BELLEFONTE NUCLEAR PLANT

WELDING PROJECT REINSPECTION PLAN

REVISION 0

Preparer — Date: 10/1/86

Welding Project Engineer — Date: 10/1/86

BLEP Project Engineer — Date: 10/1/86

096272.01

WELDING PROJECT

PHASE 2, PART 2

BELLEFONTE REINSPECTION OF SELECTED WELDS

REINSPECTION PLAN

OBJECTIVE

The objective of the program described in this reinspection plan is to provide additional data addressing the adequacy of the Bellefonte weld program and to provide indicators regarding the suitability of welding in relation to continued construction and licensing the BLN units and to address nonspecific employee concerns related to welding.

BACKGROUND

Employee concerns from Watts Bar have possible generic implications to the Bellefonte plant. Some of these concerns relate to: quality of weld filler materials, control of weld filler materials, welder qualifications, inadequate training of welders, inspector qualifications, falsification of records, weld adequacy, and record keeping. A reinspection of hardware to design requirements and comparison to the records package cuts across these and other issues to address the concerns and the welding program adequacy. Nonspecific employee concerns are best addressed by reestablishing confidence in the original programs. Inadequacies in the welding program in the areas of these concerns would be reflected in the hardware quality

and the relevant records. While the concerns have generic implications, this reinspection will address them by focusing on safety-related portions of the plant. This conservative approach biases the reinspection toward items which have safety related and/or safety affecting functions. Due to an employee concern about the quality of TVA butt welds in duct work made from spiral welded pipe at Watts Bar Nuclear Plant and its subsequent investigation, TVA will reexamine a portion of a like system at BLN to verify that field welded joints meet the design requirements.

Due to normal construction sequence at a job site, the selection of different systems at various elevations and various units of the plant will cut across different timeframes of plant construction. The reinspection effort will include some modifications performed by Nuclear Operations if safety related work has been performed.

SCOPE

The reinspection of the safety-related features described in the groups below addresses the concerns described above for various installation crafts and various timeframes.

1. Selected process and instrumentation piping and attachment welds in ASME Class 1, 2, and 3 and ANSI B31.1 safety related systems at various units and elevations in the Reactor, Auxiliary, Control, and Diesel Generator Buildings and in the ERCW pumping station. The sample will include carbon and stainless steel piping components.

2. Welds of supports for piping and instrumentation lines (related to above piping components).

3. Welds of cable tray supports, conduit supports, and electrical components and mountings.

4. Structurally significant welds on miscellaneous structural steel in the Reactor, Control, Auxiliary and Diesel Generator Buildings, and in the ERCW pumping station.

5. HVAC support welds in the Reactor, Control, Auxiliary, and Diesel Generator Buildings and in the ERCW pumping station.

6. Spiral weld pipe used as ductwork in the Reactor Building.

7. Reactor building containment liner welds made to the requirements of specification N4C-871.

Welds to be reinspected will be as designated by the Welding Project from the categories and locations as listed in items 1 thru 7 above. Additional welds in other plant features may also be selected for reinspection at the option of the Welding Project. Weld selection will utilize BLN's computerized weld and component accountability program to the maximum extent practical to provide random selection of reinspection items. The scope of this reinspection is limited to visual, surface (magnetic

particle or liquid penetrant)methods , and review of radiographic film. It is not the intent of this work plan to require reinspection by any method not explicitly required by applicable codes, specifications, and drawings. It is not the intent of this work plan to re-perform any volumetric examintation. When welds which received radiography at installation are selected for reinspection, a review of radiographic film for conformance to applicable criteria will constitute the reinspection. Approximately 400 piping welds, 20 spiral weld duct welds, 170 structural items, and 50 one foot sections of containment liner welds will be reinspected in the above groups. The items to be reinspected will be selected to provide a representative look at each of the above classes and to cover work that has been performed during construction. Welds which are inaccessible due to removal of supports or equipment for inspection access will be excluded.

For all pipe welds, all containment welds, and for those structural and support welds requiring MT or PT examination, any existing coatings will be removed from all welds or portions of weld to be reinspected.

For all other welds, visual re-examination may be performed without removal of coatings. For these welds the attributes of interest are presence, size, length and location. Existing coatings will not effect this reinspection. Coating thickness as measured by a dry film thickness indicator will be reported for information.

For all welds, the generic type, carbon steel as opposed to stainless steel will be checked by magnetic means.

CRITERIA

All inspections will be conducted in accordance with established inspection procedures and this work plan. In case of conflicts, this work plan shall

govern. For purposes of this reinspection, the examination methods and acceptance criteria shall be as follows:

A. ASME Section III, Class 1 Welds

1. All complete penetration circumferential butt welds and welds attaching branch connections larger than 4" nominal pipe size

method - re-interpretation of radiographic film to N-RT-1(R4) of DPM N80E3.

criteria - welds meeting the acceptance criteria of N-RT-1(R4) as amended by Attachment 3 are acceptable. The reporting form shall be the standard form for RT interpretation used at BLN.

2. All welds in or to Class 1 Systems (including those in A.1 above)

method - perform PT or MT and visual examination using the methods as required by N-PT-1(R6) or N-MT-1(R5) and N-VT-3 (R5) of DPM N80E3 respectively. The method used (PT or MT) should be that used originally.

criteria - welds meeting the acceptance criteria of N-MT-1(R5) or N-PT-1(R6), as applicable and N-VT-3 (R5) as modified by Attachment 1 are acceptable. The reporting form for PT or MT examination shall be the standard form for the

particular method at BLN. The reporting form for visual examination shall be as shown in attachment 1.

B. ASME Section III, Class 2 Welds

1. All complete penetration circumferential butt welds and welds attaching branch connection larger than 4" nominal pipe size.

method - re-interpretation of radiographic film to N-RT-1(R4) of DPM N80E3 and visual examination to the requirements of N-VT-3(R5) of DPM N80E3.

criteria - welds meeting the acceptance criteria of N-RT-1(R4) as amended by Attachment 3 and N-VT-3(R5) as modified by Attachment 1 are acceptable. The reporting form for RT interpretation shall be the standard form used at BLN. The reporting form for visual examination shall be as shown in Attachment 1.

2. All other welds in or to Class 2 systems

method - PT or MT and visual examination as detailed in A.2 above.

criteria - As stated in A.2 above.

C. ASME Section III Class 3 Welds

1. Circumferential butt welds in pipe greater than 4" nominal pipe

size and welds attaching branch connections greater than 4" nominal pipe size.

method - PT or MT and visual examination as detailed in A.2 above.

criteria - As stated in A.2 above.

2. All welds in or to Class 3 systems (including those in C.1 above)

method - Perform visual examination to the requirements of N-VT-3(R5) of DPM N80E3.

criteria - Welds which meet the criteria of N-VT-3(R5) as modified by Attachment 1 are acceptable. The reporting form shall be as shown in Attachment 1.

D. ANSI B31.1 Welds

1. All welds

method - visual examination as detailed in C.2 above.

criteria - as stated in C.2 above.

E. Containment Liner Welds

1. Welds which received spot radiography during construction per

Construction Specification N4C-871.

method - re-interpretation of radiographic film as detailed in A.1 above.

criteria - as stated in A.1 above. Appendix H of Attachment 3 was used for the evaluation of root conditions in these welds.

2. All welds (including those in E.1 above).

method - MT and visual examination as detailed in A.2 above.

criteria - As stated in A.2 above.

F. Structural and support welds (ASME Section III, NF)

1. All welds

method - visual examination as detailed in C.2 above.

criteria - as stated in C.2 above, except that the reporting form of Attachment 2 shall be used.

2. Welds which required PT, MT, or RT during construction. (Refer to applicable drawings and construction records.)

method - perform PT, MT or re-interpretation of radiographic film as applicable and as detailed in A.1 and B.2 above. PT examination of NF class I and 2 welds shall include at least 1/2 inch of base material on either side of the weld.

criteria - as stated in A.1 or B.2 above (as applicable). Porosity in radiographs shall not be cause for rejection of the weld.

G. Structural and Support Welds (other than ASME III, NF)

1. All welds

Method - Structural steel and support welds which were designed based upon the AISC specification will be reinspected visually to drawing requirements in accordance with N-VT-6(R0) of DPM N80E3.

Criteria - Welds meeting the criteria of N-VT-6(R0) and attachment 2 are acceptable. The reporting form is included in attachment 2.

2. Welds requiring MT or PT examination per applicable drawings

Method - MT or PT (as applicable) using the methods of N-MT-1(R5) or N-PT-1(R6)

Criteria - Welds meeting the MT acceptance criteria of Attachment 4 are acceptable. Welds meeting the PT acceptance criteria of Attachment 5 are acceptable.

H. Spiral Duct Butt Welds

Method - Perform visual examination

Criteria - The acceptance criteria for spiral duct butt welds will be the presence of weld.

I. All Welds

The generic filler metal type for all welds will be checked by the use of magnets. The acceptability will be based upon the weld metal being of the correct type; carbon steel (magnetic), stainless steel (not magnetic or slightly magnetic) as appropriate for the materials being joined. The confirmation of generic filler material type does not require a special procedure, as it is an accept/reject test. The results of filler metal type shall be recorded on the respective visual examination records.

Any base material defects found during this reinspection shall be reported via the site QA program requirements but shall not be cause for rejection of the weld to the requirements of this reinspection program.

REINSPECTION PERSONNEL

For inspection of structural and support welds other than ASME NF, inspection personnel shall be qualified AWS-Certified Welding Inspectors (CWIs). The CWIs will be from TVA's Procurement Quality Assurance Branch (Vendor Surveillance). For piping and ASME NF support welds, inspection personnel shall be qualified in accordance with SNT-TC-1A or equivalent (certification program for visual patterned after the format for NDE established in SNT-TC-1A) Level II or III.

SPECIAL DATA

For structural and support welds, in addition to accepting or rejecting a weld, the inspector will note their own opinion of the workmanship of the weld: better than average, average, or below average. This judgemental evaluation may be made independent of the presence or absence of rejectable attributes used for formal acceptance or rejection of the weld.

QUALITY ASSURANCE

Overview of this reinspection effort will be provided by a person or persons independent of TVA who have current certification as AWS Certified Welding Inspectors (CWIs) for structural steel, non-ASME NF supports, and duct and SNT-TC-1A Level III for piping and ASME NF support welds. The independent inspector(s) will provide a written report to the Welding

Project Engineer summarizing the overview activity and their concurrence or reason for disagreement with the results.

RECORDS

For each weld there will be a record of acceptability as to presence, size, length, location of defects, and the generic type of filler metal. Weld discrepancies shall additionally be reported on a Weld Discrepancy Report (attachment 6).

PLANT SAFETY & SECURITY

Plant safety and security procedures shall apply.

DISPOSITION OF DISCREPANT CONDITION

Discrepancies will be documented on attached forms in accordance with TVA quality assurance program and dispositioned by the design organization using engineering justification to use as-is or to provide corrective action. Determination of generic importance of discrepancies to the welding program will be performed by the Welding Project. All defects which require design disposition will be reported along with the ultimate disposition. The NRC will be notified immediately if significant discrepancies are identified during the reinspection. Root causes will be investigated. All this will be included in the Phase 2 Final Report.

INSPECTION REPORT

The results of this reinspection will be forwarded to TVA Management and will subsequently be included in the overall report on the Welding Project activities on BLN to be submitted to the NRC.

ATTACHMENT 1

Exceptions to N-VT-3(R5) for reinspection of piping and ASME NF support welds are tabulated below:

Paragraph From N-VT-3	Exception To Be Taken
5.0	Examination prior to welding does not apply.
6.2.1.1	Overlap - Overlap for which the fusion zone can be seen is acceptable. If surface examination is performed and is acceptable, the overlap is acceptable.
	Porosity - Visually detected porosity is acceptable if surface examination (MT/PT) is performed and the surface examination is acceptable. If surface examination is not performed, porosity and slag inclusions may be evaluated to the RT porosity chart in Attachment 1 to this reinspection plan.
	Arc Strikes - Arc strikes are acceptable on ASTM A105, A106, A234 carbon steel materials and on type 304 and 316 stainless steel if no cracking is apparent and they do not reduce the base material thickness. Report the depth of material reduction, to the nearest 1/32 inch, for any arc strike 1/32 of an inch deep or more.

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Paragraph From N-VT-3	Exception To Be Taken
	Weld Spatter - Weld spatter is acceptable. It has no metallurgical significance and is not related to weld quality.
6.2.3	The maximum offset does not apply.
6.2.7.2	Figure 5 (c) applies to all socket weld joints, including slip-on flanges for ANSI B31.1 welds.

Documentation of examinations shall be on the form attached.

The magnetic check is to be performed by touching a small permanent magnet to the weld deposit and noting whether the weld deposit is strongly magnetic, weakly magnetic, or non-magnetic.

Base material defects, judged not to be the result of welding, shall be reported and handled separetely via site QA requirements.

NONDESTRUCTIVE EXAMINATION PROCEDURE TVA - DIVISION OF NUCLEAR POWER	Procedure No. Revision Page of

ATTACHMENT B

RECORD OF VISUAL WELD EXAMINATION (Mechanical/Piping Welds)

PROCEDURE NO. N-VT- REV. ____ WR/WP NO. _____

REF. DRAWING _____ ITEM/SYS. DESCRIP. _____

CRITERIA	WELD NO.	WELD NO.	WELD NO.	WELD NO.
	«ACC=REJ»	«ACC=REJ»	«ACC=REJ»	«ACC=REJ»
WELD DEFECTS				
CONTOUR/TRANSITION				
OFFSET/ALIGNMENT				
UNDERCUT				
REINFORCEMENT				
ARCSTRIKES				
WELD LOCATION				
Fillet Weld Size				
WELD METAL	NON-MAGNETIC ☐ STRONGLY MAGNETIC ☐ WEEKLY MAGNETIC ☐	NON-MAGNETIC ☐ STRONGLY MAGNETIC ☐ WEEKLY MAGNETIC ☐	NON-MAGNETIC ☐ STRONGLY MAGNETIC ☐ WEEKLY MAGNETIC ☐	NON-MAGNETIC ☐ STRONGLY MAGNETIC ☐ WEEKLY MAGNETIC ☐
BASE METAL	STAINLESS ☐ CARBON ☐	STAINLESS ☐ CARBON ☐	STAINLESS ☐ CARBON ☐	STAINLESS ☐ CARBON ☐
WELD TYPE	BUTT/GRV. ☐ SOCKET ☐ FILLET ☐	BUTT/GRV. ☐ SOCKET ☐ FILLET ☐	BUTT/GRV ☐ SOCKET ☐ FILLET ☐	BUTT/GRV ☐ SOCKET ☐ FILLET ☐
COMPONENT	PIPE TO PIPE ☐ PIPE TO FTG. ☐ PIPE TO VLV. ☐ FTG. TO FTG. ☐ FTG. TO VLV. ☐	PIPE TO PIPE ☐ PIPE TO FTG. ☐ PIPE TO VLV. ☐ FTG. TO FTG. ☐ FTG TO VLV. ☐	PIPE TO PIPE ☐ PIPE TO FTG. ☐ PIPE TO VLV. ☐ FTG. TO FTG ☐ FTG. TO VLV ☐	PIPE TO PIPE ☐ PIPE TO FTG ☐ PIPE TO VLV ☐ FTG TO FTG ☐ FTG TO VLV ☐

EXAMINED BY: _____ LEVEL _____ DATE _____

ATTACHMENT 2

Exceptions to N-VT-6(R0) and N-VT-3(R5) for reinspection of structural welds are tabulated below:

Inspect and accept/reject for all attributes on the documentation form included in this attachment. Your judgement will be based only on your ability to see the attribute through paint on those welds from which paint is not required to be removed by this reinspection plan.

The inspector should attempt to manually remove or have removed surface slag prior to rejecting a weld for slag.

The magnetic check is to be performed by touching a small permanent magnet to the weld deposit and noting whether it is strongly magnetic, weakly magnetic, or non-magnetic.

The judgemental evaluation will consider the overall workmanship of the weld: above average, average or below average.

NONDESTRUCTIVE EXAMINATION PROCEDURE
TVA - DIVISION OF NUCLEAR POWER

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ATTACHMENT B
RECORD OF VISUAL WELD EXAMINATION (Structural and Support Welds)
PROCEDURE NO. N-VT- REV. WR/WP NO.
REF. DRAWING ITEM/SYS. DESCRIP.

CRITERIA	WELD NO.	WELD NO.	WELD NO.	WELD NO.
	ACC. REJ. NA	ACC. REJ. NA	ACC. REJ. NA	ACC. REJ. NA
WELD CRACKS				
FILLET WELD SIZE				
INCOMPLETE FUSION				
WELD OVERLAP				
UNDERFILLED CRATERS				
WELD PROFILES				
UNDERCUT				
SURFACE POROSITY				
WELD LENGTH				
WELD LOCATION				
ARC STRIKES				
SURFACE SLAG				
WELD SPATTER				
WELD METAL (MAGNETIC ATTRACTION)	☐ NONE ☐ STRONG ☐ WEAK	☐ NONE ☐ STRONG ☐ WEAK	☐ NONE ☐ STRONG ☐ WEAK	☐ NONE ☐ STRONG ☐ WEAK
BASE METAL	☐ STAINLESS ☐ CARBON	☐ STAINLESS ☐ CARBON	☐ STAINLESS ☐ CARBON	☐ STAINLESS ☐ CARBON
SURFACE PAINTED	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO
PAINT THICKNESS				
INSTRUMENT USED				
JUDGEMENTAL EVALUATION	☐ > AVG. ☐ AVG. ☐ < AVG	☐ > AVG ☐ AVG ☐ < AVG	☐ > AVG ☐ AVG ☐ < AVG	☐ > AVG ☐ AVG ☐ < AVG

NOTE: DESCRIBE REJECTABLE CONDITION(S) IN DETAIL ON REVERSE SIDE

EXAMINED BY: _____ LEVEL _____ DATE _____

TABLE 2
PENETRAMETER SELECTION TABLE

Class	Code	Applicable Section of ASME Code	Single Wall Exposure	Double Wall Exposure
1,2,3,CS	ASME III NB,NC,ND VIII Divisions 1 and 2	V Article 2	Table 4	Table 6
MC	ASME III NE	ASME III, Appendix X	Table 5	Table 5
--	ANSI B31.1 ASME I, III NF	V Article 3	Table 3	Table 3
Liner	TVA N4C-871 ASME III CC	V Article 3[1], Appendix H of this specification	Table 3	NA

[1]Penetrameters used for radiography of liner plates may be in accordance with Figure A2.

TABLE 3

THICKNESS, PENETRAMETER DESIGNATIONS, AND ESSENTIAL HOLES

FOR SINGLE-WALL RADIOGRAPHIC TECHNIQUE

Applicable to ANSI B31.1*, ASME I*, III (NF), III (Division 2), and TVA N4C-871 (ASME III, CC)*, **

Single-Wall Material Thickness Range, (Inches)	Penetrameter			
	Source Side		Film Side	
	Desig	Essential Hole	Desig	Essential Hole
Up to 1/4 inclusive	10	4T	7	4T
Over 1/4 through 3/8	12	4T	10	4T
Over 3/8 through 1/2	15	4T	12	4T
Over 1/2 through 5/8	15	4T	12	4T
Over 5/8 through 3/4	17	4T	15	4T
Over 3/4 through 7/8	20	4T	17	4T
Over 7/8 through 1	20	4T	17	4T
Over 1 through 1-1/4	25	4T	20	4T
Over 1-1/4 through 1-1/2	30	2T	25	2T
Over 1-1/2 through 2	35	2T	30	2T
Over 2 through 2-1/2	40	2T	35	2T
Over 2-1/2 through 3	45	2T	40	2T
Over 3 through 4	50	2T	45	2T
Over 4 through 6	60	2T	50	2T
Over 6 through 8	80	2T	60	2T
Over 8 through 10	100	2T	80	2T
Over 10 through 12	120	2T	100	2T
Over 12 through 16	160	2T	120	2T
Over 16 through 20	200	2T	160	2T

*Penetrameters shall be as specified in this table for either single or double wall radiography.

**Penetrameters used for radiography of liner plates may be in accordance with Figure A2.

TABLE 4

THICKNESS, PENETRAMETER DESIGNATIONS, AND ESSENTIAL HOLES

FOR SINGLE-WALL RADIOGRAPHIC TECHNIQUE*

Applicable to ASME III (NB, NC, ND) ASME VIII

Single-Wall Material Thickness Range (Inches)	Penetrameter			
	Source Side		Film Side	
	Desig	Essential Hole	Desig	Essential Hole
Up to 1/4 inclusive	5	4T	5	4T
Over 1/4 through 3/8	7	4T	7	4T
Over 3/8 through 1/2	10	4T	10	4T
Over 1/2 through 5/8	12	4T	12	4T
Over 5/8 through 3/4	15	4T	12	4T
Over 3/4 through 7/8	17	4T	15	4T
Over 7/8 through 1	20	2T	15	2T
Over 1 through 1-1/4	25	2T	17	2T
Over 1-1/4 through 1-1/2	30	2T	20	2T
Over 1-1/2 through 2	35	2T	25	2T
Over 2 through 2-1/2	40	2T	30	2T
Over 2-1/2 through 3	45	2T	35	2T
Over 3 through 4	50	2T	40	2T
Over 4 through 6	60	2T	45	2T
Over 6 through 8	80	2T	50	2T
Over 8 through 10	100	2T	60	2T
Over 10 through 12	120	2T	80	2T
Over 12 through 16	160	2T	100	2T
Over 16 through 20	200	2T	120	2T

*For double wall exposure, single or double wall viewing, use Table 6 for penetrameter and essential hole selection.

TABLE 5
STANDARD PENETRAMETER SIZES
FOR ASME SECTION III, NE CLASS MC

Weld Thickness[1] Range, Inches	Thickness of Penetrameter on Source Side, Inch	Designation on Penetrameter	Thickness of Penetrameter on Film Side, Inch	Designation on Penetrameter
Up to 1/4 inclusive	0.005	5	0.005	5
Over 1/4 thru 3/8	0.0075	7	0.0075	7
Over 3/8 thru 1/2	0.010	10	0.010	10
Over 1/2 thru 5/8	0.0125	12	0.010	10
Over 5/8 thru 3/4	0.015	15	0.012	12
Over 3/4 thru 7/8	0.0175	17	0.015	15
Over 7/8 thru 1	0.020	20	0.017	17
Over 1 thru 1-1/4	0.025	25	0.020	20
Over 1-1/4 thru 1-1/2	0.030	30	0.025	25
Over 1-1/2 thru 2	0.035	35	0.030	30
Over 2 thru 2-1/2	0.040	40	0.030	30
Over 2-1/2 thru 3	0.045	45	0.035	35
Over 3 thru 4	0.050	50	0.040	40
Over 4 thru 6	0.060	60	0.050	50
Over 6 thru 8	0.080	80	0.060	60
Over 8 thru 10	0.100	100	0.080	80
Over 10 thru 12	0.120	120	0.100	100
Over 12 thru 16	0.160	160	0.120	120
Over 16 thru 20	0.200	200	0.160	160

[1]Including any weld reinforcement or backing strip thickness, if not removed. In the case of double wall tube radiography, the thickness of the weld next to the film.

[2]The images of the identifying numbers of the penetrameter outline and of the 2T hole are all essential indexes of image quality on the radiograph, except that for penetrameters 5, 7, and 10, the slit shall appear clearly; and the hole need not appear.

TABLE 5

THICKNESS, PENETRAMETER DESIGNATIONS, AND ESSENTIAL HOLES FOR DOUBLE-WALL RADIOGRAPHIC TECHNIQUE
(For ASME Section III, NB, NC, ND; ASME Section VIII)

Nominal Single-Wall Material Thickness Range Inches	Penetrameter Film or Source Side	
	Designation	Essential Hole
0 through 0.375	10	4T
Over 0.375 through 0.625	12	4T
Over 0.625 through 0.875	15	4T
Over 0.875 through 1.00	17	4T
Over 1.00 through 1.50	25	2T
Over 1.50 through 2.50	30	2T
Over 2.50 through 3.00	35	2T
Over 3.00 through 4.00	40	2T
Over 4.00 through 6.00	50	2T

APPENDIX A

PENETRAMETER REQUIREMENTS

1. Penetrameters shall be procured to Purchase Specification PF-1058 which meets the requirements of ASME SE-142, which is identical to ASTM E 142, 1977. In addition penetrameters 5 through 10 may be procured to the requirements of ASME, Section III, Appendix X.

2. Penetrameters shall be fabricated of radiographically similar material to the weld material or weld metal to be examined. Radiographically similar material is a material or alloy having the same radiation absorption as that being examined.

3. Penetrameters shall be fabricated in accordance with Figure A1 and/or A2 as applicable.

4. Penetrameters shall be identified by permanently attached lead numbers at least 3/32-inch wide. The numbers shall indicate the penetrameter thickness in accordance with Table A1 in thousandths of an inch.

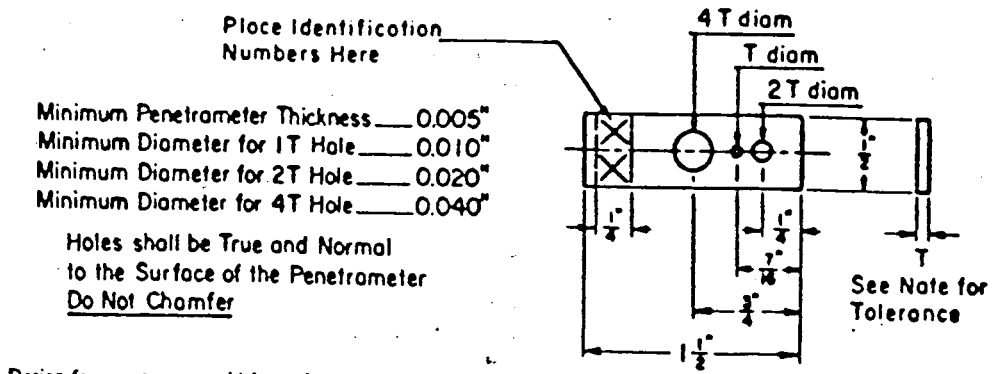
5. Penetrameters which otherwise conform to the requirements of this specification method, but do not have the proper identification, may be used provided the lead numbers indicating penetrameter thickness are placed adjacent to the penetrameter.

TABLE A1

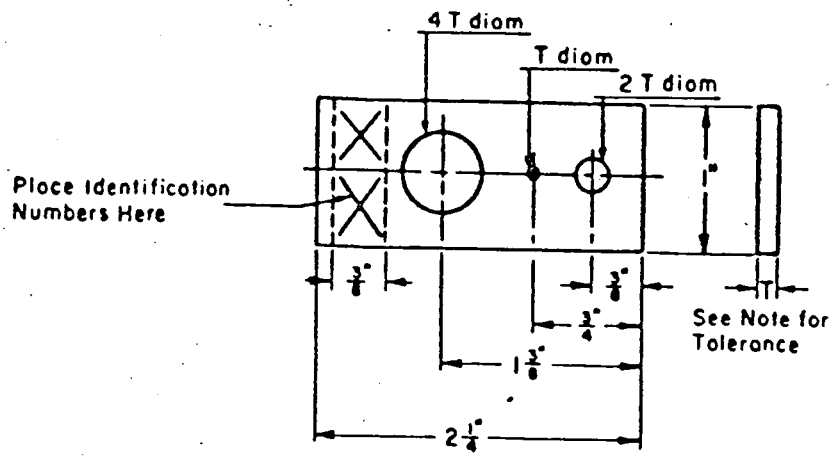
PENETRAMETER DESIGNATION AND ESSENTIAL HOLES

Penetrameter Designation	Penetrameter Thickness	1 T Hole Diameter	2 T Hole Diameter	4 T Hole Diameter
5	0.005	0.010	0.020	0.040
7	0.007	0.010	0.020	0.040
10	0.010	0.010	0.020	0.040
12	0.012	0.012	0.025	0.050
15	0.015	0.015	0.030	0.060
17	0.017	0.017	0.035	0.070
20	0.020	0.020	0.040	0.080
25	0.025	0.025	0.050	0.100
30	0.030	0.030	0.060	0.120
35	0.035	0.035	0.070	0.140
40	0.040	0.040	0.080	0.160
45	0.045	0.045	0.090	0.180
50	0.050	0.050	0.100	0.200
60	0.060	0.060	0.120	0.240
80	0.080	0.080	0.160	0.320
100	0.100	0.100	0.200	0.400
120	0.120	0.120	0.240	0.480
160	0.160	0.160	0.320	0.640
200	0.200	0.200	0.400	0.800

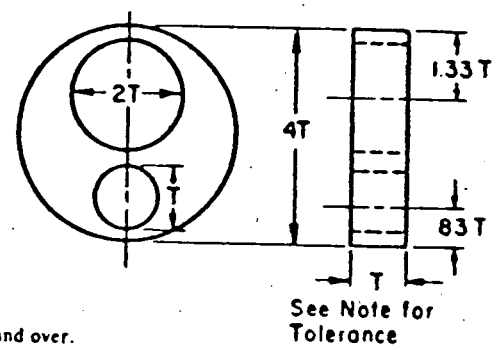
APPENDIX A (Continued)



Design for penetrameter thickness from 0.005 in. and including 0.050 in.



Design for penetrameter thickness from 0.060 in. to 0.160 in. incl.
Made in 0.010-in. increments.

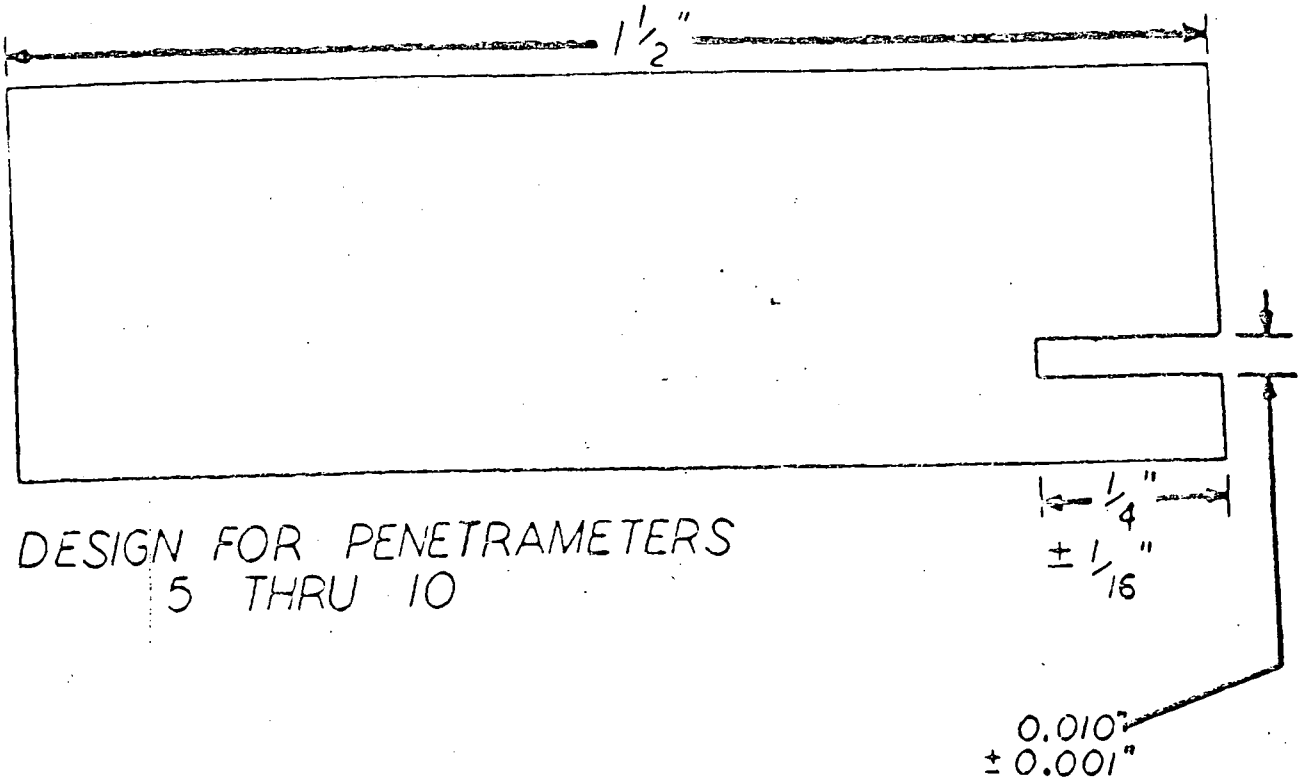


Design for penetrameter thickness of 0.180 in. and over.
Made in 0.020-in. increments.

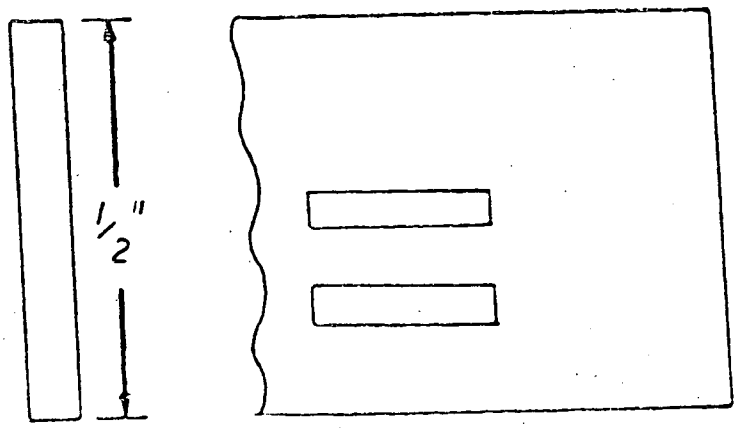
NOTE 1 – Tolerances on penetrameter thickness and hole diameter shall be ±10 % or one half of the thickness increment between penetrameter sizes, whichever is smaller.

FIGURE A1. PENETRAMETER DESIGN

APPENDIX A (Continued)



DESIGN FOR PENETRAMETERS
5 THRU 10



ALTERNATE SLIT LOCATIONS

NOTE: ALL OTHER PENETRAMETER DIMENSIONS SHALL BE IN ACCORDANCE WITH APPENDIX A

FIGURE A2. PENETRAMETER DESIGN - LINER PLATES

APPENDIX E

BELLEFONTE NUCLEAR PLANT DENSITY REQUIREMENTS

Applicable Codes	RT Performed Per	Minimum Density for Single Film Viewing	Minimum Density for Composite Viewing	Maximum Density for Single or Double Film Viewing
ASME III NB, NC, ND VIII DIVISIONS 2 AND 2	Section V Article 2	2.0	2.6*	3.8
Linear plate (TVA N4C-871) ASME I, III NF, III Division 2 ANSI B31.1	Section V Article 3	1.3	1.8	3.8
NE	Appendix X	1.3	1.8	No maximum

*Each radioagraph of a composite set shall have a minimum density of 1.3.

APPENDIX H

ACCEPTANCE CRITERIA FOR ROOT CONDITIONS IN BACKING RING WELDS

1.0 Scope

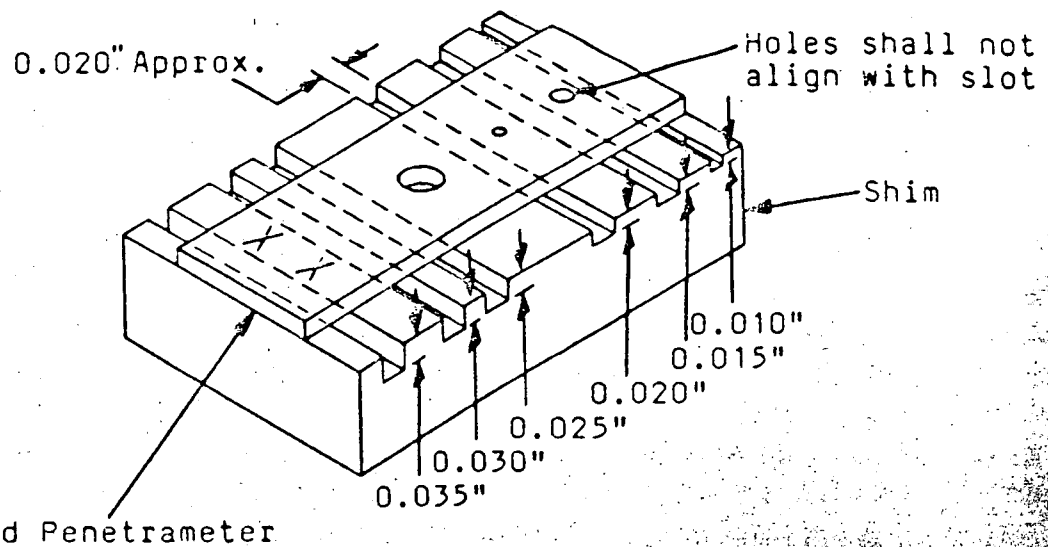
1.1 This appendix will not be used unless invoked by OE. The criteria specified in this appendix shall be used when interpreting radiographs of backing ring welds when such radiographs show indications that can be attributed to a condition along the root of the weld. This criteria shall apply only to such root conditions and indications accepted must be clearly identifiable to this area.

2.0 The film interpreter shall record which figure most closely represents the weld root condition shown on the radiograph. The completed joint is then ajudged acceptable or unacceptable according to the acceptance criteria of this procedure.

3.0 The following figures show shim geometry and diagrams of root conditions most commonly found in backing ring welds.

3.1 Figure 1 gives the size and location of the grooves in the shim. This appendix provides the limits for undercuts or depressions allowed in a weld. The interpreter must evaluate the depth of a depressed area by visually comparing the density of the image of the grooves with the density of the depressed weld area.

3.1.1 The penatrameter should be positioned as shown in the diagram to avoid distortion of required sensitivity. If an ungrooved shim is inadvertently used and the weld does not contain any questionable root conditions, use of the ungrooved shim shall not be cause for rejection of the radiographs.



APPENDIX H (Continued)

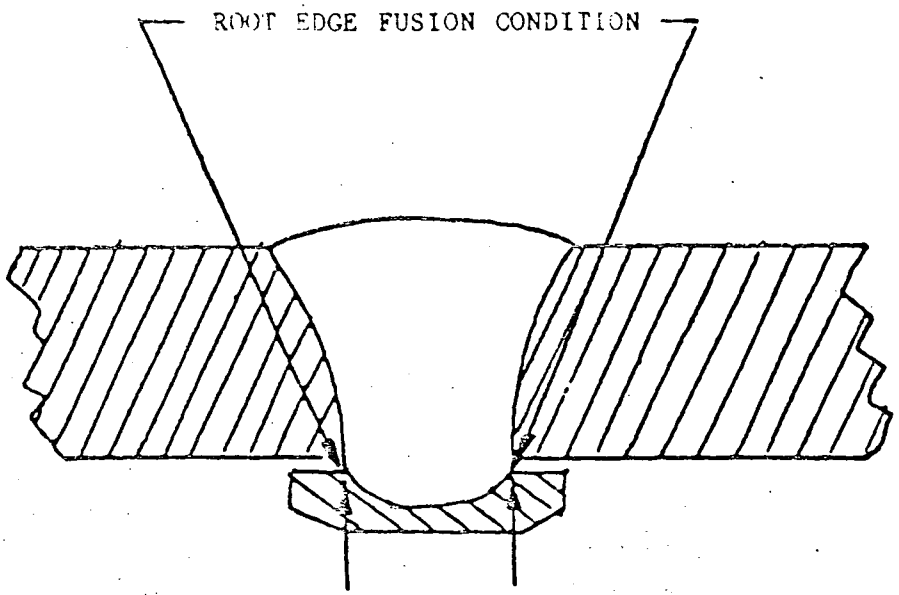
ACCEPTABLE WELD JOINT

3.2 Weld Root

The weld joint illustrated in Figure 2 meets the requirements of this procedure. The weld metal is fused to the backing ring and fills the root gap without any harmful depressions, grooves, etc.

3.2.1 Description of Radiograph

Because the root face is free of depressions, grooves, etc., just two different photographic densities are apparent; the lighter density of the weld deposit contrasts with the darker base metal. The line of demarcation between the two areas is usually distinctive, but normally not straight.



CHANGE IN DENSITY OF IMAGE
OCCURS HERE AS A RESULT
OF ROOT EDGE FUSION

FIGURE 2 - ACCEPTABLE WELD JOINT

APPENDIX H (Continued)

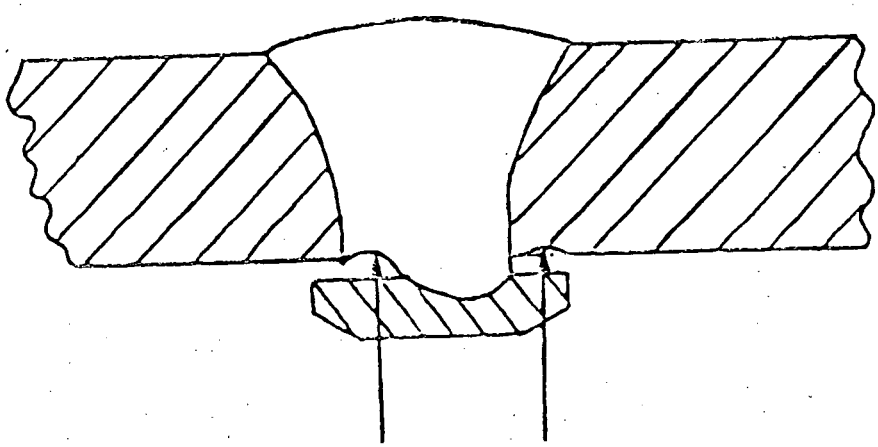
CONDITIONALLY ACCEPTABLE WELD JOINT

3.3 Weld Root

The weld joint illustrated in Figure 3 could meet the requirements of this procedure, even though some cavity is evident in the weld deposit or the base metal at the root. As long as these cavities do not present any sharp edges, do not exceed 1/32-inch, and do not encroach on the minimum wall thickness, they may be accepted. Cavities (or depressions) in both the weld deposit and base metal may coexist.

3.3.1 Description of Radiograph

Cavities (or depressions) appear in radiographs as areas of greater density (darker) because the part is thinner at these locations, i.e., there is less material for the radiation to penetrate. The change in density from one area to another is gradual. The radiographic density of this area should not exceed the density of the image of the applicable groove in the shim. The density of the image of the shim groove should be compared to the portion of the groove not covered by the penetrameter.



TYPICAL ROOT UNDERCUT

FIGURE 3 - CONDITIONALLY ACCEPTABLE WELD JOINT

APPENDIX H (Continued)

UNACCEPTABLE WELD JOINT

3.4.1 Weld Root

The weld joint illustrated in Figure 4 does not meet the requirements of this procedure. The cavities (or depressions) at the edge of the weld root in either the weld deposit or base metal are sharper but not necessarily deeper than those in Figure 3; they may or may not exceed 1/32-inch and/or encroach on the minimum wall thickness. In this case, the primary criterion is the sharpness of the edges of the weld root rather than depth of the cavities.

NOTE: The cavity (or depression) at the right edge of the weld root (Figure 4) often occurs in tack welding. The cavity at the left shows part of the root face still unmelted.

3.4.2 Description of Radiograph

Cavities (or depressions) are depicted as darker areas (more dense). The transition in density from the defect to the adjoining area appears sharp and usually narrow. The length of the defect is usually short and generally occurs intermittently along the weld.

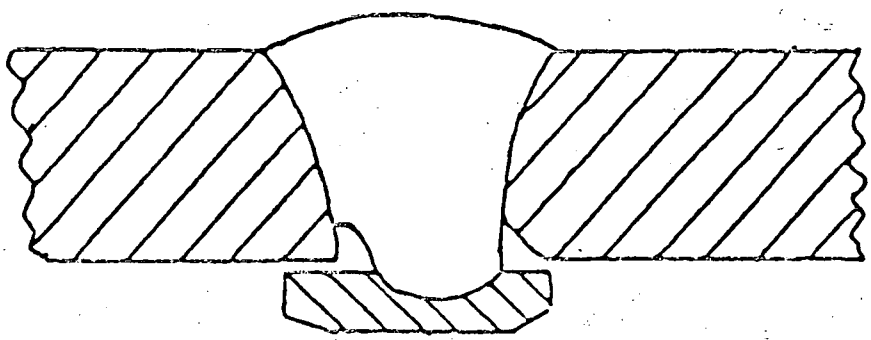


FIGURE 4 - UNACCEPTABLE WELD JOINT

APPENDIX H (Continued)

4.0 Workmanship samples(WS) may be used as an aid in evaluation of Figure 3 conditions in radiographs. If there is any doubt if a WS is needed, one should be used.

4.1 A WS consists of a joint of the same design and same nominal thickness and material as the production weld and may be a welder or procedure qualification test assembly. Radiograph the area of a weld to be used for a WS and prove it acceptable by visual or macro examination.

4.2 The radiograph of a WS used to evaluate a condition in a production weld must be made using the same radiographic technique as is used to make the production radiograph.

4.2.1 The parameters of the radiographic technique which should have the same nominal values for both the WS and the production radiograph are: type source, source intensity, source-to-film distance, film, intensifying screen type and thickness, whether source-side or film-side penetrameter used, whether single- or double-wall exposure, and whether for single- or double-wall viewing.

4.2.2 The film density of the WS radiograph must be accaptable and within -10% to +30% of the density of the questionable area of the production weld radiograph so that an accurate comparison may be made.

4.3 Method of Manufacture of a WS

4.3.1 Select an area of a test assembly containing a Figure 3 indication.

4.3.2 Identify for radiography the area selected using a unique WS number.

4.3.3 Radiograph this area using the same technique and parameters as will be used in production.

APPENDIX H (Continued)

4.3.4 Make a section through the questionable area, polish and etch for macro examination.

4.3.5 If the macro section is proven to be acceptable, the radiograph and macro should be saved for a workmanship sample.

4.4 Workmanship samples, radiographs, and macros must be numbered and retained for future use.

4.4.1 Each time the WS is used for evaluating a questionable condition, record the WS number used for evaluation.

ATTACHMENT 4

MT Acceptance Criteria for Structural Welds (AISC/AWS)

The following may be used as the acceptance criteria for welds fabricated to the requirements of Section 8, Design of New Buildings, of the Structural Welding Code:

8.1 The following discontinuities are unacceptable:

8.1.1 Cracks

8.1.2 Individual discontinuities having a greatest dimension of 3/32-inch (2.4 mm) or greater, if:

8.1.2.1 The greatest dimension of a discontinuity is larger than 2/3 of the effective throat, 2/3 the weld size, or 3/4-inch (19.0 mm).

8.1.2.2 The discontinuity is closer than three times its greatest dimension to the end of a groove weld subject to primary tensile stresses.

8.1.2.3 A group of such discontinuities is in line such that:

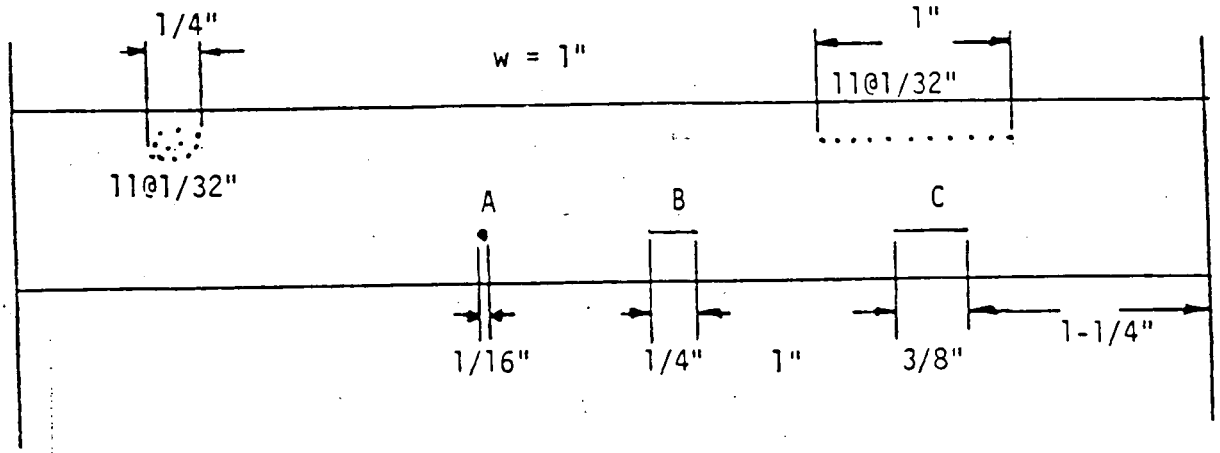
(a) The sum of the greatest dimensions of all such discontinuities is larger than the effective throat or weld size in any length of six times the effective throat or weld size. When the length of the weld being examined is less than six times the effective throat or weld size, the permissible sum of the greatest dimensions shall be proportionally less than the effective throat or weld size.

(b) The space between two such discontinuities which are adjacent is less than three times the greatest dimension of the larger of the discontinuities in the pair being considered.

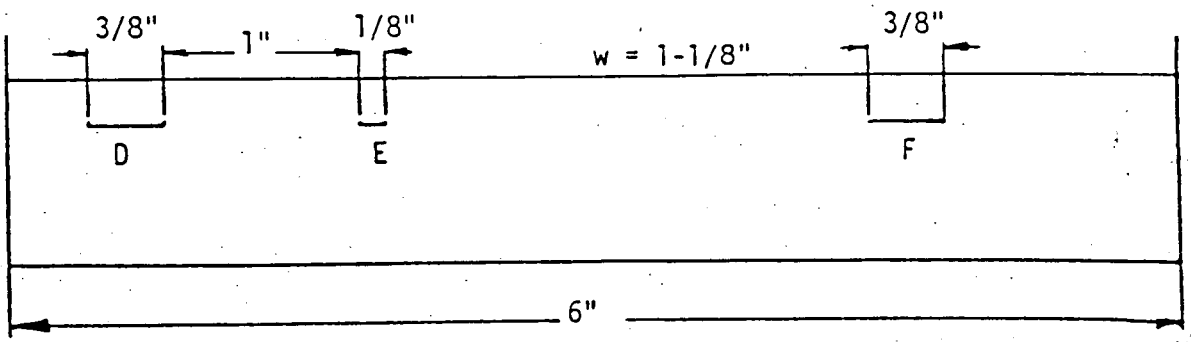
8.1.3 Any indication 3/32-inch or greater, closer than three times its greatest dimension from the end of a weld.

8.1.4 Independent of the requirements of sections 8.1.2 and 8.1.3, discontinuities having a greatest dimension of less than 3/32-inch, if the sum of their greatest dimensions exceeds 3/8-inch in any linear inch of weld.

sheet 2 provides examples of the above acceptance criteria.



C is not counted in accumulation for 1 inch (See 5.2.4).
A, B, and C are not considered aligned because A, being less than 3/32", is not evaluated as an aligned indication.
C is more than 3 times its greatest dimension from the end of the weld and is acceptable.



D, E, and F are aligned indications and indication accumulation (IA) is acceptable.
D and E are rejectable because they are closer than 3 times the size of D to each other. Removal of either D, E, or F would make this weld acceptable.

PT Acceptance Criteria for Structural Welds (AISC/AWS)

1. A weld shall be acceptable by liquid penetrant examination if it shows that:

2. The weld has no cracks.

3. Thorough fusion exists between weld metal and base metal.

4. The sum of diameters of piping porosity does not exceed 3/8-inch in any linear inch of weld nor does it exceed 3/4-inch in any 12-inch length of weld.

ATTACHMENT 6

WELD DISCREPANCY REPORT

DWG/SKETCH NO._____ WELD NO._____

I. Description of Discrepancy (Attach Sketch/Photograph).

_____

_____

_____

_____

Reported by_____ _____
Inspector Date

II. Disposition

_____

_____

_____

_____

DNE Representative_____ _____
Date

III. Corrective Action Taken

_____

_____

_____

BLN Personnel_____ _____
Date