotteries and other games of chance or activities of that nature are not allowed on Company property.

Policy 11 — Other forms of unauthorized solicitation not previously covered e.g. campaigning, handing out non-job related literature and the selling of food or material items is prohibited.

Policy 12 — Firearms, other than those in locked vehicles, are not allowed on Company property with the exception of those in the possession of our Security Department, law enforcement agency visitors or specifically approved by the General Manager. Hunting weapons which remain locked in employees' vehicles are allowed in designated parking areas.

Policy 13 — Personal cameras and radios are not allowed in the protected area except by special permission.

Policy 14 — Defacing property in any fashion will not be permitted. This includes writing or drawing on walls or equipment; unauthorized removal of tags, nameplates or components from any equipment.

Policy 15 — The posting and/or displaying of paintings, drawings and photographs of the nude or partially nude human body will not be permitted in any location on the Company property.

Policy 16 — Sleeping or fighting on the job site will not be permitted.

Policy 17 — Hunting or fishing will not be permitted on company property unless specifically approved. (Fishing is permitted at the recreation area pond).

Policy 18 — The refusal to abide by established search procedures will not be tolerated.

Policy 19 — Harassment in any form (sexual, racial, religious, etc.) will not be tolerated.

Policy 20 — It is essential that all personnel understand and comply with tagging procedures and requirements prior to working on or operating any equipment, valves, etc.

Policy 21 — All personnel requiring unescorted access at Plant Vogtle must successfully pass General Employee Training (GET) annually. Georgia Power Company employees will be allowed up to three (3) attempts to pass GET. If they do not successfully pass GET, they will be disciplined as follows: 1st attempt - counseling; 2nd attempt - written memo to file; 3rd attempt - termination. Contractor personnel may be allowed up to two (2) attempts to pass GET.

Policy 22 — All plant (and contractor) personnel are responsible for plant cleanliness. All personnel, as part of their job requirements, will pick up trash, i.e. cigarette butts, paper, candy wrappers, etc. All plant personnel are responsible for cleaning each work area after performing a work activity. Work activities are not considered complete until proper collection and removal of trash, garbage, debris, litter, spills, and/or tools are accomplished.

These rules are considered to be an employment requirement. After reading, please sign the acknowledgement form and return it to the Site Employee Services Section for filing in your personnel file.

G. Bockhold, Jr.
General Manager

Employee Acknowledgement

Date

UNITED STATES NUCLEAR REGULATORY COMMISSION
Washington, D.C. 20555

NOTICE TO EMPLOYEES

STANDARDS FOR PROTECTION AGAINST RADIATION (PART 20); NOTICES, INSTRUCTIONS AND REPORTS TO WORKERS; INSPECTIONS (PART 19); EMPLOYEE PROTECTION

WHAT IS THE NUCLEAR REGULATORY COMMISSION?

The Nuclear Regulatory Commission is an independent Federal regulatory agency responsible for licensing and inspecting nuclear power plants and other commercial uses of radioactive materials.

WHAT DOES THE NRC DO?

The NRC's primary responsibility is to assure that workers and the public are protected from unnecessary or excessive exposure to radiation and that nuclear facilities, including power plants are constructed to high quality standards and operated in a safe manner. The NRC does this by establishing requirements in Title 10, a, the Code of Federal Regulations (10 CFR) and by licenses issued to nuclear users.

WHAT RESPONSIBILITY DOES MY EMPLOYER HAVE?

Any company that conducts activities licensed by the NRC must comply with the NRC's requirements. If a company violates NRC requirements, it can be fined or have its license modified, suspended or revoked.

Your employer must tell you which NRC radiation requirements apply to your work and must post NRC Notices of Violation involving radiological working conditions.

WHAT IS MY RESPONSIBILITY?

For your own protection and the protection of your co-workers, you should know how NRC requirements relate to your work and should obey them. If you observe violations of the requirements, you should report them.

HOW DO I REPORT VIOLATIONS?

If you believe that violations of NRC rules or of the terms of the license have occurred, you should report them immediately to your supervisor. If you believe that adequate corrective action is not being taken, you may report this to an NRC inspector or the nearest NRC Regional Office.

WHAT IF I WORK IN A RADIATION AREA?

If you work with radioactive materials or in a radiation (controlled) area, the amount of radiation exposure that you may legally receive is limited by NRC Regulations. The limits on your exposure are contained in sections 20.101, 20.103, and 20.104 of Title 10 of the Code of Federal Regulations (10 CFR 20). While these are the maximum allowable limits, your employer should also keep your radiation exposure as far below these limits as is "reasonably achievable."

MAY I GET A RECORD OF MY RADIATION EXPOSURE?

Yes. Your employer is required to tell you, in writing, if you receive any radiation exposure above the limits set in the NRC regulations or your employer's license. In addition, if your job involves radiation, you may request from your employer a record of your annual radiation exposures and a written report of your total exposure when you leave your job.

HOW ARE VIOLATIONS OF NRC REQUIREMENTS IDENTIFIED?

NRC conducts regular inspections at licensed facilities to assure compliance with NRC requirements. In addition, your employer and site contractors conduct their own inspections to assure compliance. All inspectors are protected by Federal law. Interference with them may result in criminal prosecution for a Federal offense.

MAY I TALK WITH AN NRC INSPECTOR?

Yes. Your employer may not prevent you from talking with an NRC inspector and you may talk privately with an inspector and request that your identity remain confidential.

MAY I REQUEST AN INSPECTION?

If you believe that your employer has not corrected violations involving radiological working conditions, you may request an inspection. Your request should be addressed to the nearest NRC Regional Office and must describe the alleged violation in detail. It must be signed by you or your representative.

HOW DO I CONTACT THE NRC?

Notify an NRC inspector on-site or call the nearest NRC Regional office collect. NRC inspectors want to talk to you if you are worried about radiation safety or other aspects of licensed activities, such as the quality of construction or operations at your plant.

CAN I BE FIRED FOR TALKING TO THE NRC?

No. Federal law prohibits an employer from firing or otherwise discriminating against a worker for bringing safety concerns to the attention of the NRC. You may not be fired or discriminated against because you:

- ask the NRC to enforce its rules against your employer,
- testify in an NRC proceeding,
- provide information or are about to provide information to the NRC about violations of requirements,
- are about to ask for or testify, help or take part in an NRC proceeding.

WHAT FORMS OF DISCRIMINATION ARE PROHIBITED?

No employer may fire you or discriminate against you with respect to pay, benefits, or working conditions because you help the NRC.

HOW AM I PROTECTED FROM DISCRIMINATION?

If you believe that you have been discriminated against for bringing safety concerns to the NRC, you may file a complaint with the U.S. Department of Labor. Your complaint must describe the firing or discrimination and must be filed within 30 days of the occurrence.

Send complaints to:

Office of the Administrator
Wage and Hour Division
Employment Standards Administration
U.S. Department of Labor
Room S3502
200 Constitution Avenue, N.W.
Washington, D.C. 20210

or any local office of the Department of Labor, Wage and Hour Division. Check your telephone directory under U.S. Government listings.

WHAT CAN THE LABOR DEPARTMENT DO?

The Department of Labor will notify the employer that a complaint has been filed and will investigate the case.

If the Department of Labor finds that your employer has unlawfully discriminated against you, it may order you to be reinstated, receive back pay, or be compensated for any injury suffered as a result of the discrimination.

WHAT WILL THE NRC DO?

The NRC may assist the Department of Labor in its investigation. NRC may conduct its own investigation where necessary to determine whether unlawful discrimination has prevented the free flow of information to the Commission. Also, if the NRC or Department of Labor finds that unlawful discrimination has occurred, the NRC may issue a Notice of Violation to your employer, impose a fine, or suspend, modify, or revoke your employer's NRC license.

UNITED STATES NUCLEAR REGULATORY COMMISSION REGIONAL OFFICE LOCATIONS

A representative of the Nuclear Regulatory Commission can be contacted at the following addresses and telephone numbers. The Regional Office will accept collect telephone calls from employees who wish to register complaints or concerns about radiological working conditions or other matters regarding compliance with Commission rules and regulations.

Regional Offices

REGION	ADDRESS	TELEPHONE
I	U.S. Nuclear Regulatory Commission Region I 475 Allendale Road King of Prussia, PA 19406	215 337 5000
II	U.S. Nuclear Regulatory Commission Region II 101 Marietta St., N.W. Atlanta, GA 30323	404 331 4503
III	U.S. Nuclear Regulatory Commission Region III 799 Roosevelt Road Glen Ellyn, IL 60137	312 790 5600
IV	U.S. Nuclear Regulatory Commission Region IV 611 Ryan Plaza Drive, Suite 1000 Arlington, TX 76011	817 860 8100
V	U.S. Nuclear Regulatory Commission Region V 1450 Maria Lane, Suite 210 Walnut Creek, CA 94596	415 943 3700

NRC FORM 3
(5-92)

EMPLOYEE'S COPY

QUALITY CONCERN PROGRAM
EMPLOYEE ORIENTATION

Welcome to Nuclear Plant Vogtle. You are now a part of a team - a team dedicated to building this plant using the highest possible quality standards. As part of this team, you have two very important responsibilities. These are:

1. To do your job to the very best of your ability and to make sure that your work is safe and of the highest possible quality; and

2. To report any event, activity, practice or procedure which you feel adversely affects the quality of this project or the safety of construction or future plant operation.

Georgia Power Company has a "Quality Concern Program", which allows you to report any questionable act or practice, either orally or in writing to the Georgia Power Company's Quality Concern Program Coordinator. There are posters explaining the program, forms for submitting your concerns, and collection boxes for concern forms located throughout the site. You can also contact the Quality Concerns Representative directly at Extension 3294 or at 1-800-225-2055 (toll free). Any concern or complaint will be held in confidence; you can remain anonymous if you request. Each concern will be investigated and you will receive a response if you request it.

You have received a letter from General Manager, Nuclear Plant Vogtle, G. Bockhold, Jr. regarding the Company's concern for safe, quality construction. Read the letter, familiarize yourself with the Quality Concern Program, and remember your two primary obligations - to do good work and to report bad work.

ACKNOWLEDGEMENT

I, the undersigned acknowledge that I have received a copy of the Bockhold quality letter, am aware of the existence of the QUALITY CONCERN PROGRAM, know what my obligations are regarding the reporting of substandard or poor quality work or unsafe practices to my supervision, to the Quality Concern Program or to the NRC.

Also, I understand by raising of a quality issue through any forum (Supervision, Quality Concern Program, Quality Control, Quality Assurance, NRC or others) should have no effect on my employment and if I should believe that such retaliation has taken place I understand Georgia Power Company's commitment to correct any such retaliation and I further understand my options of reporting this retaliation to my supervisor, to the Quality Concern Program, to the NRC and/or to the Department of Labor. I understand that should I report this retaliation to the Quality Concern Program they are obligated to respond to me within seven working days.

WITNESS

EMPLOYEE: _____

DATE: _____

FIGURE 9
(Example)

June 1, 1989

TO ALL PERSONS INVOLVED WITH NUCLEAR PLANT VOGTLE:

You are important to our success because you have special talents, skills, and experience which allow you to make a positive contribution to the Vogtle Project. An important part of the service which we expect you to render is to notify us of any condition that you see or suspect which may be detrimental to either quality or safe operation. In return, you have the right to be heard, you deserve considered response, and you can be assured you will not be retaliated against, in any way, for raising quality concerns.

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Georgia Power Company is committed to operating Vogtle in compliance with all safety and quality requirements. As a part of the Vogtle team, it is your responsibility and obligation to assist Georgia Power in meeting that commitment by informing us of any and all conditions which might prevent such compliance.

G. Bockhold, Jr.
General Manager
Nuclear Plant Vogtle

FIGURE 1
(Example)

PLANT VOGTLE
FITNESS FOR DUTY POLICY

GENERAL

It is the policy at Plant Vogtle that personnel be reliable, trustworthy and fit for duty, free from the influence of any substances, legal or illegal, or mentally or physically impaired from any cause, which in any way might adversely affect their ability to safely and competently perform their duties. Accordingly, the possession, sale or use of illegal drugs on or off company time or property; the unauthorized possession, sale or use of controlled substances on or off company time or property; the possession sale or use of alcohol on company time or property; the abuse of non-prescription drugs on or off company time or property; or the consumption of alcohol five (5) hours prior to or during the period of any working tour, is expressly prohibited.

It is the responsibility of each and every individual reporting for duty at Plant Vogtle to be free from the effects of substances which might affect their ability to safely perform their duties. Likewise, individuals who are aware of any mental or physical problem(s) or individuals who are taking prescription or over-the-counter medication which may affect their ability to safely perform their duties should immediately report this to their supervision. If necessary, alternative duties may be assigned until the individual(s) can resume normal and safe work activities. If alternative duties are not available, the individual may be subject to a temporary layoff. Non-compliance with any of the above policies/requirements will result in disciplinary action up to and including termination.

PROGRAM CONTENTS

To aid in providing reasonable assurances that the work force is fit for duty, the company has implemented a Fitness For Duty Program to include:

1. On site drug and alcohol screenings
   a. Preemployment/Preaccess
   b. Random
   c. For Cause
   d. Post Accident
   e. Call-in/Hotline Tips
   f. Follow-up

2. Training
   a. Employee - Program/Policy Compliance
   b. Managers and Supervisors - Their role in implementing the program, the role of the medical and Employee Assistance Program staff, techniques for recognizing drug/alcohol use, sale or possession and aberrant behavior, procedures for initiating corrective action, etc.
   c. Escorts - Techniques for recognizing drug/alcohol use, sale or possession and aberrant behavior, procedure for reporting problems, etc.

3. Medical Review Officer - A licensed physician to assist, as necessary, in determining fitness-for-duty.

4. Employee Assistance Program (EAP) - A confidential counseling and referral service available to assist individuals with various problems such as drug and/or alcohol dependency, occupational stress, personal, etc. This program is provided as an additional means to help ensure that employees are fit for duty; its use is highly encouraged.

CALL OUTS

Employees who are called out to perform work outside their normal work hours shall be required by their supervisor to indicate if alcohol has been consumed within the five (5) hour pre-duty abstinence period. In addition, employees should advise their supervisor whether or not they can safely drive to the Plant. If the employee is required to report to work, he will normally be tested upon arrival and the final determination as to whether or not to grant unescorted access will be made by the Duty Manager. (Note: All alcohol screenings will use a 0.04% blood alcohol content (BAC) cutoff level.)

DISCIPLINE (GPC and Contractor Employees)

Employees who test positive for drugs or alcohol, who fail to notify their supervisor of factors adversely affecting their fitness for duty, or who refuse to submit to tests as required, will be subject to discipline up to and including immediate termination.

Any individual determined to have been involved in the sale, use or possession of illegal drugs while on company property or on company time will be removed from duty and such activity will constitute grounds for termination.

The unathorized or undeclared use of prescription medication or over-the-counter medication which may adversely impact an employee's fitness for duty may result in discipline up to and including termination.

Any involvement with illegal drugs may result in discipline up to and including termination.

Any unauthorized consumption of alcohol on company property or company time will constitute grounds for immediate termination.

Any unauthorized possession of alcohol on company property or company time may result in discipline up to and including termination.

ADDITIONAL DISCIPLINE GUIDELINES/PROVISIONS (GPC Employees Only)

1. Drug Tests - The first confirmed positive test shall result in the employee being given a Decision Making Leave (DML), removal from duty for a minimum of fourteen (14) days and mandatory referral to the Employee Assistance Program.

When the individual reports back to work he/she will be given a drug test. If the drug test is negative, the individual will be allowed to return to work; if this test, or any subsequent confirmed drug or alcohol test, is positive the individual will be terminated.

2. Alcohol Tests - The first confirmed positive test for alcohol will result in the employee being given a DML and referral to the Employee Assistance Program.

   When the individual reports back to work, he/she will be given another alcohol test. If this test is negative the individual will be allowed to return to work; if this test, or any subsequent confirmed drug or alcohol test, is positive the individual will be terminated.

   NOTE: Any employee who is already under an active DML (attendance, work performance, safety, etc.) will be terminated upon the first confirmed drug or alcohol test.

3. Employee Appeals
   a. Non-Covered Employees - Non-covered employees who are removed from duty due to a confirmed positive drug screen or blood alcohol of 0.04% or greater will have the right to appeal the results to the Executive Vice-President Nuclear Generation (EVP-NG). The employee must provide a detailed written explanation of the reasons for the appeal to his manager within three (3) days from the date of his removal. This document will then be forwarded to the EVP-NG for final dispositioning.
   b. Covered Employees - The appeal process for covered employees will be through the existing grievance and arbitration procedures.

Approved: _____
G. Bockhold FOR GB

Date: 12-20-89

Walton Way to Gordon Hwy (RT) 2 mi Road 56
Spur - New Savannah Road (LT) - Interstate 520 (RT).
1 Exit (RT 56) 2 1/4 miles - McBean Community
Hwy 56 Spur Vogtle Plant.

Sheet 1 of 2

DATA SHEET 4
COMMUNICATIONS SYSTEMS TESTING

MONTHLY TESTING OF THE ENS AND HPN

NOTE

Failure of the HPN or ENS equipment or telephone service may require notification of OSOS as specified in section 5.9.10.4 of this procedure.

I. Station personnel in the Control Room, TSC and EOF.

A. Initiate calls on the ENS from the Control Room, TSC and EOF in accordance with paragraph 5.2.2.3 and establish communications with NRC Operations Center and all other VEGP ENS phones as follows:

B. Initiate call from the Control Room. Verify proper operation.

	SAT.	UNSAT.
1. NRC Operations Center	[ ]	[✓]
2. TSC	[ ]	[✓]
3. EOF	[ ]	[✓]

DATE: 3/2/90
PERFORMED BY: [illegible]

C. Initiate call from the TSC. Verify proper operation.

	SAT.	UNSAT.
1. NRC Operations Center	[ ]	[✓]
2. CR	[ ]	[✓]
3. EOF	[ ]	[✓]

DATE: 3/2/90
PERFORMED BY: [illegible]

D. Initiate call from the EOF. Verify proper operation.

	SAT.	UNSAT.
1. NRC Operations Center	[ ]	[✓]
2. CR	[ ]	[✓]
3. TSC	[ ]	[✓]

DATE: 3/2/90
PERFORMED BY: [illegible]

II. Request NRC to initiate an incoming call on the ENS to VEGP. Verify proper operation in accordance with paragraph 5.2.2.4.

	SAT.	UNSAT.
1. NRC to EOF	[ ]	[✓]
2. NRC to TSC	[ ]	[✓]
3. NRC to CR	[ ]	[✓]

DATE: 3/2/90
PERFORMED BY: [illegible]

DATA SHEET 4
COMMUNICATIONS SYSTEMS TESTING

MONTHLY TESTING OF THE ENS AND HPN

III. Initiate and receive calls on the HPN in the TSC and EOF to and from any commercial telephone line. Verify proper operation.

1. TSC HPN — SAT. [✓] UNSAT. [ ]

DATE: 3/2/90
PERFORMED BY: J Robert

2. EOF HPN — SAT. [✓] UNSAT. [ ]

DATE: 3/2/90
PERFORMED BY: J Roberts

COMMENTS: ENS test declared UNSAT due to NRC having problems with their end of equipment. NRC Acknowledged that they would report this problem to ATT. 8:15 CST 3-2-90

REVIEWED BY: J Roberts DATE: 3/2/90

Sheet 1 of 1

DATA SHEET 7

RETEST DATA SHEET

Equipment or Circuit	RETEST DATE SAT.	UNSAT	Comments/Performed By
ENS-ELF, CR, TSC	3-12-90		JGilmyn
ENN - Allendale			Speaker tested by SRS Sat.
Co Sheriff Dispatch			Another speaker to be installed to enhance audibility of system.

Reviewed By: _____

Date: _____

J-87 3/20/90 NOTES ERF Emer. Resp. Facility EP (5)

@ Site area did they sound siren & make PA announ
* Media information why so much pressure on site? not Berwin as plan states?
* TSC interface # #'s of people & what they were doing
* Timely SAE —
* Alert to SAE —
* Downgrade Condition —
* Notification times
* ERF Augmentation
* Accountability —
* Sound / Site Siren & PA announcement
* Met tower problem on ERF
* ENS Test for Maint

— G.O. info center did they have adequate input

Info should be in place 3/21

* TSC # Emergency Phone #?
ERF too

1A

3025-022
-138

7-phone

Rick Odom 3201 Beeper 22 > Reg Compliance
Herb B[illegible] 3769 Beeper 138

1 Loss for Refueling
Criteria

Procedure 5-7

Ken Holmes - Glenn Harris
Paul [illegible]

Bridge Line went out - lose ye power?

[illegible] action

Jim Roberts - Plant Status Pres
EP Plan

ext 3416 435 Home 860-6430

1) Tennis Site Area Emergency
when declared
* what EAL [illegible]

Partridge Inn Day
~~[illegible]~~ INN
~~[illegible]~~ Rd.
Wheeler
860-8610

731-0826
Register Wednesday August, 0-Day

Not guaranteed
3

* Alert to SAE?
* Downgrade [illegible]
* Hotspots offsite?
* EPZ procedures * { S.C. yes. GA ?
* - Augmentation ERF's
* Second site [illegible]

* M of towns MERF NO

* 0820	Loss of Power	CDT
0840	SAE	CDT
9:15	abort	CDT
1247	Terminate	CDT

Sept. 1959 cdl

-/21

- Change PBX to sept AT&T 85

Had Dennis 2000

↓

Ending from Batt

During change someone did not want to guide backup power

Got Dial tone PBX

NO effect or interaction with ENN

Never lost power to PBX during cutover

, 21

③ 10:40 - PA & all notification ~~alarms~~ ... - ... in ...
Office

Alan ... - ENN Briefing

Dwg No:
1X3D 4020
- 1NLP-35 (Lighting Panel) > 2 sep bus
- 1NLP-36 " "
- MCC - 1NBS / 2 1NBR 2 Sep Motor Control Centers

Dwg No.
1X ... -F58A
1NBS

Feed same ... No 15 ← off ... CC / ... CC

1X3D HA-F27A
1NBR

~~all ... to Diesel~~

Dwg No - 1X3D-AA-A01A

1NBS Feeds back to 480 volt (1NB01) → Diesel 1A ← ... to ...

1NBR " " " 480 volt switch gear (1NB10) → Diesel 1B (OOS)

* Batt back up? Find out

Shift plan

3/21/90

From Jim

* Shut Page and problem

from ENN — Unit 1 vital — SC / GO } lost

Backup ENN — Unit 2 vital only goes to SC

Merlin system — Unit 1 off unit 1 lost / Unit 2 off unit 2 OK } should have had minimal effect

* SC notified GO — find out / or conclude problem

Met Tower → micro wave to ERF

ERF computer may be on Unit 1

may have caused loss of info

lost communication signal ?

no strip chart

Backup is to go to tower & phone info in. This was done

* Find out time of outage

Site assembly Siren — 91001 (Procedure) — Pg announcement / procedure was not followed verbatim

Site Siren not sounded — only required for site evac.

Page announcement would have required account & was not followed

920 EAS/GO alert Before — proc 91001 — I < 15 min alert

940 Declare — > 15 min SAE