INFORMATION COPY

ENGINEERING CRITERIA DOCUMENT

APPENDIX 3

WNP-2

ELECTRICAL SEPARATION PRACTICES

THIS DOCUMENT FORMS A PART OF THE WNP-2 ENGINEERING CRITERIA DOCUMENT BUT IS CONTROLLED IN ACCORDANCE WITH ITS OWN CONTROLLED DISTRIBUTION LIST.

REV. NO.	DATE	PREPARED BY:	REVIEWED BY:	APPROVED BY:
0	12-3-82	G.W. BRASTAD Shawn Salyrte John J. Mallanda	G W Brastad	John J. Mallanda
1	12/22/82	G.W. BRASTAD	G W Brastad	John J. Mallanda
2	3/21/83	G.W. BRASTAD	G W Brastad Corey	John J. Mallanda

WNP-2
ELECTRICAL SEPARATION PRACTICES

2

I. Purpose

The purpose of this document is to clarify the WNP-2 electrical separation criteria, describe practices used to implement the criteria, and to provide sufficient information in a manner to simplify verification of implementation in the field. There are no differences in the design criteria between this document and the WNP-2 FSAR.

This document should be used by engineers, designers, contractors, QA/QC personnel and operations personnel.

II. Electrical Separation Criteria

A. Definitions

1. Class 1E

Class 1E is the safety classification of the electrical circuits, components, equipment and systems that are essential to emergency reactor shutdown, containment isolation, reactor core cooling, and containment and reactor heat removal, or otherwise prevent significant release of radioactive material to the environment. 2

2. Power Circuits

Power circuits provide electrical energy for component motive power and heating requiring 14.4 kV, 6.9 kV, 4.16 kV, 480 volts, 240 volts, 120/208 V AC, 250 and 125 V DC (see Table I for details).

3. Control Circuits

Control circuits use 120 V AC (or below) or 125 V DC (or below), and are designed to supply control power for plant systems. The largest control circuit protective device (fuse/breaker) has a 35 amp rating. The majority of the control circuits are intermittent in operation. Control circuits include the following functions (see Table I for details):

a. 125 V DC or 120 V AC control to switchgear, control room and local panels, and logic interlock circuits.

b. 125 V DC or 120 V AC control power to solenoids.

c. Annunciator/computer digital circuits.

d. Space heaters including motor heaters.

Three exceptions to the 35 amp maximum rating exist; two 100 amp circuit breakers and a 60 amp breaker for circuits in the Reactor Protection System and the Reactor Manual Control System. Within the General Plant Areas these circuits are routed separately in rigid conduit. Within PGCC these circuits are routed separately in flexible conduits with an attached ground conductor. 2

4. Instrumentation Circuits

Instrumentation circuits are low level analog or digital signals.

5. Low Energy Circuits

Low energy circuits are control and instrumentation circuits.

6. Isolation Device

An isolation device prevents an electrical event in one section of a circuit from causing unacceptable consequences in other sections of the circuit or other circuits.

7. Raceway

For the purposes of this document raceways shall include open or enclosed cable trays, flexible and rigid conduit (not EMT) and PGCC modular floor ducts. Device/component nipples and conduits up to the first tee are not included in this definition but shall be considered as part of the device/component. 2

8. Associated Circuits

Associated circuits are defined as either prime or proximity circuits as follows:

a. Prime Circuits

A Non-Class 1E circuit which receives power from a Class 1E source. The circuit begins at the load side of the source circuit protective device (isolation device), through the interconnecting cables, and up to the final connected load. The portion of a prime circuit which is routed in a Class 1E raceway is additionally termed "Associated By Proximity".

b. Proximity Circuits

A proximity circuit is a Non-Class 1E circuit which is routed (along any portion of its length) in a raceway with a Class 1E circuit or is contained in an enclosure with Class 1E circuits and physically routed less than 6" from a Class 1E circuit (without an appropriate barrier). The portion of the proximity circuit which is routed in a Class 1E raceway is termed "Associated By Proximity". If the circuit leaves the Class 1E raceway, the circuit is termed and treated as Non-Class 1E unless the circuit is also prime (see Figure 4).

9. Redundant 2

For the purposes of this document redundant shall refer to the collection of Class 1E circuits, components, equipment, etc. (system(s)) performing a specific plant safety function which is a backup to other Class 1E system(s) independently performing the same safety function. Safety functions are Emergency Reactor Shutdown, Containment Isolation, Reactor Core Cooling, Containment and Reactor Heat Removal, and Offsite Radioactive Release prevention. For example, the Low Pressure Core Spray System is redundant to the Residual Heat Removal System (Low Pressure Coolant Injection mode) Loop C for the "Reactor Core Cooling" safety function.

10. Intruding Circuits

Intruding circuits are of two types: 1) Class 1E or prime circuits which enter equipment or an enclosure or an area (either sub-enclosures or as defined by lines of demarcation) of an enclosure assigned to a redundant Class 1E or prime division, 2) Redundant prime circuits which enter common equipment or enclosures assigned to a Non-Class 1E division; one of these becomes intruding. For example, Division A prime and Division B prime circuits within a Division A panel requires the Division B prime circuit be treated as an intruder. 2

11. Barrier 2

A barrier is material or a structure placed between redundant Class 1E or prime equipment or circuits to limit damage to Class 1E circuits from internally generated fires. Within enclosures and equipment barriers are Haveg Siltemp tape or sleeving, conduits (flexible or rigid) and sheet metal enclosures or metal plates. Outside enclosures and equipment barriers are solid steel tray covers and bottoms, sheet metal panels, Thermolag insulation, and conduits (flexible in miniducts, PGCC periphery, or where flexibility is necessary, or rigid). 2

12. Power Generation Control Complex (PGCC) 2

The PGCC located in the Main Control Room is defined for the purposes of this document as a modular assembly of termination cabinets interconnected by floor sections comprised of multiple, separate cable ducts on which are mounted control room panels. The PGCC forms an interface between the incoming plant cables and control room panels.

13. Periphery of PGCC 2

The periphery of the PGCC is defined as the subfloor area between the termination cabinets and the Main Control Room wall.

14. Direct Bridging 2

Direct bridging is defined as a circuit which routes between redundant Class 1E raceways (see Figure 1A). Direct bridging is prohibited.

15. Secondary Bridging By Proximity 2

Secondary bridging by proximity is defined as:

a. Bridging of redundant Class 1E circuits by two (or more) Non-Class 1E (Division A, B, XXX1, XXX2, or XXX3) proximity circuits, routed together in a common enclosure or raceway, and each having part of their routing in a redundant Class 1E raceway (See Figure 1B).

b. Bridging of redundant Class 1E circuits by Non-Class 1E (Division A, B, XXX1, XXX2, or XXX3) proximity circuits within enclosures or equipment. These proximity circuits may also be extensions of circuits originating from Class 1E raceways (See Figure 1C).

16. Fail-Safe Systems

Systems used to shutdown (SCRAM) the reactor are designed to fail-safe upon loss of power(de-energize-to-operate). These systems are the Reactor Protection System (RPS) and those portions of the Neutron Monitoring System (NMS) i.e., Source Range Monitoring (SRM), Intermediate Range Monitoring (IRM), Average Power Range Monitoring (APRM), and Local Power Range Monitoring (LPRM) providing input to the RPS. In addition, system inputs and logic associated with the containment isolation function are designed to be fail-safe. 2

17. Equipment and Enclosures

For the purposes of this document equipment and enclosures are defined as panels, racks including open faced instrument racks, terminal boxes, etc. Individual device/component housings which include the conduit nipple up to the first tee are not included in this definition. 2

18. Residing/Compatible Division Wiring

Wiring of the same division as that designated for the equipment/enclosure (residing) or is acceptable to be routed with equipment or enclosure residing wires (compatible). All other wiring is intruding.

B. Class 1E Redundant Circuit Design Requirements

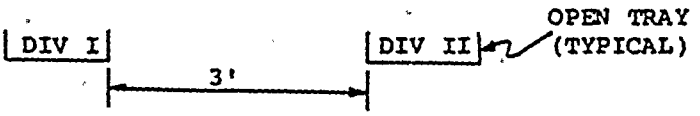
Each Class 1E component and interconnecting cabling shall be assigned to one of seven Class 1E divisions as noted in Table II. Class 1E components of one division are separated from Class 1E components of other redundant divisions. Minimum separation distances for trays, conduits, cables, and cables/wires within enclosures are described below. Note that the separation distances specified are to preclude internally generated fire propagation between redundant Class 1E divisions and do not consider effects of externally generated fires or pipe breaks and missiles. 2

1. Spatial Separation Between Raceways

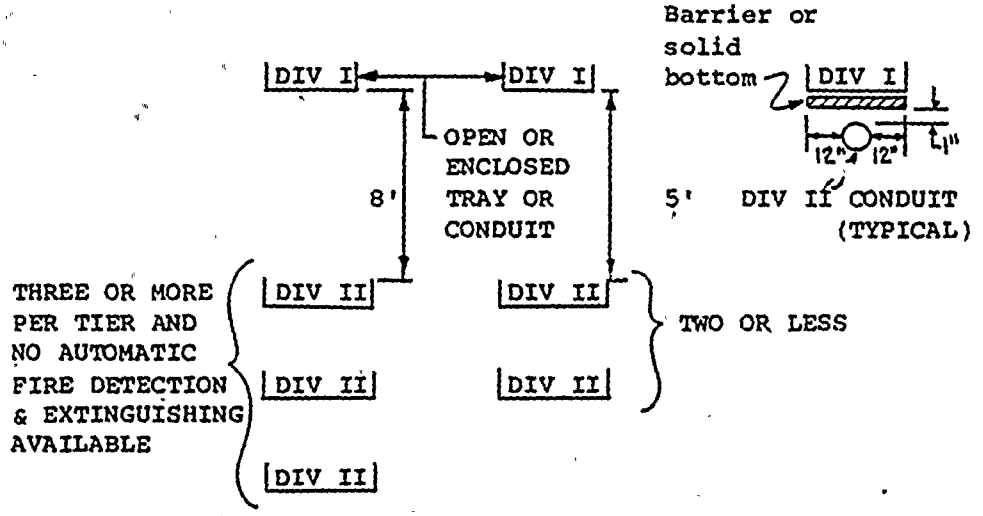
a) General Plant Areas (Outside PGCC)

Distances shown consider the ideal arrangement of two (2) raceways only. If more than two (2) raceways exist in any particular arrangement, physical separation distances chosen must be based on the complete configuration. Additionally, minimum distances are shown assuming that there are no equipment or materials in that distance that can aid in the propagation of fire.

(1) Minimum horizontal separation requirement between any two redundant Class 1E divisions is 3 feet. This is also applicable if one raceway is enclosed and the enclosed raceway is not lower than the open raceway.



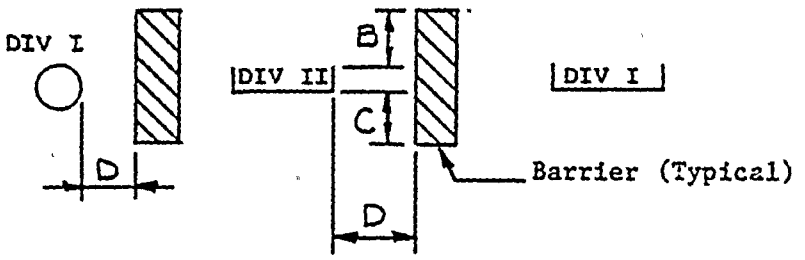
(2) Minimum vertical separation requirements between any two redundant Class 1E divisions are shown below.



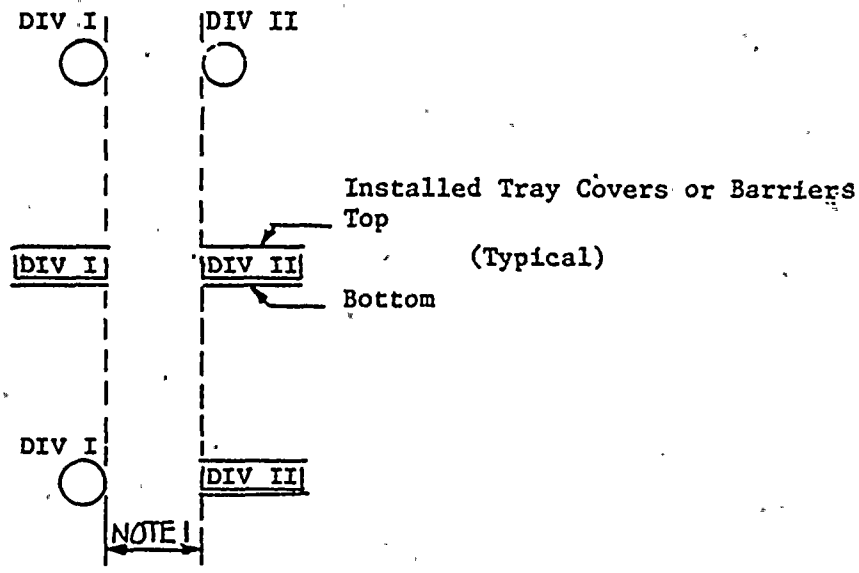
(3) Where minimum separation requirements between two raceways of redundant Class 1E divisions are not met, one of the following methods shall be implemented.

(a) Horizontal Separation

1. Open/Enclosed Raceways Installed Parallel



2. Enclosed Raceways Installed Parallel

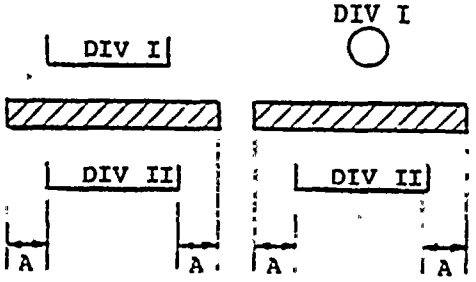


B = 12" Minimum or Flush to Ceiling
C = 12" Minimum or Flush to Floor
D = 1" Minimum

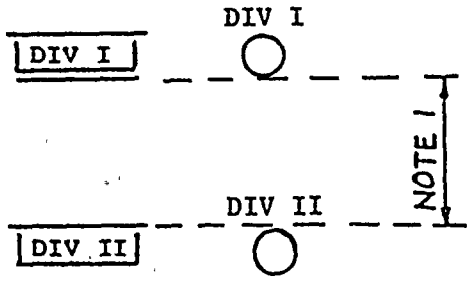
Note 1 - No minimum separation distance is required between redundant division conduits or enclosed trays but they must not physically touch.

(b) Vertical Separation

1. Open/Enclosed Raceways Installed Parallel



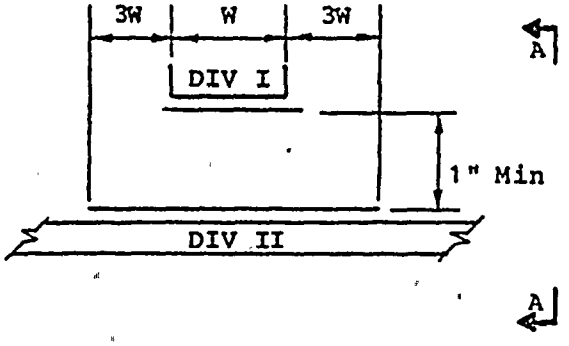
2. Enclosed Raceways Installed Parallel

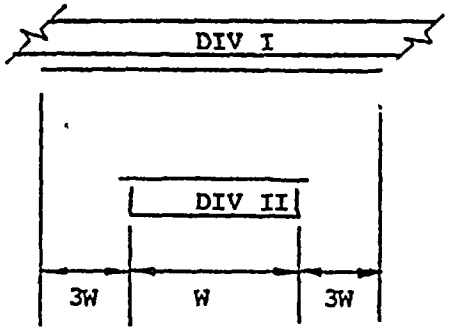


A = 12" Minimum or Flush to Wall.

Note 1 - No minimum separation distance is required between redundant division conduits or enclosed trays but they must not physically touch.

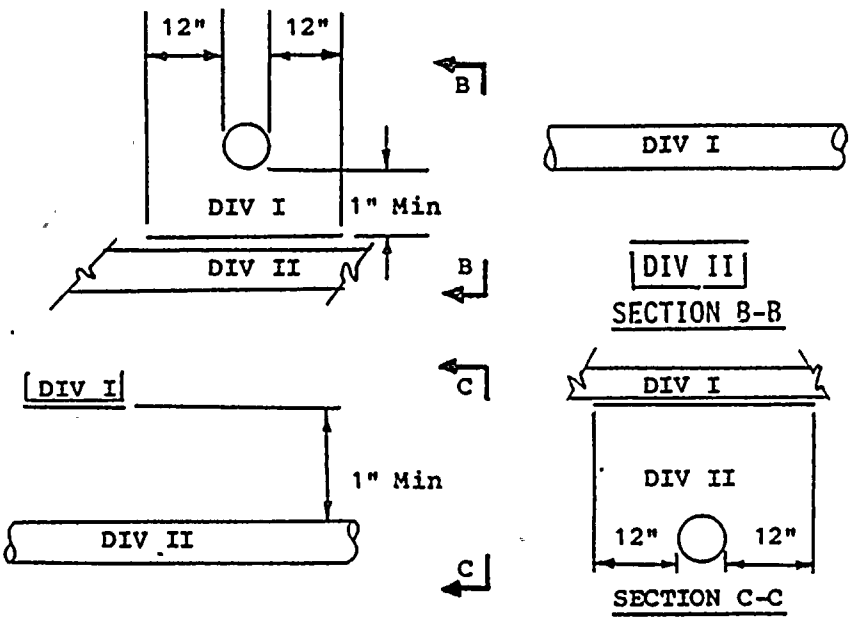
(4) Tray covers shall be used for all crossovers of redundant division raceway systems (where minimum vertical separation distance is not met), except when the bottom raceway is a conduit. The schemes shown below shall be used regardless of the voltage level of the cables in a crossover raceway system. 2





"W" is defined as the nominal tray width of the widest tray involved.
3W = 3 times the nominal tray width or flush to a wall

SECTION A-A



(5) Open raceways assigned to route Non-Class 1E power cables (Division A or B) shall be separated from all Class 1E raceways using the separation criteria specified in a). (1) through (4) above.

b) Unique Requirements For Certain General Plant Areas

1) Cable Spreading Room and Cable Chases

The minimum separation distance between open trays of redundant Class 1E divisions shall be one foot horizontally and three feet vertically. The minimum separation distance between conduits and open trays of redundant Class 1E divisions is one-inch with a barrier provided when the conduit is below or to the side of the open tray and three feet when the conduit is located above the open raceways. Where these distances cannot be maintained, fire barriers shall be installed. Automatic fire detection and suppression must be provided or these areas become General Plant Areas.

2) Periphery of PGCC

A modular floor raceway system is not provided in this area. Cables in this floor area shall be routed in grounded flexible conduit with 3 feet horizontal separation maintained between redundant Class 1E flexible conduits. Where this distance cannot be maintained, one of the redundant divisions shall be routed in rigid conduit. The redundant conduits shall not touch (a barrier may be used to physically separate the two conduits).

3) Class 1E Underground Duct System

Class 1E equipment located remotely from the plant (e.g., equipment located at the ultimate heat sink) is serviced by divisionally separated Class 1E underground duct systems and manholes. The underground duct system for Class 1E systems is constructed of steel encased in reinforced concrete. The minimum horizontal separation between

3) Class 1E Underground Duct System (Cont'd)

redundant duct banks measured from the bank edges is 18 inches. Redundant duct banks do not crossover. Separation within manholes is provided by barriers.

c) Power Generation Control Complex (PGCC)

Separation is provided by the design of the modular floor in the PGCC. The modular floor is latticed and constructed of steel "I" beams and rectangular steel tubes forming longitudinal and lateral raceways. These raceways interconnect the control panels (which are bolted on the modular floor) and the termination cabinets. The network, including transition and extension raceways, provides separation using vertical and/or horizontal barriers and fire stops. Miniducts (raceways within raceways) are of similar construction to the floor raceways and provide separation within the longitudinal raceways. Cables in the miniducts are routed in flexible metallic conduit or wrapped with Siltemp tape. | 2

When it is necessary to route cables between PGCC sections which are not directly connected by floor raceways it is permissible to route these cables through the cable spreading room. That portion of PGCC cables routed in raceways within the Cable Spreading Room shall be at least identified the same as General Plant Area cables with the interface occuring at the control room floor penetrations. | 2

2. Spatial Separation Within Enclosures and Equipment

Where devices of redundant Class 1E systems are mounted in or on the same enclosure or equipment, physical separation (six inches), barriers, or isolation devices shall be provided for the intruding devices and wiring. When it is necessary for a single device such as a relay to be connected to wiring from redundant Class 1E divisions, the intruding division wiring shall be routed immediately away from the device to attain the required six-inch separation or to the extent where a barrier can be installed. Within open faced instrument racks all wiring between terminal boxes and the instrumentation shall be routed in flexible metallic conduits. | 2

3. Separation for Fail-Safe Systems

Outside of equipment and enclosures, circuits belonging to fail-safe systems or portions of systems designed to be fail-safe shall meet the following requirements.

a) The fail-safe divisions do not provide redundant safety functions to the non-fail-safe divisions except as noted in 3) below. Therefore, in general, no separation is required between the non-fail-safe divisions (Div 1, 2, 3) and the fail-safe divisions (Div 4, 5, 6, 7). The following specific criteria applies to fail-safe circuits:

1) External to PGCC fail-safe circuits shall be routed in grounded conduit (rigid or flex) or totally enclosed raceways carrying only fail-safe cables/wires; the grounded raceways are provided only to preserve the fail-safe nature of these circuits.

2) Within PGCC fail-safe circuits shall be routed in grounded flexible metallic conduit carrying only fail-safe circuits and shall be assigned to raceways as described below.

3) Since the Nuclear Steam Supply Shutoff System logic outputs control Divisions 1 and 2 valves and PGCC contains no Division 4, 5, 6, or 7 raceways it is necessary to route the fail-safe cables with non-fail-safe cables. Hense, Divisions 4 & 6 cables are assigned compatibility with Division 1, and Divisions 5 & 7 with Division 2. These Divisions are compatible in General Plant Areas as well as in PGCC.

Considering the above, Division 1 raceways/cables/wires require no separation from Divisions 4 or 6 raceways/cables/wires; Division 2 raceways/cables/wires require no separation from Divisions 5 or 7 raceways/cables/wires. Divisions 4 and 6 shall be separated from Division 2 and Divisions 5 and 7 shall be separated from Division 1. Divisions 4, 5, 6, or 7 need not be separated from Division 3 except to preclude direct bridging between redundant Class 1E raceways.

b) RPS SCRAM Solenoid Cabling

Wires from both RPS trip system trip actuators to a single group of SCRAM solenoids are permitted to route in a single conduit. A single conduit shall not contain wires to more than one group of SCRAM solenoids. Wiring for the A and B solenoids for the same control rod can run in the same conduit. See Figure 2.

c) NMS and Main Steam Line Cabling

Cables routed through the containment penetrations are grouped so that failure of all cabling in a single penetration cannot prevent a SCRAM. This applies specifically to the NMS and main steam line inboard isolation valve position switch cables. See Figures 2 and 3.

d) RPS Power Supplies

Power supplies to systems which de-energize to operate require only that separation which is deemed prudent to ensure reliable operation. Therefore, the RPS motor generator sets output cabling are not required to comply with Class 1E separation requirements.

e) Four Division Separation

Wiring for the four RPS SCRAM group outputs and the NMS LPRM inputs shall be routed as four separate divisions. See Table XV and XVI and Figure 2.

f) The NMS cabling in the area immediately underneath the reactor need not be completely routed in enclosed raceways nor separated in accordance with Section II.B.1a due to space limitations and the need for cable flexibility.

g) Class 1E logic inputs to the RPS and Containment Isolation System from main steam turbine process and status sensing instrumentation (Load Rejection or Turbine Trip), Turbine Generator Building leak detection and Main Steam Tunnel high radiation instrumentation, their associated instrument racks, cabling and raceways are located in the Turbine Generator Building. This equipment, even though located in a non-seismic Category I structure, shall be mounted to seismic Category I requirements and all related cabling routed to Class 1E requirements.

4. Separation Within Divisions

In order to preserve functional integrity and to meet single failure criteria the MSLCS, the SGTS, and the RRCS contain certain system portions (RRC and MSLCS isolation valves/controls and the SGTS discharge dampers/controls) that require separation within a single division. In these instances separation shall be maintained between the redundant portions as though the portions were in redundant divisions or an analysis shall be performed to show that lesser separation is acceptable. 2

5. Raceway, Cable, Equipment, and Enclosure Identification

a) Class 1E cables routed within conduits need not be identified within the conduit.

b) Class 1E General Plant raceways shall be uniquely identified with a color coded marker every 15 feet, at the beginning, end, at pull boxes, and discontinuities (walls, structures, etc.) as shown in Table III.

c) Class 1E cables routed in Division 1 through 7 raceways in General Plant Areas shall be uniquely identified with a color coded marker every 15 feet and at their terminations as shown in Table III except as noted in II.B.1.C. These markers shall be provided on the cables up to the first termination within equipment and enclosures.

d) Class 1E cables routed in PGCC raceways shall be uniquely identified with a color coded marker every 5 feet near the cable divisional marker as shown in Table V. These markers are provided on the cables up to the first termination within equipment and enclosures. PGCC longitudinal raceways shall be identified with a color coded marker at approximately 5 foot intervals as shown on Dwg. E775. Each lateral raceway shall be identified at the longitudinal raceway lip centered above the lateral raceway. 2

e) Conduits in the periphery of the PGCC floor area are identified by metal tags which identify the cable number and division. Since these tags are not color coded, an additional color-coded marker shall be attached near the metal tag to identify the conduit divisional assignment.

f) Within enclosures and equipment Class 1E intruder circuits shall be uniquely identified with a color coded marker at 12 $\pm$ 2 inch intervals as shown in Table VII. 2.

g) Circuits that have been upgraded from Non-Class 1E to Class 1E and are already installed in raceways shall be identified with a Class 1E color coded marker at terminations, pull boxes, and entrances and exits to raceways. Upgraded cables shall be routed in Class 1E raceways. Cable installation records shall be reviewed to provide assurance that these cables are routed in Class 1E raceways and installed to Class 1E requirements (cable installation parameters). Otherwise, megger and continuity tests shall be performed, termination and routing reinspected to Class 1E requirements, and documentation prepared verifying the upgrade.

h) To differentiate between cables and wires where tracing cables inside equipment and enclosures is difficult, color coded wire markers are utilized as shown in Table VI. 2

i) Equipment and enclosures shall be uniquely identified with two color coded markers; one marker with the identification number and a second with the assigned separation division of the residing components, cables, and wires. These markers shall be color coded as shown in Tables III, IV and V. Individual components located on or in equipment and enclosures require identification markers only and are not necessarily color coded, but need not have individual divisional separation markers. For example, an instrument rack shall be uniquely identified with a color coded identification marker and a divisional separation marker. However, each separate instrument need not have a color coded identification marker or a divisional separation marker. 2

Open faced racks which contain components from more than one division shall be provided with appropriate divisional separation marker on each division terminal box.

The identification number marker for multidivisional equipment and enclosures shall be black lettering with a white background.

Single equipment and enclosures containing cables, wires, and/or devices of redundant divisions shall be provided with color coded divisional separation markers utilizing at least one of the following methods:

1. Equipment or enclosures containing intruding wires/cables/devices may be identified by a residing division separation marker and all intruders identified and separated as such. 2

2. Equipment and enclosures containing an area(s) or bay(s) dedicated to intruding wires/cables/devices with 6" separation (or barrier) from residing/compatible wires/cables/devices may be identified with the residing division separation marker. The intruder area, which may be enclosed partially or entirely by metal barriers, may be identified by an intruding division separation marker placed either within lines of demarcation or on the separation barrier. Intruding wires/cables/devices within these areas need not be identified as intruders.

j) Within open faced instrument racks wiring from terminal boxes to individual instruments is routed in flexible conduits. These conduits need not be identified with a cable identification number or with a divisional separation marker. | 2

k) Two different equipment, enclosure, and cable identification schemes exist within PGCC; one for those provided within the General Electric NSSS scope and the other for those provided within the Balance of Plant scope. Refer to Tables V, XIII, XIV, XV for details of these schemes. Those BOP PGCC cables that route directly between BOP and NSSS panels shall be identified using the NSSS designation scheme but with BOP system designations. | 2 | 2

6. Transient Data Acquisition System (TDAS)

The TDAS is a Non-Class 1E, computer based, data collection and reduction system which receives the majority of its inputs from Class 1E systems. The system shall be designed as follows:

a. All TDAS input circuits within raceways shall be identified and routed to Class 1E requirements up to a remote isolation device. From the isolation device to the remote multiplexer the circuits are considered to be Non-Class 1E.

b. Remote multiplexer outputs are transmitted to the computer via a fiber optic cable which is inherently an isolation device. The fiber optic cable, therefore, can be routed in any raceway without regard to separation criteria.

c. TDAS Class 1E input isolators are supplied from Non-Class 1E 24VDC current limiting power supplies. The power source to these power supplies is Class 1E and provided with a Class 1E current interrupting device. The circuit to the power supply shall be routed as prime for Division 1 and 2 isolators and as Class 1E for the Division 3 isolators. The power supply at the isolator is internally isolated from the Class 1E signal input circuit. Downstream of the power supply, the circuits shall be treated as Non-Class 1E.

7. General Plant/PGCC Interface | 2

For the purposes of cable identification General Plant Area cabling entering the PGCC interfaces with PGCC cabling at termination modules within the termination cabinets. This cabling shall be designed to the divisional compatibilities and designations as shown in Tables XIII and XIV.

8. Isolation Devices | 2

Where circuit isolation devices are required, consideration shall be given to types of devices available and the type of circuit protection required.

Isolation device types shall be applied as follows:

a) Class 1E power circuits shall be isolated from Non-Class 1E circuit faults by devices which provide adequate circuit interrupting capability. Class 1E circuit breakers tripped by an accident signal are preferable; all circuits downstream of the breaker, except the accident tripping portion of the trip circuit itself, shall be considered Non-Class 1E. However, where Non-Class 1E circuits are helpful to operations personnel following an accident, coordinated circuit breakers or fuses actuated by time overcurrent trips shall be used. Trip characteristics shall be such that for all faults the downstream device will interrupt current prior to trip of any upstream breaker or fuse. Various combinations of fuses and circuit breakers may be used. 2

In addition to current interrupting devices, current limiting devices may be used either alone or in conjunction with interrupting devices to isolate power circuits. Current limiting shall be accomplished by using current limiting or isolation transformers.

b) Low energy Class 1E circuits shall be isolated from redundant low energy Class 1E circuits by devices such as relays or isolation amplifiers. Low energy Class 1E circuits shall be isolated from non-Class 1E loads by resistors, fuses, circuit breakers, or current and potential transformers. 2

When it is necessary to interface between redundant Class 1E divisions, relay coil-to-contact isolation is acceptable. That is, the coil of the relay may be powered from one division and the relay contacts can be used for interface with a redundant division.

The contacts shall not be used in more than one redundant division circuit since this condition would be contact-to-contact separation which is not acceptable.

Class 1E instrumentation circuits may be isolated from Non-Class 1E portions of the circuit by a fuse, resistor(s), or an isolation amplifier.

C. Associated Circuit Design Requirements

1. Prime Circuits

a. Redundant prime circuits shall be physically separated with the same requirements as redundant Class 1E circuits (See Section II.B) from the load side of the source circuit protective device to the final connected load except as noted in c. below. For example, a Division A prime (A') circuit shall be separated from a Division B prime (B') circuit and a Division 2 circuit; a Division B prime (B') circuit shall be separated from a Division A prime (A') circuit and Division 1 circuit. 2

b. Class 1E power sources shall be protected from failures within prime circuits by a Class 1E isolation device.

c. Deviations to prime circuit separation criteria implementation are as follows:

1) Circuits downstream of Class 1E isolation devices (circuit breakers) which are tripped by an accident signal shall be treated as Non-Class 1E and not as prime.

2) Emergency lighting, obstruction lighting, main control room normal lighting, sync circuits, SLCS, meteorlogical tower supervisory, fire protection circuits, and the UPS Inverters (IN-1 and IN-4) shall be provided with two series Class 1E isolation devices (circuit breakers/fuses). Downstream of the second isolation device the circuit shall be treated as Non-Class 1E and not as prime. | 2

3) A single circuit supplies power to the Technical Support Center (TSC). This circuit shall be routed as prime to the Motor Control Center located in the TSC. Downstream of the MCC feeder breakers the circuits shall be treated as Non-Class 1E and not as prime.

4) Circuits supplying power to the 24VDC power sources for the Transient Data Acquisition System remote multiplexers and the General Electric scope Regulatory Guide 1.47 displays shall be routed as prime from the Class 1E isolation device (circuit breaker) to the current limiting 120VAC/24VDC power supply. Downstream of this power supply the circuits shall be treated as Non-Class 1E and not as prime.

5) Circuits supplying power to other Regulatory Guide 1.47 displays from the Division 1 and 2 24VDC batteries shall be treated as Non-Class 1E and not as prime.

6) The Non-class 1E TDAS inverter input power circuit from the Class 1E 480 VAC supply shall be treated as prime to the inverter. Downstream of the inverter the output circuits shall be treated as Non-Class 1E and not as prime.

2. Proximity Circuits

Proximity circuits when routed in a Class 1E raceway ("Associated by Proximity") shall meet the same physical separation criteria as that applied to the Class 1E circuits as follows.

a. Routing criteria for proximity circuits are as shown in Tables X, XI, and XII external to PGCC and Table XIV within PGCC. Proximity circuits may also be prime circuits. Refer to Section II.C.1 for prime circuit separation criteria.

b. Proximity circuit sections routed in Non-Class 1E raceways shall be treated as Non-Class 1E and have no specific separation criteria applied except as described in Sections II.B.1.a.5 and II.C.1 (See Figure 4).

c. Within equipment or enclosures, no specific separation criteria is applied to proximity circuits unless they are also prime circuits.

Effective April 1, 1983 each proximity circuit routed in Class 1E raceways and not protected by a Class 1E circuit protective device (fuse, circuit breaker) shall be analyzed to demonstrate that its failure and effect on Class 1E circuits cannot result in loss of ability to safely shutdown the plant. Such cables that do effect safe plant shutdown shall be assigned alternate raceway routes. | 2

d. Bridging Circuits

1) Class 1E circuits, prime circuits, and proximity circuits, as shown in Figure 1A shall not bridge between redundant Class 1E raceways. Design control to alert designers of a potential for cable direct bridging is provided by Note 4 in the computerized cable schedule (B&R Drawings E550 and E551). Refer to Table XIV, Examples 1 through 4. | 2

2) Secondary bridging within Class 1E equipment or enclosures is allowed for low energy circuits as shown in Figure 1C.

3) Secondary bridging by proximity circuits is allowed to occur within Non-Class 1E or Non-Divisional raceways as shown in Figure 1B. It is acceptable to route Divisions A, B, XXX1, XXX2, and XXX3 cables together in the same PGCC Non-Divisional raceway.

Note 4 of the computerized cable schedule is assigned to any Non-Class 1E cable with the potential to become a direct bridge. This occurs when this cable is routed in a Class 1E raceway and has a continuing section routed in a Non-Class 1E raceway. For example, Note 4 would be applied to a Division B cable routed in a Division B raceway and subsequently routed into a Division 1 PGCC raceway; potentially this cable, external to PGCC, could be routed into a Division B raceway and then into a Division 2 raceway creating a direct bridge. | 2 | 2

3. Prime and Proximity Circuit Identification

a. Prime cables routed in Division A and B raceways in General Plant Areas shall be uniquely identified with a color coded marker every 15 feet as shown in Table IV except as follows:

1) Prime cables routed in conduit need not be uniquely identified with the color coded marker.

2) Enclosed and open raceways shall be identified every 15 feet, at discontinuities, at pull boxes, and at end points with the appropriate prime color coded marker except as noted in II.C.3.f. | 2

3) Cables that have been upgraded from Non-Class 1E to prime and are already physically installed in plant raceways shall not be retrofitted with the prime color coded marker except at all terminations, pull points, and entrances and exits to raceways.

b. Prime cables routed in PGCC raceways shall be uniquely identified with a color coded marker every 5 feet near the cable divisional marker as shown in Table V except as follows:

Circuits that have been upgraded from Non-Class 1E to prime and are already physically installed in the PGCC raceways shall be identified with the prime color coded marker only at entrances and exits to PGCC raceways and at terminations within enclosures.

c. Within Class 1E enclosures and equipment intruding prime circuits shall be identified the same as Class 1E intruding circuits as in II.B.5.f above. |2

d. Within Non-Class 1E multi-divisional enclosures and equipment assigned to either Division A, B, XXX1, or XXX2, an intruding prime circuit shall be uniquely identified as in II.B.5.f above.

e. Proximity circuits shall have a unique color coded marker as described in Table IV.

f. Raceways which contain prime and proximity cables with a Division 1 through 7 compatibility shall be identified with the appropriate divisional separation marker (Division 1 through 7) even if these raceways route to Non-Class 1E enclosures or equipment. Raceways routing prime cables and identified with Division 1 thru 7 separation markers require no prime checkered markers. Prime cables routed in these raceways shall be identified with prime checkered markers except as noted in II.C.3.a.3. |2 |2

D. NON-CLASS 1E CIRCUIT DESIGN REQUIREMENTS

Non-essential circuits or portions of circuits, which are not prime or "Associated By Proximity" are termed and treated as Non-Class 1E. Refer also to Figure 4. Electrical separation criteria shall not apply to Non-Class 1E circuits except as noted in II.B.1.a.5 or below for utility power circuits. Non-Class 1E circuits shall be assigned to Non-Class 1E divisions as shown in Table XIV. Non-Class 1E raceways need not be physically separated from each other or from any Class 1E raceways unless they contain power circuits. Deviations to standard divisional assignments are as follows:

1. Digital computer signals in the reactor building are routed in Class 1E divisional raceways as applicable by the device being served. Non-Class 1E digital signals in other areas are routed in instrumentation raceways of Division B irrespective of the division by which the device is being served.

2. Analog computer signals in the reactor building are routed in Class 1E divisional raceways as applicable by the device being served. Non-Class 1E analog signals in other areas are routed in instrumentation raceways of Division A.

Non-Class 1E Division A and B raceways, excepting conduits, do not exist within the Reactor Building or the Cable Spreading Room. This requires that most Non-Class 1E cables be routed in Class 1E raceways; these cables become "Associated by Proximity". Division A and B conduits routed within these areas are designated with separation markers as shown in Table IV. If cables within these conduits have a Division 1 or 2 "compatibility" then the separation markers shall be in accordance with Class 1E requirements (see Section II.B.4).

Within PGCC, raceways are designated Division 1, 2, 3, or Non-Divisional. No Division A or B raceways exist. Thus, Division A and B cables shall be assigned to Division 1 and 2, respectively, and/or to a Non-Divisional raceway. | 2

Within Class 1E Main Control Room panels Non-Class 1E utility power circuits shall be separated by 6" or a barrier from all other wiring.

Non-Class 1E circuits need not be uniquely identified inside enclosures or equipment except for wires downstream of the first termination as shown in Table VI. | 2

Non-Class 1E cables routed in open raceways shall be uniquely identified as described in Table IV. Non-Class 1E cables shall be tagged with color coded markers at their terminations, pull points, entrances and exits to raceways, and every 100 feet. Division A and B raceways are tagged every 100 feet, at discontinuities, entrances and exits to rooms, pull boxes, and end points.

Non-Class 1E cables routed in PGCC raceways shall be uniquely identified with a cable I.D. marker every 10 feet and with a color coded cable separation marker every 5 feet as shown in Table V.

The Non-Class 1E cables which wholly route in compatible Non-Class 1E raceways (Div. A or Div. B) are routed in accordance with cable routing criteria stated in Tables X, XI and XII. Division markers for equipment/raceways and cables are color coded per Table IV.

III. Criteria Implementation

The purpose of this section is to assist the design engineer in the implementation of the design criteria. The principal elements for design consideration include:

- Device service requirement,
- Providing an appropriate power supply based on device service requirements,
- Assigning the cables to meet device/power source compatibility,
- Routing of the cables in raceways to meet the separation criteria requirements, and
- Enclosure/equipment/raceway/cable identification.

The following details explain the steps to be followed to assure proper implementation of the criteria.

A. Class 1E Circuits

Class 1E systems are listed in Table II.

All Class 1E electrical equipment and enclosures are tagged with an identification number. In addition, a division identification marker is provided which indicates the assignment to one of seven divisions (Divisions 1, 2, 3, 4, 5, 6, and 7). This division marker is inscribed with color coded characters using the color scheme shown in Table III for all equipment external to PGCC and per Tables V, XIII, and XIV for equipment internal to PGCC including control room panels. 2

All devices required to preserve Class 1E functions are supplied from Class 1E power sources of the compatible division as shown in Table II. For example, RHR Loop A is supplied from the Division 1 Class 1E power source.

The assignment of a proper cable number is key to the implementation of separation criteria. Each cable number is guided by Class 1E division designation, the equipment of origin, and the circuit/cable identification number. The methodology of cable number assignment and the significance of various characters are provided in Table VIII. In addition to the unique identification number, each cable is also identified with a divisional marker as shown in Tables III, V, XIII and XIV.

Routing criteria for Class 1E cables in General Plant Area raceways is provided in Tables X, XI and XII. Table XIII provides the routing requirements inside the PGCC raceways. As indicated in these tables, routing of Class 1E cables in non-compatible division raceways or Non-Class 1E raceways is not permitted.

Divisionalized raceways are designed to meet the criteria requirements as stated in Section II.B.1. The raceway identification scheme is provided in Tables III and V.

Class 1E equipment and enclosures are identified with an appropriate divisional marker to show the residing Class 1E division of the internal cables and wires. Intruder circuits are identified with a color coded marker in accordance with Table VII. Note that Table VII identifies circuits as intruders which are not described as such by the literal definition of intruder (refer to II.A.10) i.e., for ease of design criteria implementation not all those circuits identified as intruders are Class 1E or prime. 2 2

Class 1E cables may contain non-Class 1E circuit conductors. These cables shall be identified as Class 1E.

B. Prime Circuits

Prime circuits are identified on the cable schedules by a A'1 or B'2 designation in the "SFTY CLR" field. See Table IX Column 14 for details. A'1 signifies a cable that connects a Class 1E Division 1 power source to a Non-Class 1E Division A device. Similarly B'2 signifies a cable that connects a Division 2 power source to a Division B device.

A Division 1 power source is never connected to a Division B device via a B' cable. Similarly, a Division 2 power source is never connected to a Division A device via an A' cable.

All prime cables and the Non-Class 1E divisional raceways in which they route, in addition to the Non-Class 1E identification markers, are identified with a checkered marker as described in Tables IV and V.

A'1 and B'2 circuits are not routed in the same raceway. The separation requirements for the prime cables in enclosures is the same as that for the Class 1E cables as shown in Table VII.

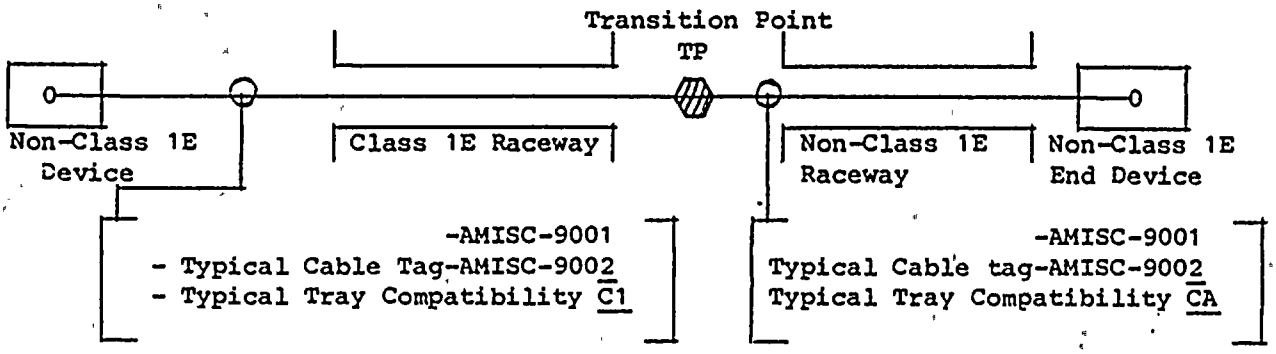
Within PGCC prime circuits are required to be routed in Class 1E compatible divisional raceways as shown in Table XIV.

C. Non-Class 1E Circuits

Non-Class 1E circuits such as Turbine Generator, plant service circuits, etc. are assigned to either Division A or Division B. As described in Section II.D, Non-Class 1E raceways for routing of Non-Class 1E cables do not exist in all plant areas. Therefore, certain Non-Class 1E cables (prefixed with A or B) are required to be routed in Class 1E raceway systems. Such cables are treated as "Associated by Proximity" and are divisionally marked as shown in Tables IV and V.

Within PGCC, Division A, Division B, XXX1, 2 and 3 Non-Class 1E circuits are allowed to be routed together in a Non-Divisional raceway. Precautions must be taken to assure that these circuits do not cause direct bridging. Refer to Table XIV for further discussion.

Detail 1



Detail 1 illustrates the treatment of a proximity cable with sections routed in both Class 1E and Non-Class 1E raceways. Due to the programming limitation of the computerized cable schedule, such a cable is treated in two sections. The section routed in the Class 1E raceway is assigned a type, a divisional compatibility, and an AXXX - 9000 series number in the cable schedule. This entry (see Table IX, Column (2)) is developed as shown in Table VIII, Item (2). The cable destination is called out to be TP - an imaginary Transition Point - with a note that the cable continues to be identified with a consecutive number. Refer to Table IX, Column (4) for details. The portion of the cable which is routed in a Non-Class 1E raceway has type/cable compatibility noted in Column 2 of Table IX. This section of the cable is assigned a consecutive cable number. The 9000 series cable as described above are color coded as shown in Table IV. Note that both consecutive cable numbers appear along the entire length of the cable in the Class 1E as well as the Non-Class 1E raceways.

D. Non-Class 1E, Non-Divisional Circuits

There are certain systems such as the security system, fire protection, lighting, communications etc. which are not assigned to a division. These cables are routed either in dedicated conduits or they are assigned a Non-Class 1E divisional circuit identification and routed in appropriate raceways.

E. General Plant/PGCC Interface

The requirements of General Plant/PGCC interface are shown in Table XIII and XIV. GE NSSS circuit design is based on the general details provided in Tables XV and XVI.

IV. References

WNP-2 FSAR Section 8.3

Contract 218 Specification

General Electric Specification 22A7416

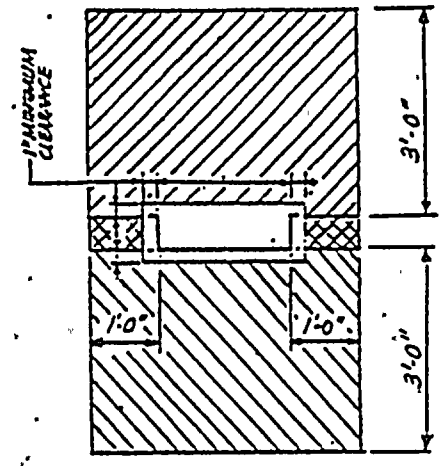
TABLE A-9

RACEWAY INSPECTION CRITERIA

FOR CLASS 1E SEPARATION (EXTERNAL TO PGCC)

COMPATIBLE RACEWAY CATEGORIES FOR SPATIAL SEPARATION		
CATEGORY No.	TRAY MARKER	CONDUIT MARKER
1A	*-CH-A1	CH-A1
	*-CH-B1	CH-B1
1	*-DIV-1	DIV-1
	*-DIV-A	DIV-A
2A	*-CH-A2	CH-A2
	*-CH-B2	CH-B2
2	*-DIV-2	DIV-2
	*-DIV-B	DIV-B
3	*-DIV-3	DIV-3
P	⊗-DIV-A	DIV-A
	⊗-DIV-B	DIV-B
C	⊙-DIV-A	DIV-A
	⊙-DIV-B	DIV-B

*-P,C,H,S,Rc
⊗-P,H
⊙-C,S



CLEARANCE IS SPECIFIED BETWEEN RACEWAY CATEGORIES.

DETAIL 'A'

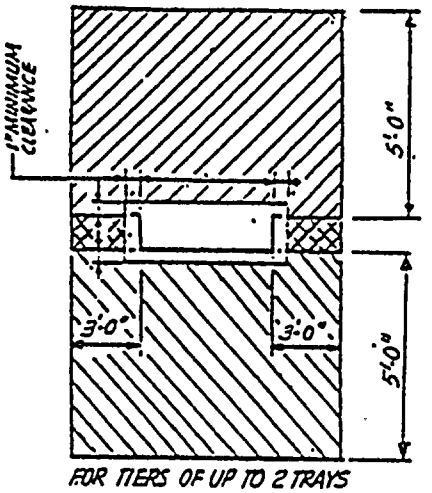
CABLE SPREADING ROOM & CABLE CHASE

RACEWAY CATEGORIES - TYPICAL

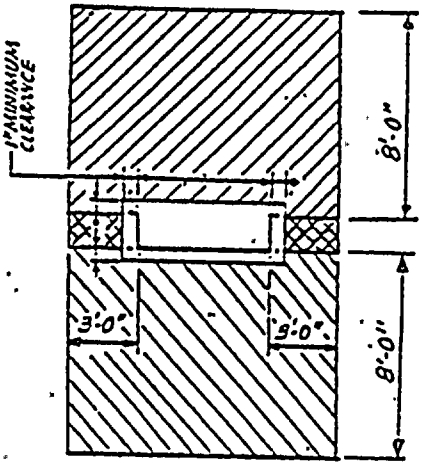
	1	1A	2	2A	3	P	C
1	O	O	X	X	X	X	O
1A	O	O	X	X	O	X	O
2	X	X	O	O	X	X	O
2A	X	X	O	O	O	X	O
3	X	O	X	O	O	X	O
P	X	X	X	X	X	O	O
C	O	O	O	O	O	O	O

O - IS NOT REQUIRED TO COMPLY WITH THE SPATIAL SEPARATION CONTAINED HEREIN

X - IS REQUIRED TO COMPLY WITH THE SPATIAL SEPARATION CONTAINED HEREIN.



FOR TIERS OF UP TO 2 TRAYS



FOR TIERS OF 3 AND MORE TRAYS

REDUNDANT① INTRUDING RACEWAY	INDICATED OPEN TRAY - SEE DETAILS		
	TOP	BOTTOM	SOLID TRAY COVERS SHALL EXTEND ON EITHER SIDE OF INTRUDING RACEWAY
RIGID CONDUIT	X		12"
FLEX. CONDUIT	X	X	12"
ENCLOSED TRAY	X		3W
OPEN TRAY	X	X	3W
ALL RACEWAYS	X	X	CND 12", TRAY 3W
RIGID CONDUIT		X	12"
FLEX. CONDUIT	X	X	12"
ENCLOSED TRAY		X	3W
OPEN TRAY	X	X	3W

① FOR PURPOSES OF THESE DETAILS RACEWAY CATEGORIES 1, 2, 3 & P ARE REDUNDANT TO EACH OTHER.
"W" IS DEFINED AS THE NOMINAL TRAY WIDTH OF THE WIDEST TRAY INVOLVED.
3W = 3 TIMES THE NOMINAL TRAY WIDTH OR FLUSH TO A WALL.

SYMBOL - EXPLANATION

THE INDICATED OPEN TRAY IN THE DETAILS ABOVE REQUIRES A SOLID TRAY COVER (AS SHOWN IN THE ABOVE TABLE) WHEN A REDUNDANT① RACEWAY INTRUDES IN THIS AREA (TYPICAL) AND IS NOT THERMOLAGGED.

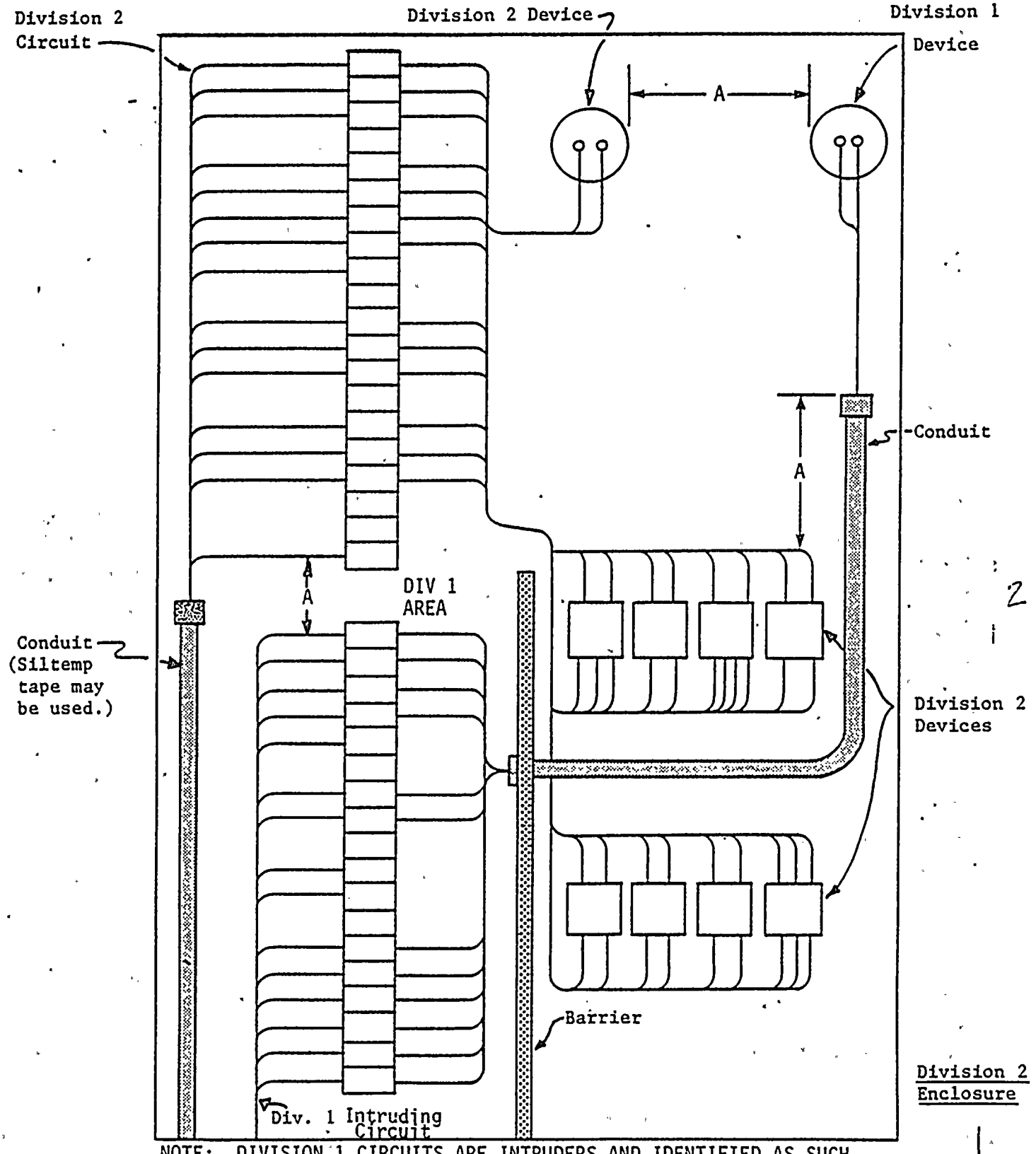
DETAIL B

GENERAL PLANT AREAS (EXCEPT DETAIL A & PGCC).

SPACIAL SEPARATION BETWEEN ENCLOSED TRAYS OR CONDUITS IS THAT THEY MUST NOT PHYSICALLY TOUCH. SEPARATION REQUIREMENTS BETWEEN FLEXIBLE CONDUITS OF REDUNDANT DIVISIONS IN THE PGCC PERIFERY IS 3'0" SEPARATION REQUIREMENTS BETWEEN FLEXIBLE CONDUIT AND RIGID CONDUIT OF REDUNDANT DIVISIONS IN THE PGCC PERIFERY IS THAT THEY DO NOT TOUCH.

AN INTRUDING THERMOLAGGED RACEWAY SHALL BE TREATED AS A RACEWAY WITH BARRIER AND WILL NOT REQUIRE THE ADDITION OF TRAY COVERS.

SKETCH B



NOTE: DIVISION 1 CIRCUITS ARE INTRUDERS AND IDENTIFIED AS SUCH EXCEPT IN THE DIVISION 1 AREA.

A - REFER TO SKETCH A

TABLE I

POWER/CONTROL CABLE CLASSIFICATION

SERVICE VOLTAGE (VOLTS)	LOAD TYPE								
	MOTORS - ALL EXCEPT SMALL MOTORS	MOTOR-OPERATED VALVES	SOLENOID VALVES	SPACE HEATER (INC. MOTOR HEATER)	PROCESS HEATER	TRANS. (INC. PWR. AND LIGHT'G.)	FDR'S TO SWG'R. & LOC. CONT. PANEL	METERING, PROTECTION & CONTROL CKTS.	SMALL MOTORS (SEE NOTE 1)
120 VAC 125 VDC & BELOW	P	P	C	C (up to 900W)	P	P	C (up to 35A circuits)	C	C
120 VAC 125 VDC & BELOW	P	P	C	P	P	P	P & C	C	NA
ABOVE 120 VAC 125 VDC	P	P	NA	P	P	P	P	NA	NA

NOTES:

1. INCLUDED ARE: ELECTRO HYDRAULIC OPERATORS (EHO'S), HVAC DAMPERS, NMS STARTUP RANGE DETECTOR DRIVE MOTOR, MOTORS UP TO 1/3 HP.

LEGEND:

P - POWER
C - CONTROL
NA - NOT APPLICABLE

TABLE II

ASSIGNMENT OF SYSTEMS TO DIVISIONS OF SEPARATION

Division 1	Division 2	Division 3	
RHR A	RHR B	HPCS	
LPCS	RHR C	HPCS Standby Emergency Power	
Containment Outboard Isolation Valves	Containment Inboard Isolation Valves	125 VDC HPCS Battery	
Standby Emergency Power 1	Standby Emergency Power 2	HPCS Service Water	2
RCIC		HPCS Safety-Related Display Instr.	
Automatic Depressurization Div. 1 controls	Automatic Depressurization Div. 2 controls		
Standby Gas Treatment 1	Standby Gas Treatment 2		
250 volt DC Battery			
125 volt DC Battery 1	125 volt DC Battery 2		
24 volt DC Battery 1	24 volt DC Battery 2		
Standby Service Water Pump A	Standby Service Water Pump B		
MSIV-LCS (Inboard)	MSIV-LCS (Outboard)		2
Leak Det. System 1	Leak Det. System 2		
CAC 1	CAC 2		
Cont. Inst. Air 1	Cont. Inst. Air 2		2
SLCS 1			
Mn. Cont. Rm. HVAC 1	Mn. Cont. Room HVAC 2		
Remote Shutdown 1	Remote Shutdown 2		
RPT 1 Output	RPT 2 Output		
Safety-Related Display Instr. 1	Safety-Related Display Instr. 2		
Suppression Pool Temp. Monit. 1	Suppression Pool Temp. Monit. 2		
Power & Control for Selected non-Class 1E Equipment (prime circuits)	Power & Control for Selected non-Class 1E Equipment (prime circuits)		2
Reactor Bldg. Pressure Control 1	Reactor Bldg. Pressure Control 2		
Drywell and Head Area Recirculation Fans 1	Drywell and Head Area Recirculation Fans 2		

ASSIGNMENT OF RPS, NSSSS AND NMS TO DIVISIONS OF SEPARATION

(FAIL-SAFE WIRING)

Division 4+	Division 5*	Division 6+	Division 7*
RPS A1	RPS A2	RPS B1	RPS B2
NSSSS A1	NSSSS A2	NSSSS B1	NSSSS B2
NMS A	NMS C	NMS B	NMS D

\+ Compatible with Division 1
* Compatible with Division 2

TABLE III

DIVISION MARKERS FOR CLASS 1E EQUIPMENT & ENCLOSURES, RACEWAYS, & CABLES EXTERNAL TO PGCC (INCLUDING FIELD SIDE OF PGCC TERMINATION CABINETS)

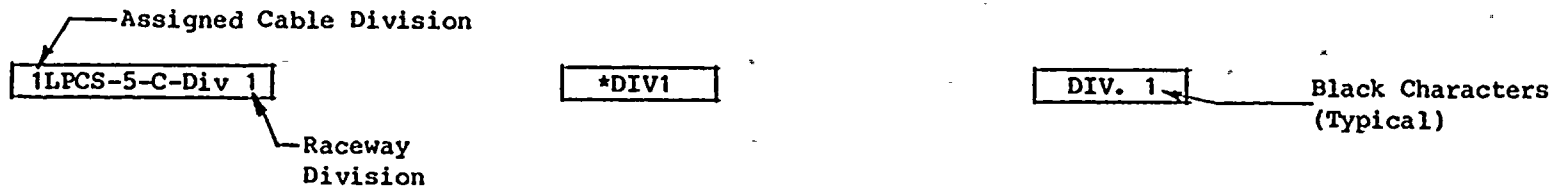
RACEWAY TYPE	ASSIGNED CABLE DIVISION	CABLE ID DIVISION MARKING CHARACTER	RACEWAY DIVISION MARKING CHARACTERS	EQUIP/ENCLOSURE/RACEWAY/CABLE MARKER	
				BACKGROUND COLOR	CHARACTER COLOR
H,P,C,S	1	DIV. 1	*DIV1	YELLOW	BLACK
H,P,C,S	2	DIV. 2	*DIV2	ORANGE	BLACK
H,P,C,S	3	DIV. 3	*DIV3	RED	BLACK
R,C,S	4	CHA1	*CHA1	LT. BLUE	RED
R,C,S	5	CHA2	*CHA2	GREEN	RED
R,C,S	6	CHB1	*CHB1	DRK. BLUE	RED
R,C,S	7	CHB2	*CHB2	BROWN	RED

Raceway Types

H - High Volt Power - 4.16 KV and above
P - Power - 480/240/208/120 V AC
250/125 V DC
C - Control-120 V AC/125 V DC and below
S - Signal
R - RPS Scram SOV Raceway

*Raceway type letter is located at beginning of marking characters
Example: PDIV1 = Power Raceway, Division 1

Typical Division 1 Markers (Yellow Background)



Cable Marker

The Cable Marker Includes Both the Cable Number & The Raceway Division Marking Characters

Raceway, Pullbox, etc. Marker

(Voltage Level is Added For Above 600 V Application)

Equip/Enclosure Marker

TABLE III (Cont'd)

NOTES

1. External to PGCC equipment and enclosure residing division separation markers shall be located on the front face.

2. Board S (H13-P851) located in the Main Control Room shall be identified with division markers the same as other equipment external to PGCC but the markers shall be placed on the inside rear door or on intruding device subenclosures (if required).

2

TABLE IV

DIVISION MARKERS FOR PRIME AND NON-CLASS 1E ENCLOSURES, EQUIPMENT, RACEWAYS, AND CABLES EXTERNAL TO PGCC (INCLUDING FIELD SIDE OF PGCC TERMINATION CABINETS)

ENCLOSURE/EQUIP./RACEWAYS			CABLES				RACEWAYS/CABLES	
							PRIME CIRCUITS (NOTE 2)	
DIVISIONAL MARKER	MARKER BACKGROUND COLOR	CHARACTER COLOR	E550/E551 CABLE COMPATI-BILITY	REPRESEN-TATIVE CABLE NUMBER	CABLE MARKER BACKGROUND COLOR	E550/E551 REFERENCE NOTES	E550/E551 SAFETY CLR FIELD	ADDITIONAL CHECKERED MARKER
*DIV A	Silver	Black	A	AMISC402	Silver	-	A'1	Red/White
			A	AMISC9001	Silver/ Yellow	***		
			1	AMISC9002	Silver/ Yellow	-		
			1	(NOTE 1) AMISC9003	Silver/ Yellow	**		
*DIV B	Gold	Black	B	BMISC402	Gold	-	B'2	Green/White
			B	BMISC9001	Gold/ Orange	***		
			2	BMISC9002	Gold/ Orange	-		
			2	(NOTE 1) BMISC9003	Gold/ Orange	**		

Notes

See Page 27 for Notes.

*See Note on Table III
**See Table VIII, Page 4, Note 5
***See Table VIII, Page 4, Note 8

TABLE IV

DIVISION MARKERS FOR PRIME AND NON-CLASS 1E EQUIP/ENCLOSURES, RACEWAYS AND CABLES EXTERNAL TO PGCC (INCLUDING FIELD SIDE OF PGCC TERMINATION CABINETS)

2

NOTES

1.a. A Non-Class 1E 9000 series cable is routed partially or wholly in a Class 1E raceway (Associated by Proximity).

b. 9000 series cables are non-Class 1E cables, which are not physically separated from a Class 1E cable within its equipment of origin or destination, but is never routed in a Class 1E raceway. These cables are marked with dual color tags the entire cable length. 2

2.a. Prime cables connect Non-Class 1E loads to Class 1E power sources.

A'1 signifies Div. 1 power feeder to Non-Class 1E Div. A device.

B'2 signifies Div. 2 power feeder to Non-Class 1E Div. B device.

A'2 & B'1 circuits are not permitted.

b. An additional checkered marker, as stated in the table, is applied to prime cables as well as to the Non-Class 1E raceways carrying prime cables. Refer to E947 for listing of prime tray nodes.

3. Internal to PGCC equipment and enclosures residing division markers shall be located on the inside rear door, on intruding device subenclosures (if required), or within lines of demarcation. 2

4. The Fire Control Panel, and the Security System Panel located in the Main Control Room shall be identified with division markers the same as other equipment external to PGCC except that the markers shall be placed on the inside rear door.

TABLE V
DIVISION MARKERS FOR EQUIPMENT, ENCLOSURES, RACEWAYS, CABLES IN PGCC

PGCC Divisional Separation	Circuit Categories			CABLE MARKERS *				PGCC raceway/equipment/encl separation marker lettering - lettering is black.	PGCC cable separation marker background color.	PGCC raceway/equipment/encl marker background color.
	Class IE	Associated By Proximity	Non Class IE	*** Cable Separation Categories as Shown On Cable IE Marker	CABLE SEPARATION MARKER: Cable Separation Categories as Shown On Cable Separation Marker	CABLE SEPARATION MARKER: MARKING COLOR	Prime Cables have an additional checkered marker with this color scheme.			
1	X			A1	RPS I	RED	N/A	DIV 1	YELLOW	YELLOW
	X			DIV-1A	DIV I	BLACK				
	X			B1	RPS I	RED				
	X			DIV-1B	DIV I	BLACK				
	X			ESSI	ESSI	BLACK				
	X			NSSI	NSS I	BLACK				
	X			SI,CI	DIV I	BLACK				
		X		XXXI, [XXXI]	N/A	N/A	RED/WHITE			
		X		SA,CA, [SA],[CA]	N/A	N/A	RED/WHITE			
2	X			A2	RPS II	RED	N/A	DIV 2	BLUE	BLUE
	X			DIV-2A	DIV II	WHITE				
	X			B2	RPS II	RED				
	X			DIV-2B	DIV II	WHITE				
	X			ESSII	ESS II	WHITE				
	X			NSSII	NSS II	WHITE				
	X			SII,CII	DIV II	WHITE				
		X		XXXII, [XXXII]	N/A	N/A	GREEN/WHITE			
		X		SB,CB, [SB],[CB]	N/A	N/A	GREEN/WHITE			
3	X			ESSIII	ESSIII	WHITE	N/A	DIV 3	GREEN	GREEN
		X		XXXIII, [XXXIII]	N/A	N/A	BLUE/YELLOW			
	X			S/CIII	N/A	WHITE	N/A			
Non-Div			X	XXXI	N/A	N/A	N/A	XXXI**	YELLOW	WHITE
			X	XXXII				XXXII**	BLUE	
			X	XXXIII				XXXIII**	GREEN	
			X	SA,CA				DIV A**	YELLOW	
			X	SB,CB				DIV B**	BLUE	

* Numbers which appear on cable markers may be either Arabic or Roman numeral; both are acceptable. Typical for all tables.

** For equipment and enclosures only. For raceways no lettering exists.

*** Cable separation categories enclosed by a box, such as [XXX1], indicate prime cables.

TABLE VI

EXTERNAL TO PGCC AND FIELD SIDE OF PGCC TERMINATION CABINETS
INTERNAL EQUIPMENT AND ENCLOSURE WIRE IDENTIFICATION

2

For the purpose of differentiating between wires and cables, all individual conductors of a multiconductor cable shall be defined as wires. In addition, single conductor cables 10 AWG and smaller shall be defined as wires within equipment and enclosures. Internal vendor supplied wiring is not required to follow this wiring identification method.

2

Wire markers shall be required only when circuits are not visually traceable to cable identification markers within equipment and enclosures.

If wires of prime cables require wire markers for traceability they shall be identified with the appropriate prime cable marker installed in a flag fashion adjacent to each wire marker.

The color of the character and marker sleeve background shall be derived from the cable number and prefix as follows:

	Wire Marker	
Cable Functional Division Prefix & (No.)	Character Color	Background Color
1	Black	Yellow
2	Black	Orange
3	Black	Red
4	Red	Gray
5	Red	Green
6	Red	Blue
7	Red	Tan
A	Red	White
B	Green	White
A (9000)	Red	White/Yellow
B (9000)	Green	White/Orange

TABLE VII

COMPATIBLE AND INTRUDING CABLES/WIRES INSIDE EQUIPMENT AND ENCLOSURES
EXTERNAL TO PGCC

CIRCUIT CATEGORIES				TYPICAL CABLE MARKER					TYP. PRIME MARKER	TYP. INTRUDING MARKER	COMPATIBLE (O)& INTRUDING (X) CABLES/ WIRES INSIDE EQUIP/ENCL													
											EXTERNAL TO PGCC EQUIP./ ENCLOSURE DIV.MARK-							PGCC TERM.CAB. (FIELD SIDE ONLY). TERM. CAB. DIV. MARKER						
CLASS 1E	AP (PRIME)	AP	NON-CLASS-1E(PRIME)	NON-CLASS-1E	TYPICAL CABLE NUMBER	COMPATIBLE RACEWAY DIVISION PER E551/E550	BACKGROUND MARKER COLOR	CHARACTER COLOR	PRIME CABLE MARKER (CHECKERED)	INTRUDING CABLE & WIRE MARKER - COLOR (STRIPED)	DIV. A	DIV. B	DIV. 1,4,6	DIV. 2,5,7	DIV. 3	DIV. A, XXXI	DIV. B, XXXII	DIV. 1	DIV. 2	DIV. 3				
X				1LPCS-5	DIV 1	YELLOW	BLACK	N/A	YELLOW/WHITE		O	X	X	X	X	X	O	X	X				
	X			ADOA-9001	DIV 1	SILVER/YELLOW	BLACK	RED/WHITE	YELLOW/WHITE		O	X	O	X	X	O	X	O	X				
		X		AM7CA-9001	DIV 1	SILVER/YELLOW	BLACK	N/A	N/A		O	O	O	O	O	O	O	O	O				
X				2RHR-10	DIV 2	ORANGE	BLACK	N/A	BLUE/WHITE			X	O	X	X	X	X	O	X				
	X			8SLC-9007	DIV 2	GOLD/ORANGE	BLACK	GREEN/WHITE	BLUE/WHITE		X	O	X	O	X	X	X	O	X				
		X		8M8CA-9001	DIV 2	GOLD/ORANGE	BLACK	N/A	N/A		O	O	O	O	O	O	O	O	O				
X				3HPCS-14	DIV 3	RED	BLACK	N/A	GREEN/WHITE			X	O	X	X	X	X	O						
X				4RPS-17	CHA1	LIGHT BLUE	RED	N/A	YELLOW/WHITE			O	X	X	X	X	O	X						
X				5RPS-17	CHA2	GREEN	RED	N/A	BLUE/WHITE			X	O	X	X	X	O	X						
X				6RPS-17	CHB1	DARK BLUE	RED	N/A	YELLOW/WHITE			O	X	X	X	X	O	X						
X				7RPS-17	CHB2	BROWN	RED	N/A	BLUE/WHITE			X	O	X	X	X	O	X						
		X		ARFWT-21	DIV A	SILVER	BLACK	RED/WHITE	YELLOW/WHITE		O	X	O	X	X	O	X	O	X				
			X	ASM7-9035	DIV A	SILVER	BLACK	RED/WHITE	YELLOW/WHITE		O	X	O	X	X	O	X	O	X				
		X		BGFD-842	DIV B	GOLD	BLACK	GREEN/WHITE	BLUE/WHITE		X	O	X	O	X	X	O	X	O	X				
		X		BSM8-9125	DIV B	GOLD	BLACK	GREEN/WHITE	BLUE/WHITE		X	O	X	O	X	X	O	X	O	X				
			X	AMISC-9001	DIV A	SILVER/YELLOW	BLACK	N/A	N/A		O	O	O	O	O	O	O	O	O	O				
		X		AANN-10	DIV A	SILVER	BLACK	N/A	N/A		O	O	O	O	O	O	O	O	O	O				
			X	BMISC-9001	DIV B	GOLD/ORANGE	BLACK	N/A	N/A		O	O	O	O	O	O	O	O	O	O				
		X		BANN-11	DIV B	GOLD	BLACK	N/A	N/A		O	O	O	O	O	O	O	O	O	O				

NOTES:

1. The equipment and enclosure divisional separation marker determines the compatible division of the residing (Unmarked) wiring and cabling. For example a "DIVA" equip. marker (Not on a term. cab) indicates that the following cable types (see above table) are "Division A compatible" ADOA-9001, AM7CA-9001, BM8CA-9001, ARFWT-21, ASM7-9035, AMISC-9001, AANN-10, ASM7-9035, BMISC-9001, BANN-11. Also all the internal panel wiring which is not identified by individual separation markers is considered "Division A compatible" wiring.

2. Each enclosure is identified with an appropriate divisional marker to show the residing division of the internal wires/cables. If a Class 1E or a prime cable intrudes into an enclosure assigned to a redundant Class 1E division or into a Division A, B, XXX1, XXX2 enclosure then that cable and the internal wiring extending from this cable shall be separated by 6" or a barrier from all enclosure/equipment residing/compatible cables and wires and shall be additionally identified with striped marker tape.

3. All cables identified as intruding cables within equipment/enclosure are identified with a striped marker, as stated above, every 12 ± 2 inches beginning at the panel entrance point and continuing to the internal wire string associated with each conductor.

4. AP- Associated By Proximity

TABLE VII

COMPATIBLE AND INTRUDING CABLES/WIRES INSIDE EQUIPMENT AND ENCLOSURES IN PGCC

CIRCUIT CATEG.		CABLE MARKERS						EQUIP/ ENCLOS DIVIS. MARKER				
CLASS 1E ASSOCIATED	NON-CLASS 1E	CABLE SEPARATION CATEGORY AS SHOWN ON CABLE ID MARKER	CABLE SEPARATION MARKERS: LETTERING	LETTERING COLOR	BACKGROUND COLOR	PRIME CABLE MARKER COLOR OF CHECKERED CABLE MARKER	INTRUDING CABLE & WIRE MARKER COLOR	DIV. A, XXXI	DIV. B, XXXII	DIV. 1	DIV. 2	DIV. 3
X		A1	RPS I	RED	YELLOW	N/A	YELLOW/WHITE	X	X	O	X	X
X		DIV-1A	DIV I	BLACK	YELLOW	N/A	YELLOW/WHITE	X	X	O	X	X
X		B1	RPS I	RED	YELLOW	N/A	YELLOW/WHITE	X	X	O	X	X
X		DIV-1B	DIV I	BLACK	YELLOW	N/A	YELLOW/WHITE	X	X	O	X	X
X		ESSI	ESS I	BLACK	YELLOW	N/A	YELLOW/WHITE	X	X	O	X	X
X		NSSI	NSS I	BLACK	YELLOW	N/A	YELLOW/WHITE	X	X	O	X	X
X		SI, CI	DIV I	BLACK	YELLOW	N/A	YELLOW/WHITE	X	X	O	X	X
X		[XXXI]	N/A	N/A	YELLOW	RED/WHITE	YELLOW/WHITE	O	X	O	X	X
X		[SA] [CA]	N/A	N/A	YELLOW	RED/WHITE	YELLOW/WHITE	O	X	O	X	X
X		A2	RPS II	RED	BLUE	N/A	BLUE/WHITE	X	X	X	O	X
X		DIV-2A	DIV II	WHITE	BLUE	N/A	BLUE/WHITE	X	X	X	O	X
X		B2	RPS II	RED	BLUE	N/A	BLUE/WHITE	X	X	X	O	X
X		DIV-2B	DIV II	WHITE	BLUE	N/A	BLUE/WHITE	X	X	X	O	X
X		ESSII	ESS II	WHITE	BLUE	N/A	BLUE/WHITE	X	X	X	O	X
X		NSSII	NSS II	WHITE	BLUE	N/A	BLUE/WHITE	X	X	X	O	X
X		SII, CII	DIV II	WHITE	BLUE	N/A	BLUE/WHITE	X	X	X	O	X
X		[XXXII]	N/A	N/A	BLUE	GREEN/WHITE	BLUE/WHITE	X	O	X	O	X
X		[SB] [CB]	N/A	N/A	BLUE	GREEN/WHITE	BLUE/WHITE	X	O	X	O	X
X		[XXXIII]	N/A	N/A	GREEN	BLUE/YELLOW	GREEN/WHITE	X	X	X	X	O
X		ESSIII	ESS III	WHITE	GREEN	N/A	GREEN/WHITE	X	X	X	X	O
X	X	XXXIII	N/A	N/A	GREEN	N/A	N/A	O	O	O	O	O
X		S/C III	N/A	WHITE	GREEN	N/A	GREEN/WHITE	X	X	X	X	O
X	X	XXXI	N/A	N/A	YELLOW	N/A	N/A	O	O	O	O	O
X	X	XXXII	N/A	N/A	BLUE	N/A	N/A	O	O	O	O	O
X	X	SA, CA	N/A	N/A	YELLOW	N/A	N/A	O	O	O	O	O
X	X	SB, CB	N/A	N/A	BLUE	N/A	N/A	O	O	O	O	O

NOTES:

1. The equipment and enclosure divisional marker determines the compatible division of the residing (unmarked) wiring and cabling. For example a "DIVA" equipment marker indicates that the following cable "SEPN" types are "Division A Compatible" [XXXI], [SA], [CA], XXXI, XXXII, XXXIII, SA, CA, SB, CB. All internal panel wiring which is not identified by individual separation markers is considered "Division A Compatible" wiring.

2. Non-Class 1E cables are routed in Non- Divisional raceways.

3. Cable separation categories enclosed by a box such as [XXXI] indicate prime cables.

TABLE VIII

EXPLANATORY INFORMATION CONCERNING CABLE ROUTING

CABLE LEGEND

The legend for the column identification in Table IX is as follows:

(1) CABLE NUMBER

Cable numbers have ten spaces allocated. Five spaces before the dash and four spaces after the dash. Each space has a specific meaning, as described below.

FIRST SPACE

1	DIVISION 1
2	DIVISION 2
3	DIVISION 3
4	DIVISION 4
5	DIVISION 5
6	DIVISION 6
7	DIVISION 7
A	DIVISION A
B	DIVISION B

SECOND, THIRD, FOURTH & FIFTH SPACE

System or Equipment Identification -
The following are typical examples:

ADS	AUTOMATIC DEPRESS. SYSTEM
RHR	RESIDUAL HEAT REMOVAL
IR1A	INSTRUMENT RACK 1A
M7BA	MOTOR CONTROL CENTER, NO. MC-7B-A
MISC	MISCELLANEOUS
P8AE	POWER PANEL, NO. PP-8A-E
SH5	SWITCHGEAR 6.9 kV (HIGH), NO. SH-5
SM7	SWITCHGEAR 4.16 kV (MEDIUM), NO. SM7
SL71	SWITCHGEAR 480 V (LOW), NO. SL-71

SIXTH SPACE

Always to be the Dash (-)

SEVENTH, EIGHTH, NINTH & TENTH SPACE

Numbers 1 thru 9999 as required

EXAMPLES OF CABLE NUMBERS:

1M7BA-221 = 1 (DIV. 1) M (MOTOR CONTROL CENTER) 7BA (MCC NO.) 221 (CABLE NO.)

2RHR-222 = 2 (DIV. 2) RHR (SYSTEM) 222 (CABLE NO.)

(2) T/C (TYPE AND COMPATIBILITY)

T = TYPE OF RACEWAY WHICH CABLE IS COMPATIBLE TO IS AS FOLLOWS:

P POWER	C CONTROL
H HIGH VOLT (6.9kV, 4.16kV)	S SIGNAL
R RPS	Rc RPS SCRAM SOV RACEWAY

C = COMPATIBILITY (OUTSIDE OF PGCC) WHICH IS AS FOLLOWS:

1 COMPATIBLE CABLES ARE ROUTED IN DIV 1 RACEWAY SYSTEM ONLY
2 COMPATIBLE CABLES ARE ROUTED IN DIV 2 RACEWAY SYSTEM ONLY
3 COMPATIBLE CABLES ARE ROUTED IN DIV 3 RACEWAY SYSTEM ONLY
4 COMPATIBLE CABLES ARE ROUTED IN DIV 4 RACEWAY SYSTEM ONLY
5 COMPATIBLE CABLES ARE ROUTED IN DIV 5 RACEWAY SYSTEM ONLY
6 COMPATIBLE CABLES ARE ROUTED IN DIV 6 RACEWAY SYSTEM ONLY
7 COMPATIBLE CABLES ARE ROUTED IN DIV 7 RACEWAY SYSTEM ONLY

(3) FROM

EQUIPMENT OR DEVICE IDENTIFICATION WHICH THE CABLE ORIGINATES FROM

(4) TO

EQUIPMENT OR DEVICE IDENTIFICATION WHICH THE CABLE TERMINATES TO

(5) FOR

SYSTEM AND/OR SERVICE CABLE IS BEING USED FOR

(6) RACEWAY ROUTING

NUMBER INDICATED DENOTES NODES THROUGH WHICH THE CABLE PASSES IN SEQUENCE. IF LETTERS "ENTR" APPEAR IN THE ROUTING, THE CABLE ENTERS AT A POINT BETWEEN THE PRECEDING AND SUCCEEDING NODES. IF THE LETTERS "ENTR" DO NOT APPEAR, THE CABLE ENTERS AT FIRST NODE SHOWN. IF THE WORD "EXIT" APPEARS IN THE ROUTING, THE CABLE EXISTS AT A POINT BETWEEN THE PRECEDING AND SUCCEEDING NODES. IF THE WORD "EXIT" DOES NOT APPEAR, THE CABLE EXITS AT THE LAST NODE SHOWN. THE ABOVE MENTIONED NODES ARE LOCATED AND SHOWN ON RACEWAY DRAWINGS. WHEN NODES DO NOT APPEAR, RACEWAYS ARE NOT USED. IN SUCH CASES, CABLES SHALL RUN "FROM" POINT OF ORIGINATION "TO" POINT OF TERMINATION WITH OR WITHOUT CONDUIT, AS INDICATED ON THE DESIGN DRAWING.

(7) CABLE REQD.

NUMBER OF SINGLE OR MULTIPLE CONDUCTOR CABLES REQUIRED.

(8) CABLE SPEC

SEE CABLE TYPES AND DESCRIPTIONS BELOW. (TYPICAL)

TYPE	NUMBER	CONDUCTOR SIZE	OD INCHES	AREA SQ. IN.
A	8kV UNGROUNDED NEUTRAL POWER CABLE 1C	250	1.276	1.2788

(9) CONDUCTOR NO.

NUMBER OF CONDUCTORS IN A CABLE. (1C = ONE CONDUCTOR, 12C = TWELVE CONDUCTORS, ETC.)

(10) CONDUCTOR SIZE

WIRE SIZE IN EITHER AWG. OR MCM.

(11) CIRCUIT LENGTH

INDICATES TOTAL LENGTH IN FEET FOR EACH CONDUCTOR INCLUSIVE OF THE DISTANCES "FROM" THE POINT OF ORIGINATION TO RACEWAY ENTRANCE AND FROM THE RACEWAY EXIT "TO" THE POINT OF TERMINATION. WHEN RACEWAY ROUTING IS OMITTED, LENGTH INDICATED REFERS TO DISTANCES "FROM" THE POINT OF ORIGINATION "TO" THE POINT OF TERMINATION IN FEET FOR EACH CONDUCTOR. THUS, IF THE CABLE CONSISTS OF THREE SINGLE CONDUCTORS, THE TOTAL LENGTH WOULD BE THREE TIMES RUN LENGTH.

(12) REV S.

REVISION NO. OF THE CABLE ISSUE IS DESIGNATED BY THE REV. NO. 'S' DESIGNATES THE CONSTRUCTION ISSUE STATUS OF THE CABLE.

(13) REFERENCE NOTES

SEE DRAWINGS E550 AND E551 FOR REFERENCE NOTES. THE LISTED NOTES BELOW WHICH RELATE TO ELECTRICAL SEPARATION ARE REITERATED FROM THE ABOVE DRAWINGS.

E550 REF. NOTES

4 THIS CABLE IS NON-CLASS 1E CABLE THAT DOES NOT ROUTE INTO REDUNDANT CLASS 1E RACEWAYS. IF THIS IS A DIVISION A CABLE AND IS TAGGED XXXII, SB, OR CB INSIDE PGCC IT SHALL NOT ROUTE INTO A DIVISION 1 RACEWAY EXTERNAL TO PGCC; SIMILARLY FOR A DIVISION B CABLE AND A DIVISION 2 RACEWAY. 2

5 THIS CABLE IS CLASSIFIED IN THE SEPARATION GROUPING AS "ASSOCIATED BY PROXIMITY".
A) CABLE NUMBERS PREFIXED (FIRST SPACE) WITH "A" AND ROUTED IN DIVISION 1 RACEWAYS.
(COMPATIBILITY IS 1)
B) CABLE NUMBERS PREFIXED (FIRST SPACE) WITH"B" AND ROUTED IN DIVISION 2 RACEWAYS.
(COMPATIBILITY IS 2)

8 THIS CABLE MAY HAVE MORE THAN ONE DESIGNATION IN THE "9000" SERIES NUMBERS. FOR ROUTING PURPOSES, THESE CABLES SHALL BE CONTINUOUS FROM ONE PIECE OF EQUIPMENT TO ANOTHER. THERE SHALL NOT BE ANY SPLICES OR TERMINATIONS AT TRANSITION POINTS, FIRE STOPS, OR CABLE NUMBER CHANGES. "TP" INDICATES A TRANSITION POINT. "CONT" INDICATES CONTINUED ON CABLE SHOWN.

9 WHEN A CABLE CANNOT BE IDENTIFIED AS AN INTEGRAL PART OF A SPECIFIC SYSTEM, THE NUMBER "9999" WILL BE INPUT AS THE MECHANICAL SYSTEM NUMBER. THE CABLES ASSIGNED THIS NUMBER WILL BE REVIEWED PERIODICALLY.

13 ALL CABLES WITH PREFIX DIVISION 1 THROUGH 7 AND PRIME CABLES DESIGNATED UNDER THE "SFTY CLR" FIELD AS A'1 OR B'2 SHALL BE INSTALLED TO QUALITY CLASS 1 REQUIREMENTS (ONLY FOR PRIME CABLES INSTALLED AFTER 10-20-81).

E551 REF. NOTES

4 SAME AS FOR E550.

5 SAME AS FOR E550.

8 SAME AS FOR E550.

9 SAME AS FOR E550.

21 THIS CABLE REVISED FROM MULTI-CONDUCTOR TO MULTIPLE SINGLE CONDUCTORS DUE TO INVENTORY REQUIREMENTS. PHASING TAPE SHALL BE USED FOR COLOR CODE LABELING ON CONDUCTOR ENDS ONLY. PHASING TAPE TO BE APPLIED APPROXIMATELY TWO INCHES FROM TERMINAL CONNECTOR. FOR COLOR CODE REQUIREMENTS SEE APPLICABLE CONNECTION DRAWING.

22 ALL CABLES WITH PREFIX (FUNCTIONAL DIV.) 1 THROUGH 7 AND PRIME CABLES DESIGNATED UNDER THE "SFTY CLR" FIELD AS A'1 OR B'2 SHALL BE QUALITY CLASS 1 (ONLY FOR PRIME CABLES INSTALLED AFTER 10-20-81).

14. SAFETY CLEARANCE FIELD

THE DESIGNATION OF A'1 IN THESE FIELDS REPRESENTS A DIVISION A (NON-CLASS 1E) CABLE THAT IS POWERED FROM DIVISION 1 (CLASS 1E). AND SIMILARLY, B'2 SIGNIFIES A DIVISION B (NON-CLASS 1E) CABLE THAT IS POWERED FROM DIVISION 2 (CLASS 1E).

TABLE IX

SAMPLE CABLE SCHEDULE

(1) CABLE NUMBER	(2) T/C	(3) FROM	(4) TO	(5) FOR	MECH SYSTEM	FROM DWG	FROM NO	(7) CABL REQD	(8) CABL SPEC	(9) CONDUCTOR NO	(10) CONDUCTOR SIZE	(14) SFTY CLR	(11) CKT LGTH	(12) REV	S	(13) REF NOTES	
AM7A-0102	P A	XFMR TR-7A-B	PNL ELP-7A-B	FEEDER	4150			4	G1	1C	2/0		0015	002	*		2
AM7A-0152	P A	LOCAL DISC SW	PUMP HOIST MT-CRA-6A	FEEDER	5110			3	G1 (9)	1C	2	A'1	0050	002	*	13	
AM7A-9010	P 1	MCC MC-7A	RFS BUS MTG GEN SET MG-1	FEEDER	2620			3	G1	1C	4	A'1	0044	002	*	5,13	2
	(6)	ENTR:COLX K.1 13'06";COLY 11 22'06"; EL 54'8"															
		RTNG:6987-ENTR-6994-EXIT-6995															
		EXIT:COLX K.1 6'00";COLY 12.2 35'00"; EL 56'4"															
AM7A-9100	P 1	MCC MC-7A	TP CONT AM7A-9101	FEEDER	4150			3	G1	1C	1/0	A'1	0062	002	*	5,13	2
		ENTR:COLX K.1 13'06";COLY 11 22'06"; EL 54'8"															
		RTNG:6992-ENTR-6987-6966-EXIT-6969															
		EXIT:COLX J 16'06";COLY 10 6'06"; EL 51'6"															
AM7A-9101	P A	TP CONT AM7A-9100	XFMR TR-7A-B	FEEDER	4150			3	G1	1C	1/0	A'1	0366	002	*	8,13	2
		ENTR:COLX J 16'06";COLY 10 6'06"; EL 48'6"															
		RTNG:6696-ENTR-6582-6583-7054-7055-7058-7062-7063-7064-7065-1050-1051-1070-EXIT-1073															
		EXIT:COLX F 6'00";COLY 14 13'06"; EL 73'6"															
AM7A-9110	P 1	MCC MC-7A CONT AM7A-9111	TP	FEEDER	5250			3	G1	1C	4/0	A'1	0066	002	*	5,13	2
		ENTR:COLX K.1 9'06";COLY 11 22'06"; EL 54'8"															
		RTNG:6992-ENTR-6987-6966-EXIT-6969															
		EXIT:COLX J 16'06";COLY 10 6'06"; EL 51'6"															
AM7A-9111	P A	TP CONT AM7A-9110	COMPRESSOR CAS-C-1A	FEEDER	5250			3	G1	1C	4/0	A'1	0278	002	*	8,13	2
		ENTR:COLX J 16'06";COLY 10 6'06"; EL 48'6"															
		RTNG:6696-ENTR-6582-6583-6549-6548-6546-6545-0429-0427-EXIT-0424															
		EXIT:COLX G 6'06";COLY 7 8'00"; EL 41'6"															
AM7A-9120	P 1	MCC MC-7A	INVERT PKG IN-1	FEEDER	4350			3	G1	1C	1/0	A'1	0054	002	*	5,13	2
		ENTR:COLX K.1 12'00";COLY 11 22'06"; EL 54'8"															
		RTNG:6987-ENTR-6992-6994-EXIT-6995															
		EXIT:COLX K.1 6'00";COLY 12.2 33'06"; EL 56'4"															

TABLE X
CABLE ROUTING CRITERIA
POWER CABLES IN RACEWAYS

		CABLE APPLICATION														
		14.4KV POWER		6.9KV POWER		4.16 KV POWER					480/240/208/120VAC 250/125VDC PWR					
		CABLE DIVISIONS														
		A	B	A	B	1	2	3	A	B	1	2	3	A	B	
Hc	A	X														- Example 1
Hc	B		X													
H	A			X					X							- Example 2
H	B				X					X						
H	1					0			AP							
H	2						0			AP						
H	3							+								- Example 3
P	A													X		
P	B														X	
P	1										0			AP		- Example 4
P	2											0			AP	
P	3												+			

X - Non-Class 1E division cables.
0 - Class 1E division 1 and 2 cables.
+ - High Pressure Core Spray (HPCS) Class 1E Division 3 cables. | 2
AP - "Associated by Proximity" cables - Non-Class 1E cables routed in compatible Class 1E raceway.
Hc - High Voltage Raceway - Conduit.
H - High Voltage Raceway - Conduit or tray.
P - 480V or below Power Raceway - Conduit or tray.

Example 1 - 14.4KV Div. A power cable can only be routed in Div. A conduit.
Example 2 - It is permissible to route 6.9KV & 4.16KV Div. A power cables in same Div. A raceway.
Example 3 - 4.16KV Div. 3 power cables can only be routed in Div. 3 H raceways.
Example 4 - It is permissible to route Div. A power cable in Div. 1 power raceway. Such cables are identified by "NOTE 5" in the E550 Cable Schedule Reference Note Column. (For details, see Table IX, Column 13). These cables have raceway compatibility identified per Table IX, column 2.

TABLE XI

CABLE ROUTING CRITERIA
CONTROL CABLES IN RACEWAYS
EXTERNAL TO PGCC

Raceway Type	Raceway Division	CABLE APPLICATION												
		Control Indic. & Annun.			RPS/NSSS Trip Logic Cables				Control Ind,Ann. & *		RPS Scram SOV Control Ckts.			
		CABLE DIVISIONS												
		1	2	3	4	5	6	7	A	B	4	5	6	7
C	1	0							AP					
C	2		0							AP				
C	3			+										
C	4				0									
C	5					0								
C	6						0							
C	7							0						
C	A								X					
C	B									X				
Rc	4										0			
Rc	5											0		
Rc	6												0	
Rc	7													0

- Example 1
- Example 2

* Digital Computer Signal in Reactor Building only.

C - Raceway to route control circuits.
Rc - RPS Scram Solenoid Raceway - Conduit.
X - Non-Class 1E Division Cables.
\+ - High Pressure Core Spray (HPCS) Class 1E Division 3 Cables.
0 - Class 1E 1 & 2 Division Cables.
AP - "Associated by Proximity" - Non-Class 1E Cables routed in compatible Class 1E raceway.

Example 1 - Class 1E Div. 1 Control Cables can only be routed in Div. 1 control raceways. It is permissible to route non-Class 1E Div. A Control/Indication/Ann. Cables in Class 1E Div. 1 raceways. Such cables are termed "Associated by Proximity" and are identified by "Note 5" in the E551 Cable Schedule Reference Note Column. (For details see Table VIII, Column 13.). These cables have raceway compatibility identified per Table VIII, Column 2.

Example 2 - Class 1E Div. 3 control cables can only route in Div. 3 raceways.

2

TABLE XII

CABLE ROUTING CRITERIA

INSTRUMENTATION/SIGNAL CABLES IN RACEWAYS

EXTERNAL TO PGCC

Raceway Type	Raceway Division	CABLE APPLICATION									
		ANALOG SIGNAL			NMS/NSSS/RPS TRIP LOGIC SIGNAL CABLES				SIGNAL		
		CABLE DIVISION							Analog	Digital	
		1	2	3	4	5	6	7	A	B	
S	1	0							AP		- Example 1
S	2		0							AP	
S	3			+							
S	4				0						
S	5					0					- Example 2
S	6						0				
S	7							0			
S	A								X		- Example 3
S	B									X	

X - Non-Class 1E Division Signal Cables.

0 - Class 1E Division 1 & 2 Signal Cables.

\+ - Class 1E HPCS Division 3 Signal Cables.

AP - "Associated by Proximity" - Non-Class 1E Cables routed in compatible Class 1E raceways.

S - Signal Cable Raceway - solid tray or conduit.

Example 1 - It is permissible to route Div. A signal cable in Div. 1 raceway. Such cables are termed as "Associated by Proximity" and are identified by "Note 5" in the E551 Cable Schedule Reference Note Column (For details see Table VIII, Column 13). These cables have raceway compatibility identified per Table VIII, Column 2.

Example 2 - Div. 5 RPS/NMS signal cable can only be routed in Div. 5 signal raceways.

Example 3 - Non-Class 1E Div. A signal cables route only in Div. A signal raceways.

TABLE XIII

GENERAL PLANT AND PGCC

CLASS 1E CABLE INTERFACE

CONTROL/INDICATION/SIGNAL

INTER-FACE BOP CABLE DIV.	NSSS PGCC CABLE ID	BOP PGCC CABLE ID	PGCC RACEWAY DIVISION			
			1	2	3	
1	ESSI	SI,CI	0			
2	ESSII	SII,CII		0		Note 1
3	ESSIII	S/C III			+	
4	RPS A1		0			Note 2
6	RPS B1		0			
5	RPS A2			0		
7	RPS B2			0		
1	NSSI		0			Note 2
2	NSSII			0		
4	DIV1A		0			
6	DIV1B		0			
5	DIV2A			0		
7	DIV2B			0		

General Plant Area-Raceways | PGCC Raceways

0 - Class 1E Division Cables

\+ - High Pressure Core Spray (HPCS) Class 1E Division Cables

Note 1 - Class 1E circuits are routed in compatible Class 1E division of PGCC raceways.

Note 2 - RPS/NSS Class 1E control and signal cables are considered compatible to either Div 1 or Div 2 PGCC raceway routing as stated in Table II.

TABLE XIV
GENERAL PLANT AND PGCC

NON-CLASS 1E CABLE INTERFACE
CONTROL/INDICATION/SIGNAL

CABLE ROUTED IN GENERAL PLANT RACEWAY DIVISION	GENERAL PLANT TO PGCC INTERFACING CABLE DIVISION	CIRCUIT CLASSIFICATION	SEE NOTE 1 NSSS PGCC CABLE DIVISION (a)	SEE NOTE 1 BOP PGCC CABLE DIVISION (b)	CABLE ROUTED IN PGCC RACEWAY DIVISION 1	2	3	NON-DIV.	
N/A	DIV A	PRIME (A'1) AP	XXX1	SA CA	X				Example 1
N/A	DIV A	AP	XXX1	SA,CA	X			X	Example 2
DIV 1	DIV A	AP	XXX2	SB,CB				X	Example 3
N/A	DIV A	AP	XXX2	SB,CB		X		X	Example 4
N/A	DIV B	PRIME (B'2) AP	XXX2	SB CB		X			
N/A	DIV B	AP	XXX2	SB,CB		X		X	
DIV 2	DIV B	AP	XXX1	SA,CA				X	
N/A	DIV B	AP	XXX1	SA,CA	X			X	
N/A	DIV 3	PRIME (3) AP	XXX3	S3,C3			X		
N/A	DIV 3	AP	XXX3	S3,C3			X	X	

General Plant Area Raceways ← → PGCC Raceways

AP - Associated by Proximity.

2

NOTES:

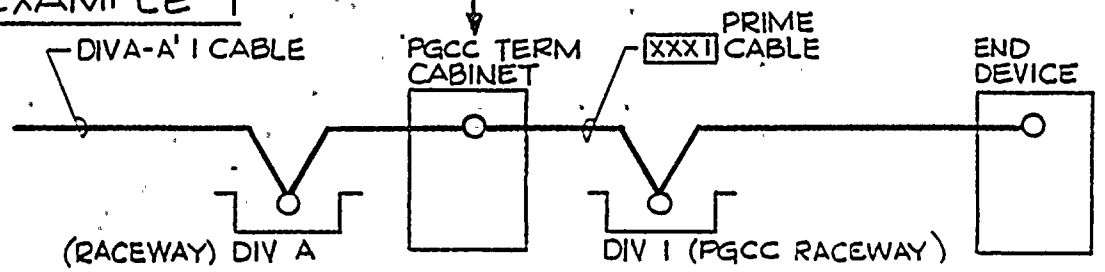
1. In PGCC there are two types of routing/cable tagging configurations. "NSSS" circuits (General Electric scope circuits interfacing with 600 Series panel modules) follow the cable divisional tagging per column (a). All other circuits (Balance of Plant circuits interfacing with 800 Series panel modules) follow the cable divisional tagging per column (b).

2. For examples see Sh. 2 of this table.

TABLE XIV

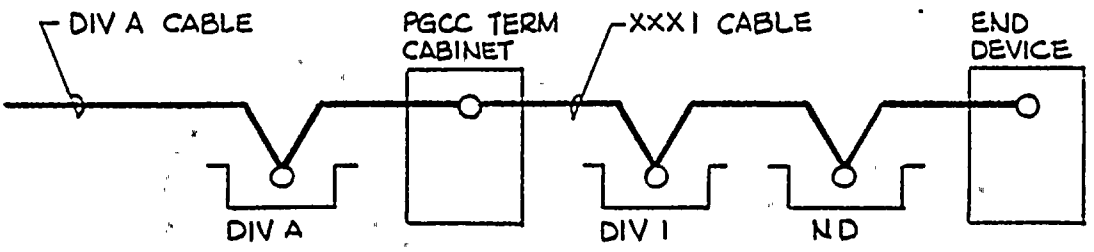
GEN. PLANT AREA ⟷ PGCC

EXAMPLE 1



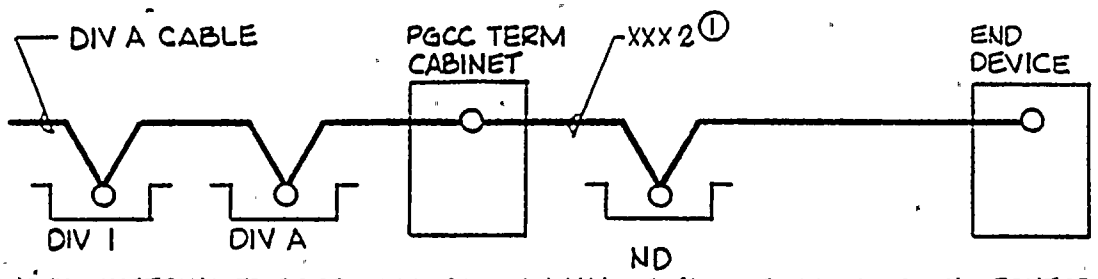
NOTE: PRIME CABLES XXX1, XXX2, XXX3 CAN NOT BE ROUTED IN NON-DIVISIONAL PGCC DUCTS. PRIME CABLES ARE ALLOWED TO ROUTE IN ONLY THE COMPATIBLE DIVISIONAL DUCTS.

EXAMPLE 2



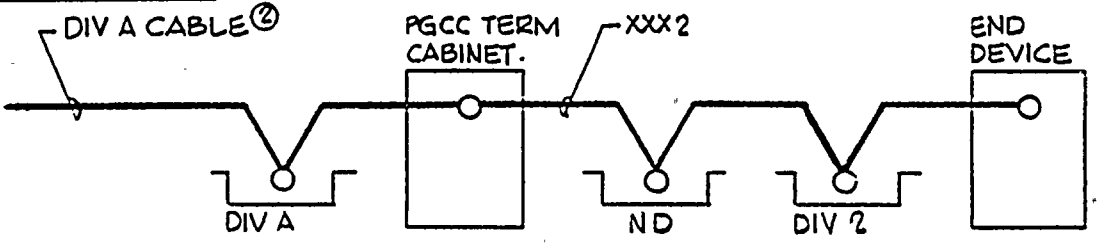
NOTE: INTERNAL TO PGCC DIV A CABLE MAY BE ROUTED IN DIV 1 OR NON-DIV. PGCC RACEWAY.

EXAMPLE 3



①NOTE: INTERNAL TO PGCC DIV A CABLE MAY BE TAGGED AS XXX2 AND ROUTED IN NON-DIVISIONAL PGCC RACEWAY. SUCH CABLE IS NOT ALLOWED TO ROUTE IN DIV 2 PGCC RACEWAY THEREBY AVOIDING DIRECT BRIDGING.

EXAMPLE 4



② NOTE: WHEN INTERFACING PGCC CABLE IS TAGGED XXX2 AND ROUTED IN ND/DIV 2 PGCC RACEWAYS, SUCH CABLE IS NOT ALLOWED TO ROUTE IN A DIVISION 1 PGCC RACEWAY IN DOWN STREAM CIRCUITS THEREBY AVOIDING DIRECT BRIDGING.

NOTE: Above examples are similar for DIV B and DIV 2.

Example 1: NSSS PGCC Cable Information Obtained from the GE System Cable

Summary: Cable No. 8708/C51B-002,
From: H13-P687
To: H13-P608
System: C51B
Signal: GE/HAC
Separation: B2

TABLE XV

POWER GENERATION CONTROL COMPLEX
CIRCUIT DESIGN
GENERAL INFORMATION

SEPARATION CODES					INDEX OF SYSTEMS
NON IE	NHS	RPS	NSS	ESS	
X				X	B22A Nuclear Boiler Process Instrumentation
X				X	B22C Auto Depressurization System (ADS)
X					B22E Jet Pump Instrumentation
			X	X	B22H Nuclear Steam Supply Shutoff System (NSSSS)
X					B35A Reactor Recirculation
X					C12A Reactor Manual Control (RMC)
X					C12B Control Rod Drive Hydraulic (CRD HYD)
X					C34A Feedwater Control
X				X	C41A Standby Liquid Control
X	X				C51A Startup Range Neutron Monitoring
X	X	X			C51B Power Range Neutron Monitoring
X					C51C Startup Drive Control
X					C51D Traversing In-Core Probe Calib (Tip)
X				X	C61A Remote Shutdown
X		X		X	C72A Reactor Protection System (RPS)
X					C72B RPS Motor Generator Set Control
X					C91A Computer Interconnection
X	X			X	D17A Process Radiation Monitoring
X					D21A Area Radiation Monitoring (ARM)
X				X	E12A Residual Heat Removal (RHR)
X				X	E21A Low Pressure Core Spray (LPCS)
X				X	E22A High Pressure Core Spray (HPCS)
X				X	E22B HPCS Power Supply
X				X	E31A Leak Detection
X				X	E51A Reactor Core Isolation Cooling (RCIC)
X					G11A Radwaste
X					G33A Reactor Water Cleanup
X					H13A Annunciator System
X					H64A Off Gas System - Low Temp.

PGCC POWER SUPPLY CLASSIFICATION

POWER SOURCE DESCRIPTION AS SHOWN ON ELEMENTARY	NON CLASS 1E			CLASS 1E PRIME			CLASS 1E		
	XXXI	XXXII	XXXIII	DIV 1	DIV 2	DIV 3	DIV 1	DIV 2	DIV 3
120VAC INSTR BUS	X	X	X	-	-	-	-	-	-
125 VDC INSTR BUS	X	X	X	-	-	-	-	-	-
24VDC INSTR BUS	X	X	X	-	-	-	-	-	-
28VDC INSTR BUS	X	X	X	-	-	-	-	-	-
120 VAC INSTR BUS A	-	-	-	X	-	-	X	-	-
120 VAC INSTR BUS B	-	-	-	-	X	-	-	X	-
125 VDC INSTR BUS A	-	-	-	X	-	-	X	-	-
125 VDC INSTR BUS B	-	-	-	-	X	-	-	X	-
24VDC INSTR BUS A	-	-	-	X	-	-	X	-	-
24VDC INSTR BUS B	-	-	-	-	X	-	-	X	-
120VAC UPS BUS	X	X	X	-	-	-	-	-	-
120VAC UPS BUS A	-	-	-	X	-	-	X	-	-
120VAC UPS BUS B	-	-	-	-	X	-	-	X	-
120VAC RPS BUS A	X	X	-	-	-	-	-	-	-
120VAC RPS BUS B	X	X	-	-	-	-	-	-	-
120VAC INSTR BUS C	-	-	-	-	-	X	-	-	X
120VDC INSTR BUS C	-	-	-	-	-	X	-	-	X
24VDC INSTR BUS C	-	-	-	-	-	X	-	-	X

Safety-Related Systems (NSSS)

PGCC CABLE SEPARATION CATEGORIES

NSSS CODE	BOP CODE(1)	DESCRIPTION
ESS1	Div 1	Core Standby Cooling System Division 1
ESS2	Div 2	Core Standby Cooling System Division 2
ESS3	Div 3	Core Standby Cooling System Division 3
A1	Div 4	Reactor Protection System/Nuclear Steam Supply Shutoff System Channel A Division 1
B1	Div 6	Reactor Protection System/Nuclear Steam Supply Shutoff System Channel B Division 1
A2	Div 5	Reactor Protection System/Nuclear Steam Supply Shutoff System Channel A Division 2
B2	Div 7	Reactor Protection System/Nuclear Steam Supply Shutoff System Channel B Division 2
NSS1	Div 1	Nuclear Steam Supply Shutoff System Division 1
NSS11	Div 2	Nuclear Steam Supply Shutoff System Division 2
DIV 1A	DIV 4	Neutron Monitoring System Trip Logic A1 Division 1A
DIV 1B	DIV 6	Neutron Monitoring System Trip Logic B1 Division 1B
DIV 2A	DIV 5	Neutron Monitoring System Trip Logic A2 Division 2A
DIV 2B	DIV 7	Neutron Monitoring System Trip Logic B2 Division 2B
XXXI	DIV A or DIV B	All other non-safety functions routed with Division 1 PGCC raceways or Non-Class 1C PGCC raceways. (XXXI cable in DIV 1 raceway is associated)
XXXII	DIV A or DIV B	All other non-safety functions routed with Division 2 cables or Non-Class 1E PGCC raceways. (XXII Div 2 raceway is associated)
XXXIII	DIV 3	All other non-safety functions routed with Division 3 PGCC raceways.

(1) This BOP code corresponds to the BOP cable separation classification that interfaces with the NSSS separation code. This code is also used in combination with the BOP PGCC signal code to describe BOP PGCC cable signal/separation classification, i.e., "C1" indicates Control, Division 1. Balance of plant of plant Div B cables can interface with XXXI PGCC cables providing "bridging" between redundant raceways does not occur. Similar for XXX/DIV A interface cables.

TABLE XV
POWER GENERATION CONTROL COMPLEX
CIRCUIT DESIGN
GENERAL INFORMATION

PGCC CABLE TYPES
(Supplied by General Electric)

NSSS CODE	BOP CODE	DESCRIPTION
SP1 AWG 20		1 Twisted Shielded Pair of #20 Wire
SP4 AWG 20	GE-7A	4 Twisted Shielded Pairs of #20 Wire
SP7 AWG 20	GE-5A	7 Twisted Shielded Pairs of #20 Wire
SP13 AWG 20		13 Twisted Shielded Pairs of #20 Wire
	GE-5	7 Twisted Shielded Pairs of #16 Wire
TC4 Cu/Cn		4 Shielded Pairs of Copper Constantan Thermocouple Wire
TC8 Cu/Cn	GE-6	8 Shielded Pairs of Copper Constantan Thermocouple Wire
TC8 Chr/Cn		8 Shielded Pairs of Chrome Constantan Thermocouple Wire
	GE-7	4 Twisted Shielded Pairs of #16 Wire
ST/1 AWG 20		Twisted Shielded Triple Conductors of #20 Wire
	GE-4	12 Conductors of #14 Wire with Overall Shield
	GE-3	7 Conductors of #14 Wire
MC7 AWG 14		
	GE-1	19 Conductors of #14 Wire
MC19 AWG 14		
		8 Conductors of #16 Wire
MC8 AWG 16		
		12 Conductors of #16 Wire
MC12 AWg 16	GE-2	19 Conductors of #16 Wire
MC19 AWG 16		27 Conductors of #16 Wire
MC27 AWG 16		37 Conductors of #16 Wire
MC37 AWG 16		7 Conductors of #20 Wire
MC7 AWG 16		12 Conductors of #20 Wire
MC12 AWG 20		19 Conductors of #20 Wire
MC19 AWG 20		27 Conductors of #20 Wire
MC27 AWG 20		37 Conductors of #20 Wire
MC37 AWG 20		48 Conductors of #20 Wire
MC48 AWG 20		
7/C AWG 14		7 Separate Conductors of #14 Wire Routed in Conduit
12/C AWG 14		12 Separate Conductors of #14 Wire Routed in Conduit
2 COND PWR		2 Power Conductors Routed in Conduit
3 COND PWR		3 Power Conductors Routed in Conduit
COAX RG-6		Coaxial Cable Type RG-6
COAX RG-22		Coaxial Cable Type RG-22
COAX RG-59		Coaxial Cable Type RG-59
COAX RG-59AM		Coaxial Cable Type RG-59AM
	GE-8	6 3/c #16 Individually Shielded
	GE-9	2 1/c #10
	GE-10	2 1/c #12
	GE-12	4 4/c #14
	GE-13	4 4/c #16 Individually Shielded
	GE-14	7/c #16 Overall Shield

Example 1: BOP PGCC Cable Information Obtained from the B&R BOP cable routing

Summary: Cable No. CM-K2-1.10
From: H13-P891
To: H13-P811
Signal & Separation: C2
Cable Type: GE-1
Raceway: Div 2

PGCC SIGNAL DESCRIPTION

NSSS CODE	BOP CODE (1)	DESCRIPTION
GE/MAC	S	Milliamp Process Signal
Low A	S	Low-Level Analog Signal
Low D	S	Low Level Digital Signal
Comp A	S	160 NV Computer Analog Signal
Comp D	S	Computer digital Signal
M/R IN	S	Meter/Recorder Input
ANN IN	C/S	Annunciator Input
28 VDC	C	28 Volt DC Power
120 VAC	C	120 Volt AC Power
125 VDC	C	125 Volt DC Power
C1 120A	C	120 Volt AC Control & Indication Signal
C1 125D	C	125 Volt DC Control & Indication Signal
C1 28D	C/S	28 Volt DC Control & Indication Signal
24 VDC	C	24 Volt DC Power
CT 5A	C	5 Amp. Current Transformer Circuit
ARM IN	S	Area Radiation Monitor Input

(1) This BOP code corresponds to BOP cable signal classification for BOP PGCC Cables and for those cables that interface with the NSSS PGCC cables.

TABLE XVI

NSSS VENDOR

GENERAL DESIGN INFORMATION

SYSTEM CABLES AND ROUTING CRITERIA

DESCRIPTION	FIELD: NON CLASS 1E	FIELD: CLASS 1E	FIELD: CABLE TYPE	FIELD: RACEWAY TYPE/DIV	IN PGCC MODULAR FLOOR DUCTS: RACEWAY DIVISION	IN PGCC MODULAR FLOOR DUCTS: PGCC SEPARATION CATEGORY	IN PGCC MODULAR FLOOR DUCTS: PGCC SIGNAL CLASS	IN PGCC MODULAR FLOOR DUCTS: PGCC CABLE TYPE	NSSS SPECIAL CABLE REQ.: IMP. (OHMS)	NSSS SPECIAL CABLE REQ.: CAPAC. (pf/ft)	NSSS SPECIAL CABLE REQ.: MAX. VOLTS (V RMS)	NSSS SPECIAL CABLE REQ.: Special Requir.	REMARKS
RPS/NSSSS TRIP LOGIC CONTROL CABLES		X	K1	C4	Div 1	A1	C1120A	12/C#14	NA				Failsafe cables routed in grounded flex CND within PGCC.
		X	K1	C6	Div 1	B1	C1120A	12/C#14					
		X	K1	C5	Div 2	A2	C1120A	12/C#14					
		X	K1	C7	Div 2	B2	C1120A	12/C#14					
RPS SCRAM SOLENOIDS CABLES		X	H2	R4	Div 1	A1	C1120A	2CONDPWR				SCRAM SOV CKT NEUTRAL TO BE #6AWG FROM MAIN CONTROL PANEL TO SCRAM GROUP PULL BOX AT SOVS	RPS scram SOV cables trip logic A1 & B1 and LPRM group 1 & 3 cables are routed in separate PGCC Division 1 ducts, similarly for RPS scram SOV cables trip logic A2 & B2 and LPRM group 2 & 4 cables.
		X	H2	R6	Div 1	B1	C1120A	2CONDPWR					
		X	H2	R5	Div 2	A2	C1120A	2CONDPWR					
		X	H2	R7	Div 2	B2	C1120A	2CONDPWR					
RPS TRIP LOGIC SIGNAL CABLES		X	L2	S4	Div 1	A1	GEMAC	SP4	NA				
		X	L2	S6	Div 1	B1	GEMAC	SP4					
		X	L2	S5	Div 2	A2	GEMAC	SP4					
		X	L2	S7	Div 2	B2	GEMAC	SP4					
C51A SRM SENSOR CA			M7				-	-	75	20.5	1000	COAX 3 SHLD HI RAD, TEMP	Neutron Monitoring System Group 1
C51A SRM PREAMP SIG. CA.			M1				LOW A	COAX RG6	75	20.0	1500	COAX STD	
C51A SRM PREAMP HV. CA.			L4				LOW A	COAX RG59	47	37.3	2000	SHLD	
C51A SRM PREAMP LV. CA.			L4				C1 28D	COAX RG59	47	37.3	2000	SHLD	
C51A IRM SENSOR CA.			M6				-	-	130	9.8	1000	COAX 3 SHLD.	
C51A IRM PREAMP SIG. CA.			M1				LOW A	COAX RG6	75	20.0	1500	COAX STD.	
C51A IRM PREAMP HV. CA.			L4				LOW A	COAX RG59	47	37.3	2000	SHLD	
C51A IRM PREAMP LV. CA.		X	L4	S4	Div 1	Div1A	C1 28D	COAX RG59	47	37.3	2000	SHLD	
C51A IRM RANGE SW CA.			-				C1 28D	MC19	NA				
C51B LPRM SENSOR/EPA. CA.			M5				-	-	62	25.7	2300	COAX HI RAD TEMP	*
C51B LPRM EPA/PGCC CA.			L4				LOW A	COAX RG59	47	37.3	2000	SHLD	
D17A PROC RAD MON SENSOR CA.			M1						75	20.5	1000	COAX 3 SHLD HI RAD, TEMP	
D17A PROC RAD MON PREAMP SIG. CA.			M1				LOW A	COAX RG6	75	20.0	1500	COAX STD	
D17A PROC RAD MON PREAMP HV. CA.			L4				LOW A	COAX RG59	47	37.3	2000	SHLD	
D17A PROC RAD MON PREAMP LV. CA.			L4				LOW A	COAX RG59	47	37.3	2000	SHLD	
SAME AS NMS GRP.1		X	1	S6	Div 1	Div1B	SAME AS NMS GROUP 1						NMS GROUP III
SAME AS NMS GRP.1		X	SEE NMS	S5	Div 2	Div2A	SAME AS NMS GROUP 1						NMS GROUP II
SAME AS NMS GRP.1		X		S7	Div 2	Div2B	SAME AS NMS GROUP 1						NMS GROUP IV

ntinued From Page 1

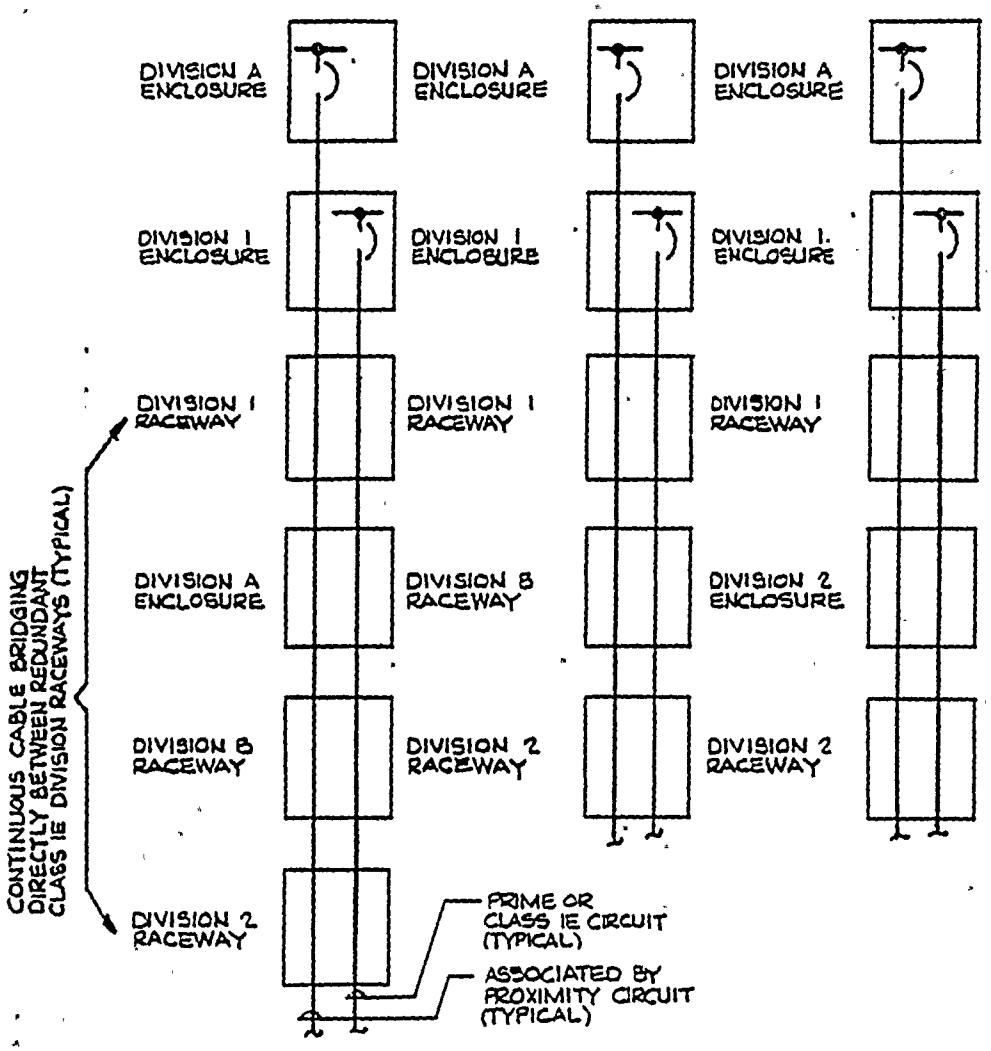
TABLE XVI

PROCESS RADIATION MONITORING (D17A)		X		SEE NMS1	S2	Div 2	XXX2	SAME AS NMS GROUP 1						
		X			SB	Div 2	XXX2	SAME AS NMS GROUP 1						
AREA RADIATION MONITORING (D21A)		X		L3	S2	Div 2	XXX2	ARM IN	MC8	NA				
		X		L3	SA	Div 2	XXX2	ARM IN	MC8	NA				
INDEX MECH CABLE		X		L3	C2	-	-	-	-				27/C SHLD	
DRIVE MECH POS IND		X		L3	C2	Div 2	XXX2	LOW D	MC48				48/C SHLD	
DRIVE MECH CONTRCA		X		L3	C2	Div 2	XXX2	LOW D	MC37				37/C SHLD	
DRIVE MECH ANALOG POS		X		L1	S2	Div 2	XXX2	LOW A	ST1					
DRIVE MECH DET SIG		X		L4	S2	Div 2	XXX2	LOW A	COAX RG59	47	37.3	2000	SHLD	
DRIVE MECH CHAMBER		X		L3	C2	-	-	-	-				4/C SHLD	
DRIVE MECH BALL VACA		X		K1	C2	-	-	-	-				2/c#16	
SHEAR VA ASSY CA.		X		L3	C2	-	-	-	-				14/c SHLD	
ROD POSITION CABINET	LEFT/RIGHT BRANCH	X		G1	CA	Div 1	XXX1	C1120A	2CONDPWR	NA				
	JUNCTION MODULES	X		M8	SA	Div 1	XXX1	LOW D	COAX RG22					
CRD PROBE/EPA CAB.		X		K2	S1					RAYCHEM 60/7180 OR EQUAL			13/C	
EPA/RPIS CABLE		X		L3	S1	Div 1	XXX1	LOW A	MC48					
EPA/H22-P007		X		J2	S1	-	-	-	-				28 PAIR OA SHLD.	
RPS POWER SUPPLY (C72B)		X		H2	C1	Div 1	XXX1	C1120A	2CONDPWR					Failsafe Power Cables Routed In Grounded Flexible Conduit Within PGCC.
		X		G2	PA	Div 1	XXX1	C1120A	2CONDPWR					
		X		G2	C2	Div 2	XXX2	C1120A	2CONDPWR					
		X		G2	P2	Div 2	XXX2	C1120A	2CONDPWR					
		X		H2	C2	Div 2	XXX2	C1120A	2CONDPWR					
		X		G2	P8	Div 2	XXX2	C1120A	2CONDPWR					
		X		H2	C1	Div 1	XXX1	C1120A	2CONDPWR					

The LPRM Cables are subdivided into four groups as follows:
Group 1 (Div 1A) APRM CHE
Group 2 (Div 2A) APRM CHC&D
Group 3 (Div 1B) APRM CHA&B
Group 4 (Div 2B) APRM CHF

FIGURE 1A

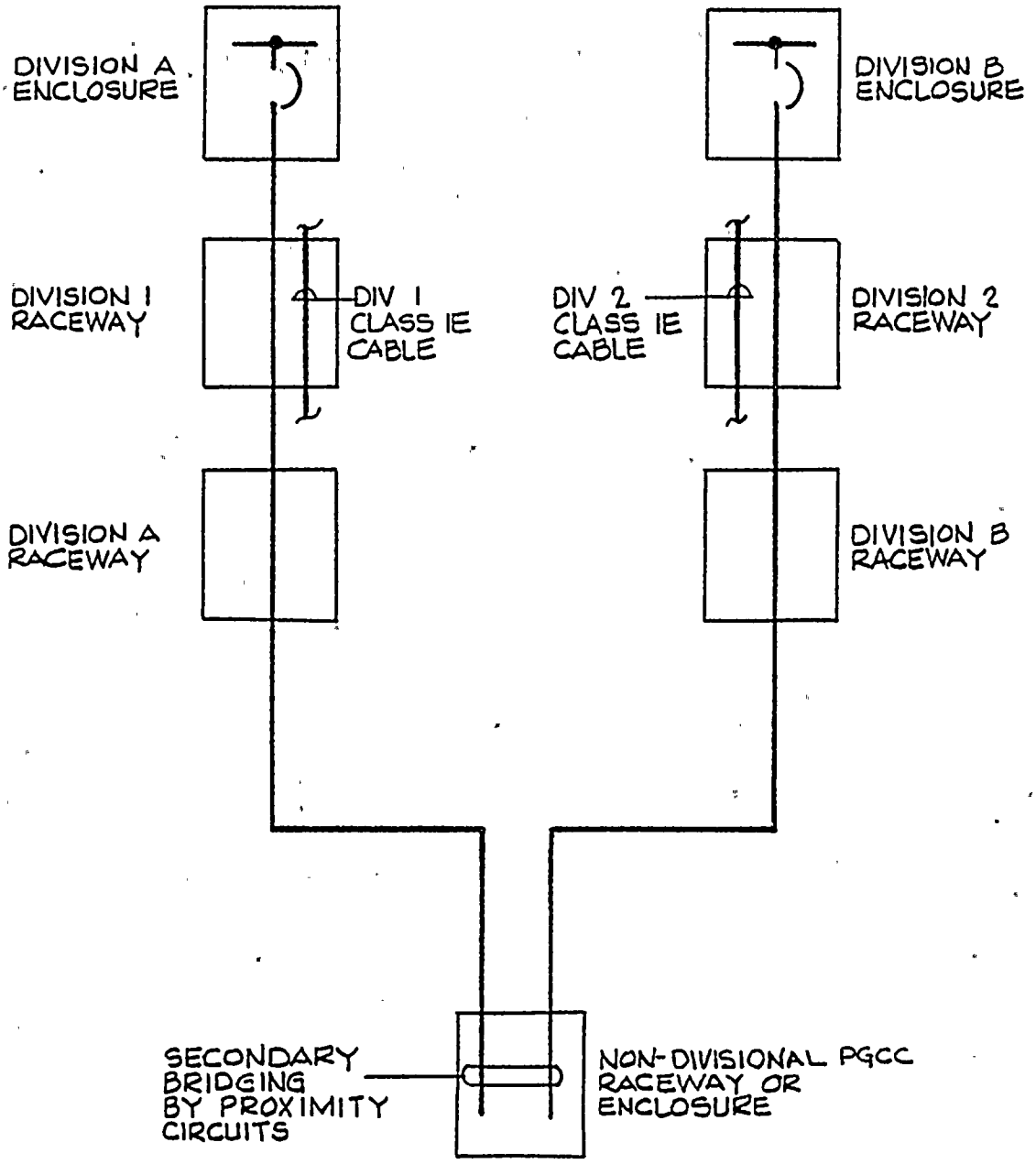
DIRECT BRIDGING BETWEEN CLASS 1E RACEWAYS



NOTE: DIRECT BRIDGING IS NOT ALLOWED

FIGURE 1B

SECONDARY BRIDGING BY PROXIMITY

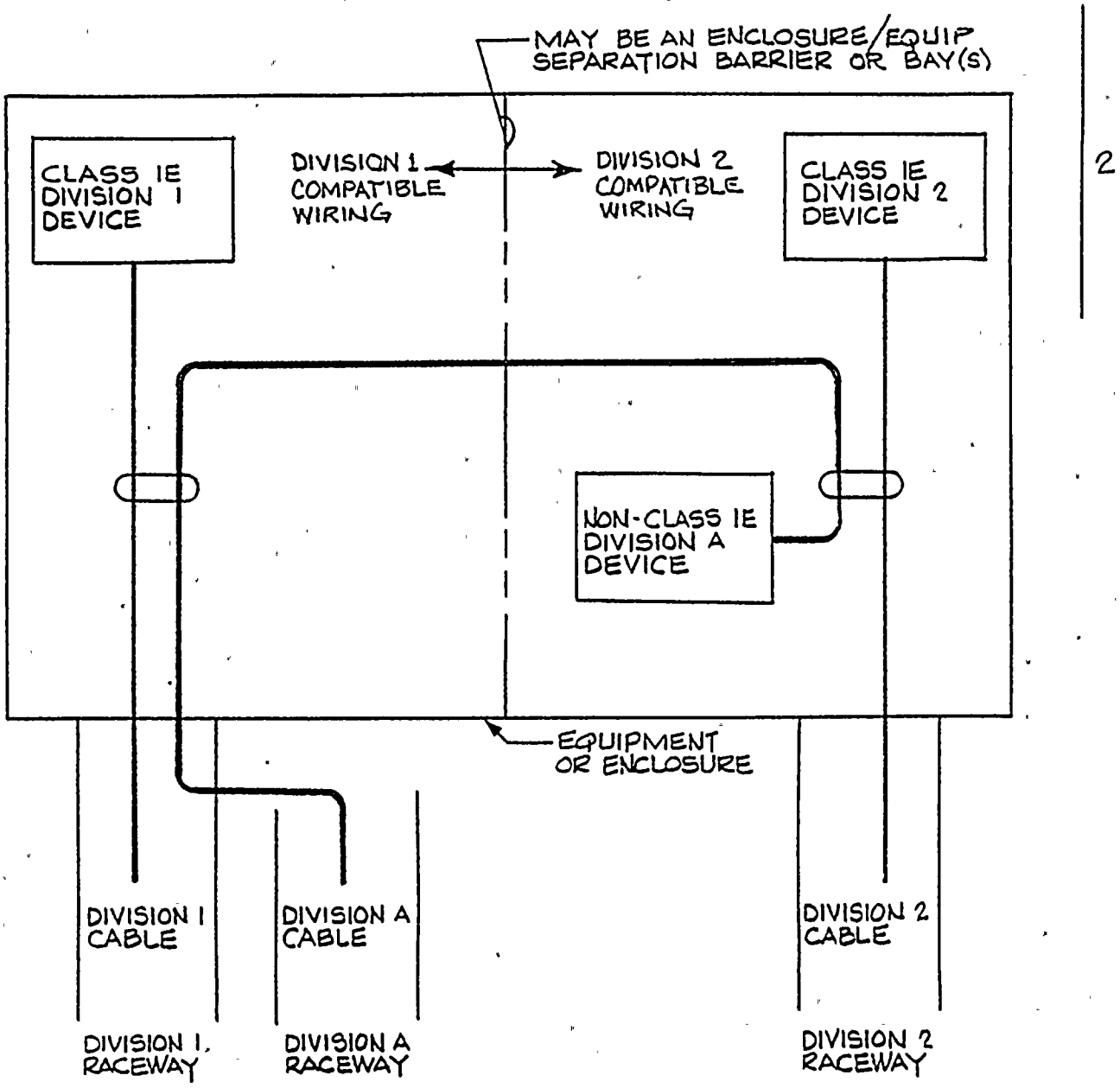


2

NOTE: SECONDARY BRIDGING IS ALLOWED WHERE ACCEPTABLE BY ANALYSIS

FIGURE 1C

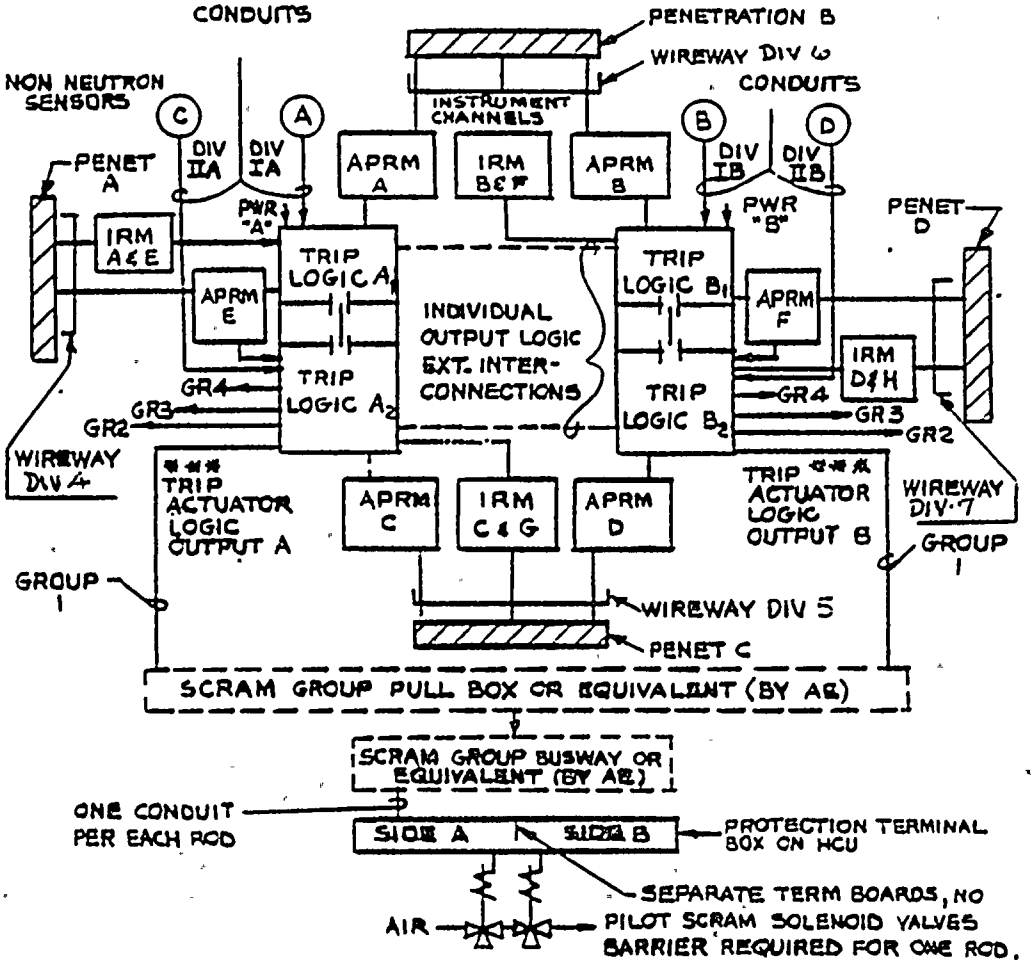
SECONDARY BRIDGING WITHIN EQUIPMENT AND ENCLOSURES



NOTE: SECONDARY BRIDGING IN ENCLOSURES IS ALLOWED WHERE ACCEPTABLE BY ANALYSIS

FIGURE 2

FOUR PENETRATION RPS SEPARATION CONCEPT



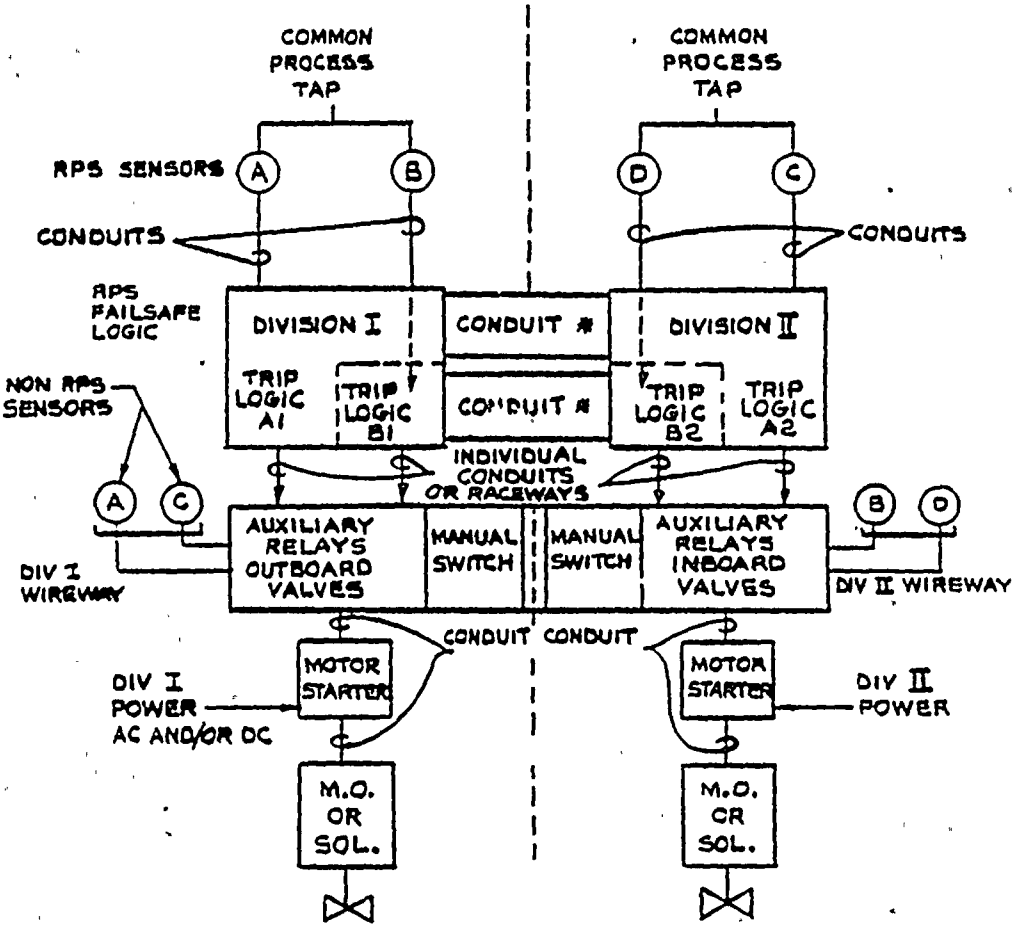
* RPS SENSORS A & B OR C & D MAY BE CONNECTED TO A COMMON PROCESS TAP. RPS SENSORS A & C OR B & D MUST NOT BE CONNECTED TO A COMMON PROCESS TAP.

** WIREWAYS NA, NB, ETC. MAY BE ASSIGNED TO SEPARATE DIVISIONS AS APPROPRIATE TO PLANT LAYOUT.

*** SEE FOUR PENETRATION RPS SEPARATION CONCEPT

FIGURE 3

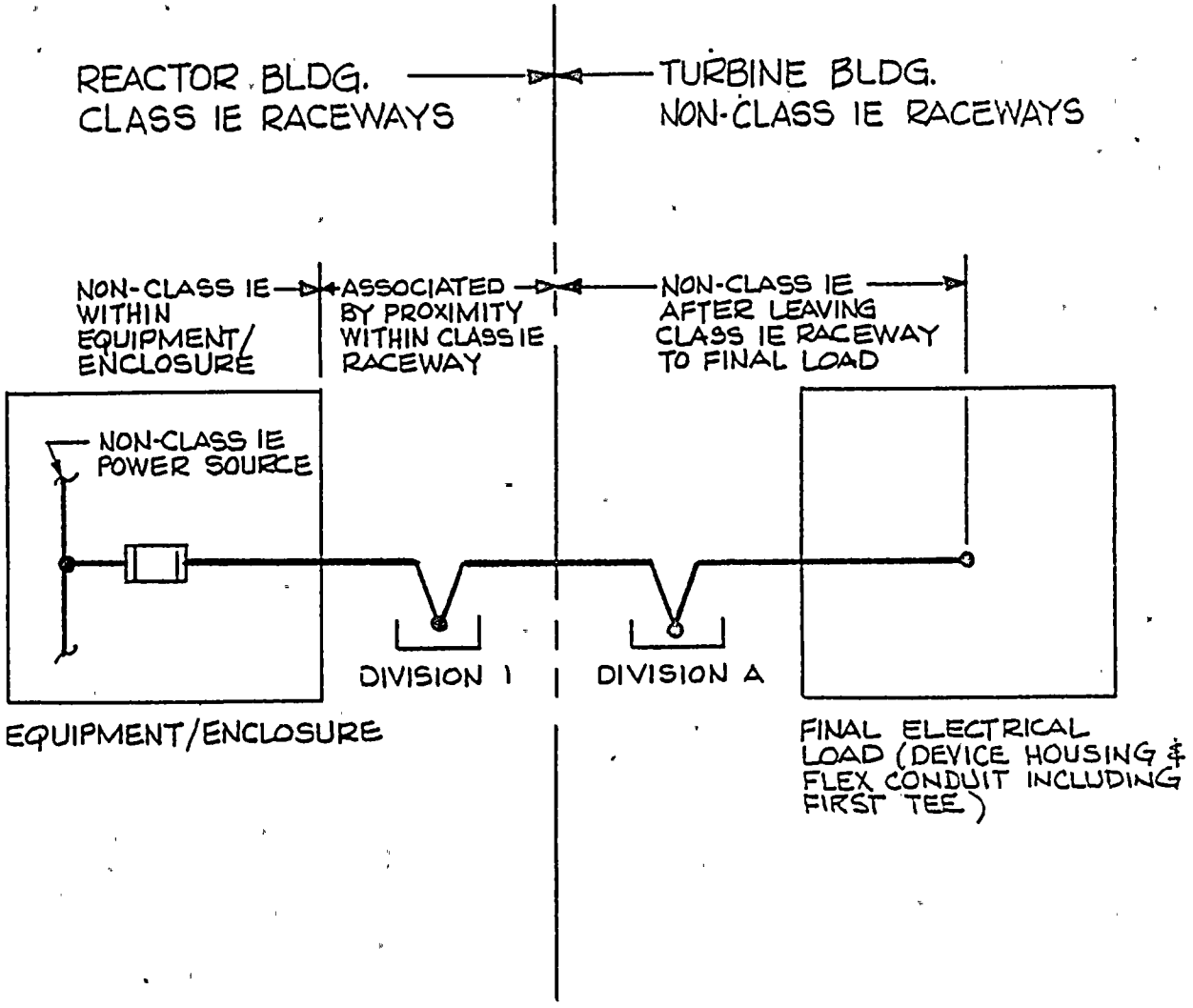
NSSSS SEPARATION CONCEPT



INTERCONNECTING CONDUITS USED FOR MAIN STEAM ISOLATION VALVE LOGIC ONLY

FIGURE 4

PROXIMITY CIRCUIT SECTIONALIZATION



APPENDIX A
FIELD VERIFICATION

The purpose of this Appendix is to provide a more simple and condensed form of the criteria in a manner to assist in field verification. This Appendix is not as comprehensive as Section II and related tables and figures, but is intended to be a verification tool capable of addressing the large majority of installations in the field.

For Contractor personnel, if during the course of construction or in-process inspection activities deviations from this Appendix are found, first consult Section II which is more complete and/or request clarification from supervisory personnel. If a deviation still exists, the specific(s) should be brought to the attention of Burns and Roe through normal project means.

It should be noted that this Appendix was principally written with assistance from Bechtel QC and Bechtel Engineering personnel to input a construction perspective. It is recognized that there is duplication between this Appendix and the remainder of the document. This Appendix has been reviewed by Burns and Roe and determined to be consistent with the other sections. It has been incorporated into the Burns and Roe document to provide a single place for a baseline for WNP-2 electrical separation.

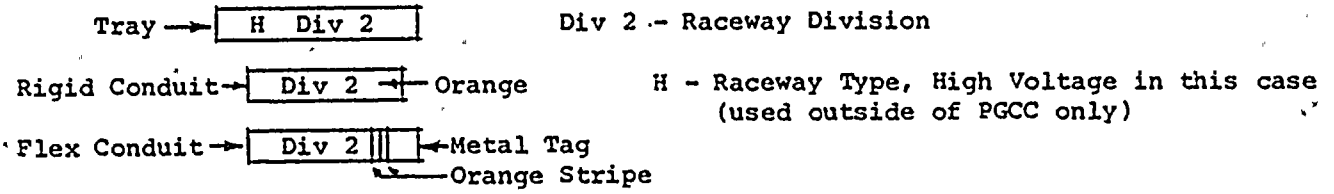
A. General

1. The Appendix describes criteria for three areas; General Plant including Cable Spreading Room, Control Room and equipment and enclosure internal circuits.

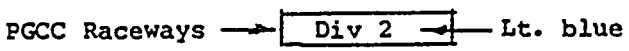
2. The typical raceway and cable markers used in all plant areas are as follows:

a. Raceway Marker

(1) External to PGCC

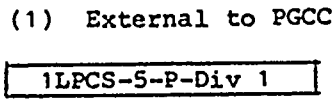


(2) Internal to PGCC



b. Cable Marker

(1) External to PGCC



Cable Division

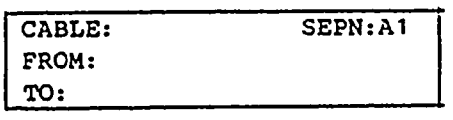
1LPCS-5 - Cable ID

P-Power

Div 1 - Raceway Division

(2) Internal to PGCC

Cable & Flex Conduit Separation Marker



Cable & Flex Conduit ID Marker

2

3. The equipment, enclosure, raceway, cable background color and characters differ for wire markers for all plant areas shown in the following tables.

Table A-1. Class 1E and Non-Class 1E Markers

Outside PGCC →				← Inside PGCC				
Eqpt/Rwy*/Cable Marker Color		Cable Division	Eqpt/Rwy/Cable Division Marking	Eqpt/Rwy/Cable Marker		Cable or Flex Conduit Markers		
						ID	Separation	
Background	Character			Character (Black)	Background Color	Characters	Characters	Character Color
Yellow	Black	1	**Div 1	Div 1	Yellow	ESSI	ESSI	Black
						NSSI	NSSI	
Lt. Blue	Red	4	**CH A1			A1	RPS I	Red
						DIV-1A	DIV I	Black
Dk. Blue	Red	6	**CH B1			RPS-B1	RPS I	Red
						SI,CI	DIV I	Black
Orange	Black	2	**Div 2	Div 2	Blue	ESSII	ESSII	White
						NSSII	NSSII	
Green	Red	5	**CH A2			A2	RPS II	Red
						DIV-2A	DIV II	White
Brown	Red	7	**CH B2			RPS-B2	RPS II	Red
						SII,CII	DIV II	White
						XXXIII	XXXIII	N/A
Red	Black	3	**Div 3	Div 3	Green	ESSIII	ESSIII	White
						S/CIII	N/A	
Silver	Black	A	**Div A+	DIV A ☐	Yellow ☐	SA/CA △	Yellow	Black
				XXXI ☐	Yellow ☐	XXXI △		
				XXXII ☐	Blue ☐	XXXII △		
Gold	Black	B	**Div B+	DIV B ☐	Blue ☐	SB/CB △	Blue	White
				XXXIII ☐	Green ☐	XXXIII △	Green	White

* Flexible conduit requires a metal tag with the separation colors in bands.

** Service type letter (P-, C-, H-, S-, R-) is provided for trays only (typical).

\+ When a Non-Class 1E Div A cable (outside PGCC) is tagged XXXII or SB/CB (inside PGCC), and is routed in Div 2 raceways inside PGCC, then it will have reference note 4 (in E551/E550) and is not allowed to route into Division 1 raceways external to PGCC. Similarly for a Non-Class 1E, Div B cable (outside PGCC).

△ When a Non-Class 1E XXXI/SA/CA cable (inside PGCC) is tagged Div B (outside PGCC) and is routed in Div 2 raceways outside PGCC, then a reference note will be added to the PGCC schedules to not allow this cable to route into Division 1 raceways inside the PGCC. Similarly for Non-Class 1E, XXXIII/XXXII/SB/CB cables (inside PGCC).

☐ These markers are for PGCC panels including all PGCC termination cabinets; the non-divisional PGCC raceway markers are white with no lettering while the non-divisional cable separation markers have background colors as indicated but have no lettering.

Table A-2. Associated by Proximity and Prime Cable Markers

			Outside PGCC →		← Inside PGCC				
Cable Marker Background Color	Additional Prime Cable Checkered Marker	Cable Div Marking	Rwy Marker Character (Black)	Rwy Marker Background Color	Rwy Marker Character (Black)	Rwy Marker Background Color	Cable Marker ID	Cable Marker Background Color	Additional Prime Cable Checkered Marker
Silver Silver/Yellow	Red/White	Div A	Div A	Silver	Div 1	Yellow	XXXI SA CA	Yellow	Red/White
Silver/Yellow	Red/White	Div A	Div 1	Yellow	Div 1	Yellow	XXXI SA CA	Yellow	Red/White
Gold Gold/Orange	Green/White	Div B	Div B	Gold	Div 2	Blue	XXXII SB CB	Blue	Green/White
Gold/Orange	Green/White	Div B	Div 2	Orange	Div 2	Blue	XXXII SB CB	Blue	Green/White
Red	N/A	Div 3	Div 3	Red	Div 3	Green	XXXIII	Green	Blue/Yellow
Silver ** Silver/Yellow	N/A	Div A	Div A	Silver	Div 1	Yellow	XXXI, SA, CA	Yellow	N/A
					Div 2	Blue	XXXII, SB, CB	Blue	N/A
Silver/Yellow	N/A	Div A	Div 1	Yellow	Div 1	Yellow	XXXI, SA, CA	Yellow	N/A
					N/A*	White	XXXI, SA, CA	Yellow	N/A
							XXXII, SB, CB	Blue	N/A
Gold ** Gold/Orange	N/A	Div B	Div B	Gold	Div 1	Yellow	XXXI, SA, CA	Yellow	N/A
					Div 2	Blue	XXXII, SB, CB	Blue	N/A
Gold/Orange	N/A	Div B	Div 2	Orange	Div 2	Blue	XXXII, SB, CB	Blue	N/A
					N/A*	White	XXII, SB, CB	Blue	N/A
							XXXI, SA, CA	Yellow	N/A

* This raceway is termed non-divisional.

** Division A cables which route entirely in Division A raceways but route within equipment or enclosures with Class 1E cables are given 9000 series cable numbers and provided with a dual color marker along their entire length (similarly for Division B). These cables may route in either Division 1 or Division 2 raceways in PGCC but not in both to preclude direct bridging.

Table A-3. Equipment and Enclosure Intruder Circuit Cable Markers

Intruding Cable Division*	Striped Marker Color
ESSI, NSSI, A1, B1, C1, S1, 1, 4, 6, A', Div 1A, Div 1B, XXXI SA CA	Yellow/White
ESSII, NSSII, A2, B2, S2, C2, 2, 5, 7, B', Div 2A, Div 2B, XXXII SB CB	Blue/White
ESSIII, 3, XXXIII	Green/White

Markers are provided every 12 ± 2 inches within the equipment or enclosure boundary.

* Intruding cable divisions shown are those selected based upon criteria implementation rather than literal application of design criteria.

All Cables External to PGCC*

Table A-4. Wire identification markers for cables where visual traceability to cable marker is not possible.

Cable Functional Division	Cable ID Marker	Wire Marker Color	
	Outside PGCC	Background	Character
1	Div 1	Yellow	Black
2	Div 2	Orange	
3	Div 3	Red	
4	CHA1	Gray	Red
5	CHA2	Green	
6	CHB1	Blue	
7	CHB2	Tan	
A	Div A	White	Red
B	Div B		Green
A (Asso. by Proximity)	Div A	White/ Yellow	Red
B (Asso. by Proximity)	Div B	White/ Orange	Green
(Asso. by Proximity) Div 3	Div 3	Red	Black

2

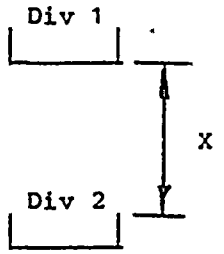
* Cables that terminate on the field side of the PGCC termination cabinets including the digital and analog computer cabinets are included in this classification of cables and are listed in E551.

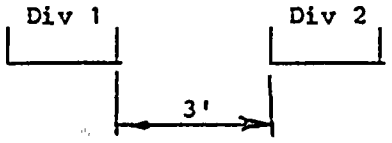
B. General Plant Areas

Refer to Table A-9 for Raceway Inspection Criteria for General Plant Areas.

1. The following separation distances apply to Div 1, Div 2 and Div 3 raceways, and between open power trays of Div A or Div B from Div 1, Div 2 or Div 3.

   a. Open Trays





(1' in Cable Spreading Room)

X = 5'; 8' for 3 or more tiers of Div 2 with no automatic fire suppression (X = 3' in Cable Spreading Room)

b. Where above separation distances cannot be maintained, barriers are installed per Section II.B or as specified in design documents.

c. Redundant Class 1E totally enclosed raceways do not require separation from each other except that they are installed to avoid touching each other.

2. Cables with the following color coded markers are compatible and may be routed together in the raceways shown below.

Table A-5. Cable Markers in Raceways (Outside PGCC)

Raceway Marker (Note 1)	Cable Marker Background Color		
	Residing	Proximity	Prime
Yellow (Background) — P Div 1	Yellow	Silver. Yellow	Red/White
Orange — P Div 2	Orange	Gold Orange	Green/White
Silver — P Div A	Silver	Silver Yellow	Red/White
Gold — P Div B	Gold	Gold Orange	Green/White

Notes

1. P Div 1, etc., represent power raceways. The above table is typical for Control (C Div 1, etc.) and Signal (S Div 1, etc.) raceways.

2. Other divisional raceways, Div 3, Div 4, etc., carry cables of their corresponding division only.

3. Class 1E raceway markers are required every 15 feet, at the beginning, end, discontinuities, and at pull boxes.

   Class 1E cable markers, where cables are visible, are required every 15 feet and at their terminations.

   Non-Class 1E cable and raceway markers are required every 100 feet and at their terminations.

C. Control Room Area

1. The following separation requirements apply to raceways in the Control Room Area.

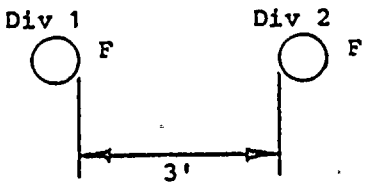
a. PGCC

(1) PGCC raceways are formed of modular floor sections. No specific separation distances apply except that the raceways of redundant Class 1E divisions are to be separated by steel barriers which may be part of the PGCC floor modules. The separation between Class 1E divisions and non-divisional raceways within the PGCC shall be by using firestops to prevent an air channel between redundant Class 1E divisional raceways. 2

(2) Miniducts within the longitudinal raceways also serve as divisional raceways. The cables in the miniducts are enclosed in flexible metallic conduit or Siltemp tape.

b. Periphery of PGCC and Remainder of Control Room

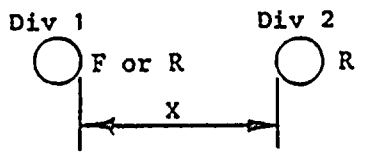
(1) Flexible Conduits



F - Flexible Conduit

Typical for Div 1 & Div 3 and Div 2 & Div 3 or redundant prime circuits.

(2) Flexible and Rigid Conduits

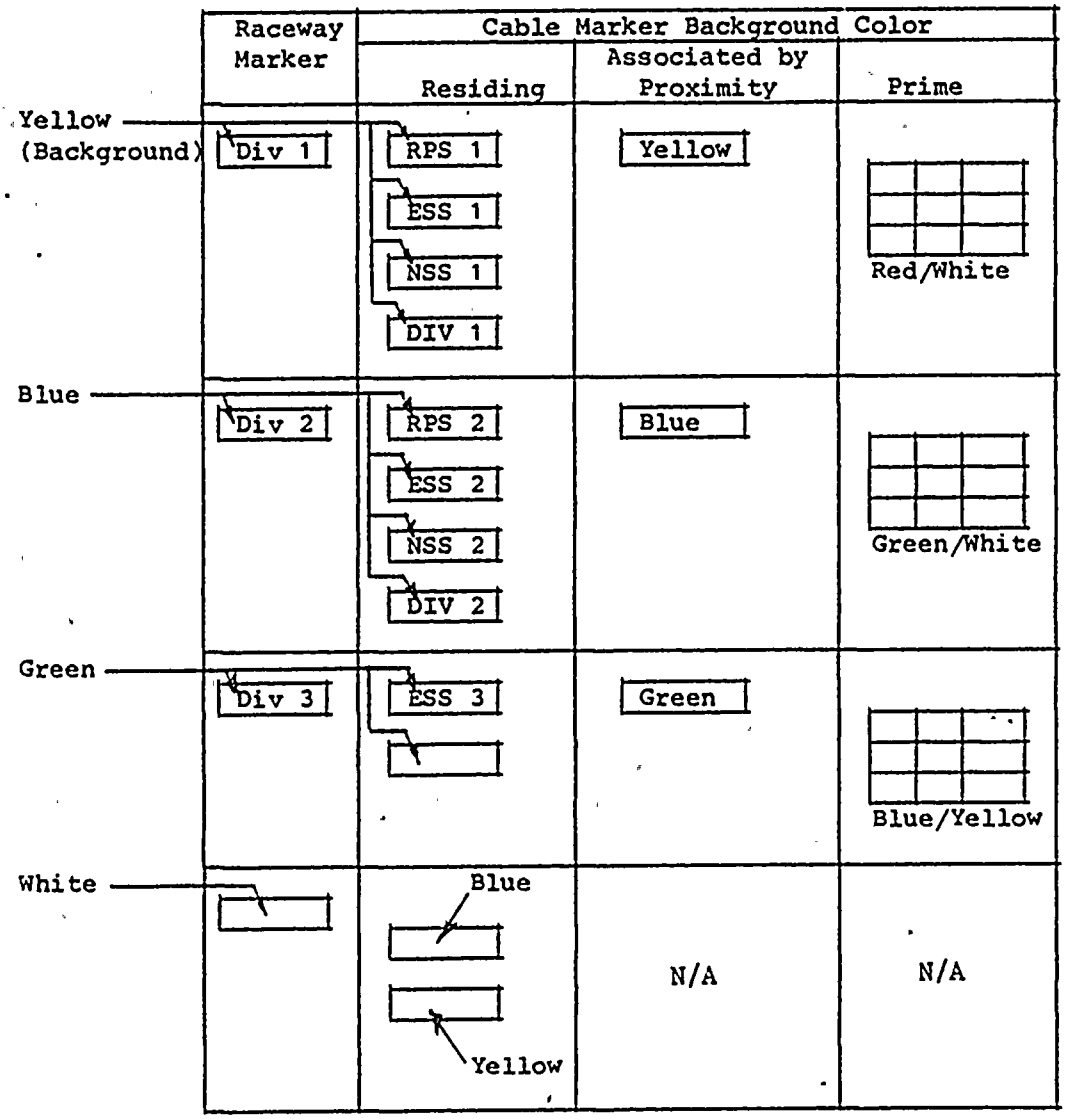


R - Rigid Conduit

X - Conduits must not touch.

2. Cables with the following color coded markers are compatible and may be routed together in the PGCC raceways as shown below.

Table A-6. Cable Markers in Raceways (Inside PGCC)



3. PGCC longitudinal raceways are marked every 5 feet. Lateral raceways are marked at the longitudinal raceway lip centered above the lateral raceway in accordance with Drawing E775 Sheet 3.

All PGCC cables are marked every five feet with a separation marker and every ten feet with a cable identification marker.

Table A-7. Cable Markers Within PGCC Equipment/Enclosures (See Paragraph D.2 of this Appendix.)

Designated Panel Division	Up To First Termination To A Device or Terminal Block		
	Cable Marker Background Color		
	Residing*	Compatible & Assoc. by Proximity *	Prime
Yellow — Div 1	Yellow	Blue Green	Red/White
Blue — Div 2	Blue	Yellow Green	Green/White
Green — Div 3	Green	Yellow Blue	Blue/ Yellow
Yellow — Div A Yellow — XXXI	Yellow	Yellow Blue	Red/White
Blue — Div B Blue — XXXII	Blue	Green	Green/White

* Cables with Division IDs of Div A, Div B, XXXI, XXXII & XXXIII only.

Table A-8. Cable/Wire Markers Within Equipment/Enclosures Outside of PGCC & Field Side of PGCC Termination Cabinets (See Paragraph D.2 of this Appendix.)

Designated Panel Division	Up To First Termination To A Device or Terminal Block			For Traceability		
	Cable Marker Background Color			Wire Marker Background Color		
	Residing	Compatible & Assoc. by Proximity	Prime	Residing	Compatible & Assoc. by Proximity	Prime
Yellow Div 1	Yellow	Silver Yellow Silver Yellow	Red/White	Yellow Gray Blue	Yellow Gray Blue White Yellow White Orange White	Red/White
Lt Blue Div 4	Lt Blue	Lt Blue Gold				
Dk Blue Div 6	Dk Blue	Dk Blue Gold Orange				
Orange Div 2	Orange	Gold Orange Gold Orange	Green/White	Orange Green Brown	Orange Green Brown White Orange White Yellow White	Green/White
Green Div 5	Green	Green Silver				
Brown Div 7	Brown	Brown Silver Yellow				
Red Div 3	Red	Gold Gold Orange Silver Silver Yellow	N/A	Red	White Yellow White Orange White	N/A
Silver Div A	Silver	Silver Silver Yellow	Red/White	White	White Orange	N/A
Gold Div B	Gold	Gold Gold Orange	Green/White		White Yellow	

D. Equipment and Enclosure Internal Circuits

1. The following separation requirements apply to redundant Class 1E and prime devices, cables and wires. The redundant division circuit, which is not the residing equipment/enclosure division, is the intruder circuit.

   a. A minimum of 6" physical separation is required.

   b. Where 6" separation cannot be achieved, barriers are required e.g.; flexible conduit or Siltemp tape for wiring and metal enclosures for devices.

   c. When a common device (relay) is used by design to terminate wiring of two redundant Class 1E divisions, the intruding division wiring is to be routed immediately away from the device to attain the required separation or until a barrier can be installed.

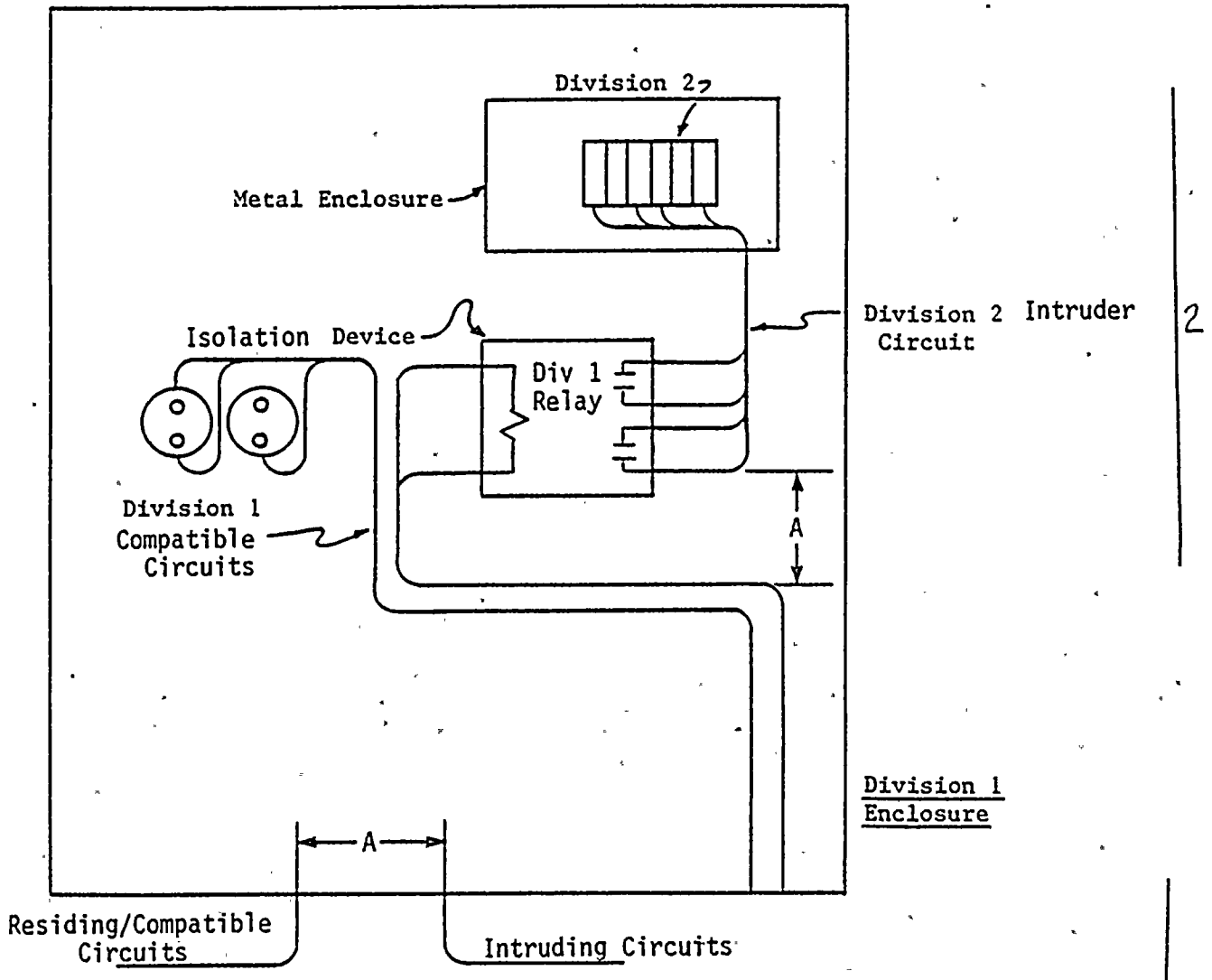
   d. Non-Class 1E utility circuits are to be separated by 6" or a barrier from all other circuits within Main Control Room panels.

   e. Some examples of separation inside equipment and enclosures are shown in Sketches A, B and C.

2. Within equipment and enclosures, cables and wires with the following color coded markers are compatible and may be routed together. Cables and wires with markers other than those shown below are to be separated as in D.1 above and marked as intruder circuits per this Appendix, table A-3.

3. Outside PGCC equipment and enclosure residing division separation markers are located on the front. Equipment and enclosures mounted on PGCC have the separation markers located inside the rear door, on barrier (covers), or within lines of demarcation. 2

SKETCH A



2

2

A - 6" minimum air space or a barrier is installed. At isolation device where 6" cannot be maintained intruding wiring shall be routed immediately away from the isolation device to attain the required 6" separation or to the extent where a barrier can be installed.