EVALUATION RESEARCH CORPORATION

CONTROLLED COPY
CONTROL NO. DF-001

COMANCHE PEAK RESPONSE TEAM

QUALITY INSTRUCTION FOR ISSUE-SPECIFIC ACTION PLAN VII.c

INSTRUCTION NO.: QI-055

REVISION NO.: 2

ISSUE DATE: 02/27/86

REINSPECTION OF INSTRUMENT PIPE/TUBE SUPPORTS/I-S-INSP

Prepared by: A Kaufman Date: 2/3/86

Approved by: [signature] Date: 2/26/86
Issue Coordinator

Approved by: E. C. Baiardo Date: 2/26/86
On-Site QA Representative

Approved by: [signature] Date: 2/26/86
QA/QC Review Team Leader

8607170183 860711
PDR ADOCK 05000445
A PDR

1.0 PURPOSE

This procedure provides instructions to be used and the accept/reject criteria to be applied in performing reinspections of instrument pipe/tube supports by the QA/QC Inspection Team.

2.0 APPLICABILITY

This procedure applies to the reinspection of samples selected from the instrument pipe/tube support population at Comanche Peak Units 1, 2 and areas common to both units. The population is discussed in the Population Description for Instrument Pipe/Tube Supports.

3.0 REFERENCES

3.1 Memo (QA/QC-RT-433) to A. A. Patterson from R. H. Brown delineating documentation used in development of procedure including specific sources for attributes and exclusions.

3.2 CPP-009, "Performance of Reinspection and Documentation Reviews."

3.3 QI-QP-11.18-4, "Ultrasonic Examination of Hilti Bolts."

4.0 GENERAL

4.1 Responsibilities

a. QA/QC Discipline Engineers

The QA/QC Discipline Engineers prepare the inspection procedure delineating reinspection requirements and attributes.

b. QA/QC Inspectors

The QA/QC Inspectors perform reinspection/verification in accordance with Reference 3.2 and this inspection procedure and record observations and deviations.

4.2 Policy

Activities performed under this procedure shall conform to the policies contained in the latest Comanche Peak Response Team Program Plan and Issue-Specific Action Plan VII.c.

5.0 INSTRUCTION

Notes (1,2,3) refer to attachment 6.1 which shows the inspection checklist that inspectors will use to document the reinspection/verification.

Supports contained in the reinspection envelope of a specified instrument include the instrument support itself, if any, and instrument tubing supports from the instrument to the process root valve.

1. Location and Orientation

   a. Verify that support spacing is in accordance with the generic details governing support placement as shown on the applicable drawings of the 2323-I-001 and 2323-I-002 drawing series and that maximum spans as shown on drawing FSI-00069 have not been exceeded.

   b. Verify that the location and orientation on individually designed supports is in accordance with the design drawing. Dimensions to the support shall be from a specific point on the piping (elbows, valve, tee, etc.) or from surveyors reference points.

   c. Verify that when no generic or individually designed supports are required (i.e., limit switches, thermocouples) the tube span, if any, is in accordance with maximum allowable spans as shown on drawing FSI-00069.

2. Configuration

   2.1 Components

      a. Verify type, size, and model/catalogue number for all support components as shown on the applicable generic/design drawings.

      b. Verify that the number of tubes attached to a support does not exceed the number of allowed attachments as given on the applicable generic/design drawings.

   2.2 Dimensions

      Verify support dimensions* with those shown on the applicable generic/design drawing except that supports with maximum dimensions specified may be shortened as necessary for field requirements.

5.0 INSTRUCTION (Cont'd)

*NOTE: The following tolerances shall apply:

- Length $\leq$ 12" ± 1/8"
- Length $>$ 12" ± 1/4"
- Hole centerline location ± 1/8"
- Attachments to baseplates ± 1/4"

2.3 Shims

Verify that shims, where required per the generic/design drawing or installed as spacers, are in accordance with the applicable generic/design drawings.

2.4 Baseplates

Verify that baseplates fit flush against the mating surface. The following is acceptance criteria where baseplates are not flush:

° The gap between the plate and concrete for a maximum of 20% of the plate perimeter may exceed 1/16 inch, but at no point shall the gap exceed 1/2 inch.

° If the above acceptance criteria is not met, the inspector shall, using a feeler gage, map gap depth beneath the baseplate and determine if the area exceeding 1/16" gap is limited to less than 20% of the baseplate area. If verified, the attribute is acceptable.

3. Material Verification

Record item number, description, and heat number (or unique identifier) for non-catalogue items (i.e. tube steel, plate, etc.) and shop fabricated supports on Attachment 6.2 for later use in document review. Should heat number (or unique identifier) be missing or illegible, record such on form.

4. Bolting

4.1 Engagement

Verify that all bolts, studs, or threaded rods have full thread engagement in the nut or meet minimum thread engagement specified on the generic/design drawing. (Note 4)

5.0 INSTRUCTION (Cont'd)

4.2 Surface Contact

a. Verify, by means of a bevel gauge, that surfaces of bolted parts in contact with the bolt or nut shall have a slope of no more than 1:20 with respect to a plane normal to the bolt axis.

b. Verify that a beveled washer has been used where the slope is greater than 1:20. (See Attachment 6.3)

4.3 Washers

Verify that all threaded fasteners are provided with washers where required on the generic/design drawing. (Notes 5,6)

4.4 Edge Distance

Minimum bolt edge distance on non-catalogue items (i.e. plate, etc.) shall be in accordance with Attachment 6.4.

4.5 Spring Nuts

Verify that the serrated grooves align with the channel clamping ridge.

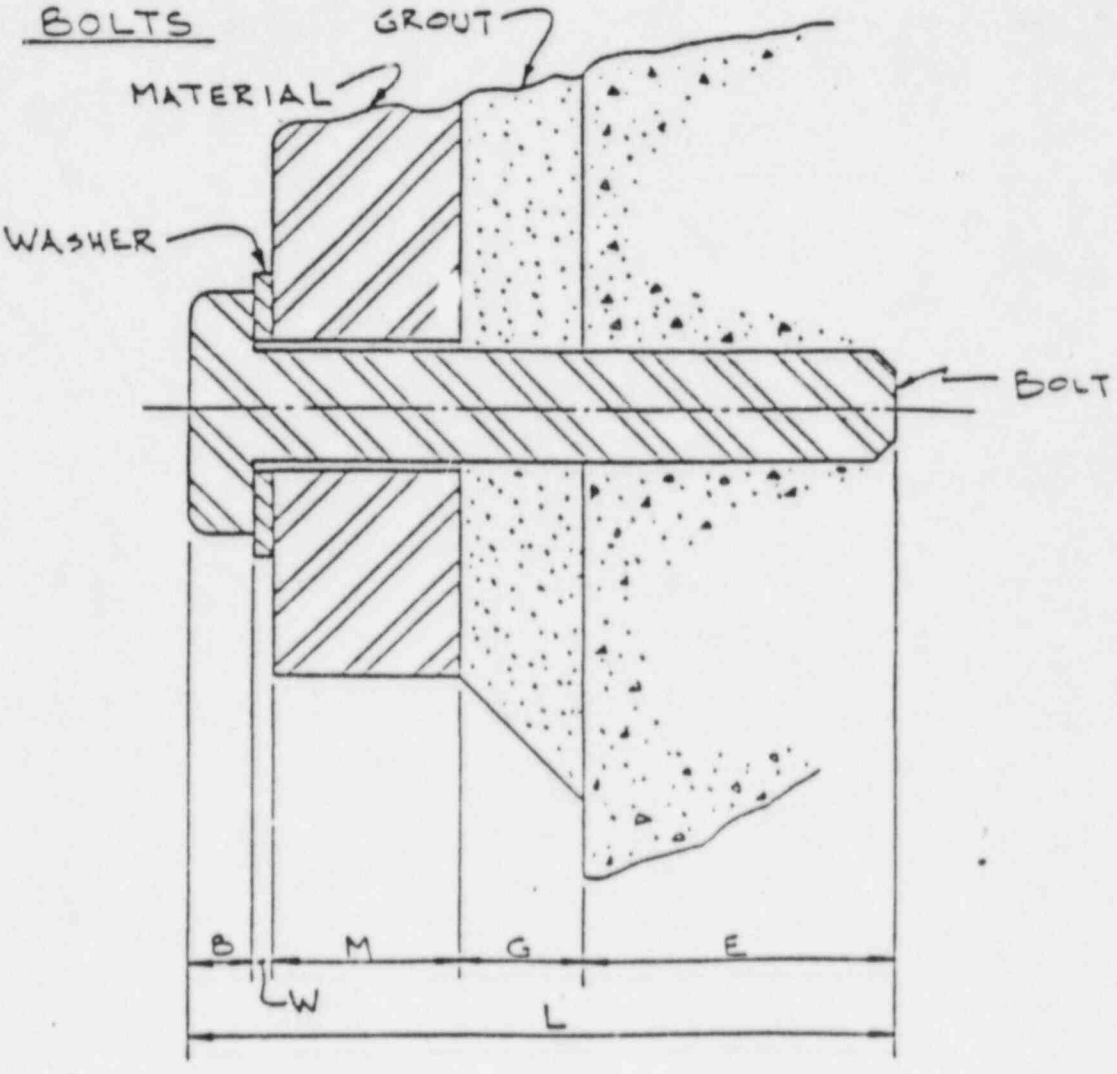
4.6 Richmond Inserts

a. If the information necessary to calculate thread engagement is available on the design drawing, DCA, marking on the bolt, etc. then verify the thread engagement for Richmond Inserts is at least two (2) times the bolt diameter plus 1/8 inch. Thread engagement shall be calculated as shown in Attachment 6.18. Where bolt length information is not retrievable, the length shall be determined by an ultrasonic examination performed by Brown & Root in accordance with procedure QI-QP-11.18-4. This information shall be transmitted to the inspector by Brown & Root in writing. The inspector shall include this report in the reinspection package and based on this information verify the thread engagement in accordance with Attachment 6.18.

b. Verify nuts or bolts in Richmond inserts are hand tight. The stud shall not rotate.

5.0 INSTRUCTION (Cont'd)

4. Bolting (Cont'd)



R I C H M O N D I N S E R T S O N L Y

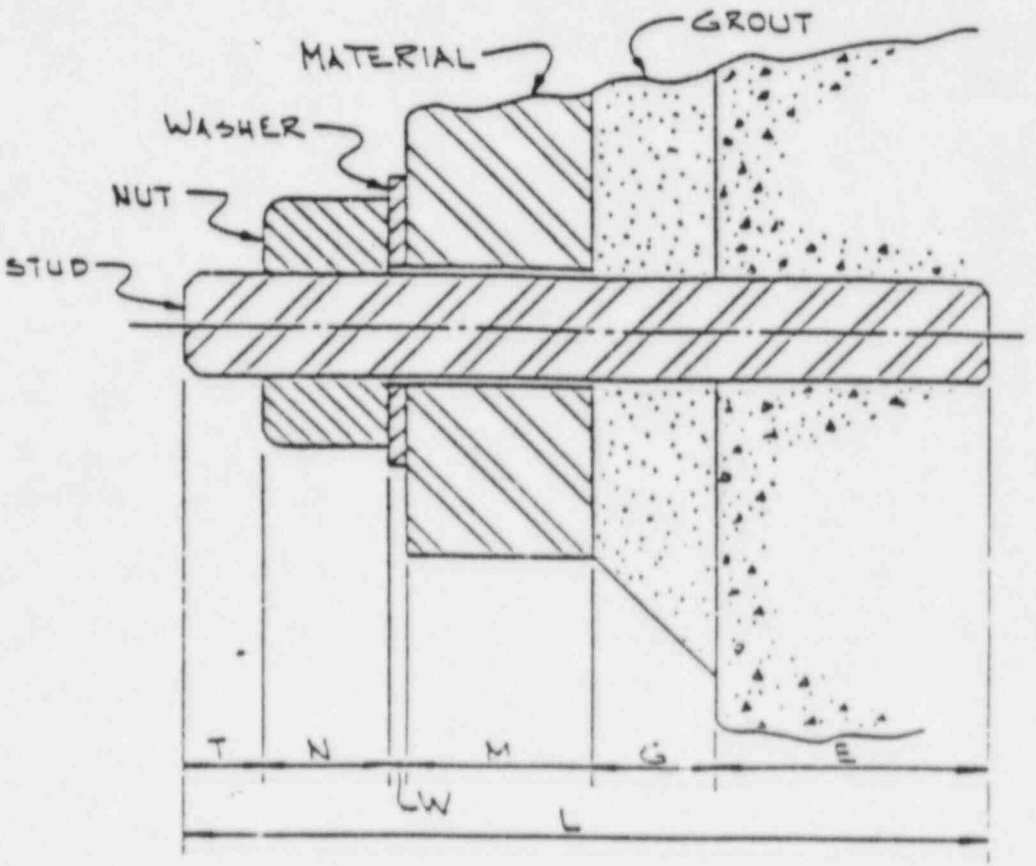
Thread engagement (E) = L - (B + W+ M + G)
Where:

B = thickness of bolt head, in.
W = thickness of washer stack, in.
M = thickness of material, in. (i.e., baseplate, tube steel, etc.)
G = thickness of grout, in. (where applicable)
L = overall length, in. (if from design drawings: B=0)

5.0 INSTRUCTION (Cont'd)

4. Bolting (Cont'd)

STUDS



RICHMOND INSERTS ONLY

Thread engagement (E) = L - (T + N + W + M + G)
Where:
T = extension from top of nut, in.
N = thickness of nut, in.
W = thickness of washer stack, in.
M = thickness of material, in. (i.e., baseplates)
G = thickness of grout, in. (where applicable)
L = overall length, in. (from design drawings)

b. Verify nuts or bolts in Richmond inserts are hand tight. The stud shall not rotate.

5.0 INSTRUCTION (Cont'd)

4.7 Torque

a. Verify that bolts are torqued to 70% of the requirements specified in the generic/design drawings or as shown in attachment 6.5 for connections which have not been painted. (Notes 7,8)

b. Verify that nut is hand tight on bolted connections where no torque is specified in the generic/design drawings. This applies only to connections which have not been painted.

c. Verify that nut is hand tight on connections that have been painted.

5. Concrete Expansion Anchors (Hilti)

5.1 Size and Number

a. Verify anchor bolt diameter. This can be accomplished by using a gauge or rule to distinguish nominal diameter sizes ranging between 1/4 and 1 1/4 inch diameter in increments of 1/8 inch.

b. Verify that type, length, and number of anchors installed match those shown on the design drawing. (Notes 9,10)

5.2 Embedment

Verify that the Hilti anchor bolt embedment plus the nut thickness (from Attachment 6.6) for the anchor being measured, is not less than the 'Embedment Length' or 'Minimum Embedment Length' identified on the design drawings (remove paint if necessary); or lacking such information use the "Minimum Embedment" identified on Attachment 6.6. page 3. (Notes 11,12)

5.3 Bolt Spacing

a. Verify for each Hilti, center-to-center spacing of adjacent anchors of the same size (not on the same attached fixture) is not less than ten (10) anchor diameters unless specified on the design drawing. For unequal sized bolts, the minimum spacing (unless shown on the design drawing) is as shown on Attachment 6.7.

5.0 INSTRUCTION (Cont'd)

b. Verify that spacing of each Hilti to existing Richmond Inserts, concrete edges, abandoned holes, Hilti anchors and embedded anchor bolts that have been cut off meets the minimum spacing requirements specified in Attachment 6.8 unless shown on the design drawing.

c. Verify that the minimum distance of each Hilti anchor to any adjacent embedded plate meets the following requirements of Attachment 6.9.

- Attachments located within twelve (12) inches of a Hilti anchor bolt shall be spaced as shown on Attachment 6.9.
- For embedment plates without any attachment within a twelve (12) inch clearance distance, the anchor may be as close as practical to the edge of the plate without damage to the plate.

5.4 Angularity

Verify that each Hilti anchor installed has its longitudinal axis within 6° from the perpendicular to the surface in which it is installed. Attachment 6.10 gives inspection requirements.

5.5 Concrete Damage

Verify structural concrete surrounding the fixture is not spalled as a result of installing the Hilti anchor. If spalling exists, verify the depth does not exceed the following:

Hole Size	Maximum Acceptable Spall Depth*
5/8 inch	1/2 inch
3/4 inch to 1 1/4 inch	3/4 inch

* If the area in question includes a two (2) inch topping, the maximum spall depth may be increased to the depth of topping.

5.0 INSTRUCTION (Cont'd)

5.6 Nut Engagement and Bearing

a. Verify nut of each Hilti anchor has proper engagement such that the end of the anchor bolt is not lower than the top of nut, unless otherwise shown on design drawings.

b. Verify surfaces of bolted parts in contact with the nut and washer of each Hilti anchor have a slope of no more than 1:20 and that a minimum of one washer (standard or plate) has been provided. The washer shall completely cover the hole in the base plate. A bevel gauge shall be used for determining if the gap is less than 1:20 (Attachment 6.3)

c. Verify that the nut for each anchor has not bottomed out. Use thread length in Attachment 6.6 and measured projection to determine acceptance.

d. Verify no visible weld has been made to anchor bolt nut.

6. Welding

Prior to the start of inspection assure that welds are clean of any foreign material which would impede an adequate visual inspection. Coatings need not be removed unless an inspector feels that he is unable to provide an adequate inspection of the weld due to excessive and/or uneven coating application. The inspector shall contact the Level III Inspector and, with his concurrence, request that the coating be removed.

Where it is necessary to measure weld dimensions during the course of an inspection, such dimensions should be determined as accurately as is practically achievable using standard weld inspection tools.

6.1 Location

Verify that the weld locations are as specified per the detailed drawing.

6.2 Weld Size

Verify that the weld size meets the requirements of the applicable drawings except that:

5.0 INSTRUCTION (Cont'd)

- Fillet welds may be undersized to a maximum of 1/16" provided that the undersized portion(s) do not exceed 1/4 of the weld length.

- Oversized fillet welds shall be acceptable if the oversized weld does not interfere with mating parts.

- For Bevel welds that are inaccessible from the backside, the size is verified by assuring that the joint is welded flush (except as noted in Attachment 6.11).

6.3 Weld Length

Verify that the weld length complies with the referenced drawing with the following allowances:

-

Weld length Specified on Drawing	Permissible Underlength
< 3"	1/8"
≥ 3"	1/4"

- Weld lengths may be longer than specified.

- The spacing of intermittent welds may vary within 1" of the location specified on the drawing.

6.4 Fusion

Verify that if any incomplete fusion is visible it complies with the following:

- For fillet welds 3/8'' maximum incomplete fusion in any 4" segment and 1/4" maximum incomplete fusion in welds less than 4" long.

- For groove welds no incomplete fusion is permitted.

6.5 Craters

Verify that the weld size is met on all welds with underfilled craters. Craters outside the specified weld length are irrelevant provided there are no cracks visible through the coated surface if the weld has been coated or on the uncoated surface if the coating has not been applied.

5.0 INSTRUCTION (Cont'd)

6.6 Weld Profiles

Verify visually that the weld profiles are acceptable per Attachment 6.11.

6.7 Undercut

Verify that any undercut present does not exceed the following criteria:

- For base material less than 1/8", no undercut is permitted.

- For base material > 1/8" and < 3/8" the following requirements apply:

  1. When the member is welded from both sides and the undercut is in the same plane, the following undercut is permitted:

     a. 1/32" for 1/2 the length of the *total weld, or

     b. 1/32" for 1/4 the length of the *total weld and 1/16" for 1/8 the length of the *total weld.

     *Total weld equals the cumulative length of both sides.

  2. For all other welds the permitted undercut is:

     a. 1/32" for the full length of the weld, or

     b. 1/32" for 1/2 the length of the weld and 1/16" for 1/4 the length of the weld.

- For base material greater than 3/8", the following requirements apply:

  1. For members welded on both sides, where the undercut is in the same plane, the permitted undercut is 1/32" for 3/4 of the length of the weld and 1/16" for the remaining 1/4 of the length of the weld on both sides, or

5.0 INSTRUCTION (Cont'd)

2. For members welded only on one side, or where the undercut is not in the same plane, the undercut may be 1/16" for the full length of the weld.

6.8 Porosity

Considering that only surface porosity whose major surface dimension exceeds 1/16" shall be considered relevant, verify the following:

a. The sum of the diameters of porosity do not exceed 3/8" in any linear inch of weld and shall not exceed 3/4" in any 12" of weld.

b. If four (4) or more pores are aligned, the edge-to-edge separation of the pores shall exceed 1/16".

6.9 Overlap

If overlap is present, verify that the required weld size and the fusion acceptance criteria are met. If fusion in the overlap length cannot be verified, then verify that the overlap length, whose fusion cannot be verified, does not exceed 3/8" in any 4" segment or 1/4" in welds less than 4" long.

6.10 Surface Slag

Verify that the major surface dimensions of the slag do not exceed 1/8" or 1/4" for any isolated surface slag. (Slag is considered to be isolated when it does not occur more frequently than once in a 3" weld segment.)

6.11 Cracks

Verify that there are no cracks visible through the coated surface if the weld has been coated or on the uncoated surface if the coating has not been applied.

6.12 Welder's ID Symbol

Determine if a welder symbol is present (do not remove paint) and record on Attachment 6.12. This information is required for document review only and has no accept/reject criteria.

5.0 INSTRUCTION (Cont'd)

NOTES:

1. In the course of inspection the inspector shall note any item not covered by reinspection/verification which appear out of the ordinary as related to the construction of the inspected item . Note such in the remarks column of inspection checklist and initiate an out-of-scope observation.

2. Inspector shall record the inspection tool code and other applicable data (i.e., tool number, calibration data, etc.) on Attachment 6.13 for those tools used in the inspection.

3. Should additional space be required for remarks on checklist, use Attachment 6.14.

4. For full thread engagement end of bolt shall be flush with top of the nut.

5. It is acceptable to have washers installed where none are required.

6. Washers are not required on Hilti bolts anchoring 2D or 3D block-type clamps (i.e., J. C. White, etc.) to concrete.

7. Inspector shall ensure that torque wrenches are properly calibrated and logged as such.

8. Where threaded fasteners require a torque check (excluding Hilti concrete anchors) and do not meet minimum torque criteria as shown on Attachment 6.5 the inspector shall record in the remarks column the actual torque at which the nut begins to rotate.

9. Determine anchor length by the letter designation stamped on the top of the bolt (Attachment 6.6). Super Kwik bolts are identified by a star in addition to the letter designation.

10. If length identification is not verifiable or visible, an ultrasonic examination shall be performed by Brown & Root in accordance with Reference 3.3. Once ultrasonic examination is complete, record actual length on inspection checklist and include test results in the verification package.

11. Determine embedment length of installed anchor by measuring the projected length of the anchor from the concrete surface*. Subtract the projected length from the designated length to obtain embedment length. The designated length is that shown on Attachment 6.6, unless ultrasonic examination is used in which case the examination length shall be used.

5.0 INSTRUCTION (Cont'd)

*NOTE: In floor and roof areas where topping has been placed, the thickness of the topping shall be taken into account in determining the projected length unless shown on design drawing. In these areas the thickness of the topping shall be added to measured length taken from the concrete surface. The inspector shall ensure that thickness for topping is provided by the engineer and recorded on the inspection checklist.

12. Where a Hilti bolt has been installed in the field but is not listed in Attachment 6.6, Page 1 of 3 and Page 2 of 3, the bolt length is conservatively derived using the manufacturer's stamp (A,B,C, etc.) and the information shown on Page 3 of 3 of Attachment 6.6. In general, each letter designation defines a bolt length which is independent of bolt diameter. Minimum embedment length is consistent with bolt diameter and is independent of bolt length.

13. The acceptability of support types not shown on the FSI isometric drawing but indicated as adequate substitutions by the 2323-I-001 and 2323-I-002 generic drawing series shall be determined in writing by a QC discipline or lead discipline engineer.

14. The definition of 'run' as applied to tube span configurations shall be as noted on the applicable design/generic drawings (2323-I-001 and 2323-I-002). Where the definition is not explicit with regards to a specific drawing, a determination will be made, using any applicable information (relating to instrument tube supports design and/or installation procedures), with concurrance of both the QC engineering and inspection groups.

6.0 ATTACHMENTS

6.1 Inspection Checklist

6.2 Material Identification

6.3 Nut Bearing

6.4 Minimum Bolt Edge Distances

6.5 Torque Requirements

6.6 Hilti Anchor Designation and Setting Requirements

6.7 Minimum Spacing Between Hilti Expansion Anchors

6.8 Minimum Anchor Clearances

6.9 Minimum Clearances to Embedded Plates

6.10 Anchor Angularity

6.11 Weld Profiles

6.12 Welder I.D.

6.13 Inspection Tools and Codes

6.14 Supplemental Remarks

COMANCHE PEAK RESPONSE TEAM CHECKLIST

POPULATION DESC	VERIFICATION PKG NO.	PAGE 1 OF 3
INSTRUMENT PIPE/TUBE SUPPORTS	I-S-INSP-	
QUALITY INSTRUCTION QI-055	☒ REINSPECTION ☐ DOCUMENTATION REVIEW	☐ UNIT 1 ☐ UNIT 2 ☐ COMMON
EQUIPMENT MARK/TAG NO. SUPPORT ID		

ATTRIBUTE	VERIFICATION			REMARKS
	ACCEPT	REJECT	DATE	
1. Location and Orientation				
a.				
b.				
c.				
2. Configuration				
2.1 Components				
a.				
b.				
2.2 Dimensions				
2.3 Shims				
2.4 Baseplates				
3. Material Verification	N/A	N/A		For information only
4. Bolting				
4.1 Engagement				
4.2 Surface Contact				
a.				
b.				

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

COMANCHE PEAK RESPONSE TEAM
CHECKLIST

POPULATION DESC INSTR PIPE/TUBE SUPPORTS	VERIFICATION PKG NO. I-S-INSP-			PAGE 2 OF 3
ATTRIBUTE	VERIFICATION			REMARKS
	ACCEPT	REJECT	DATE	
4. Bolting (cont.)				
4.3 Washers				
4.4 Edge Distance				
4.5 Spring Nuts				
4.6 Richmond Inserts				
a.				
b.				
4.7 Torque				
a.				
b.				
c.				
5. Concrete Expansion Anchors				
5.1 Size and Number				
a.				
b.				
5.2 Embedment				
5.3 Bolt Spacing				
a.				
b.				
c.				
5.4 Angularity				
5.5 Concrete Damage				

COMANCHE PEAK RESPONSE TEAM
CHECKLIST

POPULATION DESC INSTR PIPE/TUBE SUPPORTS	VERIFICATION PKG NO. I-S-INSP-			PAGE 3 OF 3
ATTRIBUTE	VERIFICATION			REMARKS
	ACCEPT	REJECT	DATE	
5. Concrete Expansion Anchors (Cont'd)				
5.6 Engagement and Bearing				
a.				
b.				
c.				
d.				
6. Welding				
6.1 Location				
6.2 Weld Size				
6.3 Weld Length				
6.4 Fusion				
6.5 Craters				
6.6 Weld Profiles				
6.7 Undercut				
6.8 Porosity				
6.9 Overlap				
6.10 Surface Slag				
6.11 Cracks				
6.12 Welde. ID	N/A	N/A		For Information Only

COMANCHE PEAK REVIEW TEAM

INSPECTION CHECKLIST

VERIFICATION PACKAGE NO. I-S-INSP-_____

INSTRUMENT NO./DRAWING NO. _____

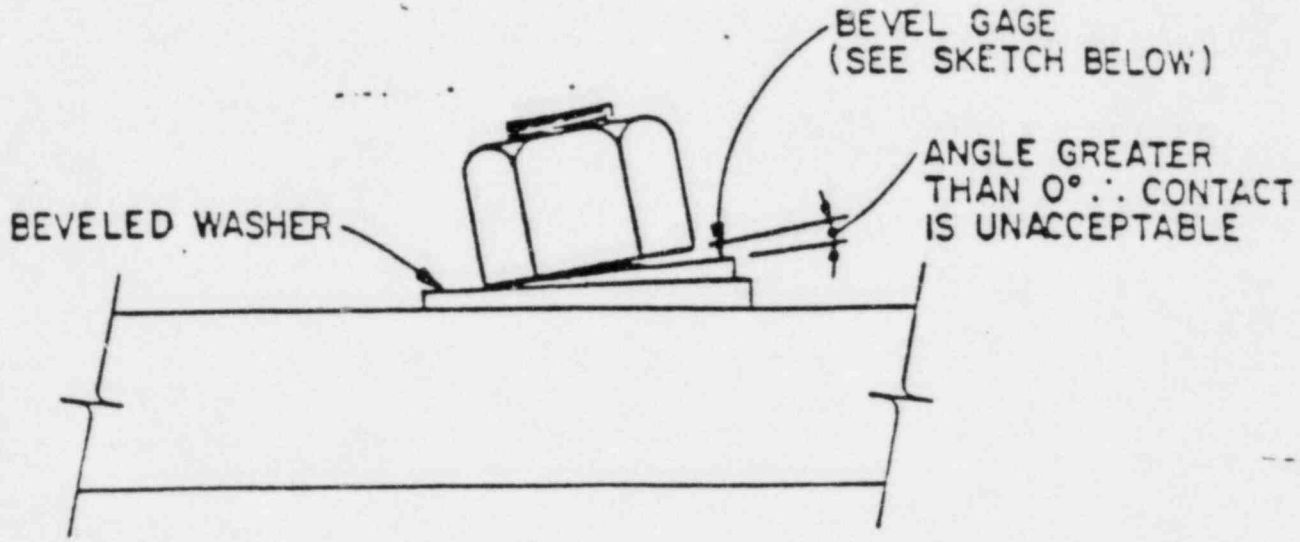
MATERIAL IDENTIFICATION

ITEM NO.	DESCRIPTION	IDENTIFICATION INFORMATION

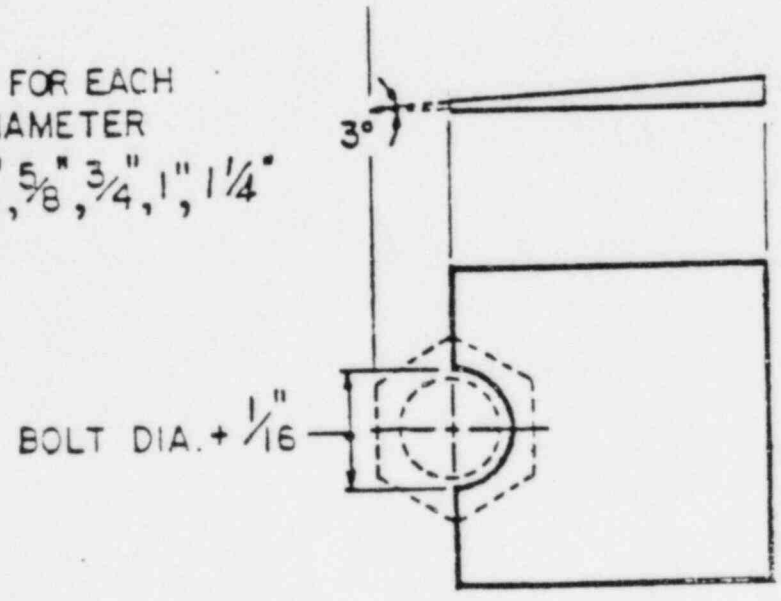
_____ _____

Inspector Date

NUT BEARING



1 GAGE FOR EACH
BOLT DIAMETER
1/4", 3/8", 1/2", 5/8", 3/4", 1", 1 1/4"



MINIMUM BOLT EDGE DISTANCES

BOLT Ø	MIN. EDGE DISTANCE
3/8"	9/16"
1/2"	3/4 "
5/8"	7/8 "
3/4"	1 "
1 "	1 1/4 "
1 1/4"	1 5/8 "
1 1/2"	1 7/8 "
1 3/4"	2 3/16"
2 "	2 1/2 "

TORQUE REQUIREMENTS

UNISTRUT BOLTS

Bolt Diameter	Installation Torque	Test Torque
1/4"	6 ft-lb	50"-lb
5/16"	11 ft-lb	92"-lb
3/8"	19 ft-lb	160"-lb
1/2"	50 ft-lb	420"-lb

J. C. WHITE CLAMPS (UNPLATED FASTENERS)

Type	Installation Torque	Test Torque
2D	43"-lb	30"-lb
3D	43"-lb	30"-lb

J. C. WHITE CLAMPS (PLATED FASTENERS)

Type	Installation Torque	Test Torque
2D	33"-lb	24"-lb
3D	33"-lb	24"-lb

NOTE: For 5/8" diameter bolts used in conjunction with Uni-Strut members for instrument supports where the bearing surface under the nut, used with a flat washer, bears against the open side of the Uni-Strut the minimum installation torque shall be 80 ft-lbs.

HILTI ANCHOR DESIGNATION AND SETTING REQUIREMENTS

Stamp on Anchor	Actual Bolts Sizes	Minimum Embedment (Before Torque) KWIK	Super Kwik	Length of Threads	Nut Thickness
A.	1/4 x 1 5/8	1 1/8	-	3/4	7/32
B.	1/4 x 2 1/4	1 1/8	-	3/4	7/32
	3/8 x 2 1/8	1 5/8	-	7/8	11/32
C.	3/8 x 2 3/4	1 5/8	-	7/8	11/32
	1/2 x 2 3/4	2 1/4	-	1 1/4	7/16
D.	1/4 x 3	1 1/8	-	3/4	7/32
E.	1/4 x 3 1/2	1 1/8	-	3/4	7/32
	3/8 x 3 1/2	1 5/8	-	1 1/8	11/32
	1/2 x 3 3/4	2 1/4	-	1 1/4	7/16
	5/8 x 3 1/2	2 3/4	-	1 1/2	17/32
F.	3/4 x 4 1/4	3 1/4	-	1 1/2	5/8
G.	5/8 x 4 1/2	2 3/4	-	1 1/2	17/32
	3/4 x 4 1/2	3 1/4	-	1 1/2	5/8
H.	3/8 x 5	1 5/8	-	1 1/8	11/32
I.	1/2 x 5 1/2	2 1/4	-	1 1/4	7/16
	3/4 x 5 1/2	3 1/4	-	1 1/2	5/8
J.	5/8 x 6	2 3/4	-	1 1/2	17/32
	1 x 6	4 1/2	-	2 1/4	27/32
K.	-	-	-	-	-
L.	1/2 x 7	2 1/4	3 1/4	1 1/4	7/16
	3/4 x 7	3 1/4	-	1 1/2	5/8
	1 x 7	4 1/2	-	2 1/4	27/32
M.	-	-	-	-	-
N.	-	-	-	-	-
O.	5/8 x 8 1/2	2 3/4	-	1 1/2	17/32
	3/4 x 8 1/2	3 1/4	-	1 1/2	5/8
P.	1/2 x 9		3 1/4	1 1/4	7/16
	1 x 9	4 1/2	6 1/2	2 1/4	27/32
	1 1/4 x 9	5 1/2	-	3 1/4	1 1/32
Q.	-	-	-	-	-

HILTI ANCHOR DESIGNATION AND SETTING REQUIREMENTS

Stamp on Anchor	Actual Bolts Sizes	Minimum Embedment (Before Torque) KWIK	Super Kwik	Length of Threads	Nut Thickness
R.	1/2 x 10	2 1/4	-	1 1/4	7/16
	3/4 x 10	3 1/4	-	1 1/2	5/8
S.	-	-	-	-	-
T.	1/2 x 12	-	3 1/4	1 1/4	7/16
	1 x 12	4 1/2	6 1/2	2 1/4	27/32
	1 1/4 x 12	5 1/2	8 1/8	3 1/4	1 1/32
U.	1 x 13 1/2	4 1/2	6 1/2	2 1/4	27/32
	1 1/4 x 13 1/2	5 1/2	8 1/8	3 1/4	1 1/32
V.	-	-	-	-	-
W.	1 x 15	-	6 1/2	2 1/4	27/32
	1 1/4 x 15	5 1/2	8 1/8	3 1/4	1 1/32
X.	1 1/4 x 16 1/2	5 1/2	8 1/8	3 1/4	1 1/32
Y.	-	-	-	-	-
Z.	1 1/4 x 18	5 1/2	8 1/8	3 1/4	1 1/32
DD.	1 1/4 x 22	-	8 1/8	3 1/4	1 1/32
EE.	1 1/4 x 23	-	8 1/8	3 1/4	1 1/32

* 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 below.

LENGTH IDENTIFICATION SYSTEM

Stamp On Anchor	Length of Anchor* (Inches)
A	1 1/2
B	2
C	2 1/2
D	3
E	3 1/2
F	4
G	4 1/2
H	5
I	5 1/2
J	6
K	6 1/2
L	7
M	7 1/2
N	8
O	8 1/2
P	9
Q	9 1/2
R	10
S	11
T	12
U	13
V	14
W	15
X	16
Y	17
Z	18

*To be used for checking embedment length only

STANDARD HILTI DATA

Bolt Diameter	Minimum Embedment KWIK (before torque	Length of Threads
1/4	1 1/8	3/4
3/8	1 5/8	varies
1/2	2 1/4	1 1/4
5/8	2 3/4	1 1/2
3/4	3 1/4	1 1/2
1	4 1/2	2 1/4
1 1/4	5 1/2	3 1/4

MINIMUM SPACING BETWEEN HILTI EXPANSION ANCHORS*

Hilti Anchor Size	1/4" Hilti	3/8" Hilti	1/2" Hilti	5/8" Hilti	3/4" Hilti	1" Hilti	1 1/4" Hilti
1/4	2 1/2	3 1/8	3 3/4	4 3/8	5	6 1/5	7 1/2
5/16	2 13/16	2 7/16	4 1/16	4 11/16	5 5/16	6 9/16	7 13/16
3/8	3 1/8	3 3/4	4 3/8	5	5 5/8	6 7/8	8 1/8
1/2	3 3/4	4 3/8	5	5 5/8	6 1/4	7 1/2	8 3/4
5/8	4 3/8	5	5 5/8	6 1/4	6 7/8	8 1/8	9 3/8
3/4	5	5 5/8	6 1/4	6 7/8	7 1/2	8 3/4	10
7/8	5 5/8	6 1/4	6 7/8	7 1/2	8 1/8	9 3/8	10 5/8
1	6 1/4	6 7/8	7 1/2	8 1/8	8 3/4	10	11 1/4
1 1/4	7 1/2	8 1/8	8 3/4	9 3/8	10	11 1/4	12 1/2

Dimension in inches.

* The minimum spacing outlined in the above chart applies to Hilti anchors detailed on separate adjacent fixtures.

Hilti bolts details on an individual fixture drawing may have less than the minimum spacing tabulated above.

MINIMUM ANCHOR CLEARANCES*

Hilti Anchor Size	MINIMUM DISTANCE TO: Richmond Screw Anchors 1-inch	Richmond Screw Anchors 1 1/2-Inch	Concrete Edge* (Note 1)	Abandoned Hilti Anchors or Holes and Embedded Anchor Bolts that are Cut Off**
1/4	7 5/8	12 1/4	1 1/4	1/2
3/8	8 1/4	12 7/8	1 7/8	3/4
1/2	8 7/8	13 1/2	2 1/2	1
5/8	9 1/2	14 1/8	3 1/8	1 1/4
3/4	10 1/8	14 3/4	3 3/4	1 1/2
1	11 3/8	16	5	2
1 1/4	12 5/8	17 1/4	6 1/4	2 1/2

* Measured Center-to-Center of anchors and anchor center to edge of concrete in inches.

** Minimum spacing between holes covered by this column shall be measured center-to-center and based on size of hole being drilled. (e.g., Pilot hole spacing is based on pilot bit size.)

Hilti bolts may be installed as close as practical to unused Richmond Screw Anchors which have been plugged (i.e., grouted, Richmond Screw-in plug or snap-in plug, etc.).

NOTE 1: Where embedded angles are used for framing water tight door or removable block wall openings, the minimum clearance from center line of Hilti anchor to the opening edge is 5 inches + 5 times the Hilti anchor diameter.

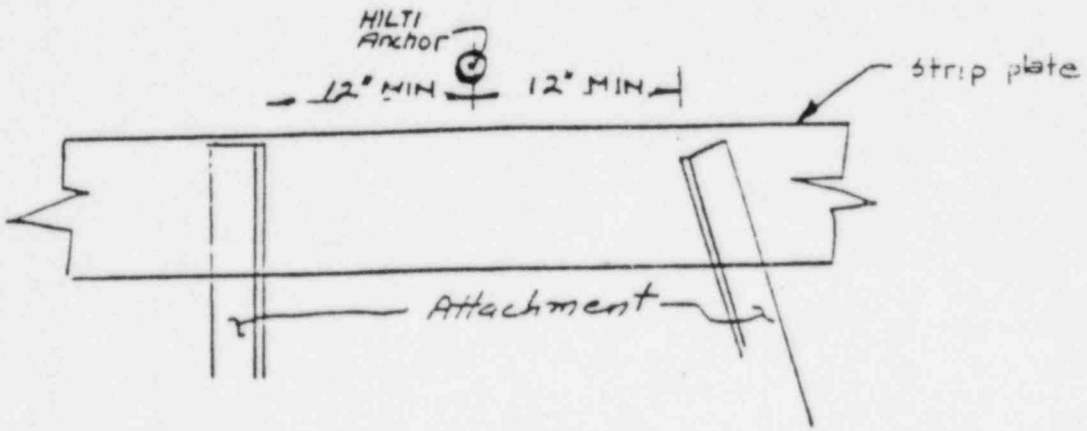
MINIMUM CLEARANCES TO EMBEDDED PLATES

Where the embedded steel plates are occupied by attachments within minimum distances shown below, the minimum clearance to Hilti Anchors shall be as follows:

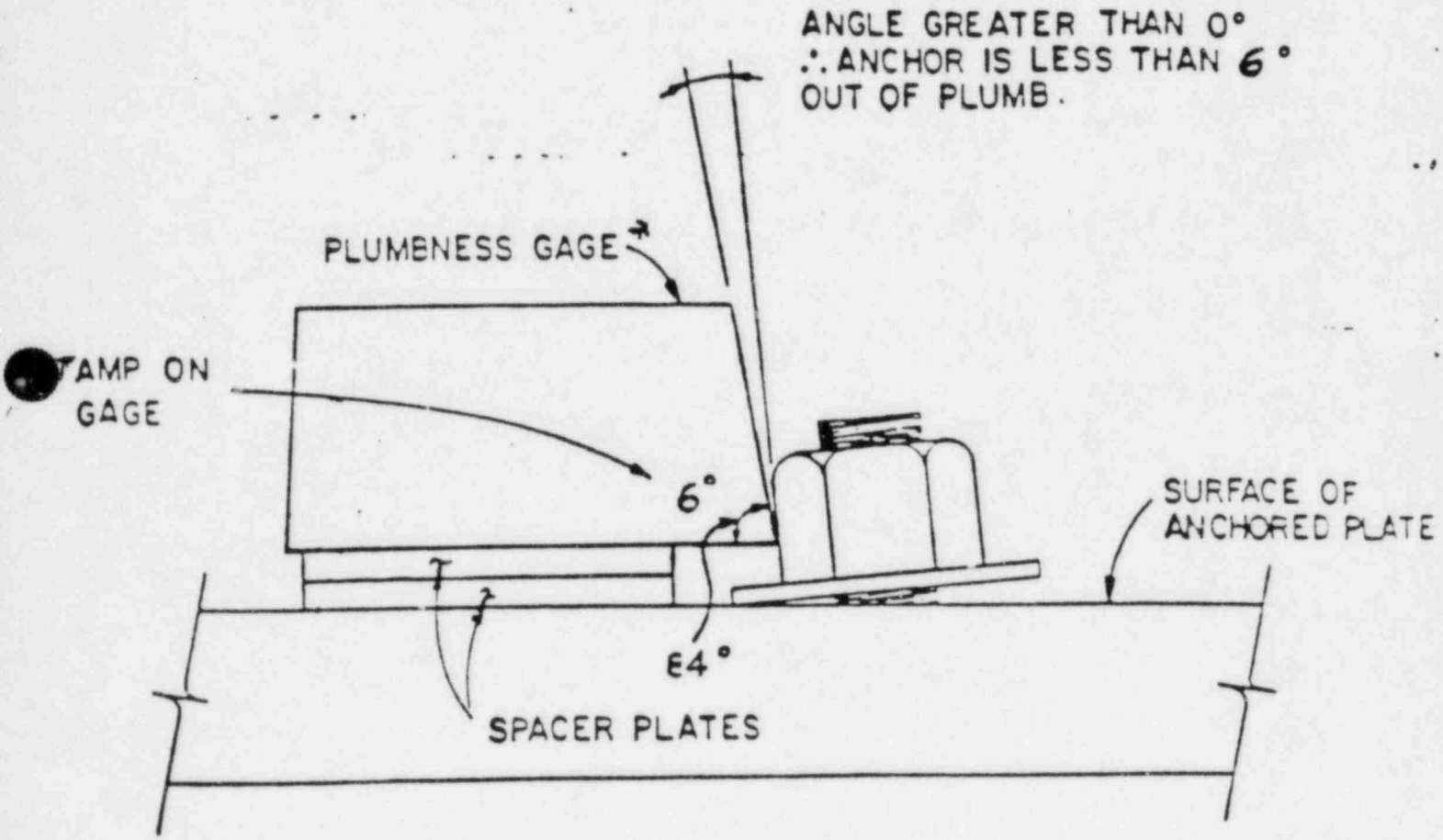
Hilti Anchor Size	Nelson Stud to Hilti Anchor	Edge of Plate to Hilti Anchor
1/4	5 1/4	3 3/4
3/8	5 7/8	4 3/8
1/2	6 1/2	5
5/8	7 1/8	5 5/8
3/4	7 3/4	6 1/4
1	9	7 1/2
1 1/4	10 1/4	8 3/4

Dimensions are in inches.
Distance measured with reference to center of bolts and studs.

Where location of the nearest Nelson Stud can be determined from the "S" stamps on the embedded steel plate, the minimum center-to-center clearance to the Hilti Anchor as shown above shall govern. Where location of the nearest Nelson Stud cannot be so determined, the minimum clearance to Edge of Plate as shown above shall govern.

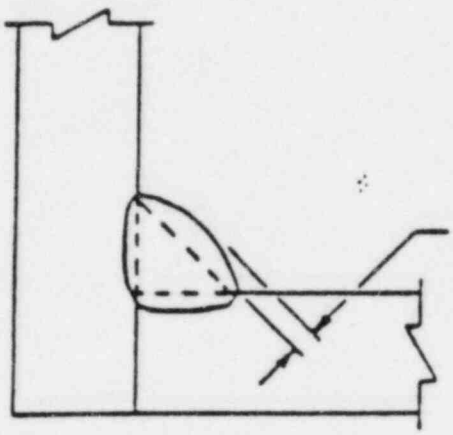


ANCHOR ANGULARITY

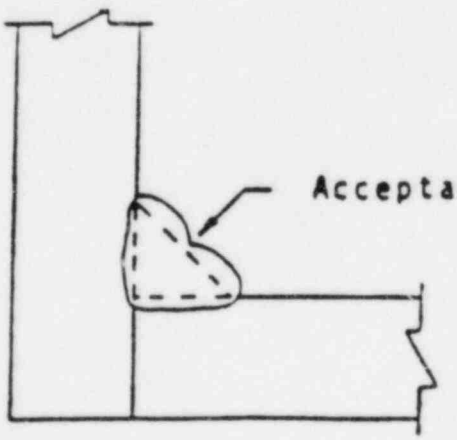


* Use this or other acceptable devise in determining acceptable angularity.

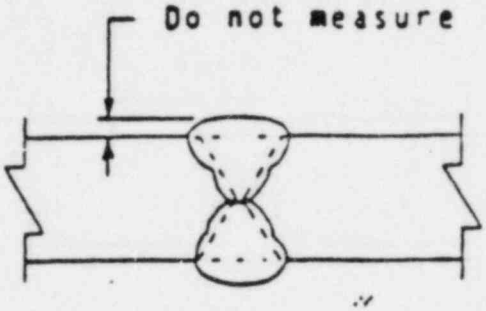
Fillet Weld Profiles



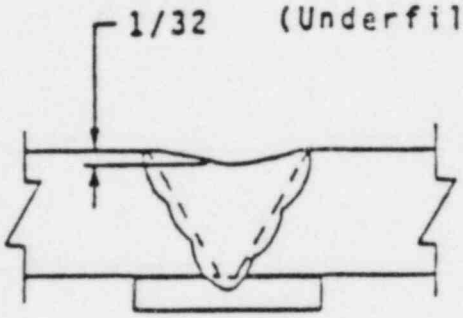
Acceptable Convexity



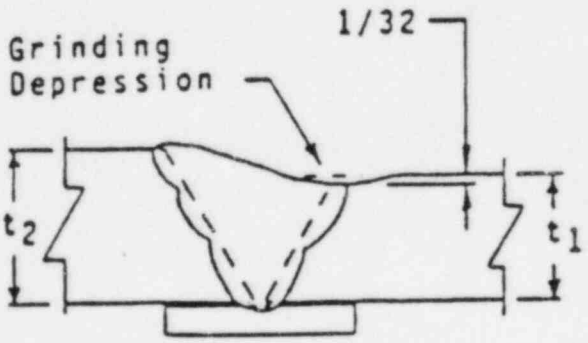
GROOVE WELD PROFILES



Acceptable Convexity

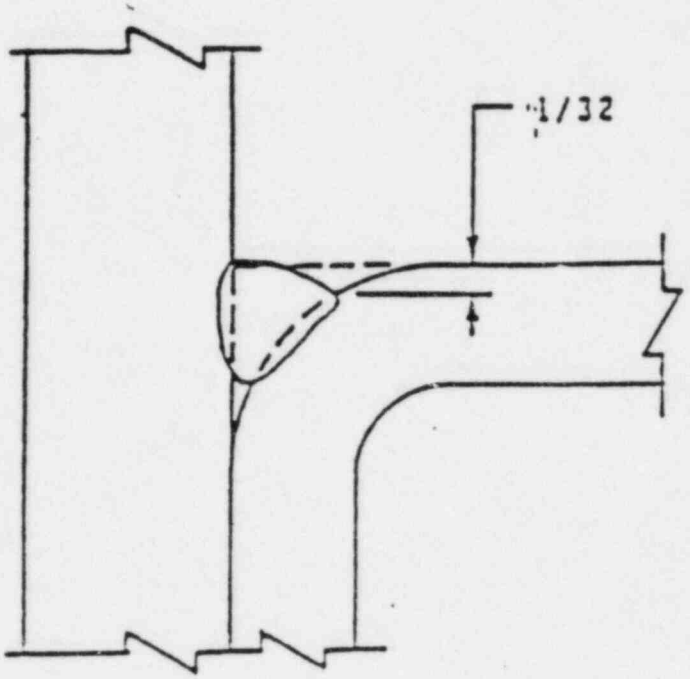


Acceptable Concavity
or Underfill



Acceptable

FLARE BEVEL PROFILE



Acceptable*

* NOTE: The profile shown is acceptable for flare bevel welds specified to be flush. If other fill requirements are specified, refer to project specifications for acceptance requirements.

COMANCHE PEAK REVIEW TEAM
INSPECTION CHECKLIST

WELDER IDENTIFICATION

VERIFICATION PACKAGE NO. I-S-INSP-_____

INSTRUMENT NO. _____

WELDER IDENTIFICATION

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ _____
Inspector Date

VERIFICATION PACKAGE NO. I-S-INSP-____

INSPECTION TOOLS USED

ATTRIBUTE	TOOL CODE(s)	SERIAL NO./CALIBRATION DUE DATE
1. Location/Orientation		
a.		
b.		
2. Configuration		
2.1 Components		
a.		
b.		
2.2 Dimensions		
2.3 Shims		
2.4 Baseplates		
3. Material Verification		
4. Bolting		
4.1 Engagement		
4.2 Surface Contact		
a.		
b.		
4.3 Washers		
4.4 Edge Distance		
4.5 Spring Nuts		

_____ _____
INSPECTOR DATE

VERIFICATION PACKAGE NO. I-S-INSP-____

INSPECTION TOOLS USED

ATTRIBUTE	TOOL CODE(s)	SERIAL NO./CALIBRATION DUE DATE
4.6 Richmond Inserts		
a.		
b.		
4.7 Torque		
a.		
b.		
c.		
5. Concrete Expansion Anchors		
5.1 Size/Number		
a.		
b.		
5.2 Embedment		
5.3 Bolt Spacing		
a.		
b.		
c.		
5.4 Angularity		
5.5 Concrete Damage		
5.6 Nut Engagement/Bearing		
a.		
b.		

_____ _____
INSPECTOR DATE

VERIFICATION PACKAGE NO. I-S-INSP-____

INSPECTION TOOLS USED

ATTRIBUTE	TOOL CODE(s)	SERIAL NO./CALIBRATION DUE DATE
c.		
d.		

6. Welds

6.1 Location _____

6.2 Weld Size _____

6.3 Weld Length _____

6.4 Fusion _____

6.5 Craters _____

6.6 Weld Profiles _____

6.7 Undercut _____

6.8 Porosity _____

6.9 Overlap _____

6.10 Surface Slag _____

6.11 Cracks _____

6.12 Welder's ID Symbol _____

_____ _____
INSPECTOR DATE

INSPECTION TOOLS AND CODES

CODE	TOOL
AF	Angle Finder
BL	Bubble Level
BS	Boroscope
BW	1/32", 1/16", 3/32", 1/8" Wire
CG	Contour Gage
DF	Dry Film Thickness Gage
FG	Feeler Gages
FL	Flashlight
FM	Fibre Metal Fillet Gages
GG	Gal Fillet Gages
HL	Hi-Low Gage
MG	Magnifying Glass
MI	Micrometers
MM	Mirror
MN	Magnet
PB	Plum Bob
PR	Protractor
SC	Slide Caliper
SR	6" Rule
ST	Steel Tape Measure
TG	Taper Gage
TW	Torque Wrench
UD	Undercut Gage (Dial)
UP	Undercut Gage (Pit)
VC	Vernier Caliper
VT	Visual Inspection

SUPPLEMENTAL REMARKS

VERIFICATION PACKAGE NO. I-S-INSP-

ATTRIBUTE (NO./DESCRIPTION)	REMARKS

Inspector

Date