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TITLE: INSTALLATION INSPEC- TIONS OF ASME COMPONENT SUPPORTS, CLASS 1,2, & 3	ORIGINATOR: <u>William Hartson</u>	<u>1-7-81</u>
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FOIA-85-59

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2.0 GENERAL

2.1 PURPOSE AND SCOPE

This instruction delineates the criteria and requirements to be used when performing installation inspection of ASME component supports, Class 1, 2, and 3. If a conflict exists between this instruction and the support drawing, the drawing shall take precedence.

2.2 RESPONSIBILITY

The QC superintendent shall be responsible for the inspection of component supports in accordance with this instruction.

3.0 INSTRUCTION

3.1 MATERIALS

3.1.1 Traceability Marking Transfer

During construction activities, I.D. markings on bulk material are transferred prior to the material being cut. This operation shall be monitored by QC on a random surveillance basis. The surveillance activity will be documented at a minimum of once per shift on an "IR" and filed in the QA department. The "IR" shall note the hanger numbers of items for which marking transfer is witnessed.

3.1.2 Material Traceability Control

During fabrication, evidence of material acceptability will be provided through the use of a "Material Identification Log" (Attachment #7) by the craft. The log shall then be presented to the QC inspector for material verification and signature. The log will remain as part of the construction hanger package.

At installation inspection, the QC inspector shall verify the material type, grade and heat number on the "QC Hanger Inspection Report" or the MWDC, as applicable, using the information provided on the "Material Identification Log."

3.1.3 Material Dimensional Control

Component support material type and description shall be as shown on the "Bill of Materials" of the BRH and any applicable CMCs.

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Component support material "cut lengths" shall be as shown in the detail sketch of the BRH and any applicable CMCs. The BRH/CMC "Bill of Materials" will not be used to verify material cut length.

3.1.4 Material Salvaging

Component support parts such as structural steel, snubbers, spring cans, etc., may be used on component supports other than those for which they are designated, provided traceability is maintained. The Material Identification Log in the hanger package shall be used to identify the hanger from which the substituted part came and shall be verified by the QC inspector.

4.0 WELDING

4.1 WELDING INSPECTION REQUIREMENTS (GENERAL)

Weld filler material used in the welding of component supports shall be verified using the WFML in the construction "Hanger Package."

NOTE: QC surveillance of proper completion of the "Weld Filler Material Log" shall be verified by comparing the WPG against the WDC and WFML. This verification shall be documented by the inspector's initials and date on the WFML.

4.2 WELDING INSPECTION REQUIREMENT (FIT-UP)

Welding Engineering will enter weld numbers on the BRH for welds to pressure retaining members, full penetration welds except flare beveling on structural tubing, hangers with multiple processes or multi-filler materials or welds requiring NDE, other than visual and all Class 1 support welds. Inspection of fit-up will be required by QC for the above mentioned welds if delineated on a MWDC.

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NOTE: Cleanliness and fit-up hold points may be inspected simultaneously.

The fit-up gap for butt weld joints shall not exceed 1/8 inch beyond the diameter of the electrode used at the root of the joint.

The fit-up gap for "T" fillet joints shall be as small as practical; however, it should not exceed 1/16 inch. If gap is in excess of 1/16 inch but not exceeding 5/32 inch, this condition will be considered acceptable provided the leg of the fillet weld is increased by the amount of separation in excess of 1/16 inch. (The increase in fillet size applies only when the excess separation exceeds 10% of the joint length.)

The fit-up gap for "lap" fillet weld joints shall not exceed 1/8 inch at any location along the length of the joint.

4.3 WELDING INSPECTION (FINAL)

Fillet weld sizes specified on the drawing are the minimum size required along the full length of the weld joint. Oversize fillet welds are acceptable providing they do not exceed twice the leg size specified on the drawing. Excessive distortion where oversize fillet welds are used should be avoided.

The final surface of all welds shall be free from sharp surface irregularities, slag, cracks and undercut in excess of 1/32" in depth. Undercuts shall not encroach on the required section thickness.

Excess surface irregularities may be removed by grinding or clipping, provided the minimum weld size is maintained.

4.4 NONDESTRUCTIVE TESTING

All NDE will be as shown on drawings.

4.5 NDE INSPECTIONS

Each Inspector will be issued an "NDE Guide" (Attachment 6) which provides information on the acceptance criteria of welded supports.

5.0 ASSEMBLED HANGER REQUIREMENTS

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5.1 FASTENERS

Fasteners will be as shown on the BRH and any applicable CMCs. Unless otherwise shown on the drawings, fasteners will be tightened securely. Bolt holes in angles shall not be closer than $1\frac{1}{2}$ times the bolt diameter from the edge of the angle to the edge of the bolt hole. Full thread engagement of bolts and nuts is required.

NOTE: If screwed adjustment fit is questionable, inspector shall notify the Quality Engineering Department.

5.2 STAINLESS SHIMS

Carbon steel supports in contact with stainless steel pipe do not require stainless shims between the support and pipe unless the operating temperature of the line exceeds 650°F.

5.3 SWAY STRUTS

5.3.1 Sway Strut (As Received)

The sway strut unit is composed of the pipe clamp assembly, the rear bracket assembly, and the sway strut assembly.

5.3.1.1 Inspection Criteria

- A. Pipe Clamp Assembly (Attachment 2) washers are installed between the clamp halves with a high-strength pin. Under no circumstances should the clamp bolts be interchanged with the high-strength pin.
- B. Rear Bracket Assembly (Attachment 3) washers shall be on the inside of the bracket arms, one on either side of the sway strut spherical bearing. If cotter pins are used, they should be the maximum size the hole will accommodate and shall be fully opened. If split snap rings are installed, they should be examined to verify that the rings are not broken, sprung or deformed.
- C. The Sway Strut Assembly (Attachment 4) spherical bearing should be staked tightly in the adjustable ends and should have a washer on either side when installed. The sway strut should have the correct adjustment as per the design drawing and the jamb nuts should be tight. If engagement sight holes are present on the strut body, engagement should be verified.

EOR



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D. Sway Strut Unit - maximum sway strut misalignment shall not exceed 6° for NPSI and 5° for ITT Grinnell from the center line of the sway strut (12° and 10° included angle, respectively).

NOTE: The degrees allowed for misalignment (see Attachment 3) are given by the spherical bearings and their relationships to the flat washers. Normally the thicker flat washers are installed on the clamp end and the thinner washers on the rear bracket end.

5.3.2 Upset Threads

Thread upset verification of all sway struts including modified struts, shall be stamped on both ends with a 5 point star or a 6 point star, indicating that thread upset was verified at time of manufacture or on site, respectively. Stamping verification shall be documented on the "completed support" I.R. or on the MWDC by the QC Inspector.

When the star stamp is not verifiable on struts that are installed, the following procedure shall be used:

- a. QC shall verify thread engagement if site holes are present in the strut body.
- b. If site holes are not present, Construction shall disconnect one end of the strut and attempt to back-out the threaded members on each end of the strut body. If the threaded members will not back-out due to proper thread upset, QC shall accept the sway strut and stamp both ends with a 6 point star. If the threaded member backs-out of the strut body, QC shall return the documentation package to Construction as per Paragraph 6.2.

5.4 Sway Strut (Modification)

Sway strut modification shall be in accordance with existing site procedures.

5.4.1 Unit Assembly Inspection Criteria

Unit assembly inspection criteria shall be the same as the original inspection criteria defined in Paragraph 5.1.1.

5.4.2 Alignment Inspection Criteria

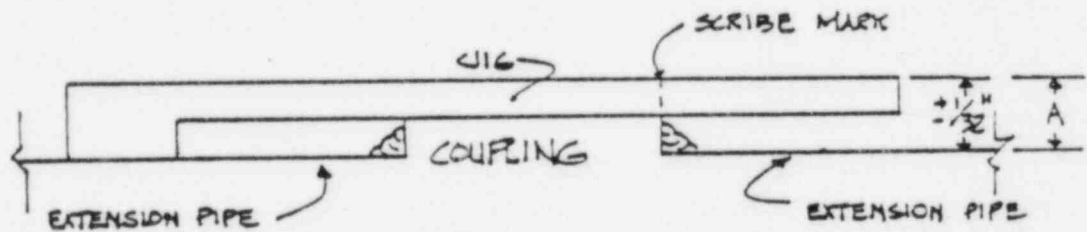
- A. ITT Grinnell sway strut sizes A, B, C, 1 through 8 end plate centerline misalignment and socket welded couplings added to the extension piece shall not exceed 1/2°.

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- B. NPS sway struts sizes SRS.06 through 36 centerline misalignment of socket welded couplings added to the extension piece shall not exceed 1/2°. Socket welded end coupling centerline misalignment shall be kept to a minimum.
- C. All socket welded couplings require a minimum of 1/16" pull back of the extension piece for proper fit-up. (ANSI minimum engagement requirements for pipe socket weld couplings are not applicable to sway strut modification.)
- D. Alignment measurements for couplings added to the extension piece may be made utilizing a jig as shown below or other suitable measuring methods.



If the measurement as taken from the top of the jig to the sway strut varies within the dimensional tolerance given at "A" above with readings taken at 90° intervals around the strut, then the alignment may be considered to be acceptable. This measurement should be taken from both ends of the coupling.

5.4.3 Weld Inspection

Final visual inspection of weld surface shall be in accordance with Paragraph 4.3. Weld size shall be in accordance with the following table:

ITT Sway Struts

<u>Strut Size</u>	<u>Min. Weld Size</u>
A-C	3/16"
1-3	5/16"
4-6	3/8"
7	5/8"
8	3/4"

NPSI Sway Struts

<u>Strut Size</u>	<u>Min. Weld Size</u>
06-10	3/16"
12-24	1/4"
20	5/16"
24	3/8"
36	5/8"

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5.5 SEISMIC LIMITERS

5.5.1 Inspection Criteria

Seismic Limiters (arrestors) must never be used as a welding ground, be sandblasted, or painted.

The following are inspection criteria to be used when inspecting seismic limiters:

- A. Verify that the support cylinder can be manually extended and retracted through its full stroke length. (See Attachment 9, for nomenclature and the Table below for Stroke Lengths.)

TABLE

<u>Limiter Size</u>	<u>Stroke Length/Inches</u>
1/8	4
1/4	2 1/2
1	4
3	5
10	6
35	6
100	6

NOTE: The force required to extend or retract the limiter support cylinder should not exceed 1% of the rated load. The load should be applied in a steady manner. If the arrestor support cylinder moves easily, does not move, or rotates, internal damage may exist and shall be so noted on the I.R.

- B. Verify that the thread area of the load-bearing bolt (or stud) does not encroach on the load-bearing portion of the bolt.
- C. Verify special flat washers are installed between the spherical bearing and each clamp half.

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NOTE: The washers allow the limiter to have $\pm 6^\circ$ of freedom (12° included angle).

- D. Verify seismic limiter clamp bolts are double nuted.
- E. Verify pinned connections have fully opened cotter pins or split snap rings installed.
- F. Verify spherical bearings are tightly staked in the attachment ends.

5.5.2 Relative Angle Adjusting

When the relative angle between the end cap and the forward bracket has been adjusted, the extension and retraction of the support cylinder shall be verified in accordance with Paragraph 5.5.1-A.

Verify split rings on sizes $\frac{1}{4}$, $\frac{1}{2}$, 1, 3, and 10 are not broken, sprung or deformed.

Verify re-torque of ring nut for sizes 35 to 100 is 150 ± 20 ft./lb.

NOTE: Under no circumstances shall the end cap be rotated more than one complete turn from the bottomed-out position.

5.5.3 Extension Pipe

The following are inspection criteria to be used when an extension pipe is welded to the seismic limiter.

- A. Final weld surface inspection shall be in accordance with Paragraph 4.3.
- B. Alignment shall be maintained within 1°. An inspection jig similar to the description given in Paragraph 5.4.2.1-D or other appropriate inspection techniques may be used.
- C. Verify spherical bearing is properly masked and paint is applied only to the transition tube, extension pipe and forward adapter.

5.5.4 Transition Tube/Forward Adapter Assembly

The following are inspection criteria to be used when attaching the transition tube/forward adapter assembly to the arrestor:

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A. Verify fastner torque as follows:

<u>Arrestor Size</u>	<u>Torque Required</u>
1/4	22 ±1 in./lb.
1/2	22 ±1 in./lb.
1	45 ±5 in./lb.
3	120 ±10 in./lb.
10	440 ±20 in./lb.

B. Verify bolts are safety-wired with 0.040" stainless steel wire.

5.5.5 Cold Setting

The cold setting shall be as per the design drawing with an installation tolerance of ±1/4".

5.6 TEMPORARY SPACERS

Temporary flat bar cut to the appropriate "pin-to-pin" length requirement may be used when seismic limiters or struts are not available for immediate installation. When supports are completed, with the exception of items such as struts or limiters, all other inspections may be performed and the applicable items signed as acceptable. Any exceptions shall be noted on the applicable inspection document placing an asterisk next to the inspection which cannot be completed. An explanation of the uncompleted inspections shall be entered in the comments section of the IR and/or in the operation section of the MWDC as per the following example:

EXAMPLE: Limiter (or strut) not installed.

5.7 SPRING CANS

Spring cans shall be inspected to verify the spring travel stops are in place, the spring can turnbuckle is fully engaged with the support rod, all slack is removed from the support rod, and the jamb nut is tight.

Installation verification of the spring can travel stop shall be documented in the comments section of the QC Hanger Inspection Report and/or in the operation section of the MWDC.

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5.8 LUBRITE PLATE

Check the support for correct hardware. Supports containing lubrite plate assemblies should come with a lubrite plate (2 for type "G" & "H" assemblies) a keeper (2 for type "G" & "H" assemblies for 14" thru 30" pipe) (the keeper is generally small slice of tubing), the pipe attachment (generally a channel, tee or wide flange assembly) and usually a pipe clamp.

The pipe attachment will have a smooth surface left unpainted where it mates with the lubrite plate. This surface should be coated with Liquid Lubricant AE-6 to protect it from rusting. Check the coating for good coverage. If the mating surface is not covered or the coating is damaged, apply additional Liquid Lubricant AE-6.

NOTE: The lubrite plate should not be in place when welding the keeper.

Care should be taken to assure the surface where the lubrite plate will rest is level or follows the slope of the pipe and is aligned properly.

5.9 CRITERIA FOR SHIMMING AND GROUTING WALL OR CEILING SUPPORT BASE PLATES

Component supports utilizing base plates must have a minimum of 80% bearing surface between the plate and the concrete. The maximum allowable gap for the remaining portion of the plate shall not exceed 1/16 inch. If this criteria cannot be met, the plate must be shimmed and grouted with an epoxy grout. Shim material may consist of steel shim plates or washers of a size necessary to allow proper Hilti Bolt torquing without base plate deformation. The grout filling hole shall be 1/4" in diameter and shall not be drilled within 1 inch of a concrete anchor. The hole shall be located outside of the bolt hole pattern.

Floor mounted component supports that are not flush mounted, require shimming and grouting. Shim material may consist of steel shim plates or washers of a size necessary to allow proper Hilti Bolt torquing without base plate deformation.

5.10 TOLERANCES

For tolerances not given in the text of this Instruction, refer to those listed in Attachment #3.

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Small bore hanger installation/tolerances shall be in accordance with this procedure and small bore general notes.

6.0 DOCUMENTATION

The results of component support inspections shall be documented on the "Quality Control Hanger Inspection Report" (see attachment 1) or the Multiple Weld Data Card "(See Attachment 10) for that support, as appropriate. The information needed to complete this Report will be obtained from the construction hanger documentation package and physical inspection of the component support. The Inspection Report Status Log (Attachment 5) shall be maintained by QC for the purpose of tracking "QC Hanger Inspection Report." All hold points on the Inspection Report and the Multiple Weld Data Card shall be satisfied as applicable. The MWDC welding hold point shall be satisfied per paragraph 4.2.

6.1 Inspection Documentation for Modified Sway Struts

All hold points assigned in the "Sway Struts Modification" stamp (See Attachment 11) on the back side of the MWDC shall be satisfied, as applicable.

6.2 Final Support Inspection

When the support is ready for final inspection, Construction shall notify Quality Control and present to the inspector the support documentation package for review. (Incomplete packages shall be returned to Construction for further processing.)

If the support package is acceptable, the inspector will perform a detailed visual inspection per the provisions of this Instruction, complete the Inspection Report or the Multiple Weld Data Card, as appropriate, sign and return the Transmittal Form to Construction and transmit the support package Documentation to the Vault.

If the support base plate requires shimming and grouting per Paragraph 5.9 and has not been shimmed and grouted, an Unsatisfactory Inspection Report shall be generated. It will be sent to Civil QC for further action.

Discrepancies found during inspection which can be corrected through normal clean-up or minor rework, shall be indicated on the Construction Transmittal. The transmittal and support package shall be returned to Construction for rework as needed.

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When the discrepant areas have been corrected, the craft foreman will notify Quality Control of reinspection needs and resubmit the support package to the QC Inspector. If acceptable, he shall sign and date both the IR/MWDC and the Construction Transmittal. The support documentation package shall then be transmitted to the Vault by QC and the Transmittal returned to the craft foreman for processing in accordance with existing Site procedures.

7.0 DISCREPANCIES THAT CANNOT BE CORRECTED

Discrepancies that cannot be corrected through normal course of construction shall be reported on an NCR in accordance with existing site procedures.

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ATTACHMENT NO. 1

QUALITY CONTROL
HANGER INSPECTION REPORT Report No. _____

IDENTIFICATION

HANGER NO. ① _____ CLASS ② _____ DATE OF INSP. ③ _____
DRAWING NO. REV. ④ _____ WRC ⑤ _____ PWBP ⑥ _____

MATERIAL ACCEPTABILITY

GRADE/TYP ⑦ _____ HT NO. ⑧ _____

INSTALLATION

DIMENSIONS ⑨ _____ SWAY STRUT ⑩ _____
Inspector _____ Date _____ Inspector _____ Date _____
CONFIGURATION ⑪ _____ LOC. PER DWG. ⑫ _____
Inspector _____ Date _____ Inspector _____ Date _____
FASTENERS ⑬ _____
Inspector _____ Date _____

WELDING (Visual)

Fit-up Inspection ⑭ _____
Inspector _____ Date _____
All weld per ASME Sec. III ⑮ _____
Inspector _____ Date _____

ADDITIONAL NDE

⑯ _____
Process NDEP Rev./Date _____ Inspector _____ Date _____
Process NDEP Rev./Date _____ Inspector _____ Date _____

COMMENTS ⑰ _____

GROUTING COMPLETE: YES NO N/A

NCs ⑱ _____

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ATTACHMENT NO. 1A

INSTRUCTIONS TO CC HDR

1. The drawing number of the hanger
2. The class of the hanger (1,2,3,)
3. The date of the inspection
4. The revision of the drawing used to perform the inspection
5. The CMC No. and Rev. used to perform the inspection
6. The PHBP No. and Rev. used to perform the inspection
7. The grade/type of the material
8. The heat No. of the material (only on Class 1)
9. Inspector's signature/initial and date of dimensional correctness per procedure
10. Inspector's signature/initial and date of configuration correctness per procedure
11. Inspector's signature/initial and date of fastener correctness per procedure
12. Inspector's signature/initial and date of sway strut correctness per procedure
13. Inspector's signature/initial and date of location correctness per procedure
14. Verify that required fit-up inspection was accomplished and documented on MWDC
15. Inspector's signature/initial and date of visual (ASME Sec. III) acceptance of welds per procedure
16. Enter additional NDE (i.e. LP, MT, UT, RT) processes, enter NDEP and revision date.
17. Inspector's signature/initial and date of acceptance of these processes
18. Any comments that may be pertinent to acceptance
19. The NCR(s) written on hanger, if any

*NOTE: When form item numbers are not applicable, enter N/A

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ATTACHMENT NO. 2

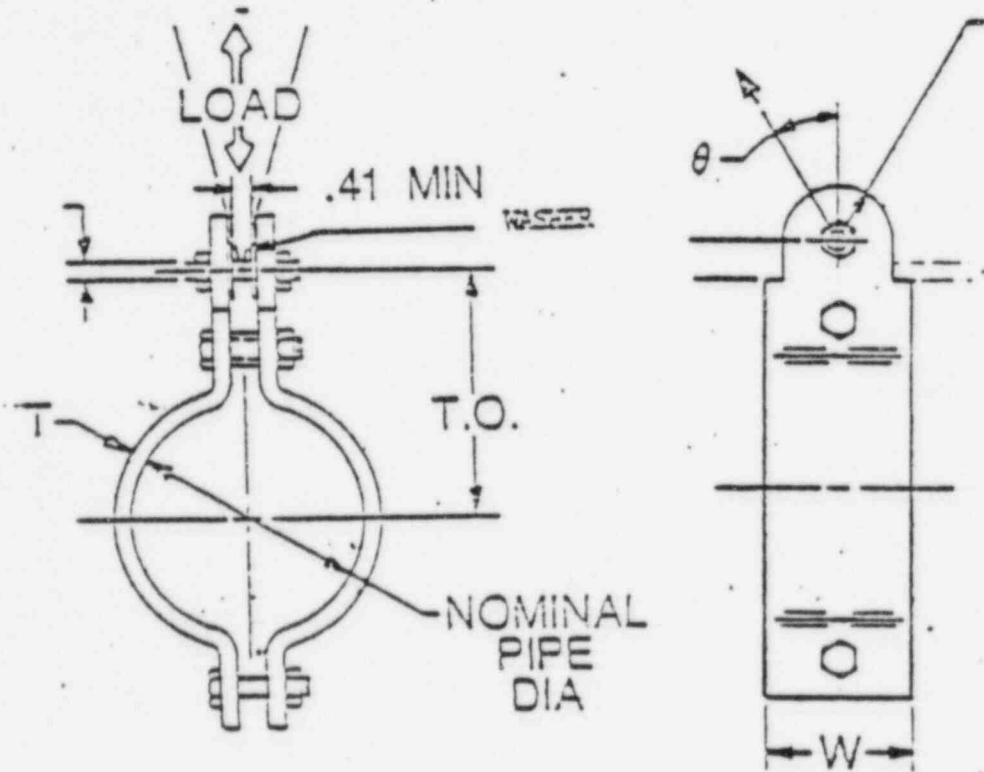


FIG 1

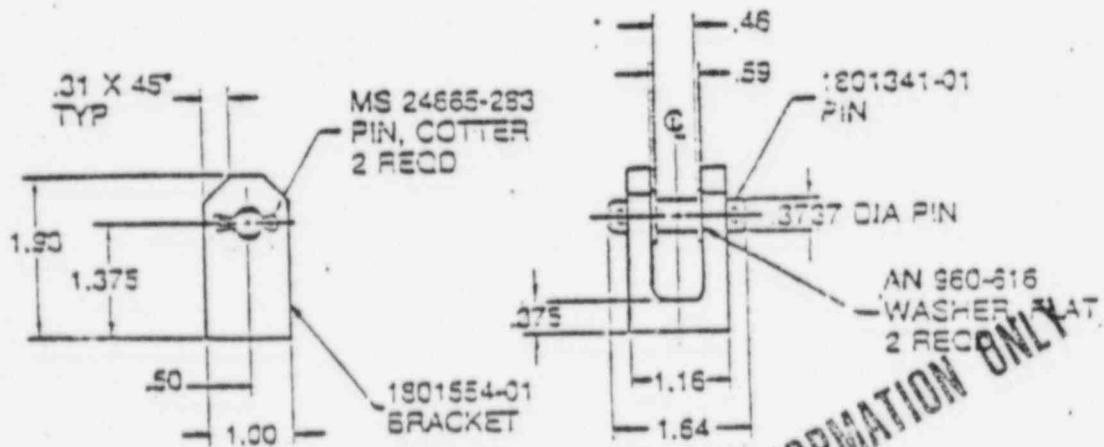
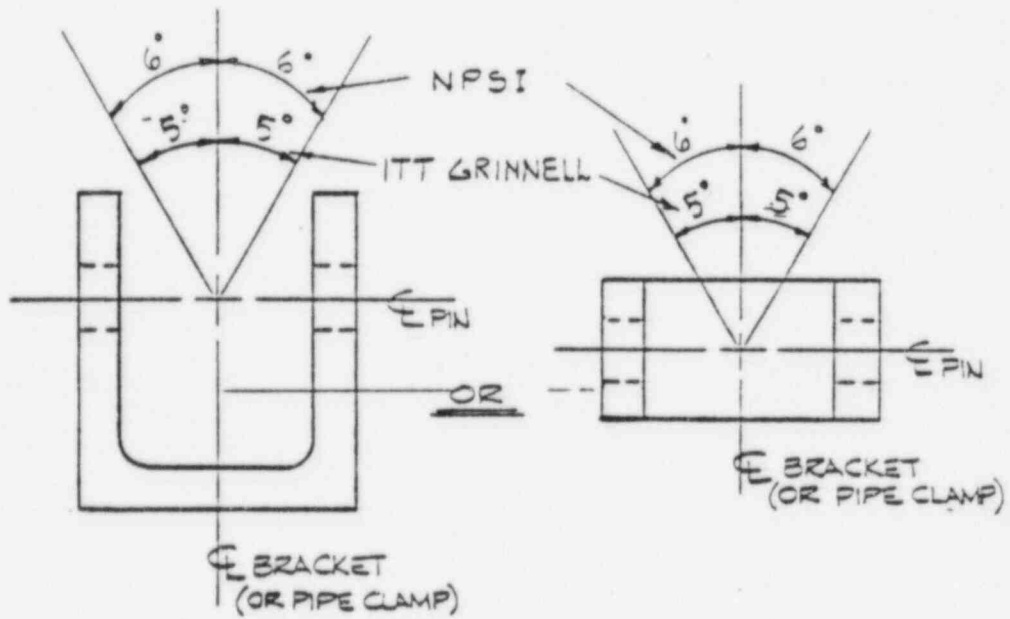


FIG 2



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ATTACHMENT NO. 3

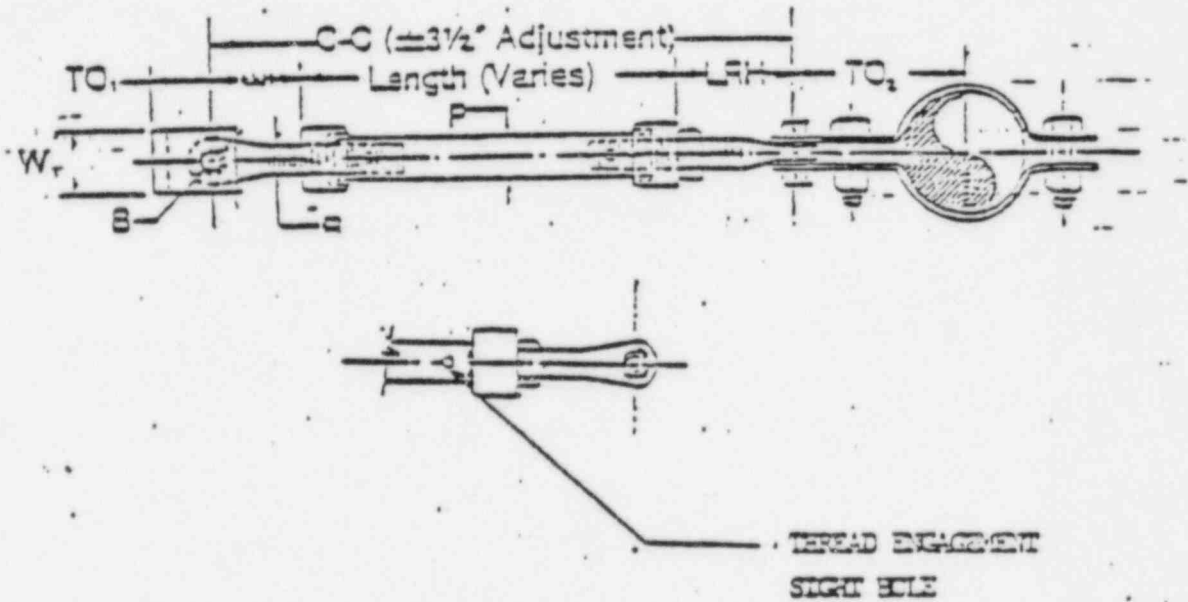


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ATTACHMENT NO. 4



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ATTACHMENT NO. 6

NDE GUIDE

ASME SECTION III
SUBSECTION NF
WINTER 1974 ADDENDA

NF-530 ULTRASONIC (UT) ACCEPTANCE STANDARDS

All indications which produce a response greater than 20% of the reference level shall be investigated to the extent that the operator can determine the shape, identity, and location of all such reflectors and evaluate them in terms of the acceptance-rejection standards as stipulated in (a) and (b) below.

(a) Discontinuities are unacceptable, if the amplitude exceeds the reference level, and discontinuities have lengths which exceed:

- (1) $\frac{1}{2}$ in. for t up to $\frac{1}{2}$ in., inclusive
- (2) $\frac{1}{2}t$ for t from $\frac{1}{2}$ in. to $2\frac{1}{2}$ in., inclusive
- (3) $\frac{1}{2}$ in. for t over $2\frac{1}{2}$ in.

where t is the thickness of the weld being examined; if a weld joins two members having different thicknesses at the weld, t is the thinner of these two thicknesses.

(b) Where discontinuities are interpreted to be cracks or incomplete penetrations, they are unacceptable regardless of discontinuity or signal amplitude.

NF-530 ACCEPTANCE STANDARDS FOR VISUAL EXAMINATION OF WELDS

(a) Only indications with major dimensions greater than $\frac{1}{16}$ in. shall be considered relevant.

(b) Unless otherwise specified in this Subsection, cracks or other linear indications are unacceptable.

RADIOGRAPHIC (RT) ACCEPTANCE STANDARDS

RF-5321

(a) Any type of crack or zone of incomplete fusion or penetration;

(b) Any other elongated indication which has a length greater than:

- (1) $\frac{1}{8}$ in. for t up to $\frac{1}{2}$ in., inclusive
- (2) $\frac{1}{2}t$ for t from $\frac{1}{2}$ in. to $2\frac{1}{2}$ in., inclusive
- (3) $\frac{1}{8}$ in. for t over $2\frac{1}{2}$ in.

where t is the thickness of the thinner portion of the weld;

(c) Any group of indications in line that have an aggregate length greater than t in a length of $12L$, except where the distance between the successive indications exceeds $2L$, where L is the longest indication in the group;

(d) Porosity is not a factor in the acceptability of welds that are radiographed.

NF-530 MAGNETIC PARTICLE (MP) ACCEPTANCE STANDARDS

RF-5342

(a) Only indications with major dimensions greater than $\frac{1}{16}$ in. shall be considered relevant.

(b) Unless otherwise specified in this Subsection, the following relevant indications are unacceptable:

- (1) Any cracks or linear indications.
- (2) Rounded indications with dimensions greater than $\frac{1}{16}$ in.

(3) Four or more rounded indications whose major dimensions are greater than $\frac{1}{16}$ in. when the indications are in a line and are separated by $\frac{1}{16}$ in. or less edge to edge.

(4) Ten or more rounded indications whose major dimensions are greater than $\frac{1}{16}$ in. when the indications are in any 6 sq in. of surface with the major dimensions of this area not to exceed 6 in., with the area taken in the most unfavorable location relative to the indications being evaluated.

LIQUID PENETRANT ACCEPTANCE STANDARDS

NF-5354

(a) Only indications with major dimensions greater than $\frac{1}{16}$ in. shall be considered relevant.

(b) Unless otherwise specified in this Subsection, the following relevant indications are unacceptable:

- (1) Any cracks or linear indications.
- (2) Rounded indications with dimensions greater than $\frac{1}{16}$ in.

(3) Four or more rounded indications whose major dimensions are greater than $\frac{1}{16}$ in. when the indications are in a line and are separated by $\frac{1}{16}$ in. or less edge to edge.

(4) Ten or more rounded indications whose major dimensions are greater than $\frac{1}{16}$ in. when the indications are in any 6 sq in. of surface with the major dimensions of this area not to exceed 6 in., with the area taken in the most unfavorable location relative to the indications being evaluated.

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ATTACHMENT NO. 6A.

NF-4112 Cleanliness and Protection of Weld Surface

The method used to prepare the base metal shall leave the weld preparation with reasonably smooth surfaces. The surfaces for welding shall be free of scale, rust, oil, grease, and other deleterious foreign material. The work shall be protected from deleterious contamination and from rain, snow, and wind during welding. Welding shall not be performed on wet surfaces.

NF-4113 Tack Welds. Tack welds used to secure alignment shall either be removed completely, when they have served their purpose, or their stopping and starting ends shall be properly prepared by grinding or other suitable means so that they may be satisfactorily incorporated into the final weld. Tack welds shall be made by qualified welders using qualified welding procedures. When tack welds are to become part of the finished weld, they shall be visually examined and defective tack welds removed.

NF-4116 Reinforcement of Butt Welds

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.

Nominal Thickness, in.	Maximum Reinforcement, in.
Up to 1, incl.	$\frac{3}{32}$
Over 1 to 2, incl.	$\frac{5}{32}$
Over 2 to 3, incl.	$\frac{3}{16}$
Over 3 to 4, incl.	$\frac{1}{4}$
Over 4 to 5, incl.	$\frac{5}{16}$
Over 5	$\frac{3}{8}$

NF-4117 Shape and Size of Fillet Welds

Fillet welds may vary from convex to concave. The size of the fillet weld shall be determined in accordance with Figure NF-4117-1.

NF-4118 Surface of Welds

All welded surfaces are permitted. However, the surface of welds shall be sufficiently free from corrosion.

The surface condition of the finished weld shall be suitable for the proper interpretation of radiographic and ultrasonic examination of the welds. In those cases where there is a question regarding the surface condition on the interpretation of a radiograph, film, the film shall be compared to the actual weld surface for interpretation and determination of acceptability.

(a) The surface condition of the finished weld shall be suitable for the proper interpretation of radiographic and ultrasonic examination of the welds. In those cases where there is a question regarding the surface condition on the interpretation of a radiograph, film, the film shall be compared to the actual weld surface for interpretation and determination of acceptability.

(b) Reinforcements are permitted in accordance with NF-4116.

(c) Undercuts shall not encroach on the required section thickness. (SEE DRAWING)

(d) If the surface of the weld requires grinding to meet the above criteria, care shall be taken to avoid reducing the weld or base material below the required thickness.

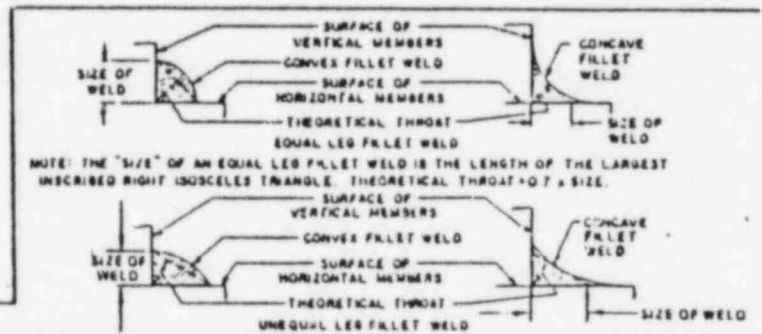
NF-4122 Maximum Offset of Aligned Surfaces

Alignment of butt joints shall be such that the maximum offset of the finished weld will not be greater than the applicable amount listed in Table NF-4122-1 where t is the nominal thickness of the thinner section of the joint.

TABLE NF-4122-1
MAXIMUM ALLOWABLE OFFSET IN
FINAL BUTT WELDED JOINTS

Section Thickness, in.	Maximum Allowable Offset
Up to $\frac{1}{2}$, incl.	$\frac{1}{16}$ in.
Over $\frac{1}{2}$ to 1, incl.	$\frac{3}{32}$ in.
Over 1 to 2, incl.	$\frac{1}{8}$ in.
Over 2	Lower of $\frac{1}{8}$ in. or $\frac{1}{16}$ in.

NF-4122-1 Filing of Offsets. Any offset within the allowable tolerance of Table NF-4122-1 shall be blended uniformly over the width of the finished weld or, if necessary, by adding additional weld metal beyond what would otherwise be the edge of the weld.



NOTE: FOR UNEQUAL LEG FILLET WELDS, THE SIZE OF THE WELD IS THE LEG LENGTH OF THE LARGEST RIGHT TRIANGLE WHICH CAN BE INSCRIBED WITHIN THE FILLET WELD CROSS SECTION.

FIG. NF-4117-1 SIZE OF FILLET WELDS

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ATTACHMENT 8

GENERAL FABRICATION AND INSTALLATION REQUIREMENTS

Tolerances

Fabrication and installation shall be performed in accordance with the drawing detail and the following permissible tolerances:

Fabrication Tolerances

1. Length
 - a. Support members (except rods) up to 12" $\pm 1/8"$
 - b. Support members (except rods) over 12" $\pm 1/4"$
2. Holes
 - a. Diameter $+1/16"$ -0
 - b. Centerline location $\pm 1/8"$

Installation Tolerances

1. Dead weight supports
 - a. Axially $\pm 12"$
 - b. Plumbness ± 2 degrees
 - c. Bolts
3. A. U-Bolts, "Bilateral restraints" shall have $1/16"$ clearance and be double nutted on each side.
4. Knee Brace, "Kicker" may have a $\pm 2^\circ$ tolerance from the specified angle.
5. Seismic Restraints
 - a. Restraints, anchors, guides, etc.
 ± 2 x pipe wall thickness $\pm 2"$ from theoretical position
 - b. Attachments to center of structural steel reaction members $\pm 2"$, and plumbness ± 2 degrees
 - c. Pipe Clearances
 1. Where the design shows $1/16"$ on both sides, the total dimensional tolerance shall be $1/8" \pm 1/16"$ (e.g., 0" on one side w/ $1/8" \pm 1/16"$ on the other, $1/16" \pm 1/32"$ on both sides, or any combination).
 2. Where the design shows 0" on one side and $1/16"$ on the other side, 0" must be maintained while $1/16" \pm 1/32"$ is required on the other side.
 3. Where the design shows 0" on one side w/ $1/16"$ on the other side, 0" must be maintained while $1/16" \pm 1/32"$ is required on the other side.

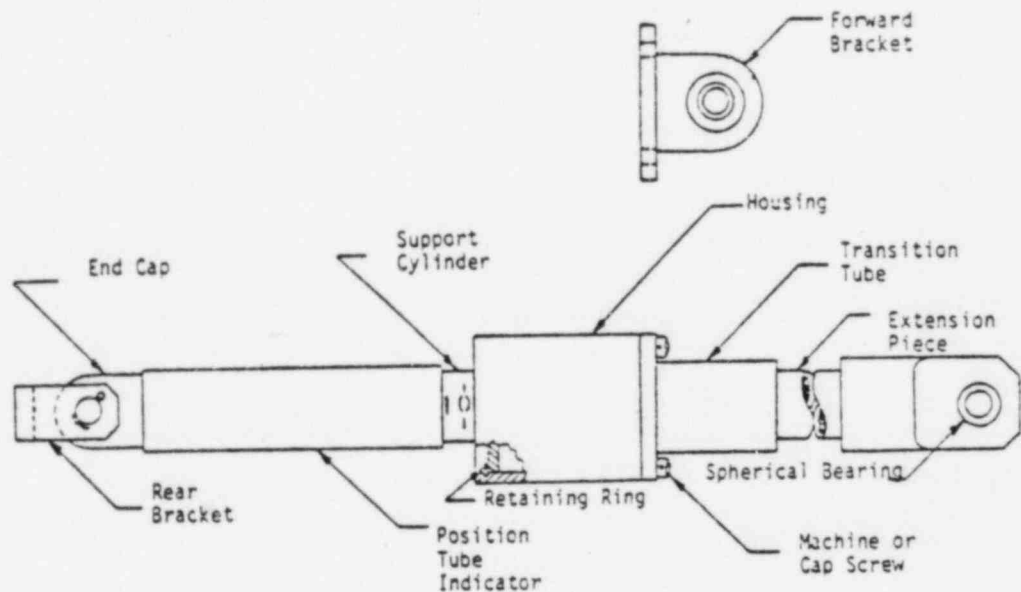
For low energy lines, if the clearances detailed above cannot be maintained due to ambient thermal expansion, a total clearance of $1/8" \pm 1/16"$ on any two adjacent lines is acceptable. (Low energy lines are defined as those having operation temperatures and pressures less than 200°F and 275 PSI, respectively.)



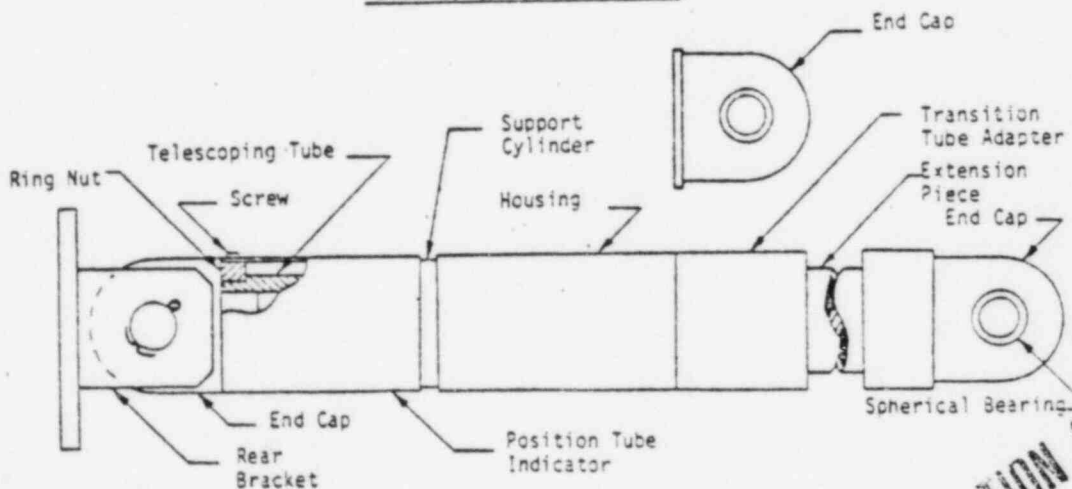
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ATTACHMENT NO. 9



SIZE 1/4, 1/2, 1, 3, AND 10



SIZE 35 AND 100

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ATTACHMENT NO. 11

SWAY STRUT MODIFICATION
(Operations as Established Below)

B Material added or deleted (document on MRS)
 C ID/Marking transfer prior to cutting
 D Acceptable WPS
 E.1 Fit-up/Socket Engagement (as applicable)
 E.2
 F Final Surface/Dimensional Inspection
 G PT/MT
 Dwg. Rev./CMC

B
C
D
E
E
F
G
H

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