EVALUATION RESEARCH CORPORATION

COMANCHE PEAK RESPONSE TEAM

QUALITY INSTRUCTION FOR ISSUE SPECIFIC ACTION PLAN VII.c

INSTRUCTION NO.: QI-008

REVISION: 2

EFFECTIVE DATE: 09/10/85

REINSPECTION OF CONDUIT/I-E-CDUT

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Reinspection of Conduit/I-E-CDUT

1.0 PURPOSE

To provide methods to be used and the accept/reject criteria to be applied when performing reinspection of conduit.

2.0 APPLICABILITY

This procedure applies to reinspection of samples selected from the conduit population. The population is described in the Population Description for Conduit.

3.0 REFERENCES

3.1 Description Memorandum QA/QC-RT-216 dated July 12, 1985 delineating documentation used in the development of this procedure including specific sources for attributes and exclusions.

3.2 CPP-009, Performance of Reinspection and Documentation Reviews

3.3 2323-E1(E2)-1700, Cable and Raceway Schedule

3.4 2323-E1(E2)-1800, Material List

3.5 2323-S-0910, Conduit Support Package

4.0 GENERAL

Reinspection reviews are performed and documented in accordance with established project procedures and instructions. This instruction establishes the attributes and accept/reject criteria for reinspections of conduit. Reference 3.2 addresses the method to perform reinspections, document and process the results.

5.0 PROCEDURE

5.1 Using the information in Reference 3.2 and below, perform the reinspections on the items in this population and document the results of the reinspection on the checklist (Attachment 6.9).

1. Size and Material

a. Verify that installed conduit size agrees with size as called for on the conduit layout drawings. Conduit of the next larger size in accordance with the following size range is not considered a deviation from the designed size: conduit size range (1/2, 3/4, 1, 1-1/2, 2, 3, 4, 5).

b. Verify that where rigid conduit is used it is rigid steel, zinc coated unless otherwise noted on drawings.

2. Identification

a. Verify that the exposed conduit, except lighting conduit, has permanent identification markings (alphanumeric code designation) and that the identification agrees with the cable and raceway schedule report. Report Section No. 70, 2323-E1-1700 and 2323-E2-1700 including outstanding DCA's. Markings may be any of the following:

- Freehand markings with black ink marker or paint
- Adhesive markers factory pre-printed (except reactor containment, and manholes)
- Metal or plastic tags

Metal tags used inside the Reactor Containment must be attached to the conduit with either wire, Tefzel ty-raps, or fastener required per drawing.

b. Verify, except for lighting conduit, that permanent identification markings have been applied at the following locations;

- At both ends of each run
- Entering or leaving a junction/pull box each side
- Entering or leaving a tray
- On each side of a floor or wall

NOTE: Conduit 10 feet in length or less need only be identified at a single point in the run. A single conduit entering and leaving a pull box is not required to be identified on either side of the box.

c. Verify that color code markings have been applied at intervals not to exceed 15 feet.

For conduit identification and color code explanations see Attachment 6.1.

NOTE: For cable tray identification explanation see Attachment 6.2.

3. Origin and Destination

Verify that the conduit origin and destination agree with the initial point and ending point designation per the Cable and Raceway Schedule Report No. 70 (conduit list), 2323-E1-1700, and 2323-E2-1700, including all approved outstanding design change authorization (DCAs).

4. Fittings

a. Verify that either an insulated bushing or sleeve insert has been installed on all conduit ends including conduit terminating at equipment/cabinets, junction/pull boxes, except for conduit connections to equipment with hubs.

b. Verify that conduit terminating at either a junction/pull box or cabinet is fastened with a locknut or bushing to the enclosure.

c. Verify that couplings are secure (i.e., couplings are not loose).

d. Conduit connections at outdoor enclosures containing terminations, shall be made with liquid tight hub fittings. Fitting type shall be as specified on the Material list. Gasketed locknuts are an acceptable substitute. Conduits entering the top of equipment subject to water spray from fire protection sprinkler activation should be sealed according to details provided on the drawings.

5. Expansion Fittings

Verify that either expansion fitting or flexible conduit has been used in long straight runs of conduit. Long straight runs (bends less than 15° are considered straight for this application only) of continuous conduit shall be provided with either an expansion fitting or flexible conduit at 75-foot intervals.

6. Bends

N.I.S. conduit raceway, function 6R, 6W, 6B and 6Y (for third and fourth character respectively in the conduit identification number) field bends shall comply with the following dimensions:

Size of Conduit	Minimum Bend Radius
3" diameter conduit -	15" min. bend radius
4" diameter conduit -	20" min. bend radius

7. Total Conduit Length and Bends Between Pull Points

N.I.S. conduit raceway functions 6R, 6W, 6B and 6Y are to be installed to the dimension provided on the drawings with a maximum tolerance of ±6 inches from the design dimension. The distance between junction boxes/pull points and the length of conduit between boxes/pull points shall be in accordance with the dimensions provided on the drawings.

Where design dimensions are not provided on drawings, verify the installation of N.I.S. conduit in accordance with the following requirements:

Pull boxes are to be located at intervals defined by A + B = 100, where "A" is the total number of degrees of conduit bends between pull points and "B" is the total number of running feet between pull points.

8. Flexible Conduit

a. Verify that conduit connections made to motors and free standing equipment is made with flexible conduit.

b. Verify length of flexible conduit in accordance with the following:

Motors and other freestanding equipment.

The minimum flexible conduit length is 18 inches for flexible conduit greater than 2 inches in diameter. For flexible conduit 2 inches in diameter or smaller, the minimum length is that which allows a minimum of 1 inch slack movement of the flexible conduit.

Flexible lengths shall be in accordance with the above, unless otherwise shown on the drawings.

c. Verify that flexible conduit has been used for continuous runs of conduit across shake spaces between adjacent buildings. Verify 1" movement (slack) has been provided. Shake space requirements are applicable for continuous runs of conduit between the safeguard building or fuel building and auxiliary building.

d. Verify that stainless steel flexible conduit is used in containment.

NOTE: Slack shall be defined as the actual length of flexible conduit between the couplings less the straight line distance between the couplings.

9. Conduit and Cable Tray Interface

a. Where conduit attaches to a cable tray verify that the connection is made with flexible conduit.

b. Where conduit interfaces with a cable tray verify that the conduit terminates at the tray in accordance with Attachment 6.3 detail 23.

10. Clearance

a. Verify that conduit, including SBM over the conduit, is not touching bare pipe.

b. Minimum clearance between conduits containing power cables (raceway function 1Ø, 2Ø, 1G, 2G, 1K, 2K and 5K) shall not be less than outside diameter of larger conduit except as defined below:

1. At such points where exposed conduits enter or exit any equipment or box to a point of 4'-0" from such equipment or box, but not less than 1-inch between different train conduit.

2. In general plant areas where conduits have a minimum clearance of 1/4 O.D. of the larger conduit, but not less than 1" between different train conduits, for conduit runs not exceeding 10 feet in length.

11. Fire Stops and Seals

Verify that sealing material has been installed for the following types of conduit installations.

a. Conduit connections to floor mounted equipment where the conduit connecting to the equipment passes through either a fire rated wall or floor.

b. Conduit connections to nonfloor mounted totally enclosed equipment, where the conduit connecting to the equipment passes through either a fire rated wall or floor and when the conduits length as measured from the penetration to the equipment is less than 10 feet.

NOTE: If subject sample is a conduit run between a junction box and a fire rated wall/floor penetration then the junction box shall be considered as a nonfloor mounted totally enclosed piece of equipment and the above rule shall apply.

c. Conduit penetrating either a fire rated wall or floor, without connecting to equipment.

d. Conduit stub-ups (stove pipes) out of equipment.

NOTE: DBD-SY1 FHA drawings show location of fire rated floors and walls.

12. Separation

NOTE: For the following all measurements shall be taken from either the conduit or SBM around the conduit.

a. For all conduits except N.I.S. conduit raceway function 6R, 6W, 6B, and 6Y, verify separation as follows:

1. Minimum separation between conduits having different trains and/or channels including Train A & B lighting conduit shall be one inch.

Attachment 6.4 lists the trains and channels and their associated raceway functions (third and fourth characters of conduit ID number).

2. A minimum separation of 2'-0" must be maintained between conduit raceway Systems (2Ø, 2G, 2K, 3Ø, 3G, 3K, 5R, 5W, 5B, 5Y, 5K, 6K,) and NIS conduit raceway functions (6R, 6W, 6B, 6Y) run in parallel except as noted.

b. Separation between N.I.S. conduit and other conduit to be as follows:

1. A minimum separation of 2'-0" must be maintained between "NIS" conduit systems Raceway functions (6R, 6W, 6B and 6Y) and different channel "NIS" Conduit run in parallel.

2. A minimum separation of 2'-0" must be maintained between "N.I.S." conduit raceway functions (6R, 6W, 6B, 6Y) and raceway systems (2Ø, 2G, 2K, 3Ø, 3G, 3K, 5R, 5W, 5B, 5Y, 5K, 6K) run in parallel.

NOTE: Minimum separation of non-parallel runs of "NIS" conduit and the above mentioned systems (i.e., crossing each other at an angle greater than 15 degrees) is 1-inch.

c. Verify separation between conduit (including lighting Train A or B conduit) and cable tray except N.I.S. system per the following:

1. Minimum vertical separation between a Train A, B, non N.I.S. channels I, II, III, & IV

conduit and the top of an open tray having different train or channel shall be 2'-0" in the cable spreading room and 3'-0" in general plant areas. The minimum separation is 1-inch where a solid cover is provided. See Attachment 6.5.

2. Minimum separation between a Train A, B, non N.I.S. channels I, II, III, & IV conduit and either the bottom or side of a cable tray having different train or channel shall be per Attachment 6.6.

3. Verify separation for all conduit except N.I.S. system conduit passing a vertical tray per Attachment 6.8.

d. Verify N.I.S. conduit to cable tray separation as follows:

1. A minimum separation of 6'-0" must be maintained between "NIS" conduit systems (Raceway functions 6R, 6W, 6B, 6Y) and 6.9Kv raceway functions (1Ø, 1G, 1K) including cable bus duct. See Attachment 6.7.

2. A minimum separation of 2'-0" must be maintained between "NIS" conduit (Raceway functions 6R, 6W, 6B & 6Y) and cable tray raceway systems (2Ø, 2G, 2K, 3Ø, 3G, 3K, 5R, 5W, 5B, 5Y, 5K, 6K) run in parallel. Minimum separation of non-parallel runs of "NIS" conduit and the above mentioned systems (i.e., crossing each other at an angle greater than 15 degrees) reduce such separation to 1" with the addition of tray covers. (Top only required for N.I.S. conduit passing over the top, and bottom only required for N.I.S. conduit passing on the bottom. Solid bottom tray constitutes a cover.)

e. Verify separation between conduit and exposed cable (i.e., cable not enclosed in a raceway) per the following:

1. Separation between train or channel conduit except N.I.S. system and other exposed train or channel cable shall be as follows:

* 3'-0" in general plant areas
* 1'-0" in cable spreading area

The 1 foot - 3 foot dimension may be reduced provided either conduit or cable has a

separation barrier material (SBM) blanket applied for a distance to provide required separation for the area. See Attachment 6.7, detail 57.

2. Separation between N.I.S. system conduit and exposed cable shall be as follows:

   a. A minimum separation of 6'-0" must be maintained between N.I.S. conduit and exposed power cables (raceway functions 1Ø, 1G, 1K).

   b. A minimum separation of 2'-0" must be maintained between N.I.S. conduit and exposed cable (raceway functions 2Ø, 2G, 2K, 3Ø, 3G, 3K, 5R, 5W, 5B, 5Y, 6K) run in parallel except as noted.

5.2 Document the results of the reinspection on the attributed checklist (Attachment 6.9).

6.0 ATTACHMENTS

6.1 Conduit Identification

6.2 Cable Tray Identification

6.3 Conduit/Cable Tray Interfaces

6.4 Trains and Channels and Associated Raceways

6.5 Separation Requirements

6.6 Separation Requirements

6.7 Separation Requirements

6.8 Separation Requirements

6.9 Checklist

TABLE 1 (Unit Number)

0 - Common to Both Units

1 - Unit 1

2 - Unit 2

TABLE 2 (Raceway Function)

1Ø, 1G, 1E	-	6.9 KV A.C.
2Ø, 2G, 2E	-	480 Vac, 120, 208 Vac - 125V-250V D.C. power
3Ø, 3G, 3E	-	Control AC & DC & Small Power Feeders Under 480V
4Ø, 4G, 4E	-	Low Level Signals
4R, 4W, 4B, 4Y	-	Reactor Protection Instrumentation Low Level Signals
5Ø, 5G, 5E	-	480V AC & Heavy Power Feeders Under 480V (Local Control)
5R, 5W, 5B, 5Y	-	Reactor Protection Instrumentation 120V Signal
6Ø, 6G, 6E	-	Control AC & DC & Small Power Feeders Under 480V (Local Control)
6R, 6W, 6B, 6Y	-	Nuclear Instrumentation System
7Ø, 7G, 7E	-	Low Level Signals (Local Control)
8E	-	Telephone & Communications

TABLE 3 (Safety Related Train)

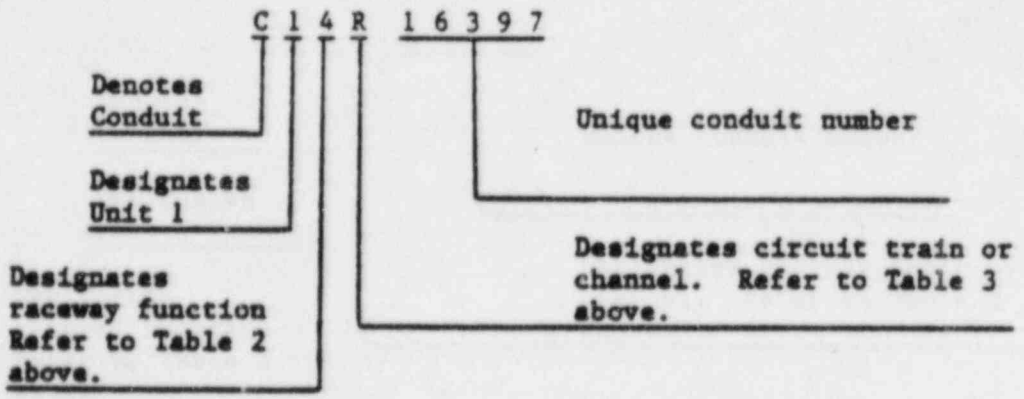
"A" Train - Orange - Ø -
Associated "A" Train - Orange with white stripe

"B" Train - Green - G -
Associated "B" Train - Green with white stripe

"C" Train - Black - K - (Non-Q)

Inst. Channel I	-	Red	- R -
Inst. Channel II	-	White	- W -
Inst. Channel III	-	Blue	- B -
Inst. Channel IV	-	Yellow	- Y -

A typical conduit identification number is depicted as follows:



TRAY NUMBER EXPLANATION

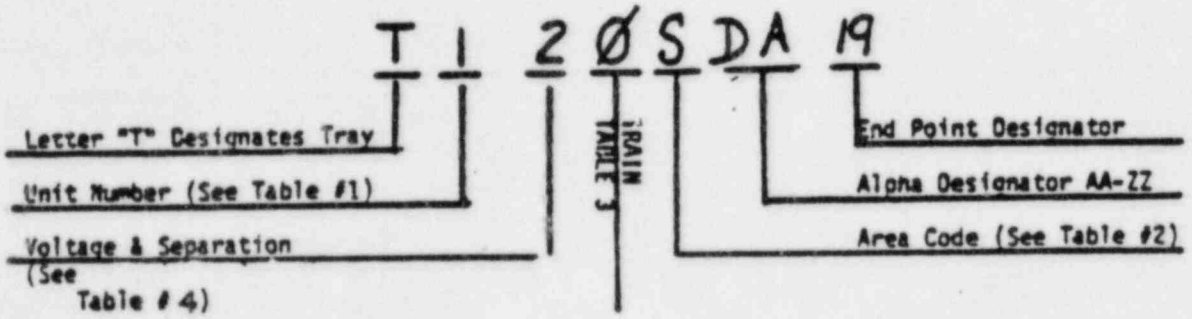


TABLE 1

0 - Common
1 - Unit 1
2 - Unit 2

TABLE 2

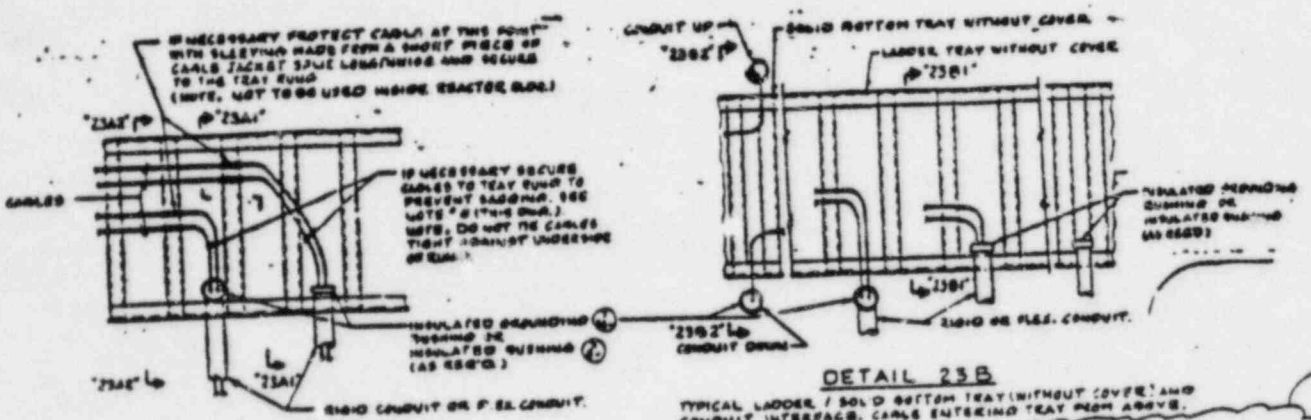
A - Auxiliary
C - Electrical & Control
D - Diesel
E - Electrical Equipment Area (in Safeguard)
F - Fuel
M - Miscellaneous Buildings
R - Reactor
S - Safeguard
T - Turbine & Switchgear

TABLE 3

Ø - Orange - A Train
G - Green - B Train
K - Black - C Train
R - Red - Channel I
W - White - Channel II
B - Blue - Channel III
Y - Yellow - Channel IV

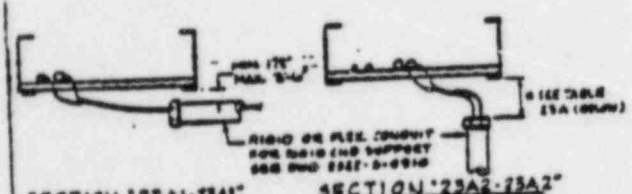
TABLE 4 (Raceway Function)

1Ø, 1G, 1K - 6.9 KV A.C.
2Ø, 2G, 2K - 480 Vac, 120, 208 Vac - 125V-250V D.C. power
3Ø, 3G, 3K - Control AC & DC & Small Power Feeders Under 480V
4Ø, 4G, 4K - Low Level Signals
4R, 4W, 4B, 4Y - Reactor Protection Instrumentation Low Level Signals
5Ø, 5G, 5K - 480V AC & Heavy Power Feeders Under 480V (Local Control)
5R, 5W, 5B, 5Y - Reactor Protection Instrumentation 120V Signal
6Ø, 6G, 6K - Control AC & DC & Small Power Feeders Under 480V (Local Control)
6R, 6W, 6B, 6Y - Nuclear Instrumentation System
7Ø, 7G, 7K - Low Level Signals (Local Control)
8K - Telephone & Communications



DETAIL 23A

TYPICAL LADDER TYPE TRAY & CONDUIT INTERFACE. CABLE ENTERING TRAY FROM BELOW.



SECTION "23A1-23A1"

SECTION "23A2-23A2"

TABLE 23A

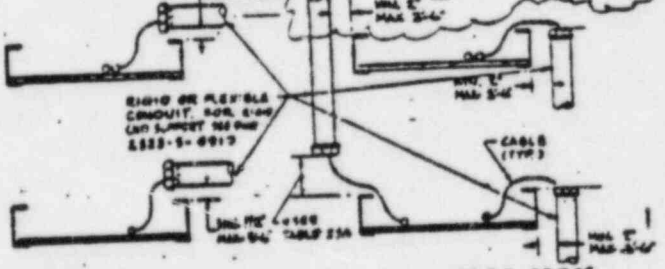
RACEWAY FUNCTION	TRAY WIDTH	CABLE BEND RAD.	NOTE
1E & 2E	12"	5'-6"	THE MINIMUM DIMENSIONS WHEN CAN BE REDUCED TO 5" MINIMUM PROVIDED THAT THE MINIMUM CABLE BENDING RADIUS IS NOT VIOLATED AND THAT THE REQUIREMENT OF GENERAL NOTE "5" ARE FOLLOWED.
1B & 2B	10"	5'-6"	
1A & 2A	6"	5'-6"	

DETAIL 23B

TYPICAL LADDER / SOLID BOTTOM TRAY (WITHOUT COVER) AND CONDUIT INTERFACE. CABLE ENTERING TRAY FROM ABOVE.

EF 9-7-85

-APPLIES TO NEXT ATTACHED TRAY ONLY



SECTION "23B1-23B1"

SECTION "23B2-23B2"

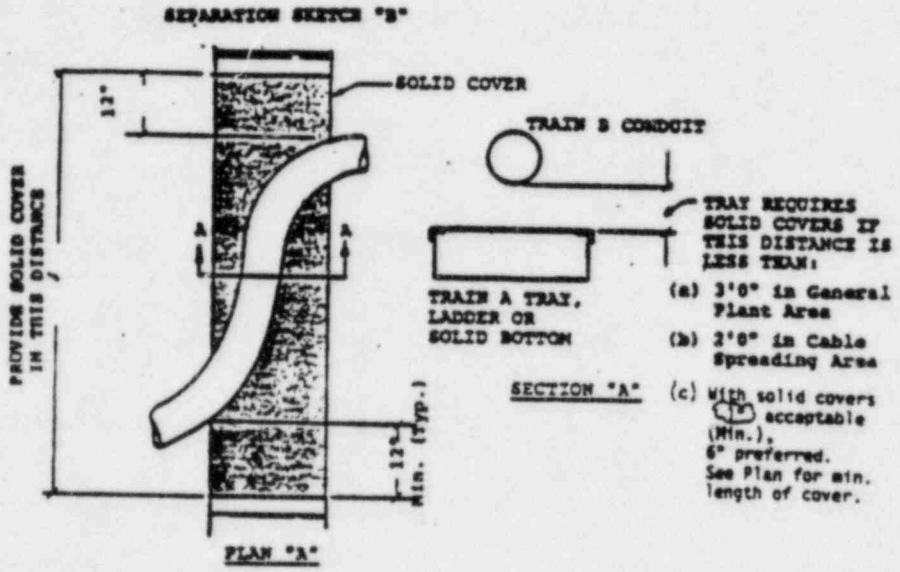
DETAIL 23

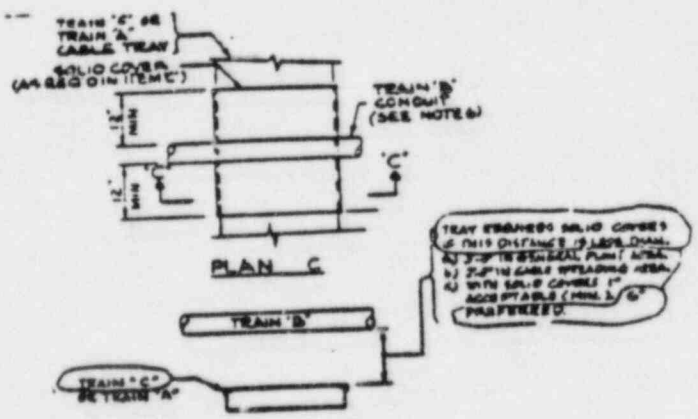
TYPICAL CABLE TRAY & CONDUIT INTERFACE DETAIL FOR CATEGORY 1 BLDGS ONLY (SEE NOTE 6.)

USE PERMANENT CABLE TRAINING RADIUS PER QI-014

EF 9-7-85

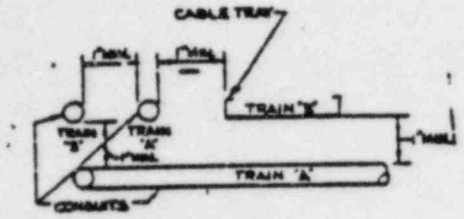
Class	DWG Symbol	Train or Channel	Raceway Function
1E" 1E Associated"		Train "A"	1Ø, 2Ø, 3Ø, 4Ø
1E" 1E Associated"		Train "B"	1G, 2G, 3G, 4G
Non "1E"	NONE	Train "C"	1K,2K,3K,4K,5K,6K
1E"		Channel I	4R, 5R
1E"		Channel II	4W, 5W
1E"		Channel III	4B, 5B
1E"		Channel IV	4Y, 5Y





DETAIL 48

TYPICAL DETAIL FOR SEPARATION REQUIREMENTS OF REDUNDANT SYSTEM (TRAINS OR CHANNELS) HORIZONTAL CONDUIT CROSSING HORIZONTAL CABLE TRAY

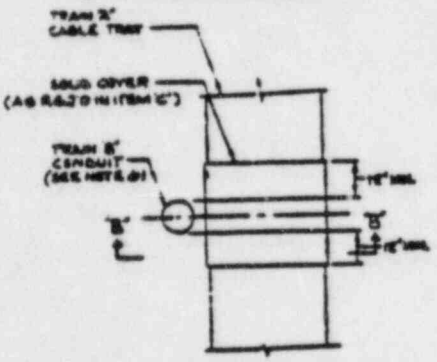


DETAIL 45

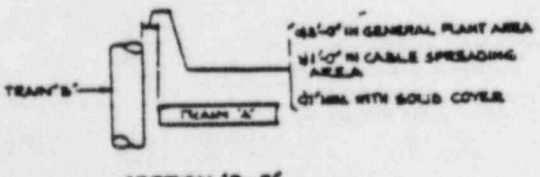
TYPICAL DETAIL FOR SEPARATION REQUIREMENTS OF REDUNDANT SYSTEM (TRAINS OR CHANNELS) NON-POWER CONDUITS AND CABLE TRAYS

Ef 9-7-85

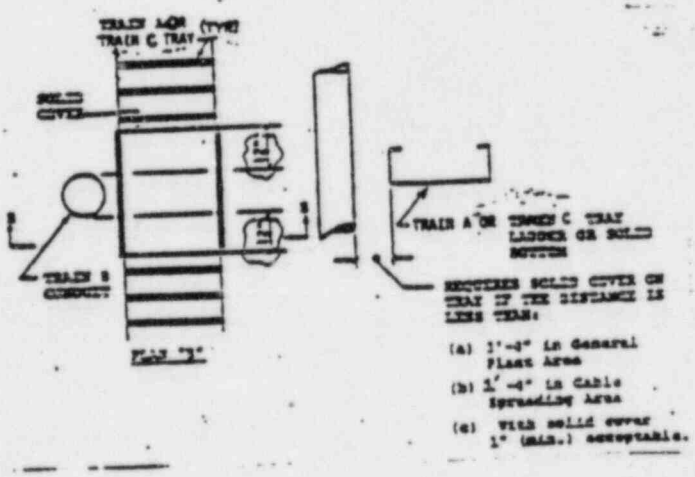
POWER CONDUIT CLEARANCE/SEPARATION REFER TO ATTRIBUTE 10 OF THIS QI. POWER CONDUIT TO TRAY SHALL BE 1 INCH PER THIS DETAIL



PLAN B

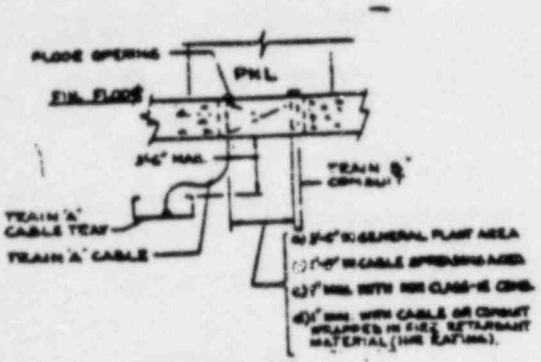


SECTION 'B-B'



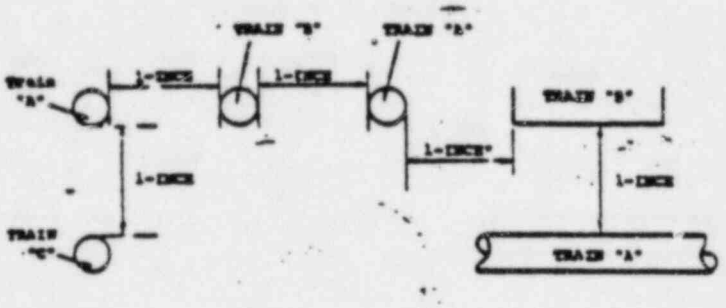
DETAIL 47

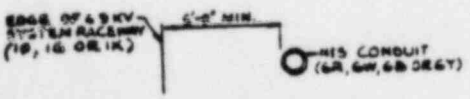
TYPICAL DETAIL FOR SEPARATION REQUIREMENTS OF REDUNDANT SYSTEM (TRAINS OR CHANNELS) VERTICAL CONDUIT CROSSING HORIZONTAL CABLE TRAY



DETAIL 57

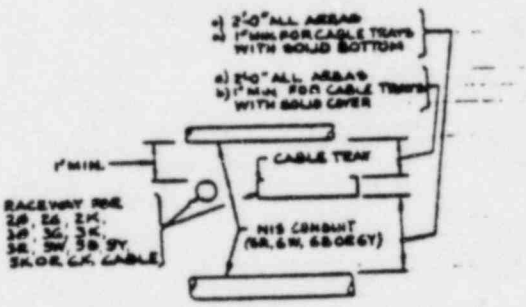
TYPICAL DETAIL FOR SEPARATION REQUIREMENTS OF REDUNDANT SYSTEM (TRAINS OR CHANNELS) CABLE RUNNING VERTICALLY PARALLEL WITH OTHER SYSTEM CONDUIT.





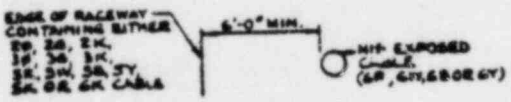
DETAIL 60A

TYPICAL DETAIL FOR SEPARATION REQUIREMENTS OF NIS CONDUIT AND 4.9 KV SYSTEM RACEWAY



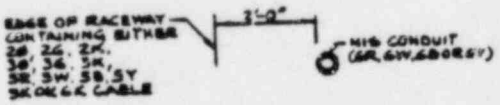
DETAIL 60C

TYPICAL DETAIL FOR SEPARATION REQUIREMENTS OF OTHER THAN 4.9KV SYSTEM RACEWAY AND NIS CONDUIT CROSSING EACH OTHER AT AN ANGLE GREATER THAN 15 DEGREES.



DETAIL 60B

TYPICAL DETAIL FOR SEPARATION REQUIREMENTS OF EXPOSED NIS CABLE (NEAR PENETRATIONS) AND OTHER THAN 4.9 KV SYSTEM RACEWAY

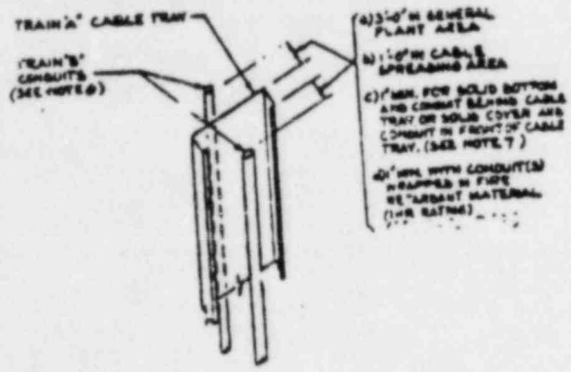


DETAIL 60D

TYPICAL DETAIL FOR SEPARATION REQUIREMENTS OF NIS CONDUIT RUNNING PARALLEL TO OTHER THAN 4.9 KV SYSTEM RACEWAY

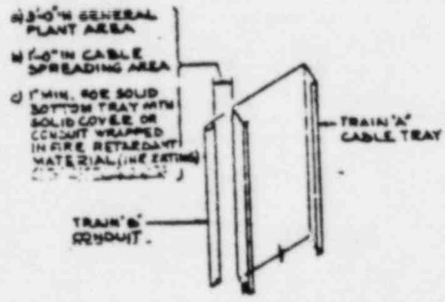
DETAIL 60

TYPICAL DETAILS FOR VERTICAL AND HORIZONTAL SEPARATION REQUIREMENTS OF NIS SYSTEM. INSTALLATION OF FIRE BARRIERS WILL NOT REDUCE THE MINIMUM SEPARATION REQUIREMENTS.



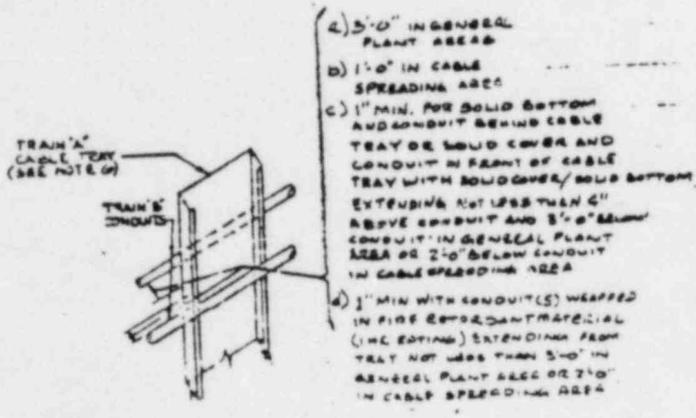
DETAIL 52

TYPICAL DETAIL FOR SEPARATION REQUIREMENTS OF REDUNDANT SYSTEM/TRAINS OR CHANNELS) VERTICAL CONDUITS ROUTED IN FRONT & REAR OF VERTICAL CABLE TRAY



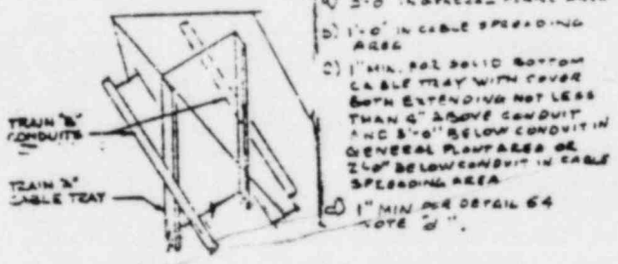
DETAIL 53

TYPICAL DETAIL FOR SEPARATION REQUIREMENTS OF REDUNDANT SYSTEM/TRAINS OR CHANNELS) VERTICAL CONDUIT RUNNING ALONGSIDE OF VERTICAL CABLE TRAY



DETAIL 54

TYPICAL DETAIL FOR SEPARATION REQUIREMENTS OF REDUNDANT SYSTEM/TRAINS OR CHANNELS) HORIZONTAL CONDUITS CROSSING IN FRONT & REAR OF VERTICAL CABLE TRAY



DETAIL 55

TYPICAL DETAIL FOR SEPARATION REQUIREMENTS OF REDUNDANT SYSTEM/TRAINS OR CHANNELS) HORIZONTAL CONDUITS CROSSING AT SIDES OF VERTICAL CABLE TRAY

COMANCHE PEAK RESPONSE TEAM
CHECKLIST

POPULATION DESC Conduit	VERIFICATION PKG NO. I-E-CDUT	PAGE 1 OF 2
QUALITY INSTRUCTION	[X] REINSPECTION	[ ] UNIT 1
EQUIPMENT MARK/TAG NO.	[ ] DOCUMENTATION REVIEW	[ ] UNIT 2 [ ] COMMON

ATTRIBUTE	VERIFICATION ACCEPT	VERIFICATION REJECT	VERIFICATION DATE	REMARKS
1) Size & Material a b				
2) Identification a b c				
3) Origin and Destination				
4) Fittings a b c d				
5) Expansion Fittings				
6) Bends				
7) Length and Pull Points				

SAMPLE

PREPARED BY:	APPROVED BY:
DISCIPLINE ENGR. DATE	LEAD DISCIPLINE ENGR. DATE
INSPECTED BY:	APPROVED BY:
INSPECTOR DATE	LEAD INSPECTOR DATE

CPP-007.1A, Revision 0

COMANCHE PEAK RESPONSE TEAM
CHECKLIST

POPULATION DESC: Conduit	VERIFICATION PKG NO.: I-E-CDUT			PAGE 2 OF 2
ATTRIBUTE	VERIFICATION			REMARKS
	ACCEPT	REJECT	DATE	
8) Flexible Conduit a				
b				
c				
d				
9) Cable Tray Interface a				
b				
10) Clearance a				
b				
11) Fire Stops and Seals a				
b				
c				
d				
12) Separation a1				
a2				
b1				
b2				
c1				
c2				
c3				
d1				
d2				
e1				
e2				

(CP-QP-15, Revision 0)

EVALUATION RESEARCH CORPORATION

COMANCHE PEAK RESPONSE TEAM

QUALITY INSTRUCTION FOR ISSUE SPECIFIC ACTION PLAN VII.c

INSTRUCTION NO.: QI-008

REVISION: 2

EFFECTIVE DATE: 09/10/85

REINSPECTION OF CONDUIT/I-E-CDUT

Prepared by: E. Farino Date: 9-9-85

Approved by: Albert A. Potter — Date: 9-9-85
Issue Coordinator

Approved by: C.W. Ross Date: 9-9-85
On Site QA Representative

Approved by: [signature] for Date: 9/9/85
QA/QC Review Team Leader

Reinspection of Conduit/I-E-CDUT

1.0 PURPOSE

To provide methods to be used and the accept/reject criteria to be applied when performing reinspection of conduit.

2.0 APPLICABILITY

This procedure applies to reinspection of samples selected from the conduit population. The population is described in the Population Description for Conduit.

3.0 REFERENCES

3.1 Description Memorandum QA/QC-RT-216 dated July 12, 1985 delineating documentation used in the development of this procedure including specific sources for attributes and exclusions.

3.2 CPP-009, Performance of Reinspection and Documentation Reviews

3.3 2323-E1(E2)-1700, Cable and Raceway Schedule

3.4 2323-E1(E2)-1800, Material List

3.5 2323-S-0910, Conduit Support Package

4.0 GENERAL

Reinspection reviews are performed and documented in accordance with established project procedures and instructions. This instruction establishes the attributes and accept/reject criteria for reinspections of conduit. Reference 3.2 addresses the method to perform reinspections, document and process the results.

5.0 PROCEDURE

5.1 Using the information in Reference 3.2 and below, perform the reinspections on the items in this population and document the results of the reinspection on the checklist (Attachment 6.9).

1. Size and Material

a. Verify that installed conduit size agrees with size as called for on the conduit layout drawings. Conduit of the next larger size in accordance with the following size range is not considered a deviation from the designed size: conduit size range (1/2, 3/4, 1, 1-1/2, 2, 3, 4, 5).

b. Verify that where rigid conduit is used it is rigid steel, zinc coated unless otherwise noted on drawings.

2. Identification

a. Verify that the exposed conduit, except lighting conduit, has permanent identification markings (alphanumeric code designation) and that the identification agrees with the cable and raceway schedule report. Report Section No. 70, 2323-E1-1700 and 2323-E2-1700 including outstanding DCA's. Markings may be any of the following:

- Freehand markings with black ink marker or paint
- Adhesive markers factory pre-printed (except reactor containment, and manholes)
- Metal or plastic tags

Metal tags used inside the Reactor Containment must be attached to the conduit with either wire, Tefzel ty-raps, or fastener required per drawing.

b. Verify, except for lighting conduit, that permanent identification markings have been applied at the following locations;

- At both ends of each run
- Entering or leaving a junction/pull box each side
- Entering or leaving a tray
- On each side of a floor or wall

NOTE: Conduit 10 feet in length or less need only be identified at a single point in the run. A single conduit entering and leaving a pull box is not required to be identified on either side of the box.

c. Verify that color code markings have been applied at intervals not to exceed 15 feet.

For conduit identification and color code explanations see Attachment 6.1.

NOTE: For cable tray identification explanation see Attachment 6.2.

3. Origin and Destination

Verify that the conduit origin and destination agree with the initial point and ending point designation per the Cable and Raceway Schedule Report No. 70 (conduit list), 2323-E1-1700, and 2323-E2-1700, including all approved outstanding design change authorization (DCAs).

4. Fittings

a. Verify that either an insulated bushing or sleeve insert has been installed on all conduit ends including conduit terminating at equipment/cabinets, junction/pull boxes, except for conduit connections to equipment with hubs.

b. Verify that conduit terminating at either a junction/pull box or cabinet is fastened with a locknut or bushing to the enclosure.

c. Verify that couplings are secure (i.e., couplings are not loose).

d. Conduit connections at outdoor enclosures containing terminations, shall be made with liquid tight hub fittings. Fitting type shall be as specified on the Material list. Gasketed locknuts are an acceptable substitute. Conduits entering the top of equipment subject to water spray from fire protection sprinkler activation should be sealed according to details provided on the drawings.

5. Expansion Fittings

Verify that either expansion fitting or flexible conduit has been used in long straight runs of conduit. Long straight runs (bends less than 15° are considered straight for this application only) of continuous conduit shall be provided with either an expansion fitting or flexible conduit at 75-foot intervals.

6. Bends

N.I.S. conduit raceway, function 6R, 6W, 6B and 6Y (for third and fourth character respectively in the conduit identification number) field bends shall comply with the following dimensions:

Size of Conduit	Minimum Bend Radius
3" diameter conduit -	15" min. bend radius
4" diameter conduit -	20" min. bend radius

7. Total Conduit Length and Bends Between Pull Points

N.I.S. conduit raceway functions 6R, 6W, 6B and 6Y are to be installed to the dimension provided on the drawings with a maximum tolerance of ±6 inches from the design dimension. The distance between junction boxes/pull points and the length of conduit between boxes/pull points shall be in accordance with the dimensions provided on the drawings.

Where design dimensions are not provided on drawings, verify the installation of N.I.S. conduit in accordance with the following requirements:

Pull boxes are to be located at intervals defined by A + B = 100, where "A" is the total number of degrees of conduit bends between pull points and "B" is the total number of running feet between pull points.

8. Flexible Conduit

a. Verify that conduit connections made to motors and free standing equipment is made with flexible conduit.

b. Verify length of flexible conduit in accordance with the following:

Motors and other freestanding equipment.

The minimum flexible conduit length is 18 inches for flexible conduit greater than 2 inches in diameter. For flexible conduit 2 inches in diameter or smaller, the minimum length is that which allows a minimum of 1 inch slack movement of the flexible conduit.

Flexible lengths shall be in accordance with the above, unless otherwise shown on the drawings.

c. Verify that flexible conduit has been used for continuous runs of conduit across shake spaces between adjacent buildings. Verify 1" movement (slack) has been provided. Shake space requirements are applicable for continuous runs of conduit between the safeguard building or fuel building and auxiliary building.

d. Verify that stainless steel flexible conduit is used in containment.

NOTE: Slack shall be defined as the actual length of flexible conduit between the couplings less the straight line distance between the couplings.

9. Conduit and Cable Tray Interface

a. Where conduit attaches to a cable tray verify that the connection is made with flexible conduit.

b. Where conduit interfaces with a cable tray verify that the conduit terminates at the tray in accordance with Attachment 6.3 detail 23.

10. Clearance

a. Verify that conduit, including SBM over the conduit, is not touching bare pipe.

b. Minimum clearance between conduits containing power cables (raceway function 1Ø, 2Ø, 1G, 2G, 1K, 2K and 5K) shall not be less than outside diameter of larger conduit except as defined below:

1. At such points where exposed conduits enter or exit any equipment or box to a point of 4'-0" from such equipment or box, but not less than 1-inch between different train conduit.

2. In general plant areas where conduits have a minimum clearance of 1/4 O.D. of the larger conduit, but not less than 1" between different train conduits, for conduit runs not exceeding 10 feet in length.

11. Fire Stops and Seals

Verify that sealing material has been installed for the following types of conduit installations.

a. Conduit connections to floor mounted equipment where the conduit connecting to the equipment passes through either a fire rated wall or floor.

b. Conduit connections to nonfloor mounted totally enclosed equipment, where the conduit connecting to the equipment passes through either a fire rated wall or floor and when the conduits length as measured from the penetration to the equipment is less than 10 feet.

NOTE: If subject sample is a conduit run between a junction box and a fire rated wall/floor penetration then the junction box shall be considered as a nonfloor mounted totally enclosed piece of equipment and the above rule shall apply.

c. Conduit penetrating either a fire rated wall or floor, without connecting to equipment.

d. Conduit stub-ups (stove pipes) out of equipment.

NOTE: DBD-SY1 FHA drawings show location of fire rated floors and walls.

12. Separation

NOTE: For the following all measurements shall be taken from either the conduit or SBM around the conduit.

a. For all conduits except N.I.S. conduit raceway function 6R, 6W, 6B, and 6Y, verify separation as follows:

1. Minimum separation between conduits having different trains and/or channels including Train A & B lighting conduit shall be one inch.

Attachment 6.4 lists the trains and channels and their associated raceway functions (third and fourth characters of conduit ID number).

2. A minimum separation of 2'-0" must be maintained between conduit raceway Systems (2Ø, 2G, 2K, 3Ø, 3G, 3K, 5R, 5W, 5B, 5Y, 5K, 6K,) and NIS conduit raceway functions (6R, 6W, 6B, 6Y) run in parallel except as noted.

b. Separation between N.I.S. conduit and other conduit to be as follows:

1. A minimum separation of 2'-0" must be maintained between "NIS" conduit systems Raceway functions (6R, 6W, 6B and 6Y) and different channel "NIS" Conduit run in parallel.

2. A minimum separation of 2'-0" must be maintained between "N.I.S." conduit raceway functions (6R, 6W, 6B, 6Y) and raceway systems (2Ø, 2G, 2K, 3Ø, 3G, 3K, 5R, 5W, 5B, 5Y, 5K, 6K) run in parallel.

NOTE: Minimum separation of non-parallel runs of "NIS" conduit and the above mentioned systems (i.e., crossing each other at an angle greater than 15 degrees) is 1-inch.

c. Verify separation between conduit (including lighting Train A or B conduit) and cable tray except N.I.S. system per the following:

1. Minimum vertical separation between a Train A, B, non N.I.S. channels I, II, III, & IV

conduit and the top of an open tray having different train or channel shall be 2'-0" in the cable spreading room and 3'-0" in general plant areas. The minimum separation is 1-inch where a solid cover is provided. See Attachment 6.5.

2. Minimum separation between a Train A, B, non N.I.S. channels I, II, III, & IV conduit and either the bottom or side of a cable tray having different train or channel shall be per Attachment 6.6.

3. Verify separation for all conduit except N.I.S. system conduit passing a vertical tray per Attachment 6.8.

d. Verify N.I.S. conduit to cable tray separation as follows:

1. A minimum separation of 6'-0" must be maintained between "NIS" conduit systems (Raceway functions 6R, 6W, 6B, 6Y) and 6.9Kv raceway functions (1Ø, 1G, 1K) including cable bus duct. See Attachment 6.7.

2. A minimum separation of 2'-0" must be maintained between "NIS" conduit (Raceway functions 6R, 6W, 6B & 6Y) and cable tray raceway systems (2Ø, 2G, 2K, 3Ø, 3G, 3K, 5R, 5W, 5B, 5Y, 5K, 6K) run in parallel. Minimum separation of non-parallel runs of "NIS" conduit and the above mentioned systems (i.e., crossing each other at an angle greater than 15 degrees) reduce such separation to 1" with the addition of tray covers. (Top only required for N.I.S. conduit passing over the top, and bottom only required for N.I.S. conduit passing on the bottom. Solid bottom tray constitutes a cover.)

e. Verify separation between conduit and exposed cable (i.e., cable not enclosed in a raceway) per the following:

1. Separation between train or channel conduit except N.I.S. system and other exposed train or channel cable shall be as follows:

- 3'-0" in general plant areas
- 1'-0" in cable spreading area

The 1 foot - 3 foot dimension may be reduced provided either conduit or cable has a

separation barrier material (SBM) blanket applied for a distance to provide required separation for the area. See Attachment 6.7, detail 57.

2. Separation between N.I.S. system conduit and exposed cable shall be as follows:

   a. A minimum separation of 6'-0" must be maintained between N.I.S. conduit and exposed power cables (raceway functions 1Ø, 1G, 1K).

   b. A minimum separation of 2'-0" must be maintained between N.I.S. conduit and exposed cable (raceway functions 2Ø, 2G, 2K, 3Ø, 3G, 3K, 5R, 5W, 5B, 5Y, 6K) run in parallel except as noted.

5.2 Document the results of the reinspection on the attributed checklist (Attachment 6.9).

6.0 ATTACHMENTS

6.1 Conduit Identification

6.2 Cable Tray Identification

6.3 Conduit/Cable Tray Interfaces

6.4 Trains and Channels and Associated Raceways

6.5 Separation Requirements

6.6 Separation Requirements

6.7 Separation Requirements

6.8 Separation Requirements

6.9 Checklist

TABLE 1 (Unit Number)

0 - Common to Both Units

1 - Unit 1

2 - Unit 2

TABLE 2 (Raceway Function)

1E, 1G, 1Z	-	6.9 KV A.C.
2E, 2G, 2Z	-	480 Vac, 120, 208 Vac - 125V-250V D.C. power
3E, 3G, 3Z	-	Control AC & DC & Small Power Feeders Under 480V
4E, 4G, 4Z	-	Low Level Signals
4R, 4W, 4B, 4Y	-	Reactor Protection Instrumentation Low Level Signals
5E, 5G, 5Z	-	480V AC & Heavy Power Feeders Under 480V (Local Control)
5R, 5W, 5B, 5Y	-	Reactor Protection Instrumentation 120V Signal
6E, 6G, 6Z	-	Control AC & DC & Small Power Feeders Under 480V (Local Control)
6R, 6W, 6B, 6Y	-	Nuclear Instrumentation System
7E, 7G, 7Z	-	Low Level Signals (Local Control)
8Z	-	Telephone & Communications

TABLE 3 (Safety Related Train)

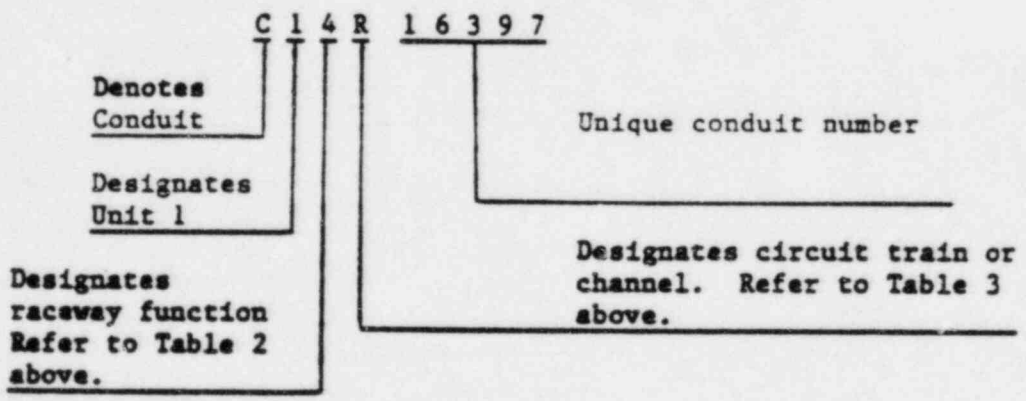
"A" Train - Orange - Ø -
Associated "A" Train - Orange with white stripes

"B" Train - Green - G -
Associated "B" Train - Green with white stripes

"C" Train - Black - K - (Non-Q)

Inst. Channel I	- Red	- R -
Inst. Channel II	- White	- W -
Inst. Channel III	- Blue	- B -
Inst. Channel IV	- Yellow	- Y -

A typical conduit identification number is depicted as follows:



TRAY NUMBER EXPLANATION

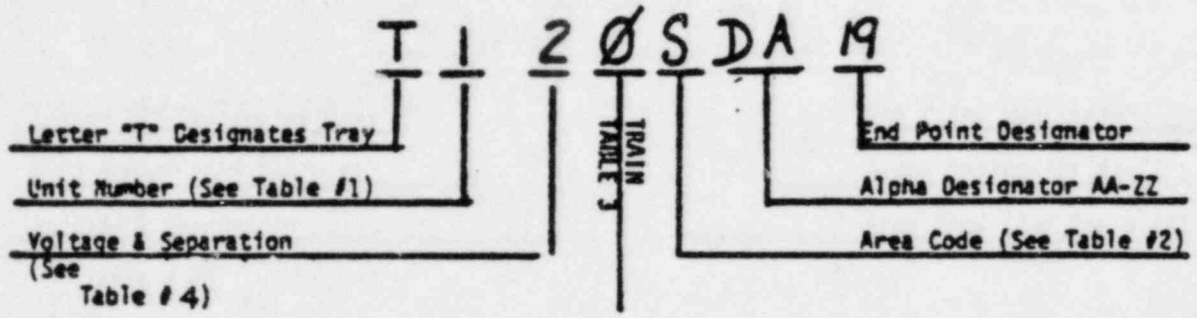


TABLE 1

0 - Common
1 - Unit 1
2 - Unit 2

TABLE 2

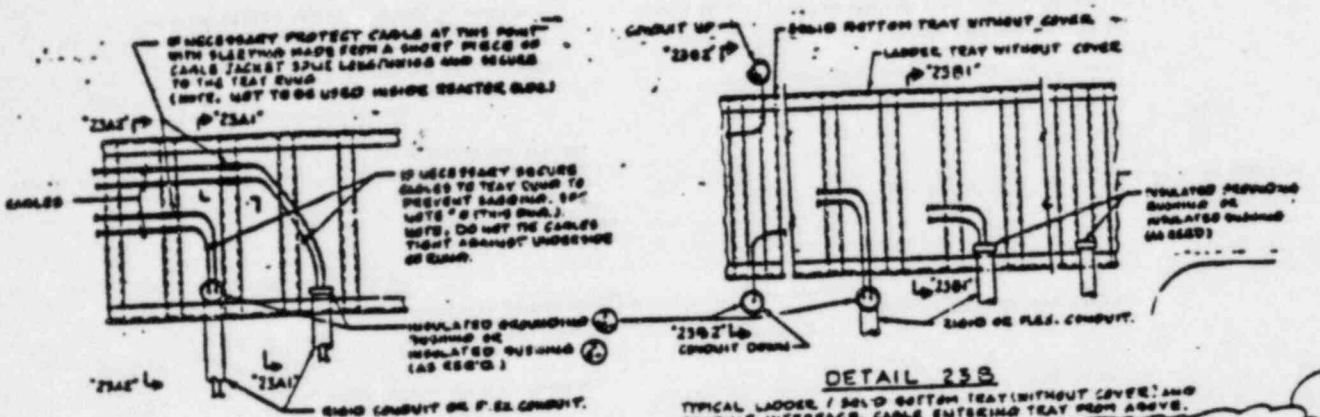
A - Auxiliary
C - Electrical & Control
D - Diesel
E - Electrical Equipment Area (in Safeguard)
F - Fuel
M - Miscellaneous Buildings
R - Reactor
S - Safeguard
T - Turbine & Switchgear

TABLE 3

Ø - Orange - A Train
G - Green - B Train
K - Black - C Train
R - Red - Channel I
W - White - Channel II
B - Blue - Channel III
Y - Yellow - Channel IV

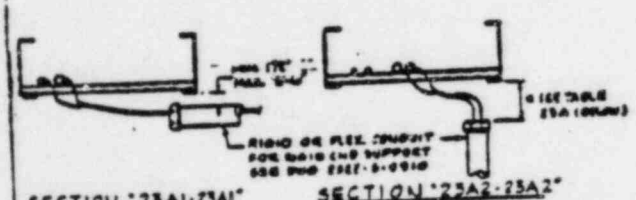
TABLE 4 (Raceway Function)

1Ø, 1G, 1K - 6.9 KV A.C.
2Ø, 2G, 2K - 480 Vac, 120, 208 Vac - 125V-250V D.C. power
3Ø, 3G, 3K - Control AC & DC & Small Power Feeders Under 480V
4Ø, 4G, 4K - Low Level Signals
4R, 4W, 4B, 4Y - Reactor Protection Instrumentation Low Level Signals
5Ø, 5G, 5K - 480V AC & Heavy Power Feeders Under 480V (Local Control)
5R, 5W, 5B, 5Y - Reactor Protection Instrumentation 120V Signal
6Ø, 6G, 6K - Control AC & DC & Small Power Feeders Under 480V (Local Control)
6R, 6W, 6B, 6Y - Nuclear Instrumentation System
7Ø, 7G, 7K - Low Level Signals (Local Control)
8K - Telephone & Communications



DETAIL 23A

TYPICAL LADDER TYPE TRAY & CONDUIT INTERFACE. CABLE ENTERING TRAY FROM BELOW.



SECTION "23A1-23A1"

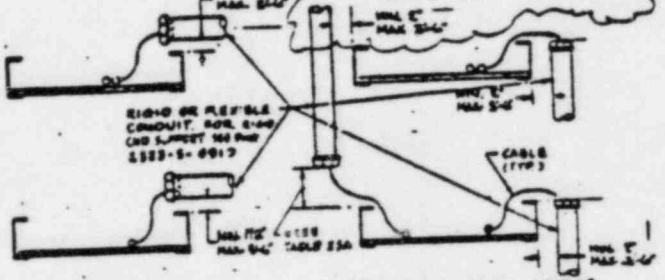
SECTION "23A2-23A2"

DETAIL 23B

TYPICAL LADDER / SOLID BOTTOM TRAY (WITHOUT COVER) AND CONDUIT INTERFACE. CABLE ENTERING TRAY FROM ABOVE.

EF 9-7-85

-APPLIES TO NEXT ATTACHED TRAY ONLY



SECTION "23B1-23B1"

SECTION "23B2-23B2"

TABLE 23A

RACEWAY FUNCTION	TRAY WIDTH	TRAY DEPTH	NOTE
1E & 2E	12"	5'-6"	THE MINIMUM DIMENSIONS GIVEN CAN BE REDUCED TO 6" MINIMUM PROVIDED THAT THE MINIMUM CABLE BENDING RADIUS IS NOT VIOLATED AND THAT THE REQUIREMENT OF GENERAL NOTE "E" ARE FOLLOWED.
1B & 2B	10"	5'-6"	
1A & 2A	6"	5'-6"	

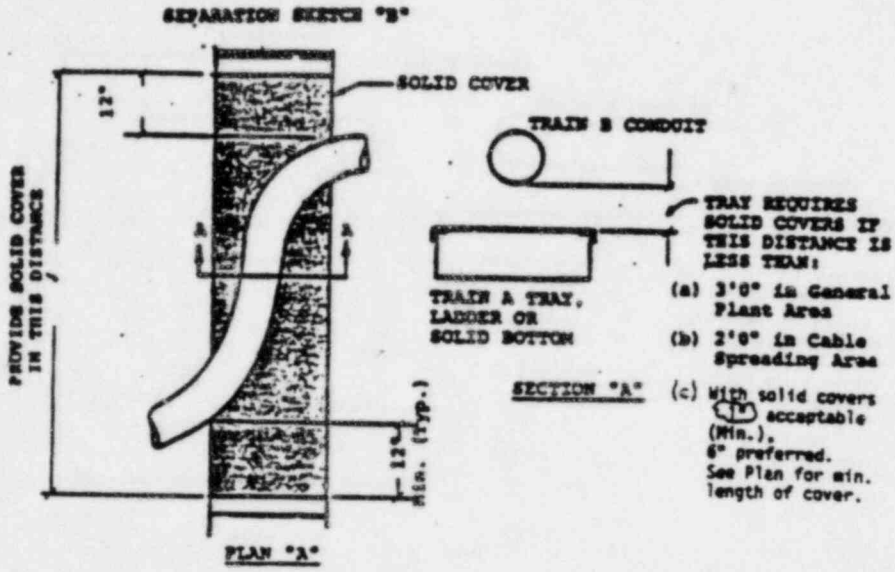
DETAIL 23

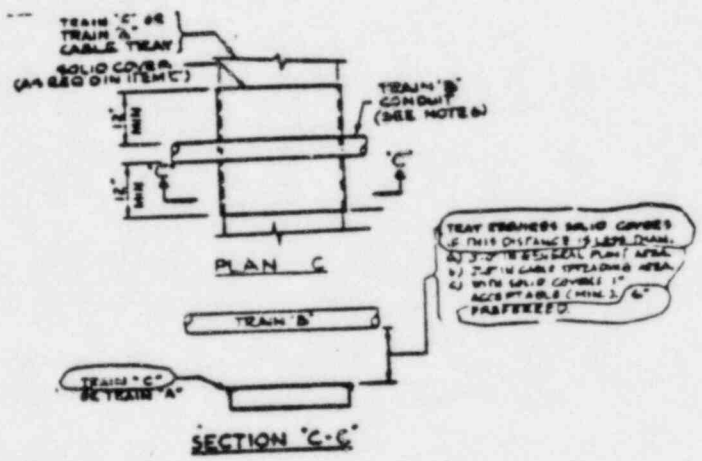
TYPICAL CABLE TRAY & CONDUIT INTERFACE DETAIL FOR CATEGORY I BLDGS ONLY (SEE NOTE 6)

USE PERMANENT CABLE TRAINING RADIUS PER QI-014

EF 9-7-85

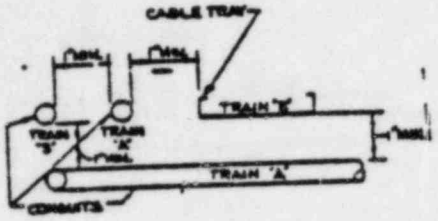
Class	DWG Symbol	Train or Channel	Raceway Function
1E" 1E Associated"		Train "A"	1Ø, 2Ø, 3Ø, 4Ø
1E" 1E Associated"		Train "B"	1G, 2G, 3G, 4G
Non "1E"	NONE	Train "C"	1K, 2K, 3K, 4K, 5K, 6K
1E"		Channel I	4R, 5R
1E"		Channel II	4W, 5W
1E"		Channel III	4B, 5B
1E"		Channel IV	4Y, 5Y





DETAIL 48

TYPICAL DETAIL FOR SEPARATION REQUIREMENTS OF REDUNDANT SYSTEM (TRAINS OR CHANNELS) HORIZONTAL CONDUIT CROSSING HORIZONTAL CABLE TRAY

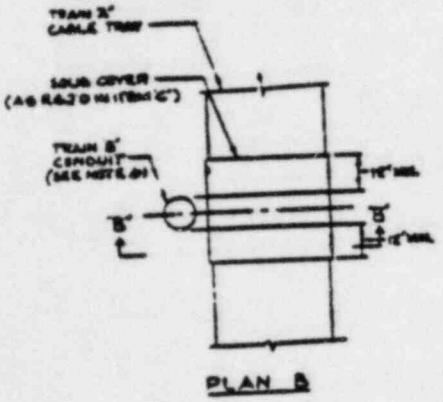


DETAIL 45

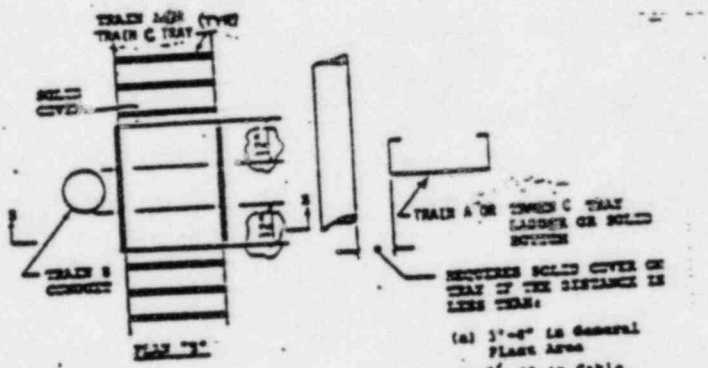
TYPICAL DETAIL FOR SEPARATION REQUIREMENTS OF REDUNDANT SYSTEM (TRAINS OR CHANNELS) NON-POWER CONDUITS AND CABLE TRAY

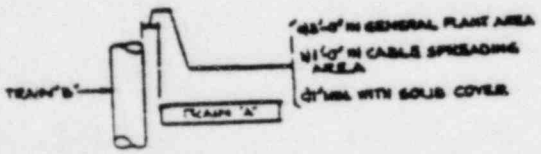
EF 9-7-85

POWER CONDUIT CLEARANCE/SEPARATION REFER TO ATTRIBUTE 19 OF THIS QI. POWER CONDUIT TO TRAY SHALL BE 1 INCH PER THIS DETAIL



PLAN B

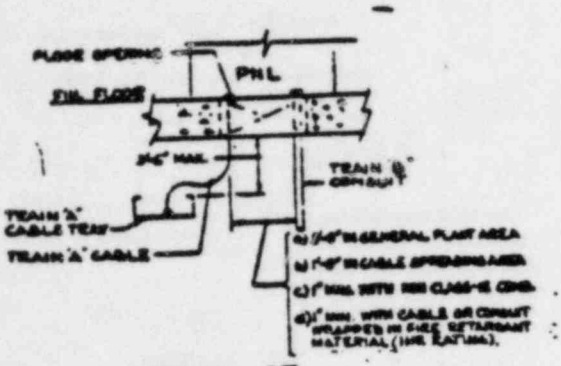




SECTION 'B-B'

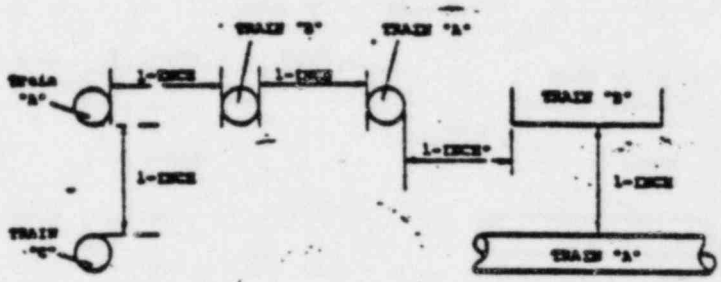
DETAIL 47

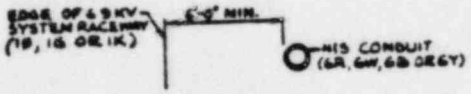
TYPICAL DETAIL FOR SEPARATION REQUIREMENTS OF REDUNDANT SYSTEM (TRAINS OR CHANNELS) VERTICAL CONDUIT CROSSING HORIZONTAL CABLE TRAY



DETAIL 57

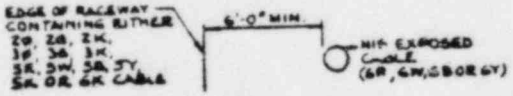
TYPICAL DETAIL FOR SEPARATION REQUIREMENTS OF REDUNDANT SYSTEM (TRAINS OR CHANNELS) CABLE RUNNING VERTICALLY PARALLEL WITH OTHER SYSTEM CONDUIT.





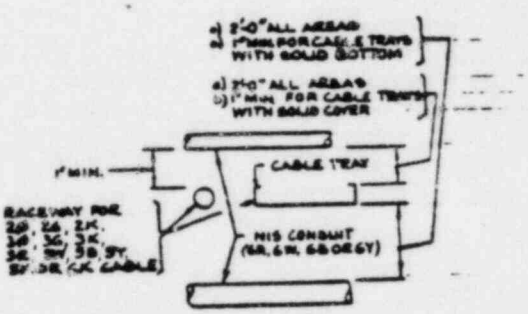
DETAIL 60A

TYPICAL DETAIL FOR SEPARATION REQUIREMENTS OF NIS CONDUIT AND 4.9 KV SYSTEM RACEWAY



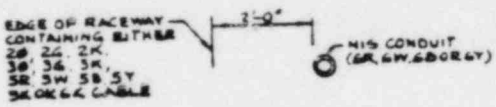
DETAIL 60B

TYPICAL DETAIL FOR SEPARATION REQUIREMENTS OF EXPOSED NIS CABLE (NEAR PENETRATIONS) AND OTHER THAN 4.9 KV SYSTEM RACEWAY



DETAIL 60C

TYPICAL DETAIL FOR SEPARATION REQUIREMENTS OF OTHER THAN 4.9KV SYSTEM RACEWAY AND NIS CONDUIT CROSSING EACH OTHER AT AN ANGLE GREATER THAN 15 DEGREES.

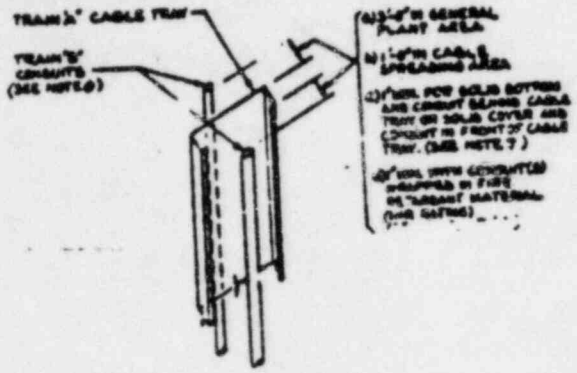


DETAIL 60D

TYPICAL DETAIL FOR SEPARATION REQUIREMENTS OF NIS CONDUIT RUNNING PARALLEL TO OTHER THAN 4.9 KV SYSTEM RACEWAY

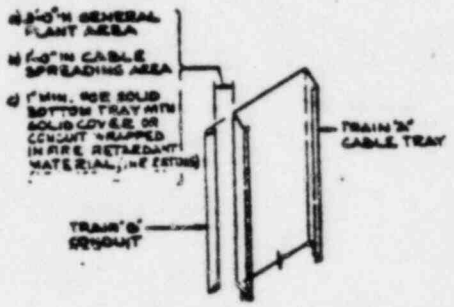
DETAIL 60

TYPICAL DETAILS ON VERTICAL AND HORIZONTAL SEPARATION REQUIREMENTS OF NIS SYSTEM. INSTALLATION OF FIRE BARRIERS WILL NOT REDUCE THE MINIMUM SEPARATION REQUIREMENTS.



DETAIL 52

TYPICAL DETAIL FOR SEPARATION REQUIREMENTS OF REDUNDANT SYSTEM/TRAINS OR CHANNELS) VERTICAL CONDUITS ROUTED IN FRONT & REAR OF VERTICAL CABLE TRAY

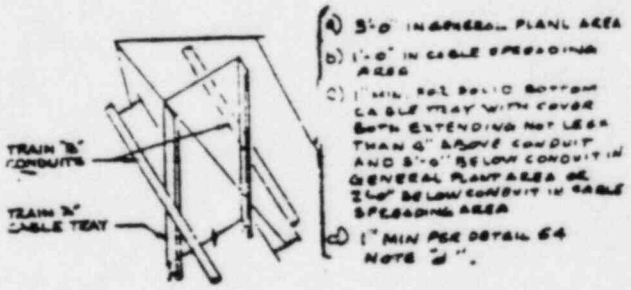


DETAIL 53

TYPICAL DETAIL FOR SEPARATION REQUIREMENTS OF REDUNDANT SYSTEM/TRAINS OR CHANNELS) VERTICAL CONDUIT RUNNING ALONGSIDE OF VERTICAL CABLE TRAY

DETAIL 54

TYPICAL DETAIL FOR SEPARATION REQUIREMENTS OF REDUNDANT SYSTEM/TRAINS OR CHANNELS) HORIZONTAL CONDUITS CROSSING IN FRONT & REAR OF VERTICAL CABLE TRAY



DETAIL 55

TYPICAL DETAIL FOR SEPARATION REQUIREMENTS OF REDUNDANT SYSTEM/TRAINS OR CHANNELS) HORIZONTAL CONDUITS CROSSING AT SIDES OF VERTICAL CABLE TRAY

COMANCHE PEAK RESPONSE TEAM
CHECKLIST

POPULATION DESC Conduit	VERIFICATION PKG NO. I-E-CDUT	PAGE 1 OF 2
QUALITY INSTRUCTION EQUIPMENT MARK/TAG NO.	[X] REINSPECTION [ ] DOCUMENTATION REVIEW	[ ] UNIT 1 [ ] UNIT 2 [ ] COMMON

ATTRIBUTE	VERIFICATION			REMARKS
	ACCEPT	REJECT	DATE	
1) Size & Material a b				
2) Identification a b c				
3) Origin and Destination				
4) Fittings a b c d				
5) Expansion Fittings				
6) Bends				
7) Length and Pull Points				

SAMPLE

PREPARED BY:	APPROVED BY:
DISCIPLINE ENGR. DATE	LEAD DISCIPLINE ENGR. DATE
INSPECTED BY:	APPROVED BY:
INSPECTOR DATE	LEAD INSPECTION DATE

COMANCHE PEAK RESPONSE TEAM
CHECKLIST

POPULATION DESC: Conduit	VERIFICATION PKG NO.: I-E-CDUT			PAGE 2 OF 2
ATTRIBUTE	VERIFICATION: ACCEPT	REJECT	DATE	REMARKS
8) Flexible Conduit a				
b				
c				
d				
9) Cable Tray Interface a				
b				
10) Clearance a				
b				
11) Fire Seals and Seals a				
b				
c				
d				
12) Separation a1				
a2				
b1				
b2				
c1				
c2				
c3				
d1				
d2				
e1				
e2				

(20-40) 12, Revision 0