

#45

BROWN & ROOT, INC.

- CPSES - 35-1195

BROWN & ROOT INSTRUCTION
QI-QAP-11.1-28
FABRICATION AND INSTALLATION INSPECTION
OF SAFETY CLASS COMPONENT SUPPORTS

~~CONTROLLED COPY~~
~~CONTROL No. AG18~~

REVISION: 38

ISSUE DATE: 007 09 1987

REVIEW: *[Signature]*
Construction Project Manager

APPROVAL: *[Signature]*
Site QA Manager

8803280285 880331
PDR ADOCK 05000445
E PDR

TS PRO...

BROWN & ROOT INSTRUCTION
QI-QAP-11.1-28
FABRICATION AND INSTALLATION INSPECTION
OF SAFETY CLASS COMPONENT SUPPORTS

TABLE OF CONTENTS

1.0	<u>REFERENCES</u>
2.0	<u>GENERAL</u>
2.1	<u>PURPOSE AND SCOPE</u>
2.2	<u>RESPONSIBILITY</u>
2.3	<u>PERSONNEL QUALIFICATIONS</u>
2.4	<u>NON-CONFORMANCE CONTROL</u>
3.0	<u>INSTRUCTION</u>
3.1	<u>COMPONENT SUPPORT CONFIGURATION CONTROL</u>
3.1.1	<u>Component Support Drawings</u>
3.1.2	<u>Component Support Fabrication/Installation Process</u>
3.2	<u>MATERIAL IDENTIFICATION</u>
3.2.1	<u>Material Identification Requirements</u>
3.2.2	<u>Material Identification Documentation</u>
3.3	<u>COMPONENT SUPPORT FABRICATION/INSTALLATION INSPECTION</u>
3.3.1	<u>Material Dimensional Control</u>
3.3.2	<u>Sway Strut</u>
3.3.3	<u>Snubber</u>
3.3.4	<u>Spring Cans/Constant Supports</u>
3.3.5	<u>Pipe Supports Containing Low-Friction Bearing Plates</u>
3.4	<u>WELDING</u>
3.4.1	<u>Cleanliness and Fit-up Requirements</u>
3.4.2	<u>Preheat/Interpass Temperature</u>
3.4.3	<u>Welder and Welding Material Verification</u>
3.4.4	<u>Weld and Base Material Inspection Requirements</u>
3.5	<u>WELD DOCUMENTATION OF COMPONENT SUPPORTS</u>
3.6	<u>CRITERIA FOR INSTALLATION OF CONCRETE ANCHOR BOLTS</u>
3.6.1	<u>Documentation</u>
3.6.2	<u>Bolt Length Identification System</u>
3.6.3	<u>Embedment Length</u>
3.6.4	<u>Bolt Installation/Setting of Wedges</u>
3.6.5	<u>Richmond Inserts</u>
3.7	<u>CRITERIA FOR INSTALLATION OR AIRCRAFT CABLE SUPPORTS</u>
3.7.1	<u>Installation/Documentation</u>
3.7.2	<u>Inspection Criteria</u>

- 4.0 WORK INVOLVING SUPPORT MODIFICATION AFTER QC ACCEPTANCE
- 5.0 WORK ON COMPONENT SUPPORTS AFTER QC AND ANI ACCEPTANCE
- 5.1 WORK ADDING, REPLACING OR REMOVING PARTS
- 6.0 COMPONENT SUPPORT PROCESSING/STATUSING

ATTACHMENTS

- 1 Baseplate Tolerances/(laying flat)
- 2 Alternate Baseplate Tolerances (laying flat)
- 3 CSSIR
- 4 Sway Strut Inspection Report
- 5 Snubber Inspection Report
- 6 Spring Can/Constant Support Inspection Report
- 7 Low-Friction Bearing Plate Inspection Report
- 7A Lubrite/Lubron Plates
- 8 Weld Inspection Report
- 9 Weld Reinforcement
- 10A Fillet Weld - Corner Wrap
- 10B Flare Bevel Weld - Corner Wrap
- 10C Fillet Weld - Stepped Joints
- 11 Skewed Fillet Weld Measurement
- 12 Full/Partial Penetration Welds/Skewed Stanchion
- 13 Concrete Anchor Bolt Inspection Report
- 14 Hilti Embedment/Identification
- 15 Hilti Size Chart
- 16 Bolting Substitution
- 17 Air Craft Cable Typical Details
- 18 Air Craft Cable Inspection Report
- 19 Beveled Washer Dimensions
- 20 Intermittent Welds
- 21 Structural Shapes, Tolerances

ABBREVIATIONS

ANII -	Authorized Nuclear Inservice Inspector
QCI -	Quality Control Inspector
QA -	Quality Assurance
QC -	Quality Control
CD -	Certified Drawing
PFG -	Paper Flow Group
WP -	Work Package
MR -	Material Requisition
WDC -	Weld Data Card
MWDC -	Multiple Weld Data Card
WFML -	Weld Filler Material Log
MRS -	Manufacturing Record Sheet
SAVC -	Structural Assembly Verification Card
MIL -	Material Identification Log
RPS -	Repair Process Sheet
OT -	Operational Traveler
NCR -	Nonconformance Report
IR -	Inspection Report
MIC -	Material Identification Code
CMTR -	Certified Material Test Report
BOM -	Bill of Materials
CSSIR -	Component Support Structural Inspection Report
WPS -	Weld Procedure Specification
IRN -	Inspected Item Removal Notice
DOA -	Description of Activities
IRV -	Interim Records Vault
HIR -	Hanger Index Report

1.0 REFERENCES

- 1-A ASME Section III, Division 1, Subsection NF, 1974 Edition through Winter 1974 Addenda
- 1-B ASME Section XI, Division 1, 1980 Edition, Winter 1981 Addenda
- 1-C CPSES Specification 2323-MS-46A
- 1-D CPSES Specification 2323-MS-100
- 1-E Brown & Root Quality Assurance Manual
- 1-F Index "BRH" Typical Inspection Drawings

2.0 GENERAL

2.1 PURPOSE AND SCOPE

This instruction delineates the inspection criteria, requirements and methods to be used when performing fabrication, installation, examination and inspection of Unit 1 and Common ASME Class 1, 2, and 3 and Seismic Category I and II component support repairs, replacements or modifications and to assure compliance with the above references. Verification of support location will be performed in accordance with CP-QAP-12.1.

2.2 RESPONSIBILITY

The Quality Control Supervisor shall be responsible for implementation of this instruction.

2.3 PERSONNEL QUALIFICATIONS

All QC Inspectors (QCI) performing inspections in accordance with this instruction shall be trained, qualified and certified in accordance with the requirements of AAP-2.4.

2.4 NON-CONFORMANCE CONTROL

During QC inspection, characteristics which are identified as unacceptable shall be documented in accordance with QA Procedure AAP-16.1. QCI shall document the NCR number on the applicable process documentation.

3.0 INSTRUCTION

3.1 COMPONENT SUPPORT CONFIGURATION CONTROL

3.1.1 Component Support Drawings

Component support construction drawings issued by Engineering shall be used to define structural configuration. Additionally, "Typical Inspection Drawings" are issued by Engineering to further define fabrication/installation inspection details, generic component modification methods, and Engineering approved alternative fabrication/installation processes. Component support drawings and typical inspection drawings are issued by Engineering through the Site Document Control Center as "Controlled Documents" in accordance with Section 7 of Reference 1-E.

In addition, a controlled copy of the vendor catalog may be used for vendor supplied items that are not included in the Typical Inspection Drawings. The vendor catalog are controlled by SWEC Project Manager and issued by PSE Training Coordinator. The QCI shall document these

inspections on the CSSIR Section C-2 by entering "Catalog" in lieu of Typical Inspection Drawing description.

Engineering may issue design changes to document changes or deviations to specified design/construction requirements.

Prior to final QA acceptance of a component support, Engineering will issue a Certified Drawing (CD). This drawing will incorporate all outstanding design changes.

Construction drawings and all applicable outstanding design changes shall be used as the basis for QC to verify as-constructed acceptability. If the CD or Category II drawing does not agree with the Construction drawing, Paper Flow Group (PFG) will issue proper documentation for QC to re-inspect to verify compliance. In addition, the QC Document Review Group will assure all drawing design changes have been implemented, verified and documented whether identified by PFG or not. Implementation of the above will be verified per CP-QAP-12.1.

NOTE A: When a difference exists between the drawing and this procedure, the criteria delineated on the drawing governs. The design and installation specifications contain generic data that shall be considered part of the drawing, unless specifically noted otherwise on the drawing.

NOTE B: When a difference exists between this procedure and the specification, the requirements of the specification governs.

3.1.2 Component Support Fabrication/Installation Process

QCI shall inspect and complete the applicable process control documentation and applicable Inspection Reports for any new installations. For modification, the Inspection Reports are required to be completed (as applicable) for the modification portion of the component support. Design changes/drawing revisions that require inspections only, (no physical work) shall be inspected and documented on the process documentation (MWDC) only. Inspection reports are not required.

The Unit I Reinspection effort is generally paralleled by Inspection reports either from QI-QAP 11.1-28 (In-process work) and CP-QAP 12.1 (Final Verification). Redundant inspection attributes exist within these check lists. It is acceptable for QCI to document inspections on either type of checklist when attributes are redundant.

3.1.2.1 Component Support Work Package (WP) Contents

Package Flow Group (PFG), upon receipt of the controlled construction drawing, will prepare the fabrication/installation WP. The typical WP will contain the following documents, as applicable:

- a. Controlled copy of the hanger drawing.
- b. Material Requisition(s) (MR) for material used in fabrication/installation.
- c. Weld/Multiple Weld Data Card(s) (WDC/MWDC) for B&R installed welds.
- d. Weld Filler Material Log(s) (WFML) for weld filler material consumed in B&R welds.
- e. Manufacturing Record Sheet (MRS) for fabrication or modification.
- f. Material Identification Log/Structural Assembly Verification Card (MIL/SAVC) to provide traceability of installed items or material.
- g. Repair Process Sheets (RPS) for B&R repaired welds.
- h. Construction Operation Travelers (OT) for mechanical assembly activities.
- i. Vendor-supplied Component Modification Record for modification of component standard supports.
- j. Applicable QC Inspection Reports (IR).
- k. Applicable "Typical Inspection Drawings".
- l. Nonconformance Report (NCR).
- m. Non-destructive Examination Report.
- n. Design Changes.

3.1.2.2 Package Preparation/Transition

The following delineates the exceptions and action required for implementing the transition for existing work packages generated per N61-1 to the new Section XI Program, (ECE-2.26-06).

Packages with open Operational Travelers which were initiated and processed through the Operations Interface Task Force (ITF) may be completed and inspected per the instructions on the traveler in the following manner:

- a. Design change package drawings/design changes will remain in the package. Additionally, Paper Flow Group (PFG) will request controlled copies of the drawing from DCC and place in package for inspection purposes.
- b. PFG will revise the Operational Traveler to delete all open operational steps and will initiate a Multiple Weld Date Card (MWDC) with hold points that re-establish the deleted operational steps. Operational Traveler revision will require routing of the package for the same approvals as required for the original traveler. For those Operational Travelers where no operational steps have been signed, the traveler will be voided and a MWDC will be issued.

NOTE: Those design change packages with open Operational Travelers that have been issued to delete supports may be completed per the instructions on the traveler.

3.1.2.3 Voided Supports

When a support is voided, craft shall notify QC by means of a MWDC and QC shall document as such by signing the appropriate hold points. Voided supports are defined as supports which no longer support piping. Portions of supports may still exist.

3.2 MATERIAL IDENTIFICATION

3.2.1 Material Identification Requirements

3.2.1.1 Vendor Supplied Component Supports and Bulk Items

Vendor supplied "NPT" stamped component supports shall bear

manufacturers serial number. Component supports requiring field welds at installation shall bear mechanically marked, unique identification on each part traceable to the vendor data package.

NPSI supplied hardware is identified by miscellaneous markings such as NF, NR, etc; ITT supplied hardware is identified by alpha markings A, B, C, etc. NPSI & ITT bulk items shall not be interchanged for vendor supplied component supports, unless authorized by Engineering.

3.2.1.2 Component Standard Supports (Catalog Items)

Component standard supports, such as pipe clamps, U-bolts, etc., shall be traceable to the material type and grade until the material is installed and verified by QC. Component standard supports shall be controlled until issuance for fabrication/installation in accordance with Brown & Root Quality Procedure AQP-11.4.

The acceptability of a component standard support, or fastener, for fabrication/installation is identified by the vendor's unique marking (i.e., letter code, MIC no., serial no. etc.) or a Brown and Root applied color code (Class 1 - Black, Classes 2 and 3 - Green.)

Dimensional verification through the use of "Typical Inspection Drawings" (i.e., FXB, FXN, etc.) or a specific material grade stamp (i.e., B7 for bolts, 2H for nuts, etc.) are acceptable identification means for fasteners utilized in Non-ASME applications.

3.2.1.3 Brown and Root Fabricated/Modified Component Supports

Brown and Root fabricated Class 1 component supports shall bear unique markings on each item of structural steel used in the fabrication of the component traceable to a Certified Material Test Report (CMTR). Structural steel used in the fabrication of Class 2 and 3 component supports shall bear unique identification traceable to the material type and grade. Materials used to modify vendor-supplied component supports shall also comply with the preceding requirements.

3.2.1.4 Material Traceability Requirements

Material for component supports shall carry identification markings which will remain distinguishable until the fabri-

cation and installation of the component support is accepted. Identification marking shall be documented on the MIL/SAVC. If the original identification markings are cut off/divided or covered by additional fabrication, the identification shall be accurately transferred to assure identification of each piece of material during subsequent fabrication or installation. QC shall verify marking transfer prior to separation/coverage and document on the MIL/SAVC.

NOTE: When shim material is used to maintain pipe clearance and traceability markings are covered by additional fabrication, reverification of traceability after installation is not required by QCI.

NOTE: For support modifications that require complete removal of previously accepted permanent material, previously accepted identification markings shall be transferred to each piece of material to assure accurate identification. QC shall verify identification markings prior to removal and document on the MIL. Fastener materials shall be bagged and tagged to prevent loss of materials or identification.

3.2.2 Material Identification Documentation

3.2.2.1 Material Identification Log (MIL)/Structural Assembly Verification Card (SAVC)

During fabrication/installation of component supports, material acceptability shall be documented on the MIL/SAVC. The QCI shall sign and date the MIL/SAVC to indicate that materials listed are properly identified and documented.

NOTE: The SAVC is utilized to document material acceptability for Moment Restraints and Equipment Supports.

NOTE: The shop/field QCI shall compare entries on the MIL/SAVC with the respective MR to assure that the material has been verified by Receiving QCI and is acceptable for its intended use. The MR number shall be recorded on the MIL/SAVC. Copies of MRs for bulk material verified by shop QCI are not required to be included in the support package.

3.2.2.2 Material Issuance

Material required for the repair or replacement shall be provided by TU Electric.

3.3 COMPONENT SUPPORT FABRICATION/INSTALLATION INSPECTION

3.3.1 Material Dimensional Control

3.3.1.1 Component Support Structural Items

Fabrication/installation of structural items shall be inspected to ensure compliance with the dimensions on the construction drawing and applicable criteria delineated on the Component Support Structural Inspection Report (CSSIR), Attachment 3.

When the design drawing shows a structural member laying flat on the base plate, the applicable tolerances for the dimensions indicated on the design drawing shall be as shown in Attachments 1 and 2 as applicable.

Cut lengths of structural members shown in the Bill of Materials on design drawings are for material take-off purposes only and are not intended for inspection by QCI.

The actual as-built location of shims used to maintain pipe clearance (installed per typical shim drawing) are not required to be shown on the design drawing.

Dimensional acceptability of structural shapes shall be determined by utilizing the tolerances specified in Attachment 21. The required flange width and height may be obtained from AISC Tables.

3.3.1.2 Component Standard Support (Catalog) Items

The dimensions/configuration of vendor-supplied catalog items (except struts, snubbers, and spring cans) shall be inspected to ensure compliance with the item description stated on the construction drawing BOM by referring to the applicable "Typical Inspection Drawing" for the item contained in the WP. Results of this inspection shall be documented on the CSSIR.

3.3.1.3 Fab Shop Threaded Items

Rods threaded at the Fabrication Shop will be inspected to assure smooth and even thread form. To establish acceptable fit, each item will be checked by installing the correct size and type Class 2B nut on the threaded item. The Class 2B nut for this verification shall be obtained from the warehouse and

will be controlled by QC. The nut shall exhibit slight friction while installing by hand to a length of one-nut thickness. QCI will document acceptability of the fit in the bolt hole column of MIL.

3.3.1.4 Fastener Requirements (Other than Hilti, Richmond & Embedded Anchors)

Fasteners will be as shown on the construction drawing/"Typical Inspection Drawing". Substitution of bolting material specified on the drawing/"Typical Inspection Drawing" is permissible and shall be in accordance with Attachment 16. All bolts, studs and threaded rods shall at least have one complete thread exposed above the nut face. Threaded parts shall be sufficiently free of extraneous material to allow free movement of the threaded part. Unless otherwise specified by Engineering, all nuts will be of standard size as a minimum.

The acceptable thread engagement of a standard nut used as a jam nut, is minimum of 75% of the standard nut depth, unless otherwise stated on design drawing.

When the surface of a bolt head or nut has a slope greater than 1:20 with its mating surface, a beveled washer shall be fabricated and installed in accordance with Attachment 19. Beveled washers need not be shown on design drawing.

When hardened washers are required, they shall be indicated on the drawing. Receiving QCI shall identify hardened washers by presence of a "Star Stamp". QCI shall verify the presence of "Star Stamp" on the washers and document this verification on the MIL.

NOTE: Hardened washers are acceptable for installation in place of standard washers.

All threaded fasteners shall be provided with locking devices as specified on the drawing, or "Typical Inspection Drawing", except for high strength bolting when the torque value specified on drawing is equal to or greater than the values shown in Table 1. Lock nuts, jam nuts, drilled and wired nuts, or upset threads may be used as locking devices, when the drawing does not specify a locking device.

When the design document shows a specific type of locking device, substituting will not be allowed.

When torque values equal to those in Table 1 are required on the drawing for high strength bolting, the turn of the nut method shown in Table 2 may be used interchangeably. NOTE: Use hardened washers under the bolt head and nut except where the bolt head or nut is welded to the bolt-up assembly.

All threaded fasteners that do not require specific torque values shall be tightened snug tight. Snug tight is defined as the tightness attained by a few impacts on an impact wrench or the full effort of a man using an ordinary spud wrench. In lieu of QCI witnessing "snug tight" operations, a visual observation of "tight iron" shall be sufficient to verify the bolting condition. "Tight iron" is defined as tight contact (exhibits no looseness) between the faying surface of the bolt head/hex nut and the member being attached.

For small bore (2" diameter piping and smaller) U-bolts, if it is not possible to install a nut on the pipe side of the member, it is acceptable to let the U-bolt rest on the pipe and install both nuts on the opposite side from the pipe with the required gap between the nut and restraining member, without drawing depicting this arrangement.

Component Support pipe clamp spacers used to help maintain clamp parallelism installed over clamp bolts shall be installed tight and exhibit no looseness. Pipe clamps also shall exhibit no looseness.

TABLE 1

BOLT SIZE	REQUIRED TORQUE
1/2 in. diameter bolt	110 foot-lbs
5/8 in. diameter bolt	215 foot-lbs
3/4 in. diameter bolt	390 foot-lbs
7/8 in. diameter bolt	620 foot-lbs
1 in. diameter bolt	930 foot-lbs

TABLE 2

Bolt Length (L)	Turn Past Snug Tight
$L \leq 4$ diameters	$120^\circ \pm 30^\circ$
$4 \text{ DIA} < L \leq 8$ diameters	$180^\circ \pm 30^\circ$
$L > 8$ diameters	$240^\circ \pm 45^\circ$

Fastener inspections shall be documented on the CSSIR as required.

3.3.2 Sway-Strut

For modification/installation of a sway-strut, the inspection shall be in accordance with the construction drawing and ap-

plicable "Typical Inspection Drawings" in the WP. The results of sway-strut inspection shall be documented on the Sway-Strut Inspection Report (Attachment 4.)

NOTE: Paint on spherical bearings is not to be considered as an extraneous material on previously accepted or installed items, as long as the bearings exhibits free movement.

When weld size (leg size along the barrel) cannot be determined due to welding the full thickness of the coupling collar, QCI shall assure that the weld profile is uniform. QCI shall document the acceptance by annotating "FT" (full thickness) on the Weld IR/Sway-Strut IR.

Sight holes in the strut barrel on ITT Grinnell sway struts (Fig-211) may penetrate the toe of the coupling weld, provided that, the "K" dimension specified on the typical inspection drawing, BRH-Fig. 211, is not violated.

3.3.2.1 Sight Hole Verification

Thread engagement of all sway-struts and snubber transition kits shall be verified by QCI utilizing sight holes drilled in either the barrel or coupling in accordance with applicable "Typical Inspection Drawing" requirements.

3.3.3 Snubber

For modification/installation of a snubber, the inspection shall be in accordance with the construction drawing and applicable "Typical Inspection Drawings" in the WP. The results of snubber inspection shall be documented on Snubber Inspection Report (Attachment 5).

NOTE: Refer to note in Paragraph 3.3.2 above.

When weld size (leg size along the barrel) cannot be determined due to welding the full thickness of the coupling collar, QCI shall assure that the weld profile is uniform. QCI shall document the acceptance by annotating "FT" (full thickness) on the Weld IR/Snubber IR.

During the installation of size 10 snubbers, QC is to inspect the snubber to assure a 5° swing angle cone can be achieved without binding.

3.3.4 Spring Cans/Constant Supports

For modification/installation of spring cans/constant supports, the inspection shall be in accordance with the construction drawing and applicable "Typical Inspection Drawings" in the WP.

The results of spring can/constant supports inspections shall be documented on the Spring-Can/Constant Support Inspection Report (Attachment 6).

3.3.5 Pipe Supports Containing Low-Friction Bearing Plates

Modification/installation of low friction bearing plates shall be in accordance with the construction drawing and the attributes listed on the Low-Friction Bearing Plate Inspection Report (Attachment 7). The results of low-friction bearing plate inspection shall be documented on Attachment 7. See Attachment 7A for distinguishing various types of low-friction bearing plates used at CPSES.

3.4 WELDING

3.4.1 Cleanliness and Fit-up Requirements

Cleanliness inspection, when required by process control documentation, shall be as follows:

- a. Before welding, the weld joint shall be free of moisture, dirt, oil, grease and other foreign materials within an area two inches (2") each side of the joint;
- b. The base material shall be mechanically cleaned at least 1/2" inch each side of the weld joint; and
- c. For a partial or full penetration weld, joint preparation shall be as follows, unless otherwise shown on the drawing:
 1. The bevel angle as shown on the drawing shall have +10°, -5° tolerance.
 2. The bevel angle for single groove, when not shown on the drawing, shall be 45° with +10°, -5° tolerance.
 3. The bevel angle for V-groove, when not shown on the drawing, shall be 60° included with -10°, -5° tolerance.

NOTE #1: Any deviation from the weld-end preparation requirements shall be approved by Welding Engineering on the process control document.

NOTE #2: QCI shall verify material acceptability of adjoining members per paragraph 3.2.2.1.

3.4.1.2 Fit-up Inspection

Fit-up inspection, when required by process control documentation, shall be performed as follows:

- a. For full penetration welds, the root opening shall be as specified on the Weld Procedure Specification (WPS), unless more stringent criteria is specified on the drawing.
- b. For partial penetration welds, the root opening shall be 3/16" maximum, unless more stringent criteria is specified on the drawing.
- c. The fit-up gap for "T" fillet welds and lap joints shall be as small as practical; however, the gap should not exceed 1/16". Joints where the gap exceeds 1/16" shall be evaluated by Welding Engineering in accordance with ACP-11.6.
- d. Maximum allowable offset in final butt welded joints shall not exceed (1/4)T up to and including 3/4" thickness and 3/16" for thickness greater than 3/4". (T = Nominal wall thickness)
- e. For partial penetration welds, when the depth of preparation called out on the drawing exceeds the nominal thickness of the member, preparation through the full thickness of the member is required.
- f. The fit-up gap for flare bevel weld joints using 2" x 2" x 3/16" tube steel or 2" x 2" x 1/4" tube steel shall be 1/16" minimum 3/32" maximum. The fit-up gap shall be measured on the adjacent ("T" joint) side of the member. Maximum nominal rod size used for root pass for this application shall be 3/32". This criteria is effective as of 5/1/87.

NOTE: When a cleanliness hold point is not required QCI shall verify material acceptability of adjoining members per paragraph 3.2.2.1.

3.4.2 Preheat/Interpass Temperature

The preheating and interpass temperature to be used for welding shall be in accordance with the applicable WPS. The preheat specified on the WPS shall be established before any welding. Preheat and interpass temperatures shall be measured by the use of approved temperature indicating crayons, attached thermocouples, pyrometers or thermometers.

Temperature indicating crayons, when used for preheat and interpass temperature measurement shall be applied to avoid direct contact with the surface to be welded.

Interpass and preheat temperature shall be measured on the surface of the base material, on the side which the welding is

performed, within 1-inch of the weld joint edge, and along the joint 1-inch from the starting point for the next weld pass.

3.4.3 Welder and Welding Material Verification

The QCI shall verify that the welder is qualified to make the weld, utilizing the Welder Qualification Matrix; that the WPS and type of filler material listed on the WFML are the same as those listed on the WDC; and the welder's symbol has been recorded on the WFML.

3.4.4 Weld and Base Material Inspection Requirements (Final)

3.4.4.1 Weld Inspection

For visual inspection, as-welded surfaces are permitted. However, the surface of welds should be free of coarse ripples, grooves, overlaps, and abrupt ridges and valleys to the extent that the surface condition of the finished weld shall be suitable for proper interpretation of required nondestructive examinations of the welds.

For visual inspection, only indications with major dimensions greater than 1/16" shall be considered relevant indications; cracks are not acceptable. The weld joint and adjacent base metal shall also be free of defects such as incomplete fusion, incomplete penetration and slag.

Arc strikes are acceptable on Class 2, 3 and 5 component supports providing:

- 1) Material is P-1 (carbon steel)
- 2) No linear indications such as cracks or unacceptable undercuts or craters are visible. QCI may use abrasive paper or a file as necessary to determine visual acceptance providing minimum wall is not violated.
- 3) Minimum wall is not violated.

Arc strikes are unacceptable on all Class 1 component supports and also all material other than P-1 (carbon steel).

Fillet and skewed welds shall be inspected to the visual criteria provided on the Fillet and Skewed Weld IR (Attachment 8).

Undercuts shall not violate minimum wall as described in 3.4.4.3.

Full penetration/partial penetration welds shall be flush with the base material, as a minimum.

Pipe attachment welds shall be inspected in accordance with AQP-11.2.

Where structural tubing is welded as shown in Attachment 9, Figures 1 and 2, and the weld size is not specified, the minimum weld size shall fill the groove so that the weld is at least flush with the outer surface of the member.

The weld symbol for partial penetration "T" weld joint requiring unequal leg size with fillet cap, is shown on the construction drawing. The larger leg size shall be applied to the chamfered member.

The maximum weld crown on flare V-groove welds and flare bevel welds shall be $3/16"$, except for the configuration shown in Attachment 9, Figure 1. The reinforcement shown in Figure 1 shall not cause distortion in adjoining members.

Distortion due to welding shall be reported in accordance with Paragraph 2.4.

For Small Bore Supports (2" and under), Class 2 and 3 welds are to be inspected to the visual inspection criteria described in this procedure/IR. In those cases where the configuration of a joint facilitates using flare bevel welds in place of an indicated fillet weld, flare bevel welds of equal or greater length than the indicated fillet weld may be used. However, this option is only to be used when specified on the drawing.

When Category II supports attach to Class 1, 2 or 3 structures, the connecting weld(s) shall be shown on the Class 1, 2 or 3 drawing. The weld symbol shown on the Category II support drawing shall be for reference only.

When Class 2 or 3 supports attach to Class 1 pipe supports, the connecting weld(s) shall be shown on the Class 1 drawing. The weld symbol shown on the Class 2 or 3 support drawings shall be for reference only. When Class 2 or 3 supports connect to Class 1 moment restraints the weld shown on the Class 2 or 3 drawing shall be inspected and documented as a Class 1 NF weld (NF5212) unless such documentation exists per moment restraint.

All weld lengths shall be equal to or greater than specified on drawing, with the exception as noted in Attachment 1 and 2. However, for welds on component standard supports (catalog items) which are intended to be "full length welds" by design, the weld length shall have a $-1/16"$ tolerance (provided the actual length is equal to that of the installed component).

Where the weld size noted on the design drawing is equal to the nominal thickness of the member and actual thickness is less, inspection criteria will be provided on the "Typical Inspection Drawings".

Transition type fillet or flare bevel welds, which have a design length greater than the flat portion of the tube steel, shall be inspected in accordance with Attachments 10A and 10B to assure the required weld length has been achieved. In this configuration, QCI shall record the appropriate attachment number used in the remarks section of the Weld Inspection Report in lieu of recording individual weld lengths.

Fillet welds (other than transition type weld joints) which have a design length greater than the flat portion of the tube steel shall follow the contour of the tube on both corners, unless otherwise stated on the drawing. QCI shall measure the weld length along the surface of the tube steel to assure the proper weld length has been achieved.

Inspection of intermittent welds shall be in accordance with Attachment 20 of this procedure.

Fillet welds at stepped joints shall be measured as shown on Attachment 10C.

Fillet or flare bevel welds where no length is specified, shall be full sized for the entire length of the flat of the branch members. The "flat" is defined as the width of the tube steel, minus two times the thickness on each side.

Where shim material is to be welded, shims and weld size shall be in accordance with the construction drawing/"Typical Inspection Drawing" for shim installation.

For shim material in which the thickness is 1/8" or less; when weld size (leg size along the structural member) cannot be determined due to welding the full thickness of the shim, QCI shall assure that the weld profile is uniform, in lieu of measuring actual fillet weld size.

3.4.4.2 Component Support Welds at Skewed Joints

Component support welds at skewed joints shall be inspected to the design criteria provided on the "Typical Inspection Drawing".

Groove welds which require a measurement of the "d" dimension for weld size per the "Typical Weld Inspection Drawing" shall be recorded on the weld IR.

Skewed fillet weld measurement of stanchions shall be inspected in accordance with Attachment 11. Stanchion connections may be of a cylindrical or square/rectangular shape.

Full penetration and partial penetration weld joints on skewed stanchions to pad/saddle will be inspected in accordance with Attachment 12.

3.4.4.3 Base Material Inspection Requirements (Minimum Wall)

Base metal damage/defects may be removed by grinding, without weld buildup, provided:

- a. The final imperfection is well faired without abrupt changes in contour;
- b. There are no visual indications showing previous repair(s); and

The depression depth produced by grinding shall not exceed the following:

- a. Structural Shapes
 1. 1/32" for material less than 3/8" thick
 2. 1/16" for material 3/8" to 2" inclusive in thickness
 3. 1/8" for material over 2" in thickness
- b. Plate
 1. 7% of the nominal plate thickness up to a maximum of 1/8".
- c. Tube Steel - 10% of the nominal wall thickness
- d. Pipe - The minimum wall thickness requirements for pipe shall be as detailed in AQP-11.2.

NOTE: Material thickness of structural shapes taken from tables in an approved code or standard (AISC, ASTM-A6) may be used in the decimal or nominal equivalent format. To facilitate construction and inspection and to establish consistency the nominal value should be used.

When welds are removed from permanent structural members, craft shall notify the QCI to perform a base metal inspection. QCI shall assure that section minimum wall is not violated and document the examination by signing the appropriate hold point on the WDC.

NOTE: For voided supports which attach to a permanent support, base metal inspection after weld removal shall be documented with the permanent support.

Minimum wall violations shall be documented in accordance with Paragraph 2.4.

3.4.4.4 Weld Repairs

Weld repairs shall meet acceptance criteria applicable for the original weld.

3.4.4.5 Reinforcement of Butt Welded Joints

The surface of the reinforcement of all butt welded joints may be flush with the base material or may have uniform crowns. The height of reinforcement on each face of the weld shall not exceed the following thickness.

<u>Nominal Thickness, in.</u>	<u>Maximum Reinforcement, in.</u>
Up to 1, incl.	3/32
Over 1 to 2, incl.	1/8
Over 2 to 3, incl.	5/32
Over 3 to 4, incl.	7/32
Over 4 to 5, incl.	1/4
Over 5	5/16

3.4.4.6 Temporary Attachments

The base material used for temporary attachments shall be the same "P" number as the base material of the component/part to which it is to be attached; however, that attachment need not be certified material.

Temporary attachments shall be marked with material specification and type, grade or class, as applicable.

All temporary attachments shall be marked in red so that removal of the attachment is ensured.

The surface of the support shall be visually examined (per paragraph 3.4.4.3) after removal of the temporary attachment. This inspection shall be documented on the applicable process control sheet.

3.4.4.7 "Weep Holes"

"Weep holes" necessary for the exhaust of welding gases are not required to be shown on the design drawing provided there is only one hole per item and the hole drilled is 1/4" or

smaller in diameter. Any deviation from the preceding shall be brought to the attention of the Engineer for proper disposition. Craft personnel shall be responsible for evaluating whether or not weep holes are necessary.

3.5 WELD DOCUMENTATION OF COMPONENT SUPPORTS

Results of visual and NDE examinations shall be documented on the applicable process documentation. In addition, results of NDE examinations shall be documented on the applicable NDE Report. During in-process fabrication/installation for welds that will eventually be hidden, QCI will document acceptability of the weld on the applicable process control document. Fillet and skewed weld sizes/lengths shall be recorded on the Weld Inspection Report (Attachment 8).

3.6 CRITERIA FOR INSTALLATION OF CONCRETE ANCHOR BOLTS

3.6.1 Documentation

Inspections performed on installation of concrete anchor bolts shall be documented on the Concrete Anchor Bolt IR (Attachment 13).

3.6.2. Bolt Length Identification System

The threaded end of concrete anchor bolts shall be die stamped with a letter or number which indicates bolt length in accordance with "length identification system" (Attachment 14). Super Kwik bolts shall be additionally identified with a "star". The "star" stamp is normally added to the bolt on-site indicating that the bolt has two sets of wedges. The "star" stamp shall be controlled by QC. NOTE: Hilti bolt length shown on drawing shall be considered a minimum. Longer lengths are acceptable as long as embedment is not violated. The drawing needs not reflect this condition.

3.6.2.1 Bolt Modification

Modification of bolts requires prior approval of the Design Engineer. When modification is authorized, QC shall witness the on-site shortening, re-threading and stamping.

Bolts that are to be shortened and/or re-threaded shall be checked prior to cutting by the QC Inspector to verify original length code and acceptability of thread fit. The site fabricated threads shall have the same fit as the factory

threads. Fit shall be verified by comparing tightness/looseness of site fabricated threads to vendor threads by turning on a nut. After the bolt has been shortened, the QC Inspector shall verify the bolt has been correctly identified as to its length per Attachment 14.

3.6.3 Embedment Length

Concrete anchor bolts shall be installed into structural concrete with the minimum embedment lengths as shown on the design drawings. Where not shown on the design drawings, the minimum embedment length shall be as shown on Attachment 14.

Bolt embedment shall be determined by subtracting the length of the bolt extending from the structural concrete surface, from overall bolt length.

Maximum Projection =	Length minus
(after torque)	embedment plus
	one nut thickness

If no letter designation exists on the bolt, the QCI shall request that Ultrasonic Testing (UT) be performed in accordance with AQP-10.10 to determine bolt length; no UT report is required. QCI shall record the results and M&TE number on the Concrete Anchor Bolt IR and assure that the appropriate letter designation has been stamped (after torquing) onto the end of the bolt.

NOTE: Embedment lengths shown on pipe support drawings, are considered to be the depth of the bolt below the finished concrete surface prior to tightening. PSE has already incorporated the 2" topping (if applicable) into the embedment length when determining what embedment to show on the drawing, unless otherwise shown on the drawing.

3.6.4 Bolt Installation/Setting of Wedges

When witnessing bolt installation, the QC Inspector shall verify bolt threads are protected by use of double nuts or mandrel prior to driving the bolt, and bolts do not visually indicate any cracks. Bolts that are bent, cracked, or have thread damage shall not be used. Hilti bolts shall not be skewed by more than 6°.

Beveled washers previously installed on civil applications (Hilti, Richmond, Embedded Anchors) shall comply with the dimensions and tolerances delineated on Attachment 19, unless otherwise shown on the drawing.

Bolts shall be set by torquing the nut. QCI shall verify the torquing of all concrete anchor bolts. Anchor bolts shall be torqued to the values shown in Attachment 14.

The engagement of the nut shall be such that after torquing, the end of the bolt is not lower than flush with the top of the nut. When initial torquing (or setting) of a bolt the change in bolt projection shall not exceed one (1) nut thickness, unless otherwise approved by the engineer.

When torque is verified, the nut may turn additionally due to the initial relaxation. Torque must be obtained prior to the nut bottoming-out in the threads. Minimum length of threads for the various sizes of Hilti bolts may be found in Attachment 15. If necessary, thread engagement may be verified by removing the nut.

If the torque value cannot be achieved, or if the pullout is greater than one (1) nut thickness, the bolt shall be documented as "Unsat" on Attachment 13 and documented in accordance with paragraph 2.4.

For base plates/bearing plates which require grouting, Hilti bolts may be set before or after grouting operations. This applies only when using a non-epoxy type grout. When epoxy grout is used; the Hilti bolts shall be set before grouting.

3.6.5 Richmond Inserts/Embedded Anchor Bolts/"Grouted In" Bolts

3.6.5.1 Documentation

Inspections performed on installation of bolt/threaded rod in a Richmond Insert/Embedded Anchor Bolts or grouted in bolts shall be documented on Concrete Anchor Bolt IR (Attachment 13).

3.6.5.2 Richmond Insert Engagement

Verify that engagement of the bolt/threaded rod into the Richmond Insert equals or exceeds 2 times the bolt diameter minus 1/4".

If the actual length of the bolt/threaded rod has not been verified by QCI on the MIL prior to installation, the QCI shall request that Ultrasonic Testing (UT) be performed in accordance with AQP-10.9 to determine bolt/threaded rod length. No UT report is required. QCI shall record the results and M&TE number on Attachment 13.

The QC Inspector shall verify that the bolt or hex nut is "snug tight". In lieu of QCI witnessing "snug tight" operations, a visual observation of "tight iron" shall be sufficient to verify the bolting condition. "Tight iron" is defined as tight contact (exhibits no looseness) between the faying surface of the bolt head/hex nut and the member being attached. For threaded rod applications, at least one complete thread shall be exposed above the nut face. Where applicable, the acceptable thread engagement of a standard nut used as a jam nut shall be 75% of the standard nut depth, unless otherwise stated on the drawing.

3.6.5.3 Unused Richmond Inserts

Unused Richmond Inserts may be plugged by the use of a Richmond screw-in plug, a snap-in cap, or patched.

Unused Richmond Screw Anchors which have been plugged by Richmond screw-in plugs may be used for permanent anchorage only after specific approval by the Engineer.

3.6.5.4 Embedded Anchor Bolts/"Grouted In" Bolts

The QC Inspector shall verify that the hex nut is "snug tight". In lieu of QCI witnessing "snug tight" operations, a visual observation of "tight iron" shall be sufficient to verify the bolting condition. "Tight iron" is defined as tight contact (exhibits no looseness) between the faying surface of the hex nut and the member being attached. At least one complete thread shall be exposed above the nut face. Where applicable, the acceptable thread engagement of a standard nut used as a jam nut shall be 75% of the standard nut depth, unless otherwise stated on the drawing.

3.6.5.5 Spacing violation dimensions shown on the drawing shall be considered a minimum.

3.7. CRITERIA FOR INSTALLATION OF AIRCRAFT CABLE SUPPORTS

3.7.1 Installation/Documentation

Aircraft Cable Seismic Restraints for Seismic Category II supports shall be installed as required by individually engineered restraint drawings. Installation criteria and typ-

ical fabrication details for Seismic Cable Restraints shall be per Attachment 17. NOTE: Unique vendor markings (i.e., letter code, MIC #, etc.) or a Brown & Root applied color code are not required for aircraft cable or cable clamps. No material requisition is required by shop/field QCI for cable or cable clamps. QCI shall enter and sign for the cable and clamp size on the MIL.

The results of the inspection shall be documented on the Aircraft Cable Seismic Support IR (Attachment 18).

3.7.2 Inspection Criteria

The QCI shall verify that the restraint conforms to the design drawing and the following:

- a. Stainless steel cable is of the proper size. Aircraft cable may be upgraded in diameter to the next larger size without the drawing showing this condition. For aircraft cable sizes see note "g".
- b. Stainless steel cable is not frayed or broken.
- c. Stainless steel cable end loops are bent smooth without any deformation.
- d. Sufficient slack exists in the cable.

This can be verified if:

1. A visual gap 1/8" minimum exists between the inside of the eye-nut and the cable (as shown) is in the relaxed condition.
2. If the cable bears against the eye-nut, then a 1/8" diameter rod should slide between the cable and the eye nut using normal hand pressure.

This inspection shall be made after the eye-nut has been torqued to the Hilti Bolt; or tensioned snug tight when using other anchors. Crosby clamp torquing shall also precede this inspection (as applicable).

- e. All eye-nuts secured to the building structure by expansion anchors shall be inspected for torque, as specified on Attachment 14, for anchor bolts of given size. If an eye-nut torquing tool is used, it should be verified that the eye-nut is fully seated in the eye-nut torquing tool.
- f. Eye-nuts on threaded rods shall be snug tight and lock washers shall be provided under the eye-nuts.

- g. Cable clamps shall be bolted-type Crosby cable clamps and shall be torqued in accordance with the following table. The cable clamps are identified with the cable size on the clamp body.

Minimum Torque Values for Crosby Cable Clamp

Cable Size (in.)	1/2	7/16	3/8	5/16	1/4	3/16
Torque Value (ft-lb)	65	65	45	30	15	7.5

- h. No locking devices are required for Crosby cable clamps.

4.0 WORK INVOLVING SUPPORT MODIFICATION AFTER QC ACCEPTANCE

Work involving modification of a support shall require retrieval of the hanger package from PFG/Interim Records Vault (IRV).

All new required process documentation that is added to the hanger package, shall be submitted to the ANII for preliminary review and assignment of chosen hold points.

The QCI shall complete all applicable portions of the new process documentation and fill out the applicable Inspection Report for rework. All rework to component support shall be inspected in accordance with the requirements of this procedure. As a minimum, QCI shall assure that the work called out on the Description of Activities (DOA) of the Weld Data Card is complete.

5.0 WORK ON COMPONENT SUPPORTS AFTER QC AND ANI ACCEPTANCE

5.1 WORK ADDING, REPLACING, OR REMOVING PARTS

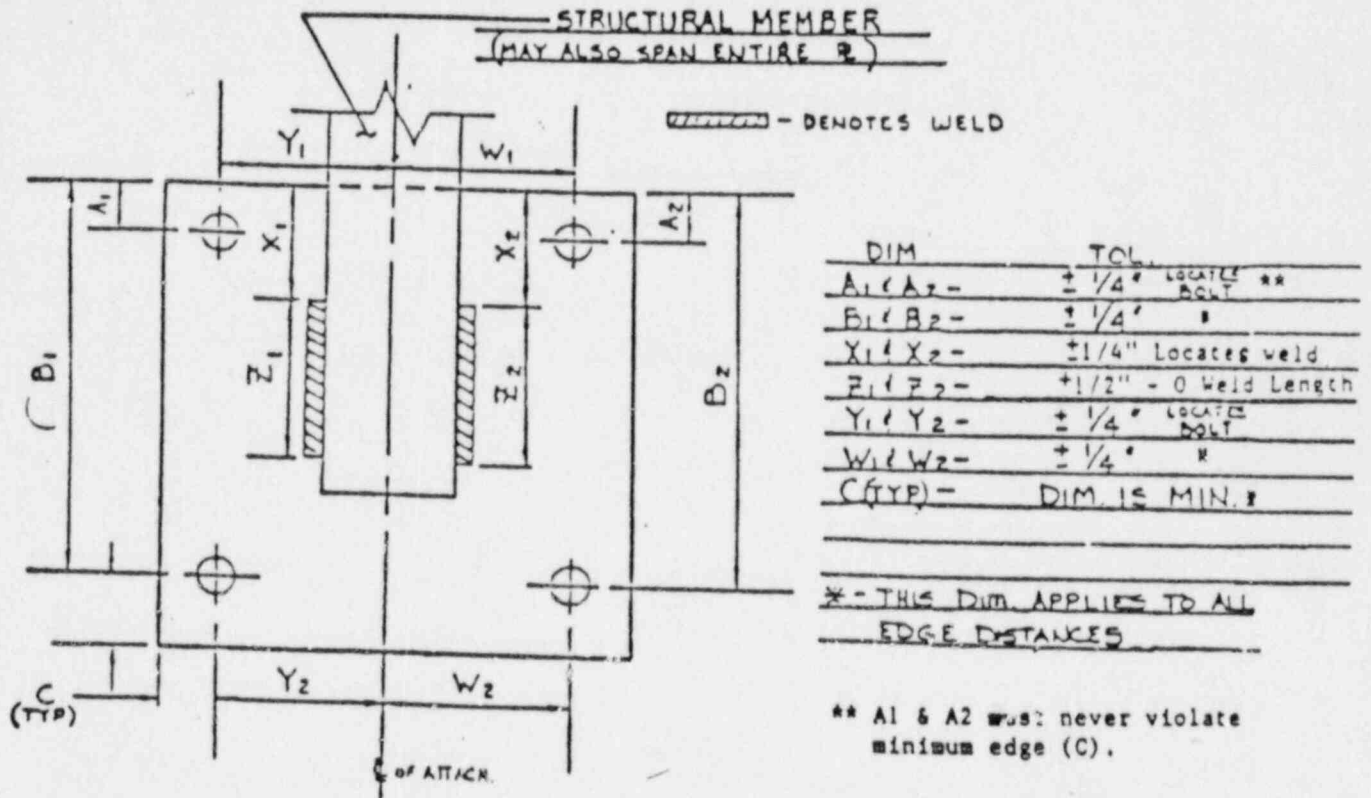
Any rework of a support due to item deficiencies or design changes after QC and ANI acceptance, will require retrieval of the support package from the IRV. PFG authorization to remove a support package from the IRV shall be in the form of an engineering issued drawing revision, NCR or IRN. Upon receipt of the authorization, PFG shall void the HIR (Figure 6 in CP-QAP-12.1) in the hanger package.

Upon completion of the work and acceptance of the rework documentation, the hanger package with a new HIR shall be submitted to the ANII for acceptance.

6.0 COMPONENT SUPPORT PROCESSING/STATUSING

Continued processing/statusing of completed component support packages shall be in accordance with QA Procedure CP-QAP-12.1.

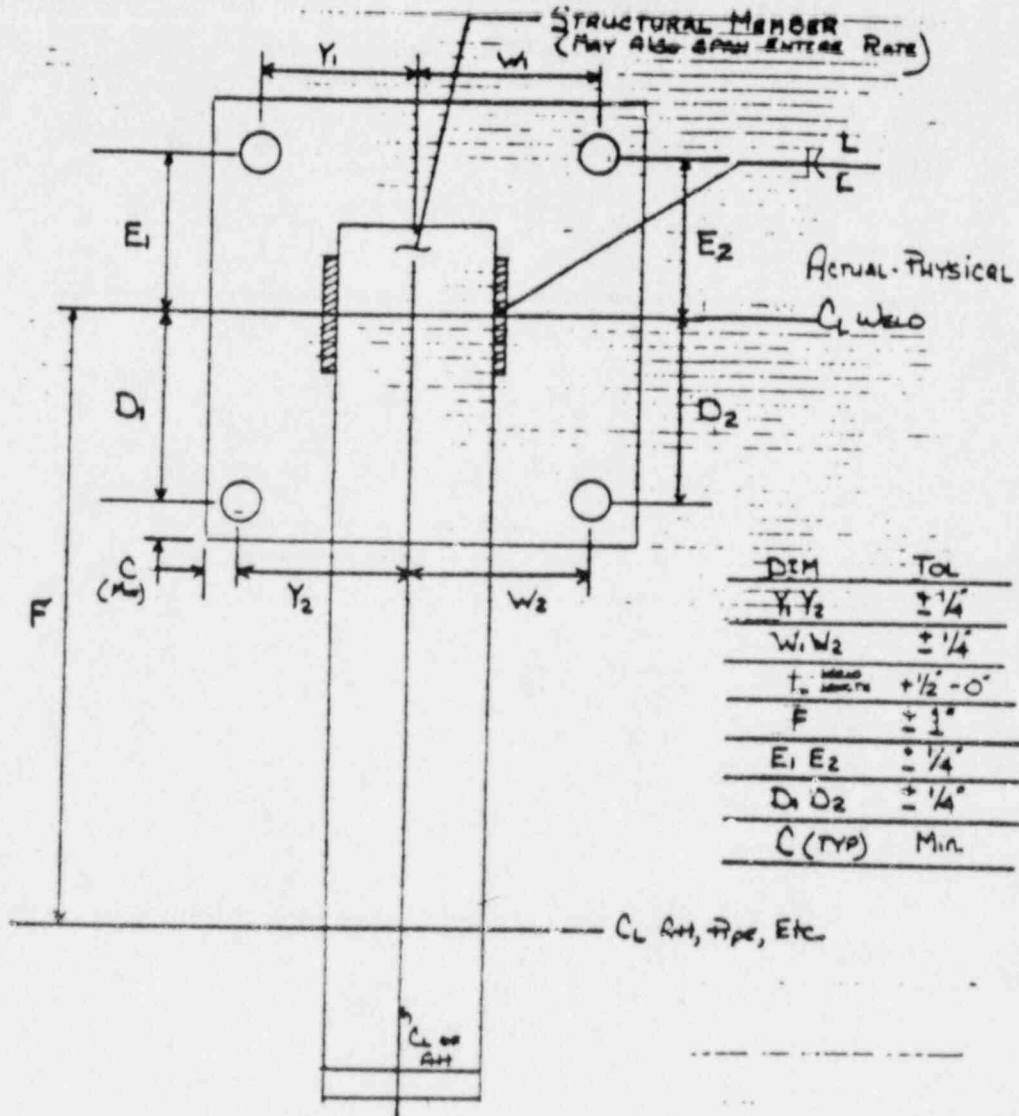
ATTACHMENT 1
BASEPLATE TOLERANCES



NOTE: FOR SIMILAR B/P CONFIGURATIONS WHERE DIMS ARE SHOWN FROM THE EDGE OF THE STRUCTURAL MEMBER ON THE Φ , THE FOLLOWING INSPECTION CRITERIA APPLIES:

DIMENSION	CRITERIA
END OF MEMBER TO BOLTS	TOL. OF $\pm 1/4"$
END OF MEMBER TO START OF WELD	TOL. OF $\pm 1/4"$
LENGTH OF WELD	TOL. OF $+1/2" - 0"$

ATTACHMENT 2
ALTERNATE BASEPLATE TOLERANCES



NOTES:

1. The acceptance of dimensions D₁, D₂, E₁, E₂ shall be determined by starting at the actual-physical center line of the weld on their respective sides of the structural member and then measuring back to center line of bolt, (± 1/4").
2. The acceptance of dimension "F" shall be determined by starting at the actual-physical center line of the weld on both sides of the structural member and then measuring back to center line of attachment, etc. (± 1").

ATTACHMENT 3
CSSIR

Page 1 of 7

COMPONENT SUPPORT STRUCTURAL INSPECTION REPORT

DRAWING NO. _____ REV _____ DESIGN CHANGE NO. _____ REV. _____

QI-QAP-11.1-28 REV/DCN _____

A. QC INSTRUCTIONS

This IR will be completed for new installations and for modifications, repair or replacement portions of a component support.

1. Supports shall be fabricated and installed in compliance with the Construction Drawing, unless affected by an outstanding design change. The Quality Control Inspector (QCI) shall assign a number to each dimensional attribute identified as a specific dimension, or a typical dimension, on the drawing. The QCI shall annotate an "Office and Engineering Use Only", (O&E) copy of the drawing, to identify the dimensions to be inspected, and shall record the actual measurements on this inspection report.
2. Dimensions on the Drawings, which reflect support location from column lines or adjacent fixtures, for example, need not be inspected or recorded on this IR since dimensions are for reference purposes only.
3. Dimensions which reflect member orientation (e.g. rectangular tube steel turned correctly, shear lugs turned correctly) shall be inspected and recorded in section C-3 but need not be recorded in section E of this IR.
4. Dimensions which reflect Wirtl bolt embedment are inspected and recorded per Attachment 13 but need not be recorded in Section E of this IR.
5. Dimensions which reflect grout requirements are inspected by Civil QCI and need not be recorded on this IR.
6. Dimensions locating phantom items shall not be considered as their installation may be verified from the drawing on which they appear. However, dimensions which locate phantom or ghosted items which are physically attached to the support being inspected shall be considered.
7. Dimensions which are not capable of being measured with standard metrological methods (e.g., scale, tape measurement) shall be obtained for QC by Construction Field Engineering (Surveyor). QC will assure that these measurements recorded (on Field Shot Card) by Field Engineering are within the specified tolerance. The Field Shot Card shall remain in work package.
8. If the space available for documenting the inspection results is not sufficient, continuation sheet(s), on the backside of the IR, if required to clarify specific detail. Sections or non-applicable attributes on the IR shall be marked "N/A" and initial and date.
9. If more than one (1) QCI conducts dimensional inspections on this support, the QCI will initial and date only for those dimensional inspections actually performed.
10. QCI shall initial and date the "O&E" drawing when assigning dimensions number.

B. INSPECTION TOLERANCES

Except as permitted below, all material and dimensions shall be in accordance with the drawing.

QI-QAP-11.1-28

Rev. 38
Date: OCT 08 1987
Page 30 of 64

ATTACHMENT 3 (Cont)

1. Bolt Hole Size(s)
Bolt hole size shall be as specified on the drawing $\pm 1/32"$.
QCI at the fab shop shall measure the size and document the acceptance by initial and date on MIL/SAVC.

2. Bolt Locations (base plates)
 - a. From C/L of base plate attachment to bolt C/L $\pm 1/4"$.
 - b. Edge Distance (measured to center line of bolt).
 - i. The minimum edge distance shall be equal to or greater than the drawing if specified as "min. typ" or "typ".
 - ii. If specific dimensions are given to edges on the base plate, then these dimensions shall be $\pm 1/4"$, providing the actual dimension is equal to or greater than values shown in Column 4.
 - iii. When no edge distance is shown on drawing, the edge distance shall be equal to or greater than values shown in Column 4 and documented in Section "E" of this I.R.

1	2	3	4
BOLT SIZE	BOLT SIZE	TOL. ON BOLT	MIN. EDGE WHEN NOT SHOWN ON DWG
1/4	5/16	$\pm 1/32$	1/8
3/8	7/16	$\pm 1/32$	9/16
1/2	9/16	$\pm 1/32$	1/4
5/8	11/16	$\pm 1/32$	7/8
3/4	13/16	$\pm 1/32$	1
7/8	15/16	$\pm 1/32$	1 1/8
1	1 1/16	$\pm 1/32$	1 1/4
1 1/4	1 1/8	$\pm 1/32$	1 1/4
1 1/2	1 3/8	$\pm 1/32$	1 5/8
1 3/4	1 5/8	$\pm 1/32$	1 7/8
2	1 7/8	$\pm 1/32$	2 3/16
2 1/2	2 1/8	$\pm 1/32$	2 1/2

* Edge distance applicable to U-bolts and bolted U-plates only.
For all other bolting less than 1/2", edge distance must be shown on the drawing.

3. Bolt Location (other than base plates): $\pm 1/4"$ Laterally, $\pm 1"$ Axially
4. Edge Distance (other than base plates)
 - a. If specific dimensions are given, the tolerances shall be $\pm 1/4"$, providing the actual dimension is equal to or greater than values shown in Column 4.
 - b. When no edge distance is specified the actual dimension shall be equal to or greater than values shown in Column 4.
 - c. If specific dimensions are given that are less than values shown in Column 4 these dimensions shall be considered a minimum.

NOTE: Tolerance may not be used to combined to violate minimum required.

NOTE: Inspections shall be documented in Section E and Section H of this IR, as applicable.
5. Attachments to base plates $\pm 1/4"$.
6. Member Lengths $\pm 1/2"$.
7. Member Locations
 - a. Dimensions locating structural members $\pm 1"$.
 - b. For small bore, dimensions indicated by (REF) on the drawing.

ATTACHMENT 3 (Cont)

DRAWING NO. _____

Page 3 of 7

8. Clearances

a. Pipe Clearance

For box frame type supports

1. Where the drawing shows 1/16" on both sides or 0" on one side and 1/16" on the other, the sum of the two gaps shall not be less than 1/32" or greater than 1/8".

b. Pipe Clearance (U-Guide type supports)

When the drawing shows 1/16" on one or both sides, or if design does not specify a clearance, the sum of the two gaps (in both directions) shall not be less than 1/32" or greater than 1/8".

b-1. Pipe Clearance (U-Bolt type supports)

When the drawing shows 1/16" on one or both sides, the sum of the two gaps (in both directions) shall not be less than 1/32" or greater than 1/8". For U-bolts used on variable or constant spring support, when the drawing does not specify a clearance, the 2 nuts bearing against the structural member shall be torqued to the values shown in table below, unless otherwise shown on the drawing. The 2 lock nuts shall be snug tight.

PIPE SIZE	TORQUE, INCH LBS.	TOLERANCE, INCH LBS.
≤ 1	12	6
1 1/2	36	12
> 2	60	24

NOTE 1: Where the drawing shows clearances greater than or equal to 1/4", the dimension shown is minimum. (These clearances are not accumulative.)

NOTE 2: The total gap measured on opposite sides of the pipe shall be the sum of the minimum dimensions between the restraining member and the pipe.

c. Shear Lug Clearances:

- i. Where the drawing shows "0" clearance (either dimensionally or pictorially) between shear lug and restraining member, the total accumulative dimensional clearance for any two opposing lugs shall range from "0" to 1/16" maximum.
- ii. The axial deviation (difference in gaps) between any two shear lugs on the same side of the restraining member shall not exceed 1/32".
- iii. The allowable relative circumferential deviation in the pipe attachment location of lugs, in relationship to each other, is the following: (Dimension to be measured along the pipe surface.)

NOTE: The location of the lugs in relationship to the restraining member is intended to be verified per attribute C-3) on the IA.

Nominal pipe size (in.)	Allowable Circumferential Deviation (in.)
≤ 4	± 1/8
5 thru 10	± 1/4
≥ 12	± 1/2

NOTE: The total accumulative clearance for opposing sides shall be recorded as one (1) dimension in Section "E" of this IA.

ATTACHMENT 3 (Cont)

Page 4 of 7

9. OVERHANG LENGTH

- a. When overhang length is specified on dwg., acceptable tolerance shall be (+3", -0").
- b. When overhang length is not specified on dwg., acceptable tolerance shall be a maximum of 3".
- c. For bolt/u-bolt/rod overhang configurations, acceptable tolerance shall be the minimum edge distance (+3", -0").

NOTE: The free end overhang of members welded flat to baseplates are excluded from overhang criteria.

10. PROJECTION LENGTH

- a. When projection length is specified on dwg., acceptable tolerance shall be (+3", -0").
- b. When projection length is not specified on dwg., acceptable tolerance shall be min: (1" +1/2 O.D.), max: (3" + 1/2 O.D.).

C. SUPPORT MATERIAL DESCRIPTION/CONFIGURATION VERIFICATION

- 1. Material descriptions called out on the BOM of the drawing when compared to field installed material is acceptable.
Set Unset QCI/DATE _____
- 2. The dimension/configuration of vendor supplied catalog items (EXCEPT STUDS, SPACERS, AND SPRING CASIS) shall be verified by utilizing the "Typical Inspection Drawings" for the item(s). QCI verification of the "Typical Inspection Drawing" description attributes shall be documented below.

	BOM ITEM#	GROUP #	QTY. REQ'D	TYPICAL INSPECTION DRAWING DESCRIPTION	REV	SAT/UNSAT	QCI/DATE
1							
2							
3							
4							
5							
6							
7							

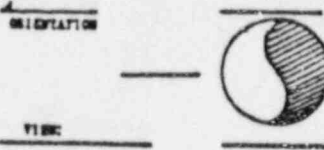
- 3. Support configuration complies with design drawing.
Set Unset QCI/DATE _____

D. SHIM INSTALLATION

- 1. When shims are installed using typical inspection shim drawings and documented on MIL, QCI shall enter the appropriate typical shim drawing type number on the sketch below to reflect the "shim-to-suit" condition as it exists in the field.

ATTACHMENT 3 (Cont)

DRAWING NO. _____



NOTE: QCI shall add additional sketches as required.

- 2. Shim size and installation in accordance with typical inspection shim details.
TYPE _____ REV _____ Sat _____ Unsat _____ QCI/DATE _____
- * 3. Shim weld size and length is in accordance with typical inspection shim drawings.
TYPE _____ REV _____ Sat _____ Unsat _____ QCI/DATE _____

E. DIMENSION INSPECTIONS

Dim. S/E	Req. Dim.	Act. Dim.	QCI/Date	Dim. S/E	Req. Dim.	Act. Dim.	QCI/Date

F. SHEAR LUG INSTALLATION

- 1. Alignment and relative circumferential deviation of shear lug is acceptable per 8c. Sat _____ Unsat _____ QCI/DATE _____

H. STRUCTURAL MEMBER/BASEPLATE EDGE DISTANCE

- 1. Verify minimum edge dimension when not shown on drawing is in accordance with section B.2/B.4. Sat _____ Unsat _____ QCI/DATE _____

* Reference Paragraph 3.4.4.1

ATTACHMENT 3 (Cont)

Page 6 of 7

- I. OVERHANG LENGTH
1. Verify overhang length is in accordance with section 8.9.
Sat ___ Unsat ___ QCI/Date _____
- J. PROJECTION LENGTH
1. Verify projection length is in accordance with section 8.10.
Sat ___ Unsat ___ QCI/Date _____
- K. THREADED FASTENER INSTALLATION (Including Thru-Wall Bolts)
1. Surface of bolted part in contact with bolt head/nut has a slope of 1:20 or less.
Sat ___ Unsat ___ QCI/Date _____
2. Fasteners are sufficiently free of extraneous material.
NOTE: Paint is not to be considered as extraneous material on previously accepted or installed fasteners.
Sat ___ Unsat ___ QCI/Date _____
3. Fasteners have acceptable thread engagement in nuts.
Sat ___ Unsat ___ QCI/Date _____
4. Bolts/nuts are properly tightened
a) Witness "Snug Tight" Sat ___ Unsat ___ QCI/Date _____
b) Verify "Tight Iron" Sat ___ Unsat ___ QCI/Date _____
5. Locking devices are installed per DWG, if specified.
Sat ___ Unsat ___ QCI/Date _____
6. If a locking method is not specified by the drawing, assure that a proper locking device is installed (upset threads, jam nuts, etc.). Ref. Para. 3.3.1.4.
Sat ___ Unsat ___ QCI/Date _____
7. Washers are installed per the DWG (Star stamped on hardened washers, if applicable).
Sat ___ Unsat ___ QCI/Date _____
8. Special type fasteners, (such as Western Clamps or Cinches-down U-Bolts, Removable supports) which require specific torque values shall be witnessed and recorded.
a. Item# ___ Torque Value Req. ___ Actual ___ NATE ___ QCI/DATE _____
b. Turn of the nut method Sat ___ Unsat ___ QCI/Date _____

ATTACHMENT 3 (Cont)

page 7 of 7

DRAWING NO. _____

L. ADJACENT WELD DISTANCE

1. Instruction: Complete this section when the configuration of the support is such that the pipe may move axially, independent of the support movement. (Distance measured from toe of weld to outer face of restraint.)

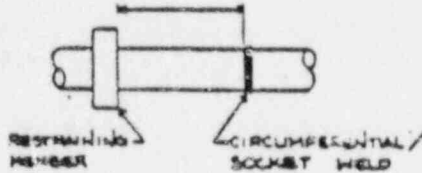
2. Tolerances:

- a. A minimum of two (2) inches for piping with an operating temperature less than 200° F.
- b. A minimum of three (3) inches for piping with an operating temperature equal to or greater than 200° F.

Sat _____ Unsat _____ QCI/Date _____

NOTE: When weld clearance distance is specified on the drawing it shall be considered a minimum.

(NOTE: IF THE DISTANCE INSPECTED IN STEP 2A & 2B IS LESS THAN THREE(3) INCHES, INDICATE ACTUAL DIMENSION BELOW.)



Looking _____

M. UNSAT ATTRIBUTES _____

UNSAT ATTRIBUTES _____

RCR# _____ QCI/DATE _____

RCR# _____ QCI/DATE _____

CORRECTED ATTRIBUTES _____

QCI/DATE _____

CORRECTED ATTRIBUTES _____

QCI/DATE _____

REMARKS: _____

ATTACHMENT 4
SWAY STRUT INSPECTION REPORT

Page 1 of 2

SWAY STRUT INSPECTION REPORT

DRAWING NO. _____ REV _____ DESIGN CHANGE NO. _____ REV _____
 SWAY STRUT S/N _____
 SWAY STRUT SIZE & TYPE _____
 DUAL APPLICATION - ENTER LETTER CODE _____

A. QC INSTRUCTIONS

This IR will be completed for new installations, modifications, repair, replacements or removal/re-installation.

1. Modification/Installation shall be in compliance with the Hanger Drawing/DCA/CHC and applicable "Typical Inspection Drawing(s)". QCI shall list all applicable typical drawings utilized for inspection.
2. QCI shall record the specified data; initial and date the inspection report for each attribute inspected. If more than one (1) QCI conducts inspections on this support, the QCI shall initial and date only those attributes actually inspected.
3. For dual sway strut installation, identify components A and B on Office and Engineering (O&E) Drawing and add additional inspection report.
4. Sections and attributes that are non-applicable shall be marked N/A and initialed and dated by the QCI.
5. The offset angle between strut and the clamp/bracket shall have a tolerance of $\pm 2^\circ$ from the angle indicated on the design drawing unless otherwise stated. However, an offset angle (in the restricted direction) of more than 5° is not permissible.

B. MODIFICATION INSPECTION QI-QAP-11.1-28 Rev/DCN _____

QCI/DATE

1. VSCOR S/N _____
 2. Fit-up. Sat _____ Unsat _____
 3. Coupling 'C' Dimension. Sat _____ Unsat _____
 4. Sight Hole 'Z' Dimension. Sat _____ Unsat _____
 5. Weld Size. Weld # _____ Actual _____
 Weld # _____ Actual _____
- Typical Drawing Description _____ Rev _____

C. INSTALLATION INSPECTION QI-QAP-11.1-28 Rev./DCN _____

1. Eye Rod Thread Engagement
 - a. Verified by sight hole. Sat _____ Unsat _____
 - b. Sight hole 'Z' dimension. Sat _____ Unsat _____

QI-QAP-11.1-28

Rev. ³⁸
 Date: OCT 09 1987
 Page 37 of 64

ATTACHMENT 4 (Cont)

SMAY STREET INSPECTION REPORT (CONTINUED)

QCI/DATE

2. Hardware Inspection

- a. Exposed eye rod threads are free of extraneous material

Sat ___ Unsat ___

Note: Paint on exposed eye rod threads is not to be considered as extraneous material on previously accepted or installed items.

- b. Eye rod end are free of binding within the clamp and/or bracket.

Sat ___ Unsat ___

- c. Jam nuts, fasteners, cotter pins in place and secure.

Sat ___ Unsat ___

- d. Proper size spherical bearing spacer/washers are installed.

Sat ___ Unsat ___

- e. Resultant spacer/washer gap is acceptable.

Sat ___ Unsat ___

- f. i) Spherical bearings are staked and free of extraneous material.

Sat ___ Unsat ___

ii) If previously accepted and eye rod is painted, verify bearing has not be dislodged and free of extraneous material.

Sat ___ Unsat ___

3. Bearing exhibited free movement. (Note: Standard strap wrench may be used to verify this attribute.)

Sat ___ Unsat ___

4. C to C Dimension (24") when shown on drawing.

Required _____ Actual _____

Sat ___ Unsat ___

5. Acceptable offset angle.

Sat ___ Unsat ___

Typical Drawing Description _____ Rev. _____

UNSAT ATTRIBUTES _____ NCR _____ QCI/DATE _____

CORRECTED ATTRIBUTES _____ QCI/DATE _____

REMARKS _____

ATTACHMENT 5
SNUBBER INSPECTION REPORT

Page 1 of 2

SNUBBER INSPECTION REPORT

DRAWING NO. _____ REV _____ DESIGN CHANGE NO. _____ REV. _____
 SNUBBER S/N _____ SIZE/TYPE _____
 FOR DUAL APPLICATIONS ENTER LETTER CODE _____

A. QC INSTRUCTIONS

This IR will be completed for new installations, modifications, replacements or removal/re-installation.

1. Modification/Installation shall be in compliance with the Hanger Drawing and typical drawings utilized for inspection.
2. QCI shall record the specified data; initial and date the inspection report for each attribute inspected. If more than one (1) QCI conducts inspections on this support, the QCI shall initial and date only those attributes actually inspected.
3. For dual snubber installation, identify components A and B on Office and Engineering Drawing (O&E) and add additional inspection report.
4. Sections and attributes that are non-applicable shall be marked N/A and initialed and dated by the QCI.
5. The offset angle between snubber and the clamp/bracket shall have a tolerance of $\pm 2^\circ$ from the angle indicated on the design drawing unless otherwise stated. However, an offset angle (in the restricted direction) of more than 5° is not permissible.

B. MODIFICATION INSPECTION QI-QAP 11.1-28 Rev/DCN _____ QCI/DATE _____

1. VSCOR S/N _____			
2. Fit-up.	Sat _____	Unsat _____	
3. Coupling "C" Dimension.	Sat _____	Unsat _____	
4. Coupling nut to pipe weld size.		Actual _____	
5. Mounting plate to extension pipe weld size.		Actual _____	
6. Forward bracket weld size.		Actual _____	
7. Sight Hole "Z" Dimension.	Sat _____	Unsat _____	
8. Torque.			
a) Transition kit/Forward bracket to snubber body.	M&TE _____	Value _____	
b) Ring nut (35 & 100 only).	M&TE _____	Value _____	
9. a) Bolting minimum thread engagement of transition kit cap screws. (4 thru 10)	Sat _____	Unsat _____	
b) Thread engagement for forward bracket (35 & 100 only)	Sat _____	Unsat _____	
10. Relative angle adjustment.	Sat _____	Unsat _____	
11. Snubber operation.	Sat _____	Unsat _____	
12. Safety wire is properly installed.	Sat _____	Unsat _____	
Typical Inspection Drawing Description		Rev _____	

C. INSTALLATION INSPECTION QI-QAP-11.1-28 Rev./DCN _____

1. Snubber operation (excluding 35 & 100).	Sat _____	Unsat _____	
2. Relative angle adjustment (when required).	Sat _____	Unsat _____	
3. Eye rod thread engagement			
a) Verified by sight hole.	Sat _____	Unsat _____	
b) Sight hole 'Z' dimension.	Sat _____	Unsat _____	
4. Hardware Inspections			
a) Exposed eye rod threads are free of extraneous material	Sat _____	Unsat _____	

QI-QAP-11.1-28

Rev. ²⁸
 Date: OCT 09 1987
 Page 39 of 64

ATTACHMENT 5 (Cont)

SNUBBER INSPECTION REPORT (CONTINUED)

QCI/DATE

C. 4.	a)	NOTE: Paint on exposed eye rod is not to be considered as extraneous material on previously accepted or installed items.			
	b)	Eye rods ends are free of binding within the clamp and/or bracket	Sat	Unsat	_____
	c)	Fasteners and cotter pins in place and secure.	Sat	Unsat	_____
	d)	Proper size spherical bearing spacers/washers and installed.	Sat	Unsat	_____
	e)	Resultant spacer/washer gap is acceptable.	Sat	Unsat	_____
	f) 1)	Spherical bearings are staked and free of extraneous material.	Sat	Unsat	_____
		ii) If previously accepted and eye-rod is painted, verify bearing has not been dislodged and free of extraneous material.	Sat	Unsat	_____
	g)	Safety wire is properly installed.	Sat	Unsat	_____
	b)	Torque of jam nut.	M&TE	Value	_____
5.		Bearing exhibit free movement	Sat	Unsat	_____
* 6.		C to C dimension (24").	Req'd	Actual	_____
* 7.		Ac dimension ± 1/8".	Sat	Unsat	_____
8.		Acceptable offset angle.	Sat	Unsat	_____
9.		Acceptable swing angle (size 10 snubbers only)	Sat	Unsat	_____
		Typical Inspection Drawing Description		Rev	_____

*Must be shown on drawing.

UNSAT ATTRIBUTES _____ NCR _____ QCI/DATE _____

CORRECTED ATTRIBUTES _____

REMARKS _____

ATTACHMENT 6
SPRING CAN/CONSTANT SUPPORT INSPECTION REPORT

SPRING-CAN/CONSTANT SUPPORT INSPECTION REPORT

DRAWING NO. _____ REV. _____ DESIGN CHANGE NO. _____ REV. _____
 SPRING-CAN/CONSTANT S/N _____
 MODEL NO. REQ'D _____ INSTL'D _____ QI-QAP-11.1-28 Rev./DCA _____
 FOR DUAL APPLICATIONS ENTER LETTER CODE _____

A. QC INSTRUCTIONS

This IR will be completed for new installations, replacements or removal/re-installation.

1. Modification/Installation shall be in compliance with the Hanger Drawing and applicable "Typical Inspection Drawing(s)". QCI shall list all applicable typical drawings utilized for inspection.
2. QCI shall record the specified data; initial and date the inspection report for each attribute inspected. If more than one (1) QCI conducts inspections on this support, the QCI shall initial and date only those attributes actually inspected.
3. For dual spring-can/constant installation, identify component's A & B on Office and Engineering Drawing (O&E) and add additional inspection report.
4. Sections and attributes that are non-applicable shall be marked N/A and initialed and dated by the QCI.
5. The offset angle between spring or constant support and the clamp bracket shall have a tolerance of $\pm 2^\circ$ from the angle indicated on the design drawing unless otherwise stated.

B. MODIFICATION INSPECTION (DUAL SPRING CANS ONLY)

		Req'd	Actual	QCI/DATE
1. VSCOR S/N		_____	_____	_____
2. 'a' Dimension		Req'd _____	Actual _____	_____
3. Plate Size		Req'd _____	Actual _____	_____
4. Plate Thickness	Max.	Req'd _____	Actual _____	_____
5. C-C Dimension		Req'd _____	Actual _____	_____
6. Weld Sized (Weld numbers will be assigned to each weld on the O & E "Typical Inspection Drawing" and recorded using the letter 'S' before each number.)	S-1	Req'd _____	Actual _____	_____
	S-2	Req'd _____	Actual _____	_____
	S-3	Req'd _____	Actual _____	_____
	S-4	Req'd _____	Actual _____	_____
	S-5	Req'd _____	Actual _____	_____
	S-6	Req'd _____	Actual _____	_____
	S-7	Req'd _____	Actual _____	_____
	S-8	Req'd _____	Actual _____	_____

C. INSTALLATION INSPECTION

1. Support rod has no slack and is fully engaged. Sat _____ Unsat _____
2. Fasteners in place and secured. Sat _____ Unsat _____
3. Threads are free of extraneous material. Note: Paint is not to be considered as extraneous material on previously accepted or installed fasteners. Sat _____ Unsat _____
4. Acceptable offset angle. Sat _____ Unsat _____
5. Spring can is set within 10% of the DWG required cold setting. Sat _____ Unsat _____
6. Constant support travel indicators are within 1/4" of the indicated cold position, but not beyond either end of the travel scale. Sat _____ Unsat _____

LIST OF TYPICAL DRAWING

UNSAT ATTRIBUTES _____ NCR _____ QCI/DATE _____
 CORRECTED ATTRIBUTES _____ QCI/DATE _____
 REMARKS: _____

ATTACHMENT 7
LOW-FRICTION BEARING PLATE INSPECTION REPORT

LOW-FRICTION BEARING PLATE INSPECTION REPORT

DRAWING NO. _____ REV _____ DESIGN CHANGE NO. _____ REV. _____
 QI-QAP-11.1-28 RPY/DCM _____

A. QC INSTRUCTIONS

This IR will be completed for new installations, replacements or removal/re-installation.

1. Low-friction bearing plates when specified, shall be installed at the location shown on the drawing.

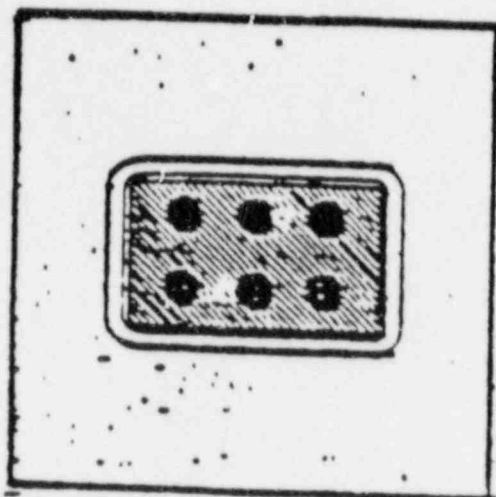
B. INSPECTION TOLERANCES

1. Lubron AE-40 shall be used for supports inside the Reactor Building regardless of the type noted on drawing bill of material. Outside the Reactor Building, regardless of the product specified on the Construction Drawing, all four bearing plates are interchangeable provided the correct lubricant is applied to mating surface.
2. No more than 10% of the bonded lubricant (AE-6, AE-7, AE-30, or AE40 as applicable) shall be missing from substrate material.
3. Mating surface shall have a 63-125 RMS finish.
4. Machined surface shall be evenly coated with an approved lubricant. (Lubrite AE-6 liquid lubricant for Lubrite AE-6/AE-7 type plates or Lubron AE-100 liquid lubricant for Lubron AE-30/AE-40 type plates).
5. Alignment of mating surfaces (i.e., lubrite plate metal surface and mating machined surface) shall be within 1/32", or as shown on the Construction Drawing.
6. For plates which have square corner radiused, the ground area shall not penetrate into the bonded lubricant.

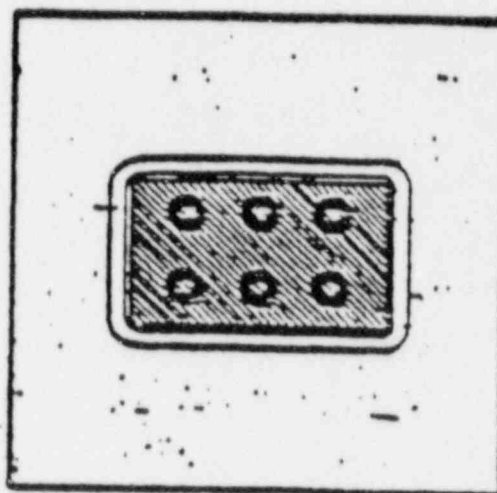
C. INSPECTION RESULTS

		QCI/DATE	
1. Plate Type	Installed	_____	_____
2. Lubricant Substrate Mat'l		Sat _____	Unsat _____
3. Surface Finish		Sat _____	Unsat _____
4. Liquid Lubricant	Req'd	Applied _____	_____
5. Alignment of Mating Surfaces	Req'd	Act. _____	_____
6. For plates which have square corner radiused, ground area(s) do not penetrate into the bonded lubricant.		Yes _____	NO _____
UNSAT ATTRIBUTES	NCR	QCI/DATE	_____
CORRECTED ATTRIBUTES		QCI/DATE	_____
REMARKS	_____		

ATTACHMENT 7A



LUBRITE AE-6
(LUBRON AE-40 SIMILAR TO
LUBRITE AE-6)



LUBRITE AE-7
(LUBRON AE-30 SIMILAR TO
LUBRITE AE-7)

- a. Lubrite AE-6 - The AE-6 lubricant is premolded into cylinders and pressed into drilled holes in the substrate material.
- b. Lubrite AE-7 - The AE-7 lubricant is a powder mix which is hydraulically extruded into circular channels in the substrate material.

NOTE: Lubrite plates can be identified by "LUBRITE" trademark stamped on the back of the plate.

- c. Lubron AE-40 - Similar in appearance to Lubrite AE-6, however the entire bearing surface has a black finish.
- d. Lubron AE-30 - Similar in appearance to Lubrite AE-7.

ATTACHMENT 8
COMPONENT SUPPORT FILLET & SKEWED WELD INSPECTION REPORT

Page 1 of 2

COMPONENT SUPPORT FILLET & SKEWED WELD INSPECTION REPORT

DRAWING NO. _____ REV _____ DESIGN CHANGE NO. _____ REV. _____

QI-QAP_11.1-28 REV/DCM _____

A. QC INSTRUCTIONS

This IR will be completed for new installations and for modification, repair or replacement portions of a component support.

1. QCI will assign numbers in numerical sequence to fillet and skewed welds on the O&E copy of the drawings, with a "Q" preceding the assigned number (e.g., Q1, Q2). Previously assigned numbers by Welding Engineering will remain the same.

The weld numbers shall be entered on the Weld Inspection Report (WIR).

QCI shall initial and date O&E drawings when assigning weld numbers.

2. If the space available for documenting the inspection results is not sufficient, continuation sheets may be utilized. The QCI should provide additional sketch(s) if required to clarify specified detail.
3. QCI shall verify:
 - Surface condition
 - Record actual weld size measured
 - Record actual weld length measured, when indicated on DWG

NOTE: Surface condition shall be marked N/A for those welds which have been previously accepted and are now painted.
4. QCI shall initial and date the WIR for each weld inspected. If more than one (1) QCI conducts weld inspections on this support, the QCI shall initial and date only those welds actually inspected.
5. Non-applicable attributes on the WIR shall be marked "N/A" and initial and dated.

B. INSPECTION TOLERANCES:

Except as permitted below, all welds shall be of the size and in the location specified on the drawing.

1. For visual inspection, as-welded surfaces are permitted. However, the surface of welds should be free of coarse ripples, grooves, overlaps and abrupt ridges and valleys to the extent that the surface condition of the finished weld shall be suitable for proper interpretation of required non-destructive examinations of the welds.

For visual inspection, only indications with major dimensions greater than 1/16" shall be considered relevant indications; cracks are not acceptable. The weld joint and adjacent base metal shall also be free of defects such as incomplete fusion, incomplete penetration, slag and arc strikes.

Undercuts shall not violate minimum wall as described in Paragraph 3.4.4.3 of this procedure.

Pipe - The minimum wall thickness requirements for pipe shall be as detailed in AQP-11.2.

OI-QAP-11.1-28

Rev. 3B
Date: OCT 09 1987
Page 44 of 64

ATTACHMENT 8 (Cont)

WIR (CONTINUED)

2. A fillet weld in any single continuous weld may be less than the specified fillet weld dimension by not more than 1/6" provided that the total under-size portion of the weld does not exceed 10% of the length of the weld. Individual under-size weld portions shall not exceed 2" in length. When measuring welds, if the weld size and length complies with the drawing requirements, any additional weld material is acceptable provided there is no distortion of the base material.

Weld lengths (including flare bevel) shall be indicated on WIR and shall be equal to or greater than the length specified on the drawing with the exceptions as stated in Para. J.4.4.1.

For recording of weld size, for the configuration detailed on Typical Inspection BRW-Weld Detail one (1), QCI shall note that weld size is the full thickness of the material (FT).

C. WELD INSPECTION

WELD NO.	SURFACE SAT. UNSAT.	WELD SIZE	WELD LENGTH	RES-WELD DETAIL	LEV	QCI/DATE	COMMENTS

D. WELDING CONFIGURATION

1. For small bore supports, flare bevel welds cannot be substituted for fillet welds, unless otherwise specified on the drawing.

Sat _____ Unsat _____ QCI/DATE _____

UNSAT WELD NO(s) _____ WCB _____ QCI/DATE _____

REMARKS: _____

ATTACHMENT 9
WELD REINFORCEMENT

FIG #1

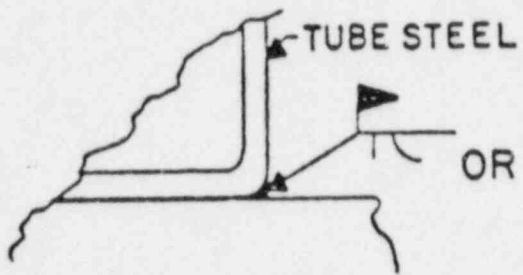
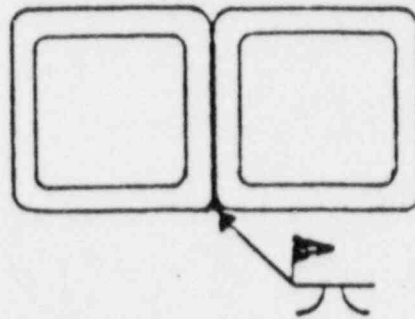
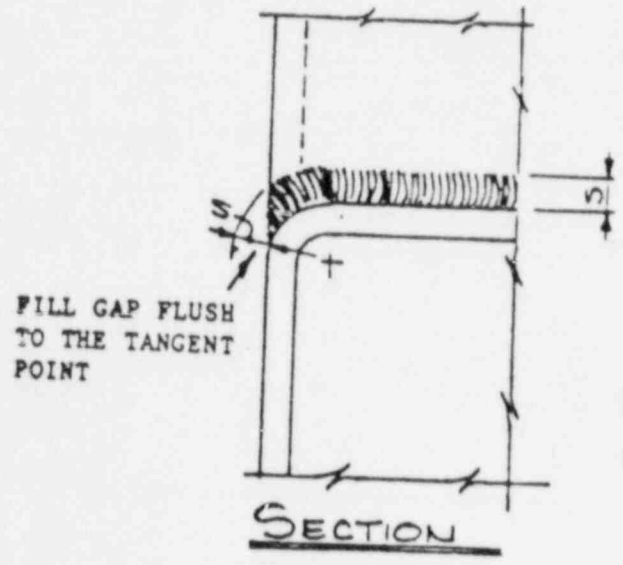
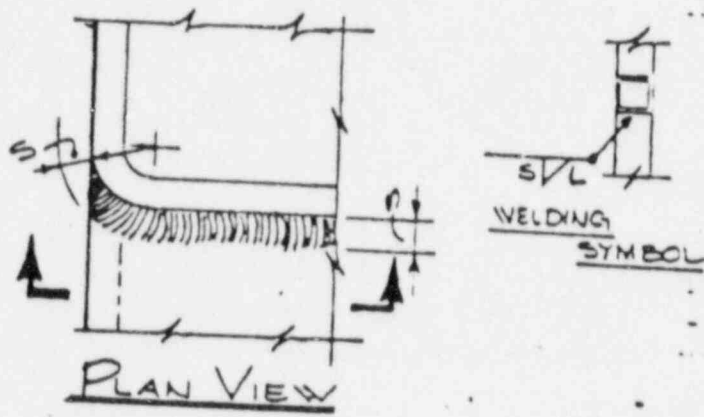
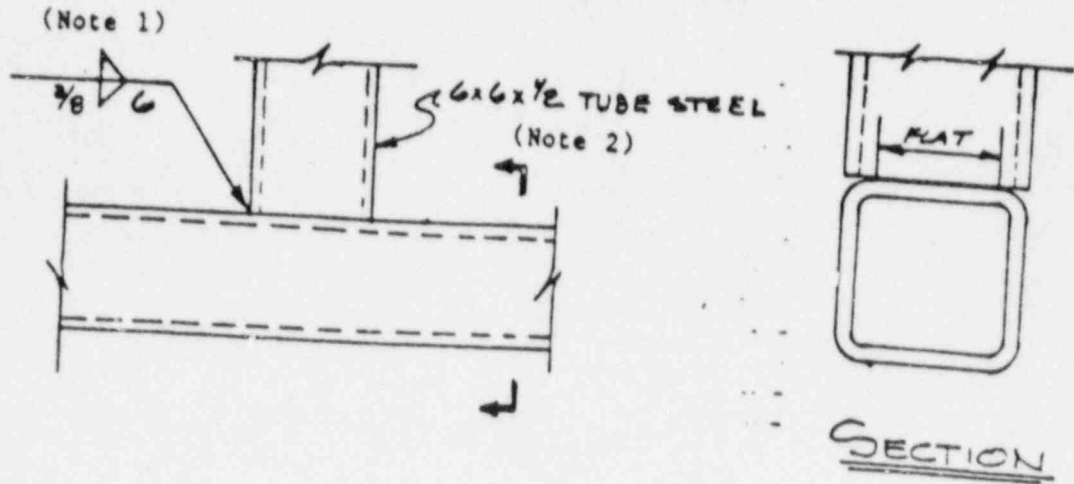


FIG #2

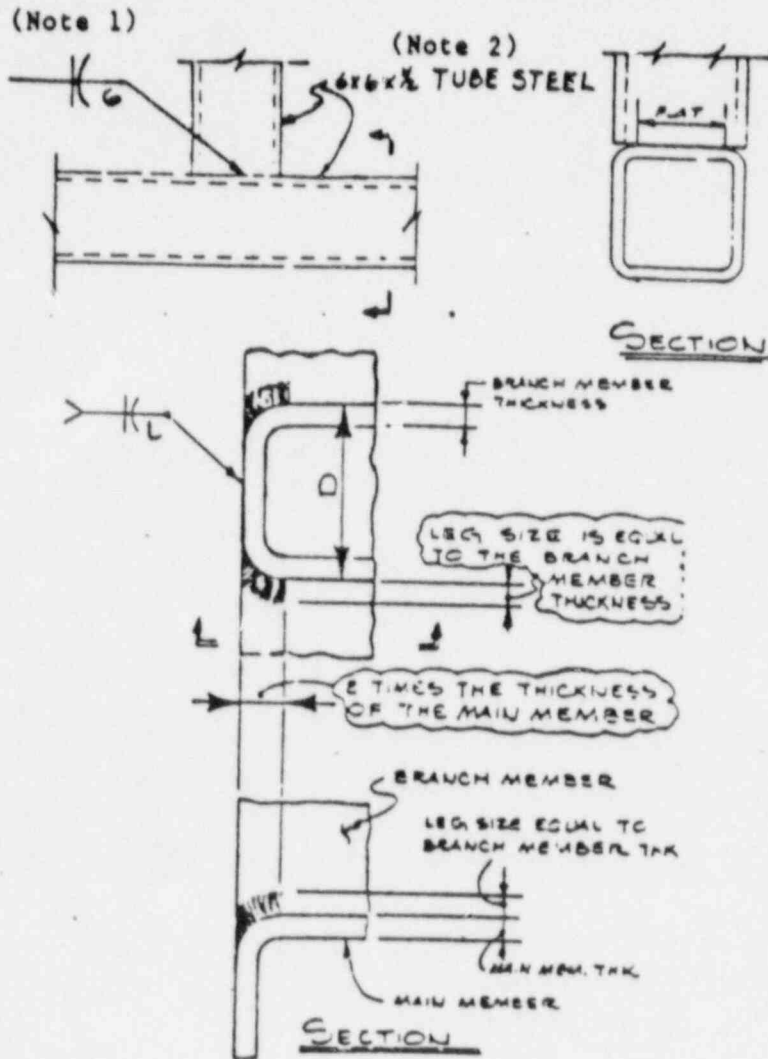


ATTACHMENT 10A
FILLET WELD - CORNER WRAP



- Note 1: Applicable for any combination of fillet and flare bevel transition type weld joints.
- Note 2: Members may be any structural shape.

ATTACHMENT 10B
FLARE BEVEL WELD - CORNER WRAP

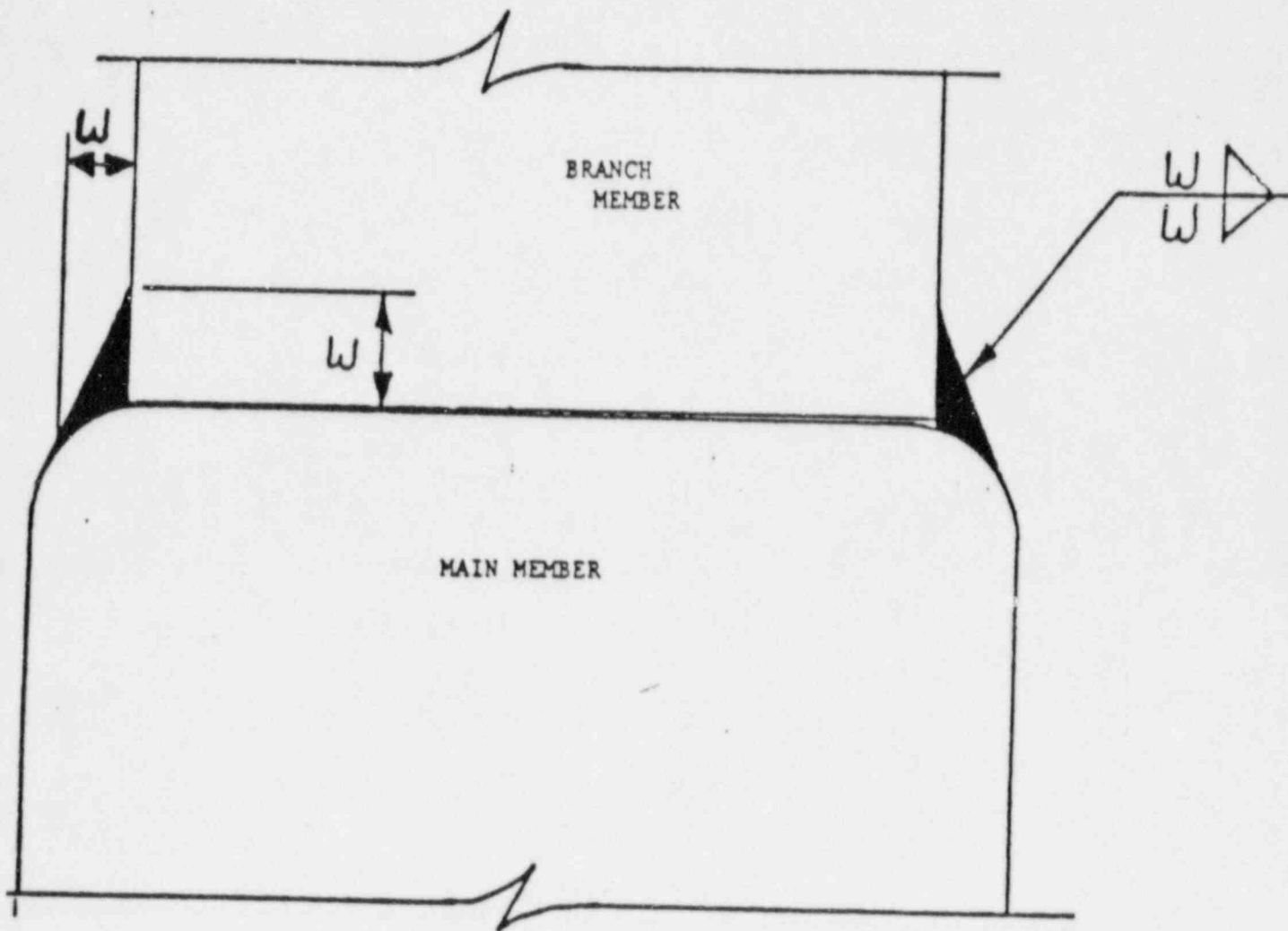


Note 1: Applicable for any combination of fillet and flare bevel transition type weld joints.

Note 2: Members may be any structural shape.

ATTACHMENT 10C
FILLET WELD - STEPPED JOINTS

W = WELD SIZE



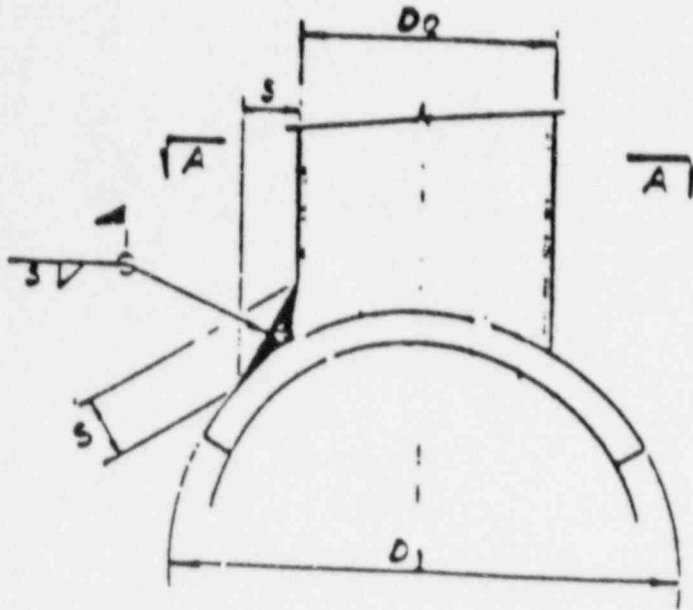
ATTACHMENT 11
SKEWED FILLET WELD MEASUREMENT

The following steps shall be followed to verify stanchion weld sizes.

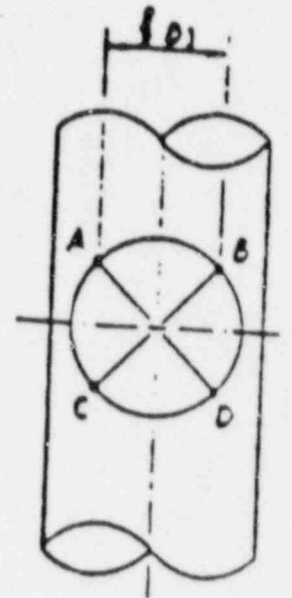
NOTE: See continuation sheet 2, for figure numbers referenced below.

1. The actual area of weld to be measured is defined on continuation sheet 1 (Ref. Type "L" and Type "S").
2. Starting at 90°, mark off pipe as shown in Figure 1, at approximately 2" on center, for stanchion larger than 8" in diameter, mark off 3" on center. Number marks clockwise on the pipe and worksheet and show the orientation of weld on the worksheet (i.e., elevation view looking west.) A mark should be placed at any point where the weld is visually smaller than the rest of the weld and measured.
3. Press the contour gage against the weld at the points marked above. Place the contour gage as perpendicular to the face of the weld as possible.
4. Prepare a worksheet per Figure 6. The hanger and NCR number, if applicable, must be on the worksheet.
5. Transfer the weld configuration to the worksheet (see Figure 2 and Fig. 6) and number each transfer with the corresponding number given in Figure 1.
6. Use a straight edge and establish tangent lines as shown at Fig. 3.
7. Using a protractor, determine the angle of the obtuse fillet. Fillet welds with an angle greater than 135° do not require inspection for size. Note on worksheet that the welds greater than 135° have not been measured. (Fig. 5 and Fig. 6 have examples of how fillet size is determined on the worksheet.
8. Draw a parallel dotted line as shown in Fig. 5 at a perpendicular distance equal to the drawing required weld leg size. This dotted line must pass thru the toe of the weld to be acceptable.
9. Completed worksheets must be signed and dated by the QCI and put in the applicable hanger package.
10. For rectangular or square type stanchions, use contour gauge on skewed weld sides of member only. Contour a minimum of every 2" starting in center of member. Angles greater than 135° do not require inspection for size.

ATTACHMENT 11 (Cont)



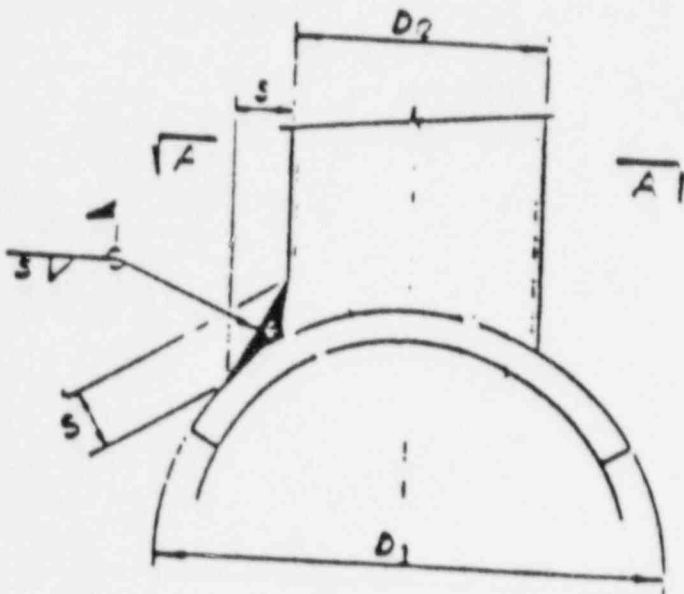
TYPE "L"
 $\frac{D_2}{D_1} > \frac{2}{3}$



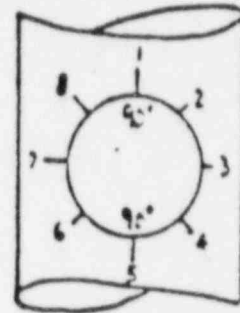
SECTION A-A

NOTE: D_1 and D_2 shall be considered "NOMINAL PIPE SIZE", not actual outside diameter.

Only the weld between points A-B and C-D need to be measured. Points A, B, C, & D will be located by dividing $\frac{2}{3} D_1$ by 2.



TYPE "S"
 $\frac{D_2}{D_1} \leq \frac{2}{3}$



SECTION A-A

Welds at all locations need to be measured.

ATTACHMENT 11 (Cont)

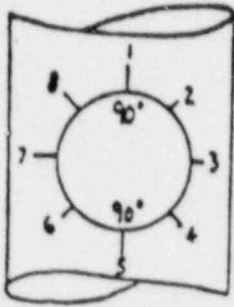


FIG. 1



FIG. 2



FIG. 3

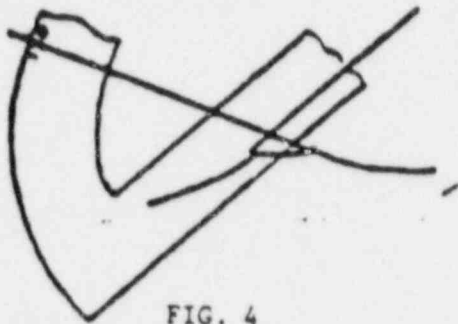


FIG. 4

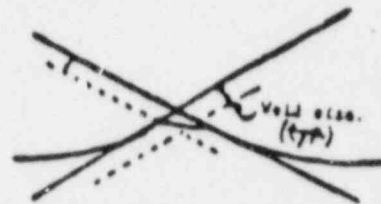


FIG. 5

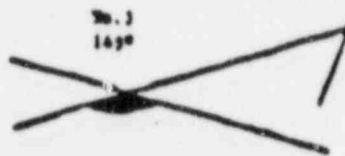
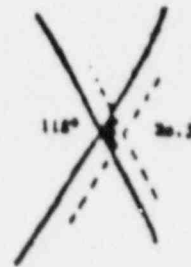
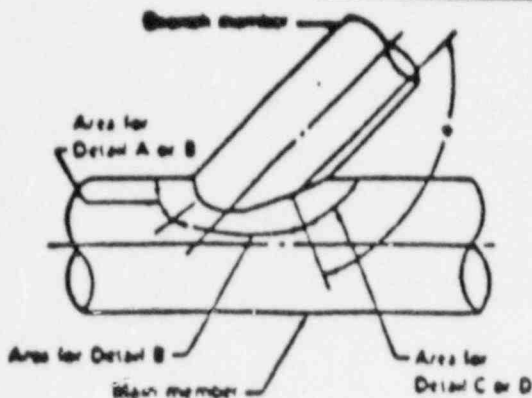


FIG. 6

QI-QAP-11.1-28

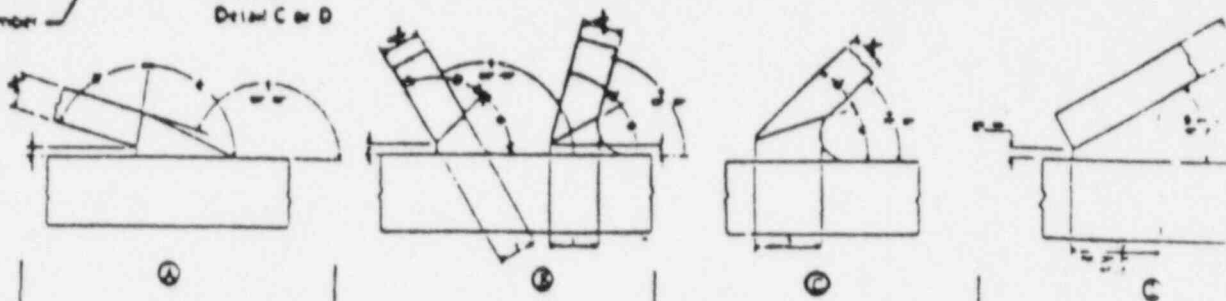
Rev. 38
Date: OCT 09 1997
Page 52 of 64

ATTACHMENT 12
FULL/PARTIAL PENETRATION WELDS/SKEWED STANCHIONS



The applicable joint detail (A, B, C, or D) for a particular part of the connection is determined by the local dihedral angle, Ψ , which changes continuously in progress around the branch member, as follows:

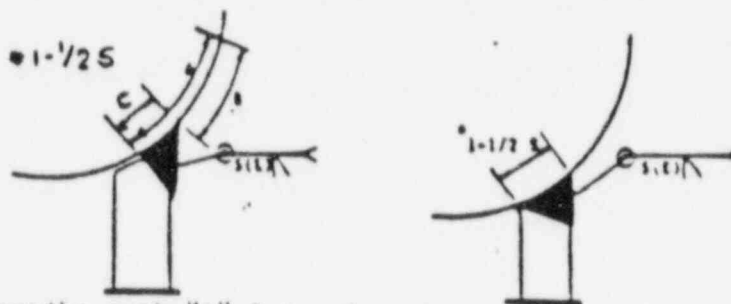
Detail	Applicable range of local dihedral angle
A	180° to 135°
B	150° to 90°
C	75° to 30°
D	60° to 15°



		(V)	(W)	(S)	(V)	(R)
Preparation (V)	MAX.	90° (Square Cut)	90° (Square Cut)	60°	As needed to obtain S	45°
Fit-up (S)	MIN.	45°	10° or 45° for $\Psi \geq 105^\circ$	37.5°	10°	$\Psi/2$

- NOTES: 1. Area C & D requires a throat thickness of $2t$.
 2. At fit-up inspection the QCI shall evaluate the joint design and weld symbol requirements to determine if reference scribe marks will aid in final weld dimensional inspection. Reference scribe mark's dimensions shall be denoted on the applicable WDC.

PARTIAL PENETRATION GROOVE WELD



Establish scribe mark "A" 3 in. from intersection of parts at fitup on pipe. At final inspection, measure "B" dimension. Subtract "B" from "A" to get "C". "C" must be $1-1/2$ times "S". Locate scribe marks about every 6 in. or 90° apart.

* This is conservative. Per AWS D1.1-75, Fig. 10.13.1 2a, $1-1/2(E)$ is acceptable when "E" is equal to the thickness of the stanchion wall

QT-QAP-11.1-28

Rev. 38
 Date: OCT 03 1987
 Page 53 of 64

ATTACHMENT 13
CONCRETE ANCHOR BOLT INSPECTION REPORT

Page 1 of 3

CONCRETE ANCHOR BOLT IR

DRAWING NO. _____ REV _____ DESIGN CHANGE NO. _____ REV. _____
 QI-QAP-11.1-28 REV _____ DCN _____

A. QC INSTRUCTIONS

- This IR will be completed for new installations and for rework of existing installations.
1. Installation shall be in compliance with Hanger drawing.
 2. QCI shall record the specified data; initial and date the inspection report for each attribute inspected.
 3. Non-applicable attributes shall be marked N/A and initialed and dated by the QCI.
 4. QCI shall either witness the torquing operation or verify the torque value after the fact.
 5. Following satisfactory torquing/tightening, the QCI shall apply torque seal at junction of nut and bolt.

B. BILTI BOLT INSTALLATION

QCI/DATE

- | | | | | | | | |
|---|-----------------|------------|-------------------|-------------|-----------|-------------|-------|
| 1. Torquing | | | | | | | |
| Qty _____ | Size _____ | Lgth _____ | Torq. Value _____ | M&T _____ | Sat _____ | Unsat _____ | _____ |
| Qty _____ | Size _____ | Lgth _____ | Torq. Value _____ | M&T _____ | Sat _____ | Unsat _____ | _____ |
| Qty Regular _____ | Qty Super _____ | | | | | | |
| 1a. Bilti blegh when determined by UT. | | | | | | | |
| Qty _____ | Lgth _____ | M&T _____ | | | | | |
| | | | Sat _____ | Unsat _____ | | | |
| 2. Thread engagement in the nut after torquing. | | | | | | | |
| | | | Sat _____ | Unsat _____ | | | |
| 3. Minimum embedment. | | | | | | | |
| | | | Sat _____ | Unsat _____ | | | |
| 4. 6° skew or less. | | | | | | | |
| | | | Sat _____ | Unsat _____ | | | |
| * 5. Washer(s)/Washer plate(s) installed. | | | | | | | |
| | | | Sat _____ | Unsat _____ | | | |
| | | | Sat _____ | Unsat _____ | | | |

C. RICHMOND INSERT INSTALLATION

- | | | | | | | |
|-----------------------------------|------------|--------------|-----------|-------------|--|--|
| 1. Qty _____ | Size _____ | Length _____ | | | | |
| 1a. Length when determined by UT. | | | | | | |
| Qty _____ | Lgth _____ | M&T _____ | | | | |
| | | | Sat _____ | Unsat _____ | | |

QI-QAP-11.1-28

Rev. 38
 Date: OCT 09 1987
 Page 54 of 64

ATTACHMENT 13 (Cont)

Page 2 of 3

		QCI/DATE
2.	Minimum engagement of bolt/threaded rod.	Sat ___ Unsat _____
3.	Bolt/Hex nut have been properly tightened.	
	3i. Witness "Smug Tight".	Sat ___ Unsat _____
	3ii. Verify "Tight Iron".	Sat ___ Unsat _____
4.	Thread engagement in the nut.	Sat ___ Unsat _____
* 5.	Washer(s)/Washer plate(s) installed. ** (When required by the drawing.)	Sat ___ Unsat _____
6.	Locking devices installed (when required by drawing.)	Sat ___ Unsat _____
D.	<u>EMBEDDED ANCHOR BOLT/"GROUTED IN" INSTALLATION</u>	
1.	Qty. ___ size ___	Sat ___ Unsat _____
2.	Thread engagement in the nut.	Sat ___ Unsat _____
* 3.	Washer(s)/Washer plate(s) installed. ** (When required by design)	Sat ___ Unsat _____
4.	Hex nut properly tightened.	
	4i. Witness "Smug Tight".	Sat ___ Unsat _____
	4ii. Verify "Tight Iron".	Sat ___ Unsat _____
5.	Locking devices installed (when required by the drawing.)	Sat ___ Unsat _____
6.	Projection Length shall be a maximum dimension (when required by the drawing.)	Sat ___ Unsat _____

ATTACHMENT 13 (Cont)

DRAWING NO. _____

E. HILTI BOLT MODIFICATION

- | | |
|---|-----------------------|
| 1. Original bolt length. _____ Qty _____ | Sat _____ Unsat _____ |
| 2. Thread fit of site fabricated threads. | Sat _____ Unsat _____ |
| 3. Letter _____ has been applied to identify new bolt length. | Sat _____ Unsat _____ |

UNSAT ATTRIBUTES _____ NCR _____ QCI/DATE _____

CORRECTED ATTRIBUTES _____ QCI/DATE _____

REMARKS _____

* NOTE: Washer(s) are not required when the drawing specifies washer plates, unless specifically noted on the drawing.

**NOTE: Washer(s) installed, but not required by design are acceptable, providing only one washer per bolt is installed.

ATTACHMENT 14
HILTI EMBEDMENT/IDENTIFICATION

BOLT DIAMETER	MINIMUM EMBEDMENT		MINIMUM TORQUE (Ft/Lbs)
	Kwik-Bolts	Super Kwik-Bolts	
1/4	1 1/8	--	8
3/8	1 5/8	--	17
1/2	2 1/4	3 1/4	70
5/8	2 3/4	--	120
3/4	3 1/4		150
1	4 1/2	6 1/2	230
1 1/4	5 1/2	8 1/8	400

TABLE 5

LENGTH IDENTIFICATION SYSTEM

Stamp On Anchor	Length of Anchor (Inches)		Stamp On Anchor	Length of Anchor (Inches)	
	From	Up to (Not including)		From	Up to (Not including)
A	1 1/2	2	AA	19	20
B	2	2 1/2	BB	20	21
C	2 1/2	3	CC	21	22
D	3	3 1/2	DD	22	23
E	3 1/2	4	EE	23	24
F	4	4 1/2	FF	24	25
G	4 1/2	5	GG	25	26
H	5	5 1/2	HH	26	27
I	5 1/2	6	II	27	28
J	6	6 1/2	JJ	28	29
K	6 1/2	7	KK	29	30
L	7	7 1/2	LL	30	31
M	7 1/2	8	MM	31	32
N	8	8 1/2	NN	32	33
O	8 1/2	9	OO	33	34
P	9	9 1/2	PP	34	35
Q	9 1/2	10	QQ	35	36
R	10	11	RR	36	37
S	11	12	SS	37	38
T	12	13	TT	38	39
U	13	14	UU	39	40
V	14	15	VV	40	41
W	15	17			
X	16	17			
Y	17	18			
Z	18	19			

- NOTES: 1. Stamped letters shall be on top (threaded) end of bolt.
2. Bolts of 19-inch length and greater may be stamped with number corresponding to the bolt length in inches in the same manner instead of the stamped letters as listed above.

ATTACHMENT 15
HILTI SIZE CHART

0.	5/8 x 0 1/2	2 3/4	1 1/2	1 1/2	1 1/2	17/32	5/8	6 9/16	5 7/8	-
1.	1/2 x 0	3 1/4	1 1/4	1 1/4	1 1/4	7/16	7/16	6 11/16	6 11/16	6 11/16
2.	1/2 x 12	4 1/2	2 1/4	2 1/4	2 1/4	27/32	1 1/32	7 17/32	6 11/16	6 11/16
3.	1/2 x 12	5 1/2	3 1/4	3 1/4	3 1/4	27/32	1 1/32	7 17/32	6 11/16	6 11/16
4.	1/2 x 12	6 1/2	4 1/2	4 1/2	4 1/2	27/32	1 1/32	7 17/32	6 11/16	6 11/16
5.	1/2 x 12	7 1/2	5 1/2	5 1/2	5 1/2	27/32	1 1/32	7 17/32	6 11/16	6 11/16
6.	1/2 x 12	8 1/2	6 1/2	6 1/2	6 1/2	27/32	1 1/32	7 17/32	6 11/16	6 11/16
7.	1/2 x 12	9 1/2	7 1/2	7 1/2	7 1/2	27/32	1 1/32	7 17/32	6 11/16	6 11/16
8.	1/2 x 12	10 1/2	8 1/2	8 1/2	8 1/2	27/32	1 1/32	7 17/32	6 11/16	6 11/16
9.	1/2 x 12	11 1/2	9 1/2	9 1/2	9 1/2	27/32	1 1/32	7 17/32	6 11/16	6 11/16
10.	1/2 x 12	12 1/2	10 1/2	10 1/2	10 1/2	27/32	1 1/32	7 17/32	6 11/16	6 11/16
11.	1/2 x 12	13 1/2	11 1/2	11 1/2	11 1/2	27/32	1 1/32	7 17/32	6 11/16	6 11/16
12.	1/2 x 12	14 1/2	12 1/2	12 1/2	12 1/2	27/32	1 1/32	7 17/32	6 11/16	6 11/16
13.	1/2 x 12	15 1/2	13 1/2	13 1/2	13 1/2	27/32	1 1/32	7 17/32	6 11/16	6 11/16
14.	1/2 x 12	16 1/2	14 1/2	14 1/2	14 1/2	27/32	1 1/32	7 17/32	6 11/16	6 11/16
15.	1/2 x 12	17 1/2	15 1/2	15 1/2	15 1/2	27/32	1 1/32	7 17/32	6 11/16	6 11/16
16.	1/2 x 12	18 1/2	16 1/2	16 1/2	16 1/2	27/32	1 1/32	7 17/32	6 11/16	6 11/16
17.	1/2 x 12	19 1/2	17 1/2	17 1/2	17 1/2	27/32	1 1/32	7 17/32	6 11/16	6 11/16
18.	1/2 x 12	20 1/2	18 1/2	18 1/2	18 1/2	27/32	1 1/32	7 17/32	6 11/16	6 11/16
19.	1/2 x 12	21 1/2	19 1/2	19 1/2	19 1/2	27/32	1 1/32	7 17/32	6 11/16	6 11/16
20.	1/2 x 12	22 1/2	20 1/2	20 1/2	20 1/2	27/32	1 1/32	7 17/32	6 11/16	6 11/16
21.	1/2 x 12	23 1/2	21 1/2	21 1/2	21 1/2	27/32	1 1/32	7 17/32	6 11/16	6 11/16

* See footnotes, Not applicable
 ** See footnotes, Not applicable
 Length - Substrate + Nut -
 Note

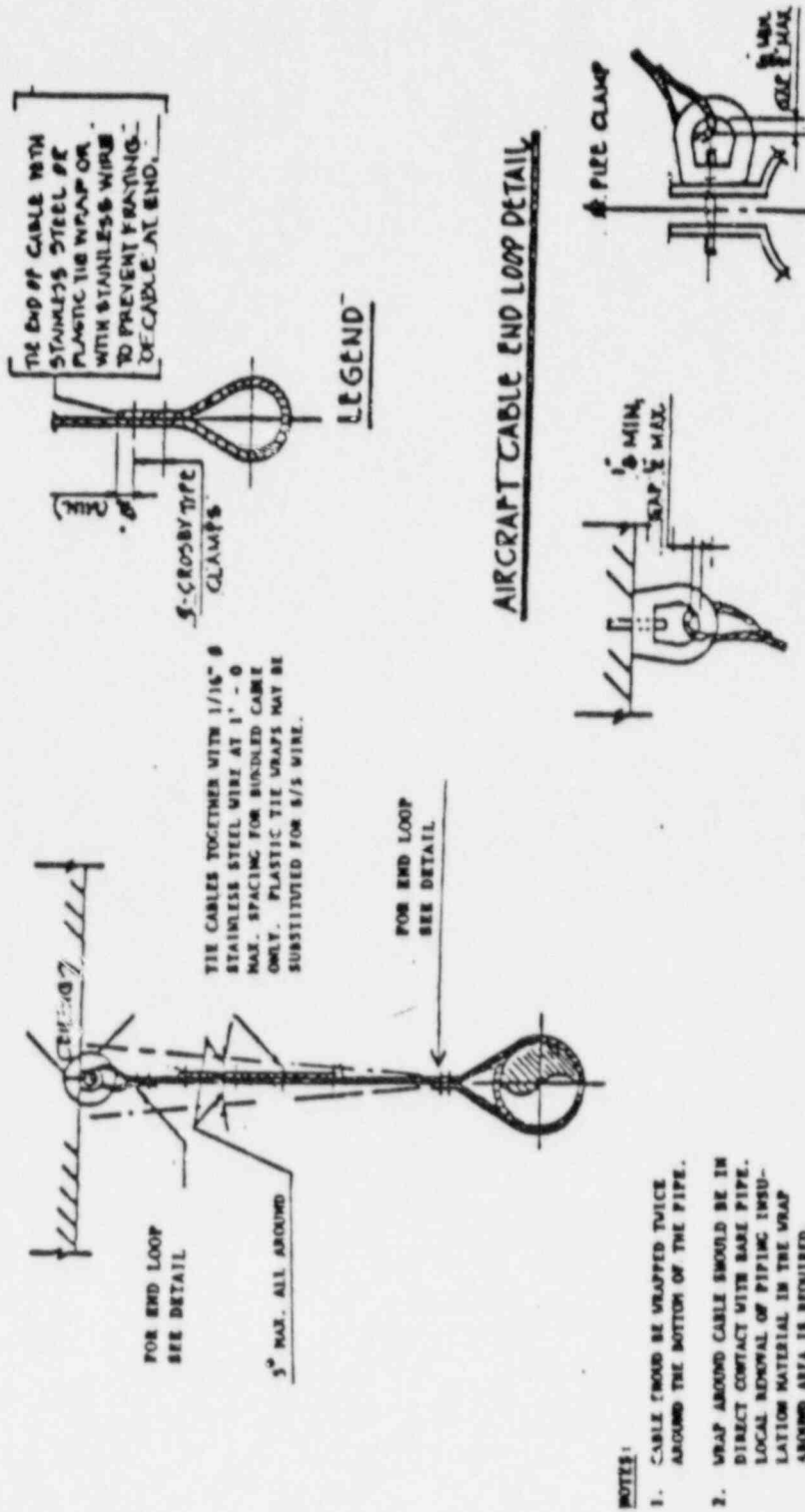
1.	1/2 x 2	2 1/4	1 1/4	1 1/4	1 1/4	27/32	1 1/32	5 9/16	4 13/16	4 13/16
2.	1/2 x 2	3 1/4	2 1/4	2 1/4	2 1/4	27/32	1 1/32	6 11/16	5 13/16	5 13/16
3.	1/2 x 2	4 1/4	3 1/4	3 1/4	3 1/4	27/32	1 1/32	7 17/32	6 11/16	6 11/16
4.	1/2 x 2	5 1/4	4 1/4	4 1/4	4 1/4	27/32	1 1/32	8 17/32	7 17/32	7 17/32
5.	1/2 x 2	6 1/4	5 1/4	5 1/4	5 1/4	27/32	1 1/32	9 17/32	8 17/32	8 17/32
6.	1/2 x 2	7 1/4	6 1/4	6 1/4	6 1/4	27/32	1 1/32	10 17/32	9 17/32	9 17/32
7.	1/2 x 2	8 1/4	7 1/4	7 1/4	7 1/4	27/32	1 1/32	11 17/32	10 17/32	10 17/32
8.	1/2 x 2	9 1/4	8 1/4	8 1/4	8 1/4	27/32	1 1/32	12 17/32	11 17/32	11 17/32
9.	1/2 x 2	10 1/4	9 1/4	9 1/4	9 1/4	27/32	1 1/32	13 17/32	12 17/32	12 17/32
10.	1/2 x 2	11 1/4	10 1/4	10 1/4	10 1/4	27/32	1 1/32	14 17/32	13 17/32	13 17/32
11.	1/2 x 2	12 1/4	11 1/4	11 1/4	11 1/4	27/32	1 1/32	15 17/32	14 17/32	14 17/32
12.	1/2 x 2	13 1/4	12 1/4	12 1/4	12 1/4	27/32	1 1/32	16 17/32	15 17/32	15 17/32
13.	1/2 x 2	14 1/4	13 1/4	13 1/4	13 1/4	27/32	1 1/32	17 17/32	16 17/32	16 17/32
14.	1/2 x 2	15 1/4	14 1/4	14 1/4	14 1/4	27/32	1 1/32	18 17/32	17 17/32	17 17/32
15.	1/2 x 2	16 1/4	15 1/4	15 1/4	15 1/4	27/32	1 1/32	19 17/32	18 17/32	18 17/32
16.	1/2 x 2	17 1/4	16 1/4	16 1/4	16 1/4	27/32	1 1/32	20 17/32	19 17/32	19 17/32
17.	1/2 x 2	18 1/4	17 1/4	17 1/4	17 1/4	27/32	1 1/32	21 17/32	20 17/32	20 17/32
18.	1/2 x 2	19 1/4	18 1/4	18 1/4	18 1/4	27/32	1 1/32	22 17/32	21 17/32	21 17/32
19.	1/2 x 2	20 1/4	19 1/4	19 1/4	19 1/4	27/32	1 1/32	23 17/32	22 17/32	22 17/32
20.	1/2 x 2	21 1/4	20 1/4	20 1/4	20 1/4	27/32	1 1/32	24 17/32	23 17/32	23 17/32

QI-QAP-11.1-28

ATTACHMENT 16
BOLTING SUBSTITUTION

ITEM DESCRIPTION SPECIFIED IN BOM	PERMITTED SUBSTITUTIONS FOR ITEM IN BOM
HEX BOLT (FHE)	<u>Heavy Hex Bolt (FHE)</u> <u>SA-36 Rod w/Hex Nut or Hvy Hex Nut (RET w/FDN or FDN)</u> <u>SA-36 End Th'd Rod w/Hex Nut or Hvy Hex Nut (RET w/FDN or FDN)</u> <u>Alloy Stud (SA-193 GR.8-7) w/Alloy Hvy Hex Nut (SA-194 GR.2H)</u>
HEAVY HEX BOLT (FHE)	<u>SA-36 Rod w/Hvy Hex Nut (RET w/FDN)</u> <u>SA-36 End Th'd Rod w/Hvy Hex Nut (RET w/FDN)</u> <u>Alloy Stud (SA-193 GR.8-7) w/Alloy Hvy Hex Nut (SA-194 GR.2H)</u>
FULL THREADED ROD w/HEX NUT (RET w/FDN)	<u>Hex Bolt (FHE)</u> <u>Hvy Hex Bolt (FHE)</u> <u>SA-36 End Th'd Rod w/Hex Nut or Hvy Hex Nut (RET w/FDN or FDN)</u> <u>Alloy Stud (SA-193 GR.8-7) w/Alloy Hvy Hex Nut (SA-194 GR.2H)</u>
FULL THREADED ROD w/ HEAVY HEX NUT (RET w/FDN)	<u>Heavy Hex Bolt (FHE)</u> <u>SA-36 End Th'd Rod w/Hvy Hex Nut (RET w/FDN)</u> <u>Alloy Stud (SA-193 GR.8-7) w/Alloy Hvy Hex Nut (SA-194 GR.2H)</u>
END THREADED ROD (RET) (Length - 18" or less)	<u>Full threaded rod (RET) under 18"</u>
HEX JAM NUT (FJN)	<u>Hex Nut (FDN)</u> <u>Heavy Hex Nut (FDN)</u>
HEAVY HEX JAM NUT (FJN)	<u>Hex Nut (FDN)</u> <u>Heavy Hex Nut (FDN)</u>

ATTACHMENT 17
AIR-CRAFT CABLE TYPICAL DETAILS



NOTE: TORQUE ADAPTED DEVICE SHALL BE UTILIZED TO TORQUE THE EYE BOLT.

ATTACHMENT 18
AIR CRAFT CABLE INSPECTION REPORT

AIR-CRAFT CABLE SEISMIC SUPPORT IR

DRAWING NO. _____ REV. _____ QI-QAP-11.1-28, REV/DCN _____
 DESIGN CHANGE NO. _____

A. QC INSTRUCTIONS

- This IR will be completed for new installations and for rework of existing installations.
1. This report shall be utilized in conjunction with Structural Inspection Report (CSSIR) for fabrication/installation of air-craft cable component support. Fabrication/Installation of air craft cable shall be documented below.
 2. QCI shall utilize Component Support Fillet & Skewed Weld Inspection Report for weld inspection, if required.
 3. The angularity verification of air-craft cable shall be checked by QCI.

B. FABRICATION INSPECTION

	QCI/DATE	
1. Cable Dia.	Req'd _____	Act'l _____
2. End loop configuration.	Sat _____	Unsat _____
3. End of cable wrapped with _____ to prevent fraying.		
a. St. steel wrap		
b. plastic tie wrap	Fill in a, b, or c as applicable.	
c. St. steel wire		
4. Ceiling or wall connection Assy.		
a. Per Design Dwg.	Sat _____	Unsat _____
b. Slotted hole ground smooth all around (Both Sides).	Sat _____	Unsat _____
5. Loop at each end is bent smooth without any permanent deformation.	Sat _____	Unsat _____

C. INSTALLATION INSPECTION

1. Cable clamps torque. Qty. Installed _____	Sat _____	Unsat _____
Req'd _____ Actual _____ M&TE _____		
2.a) Eye nut torque for Nilti.	Sat _____	Unsat _____
Req'd _____ Actual _____ M&TE _____		
b) Eye-nut on threaded rod shall be snug-tight and lock washer provided under the eye-nut.	Sat _____	Unsat _____
3. Verified cable slack by a visual gap of 1/8" min. & 1/2" max. exists between the cable and load bearing member at any one point; or	Sat _____	Unsat _____
4. Cable angle in relation to pipe and ceiling attachment shall be as shown on the drawing :5'	Sat _____	Unsat _____
5. For bundled cable, tie cables together with 1/16" # st. steel wire or plastic tie wraps at 1'-0" max. spacing.	Sat _____	Unsat _____

UNSAT ATTRIBUTES _____ NCR _____ QCI/DATE _____

CORRECTED ATTRIBUTES _____ QCI/DATE _____

REMARKS _____

ATTACHMENT 19
BEVELED WASHER DIMENSIONS

<u>Nominal Bolt Size</u>	<u>Nominal Hole Size</u>	<u>Round Washers Min. Outside Dia.</u>	<u>Sq. or Rect. Washers Min. Side Dimension</u>
1/2"	17/32"	1 1/16"	1 3/4"
5/8	11/16	1 5/16	1 3/4
3/4	13/16	1 15/32	1 3/4
7/8	15/16	1 3/4	1 3/4
1	1 1/8	2	1 3/4
1 1/8	1 1/4	2 1/4	1 3/4
1 1/4	1 3/8	2 1/2	2 1/4
1 3/8	1 1/2	2 3/4	2 1/4
1 1/2	1 5/8	3	2 1/4

BEVELED WASHER DIMENSION TOLERANCES
 (1 1/2" & Smaller Nominal Bolt Size)

Nominal Diameter of Hole	-0"; + 1/16"
Nominal Outside Dimensions	-1/32"; + 1/4"

Beveled washer shall be fabricated, as required by the amount of slope, in accordance with the table shown above. Where necessary, beveled washers may be clipped on one side to a point not closer than 7/8 of the bolt diameter from the center of the washer. The minimum washer thickness shall be 1/16" at the beveled end.

Beveled washer material shall be compatible with the bolted parts material (i.e., carbon to carbon, stainless to stainless, etc.)

Beveled washers previously installed on civil applications (Hilti, Richmond, Embedded Anchors) shall comply with the dimensions and tolerances shown above, unless otherwise shown on the drawing.

1:20 SLOPE IN TERMS OF INCHES

<u>FIN-HEAVY HEX NUTS</u>			<u>FIN-STANDARD HEX NUTS</u>		
<u>NUT SIZE</u>	<u>WIDTH ACROSS FLATS</u>	<u>MAX. GAP</u>	<u>NUT SIZE</u>	<u>WIDTH ACROSS FLATS</u>	<u>MAX. GAP</u>
1/2	7/8	.043	1/2	3/4	.037
5/8	1 1/16	.053	5/8	15/16	.046
3/4	1 1/4	.062	3/4	1 1/8	.056
7/8	1 7/16	.071	7/8	1 5/16	.065
1	1 5/8	.081	1	1 1/2	.075
1 1/8	1 13/16	.090	1 1/8	1 11/16	.084
1 1/4	2	.100	1 1/4	1 7/8	.093
1 3/8	2 3/16	.109	1 3/8	2 1/16	.103
1 1/2	2 3/8	.118	1 1/2	2 1/4	.112

ATTACHMENT 20
INTERMITTENT WELDS

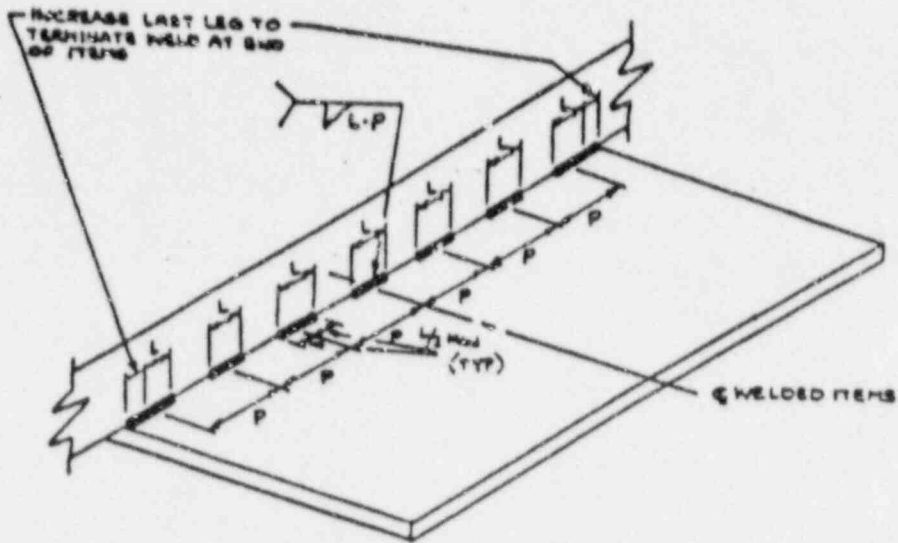
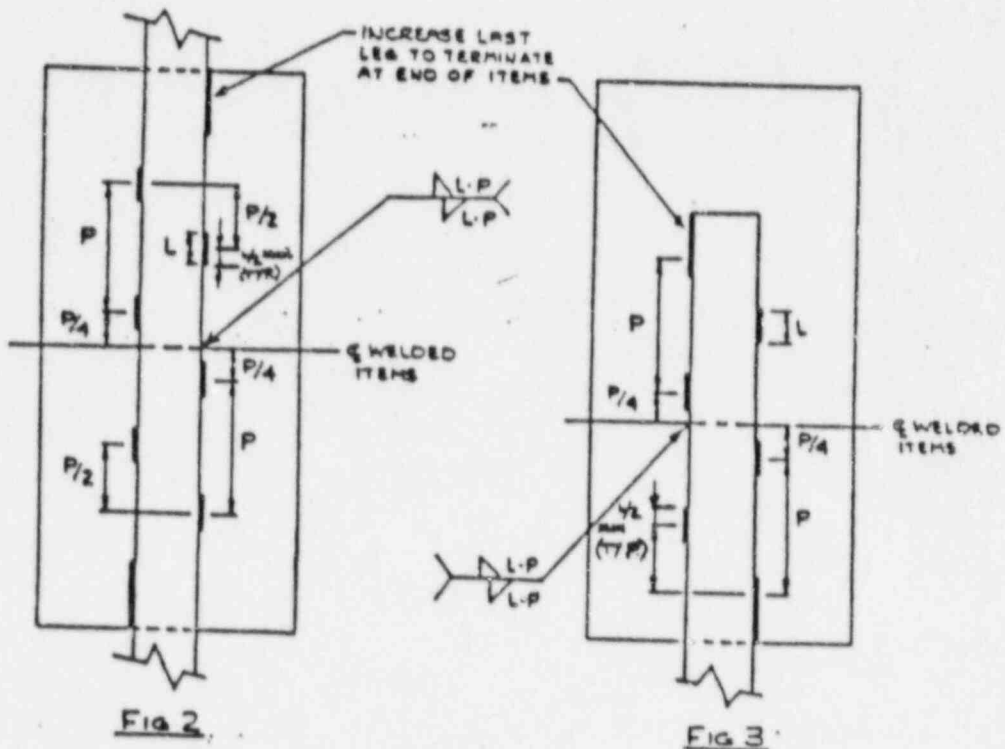


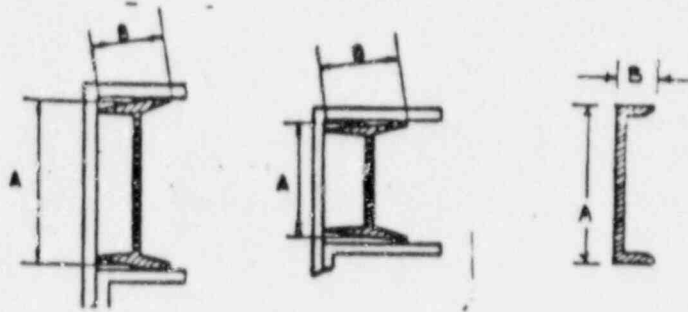
FIG 1



ATTACHMENT 21
STRUCTURAL SHAPES AND TOLERANCES

Section	Nominal size, in.	A, Depth, in. *		B, Flange width, in.	
		Over Theo- retical	Under Theo- retical	Over Theo- retical	Under Theo- retical
Standard beams "M" and "S" Shapes	3 to 7, incl	3/32	1/16	1/8	1/8
	Over 7 to 14, incl	1/8	3/32	5/32	5/32
	Over 14 to 24, incl	3/16	1/8	3/16	3/16
Channels	3 to 7, incl	3/32	1/16	1/8	1/8
	Over 7 to 14, incl	1/8	3/32	1/8	5/32
	Over 14	3/16	1/8	1/8	3/16

* A is measured at center line of web for beams; and at back of web for channels.



Section Nominal Size in.	A, Depth, in.		B, Flange width, in.	
	Over Theo- retical	Under Theo- retical	Over Theo- retical	Under Theo- retical
Up to 12, incl	1/8	1/8	1/4	3/16
Over 12 "W" Shapes	1/8	1/8	1/4	3/16

A is measured at center line of web.
B is measured parallel to flange.

