

TEXAS UTILITIES GENERATING CO.

- CPSES -



TUGCO INSTRUCTION
QI-QP-11.10-1A Rev. 1
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INSPECTION OF CLASS 1E CONDUIT RACEWAY SYSTEMS

PREPARED BY:

William C. Lott

9/17/84
Date

APPROVED BY:

Carl E. Byrd

9-17-84
Date

APPROVED BY:

Michael D. Warner

9-20-84
Date

FOR INFORMATION ONLY

1.0 REFERENCES

- 1-A CP-QP-11.10, "Inspection of Electrical Raceway Support Systems"
- 1-B 2323-S2-910, "Gibbs and Hill Drawings"
- 1-C CP-CPM-7.1, "Package Flow Control"
- 1-D 2323-ES-100, "Electrical Erection"
- 1-E CP-CPM-6.3, "Preparation, Approval and Control of Operational Travelers"
- 1-F QI-QP-11.3-21, "Embedded Conduit and Sleeves"
- 1-G CP-ECP-19, "Exposed Conduit"
- 1-H QI-QP-11.4-22, "QC Verification of Protective Coatings Unique Identification Number Transfer"
- 1-I QI-QP-11.14-4, "Control of Matl. Traceability for Site Fab. Struct./Misc. Steel"
- 1-J QI-QP-11.21-1, "Visual Weld Inspection"
- 1-K QI-QP-11.2-1, "Installation of "Hilti" Drilled in Bolts"
- 1-L CCP-45 "Permanent and Temporary Attachments to Embedded Weld Plates"

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- 1-M QI-QP-11.0-15, "Verification of Base Plates for Grouting"
- 1-N 2323-E1-1800, "Material List"
- 1-O 2323-S2-0910, "Sheet G-2A and Sheet CSD-7A"
- 1-P QI-QP-11.3-28, "Class 1E Cable Terminations"
- 1-Q 2323-E1-1702-02, "Cable and Raceway Separation Details"
- 1-R 2323-E1/E2-1710, "Junction Box Schedule"
- 1-S CP-QP-18.0, "Inspection Report"
- 1-T CP-QP-16.0, "Nonconformances"
- 2.0 GENERAL
- 2.1 PURPOSE AND SCOPE

This Instruction supplements Reference 1-A and provides the inspection criteria and the documentation requirements for performing inspections on Class 1-E Conduit Raceway and seismic supports for Class 1E and Train "C" Conduit Raceway Systems fabricated for and installed in Unit 2 Category 1 buildings (excluding electrical control building) and areas as required by Reference 1-B.

2.2 GENERAL INSTRUCTIONS

The Unit 2 Interim Vault will issue work packages for each conduit run in accordance with Reference 1-C.

The work package shall include but not be limited to, a isometric drawing of the conduit run, Operation Travelers for the fabrication and installation of conduit supports and Conduit Raceway Inspection Reports.

The support(s) location, spacing, type, and attachment as shown on the isometric drawing have been designed by Engineering in accordance with Reference 1-B and 1-D. The isometric drawings present an isometric depiction of the conduit routing and includes applicable notes and references. Other drawings such as typical detail drawings, plan drawings, material lists, schedules, etc., have been provided by Engineering to be used as applicable.



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The inspection of conduit raceway shall be documented on Inspection Reports, Attachment 1, 2, 3, and 4.

The conduit run and supports shown on the isometric drawing will be inspected according to the operations listed on the Operations Traveler and the acceptance criteria specified in this Instruction. Operations Travelers shall be processed and completed in accordance with Reference 1-E.

Individual engineered supports ("IN") which have weld numbers assigned by engineering shall have specifically prepared operations travelers and/or inspection reports prepared by the Quality Engineer for inspection documentation.

Individual engineered supports ("IN") which do not have weld numbers assigned by engineering will utilize same operations traveler format as for any other type of conduit/junction box support.

Embedded conduit and electrical "stub ups" less than 24 inches in length do not require supports and isometric drawings will not be issued for these installations. Embedded conduit and "stub ups" will be inspected in accordance with Reference 1-F.

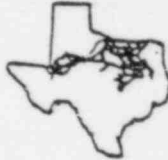
QC verification of support load and capacity, and span per LS Section of Reference 1-B are not within the scope of this instruction.

Lighting supports and lighting conduit inspection criteria will be addressed in future revisions to this instruction.

2.3

SPECIAL INSTRUCTION

- a. Quality Control Personnel who are certified in QI-QP-11.3-23 may perform the inspections required by paragraphs 3.1, 3.7, 3.8, 3.9 and 3.10 of this instruction.
- b. Quality Control Personnel who are certified in QI-QP-11.10-1 may perform inspections required by paragraphs 3.2, 3.3, 3.4, 3.5 and 3.6 of this instruction.
- c. All other paragraphs except paragraph 3.11, are applicable to both a and b above.
- d. Quality Control Personnel certified to this instruction may perform inspections required by all paragraphs of this instruction.



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3.0 INSTRUCTION

3.1 CONDUIT FABRICATION SURVEILLANCE

Fabrication inspection (i.e., selection of material, threading and bending) of Class 1E conduit, including lighting shall be performed on a random surveillance basis. The frequency of inspection shall be once per working shift when conduit fabrication activities are in progress or at the direction of the QC Supervisor. Inspections will be documented on Attachment 1.

Inspections shall include the following:

- a. Conduit shall be free of burrs, sharp edges, and foreign material which could cause cable damage during pulling and shall show no evidence of thread damage (i.e., flattening) which could cause irregularity in conduit shape.
- b. To the extent possible, the QC Inspector shall examine conduit for internal and external "flaking" of the galvanize coating. If cracking of the galvanize surface is evident on the exterior of bends, flaking has probably occurred on the interior. The QC Inspector shall affix a hold tag to all conduit exhibiting "flaking" or thread damage and cause their removal to an isolated area to prevent their use and possible vendor replacement.
- c. Threads shall be standard U.S. conduit tapered threads (NPT) and shall not be irregular, jammed or undercut.
- d. Dies being used shall be standard U.S. conduit tapered threads (NPT).
- e. Cut threads shall be cleaned to bright metal and painted with Galvanox or similar approved product.
- f. Conduit bends shall not show kinking or excessive flattening or interruption of the smooth bore of the conduit.

NOTE: Excessive flattening is defined as reduction of the outside diameter of the conduit by 25% or more.

- g. Bends and off-sets will be made with benders.



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3.2 SUPPORT FABRICATION

3.2.1 Transfer of "QP" Number and Material Traceability

3.2.1.1 Transfer of "QP" number for coated bulk steel intended for use in the Reactor Building will be in accordance with Reference 1-H.

3.2.1.2 Material traceability for conduit supports, electrical equipment supports and components associated with these supports will be in accordance with Reference 1-I.

3.2.2 Welding Inspection

All welding and stud welding inspections shall be performed in accordance with Reference 1-J.

The weld joint design shall be limited to those shown on the sketches appearing on qualified WPS's and/or applicable design document.

3.2.3 Identification of Conduit Supports

Each support inspected on a raceway system shall be assigned a number by Engineering as outlined in Reference 1-G and shown on the isometric drawing included in the conduit system work packages.

Supports with more than one conduit attached shall be assigned only one unique number with the exception of individually engineered ("IN") supports which allow attachment of conduit(s) other than those shown on the "IN" drawing. The additionally attached conduits will be assigned unique numbers and these numbers documented on the Operations Traveler for each supported conduit.

Supports shall be stamped/stenciled with the support number, with the exception of unistrut hangers. Strut channel hangers shall be marked with an approved industrial marker in a manner that will not damage the supports. In cases where not enough room is available to stencil the number, (e.g., CSM-2A type hangers) the number shall be marked on the conduit strap.

NOTE: Pull box supports will be identified in the same manner as conduit supports.



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3.2.4 Identification of Junction Box Supports

Junction box supports shall utilize the unique number of the junction box, i.e., if the junction box is identified JB2C-139G, the support number will be the same.

3.3 SUPPORT INSPECTIONS

Package flow control group or craft personnel shall notify Quality Control when the support or Raceway is ready for inspection and supply the required Operational Traveler and support package. The Inspector will perform inspections per the provisions of this instruction and the operation traveler. Following completion of required inspections, the Inspector will return the traveler to the package flow control group or craft.

NOTE: The QC Inspector will record all design change documentation (DCA's, CMC's, etc.) and the revision thereof used for inspection on the traveler for each applicable inspection operation completed.

Discrepancies found during inspection will be documented in accordance with Paragraph 3.13 of this instruction.

3.3.1 Support Assembly Inspection

The QC Inspector shall verify the acceptability of the following in accordance with Reference 1-B, isometric drawing, and applicable procedures and instructions.

NOTE: General notes of Reference 1-B do not apply to design change documents (DCA's or CMC's) for specific hangers unless otherwise noted on the document.

The QC Inspector shall inspect the support for the following:

- a. Member(s) shape (i.e., angle, channel, etc), size and dimensions
- b. Conduit clamp gap ("t") tolerance
- c. Configuration per Engineering drawing and related DCA and/or CMC, including bolt hole sizes
- d. Unique identification number per paragraph 3.2.3 and 3.2.4 of this instruction



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- e. Shim plate provides full bearing to conduit prior to torque.
- f. Welds per Reference 1-J.

3.3.2 Tolerances

Hangers for electrical raceway systems shall be installed within the following tolerances. The cumulative effect of rolling (mill), fabrication and erection tolerances shall not exceed those given below:

A hanger shall be considered plumb if the angle between the longitudinal axis of the main member(s) of the hanger is at right (90°) angle to the supporting surface (ceiling or floor). A tolerance of $\pm 2^\circ$ (unless noted otherwise) shall be acceptable provided the integrity of the supported raceway system and its attachments to the hanger remains intact.

Hangers supported on vertical surfaces (wall, column, side of a beam, etc.), shall be considered level with maximum tolerance of 1/2" in 10 feet.

3.3.3 Support Attachment

The QC Inspector shall inspect the attachment of the support for the following:

- a. Hilti bolt embedment and spacing
- b. Bearing surface per paragraph 3.5 of this instruction
- c. Attachment welds to embedded steel per paragraph 3.3.5.2 of this instruction
- d. Attachment welds to the containment liner per Paragraph 3.2.2 of this instruction.

NOTE: Additionally any NDE for attachment welds to liner shall be completed per Operations Traveler provided by Civil Engineering. A copy of this Traveler shall be included in the support package.

- e. Location per isometric drawing.

3.3.4 Bolting Inspection

3.3.4.1 General Bolting Requirements

For each support the QC Inspector shall:



- a. Verify all bolted connections have been made with approved hardware and are completed and secure. In addition, bolt tensioning requirements for bolted connections as specified by Reference 1-B shall be verified. (See Attachment 5 for bolt tensioning requirements and Attachment 6 for bolt types and marking).

All strut channel and/or bolted Structural Supports that have been installed per Reference 1-B require bolt tensioning. Electrical Raceway strut channel supports fabricated and assembled shall be inspected to verify that the bolt tensioning has been satisfactorily accomplished. One bolt/nut combination per support shall be inspected for tension acceptability. Additionally, if the support secures one (or more) vertical run of conduit, at least one bolt on one vertical conduit clamp shall be inspected to verify that proper tension has been reached. If this is not the case, all the remaining vertical clamp bolts will be inspected to assure satisfactory tension. Orange torque seal shall be applied to those bolts that are inspected.

- b. The QC Inspector shall verify in accordance with Reference 1-K. Hilti bolt embedment, spacing, torque acceptance, and Richmond Insert thread engagement ($2d + 1/8"$) and snug tight verification. Hilti and Richmond Inspections shall be documented on the Inspection Report provided in Reference 1-K.

3.3.4.2 Structural Bolting

The QC Inspector, when inspecting bolted connections, shall visually inspect for the following:

- a. Bolts are the correct length as indicated by having the bolts flush with, or outside of, the face of the nut when completely installed.
- b. Turning elements are on the correct face.
- c. Washers are used when required.

NOTE: For long slotted holes, structural plate washers or a continuous bar not less than 5/16" thick are required to cover long slots that are in the outer plies of joints.

- d. Bolt heads and nuts shall rest squarely against the metal or washer.



- e. Where bolts are used on surfaces having slopes greater than 1-in-20 with a plane normal to the bolt axis, beveled washers shall be provided to give full bearing to the head or nut.
- f. When "Turn-of-nut" method is used for bolt tightening, the impact wrench or other pneumatic device does not require calibration. However, the device shall be of adequate capacity and sufficiently supplied with air to perform the required tightening of each bolt in approximately ten seconds. When this method is used, the following steps will be followed by construction:
 - 1. All bolts in each joint shall first be brought to a "snug tight" condition (snug tight is defined as the tightness attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench or standard wrench).
 - 2. All the nuts shall then be match-marked using an approved industrial marker, i.e.: Nissen; which has certified contents.
 - 3. All the bolts in the joint shall then be tightened by the applicable amount of nut rotation specified in Attachment 5.
 - 4. Tightening shall progress systematically from the most rigid part of the joint to its freest edges.
 - 5. There shall be no rotation during tightening of the part not turned by the wrench.
 - 6. The end of all bolts shall be marked with the industrial marker when required nut rotation has been attained.
- g. When several bolts are installed in a single joint, the QC Inspector shall assure bolts previously tightened which may have been loosened by the tightening of subsequent bolts are tightened to the prescribed amount.
- h. When field connections are to be made by use of A325 or A490 bolts and tightened with a calibrated torque wrench, a hardened flat washer shall be used under the turned element and shall be tightened as follows:



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<u>Bolt Size (Inches)</u>	<u>ASTM A325 Torque (Ft. Lbs.)</u>	<u>ASTM A490 Torque (Ft. Lbs.)</u>
1/2	093	
5/8	228	
3/4	387	500
7/8	518	650
1	725	1320
1 1/4	"	2620
1 1/2	-	4565

- i. A490 and Galvanized A325 bolts shall not be reused. Other A325 bolts may be reused if approved by Engineering.

Retightening previously tightened bolts which may have been loosened by the tightening of adjacent bolts shall not be considered as a reuse.

- j. ASTM A449 bolts may be substituted for A325 bolts.
- k. ASTM A307 bolts shall be tightened to a "snug tight" condition.
- l. The QC Inspector shall apply torque seal to all satisfactory tightened nuts/bolts.

3.3.5 Welding Inspection

- 3.3.5.1 All welding and stud welding inspections shall be performed in accordance with Reference 1-J.

The weld joint design shall be limited to those shown on the sketches appearing on qualified WPS/s and/or applicable design document.

3.3.5.2 Welded Attachments to Embedded Strips/Plates

Welded attachments to embedded strip plates and large plates per Reference 1-L will be installed per the following and to the requirements of Reference 1-B.



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3.3.5.2.1 Definitions

- a. "Strip Plates" are those plates $\frac{3}{4}$ " thick, either 8" or 10" wide and of various lengths which are anchored to concrete surfaces by embedded Nelson Studs.
- b. "Large Plates" are those plates $\frac{3}{4}$ " x 4'0" x 8'0" or $\frac{3}{4}$ " x 8'0" x 12'0" which are anchored to concrete surfaces by embedded Nelson Studs. This includes plates of either of these nominal sizes which were modified to include cut-outs or irregular outside shapes to conform to building configurations.

3.3.5.2.2 Permanent Attachment Location

Permanent attachments shall be located in conformance with design documents, but where the special situations described in the following paragraphs are encountered, the locations shall be subject to the provisions stated in this section.

Attachments to "large" plates in the cantilever region as defined on Figure 1 of Attachment 8 shall not be made except in those cases where:

- a. The design document specifically states that investigation of the load being applied to the cantilever region has been accomplished by the designer, or,
- b. The design document provides for an additional member or members which serve to span the cantilever region, and are not attached to the plate within the cantilever region.

When an attachment is made to a strip plate at a location not specifically shown on approved, controlled drawings, and the attachment would be located more than $\frac{3}{4}$ " from the center line of the plate, the location shall be approved by the on-site "CPPE" (Comanche Peak Project Engineering Department) prior to doing the work (See Figure 2 on Attachment 8). Attachments to "strip" plates in the cantilever region as defined on Figure 2 of Attachment 8 shall not be made except in those cases where:

- c. The design document specifically shows that investigation of the load being applied to the cantilever region has been accomplished and that additional stiffeners are provided in the design to transfer the loads to the end set of studs, or,
- d. The design document provides for an additional member or members which serve to span the cantilever region.



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Welds for a hanger, and auxiliary steel where used for that hanger, shall be separated in minimum of 12" from an adjacent hanger and its auxiliary steel (see Figure 3 on Attachment 8), unless otherwise approved by the CPPE. Attachments to embedded weld plates which interface with installed expansion anchors shall provide the required clearances indicated in Reference 1-K, unless otherwise shown on an engineering drawing.

Strip plates which have separation violations with concrete expansion anchors may be rendered unuseable by CPPE Civil Department after an engineering evaluation has been made. Plate sections that are rendered unuseable will be so stated on a DCA. This area of the plate will then be painted red in accordance with the appropriate architectural specification. No attachments shall be made to any portion of a strip plate which has been rendered unuseable and no portion of a strip plate shall be rendered unuseable if it has an attachment already made to it.

3.4 SUPPORTS IDENTIFIED WITH "E" NUMBERS

Supports, or components identified with a unique "E" number 0001 thru 9000, need not be reinspected for welding. This support inspection shall be documented by the QC Inspector by writing opposite the support number listed on the Raceway System Operational Traveler the representative Inspection Report number or Traveler number for weld inspection. If no Inspection Report or Traveler exists, the welds shall be reinspected to requirements in Paragraph 3.3.5.

Supports numbered greater than E9000 shall require acceptance based on a satisfactory Inspection Report or Traveler.

3.5 INSPECTION OF BASEPLATES FOR GROUTING

Inspection of baseplates for grouting shall be performed in accordance with Reference 1-M.

3.6 DESIGN CHANGE VERIFICATION

Conduit supports, or miscellaneous welded electrical components modified as a result of Design Change Documents (DCA/CMC) and included in the package for inspection not yet performed shall be inspected to verify incorporation of changes reflected on the Design Change Document. Verification and inspections will be accomplished utilizing applicable section of this instruction.



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3.7 CONDUIT INSTALLATION INSPECTIONS

3.7.1 Conduit Size and Fittings

The QC Inspector's inspection of conduit size and fittings shall include the following:

- a. The conduit size and fittings shall be as shown on the latest approved Engineering drawing.
- b. Conduit of the next larger size (1/2", 3/4", 1", 1-1/2", 2, 3", 4", and 5") than shown on the electrical drawing may be substituted.
- c. Where necessary, conduit fittings or pull boxes compatible with cable bending radius requirements may be used to minimize use of condulets.

NOTE: Crouse-Hinds condulets Series Form 7, Form 8 and Mark 9 are not acceptable and shall not be used.

- d. The use of condulets is not permitted in 6.9 KV conduit-systems. Where required, sheet metal boxes or O.Z. Gedney type PBW pull box fittings shall be used to provide pull points. The minimum length of opening for cable pulling shall be as follows:

<u>Conduit Size</u>	<u>Pull Box Opening Length</u>
5"	60"
4"	60"
3"	48"

- e. Metallic conduits shall be made electrically continuous for the entire run by securely connecting conduits to boxes and enclosures by use of double locknuts. All terminal ends of conduits shall be provided with bushings-insulating type.
- f. Where required by engineering drawings, watertight enclosures will be used. The conduit connections shall be made with liquid tight hub fittings. The hub fitting shall include a recessed neoprene "O" ring and a nylon insulated throat and shall be as specified on the Material List. Gasketed locknuts may be used where space limits the use of hub fittings.



- g. Conduit shall be made up into full threaded fittings with a minimum of five (5) threads engagement.

NOTE: Thread engagement shall be checked by verifying that the number of exposed threads does not exceed that shown below:

<u>conduit nominal size</u>	<u>maximum number of exposed threads</u>
1/2"	3
3/4" to 1-1/2"	4
2" to 2-1/2"	5
3" to 4"	6
5"	7
6"	8

3.7.2 Conduit Bends

Not more than 3 - 90° bends or equivalent are permitted in any conduit run between junction boxes or pull points unless approved by the Engineer.

3.7.3 Nuclear Instrumentation System Conduits

Installation of NIS Conduit and NIS box functions 6R, W, B and Y shall have a maximum tolerance of ±6 inches when design dimensions are given on drawings.

The QC Inspector shall verify that pull points are located at intervals less than or equal to as defined by $A + B = 100$; "A" is the total number of degrees of conduit bends between the pull points and "B" is the total number of running feet between pull points. Any deviation from this criteria requires a Design Change Authorization.

All field bends for NIS conduit functions 6R, W, B and Y shall have a bending radius of 20" minimum for 4" conduit and 15" minimum for 3" conduit.

Criteria requirements apply to all conduits listed in the following Raceway Function Table:



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<u>CLASS</u>	<u>DWG SYMBOL</u>	<u>CHANNEL</u>	<u>RACEWAY FUNCTION</u>
1E		I	6R
1E		II	6W
1E		III	6B
1E		IV	6Y

The QC Inspector is instructed that Engineering control points shall be utilized to determine locations as well as floor, walls, etc., when shown on design drawings.

3.7.4 Flex Conduit Installation

The installation of the flex conduit portion of raceways that terminate at equipment are not within the scope of this instruction. All other flexible conduit for all areas except the containment shall be Sealtite or Liquied-Tite unless shown otherwise on the drawings. Stainless steel flexible conduit as shown on material list shall be used in containment building. Flex conduit shall be installed in accordance with the applicable detail drawings.

3.7.5 Conduit Identification

3.7.5.1 Conduit identification shall be as shown on the latest approved drawing.

The following are the recommended and alternative methods in identifying conduit:

- a. Recommended Method - Freehand marking of conduit with appropriate black ink marker or paint. Height of conduit number characters should be approximately 1/3 to 1/2 the conduit outside diameter and shall be visible where possible from floor level.



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- b. Alternative Method, No. 1 - Adhesive markers with factory pre-printed conduit numbers or conduit numbers field printed on marker before installation. Adhesive markers shall not be used inside containment or in manholes.
- c. Alternative Method, No. 2 - Metal or plastic tags attached to conduit by various means, i.e., ty-raps, wire. This method is recommended for conduit stub-ups. However, for inside the containment metal tags attached with wire (preferable method) or Tefzel ty-raps or other approved method shall be used.

NOTE: Where groups of conduit pass through walls and floors Alternative Method, No. 2 is recommended for identifying conduits within these groups.

Conduit shall be identified at both ends of each run; at all cable trays where conduit enters or leaves; on both sides of all walls, slabs and boxes through which conduit passes. The exception to this is a single conduit entering and leaving a pull box is not required to be identified. Exposed conduit ten (10) feet or less in length may be identified at either end or the middle of the run.

Groups of embedded conduits which are flush with the surface of walls, floors and manholes shall be identified on the surface of the wall, floor, or manhole by attaching an identification template near the conduit bank. Minimum height of markers shall be approximately two (2) inches where space permits. Marking shall be achieved by stenciling or adhesive markers. Adhesive markers shall not be used inside containment or in manholes.

TABLE 1 (Unit Number)

0 - Common to Both Units

1 - Unit 1

2 - Unit 2



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TABLE 2 (Raceway Function)

1Ø, 1G, 1K	-- 6.9kV ac
2Ø, 2G, 2K	-- 480 Vac & Heavy Power Feeders Under 480 Vac
3Ø, 3G, 3K	-- Control ac and dc and Small Power Feeders Under 480V
4Ø, 4G, 4K	-- Low Level Signals
4R, 4W, 4B, 4Y	-- Reactor Protection Instrumentation Low Level Signals
5K	-- 480V ac & Heavy Power Feeders Under 480V (Local Control)
5R, 5W, 5B, 5Y	-- Reactor Protection Instrumentation 120V Signal
6K	-- Control ac & dc and Small Power Feeders Under 480V (Local Control)
6R, 6W, 6B, 6Y	-- Nuclear Instrumentation System
8K	-- Telephone and Communication

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 -

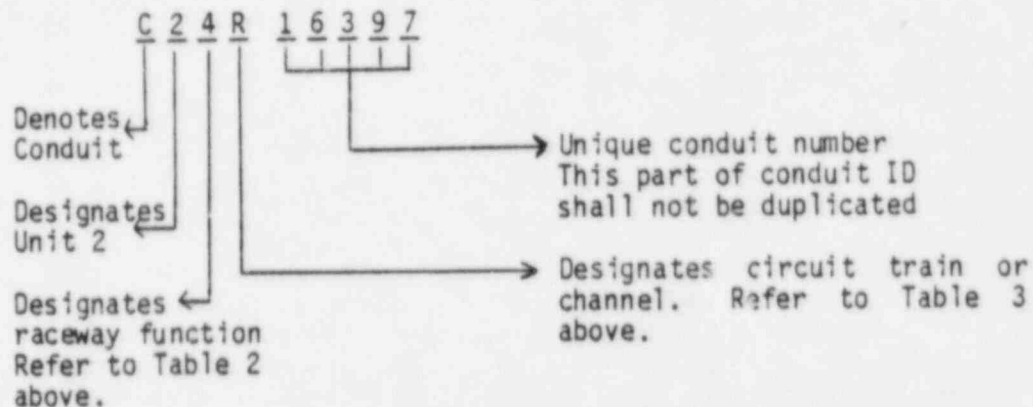
Inst. Channel III - Blue - B -

Inst. Channel IV - Yellow - Y -



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3.7.5.2 A typical conduit identification number is depicted as follows:



Conduit identification shall be verified by the QC Inspector to comply with the latest approved drawing requirements at drawing changes/revisions are released which change a conduit's identification after QC acceptance of the conduit, the following actions shall be taken:

- a. Changes to "Raceway Function", "Train/Channel Designation" or "Unique Number" shall require rework to reidentify the conduit and QC verification of proper identification. An IR, Attachment 2, shall be initiated to document the above verification. All Inspection attributes except "Verify Conduit Identification" shall be noted "N/A" and the drawing number and revision or DCA number that authorized the change shall be recorded in the "Remarks" section. The previous conduit identification shall also be referenced in the "Remarks" section.
- b. Changes to the "Unit Designation" shall not require reidentification and reinspection of the affected conduits. The Interim Vault shall prepare a Permanent Plant Records Vault Transmittal, to document these conditions and provide a cross reference record. The transmittals shall be sent to the Permanent Plant Records Vault for filing with the respective conduit records.

3.7.5.3 The following are acceptable methods of color coding conduit containing safety related cables:



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- a. Recommended Method - Paint exposed conduits with a full 360° band at intervals not to exceed 15 feet and at points of entry to and exit from enclosed areas and on both sides of floor and wall penetrations. Paint color shall match as close as possible the appropriate cable jacket color of the safety related cables to be installed in a conduit. Paint band shall be at least one inch wide and shall be readily visible from floor level. It is recognized that for conduits installed against walls and floors, it may be impossible to obtain a full 360° band for color coding requirements. In these cases, the maximum band possible shall be made.
- b. Alternative Method - Use color coded adhesive markers with similar requirements as to color, width or marker.

Adhesive marking labels shall not be used inside containment or in manholes.

3.7.6 Verify Junction and Pull Box Size and Type

Unless shown otherwise on material lists or drawings, junction boxes shall be type NEMA 12 enclosure (minimum).

Where the installation and corresponding drawing requires a Nema 4 junction box the QC Inspector shall verify that the junction box is a Nema 4.

The QC Inspector shall verify that rubber gaskets have been installed on the mounting hardware (interior and exterior) and is of the type and size as specified on the drawing, Reference 1-N and 1-O.

Electrical "pull boxes" which are unscheduled on the Engineering drawings, may be installed to minimize conduit installation problems.

Where junction boxes are provided solely as cable pulling points in the conduit system and where space or support considerations make junction box installation impractical, pull box fittings, OZ/Gedney type "PBW" or approved equal, may be substituted for the junction box shown on the drawing.

Where junction boxes are used as terminal boxes the inspector shall visually inspect for those attributes previously stated herein for boxes and, in addition, verify the mounting hardware for the terminal block installed.



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NOTE: The terminal block will be inspected by the inspector inspecting cable/wire terminations in accordance with Reference 1-P.

3.8 JUNCTION AND PULL BOX INSTALLATION INSPECTIONS

The QC Inspector shall inspect the installation of electrical boxes in accordance with applicable approved Engineering drawings. Inspections shall consist of, but are not limited to, the following items:

3.8.1 Verify Box Orientation

All box covers and fittings shall face away from walls and/or obstructions which would prohibit future maintenance.

3.8.2 Verify Box Identification

All junction boxes shall be identified as noted on the drawings and in accordance with the following.

Stencil characters in black on junction box covers. Height of junction box number characters shall be a minimum of two inches except that characters may be smaller where size of box cover would require more than two lines to complete junction box number.

NOTE: Unscheduled pull boxes shall be identified by the letters "PB" or "pull box".

Free-hand marking of junction boxes is acceptable for size 12 x 12 x 12 and smaller.

3.8.3 Verify Box Color Code

Safety-related junction boxes containing safety related cable shall be color coded prior to cable installation in accordance with the following.

Stencil an approximate 2" x 2" square on cover of junction box and also on one edge of junction box when the cover is not attached to the junction box by means of a sash chain.

NOTE: On smaller boxes, size of colored square may be reduced if there is not enough surface area for both.



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Paint color shall match as close as possible the appropriate cable jacket color of safety related cables to be pulled through the junction box. Where possible, the colored squares shall be readily visible from floor level.

NOTE: Where a Raceway or junction box contains only associated cable(s), at least one white horizontal stripe shall be applied over each applicable Train color coded marking and where possible, shall be visible from floor level.

3.8.4 Verify Box Free of Damage

All boxes shall be free from burrs, rough edges, and foreign material which could cause cable damage during pulling.

Galvanize damage shall be repaired with Galvanox or an Engineering approved equal.

3.8.5 Verify Mounting Strips Installed

Verify mounting strips installed in boxes. Mounting strips shall be in accordance with References 1-Q and 1-R. The QC Inspector shall inspect for the correct type and number of mounting strips and ensure the proper hardware is used.

3.8.6 Verify NIS Box Location

NIS box installations shall have a maximum tolerance of \pm six (6) inches when design dimensions are given on drawings.

3.9 VERIFY SEPARATION

Conduit Raceway and supports shall be inspected in accordance with the requirements of Paragraph 3.9.1, and documented on the Inspection Report, Attachment 2.

The item(s) which violate separation requirements shall be identified by affixing a "separation violation tag", Attachment 2A, and be reported on the Separation Deficiency Report, Attachment 2B, completed in accordance with the instructions given on Attachment 2C.

3.9.1 Conduit

Conduit shall be installed in accordance with the typical detail drawings and as close as practical to the location shown on engineering plan drawings. Junction boxes, pull boxes, conduit fittings, etc., are part of the conduit system and, therefore, are subject to the same separation criteria.

NOTE: The minimum separation distance between Raceways shall be defined as the "clear air distance" between them.

- a. Minimum separation between conduits having different trains or channels shall be one inch.
- b. Minimum separation of six (6) feet shall be maintained between 6.9 kV raceway and Nuclear Instrumentation System (NIS) raceways.
- c. A minimum separation of 6'-0" must be maintained between raceway functions 2Ø, 2G, 2K, 3Ø, 3G, 3K, 5K, 6K, 5R, 5W, 5B, 5Y and NIS cables not in conduit (e.g., near electrical penetrations).

NOTE: Refer to Attachment 7 for the voltage level designation.

- d. A minimum separation of 2'-0" shall be maintained between parallel runs of "NIS" conduit systems (raceway functions) 6R, 6W, 6B, & 6Y & raceway systems 2Ø, 2G, 2K; 3Ø, 3G, & 3K; 5K, 6K & 5R, 5W, 5B, & 5Y. 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) should attain the above 2'-0" minimum when feasible; however, physical constraints may reduce such separation to 1".
- e. "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.

The clearance criteria as explained above may be waived;

- a) At such points where exposed conduits enter or exit any equipment or box to a point of 4'-0" from such equipment or box.



- b) 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 ft.

All other violations of the clearance criteria shall be reviewed by Engineering on case by case basis.

- f. Minimum separation between a conduit containing safety related cables and associated cables and the top of a tray having different train or channels shall be two (2) feet in cable spreading room and three (3) feet in general plant area. This separation may be reduced to one (1) inch when the tray has a solid cover. When the conduit above an open tray contains non-safety related cable, the minimum separation is one inch and no covers are required.
- g. Minimum separation between a conduit (safety or non-safety related) and a bottom or side of a tray (solid bottom or ladder) shall be one inch.
- h. Cables routed in free air exiting or entering conduit raceway shall maintain:
 - 1. A minimum of three feet horizontally and five feet vertically between redundant cable or conduit raceway in general plant areas.
 - 2. A minimum of one foot horizontally and three feet vertically between redundant cable or conduit raceway in cable spreading area and control room.
- i. Raceways and supports shall not be located within six (6) inches of Class I or Class II piping welds or component welds (valves, gauges, etc.), except conduit or conduit supports necessary for pipe mounted instrumentation.
- j. Conduit and conduit supports shall be separated from piping (with operating temperature of 200°F or greater) or piping insulation by one inch.
- k. In no case shall any part of the raceway or raceway support system come in direct contact with uninsulated equipment in the piping system or with pipe restraints or anchors unless otherwise approved by the Engineer.



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NOTE: Class I or Class II piping welds can be identified by the mechanical ID Tags. Typical spool piece tag number: 3"-SB-1-63-301-5 (last numeral is class). If tag cannot be seen, go to pipe support typical tag number: SFX-022-700-A55D (last numeral is class). Support will be the same as pipe it supports.

1. Raceways and supports shall not be located closer than 1/8 inch from instrument sensing lines.

3.10 CONDUIT ACCEPTANCE

All conduit and boxes which have been inspected and accepted shall be documented on Inspection Reports, Attachment 2 and/or 3 and included in the Raceway Package.

3.11 FINAL RACEWAY SYSTEM INSPECTION

- 3.11.1 The QC Inspector shall verify the conduit raceway system has been installed in accordance with the requirements of the isometric drawing.

- 3.11.2 All final raceway system inspections will be documented on Attachment 4.

3.12 DOCUMENTATION

Inspection Reports shall be in accordance with Reference 1-S. Documentation packages will be processed in accordance with Reference 1-C.

3.13 NONCONFORMANCES

All unsatisfactory conditions shall be documented on an IR and/or a NCR, per References 1-S and 1-T respectively, as directed by the QC Supervisor.

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ATTACHMENT 1

COMANCHE PEAK STEAM ELECTRIC STATION

INSPECTION REPORT

ITEM DESCRIPTION CLASS 1E CONDUIT RACEWAY FABRICATION		IDENTIFICATION NO.		SYSTEM / STRUCTURE DESIGNATION	
SPEC. NO.	REV.	REF. Q.C. DOC. & REV. & CHANGE NO.	MEASURE OR TEST EQUIP. IDENT. NO.		
3	5	QI-QP-11.10-1A Rev.			
<input type="checkbox"/> IN PROCESS INSPECTION <input type="checkbox"/> PRE-INSTALLATION VERIFICATION <input type="checkbox"/> INSTALLATION INSPECTION <input type="checkbox"/> FINAL INSPECTION <input type="checkbox"/> PRE-TEST INSPECTION					
INSR RESULTS					
<input type="checkbox"/> INSPECTION COMPLETED, ALL APPLICABLE ITEMS SATISFACTORY					
<input type="checkbox"/> INSPECTION COMPLETED, UNSATISFACTORY ITEMS LISTED BELOW					
ITEM NO.	INSPECTION ATTRIBUTES				QC SIGNATURE
			SAT	UNSAT	DATE
(V) 1.	Conduit free of burrs, sharp edges and foreign material -(Paragraph 3.1A)				
(V) 2.	Conduit free of internal and external flaking - (Paragraph 3.1B)				
(V) 3.	Conduit threads not irregular, jammed or undercut - (Paragraph 3.1C)				
(V) 4.	Dies for conduit threads are standard U.S. conduit tapered threads -(Paragraph 3.1D)				
(V) 5.	Conduit threads cleaned and painted with Galvanox - (Paragraph 3.1E)				
(V) 6.	Conduit bends free of kinking or excessive flattening- (Paragraph 3.1F)				
(V) 7.	Conduit bends and offsets made with approval benders - (Paragraph 3.1G)				
REMARKS (OWGS, SPECS, ETC.)					
<div style="position: absolute; top: 50px; right: 50px; transform: rotate(-15deg); font-weight: bold; font-size: 2em;">TYPICAL</div>					
RELATED NCR NO.	I/R CLOSED	DATE	SIGNATURE		
5			QC INSPECTOR		

MIA/01 //84

TEXAS UTILITIES GENERATING CO.

- CPSES -



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ATTACHMENT 2

COMANCHE PEAK STEAM ELECTRIC STATION

INSPECTION REPORT

SHEET 26
NO

ITEM DESCRIPTION		IDENTIFICATION NO.		SYSTEM / STRUCTURE DESIGNATION	
CLASS 1E CONDUIT RACEWAY		21		1	
SPEC. NO.	REV.	REF. Q.C. DOC. & REV. & CHANGE NO.		MEASURE OR TEST EQUIP. IDENT. NO.	
5	6	QI-QP-11.10-1A Rev.		7	
<input type="checkbox"/> IN PROCESS INSPECTION		<input type="checkbox"/> PRE-INSTALLATION VERIFICATION		<input type="checkbox"/> INSTALLATION INSPECTION	
		<input type="checkbox"/> FINAL INSPECTION		<input type="checkbox"/> PRE-TEST INSPECTION	
INSPECTION RESULTS					
<input type="checkbox"/> INSPECTION COMPLETED, ALL APPLICABLE ITEMS SATISFACTORY					
<input type="checkbox"/> INSPECTION COMPLETED, UNSATISFACTORY ITEMS LISTED BELOW					
QC INSPECTOR _____ DATE _____					
ITEM NO.	INSPECTION ATTRIBUTES			SAT	UNSAT
1.	Verify conduit size and fittings (Refer to Para. 3.7.1)				
2.	Verify total conduit bends (Refer to Para. 3.7.2)				
3.	Verify NIS Conduit (Refer to Para. 3.7.3)				
4.	Verify flex conduit installation (Refer to Para. 3.7.4)				
5.	Verify conduit identification (Refer to Para. 3.7.5)				
6.	Verify pull box size and type (Refer to Para. 3.7.6)				
7.	Verify pull box installation (Refer to Para. 3.8)				
8.	Verify raceway separation (Refer to Para. 3.9 & 3.9.1)				
9.	Verify NIS raceway separation (Refer to Para. 3.9 & 3.9.1)				
REMARKS (DWGS, SPECS, ETC.)					
Separation Deficiency Item No.: _____					
RELATED RCR NO.	I.R. CLOSED	DATE	SIGNATURE		
15	<input type="checkbox"/>		QC INSPECTOR		

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ATTACHMENT 2A

YELLOW

CPSES
**SEPARATION
VIOLATION**

I.R. NO. _____

DEFICIENCY REPORT ITEM # _____

☐ **WAIVER APPROVED**

Q.C. INSPECTOR _____ DATE _____

**DO NOT REMOVE THIS TAG
WITHOUT Q.C. AUTHORITY**

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ATTACHMENT 2B

[illegible]



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ATTACHMENT 2C

The following steps will be followed in processing of the Separation Deficiency Report (Attachment 2b) for Unit 2.

- Step 1: QC will report the unsatisfactory as-found condition in the Block 2 Description Section and attach a "Separation Violation" Tag with the IR number and Deficiency Report item number entered on the line provided (Attachment 2A). The tag shall be placed at the area where the violation occurs.
- 2: The Paper Flow Group will retain a copy of the Deficiency Report and forward the original to Engineering for disposition in Block 3.
- 3: Upon completion of the Engineering Disposition Block 3, Engineering will assign the responsible craft in Block 4 and forward the original Deficiency Report to the Paper Flow Group for distribution.

NOTE: When Block three (3) is dispositioned "Use as is" and the deficiency is not in accordance with ES-100, or the disposition is "Rework" but the work is not in the scope of CPP procedures, a NCR will be issued, and the deficient item closed referencing the NCR.

EXCEPTION: When a traveler is issued for rework, it is not necessary that a procedure be issued. The traveler shall have detailed instructions.

- 4: For those unsatisfactory conditions which would restrain or impact ongoing construction activities, Engineering may request authorization to proceed providing the following conditions are satisfied:
- a. The deficiency disposition includes sufficient information and direction for accomplishing the work.
 - b. Engineering has stated the reason for waiver in Block 5.
 - c. Engineer Review/Approval shall be by the Engineering Discipline Engineer or his designee (Block 5).
 - d. Quality Assurance review/approval shall be by the Discipline Quality Engineers designated to review/approve NCR dispositions (Block 5).



ATTACHMENT 2C
(continued)

- e. After approval of the waiver, the QC Inspector shall check the waiver approved block then sign and date the appropriate section of the "Separation Violation" Tag.
- 5: When the responsible craft completed the items listed on the Deficiency Report, by working the Engineering disposition and QC has signed all steps for acceptance, the QC Inspector shall remove the "Separation Violation" tag. The QC Inspector shall obtain the original IR, with the Deficiency Reports attached, sign and date the Deficiency Report, Block 6, for the item just worked.

When all items have been completed on the Deficiency Report, the IR shall be closed and processed in accordance with Reference 1-T.

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ATTACHMENT 3

COMANCHE PEAK STEAM ELECTRIC STATION

INSPECTION REPORT

SHEET 25
NO

ITEM DESCRIPTION CLASS 1E BOX INSTALLATION		IDENTIFICATION NO		SYSTEM / STRUCTURE DESIGNATION	
SPEC NO.	REV	REF Q.C. DOC. & REV & CHANGE NO	MEASURE OR TEST EQUIP. IDENT NO		
		QI-QP-11.10-1A Rev.			
<input type="checkbox"/> IN PROCESS INSPECTION		<input type="checkbox"/> PRE INSTALLATION VERIFICATION	<input type="checkbox"/> INSTALLATION INSPECTION	<input type="checkbox"/> FINAL INSPECTION	<input type="checkbox"/> PRE-TEST INSPECTION
INSR RESULTS					
<input type="checkbox"/> INSPECTION COMPLETED, ALL APPLICABLE ITEMS SATISFACTORY					
<input type="checkbox"/> INSPECTION COMPLETED, UNSATISFACTORY ITEMS LISTED BELOW					
ITEM NO.		INSPECTION ATTRIBUTES		SAT	QC SIGNATURE
(V)	1.	Verify box size and type (Para. 3.7.6).			
		<input type="checkbox"/> Nema 12			
		<input type="checkbox"/> Nema 4			
(V)	2.	Mounting gaskets installed Nema 4 box (Para. 3.7.6).			
(V)	3.	Verify box installation (Para. 3.8).			
	a.	Verify box orientation.			
	b.	Verify alpha-numeric code (schedule boxes only).			
	c.	Verify box color code.			
	d.	Verify box free of damage.			
	e.	Verify mounting strip installed.			
	f.	Verify NIS box location.			
REMARKS (DWGS, SPECS, ETC.)					
RELATED NCR NO		I.R. CLOSED <input type="checkbox"/>		DATE	SIGNATURE
					QC INSPECTOR

TYPICAL

MIA/03 7/84

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ATTACHMENT 4

INSPECTION REPORT

[illegible]

M1A/OS 7/84

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ATTACHMENT 5

NUT ROTATION^a FROM SNUG TIGHT CONDITION

Disposition of Outer Faces of Bolted Parts

Both faces normal to bolt axis, or one face normal to axis and other face sloped not more than 1:20 (bevel washer not used)		Both faces sloped not more than 1:20 from normal to bolt axis (bevel washers not used)
Bolt length ^b not exceeding 8 diameters or 8 inches	Bolt length ^b exceeding 8 diameters or 8 inches	For all length of bolts
1/2 turn	2/3 turn	3/4 turn

a. Nut rotation is rotation relative to bolt regardless of the element (nut or bolt) being turned. Tolerance on rotation: $\pm 30^\circ$
 For coarse thread heavy hex structural bolts of all sizes and length and heavy hex semi-finished nuts.

b. Bolt length is measured from underside of head to extreme end of point.

UNISTRUT (A-307) BOLTS












BOLT SIZE (INCHES)	TORQUE (FT. LBS.)
1/4	6
5/16	11
3/8	19
1/2	50



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ATTACHMENT 6

ASTM AND SAE GRADE MARKINGS FOR STEEL BOLTS AND SCREWS

Grade Marking	Specification	Material
 NO MARK	SAE-Grade 1	Low or Medium Carbon Steel
	ASTM-A 307	Low Carbon Steel
	SAE-Grade 2	Low or Medium Carbon Steel
	SAE-Grade 5	Medium Carbon Steel, Quenched and Tempered
	ASTM-A 449	
	SAE-Grade 5.2	Low Carbon Martensitic Steel, Quenched and Tempered
	ASTM-A 325 Type 1	Medium Carbon Steel, Quenched and Tempered
	ASTM-A 325 Type 2	Low Carbon Martensitic Steel, Quenched and Tempered
	ASTM-A 325 Type 3	Atmospheric Corrosion (Weathering) Steel, Quenched and Tempered
	ASTM-A 354 Grade 8.8	Low Alloy Steel, Quenched and Tempered
	ASTM-A 354 Grade 9.8	Low Alloy Steel, Quenched and Tempered
	SAE-Grade 7	Medium Carbon Alloy Steel, Quenched and Tempered, Roll Threaded After Heat Treatment
	SAE-Grade 8	Medium Carbon Alloy Steel, Quenched and Tempered
	ASTM-A 354 Grade 8.8	Alloy Steel, Quenched and Tempered
	ASTM-A 490	Alloy Steel, Quenched and Tempered

ASTM Standards:

A 307 - Low Carbon Steel Externally and Internally Threaded Standard Fasteners.
A 325 - High Strength Steel Bolts for Structural Steel Joints, Including Suitable Nuts and Plain Hardened Washers.
A 325 - Quenched and Tempered Alloy Steel Bolts and Screws.
A 354 - Quenched and Tempered Alloy Steel Bolts and Screws with Suitable Nuts.
A 490 - Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints.

SAE Standards:

J 429 - Mechanical and Quality Requirements for Externally Threaded Fasteners.



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ATTACHMENT 7

VOLTAGE LEVEL DESIGNATION TABLE

1Ø, 1G, 1K	-- 6.9kV ac
2Ø, 2G, 2K	-- 480 Vac & Heavy Power Feeders Under 480 Vac
3Ø, 3G, 3K	-- Control ac and dc and Small Power Feeders Under 480V
4Ø, 4G, 4K	-- Low Level Signals
4R, 4W, 4B, 4Y	-- Reactor Protection Instrumentation Low Level Signals
5K	-- 480V ac & Heavy Power Feeders Under 480V (Local Control)
5R, 5W, 5B, 5Y	-- Reactor Protection Instrumentation 120V Signal
6K	-- Control ac & dc and Small Power Feeders Under 480V (Local Control)
6R, 6W, 6B, 6Y	-- Nuclear Instrumentation System
8K	-- Telephone and Communication

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ATTACHMENT 7 (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7
CH. I	CH. II	CH. III	CH. IV	Train A	Train B	Train C*

*Non-CLASS 1E (INCLUDES CONTROL CHANNELS 1, 2, 3 & 4 AS
DEFINED BY W)

Item shown in each vertical column is separated from
items in all other vertical columns by acceptable separation
distance of 3'x 5', 1'x 3', barrier, etc.
Relative arrangement within a vertical column is determined
by voltage level.



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ATTACHMENT 8
 Figure 1

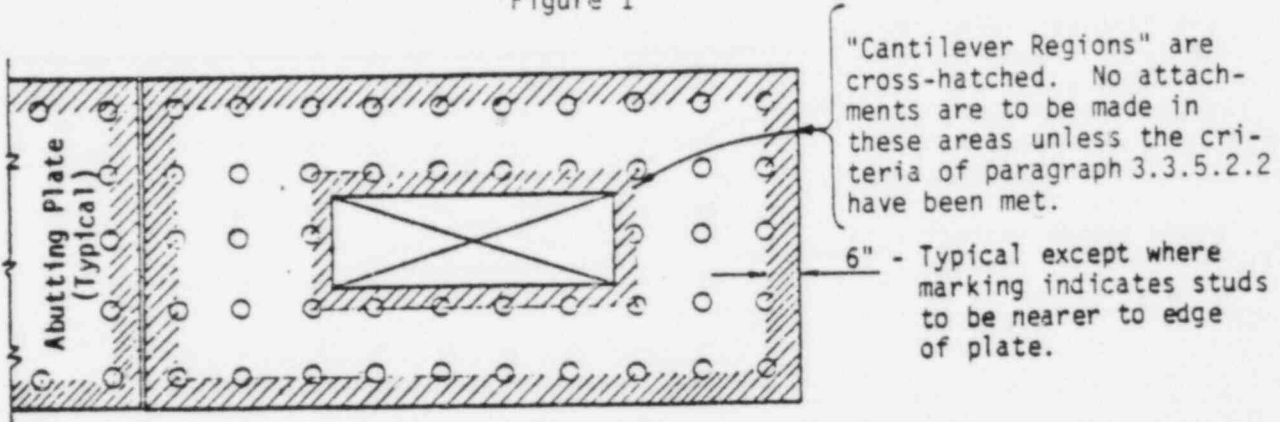
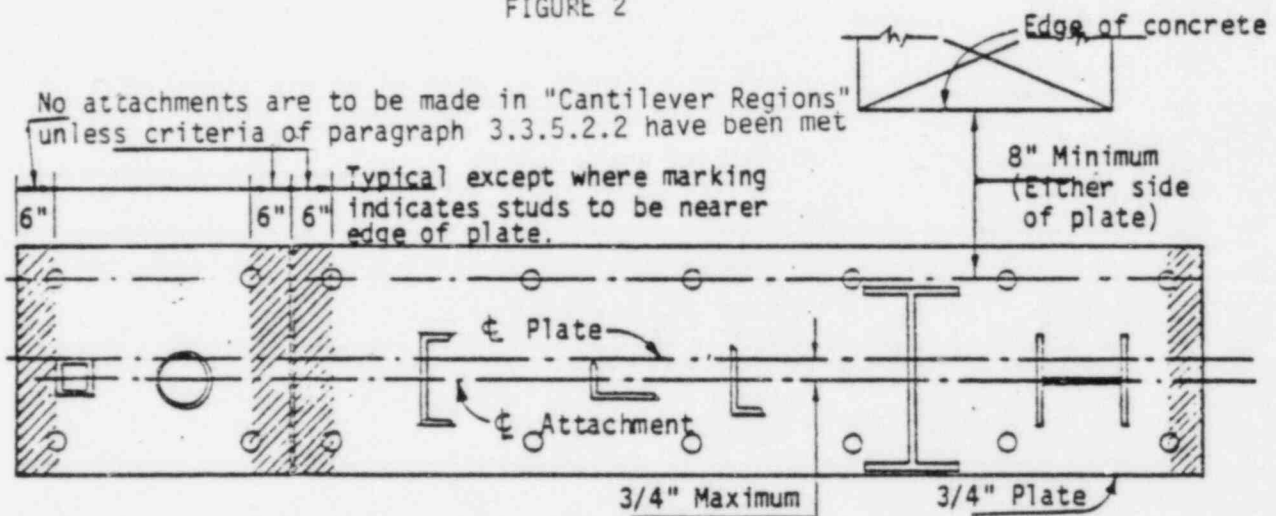
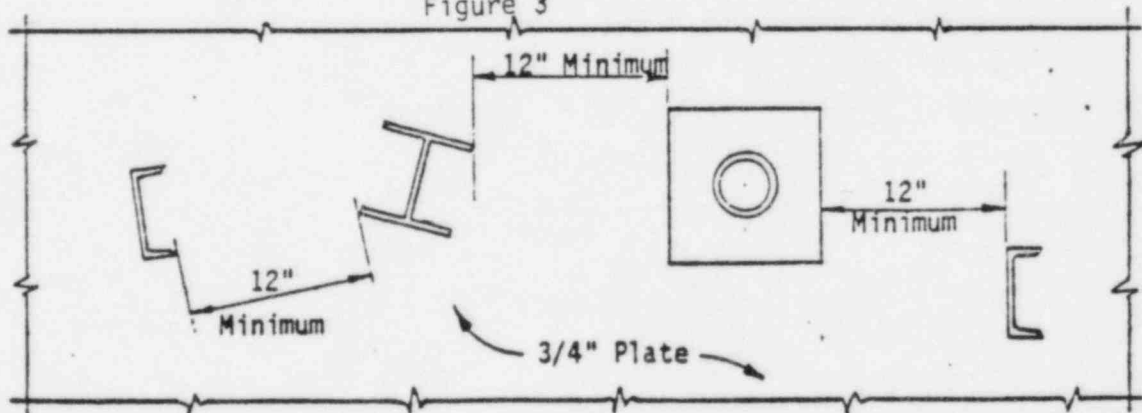


FIGURE 2



Typical either side of
 E plate unless detailed
 otherwise on design documents.

Figure 3



Bob Haddock 10-3-84

✓

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NON-ASME

CONTROL OF MATERIAL TRACEABILITY FOR SITE FABRICATED
STRUCTURAL/MISCELLANEOUS STEEL

PREPARED BY:

Michael G. Latham

9/19/84
Date

APPROVED BY:

O.T. Ott

9/19/84
Date

APPROVED BY:

Michael D. Warner

9/19/84
Date

FOR INFORMATION ONLY

1.0 REFERENCES

- 1-A QI-QP-11.14-1 "Inspection of Site Fabrication and Installation of Structural and Miscellaneous Steel"
- 1-B QI-QP-11.4-22, "QC Surveillance of Protective Coatings Unique Identification Number Transfer"
- 1-C CPM-6.3, "Preparation, Approval and Control of Operation Travelers"
- 1-D CP-QP-18.0, "Inspection Reports"
- 1-E CP-QP-16.0, "Nonconformances"

FOIA-85-59

S/119

2.0 GENERAL

2.1 PURPOSE AND SCOPE

The purpose of this instruction is to describe material traceability requirements for seismic structural/miscellaneous steel fabrication per Reference 1-A.

6-11-81

1 6-26-81

Required modification to Assignment 15

FOIA-85-59

2 9-25-81

Related to Assignment 15

S/119

3 10-23-81

Updated Assignment 15

4 2-15-82

City unique numbering added

8606170251



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3.0 INSTRUCTION

3.1 ISSUANCE AND CONTROL OF MATERIALS

The shop foreman will notify the QC Inspector when it is necessary to withdraw safety related materials from the storage area. In this case, a Material Requisition (MR) will be prepared by the craft. The MR shall provide the quantity, description, heat/mark number, and a general description of the intended use of the material (e.g., shims, etc.). This MR shall be presented to QC for material traceability verification. QC verification shall be documented by the Inspector's signature and date on the MR.

NOTE: Conduit supports, cable tray supports, electrical equipment supports, and attachments associated with these supports do not require material identification or an MR for materials conforming to ASTM A-36 or ASTM A-500 Grade B specification.

The MR shall be presented to QC at the time of inspection to expedite material traceability verification.

3.2 SUBDIVISION OF MATERIALS

The QC inspector shall verify that if it is necessary to subdivide material, that traceability is transferred prior to cutting. QC verification shall be documented on the MR, Operational Traveler, or IR as applicable.

NOTE: In the event that the steel is coated and has a Protective Coatings Unique Identification Number stamped on it (a QP number indicating use in Reactor Building), the QC inspector shall also verify transfer of this number in accordance with Reference 1-B.

3.3 UNIQUE NUMBERING

The QC Inspector shall maintain a material traceability log for safety related miscellaneous and structural steel items fabricated in the shop requiring unique numbers as shown below.

Unique numbers may be applied to items in lieu of heat numbers when due to configuration, a unique number is more feasible.

NOTE: Catalog type items such as nuts, bolts, and washers that require only a Certificate of Compliance shall not be encompassed within the scope of this instruction.



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The QC Inspector shall assign a consecutive unique I.D. control number beginning with "1001" to each unique item or group of items being fabricated for field installation.

Upon assignment of a unique I.D. control number, the QC Inspector shall enter it on the Miscellaneous/Structural Steel Traceability Log, Attachment 1, along with the following information:

- a. Assembly Quantities - The total number of unique assemblies or items being issued or fabricated.
- b. Drawing No. - The B&R miscellaneous or structural steel fabrication drawing number.
- c. Sheet - The B&R miscellaneous or structural steel fabrication drawing sheet number.
- d. Revision - The B&R miscellaneous or structural steel fabrication drawing revision number.
- e. Date - The date that fabrication of the item(s) is completed.
- f. Assembly - The unique assembly title/number of the item being issued or fabricated as shown in the Bill of Materials on the drawing.
- g. Sub-Assembly Items - The size, type and grade of material used for "Q" items to make the assembly.
- h. Item Quantity - The total number of each item used to make the required number of assemblies.
- i. Heat Number - The heat or lot number of each "Q" item used to make the assembly.
- j. P.O. Number - The purchase order number on which the material was procured.

3.3.1 Change of Sequence

The following conditions or variables shall warrant the assignment of a new unique I.D. control number:

- a. A change of P.O., heat or lot number
- b. A change of material, size, type or grade
- c. A change of assembly number or assembly dimensions
- d. A change of fabrication date
- e. A change of drawing number



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3.3.2 Field Fabricated Items

QC field inspection/verification shall be documented and processed in accordance with References 1-C or 1-D as applicable.

QC shall verify Heat Numbers applicable to material type being used and enter it in the comments section of the IR, or as directed by Operational Traveler.

3.4 DOCUMENTATION

The maintenance of operation travelers shall be in accordance with Reference 1-C.

The QC Inspector shall forward Miscellaneous/Structural Steel Traceability Log (MTL) sheets to the Permanent Plain Records Vault (PPRV). Inspection Reports, as applicable, shall be processed per Reference 1-D.

3.5 DISCREPANCIES

Discrepancies found during inspection shall be documented on the IR and/or a NCR per Reference 1-D and 1-E respectively, as directed by the QA/QC Supervisor.

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ATTACHMENT 1

[illegible]

- 5 4-23-82 minor chg - add 1.0
- 6 10-15-82 add MR right to 3.1
- 7 11-21-82 minor change to 2.1
- 8 12-15-82 add NOTE to 3.1 - exception to supports
- 9 1-3-83 ?
- 10 6-3-83 add right to verify heat = 1/2 1st & 2nd
" " Note heat on MR, terminate with
" is appropriate"
- 11 8-23-83 revise 3.5 - doc. discrepancy
on 2A (aka MR)
- 12 9-13-83 revise Note Re: A-36 trace on MR
for cutting, or removal etc
- 13 12-7-83 minor chg 3.2
- 14 9-21-84 changed to 1.0, 3.1, 3.2, 3.3

TEXAS UTILITIES GENERATING CO.

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INSPECTION OF CLASS 1E CONDUIT RACEWAY SYSTEMS

PREPARED BY:

William L. Johnson

9/17/84
Date

APPROVED BY:

Carl E. Byrd

9-17-84
Date

APPROVED BY:

Michael D. Warner

9-20-84
Date

1.0 REFERENCES

1-A CP-QP-11.10, "Inspection of Electrical Raceway Support Systems"

1-B 2323-52-910, "Gibbs and Hill Drawings"

1-C CP-CPM-7.1, "Package Flow Control"

1-D 2323-ES-100, "Electrical Erection"

1-E CP-CPM-6.3, "Preparation, Approval and Control of Operational Travelers"

1-F QI-QP-11.3-21, "Embedded Conduit and Sleeves"

1-G CP-ECP-19, "Exposed Conduit"

1-H QI-QP-11.4-22, "QC Verification of Protective Coatings Unique Identification Number Transfer"

1-I QI-QP-11.14-4, "Control of Matl. Traceability for Site Fab. Struct./Misc. Steel"

1-J QI-QP-11.21-1, "Visual Weld Inspection"

1-K QI-QP-11.2-1, "Installation of "Hilti" Drilled in Bolts"

1-L CCP-45 "Permanent and Temporary Attachments to Embedded Weld Plates"

FOR INFORMATION ONLY

FOIA-85-59

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*See 3.2.1 - Transfer to QP-11.10-1A
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- 1-M QI-QP-11.0-15, "Verification of Base Plates for Grouting"
- 1-N 2323-E1-1800, "Material List"
- 1-O 2323-S2-0910, "Sheet G-2A and Sheet CSD-7A"
- 1-P QI-QP-11.3-28, "Class 1E Cable Terminations"
- 1-Q 2323-E1-1702-02, "Cable and Raceway Separation Details"
- 1-R 2323-E1/E2-1710, "Junction Box Schedule"
- 1-S CP-QP-18.0, "Inspection Report"
- 1-T CP-QP-16.0, "Nonconformances"
- 2.0 GENERAL
- 2.1 PURPOSE AND SCOPE

This Instruction supplements Reference 1-A and provides the inspection criteria and the documentation requirements for performing inspections on Class 1-E Conduit Raceway and seismic supports for Class 1E and Train "C" Conduit Raceway Systems fabricated for and installed in Unit 2 Category 1 buildings (excluding electrical control building) and areas as required by Reference 1-B.

2.2 GENERAL INSTRUCTIONS

The Unit 2 Interim Vault will issue work packages for each conduit run in accordance with Reference 1-C.

The work package shall include but not be limited to, a isometric drawing of the conduit run, Operation Travelers for the fabrication and installation of conduit supports and Conduit Raceway Inspection Reports.

The support(s) location, spacing, type, and attachment as shown on the isometric drawing have been designed by Engineering in accordance with Reference 1-B and 1-D. The isometric drawings present an isometric depiction of the conduit routing and includes applicable notes and references. Other drawings such as typical detail drawings, plan drawings, material lists, schedules, etc., have been provided by Engineering to be used as applicable.



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The inspection of conduit raceway shall be documented on Inspection Reports, Attachment 1, 2, 3, and 4.

The conduit run and supports shown on the isometric drawing will be inspected according to the operations listed on the Operations Traveler and the acceptance criteria specified in this Instruction. Operations Travelers shall be processed and completed in accordance with Reference 1-E.

Individual engineered supports ("IN") which have weld numbers assigned by engineering shall have specifically prepared operations travelers and/or inspection reports prepared by the Quality Engineer for inspection documentation.

Individual engineered supports ("IN") which do not have weld numbers assigned by engineering will utilize same operations traveler format as for any other type of conduit/junction box support.

Embedded conduit and electrical "stub ups" less than 24 inches in length do not require supports and isometric drawings will not be issued for these installations. Embedded conduit and "stub ups" will be inspected in accordance with Reference 1-F.

QC verification of support load and capacity, and span per LS Section of Reference 1-B are not within the scope of this instruction.

Lighting supports and lighting conduit inspection criteria will be addressed in future revisions to this instruction.

2.3

SPECIAL INSTRUCTION

- a. Quality Control Personnel who are certified in QI-QP-11.3-23 may perform the inspections required by paragraphs 3.1, 3.7, 3.8, 3.9 and 3.10 of this instruction.
- b. Quality Control Personnel who are certified in QI-QP-11.10-1 may perform inspections required by paragraphs 3.2, 3.3, 3.4, 3.5 and 3.6 of this instruction.
- c. All other paragraphs except paragraph 3.11, are applicable to both a and b above.
- d. Quality Control Personnel certified to this instruction may perform inspections required by all paragraphs of this instruction.



3.0 INSTRUCTION

3.1 CONDUIT FABRICATION SURVEILLANCE

Fabrication inspection (i.e., selection of material, threading and bending) of Class 1E conduit, including lighting shall be performed on a random surveillance basis. The frequency of inspection shall be once per working shift when conduit fabrication activities are in progress or at the direction of the QC Supervisor. Inspections will be documented on Attachment 1.

Inspections shall include the following:

- a. Conduit shall be free of burrs, sharp edges, and foreign material which could cause cable damage during pulling and shall show no evidence of thread damage (i.e., flattening) which could cause irregularity in conduit shape.
- b. To the extent possible, the QC Inspector shall examine conduit for internal and external "flaking" of the galvanize coating. If cracking of the galvanize surface is evident on the exterior of bends, flaking has probably occurred on the interior. The QC Inspector shall affix a hold tag to all conduit exhibiting "flaking" or thread damage and cause their removal to an isolated area to prevent their use and possible vendor replacement.
- c. Threads shall be standard U.S. conduit tapered threads (NPT) and shall not be irregular, jammed or undercut.
- d. Dies being used shall be standard U.S. conduit tapered threads (NPT).
- e. Cut threads shall be cleaned to bright metal and painted with Galvanox or similar approved product.
- f. Conduit bends shall not show kinking or excessive flattening or interruption of the smooth bore of the conduit.

NOTE: Excessive flattening is defined as reduction of the outside diameter of the conduit by 25% or more.

- g. Bends and off-sets will be made with benders.



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3.2 SUPPORT FABRICATION

3.2.1 Transfer of "QP" Number and Material Traceability

3.2.1.1 Transfer of "QP" number for coated bulk steel intended for use in the Reactor Building will be in accordance with Reference 1-H.

3.2.1.2 Material traceability for conduit supports, electrical equipment supports and components associated with these supports will be in accordance with Reference 1-I.

3.2.2 Welding Inspection

All welding and stud welding inspections shall be performed in accordance with Reference 1-J.

The weld joint design shall be limited to those shown on the sketches appearing on qualified WPS's and/or applicable design document.

3.2.3 Identification of Conduit Supports

Each support inspected on a raceway system shall be assigned a number by Engineering as outlined in Reference 1-G and shown on the isometric drawing included in the conduit system work packages.

Supports with more than one conduit attached shall be assigned only one unique number with the exception of individually engineered ("IN") supports which allow attachment of conduit(s) other than those shown on the "IN" drawing. The additionally attached conduits will be assigned unique numbers and these numbers documented on the Operations Traveler for each supported conduit.

Supports shall be stamped/stenciled with the support number, with the exception of unistrut hangers. Strut channel hangers shall be marked with an approved industrial marker in a manner that will not damage the supports. In cases where not enough room is available to stencil the number, (e.g., CSM-2A type hangers) the number shall be marked on the conduit strap.

NOTE: Pull box supports will be identified in the same manner as conduit supports.



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3.2.4 Identification of Junction Box Supports

Junction box supports shall utilize the unique number of the junction box, i.e., if the junction box is identified JB2C-139G, the support number will be the same.

3.3 SUPPORT INSPECTIONS

Package flow control group or craft personnel shall notify Quality Control when the support or Raceway is ready for inspection and supply the required Operational Traveler and support package. The Inspector will perform inspections per the provisions of this instruction and the operation traveler. Following completion of required inspections, the Inspector will return the traveler to the package flow control group or craft.

NOTE: The QC Inspector will record all design change documentation (DCA's, CMC's, etc.,) and the revision thereof used for inspection on the traveler for each applicable inspection operation completed.

Discrepancies found during inspection will be documented in accordance with Paragraph 3.13 of this instruction.

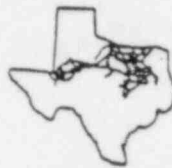
3.3.1 Support Assembly Inspection

The QC Inspector shall verify the acceptability of the following in accordance with Reference 1-B, isometric drawing, and applicable procedures and instructions.

NOTE: General notes of Reference 1-B do not apply to design change documents (DCA's or CMC's) for specific hangers unless otherwise noted on the document.

The QC Inspector shall inspect the support for the following:

- a. Member(s) shape (i.e., angle, channel, etc), size and dimensions
- b. Conduit clamp gap ("t") tolerance
- c. Configuration per Engineering drawing and related DCA and/or CMC, including bolt hole sizes
- d. Unique identification number per paragraph 3.2.3 and 3.2.4 of this instruction



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- e. Shim plate provides full bearing to conduit prior to torque.
- f. Welds per Reference 1-J.

3.3.2 Tolerances

Hangers for electrical raceway systems shall be installed within the following tolerances. The cumulative effect of rolling (mill), fabrication and erection tolerances shall not exceed those given below:

A hanger shall be considered plumb if the angle between the longitudinal axis of the main member(s) of the hanger is at right (90°) angle to the supporting surface (ceiling or floor). A tolerance of $\pm 2^\circ$ (unless noted otherwise) shall be acceptable provided the integrity of the supported raceway system and its attachments to the hanger remains intact.

Hangers supported on vertical surfaces (wall, column, side of a beam, etc.), shall be considered level with maximum tolerance of $1/2"$ in 10 feet.

3.3.3 Support Attachment

The QC Inspector shall inspect the attachment of the support for the following:

- a. Hilti bolt embedment and spacing
- b. Bearing surface per paragraph 3.5 of this instruction
- c. Attachment welds to embedded steel per paragraph 3.3.5.2 of this instruction
- d. Attachment welds to the containment liner per Paragraph 3.2.2 of this instruction.

NOTE: Additionally any NDE for attachment welds to liner shall be completed per Operations Traveler provided by Civil Engineering. A copy of this Traveler shall be included in the support package.

- e. Location per isometric drawing.

3.3.4 Bolting Inspection

3.3.4.1 General Bolting Requirements

For each support the QC Inspector shall:



- a. Verify all bolted connections have been made with approved hardware and are completed and secure. In addition, bolt tensioning requirements for bolted connections as specified by Reference 1-B shall be verified. (See Attachment 5 for bolt tensioning requirements and Attachment 6 for bolt types and marking).

All strut channel and/or bolted Structural Supports that have been installed per Reference 1-B require bolt tensioning. Electrical Raceway strut channel supports fabricated and assembled shall be inspected to verify that the bolt tensioning has been satisfactorily accomplished. One bolt/nut combination per support shall be inspected for tension acceptability. Additionally, if the support secures one (or more) vertical run of conduit, at least one bolt on one vertical conduit clamp shall be inspected to verify that proper tension has been reached. If this is not the case, all the remaining vertical clamp bolts will be inspected to assure satisfactory tension. Orange torque seal shall be applied to those bolts that are inspected.

- b. The QC Inspector shall verify in accordance with Reference 1-K. Hilti bolt embedment, spacing, torque acceptance, and Richmond Insert thread engagement ($2d + 1/8"$) and snug tight verification. Hilti and Richmond Inspections shall be documented on the Inspection Report provided in Reference 1-K.

3.3.4.2 Structural Bolting

The QC Inspector, when inspecting bolted connections, shall visually inspect for the following:

- a. Bolts are the correct length as indicated by having the bolts flush with, or outside of, the face of the nut when completely installed.
- b. Turning elements are on the correct face.
- c. Washers are used when required.

NOTE: For long slotted holes, structural plate washers or a continuous bar not less than $5/16"$ thick are required to cover long slots that are in the outer plies of joints.

- d. Bolt heads and nuts shall rest squarely against the metal or washer.



- e. Where bolts are used on surfaces having slopes greater than 1-in-20 with a plane normal to the bolt axis, beveled washers shall be provided to give full bearing to the head or nut.
- f. When "Turn-of-nut" method is used for bolt tightening, the impact wrench or other pneumatic device does not require calibration. However, the device shall be of adequate capacity and sufficiently supplied with air to perform the required tightening of each bolt in approximately ten seconds. When this method is used, the following steps will be followed by construction:
 - 1. All bolts in each joint shall first be brought to a "snug tight" condition (snug tight is defined as the tightness attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench or standard wrench).
 - 2. All the nuts shall then be match-marked using an approved industrial marker, i.e.: Nissen; which has certified contents.
 - 3. All the bolts in the joint shall then be tightened by the applicable amount of nut rotation specified in Attachment 5.
 - 4. Tightening shall progress systematically from the most rigid part of the joint to its freest edges.
 - 5. There shall be no rotation during tightening of the part not turned by the wrench.
 - 6. The end of all bolts shall be marked with the industrial marker when required nut rotation has been attained.
- g. When several bolts are installed in a single joint, the QC Inspector shall assure bolts previously tightened which may have been loosened by the tightening of subsequent bolts are tightened to the prescribed amount.
- h. When field connections are to be made by use of A325 or A490 bolts and tightened with a calibrated torque wrench, a hardened flat washer shall be used under the turned element and shall be tightened as follows:



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<u>Bolt Size</u> <u>(Inches)</u>	<u>ASTM A325</u> <u>Torque</u> <u>(Ft. Lbs.)</u>	<u>ASTM A490</u> <u>Torque</u> <u>(Ft. Lbs.)</u>
1/2	093	
5/8	228	
3/4	387	500
7/8	518	650
1	725	1320
1 1/4	-	2620
1 1/2	-	4565

- i. A490 and Galvanized A325 bolts shall not be reused. Other A325 bolts may be reused if approved by Engineering.

Retightening previously tightened bolts which may have been loosened by the tightening of adjacent bolts shall not be considered as a reuse.

- j. ASTM A449 bolts may be substituted for A325 bolts.
- k. ASTM A307 bolts shall be tightened to a "snug tight" condition.
- l. The QC Inspector shall apply torque seal to all satisfactory tightened nuts/bolts.

3.3.5 Welding Inspection

- 3.3.5.1 All welding and stud welding inspections shall be performed in accordance with Reference 1-J.

The weld joint design shall be limited to those shown on the sketches appearing on qualified WPS/s and/or applicable design document.

3.3.5.2 Welded Attachments to Embedded Strips/Plates

Welded attachments to embedded strip plates and large plates per Reference 1-L will be installed per the following and to the requirements of Reference 1-B.



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3.3.5.2.1 Definitions

- a. "Strip Plates" are those plates $\frac{3}{4}$ " thick, either 8" or 10" wide and of various lengths which are anchored to concrete surfaces by embedded Nelson Studs.
- b. "Large Plates" are those plates $\frac{3}{4}$ " x 4'0" x 8'0" or $\frac{3}{4}$ " x 8'0" x 12'0" which are anchored to concrete surfaces by embedded Nelson Studs. This includes plates of either of these nominal sizes which were modified to include cut-outs or irregular outside shapes to conform to building configurations.

3.3.5.2.2 Permanent Attachment Location

Permanent attachments shall be located in conformance with design documents, but where the special situations described in the following paragraphs are encountered, the locations shall be subject to the provisions stated in this section.

Attachments to "large" plates in the cantilever region as defined on Figure 1 of Attachment 8 shall not be made except in those cases where:

- a. The design document specifically states that investigation of the load being applied to the cantilever region has been accomplished by the designer, or,
- b. The design document provides for an additional member or members which serve to span the cantilever region, and are not attached to the plate within the cantilever region.

When an attachment is made to a strip plate at a location not specifically shown on approved, controlled drawings, and the attachment would be located more than $\frac{3}{4}$ " from the center line of the plate, the location shall be approved by the on-site "CPPE" (Comanche Peak Project Engineering Department) prior to doing the work (See Figure 2 on Attachment 8). Attachments to "strip" plates in the cantilever region as defined on Figure 2 of Attachment 8 shall not be made except in those cases where:

- c. The design document specifically shows that investigation of the load being applied to the cantilever region has been accomplished and that additional stiffeners are provided in the design to transfer the loads to the end set of studs, or,
- d. The design document provides for an additional member or members which serve to span the cantilever region.



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Welds for a hanger, and auxiliary steel where used for that hanger, shall be separated in minimum of 12" from an adjacent hanger and its auxiliary steel (see Figure 3 on Attachment 8), unless otherwise approved by the CPPE. Attachments to embedded weld plates which interface with installed expansion anchors shall provide the required clearances indicated in Reference 1-K, unless otherwise shown on an engineering drawing.

Strip plates which have separation violations with concrete expansion anchors may be rendered unuseable by CPPE Civil Department after an engineering evaluation has been made. Plate sections that are rendered unuseable will be so stated on a DCA. This area of the plate will then be painted red in accordance with the appropriate architectural specification. No attachments shall be made to any portion of a strip plate which has been rendered unuseable and no portion of a strip plate shall be rendered unuseable if it has an attachment already made to it.

3.4 SUPPORTS IDENTIFIED WITH "E" NUMBERS

Supports, or components identified with a unique "E" number 0001 thru 9000, need not be reinspected for welding. This support inspection shall be documented by the QC Inspector by writing opposite the support number listed on the Raceway System Operational Traveler the representative Inspection Report number or Traveler number for weld inspection. If no Inspection Report or Traveler exists, the welds shall be reinspected to requirements in Paragraph 3.3.5.

Supports numbered greater than E9000 shall require acceptance based on a satisfactory Inspection Report or Traveler.

3.5 INSPECTION OF BASEPLATES FOR GROUTING

Inspection of baseplates for grouting shall be performed in accordance with Reference 1-M.

3.6 DESIGN CHANGE VERIFICATION

Conduit supports, or miscellaneous welded electrical components modified as a result of Design Change Documents (DCA/CMC) and included in the package for inspection not yet performed shall be inspected to verify incorporation of changes reflected on the Design Change Document. Verification and inspections will be accomplished utilizing applicable section of this instruction.



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3.7 CONDUIT INSTALLATION INSPECTIONS

3.7.1 Conduit Size and Fittings

The QC Inspector's inspection of conduit size and fittings shall include the following:

- a. The conduit size and fittings shall be as shown on the latest approved Engineering drawing.
- b. Conduit of the next larger size (1/2", 3/4", 1", 1-1/2", 2, 3", 4", and 5") than shown on the electrical drawing may be substituted.
- c. Where necessary, conduit fittings or pull boxes compatible with cable bending radius requirements may be used to minimize use of condulets.

NOTE: Crouse-Hinds condulets Series Form 7, Form 8 and Mark 9 are not acceptable and shall not be used.

- d. The use of condulets is not permitted in 6.9 KV conduit-systems. Where required, sheet metal boxes or O.Z. Gedney type PBW pull box fittings shall be used to provide pull points. The minimum length of opening for cable pulling shall be as follows:

<u>Conduit Size</u>	<u>Pull Box Opening Length</u>
5"	60"
4"	60"
3"	48"

- e. Metallic conduits shall be made electrically continuous for the entire run by securely connecting conduits to boxes and enclosures by use of double locknuts. All terminal ends of conduits shall be provided with bushings-insulating type.
- f. Where required by engineering drawings, watertight enclosures will be used. The conduit connections shall be made with liquid tight hub fittings. The hub fitting shall include a recessed neoprene "O" ring and a nylon insulated throat and shall be as specified on the Material List. Gasketed locknuts may be used where space limits the use of hub fittings.



- g. Conduit shall be made up into full threaded fittings with a minimum of five (5) threads engagement.

NOTE: Thread engagement shall be checked by verifying that the number of exposed threads does not exceed that shown below:

<u>conduit nominal size</u>	<u>maximum number of exposed threads</u>
1/2"	3
3/4" to 1-1/2"	4
2" to 2-1/2"	5
3" to 4"	6
5"	7
6"	8

3.7.2 Conduit Bends

Not more than 3 - 90° bends or equivalent are permitted in any conduit run between junction boxes or pull points unless approved by the Engineer.

3.7.3 Nuclear Instrumentation System Conduits

Installation of NIS Conduit and NIS box functions 6R, W, B and Y shall have a maximum tolerance of ±6 inches when design dimensions are given on drawings.

The QC Inspector shall verify that pull points are located at intervals less than or equal to as defined by $A + B = 100$; "A" is the total number of degrees of conduit bends between the pull points and "B" is the total number of running feet between pull points. Any deviation from this criteria requires a Design Change Authorization.

All field bends for NIS conduit functions 6R, W, B and Y shall have a bending radius of 20" minimum for 4" conduit and 15" minimum for 3" conduit.

Criteria requirements apply to all conduits listed in the following Raceway Function Table:



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<u>CLASS</u>	<u>DWG SYMBOL</u>	<u>CHANNEL</u>	<u>RACEWAY FUNCTION</u>
1E		I	6R
1E		II	6W
1E		III	6B
1E		IV	6Y

The QC Inspector is instructed that Engineering control points shall be utilized to determine locations as well as floor, walls, etc., when shown on design drawings.

3.7.4 Flex Conduit Installation

The installation of the flex conduit portion of raceways that terminate at equipment are not within the scope of this instruction. All other flexible conduit for all areas except the containment shall be Sealtite or Liquied-Tite unless shown otherwise on the drawings. Stainless steel flexible conduit as shown on material list shall be used in containment building. Flex conduit shall be installed in accordance with the applicable detail drawings.

3.7.5 Conduit Identification

3.7.5.1 Conduit identification shall be as shown on the latest approved drawing.

The following are the recommended and alternative methods in identifying conduit:

- a. Recommended Method - Freehand marking of conduit with appropriate black ink marker or paint. Height of conduit number characters should be approximately 1/3 to 1/2 the conduit outside diameter and shall be visible where possible from floor level.



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- b. Alternative Method, No. 1 - Adhesive markers with factory pre-printed conduit numbers or conduit numbers field printed on marker before installation. Adhesive markers shall not be used inside containment or in manholes.
- c. Alternative Method, No. 2 - Metal or plastic tags attached to conduit by various means, i.e., ty-raps, wire. This method is recommended for conduit stub-ups. However, for inside the containment metal tags attached with wire (preferable method) or Tefzel ty-raps or other approved method shall be used.

NOTE: Where groups of conduit pass through walls and floors Alternative Method, No. 2 is recommended for identifying conduits within these groups.

Conduit shall be identified at both ends of each run; at all cable trays where conduit enters or leaves; on both sides of all walls, slabs and boxes through which conduit passes. The exception to this is a single conduit entering and leaving a pull box is not required to be identified. Exposed conduit ten (10) feet or less in length may be identified at either end or the middle of the run.

Groups of embedded conduits which are flush with the surface of walls, floors and manholes shall be identified on the surface of the wall, floor, or manhole by attaching an identification template near the conduit bank. Minimum height of markers shall be approximately two (2) inches where space permits. Marking shall be achieved by stenciling or adhesive markers. Adhesive markers shall not be used inside containment or in manholes.

TABLE 1 (Unit Number)

- 0 - Common to Both Units
- 1 - Unit 1
- 2 - Unit 2



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TABLE 2 (Raceway Function)

1Ø, 1G, 1K	-- 6.9kV ac
2Ø, 2G, 2K	-- 480 Vac & Heavy Power Feeders Under 480 Vac
3Ø, 3G, 3K	-- Control ac and dc and Small Power Feeders Under 480V
4Ø, 4G, 4K	-- Low Level Signals
4R, 4W, 4B, 4Y	-- Reactor Protection Instrumentation Low Level Signals
5K	-- 480V ac & Heavy Power Feeders Under 480V (Local Control)
5R, 5W, 5B, 5Y	-- Reactor Protection Instrumentation 120V Signal
6K	-- Control ac & dc and Small Power Feeders Under 480V (Local Control)
6R, 6W, 6B, 6Y	-- Nuclear Instrumentation System
8K	-- Telephone and Communication

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 -

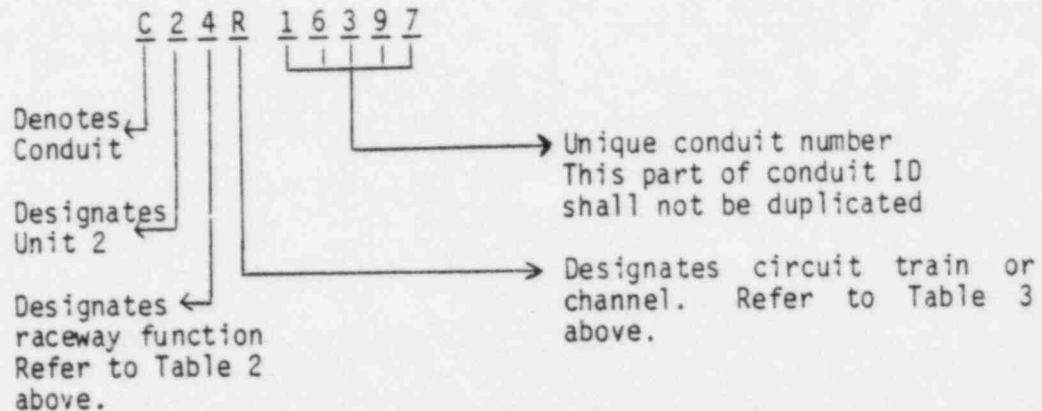
Inst. Channel III - Blue - B -

Inst. Channel IV - Yellow - Y -



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3.7.5.2 A typical conduit identification number is depicted as follows:



Conduit identification shall be verified by the QC Inspector to comply with the latest approved drawing requirements at drawing changes/revisions are released which change a conduit's identification after QC acceptance of the conduit, the following actions shall be taken:

- Changes to "Raceway Function", "Train/Channel Designation" or "Unique Number" shall require rework to reidentify the conduit and QC verification of proper identification. An IR, Attachment 2, shall be initiated to document the above verification. All Inspection attributes except "Verify Conduit Identification" shall be noted "N/A" and the drawing number and revision or DCA number that authorized the change shall be recorded in the "Remarks" section. The previous conduit identification shall also be referenced in the "Remarks" section.
- Changes to the "Unit Designation" shall not require reidentification and reinspection of the affected conduits. The Interim Vault shall prepare a Permanent Plant Records Vault Transmittal, to document these conditions and provide a cross reference record. The transmittals shall be sent to the Permanent Plant Records Vault for filing with the respective conduit records.

3.7.5.3 The following are acceptable methods of color coding conduit containing safety related cables:



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- a. Recommended Method - Paint exposed conduits with a full 360° band at intervals not to exceed 15 feet and at points of entry to and exit from enclosed areas and on both sides of floor and wall penetrations. Paint color shall match as close as possible the appropriate cable jacket color of the safety related cables to be installed in a conduit. Paint band shall be at least one inch wide and shall be readily visible from floor level. It is recognized that for conduits installed against walls and floors, it may be impossible to obtain a full 360° band for color coding requirements. In these cases, the maximum band possible shall be made.
- b. Alternative Method - Use color coded adhesive markers with similar requirements as to color, width or marker.

Adhesive marking labels shall not be used inside containment or in manholes.

3.7.6 Verify Junction and Pull Box Size and Type

Unless shown otherwise on material lists or drawings, junction boxes shall be type NEMA 12 enclosure (minimum).

Where the installation and corresponding drawing requires a Nema 4 junction box the QC Inspector shall verify that the junction box is a Nema 4.

The QC Inspector shall verify that rubber gaskets have been installed on the mounting hardware (interior and exterior) and is of the type and size as specified on the drawing, Reference 1-N and 1-0.

Electrical "pull boxes" which are unscheduled on the Engineering drawings, may be installed to minimize conduit installation problems.

Where junction boxes are provided solely as cable pulling points in the conduit system and where space or support considerations make junction box installation impractical, pull box fittings, OZ/Gedney type "PBW" or approved equal, may be substituted for the junction box shown on the drawing.

Where junction boxes are used as terminal boxes the inspector shall visually inspect for those attributes previously stated herein for boxes and, in addition, verify the mounting hardware for the terminal block installed.



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NOTE: The terminal block will be inspected by the inspector inspecting cable/wire terminations in accordance with Reference 1-P.

3.8 JUNCTION AND PULL BOX INSTALLATION INSPECTIONS

The QC Inspector shall inspect the installation of electrical boxes in accordance with applicable approved Engineering drawings. Inspections shall consist of, but are not limited to, the following items:

3.8.1 Verify Box Orientation

All box covers and fittings shall face away from walls and/or obstructions which would prohibit future maintenance.

3.8.2 Verify Box Identification

All junction boxes shall be identified as noted on the drawings and in accordance with the following.

Stencil characters in black on junction box covers. Height of junction box number characters shall be a minimum of two inches except that characters may be smaller where size of box cover would require more than two lines to complete junction box number.

NOTE: Unscheduled pull boxes shall be identified by the letters "PB" or "pull box".

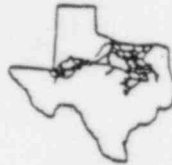
Free-hand marking of junction boxes is acceptable for size 12 x 12 x 12 and smaller.

3.8.3 Verify Box Color Code

Safety-related junction boxes containing safety related cable shall be color coded prior to cable installation in accordance with the following.

Stencil an approximate 2" x 2" square on cover of junction box and also on one edge of junction box when the cover is not attached to the junction box by means of a sash chain.

NOTE: On smaller boxes, size of colored square may be reduced if there is not enough surface area for both.



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Paint color shall match as close as possible the appropriate cable jacket color of safety related cables to be pulled through the junction box. Where possible, the colored squares shall be readily visible from floor level.

NOTE: Where a Raceway or junction box contains only associated cable(s), at least one white horizontal stripe shall be applied over each applicable train color coded marking and where possible, shall be visible from floor level.

3.8.4 Verify Box Free of Damage

All boxes shall be free from burrs, rough edges, and foreign material which could cause cable damage during pulling.

Galvanize damage shall be repaired with Galvanox or an Engineering approved equal.

3.8.5 Verify Mounting Strips Installed

Verify mounting strips installed in boxes. Mounting strips shall be in accordance with References 1-Q and 1-R. The QC Inspector shall inspect for the correct type and number of mounting strips and ensure the proper hardware is used.

3.8.6 Verify NIS Box Location

NIS box installations shall have a maximum tolerance of \pm six (6) inches when design dimensions are given on drawings.

3.9 VERIFY SEPARATION

Conduit Raceway and supports shall be inspected in accordance with the requirements of Paragraph 3.9.1, and documented on the Inspection Report, Attachment 2.

The item(s) which violate separation requirements shall be identified by affixing a "separation violation tag", Attachment 2A, and be reported on the Separation Deficiency Report, Attachment 2B, completed in accordance with the instructions given on Attachment 2C.

3.9.1 Conduit

Conduit shall be installed in accordance with the typical detail drawings and as close as practical to the location shown on engineering plan drawings. Junction boxes, pull boxes, conduit fittings, etc., are part of the conduit system and, therefore, are subject to the same separation criteria.

NOTE: The minimum separation distance between Raceways shall be defined as the "clear air distance" between them.

- a. Minimum separation between conduits having different trains or channels shall be one inch.
- b. Minimum separation of six (6) feet shall be maintained between 6.9 kV raceway and Nuclear Instrumentation System (NIS) raceways.
- c. A minimum separation of 6'-0" must be maintained between raceway functions 2Ø, 2G, 2K, 3Ø, 3G, 3K, 5K, 6K, 5R, 5W, 5B, 5Y and NIS cables not in conduit (e.g., near electrical penetrations).

NOTE: Refer to Attachment 7 for the voltage level designation.

- d. A minimum separation of 2'-0" shall be maintained between parallel runs of "NIS" conduit systems (raceway functions) 6R, 6W, 6B, & 6Y & raceway systems 2Ø, 2G, 2K; 3Ø, 3G, & 3K; 5K, 6K & 5R, 5W, 5B, & 5Y. 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) should attain the above 2'-0" minimum when feasible; however, physical constraints may reduce such separation to 1".
- e. "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.

The clearance criteria as explained above may be waived;

- a) At such points where exposed conduits enter or exit any equipment or box to a point of 4'-0" from such equipment or box.



- b) 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 ft.

All other violations of the clearance criteria shall be reviewed by Engineering on case by case basis.

- f. Minimum separation between a conduit containing safety related cables and associated cables and the top of a tray having different train or channels shall be two (2) feet in cable spreading room and three (3) feet in general plant area. This separation may be reduced to one (1) inch when the tray has a solid cover. When the conduit above an open tray contains non-safety related cable, the minimum separation is one inch and no covers are required.
- g. Minimum separation between a conduit (safety or non-safety related) and a bottom or side of a tray (solid bottom or ladder) shall be one inch.
- h. Cables routed in free air exiting or entering conduit raceway shall maintain:
 - 1. A minimum of three feet horizontally and five feet vertically between redundant cable or conduit raceway in general plant areas.
 - 2. A minimum of one foot horizontally and three feet vertically between redundant cable or conduit raceway in cable spreading area and control room.
- i. Raceways and supports shall not be located within six (6) inches of Class I or Class II piping welds or component welds (valves, gauges, etc.), except conduit or conduit supports necessary for pipe mounted instrumentation.
- j. Conduit and conduit supports shall be separated from piping (with operating temperature of 200°F or greater) or piping insulation by one inch.
- k. In no case shall any part of the raceway or raceway support system come in direct contact with uninsulated equipment in the piping system or with pipe restraints or anchors unless otherwise approved by the Engineer.



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NOTE:

Class I or Class II piping welds can be identified by the mechanical ID Tags. Typical spool piece tag number: 3"-SB-1-63-301-5 (last numeral is class). If tag cannot be seen, go to pipe support typcial tag number: SFX-022-700-A55D (last numeral is class). Support will be the same as pipe it supports.

1. Raceways and supports shall not be located closer than 1/8 inch from instrument sensing lines.

3.10 CONDUIT ACCEPTANCE

All conduit and boxes which have been inspected and accepted shall be documented on Inspection Reports, Attachment 2 and/or 3 and included in the Raceway Package.

3.11 FINAL RACEWAY SYSTEM INSPECTION

- 3.11.1 The QC Inspector shall verify the conduit raceway system has been installed in accordance with the requirements of the isometric drawing.

- 3.11.2 All final raceway system inspections will be documented on Attachment 4.

3.12 DOCUMENTATION

Inspection Reports shall be in accordance with Reference 1-S. Documentation packages will be processed in accordance with Reference 1-C.

3.13 NONCONFORMANCES

All unsatisfactory conditions shall be documented on an IR and/or a NCR, per References 1-S and 1-T respectively, as directed by the QC Supervisor.

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ATTACHMENT 1

COMANCHE PEAK STEAM ELECTRIC STATION

INSPECTION REPORT

SHEET 25
NO

ITEM DESCRIPTION CLASS 1E CONDUIT RACEWAY FABRICATION		IDENTIFICATION NO		SYSTEM / STRUCTURE DESIGNATION	
SPEC NO	REV	REF Q.C. DOC & REV & CHANGE NO	MEASURE OR TEST EQUIPMENT NO		
5		QI-QP-11.10-1A Rev.			
<input type="checkbox"/> IN PROCESS INSPECTION		<input type="checkbox"/> PRE-INSTALLATION VERIFICATION	<input type="checkbox"/> INSTALLATION INSPECTION	<input type="checkbox"/> FINAL INSPECTION	<input type="checkbox"/> PRE-TEST INSPECTION
INSPECTION RESULTS					
<input type="checkbox"/> INSPECTION COMPLETED, ALL APPLICABLE ITEMS SATISFACTORY					
<input type="checkbox"/> INSPECTION COMPLETED, UNSATISFACTORY ITEMS LISTED BELOW					
ITEM NO.	INSPECTION ATTRIBUTES			SAT	UNSAT
(V) 1.	Conduit free of burrs, sharp edges and foreign material -(Paragraph 3.1A)				
(V) 2.	Conduit free of internal and external flaking - (Paragraph 3.1B)				
(V) 3.	Conduit threads not irregular, jammed or undercut - (Paragraph 3.1C)				
(V) 4.	Dies for conduit threads are standard U.S. conduit tapered threads -(Paragraph 3.1D)				
(V) 5.	Conduit threads cleaned and painted with Galvanox - (Paragraph 3.1E)				
(V) 6.	Conduit bends free of kinking or excessive flattening- (Paragraph 3.1F)				
(V) 7.	Conduit bends and offsets made with approval benders - (Paragraph 3.1G)				
REMARKS (DWGS, SPECS, ETC)					
RELATED NCR NO	I.R. CLOSED	DATE	SIGNATURE		
5			QC INSPECTOR		

TYPICAL

MIA/01 1/84

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ATTACHMENT 2

COMANCHE PEAK STEAM ELECTRIC STATION

INSPECTION REPORT

SHEET 27
NO

ITEM DESCRIPTION CLASS 1E CONDUIT RACEWAY		IDENTIFICATION NO.		SYSTEM/STRUCTURE DESIGNATION	
SPEC. NO.	REV.	REF. Q.C. DOC. & REV. & CHANGE NO.	MEASURE OR TEST EQUIP. IDENT. NO.		
		QI-QP-11.10-1A Rev.			
<input type="checkbox"/> IN PROCESS INSPECTION		<input type="checkbox"/> PRE INSTALLATION VERIFICATION		<input type="checkbox"/> INSTALLATION INSPECTION	
		<input type="checkbox"/> FINAL INSPECTION		<input type="checkbox"/> PRE TEST INSPECTION	
INSPECTION RESULTS					
<input type="checkbox"/> INSPECTION COMPLETED, ALL APPLICABLE ITEMS SATISFACTORY					
<input type="checkbox"/> INSPECTION COMPLETED, UNSATISFACTORY ITEMS LISTED BELOW					
ITEM NO.		INSPECTION ATTRIBUTES		SAT	UNSAT
				DATE	QC SIGNATURE
1.	Verify conduit size and fittings (Refer to Para. 3.7.1)				
2.	Verify total conduit bends (Refer to Para. 3.7.2)				
3.	Verify NIS Conduit (Refer to Para. 3.7.3)				
4.	Verify flex conduit installation (Refer to Para. 3.7.4)				
5.	Verify conduit identification (Refer to Para. 3.7.5)				
6.	Verify pull box size and type (Refer to Para. 3.7.6)				
7.	Verify pull box installation (Refer to Para. 3.8)				
8.	Verify raceway separation (Refer to Para. 3.9 & 3.9.1)				
9.	Verify NIS raceway separation (Refer to Para. 3.9 & 3.9.1)				
REMARKS (DWGS, SPECS, ETC.)					
Separation Deficiency Item No.:					
RELATED NCR NO.		I.R. CLOSED		DATE	SIGNATURE
					QC INSPECTOR

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ATTACHMENT 2A

YELLOW

CPSES
**SEPARATION
VIOLATION**

I.R. NO. _____

DEFICIENCY REPORT ITEM # _____

☐ **WAIVER APPROVED**

Q.C. INSPECTOR _____ DATE _____

**DO NOT REMOVE THIS TAG
WITHOUT Q.C. AUTHORITY**

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ATTACHMENT 2B

RACEWAY SEPERATION DEFICIENCY REPORT

REFERENCE IR#:

ROOM# :

ELEV. : 373

AREA:

[illegible]



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ATTACHMENT 2C

The following steps will be followed in processing of the Separation Deficiency Report (Attachment 2b) for Unit 2.

Step 1: QC will report the unsatisfactory as-found condition in the Block 2 Description Section and attach a "Separation Violation" Tag with the IR number and Deficiency Report item number entered on the line provided (Attachment 2A). The tag shall be placed at the area where the violation occurs.

2: The Paper Flow Group will retain a copy of the Deficiency Report and forward the original to Engineering for disposition in Block 3.

3: Upon completion of the Engineering Disposition Block 3, Engineering will assign the responsible craft in Block 4 and forward the original Deficiency Report to the Paper Flow Group for distribution.

NOTE: When Block three (3) is dispositioned "Use as is" and the deficiency is not in accordance with ES-100, or the disposition is "Rework" but the work is not in the scope of CPP procedures, a NCR will be issued, and the deficient item closed referencing the NCR.

EXCEPTION: When a traveler is issued for rework, it is not necessary that a procedure be issued. The traveler shall have detailed instructions.

4: For those unsatisfactory conditions which would restrain or impact ongoing construction activities, Engineering may request authorization to proceed providing the following conditions are satisfied:

- a. The deficiency disposition includes sufficient information and direction for accomplishing the work.
- b. Engineering has stated the reason for waiver in Block 5.
- c. Engineer Review/Approval shall be by the Engineering Discipline Engineer or his designee (Block 5).
- d. Quality Assurance review/approval shall be by the Discipline Quality Engineers designated to review/approve NCR dispositions (Block 5).



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ATTACHMENT 2C
(continued)

- e. After approval of the waiver, the QC Inspector shall check the waiver approved block then sign and date the appropriate section of the "Separation Violation" Tag.
- 5: When the responsible craft completed the items listed on the Deficiency Report, by working the Engineering disposition and QC has signed all steps for acceptance, the QC Inspector shall remove the "Separation Violation" tag. The QC Inspector shall obtain the original IR, with the Deficiency Reports attached, sign and date the Deficiency Report, Block 6, for the item just worked.

When all items have been completed on the Deficiency Report, the IR shall be closed and processed in accordance with Reference 1-T.

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ATTACHMENT 3

COMANCHE PEAK STEAM ELECTRIC STATION

INSPECTION REPORT

[illegible]

M1A/03 7/84

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COMANCHE FEAR STEAM ENGINE 14" UN

WEST 28

[illegible]

TYPICAL



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ATTACHMENT 5

NUT ROTATION^a FROM SNUG TIGHT CONDITION

Disposition of Outer Faces of Bolted Parts

Both faces normal to bolt axis, or one face normal to axis and other face sloped not more than 1:20 (bevel washer not used)		Both faces sloped not more than 1:20 from normal to bolt axis (bevel washers not used)
Bolt length ^b not exceeding 8 diameters or 8 inches	Bolt length ^b exceeding 8 diameters or 8 inches	For all length of bolts
1/2 turn	2/3 turn	3/4 turn

a. Nut rotation is rotation relative to bolt regardless of the element (nut or bolt) being turned. Tolerance on rotation: $\pm 30^\circ$
For coarse thread heavy hex structural bolts of all sizes and length and heavy hex semi-finished nuts.

b. Bolt length is measured from underside of head to extreme end of point.

UNISTRUT (A-307) BOLTS












BOLT SIZE (INCHES)	TORQUE (FT. LBS.)
1/4	6
5/16	11
3/8	19
1/2	50



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ATTACHMENT 6

ASTM AND SAE GRADE MARKINGS FOR STEEL BOLTS AND SCREWS

Grade Marking	Specification	Material
 NO MARK	SAE-Grade 1	Low or Medium Carbon Steel
	ASTM-A 107	Low Carbon Steel
	SAE-Grade 2	Low or Medium Carbon Steel
	SAE-Grade 3	Medium Carbon Steel, Quenched and Tempered
	ASTM-A 149	
	SAE-Grade 3.2	Low Carbon Martensitic Steel, Quenched and Tempered
	ASTM-A 325 Type 1	Medium Carbon Steel, Quenched and Tempered
	ASTM-A 325 Type 2	Low Carbon Martensitic Steel, Quenched and Tempered
	ASTM-A 327 Type 3	Atmosphere Corrosion (Weathering) Steel, Quenched and Tempered
	ASTM-A 354 Grade 88	Low Alloy Steel, Quenched and Tempered
	ASTM-A 354 Grade 8C	Low Alloy Steel, Quenched and Tempered
	SAE-Grade 7	Medium Carbon Alloy Steel, Quenched and Tempered, Roll Threaded After Heat Treatment
	SAE-Grade 8	Medium Carbon Alloy Steel, Quenched and Tempered
	ASTM-A 354 Grade A7	Alloy Steel, Quenched and Tempered
	ASTM-A 490	Alloy Steel, Quenched and Tempered

ASTM Standards:

- A 307 - Low Carbon Steel Externally and Internally Threaded Standard Fasteners.
 A 325 - High Strength Steel Bolts for Structural Steel Joints, Including Suitable Mark and Plain Hexagonal Washers.
 A 327 - High Strength Steel Bolts for Structural Steel Joints, Including Suitable Mark and Plain Hexagonal Washers.
 A 354 - Quenched and Tempered Alloy Steel Bolts and Screws with Suitable Mark.
 A 490 - Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints.

SAE Standards:

- J 429 - Mechanical and Quality Requirements for Externally Threaded Fasteners



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ATTACHMENT 7

VOLTAGE LEVEL DESIGNATION TABLE

1Ø, 1G, 1K	-- 6.9kV ac
2Ø, 2G, 2K	-- 480 Vac & Heavy Power Feeders Under 480 Vac
3Ø, 3G, 3K	-- Control ac and dc and Small Power Feeders Under 480V
4Ø, 4G, 4K	-- Low Level Signals
4R, 4W, 4B, 4Y	-- Reactor Protection Instrumentation Low Level Signals
5K	-- 480V ac & Heavy Power Feeders Under 480V (Local Control)
5R, 5W, 5B, 5Y	-- Reactor Protection Instrumentation 120V Signal
6K	-- Control ac & dc and Small Power Feeders Under 480V (Local Control)
6R, 6W, 6B, 6Y	-- Nuclear Instrumentation System
8K	-- Telephone and Communication

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ATTACHMENT 7 (Continued)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7
CH. I	CH. II	CH. III	CH. IV	Train A	Train B	Train C*

*Non-CLASS 1E (INCLUDES CONTROL CHANNELS 1, 2, 3 & 4 AS
DEFINED BY W)

Item shown in each vertical column is separated from
items in all other vertical columns by acceptable separation
distance of 3'x 5', 1'x 3', barrier, etc.
Relative arrangement within a vertical column is determined
by voltage level.



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ATTACHMENT 8

Figure 1

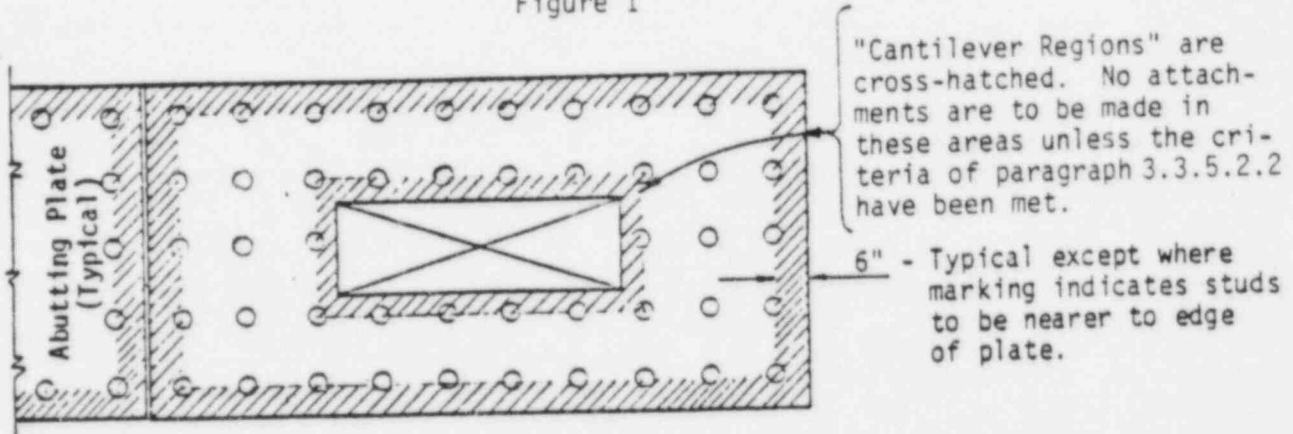


FIGURE 2

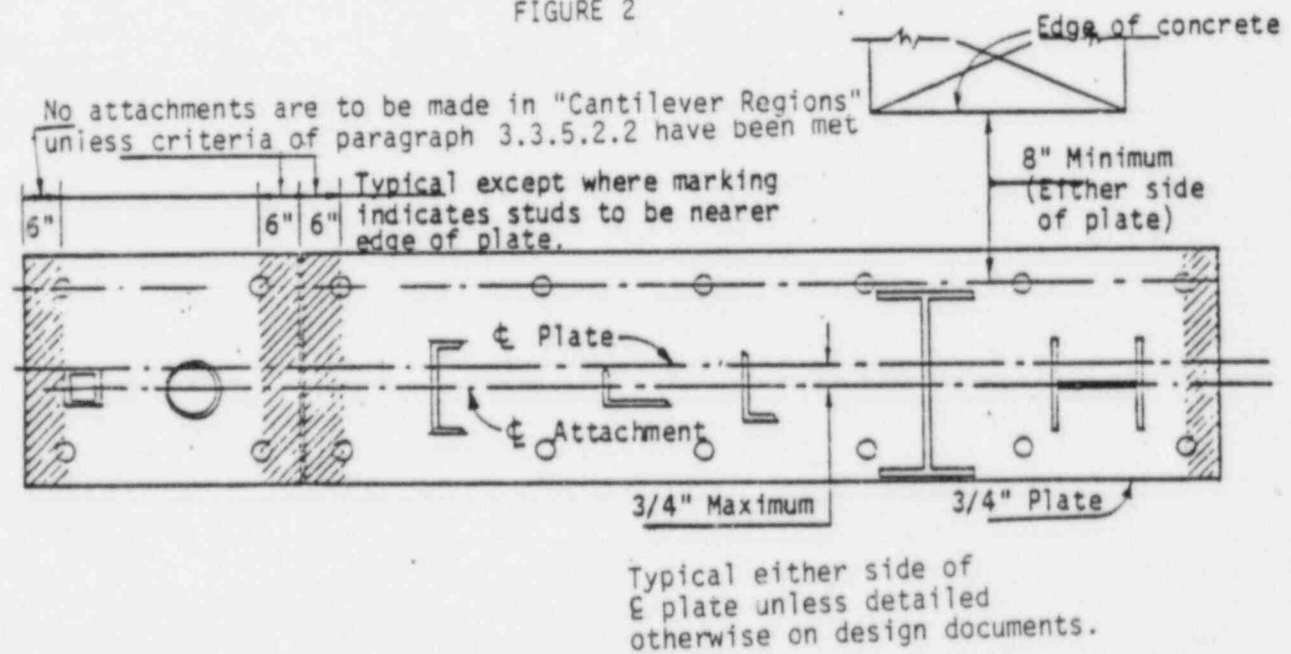


Figure 3

