طرح نگهداشت و افزایش تولید 27 مخزن

NDE Procedure

نگهداشت و افزایش تولید میدان نفتی بینک

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1. INTRODUCTION

Binak oilfield in Bushehr province is a part of the southern oilfields of Iran, is located 20 km northwest of Genaveh city. With the aim of increasing production of oil from Binak oilfield, an EPC/EPD Project has been defined by NIOC/NISOC and awarded to Petro Iran Development Company (PEDCO). Also PEDCO (as General Contractor) has assigned the EPC-packages of the Project to "Hirgan Energy - Design and Inspection" JV.

GENERAL DEFINITION

The following terms shall be used in this document.

CLIENT:	National Iranian South Oilfields Company (NISOC)
PROJECT:	Binak Oilfield Development – Manufacturing (w/Engineering & Material Supply) of Air Coolers
EPD/EPC CONTRACTOR (GC):	Petro Iran Development Company (PEDCO)
OWNER:	OWNER is collectively refer to National Iranian South Oil Company (NISOC) and Petro Iran Development Company (PEDCO)
EPC CONTRACTOR:	Joint Venture of : Hirgan Energy – Design & Inspection(D&I) Companies
VENDOR:	Aban Air Cooler (AAC)
EXECUTOR:	Executor is the party which carries out all or part of construction and/or commissioning for the project.
THIRD PARTY INSPECTOR (TPI):	Third Party Inspector
SHALL:	Is used where a provision is mandatory.
SHOULD:	Is used where a provision is advisory only.
WILL:	Is normally used in connection with the action by CLIENT rather than by an EPC/EPD CONTRACTOR, supplier or VENDOR.
MAY:	Is used where a provision is completely discretionary.

2. Liquid PENETRANT EXAMINATION PROCEDURE

1. Scope

Examination of bevelling parts of carbon steel welds & root pass & back gouged portion at shop, after finishing of satisfactory visual inspection by appointed shop inspector according to related NDT map.
Any conflict between reference codes and this document, the requirements of mentioned reference codes are in priority to this document.

2. Standard

ASME Sec. V, ARTICLE 6, Ed. 2013
ASME Sec. VIII Div.1, APPENDIX 8, Ed. 2013

3. Technique

Colour contrast: using solvent removable penetrant. It is better all set be from one manufacturer.
Brand of dye penetrant & developer shall be same but cleaner can be different due to ASME Sec. V.

4. Pre-Examination Cleaning & Drying

The surface to be examined & on area at least 1" width on either side of test surface shall be dry clean & free of all grease, flux spatter, rust, oil, that might interfere with the penetration of liquid.
Also, the surface must be dried by proper method such as heating or using clean clothes in case clean clothes in case of moisture or wet surface.
If the surfaces to be tested are coated with paint, it shall be thoroughly cleaned off to expose substrate for test.

5. Liquid Penetrant Application

Type of dye penetrant: Visible penetrant examination method. A minimum light intensity of 100 fc (1000 lx) is required on the surface to be examined to ensure adequate sensitivity during the examination and evaluation of indications.
Application: By thoroughly and uniformly spraying on the part to be examined
Dwell penetration time: Min. 5 minutes (or as per otherwise recommended by manufacturer or application spec.)
Temperature of surface: 5 - 52˚C

If drying occurred after penetrant application, penetrant shall be removed and re-applied.

6. Method of Removing Excess Penetrant

Removing will be performed by special solvent and clean clothes after elapsing of dwell time from the area of interest. It shall be achieved by means of dry wiper followed by wipes. Wiping is done by using lint free cloth or absorbent tissue. Wetting as necessary is done with cleaners. Final wiping is with dry wipe.

- Drying after excess penetrant removal:

The test surface will be allowed to dry by normal evaporation at ambient temperature. To prevent evaporation of the penetrant from flaws, excessive drying time or artificial temperature higher than the ambient temperature should be avoided.

7. Developer Application

The developer shall be applied uniformly as soon as possible after PENETRANT removal by means of spray. Blotches & drips shall be avoided.

Developing time is 10 minutes (According to table T-672 ASME Sec. V).

8. Evaluation of L.P. Examination

Final interpretation shall be made within 10-60 minutes after the application of a dry developer or as soon as a wet developer coating is dry If bleed-out does not alter the examination results, longer periods are permitted. If the surface to be examined is large enough to preclude complete examination within the prescribed or established time, the examination shall be performed in increments. All relevant indications shall be recorded and evaluated as per ASME sec. VIII Div. 1 appendix 8, Repair shall preform under supervision of inspector.

9. Post Cleaning

After evaluation of L.P. examination, the remaining material shall be removed by proper solvent or water and clean clothes.

10. Personal Qualification

Personnel performing the non-destructive examination shall be qualified in accordance with the requirements of ASNT Recommended Practice No. SNT-TC-1 A.

Only qualified and certified Level II or Level III personnel shall test all examination and evaluation.

11. Acceptance Standard Criteria

The acceptance standard for above mentioned method will be according to ASME VIII Div.1 appendix 8.

12. Documentation

Documentation shall be done in accordance with ASME Sec V T-690

13. Record

Rejectable indications shall be recorded. As a minimum, the type of indications (linear or rounded), location and extent (length or diameter or aligned) shall be recorded.

Examination Records

For each examination, the following information shall be recorded:

(a) procedure identification and revision;

(b) liquid penetrant type (visible or fluorescent);

(c) type (number or letter designation) of each penetrant, penetrant remover, emulsifier, and developer used;

(d) examination personnel identity and if required by referencing Code Section, qualification level;

(e) map or record of Rejectable indications per T-691;

(f) material and thickness;

(g) lighting equipment; and

(h) date of examination.

14. Attachment

Format of examination report

Attachment 1:

Quality Control

LIQUID PENETRANT EXAMINATION REPORT

Code No :QF-QC-03
Date & Rev :0-1386/2/10
Report No:
Date :

Projec Unit Name : Date:	Item :	Doc. No. :	Project No. :
WELD NO.:	WELD CONFIG.:		
Material : thickness:	Test Temp. :	Surface Condition	
Process Of PT	Procedure No. :		Code(REFERENCE STANDARD) :
PO. NO.:	welding process:		

Penetrant	Brand	Type MAGNAFLUX	Batch No .	Apply ☐ ☐ ☐	Brush Spray Immerse	Dwell time min.
Emulsifier	Brand	Type MAGNAFLUX	Batch No .	Apply ☐ ☐ ☐	Brush Spray Immerse	Dwell time min
Remover	Brand	Type MAGNAFLUX	Batch No .	Apply ☐ ☐ ☐	Brush Spray ☐ Immerse ☐	Remove Handwipe Wash
Developer	Brand	Type MAGNAFLUX	Batch No .	Apply ☐ ☐ ☐	Brush Spray Immerse	Bleed out

Black Light	☐ Without ☐ With	Black Light NO. N / A	Itensity N / A	☐ A ☐
Water Pressure / Temp Psi N / A C °				

Header No.	ACC.	Rej.	Step	Interpretation	Remarks
				No Recordable Indication	

Joint No.	Thickness	Defect Type	Location	Dimention	Result		Result 2	
					Acc	Rej	Acc	Rej

Map or record of rejectable indications per T691:

type: linear ☐ rounded ☐ location:

extent:(length or diameter or aligned):

SKETCH ON LINE IF NECESSARY OR ☐ ATTACHED

Remark :

A.A.C INSPECTOR	OWNER	TPA
NAME & SIGNATURE	NAME & SIGNATURE	NAME & SIGNATURE
DATE :	DATE :	DATE :

3: MAGNETIC PARTICLE PROCEDURE

1. SCOPE

This Procedure is to be used for inspection of Ferromagnetic materials for different part of air coolers weld seams according to related NDT maps. after finishing of satisfactory visual inspection by appointed shop inspector who specified by client or by referencing code.

Any conflict between reference codes and this document, the requirements of mentioned reference codes are in priority to this document.

2. Reference Documents

- ASME SEC V, ARTICLE 7, ED 2013
- ASME SEC VIII – DIV 1, ED 2013
- ASNT SNT - TC - 1A, ED 2013
- ASTM E 709, ED 2015

3. Equipment

3.1- A portable AC or DC ELECTROMAGNETIC yoke with double articulation such as magnaflux shall be used. Batch test certificate shall be kept as a part of quality records. Consumable brand name shall be same.

3.2- Examination medium shall be wet visible black powder with high permeability and low retentively. The powder type shall be magnaflux 7HF or equivalent as approved by company NDT Level III.

3.3- Contrast paint of type WCP-2 shall be used to obtain better contrast.

3.4- Total sulphur & chlorine of test consumable shall be controlled as per ASME Sec. V.

4. Surface Condition

4.1 The surface to be examined along with minimum 25 mm on both sides of weld shall be thoroughly cleaned to be free of all dirt, grease, lint, scale, spatter, slag, welding flux, paint, oil, etc. The cleaning shall be done using wire brush/paint thinner or solvent cleaner.

4.2- If the surface is rough and having irregularities that could mask the indications, then the surface may be prepared by grinding or machining.

4.3- The temperature of wet particle suspension and surface of the part shall be used with particles manufacturer recommendation.

5. Method of Examination

Examination shall be done by the continuous method. i.e., the yoke is 'ON' while the wet ink is applied and the excess of the medium is removed.

Flow of particles shall stop with the application of current.

6. Calibration of Equipment

6.1- The yoke shall have minimum lifting power as given below:

AC 101bs (4.5 kg)

DC 401bs (18.1kg)

In a normal spacing between 3-8 inches (Measured as distance between the inner edges of the yoke tips). Test shall be done at least once at start of testing every day. If yoke spacing found inadequate to the lift the specified weight, the spacing shall be reduced & lifting test repeated.

6.2- The lifting power test shall be carried out with weights weighed with a scale from a reputed manufacture and stencilled with the applicable nominal weight before use.

6.3- The weight shall be verified only if it is damaged in a manner that could have caused possible loss of material such as chipping, gouging.

6.4- The magnetizing power of yokes shall be verified prior to use each day the yoke is used. The magnetizing power of yokes shall be verified whenever the yoke has been damaged or repaired.

6.5- The lifting test shall be carried out with the leg distance same as that to be used on job.

6.6- The indicator shall be positioned on the surface to be examined, such that the copper-plated side is away from the inspected surface. A suitable field strength is indicated when a clearly defined line of magnetic particles from across the copper face of indicator when the magnetic particle is applied simultaneously with the magnetizing force. The unit meter reading shall not deviate by more than ±10% of full scale, relative to the actual current value as shown by the test meter.

Light meters shall be calibrated at least once a year or whenever a meter has been repaired. If meters have not been in use for one year or more, calibration shall be done before being used

Calibration of Magnetizing Equipment

(a) Frequency. Magnetizing equipment with an ammeter shall be calibrated at least once a year, or whenever the equipment has been subjected to major electric repair, periodic overhaul, or damage. If equipment has not been in use for a year or more, calibration shall be done prior to first use.

(b) Procedure. The accuracy of the unit's meter shall be verified annually by equipment traceable to a national standard. Comparative readings shall be taken for at least three different current output levels encompassing the usable range.

(c) Tolerance. The unit's meter reading shall not deviate by more than ±10% of full scale, relative to the actual current value as shown by the test meter.

7. Examination Procedure

7.1-Apply the suspension - The suspension is gently sprayed or flowed over the surface of the part. Usually, the stream of suspension is diverted from the part just before the magnetizing field is applied

7.2- Apply the magnetizing force - The magnetizing force should be applied immediately after applying the suspension of magnetic particles. The yoke legs shall be adjusted to suit the job surface so as to get maximum contact between legs and job surface.

Accumulation of excess magnetic particle in examination surface shall be removed by a light air stream or blow.

7.3- The direction of first field shall be perpendicular to the expected defect the direction of second field shall be approximately perpendicular to the first field.

7.4-Inspect for indications - Look for areas where the magnetic particles are clustered. Surface lose discontinuities will produce a sharp indication. The indications from subsurface flaws will be less defined

7.5- Examination shall be performed with sufficient overlap to assure 100% coverage of the part under and definition as depth increases.

7.6- Temperature limitations: Particle shall be used within the temperature range limitation set by the manufacturer of particles. Manufacturer recommendation is 5-50 ˚ C.

7.7-Demagnetization when required, the weld or component shall be demagnetized after completion of the examination in accordance with ASTM E709 and verified with a magnetic field strength meter.

Demagnetizing with yokes: AC yokes may be used for local Demagnetization by placing the poles on the surface, moving them around the area, & slowly withdrawing the yoke while is still energized.

7.8- With non-fluorescent particles, the examination is performed using visible light. A minimum light intensity of 100 fc (1000 Lx) is required to ensure adequate sensitivity during the examination and evaluation of indications. The light source, technique used, and light level verification is required to be demonstrated one time, documented, and maintained on file.

7.9- Post cleaning: finished parts processed with wet inks should be immediately cleaned and dried to prevent the chances of surface corrosion or wear between moving parts by flushing with solvent magnaflux SKC-S.

Typical post-cleaning techniques employed are: (a) the use of compressed air to blow off unwanted dry magnetic particles, (b) drying of wet particles and subsequent removal by brushing or with compressed air, (c) removal of wet particles by flushing with solvent, and (d) other suitable post-test cleaning techniques may be used if they will not interfere with subsequent requirements.

8. Evaluation of Indications

Indications will be revealed by retention of magnetic particles. All such indications are not necessarily imperfections however, since excessive surface roughness, magnetic permeability variations (such as at the edge of heat affected zones), etc., may produce similar indications.

An indication of an imperfection may be larger than the imperfection that causes it; however, the size of the indication is the basis for acceptance evaluation. Only indications which have any dimension greater than 1⁄16 in. (1.6 mm) shall be considered relevant.

(a) A linear indication is one having a length greater than three times the width.

(b) A rounded indication is one of circular or elliptical shape with a length equal to or less than three times its width.

(c) Any questionable or doubtful indications shall be re-examined to determine whether or not they are relevant.

9. Acceptance Standard Criteria

ASME Sec. VIII Div.1 Appendix 6

10. Repair Requirement

Repair shall be done as per approved repair procedure. The defect shall be removed or reduced to an imperfection of acceptable size. Whenever an imperfection is removed by chipping or grinding, it

must be subjected to full inspection. the excavated area shall be blended into the surrounding surface so as to avoid sharp notches, crevices, or corners, where welding is required after removal of an imperfection, the area shall be cleaned and welding performed in accordance with a qualified welding procedure.

Re-inspection shall be done after final welding.

11. Records

11.1- A magnetic particle inspection report shall be submitted in the attached report format.

11.2- A calibration record shall be maintained of the lifting power of the yoke & shall be dated less than 1 year ago.

11.3-Rejectable indications shall be recorded. As minimum, the type of indications (Linear or rounded). location and extent (length or diameter or aligned) shall be recorded.)

11.4- For each examination, the following information shall be recorded:

(a) procedure identification and revision

(b) magnetic particle equipment and type of current

(c) magnetic particles (visible or fluorescent, wet or dry)

(d) examination personnel identity and if required by referencing Code Section, qualification level

(e) map or record of indications per T-792 for Rejectable Indications

(f) material and thickness

(g) lighting equipment

(h) date of examination

13. Personnel

Each magnetic particle examiner shall be certified to ASNT MT level II.

Personnel performing the non-destructive examination shall be qualified in accordance with the requirements of ASNT Recommended Practice No. SNT-TC-1 A.

Interpretation of results shall be performed by personnel certified Level II or III.

14. Attachment

Format of examination report

Attachment 1:

Quality Control

MAGNETIC PARTICLE EXAMINATION REPORT

Code No : QF-QC-09
Date & Rev :0-1386/2/10
Report No:
Date :

Project Name : **DATE:**	Item :	Doc. NO. :	Rev.No.:	Project No.:
WELD NO.:	WELD CONFIG.:		PO. NO.:	
Material: thickness:	Surface Condition :	Procedure :		Code :
Equipment : Maker : **Magnaflux** Model : **Y 6** Sr. NO. : **1735**	Magnetic Particle Maker : **Magnaflux** ☐ Wet ☐ Dry ☐ Florecent ☐ Color			Magnetic Particle Color Maker : **Magnaflux** Red ☐ ☐ 7HF-BLACK Gray ☐
Magnetization Tech ☐ Continuous ☐ Residual ☐ Prod ☐ Yoke ☐ Coil	Black Light Maker Model Intensity			☐ A ☐ Ft - cd ☐ µw/cm ^{2}
Surface Temp.	Magnetization Spacing			☐ Cm. ☐ In.
Direction Of Magnetic Field ☐ Longitudinal ☐ Circular ☐ Buth	Magnetizing Current ☐ AC 2Amp. ☐ DC Amp.			Illumination
Particle Application ☐ Dusting ☐ Spraying ☐ Dipping	Demagnatization ☐ Yes No ☐			Lifting Power

Map or record of rejectable indications per T-792

type: linear ☐ rounded ☐ | location:

extent (length or diameter or aligned):

Item	Joint	Size	Acc	Repair	Step	Interpretation	Remark

Remark :

A.A.C INSPECTOR	MT OPERATOR LEVELII	OWNER OR TPA
Name:	Name:	Name:
Date:	Date:	Date:

4: RADIOGRAPHY TEST PROCEDURE

1. Scope and Purpose

Examination of all butt welds in the equipment, which has been mentioned in approved weld and NDT maps. Surface flaws that are detectable by radiography include undercuts, concavity at the weld root, incomplete filling of grooves, excessive reinforcements, overlaps & electrode spatter, overlap & internal flaws such as blow holes, gas inclusion, porosity, slag inclusion, cracks, incomplete fusion, incomplete penetration & tungsten inclusion.

2. Reference

ASME Sec. V, Article 2, Ed. 2013
ASME sec VIII Div.1, Ed. 2013
ASTM E94, Ed. 2015
ASTM E999, Ed. 2015

3. Radiation Source

Iridium 192 will be used as the radiation source, size: 3x2 mm or 2x2 mm.

4. Technique

Single wall exposure/single wall viewing (or single image):
A lead symbol "B", with min dimension of 1/2" in height & 1/16" in thickness, shall be attached to the back of each film holder during each exposure to determine if backscatter radiation is exposing the film. Source-weld-film arrangement shall be indicated as per ASME Sec. V, Article 2.

Single Wall Viewing

Single-film viewing shall be used, and the film density shall be in the range of 2.5 to 3.5.
For those instances where the variable thickness makes single film impracticable, with the Inspection Agency approval, double film viewing may be used. For the double film technique, the film density shall be in the range of 2 to 3.5 for the double film combination or each individual film. Higher densities (up to 4.0) may be acceptable if adequate viewing and satisfactory interpretation of higher density film are permitted by the viewing equipment.

Where there is no internal access, radiographs of welds in pipe shall be double wall technique with a minimum of two shots up to 4" in diameter and three shots over 4" in diameter and only that portion of the weld on the film side of the pipe (opposite to the radiation-source side) shall be interpreted. Because of the variation in pipe diameters, wall thicknesses and source-to-film distances, it may be necessary to take more than the minimum number of radiographs to properly examine the entire circumference of a weld.

a) Source Side Markers: Location markers shall be placed on the source side when doing radiography of the following:

1. Flat components or longitudinal joints in cylindrical or conical components.

2. Curved or spherical components whose concave side is toward the source and when the "source-to-material" distance is less than the inside radius of the component.

3. Curved or spherical components whose convex side is toward the source.

b) Film Side Markers: Location markers shall be placed on the film side when performing radiographs either curved or spherical components whose concave side is toward the source and when the "source-to-material" distance is greater than the inside radius.

As an alternative to source side placement in a 1. Location markers may be placed on the film side when the radiograph shows coverage beyond the location markers to the extent demonstrated, and when this alternate is documented.

c) Either Side Markers: - Location markers may be placed on either the source side or film side, when radiographing either curved or spherical components whose concave side is toward the source and the "source- to-material" distance equals the inside radius of the component.

<u>Double-Wall Technique</u>

When it is not practical to use a single-wall technique, one of the following double-wall techniques shall be used.

(a) Single-Wall Viewing. For materials and for welds in components, a technique may be used in which the radiation passes through two walls and only the weld (material) on the film-side wall is viewed for acceptance on the radiograph. When complete coverage is required for circumferential welds (materials), a minimum of three exposures taken 120° to each other shall be made.

(b) Double-Wall Viewing. For materials and for welds in components 3/4" or less in nominal outside diameter, a technique may be used in which the radiation passes through two walls and the weld (material) in both walls is viewed for acceptance on the same radiograph. For double-wall viewing, only a source-side IQI shall be used.

(1) For welds, the radiation beam may be offset from the plane of the weld at an angle sufficient to separate the images of the source-side and film-side portions of the weld so that there is no overlap of the areas to be interpreted. When complete coverage is required, a minimum of two exposures taken 90° to each other shall be made for each joint.

(2) As an alternative, the weld may be radiographed with the radiation beam positioned so that the images of both walls are superimposed. When complete coverage is required, a minimum of three exposures taken at either 60° or 120° to each other shall be made for each joint.

(3) Additional exposures shall be made if the required radiographic coverage cannot be obtained using the minimum number of exposures indicated in (1) or (2) above.

5. IQI

Placement of IQIs

Source-Side IQI(s). The IQI(s) shall be placed on the source side of the part being examined, except for the condition described in (b). When, due to part or weld configuration or size, it is not practical to place the IQI(s) on the part or weld, the IQI(s) may be placed on a separate block. Separate blocks shall be made of the same or radiographically similar materials (as defined in SE-1025) and may be used to facilitate IQI positioning. There is no restriction on the separate block thickness, provided the IQI/area-of-interest density tolerance requirements of ASME Sec. 5 (T-282.2) are met.

(1) The IQI on the source side of the separate block shall be placed no closer to the film than the source side of the part being radiographed.

(2) The separate block shall be placed as close as possible to the part being radiographed.

(3) When hole-type IQIs are used, the block dimensions shall exceed the IQI dimensions such that the outline of at least three sides of the IQI image shall be visible on the radiograph.

Film-Side IQI(s). Where inaccessibility prevents hand placing the IQI(s) on the source side, the IQI(s) shall be placed on the film side in contact with the part being examined. A lead letter “F” shall be placed adjacent to or on the IQI(s), but shall not mask the essential hole where hole IQIs are used.

IQI Placement for Welds. *Hole type IQIs*. The IQI(s) may be placed adjacent to or on the weld. The identification number(s) and, when used, the lead letter "F," shall not be in the area of interest, except when geometric configuration makes it impractical.

IQI Placement for Welds. Wire type IQIs. The IQI(s) shall be placed on the weld so that the length of the wires is perpendicular to the length of the weld. The IQI identification and, when used, the lead letter "F," shall not be in the area of interest, except when geometric configuration makes it impractical.

IQI Placement for Materials other than Welds. The IQI(s) with the IQI identification and, when used, the lead letter "F," may be placed in the area of interest.

Number of IQIs

When one or more film holders are used for an exposure, at least one IQI image shall appear on each radiograph except as outlined in (b) below.

(a) Multiple IQIs. If the requirements of T-282 are met by using more than one IQI, one shall be representative of the lightest area of interest and the other the darkest area of interest; the intervening densities on the radiograph shall be considered as having acceptable density.

(b) Special Cases

(1) For cylindrical components where the source is placed on the axis of the component for a single exposure, at least three IQIs, spaced approximately 120° apart, are required under the following conditions:

(-a) When the complete circumference is radiographed using one or more film holders, or;

(-b) When a section or sections of the circumference, where the length between the ends of the outermost sections span 240° or more, is radiographed using one or more film holders. Additional film locations may be required to obtain necessary IQI spacing.

(2) For cylindrical components where the source is placed on the axis of the component for a single exposure, at least three IQIs, with one placed at each end of the span of the circumference radiographed and one in the approximate centre of the span, are required under the following conditions:

(-a) When a section of the circumference, the length of which is greater than 120° and less than 240°, is radiographed using just one film holder, or;

(-b) When a section or sections of the circumference, where the length between the ends of the outermost sections span less than 240°, is radiographed using more than one film holder.

(3) In (1) and (2) above, where sections of longitudinal welds adjoining the circumferential weld are radiographed simultaneously with the circumferential weld, an additional IQI shall be placed on each longitudinal weld at the end of the section most remote from the junction with the circumferential weld being radiographed.

(4) For spherical components where the source is placed at the centre of the component for a single exposure, at least three IQIs, spaced approximately 120° apart, are required under the following conditions:

(-a) When a complete circumference is radiographed using one or more film holders, or;

(-b) When a section or sections of a circumference, where the length between the ends of the outermost sections span 240° or more, is radiographed using one or more film holders. Additional film locations may be required to obtain necessary IQI spacing.

(5) For spherical components where the source is placed at the centre of the component for a single exposure, at least three IQIs, with one placed at each end of the radiographed span of the circumference radiographed and one in the approximate centre of the span, are required under the following conditions:

(-a) When a section of a circumference, the length of which is greater than 120° and less than 240°, is radiographed using just one film holder, or;

(-b) When a section or sections of a circumference, where the length between the ends of the outermost sections span less than 240° is radiographed using more than one film holder.

(6) In (4) and (5) above, where other welds are radiographed simultaneously with the circumferential weld, one additional IQI shall be placed on each other weld.

(7) For segments of a flat or curved (i.e., ellipsoidal, torispherical, toriconical, elliptical, etc.) component where the source is placed perpendicular to the centre of a length of weld for a single exposure when using more than three film holders, at least three IQIs, one placed at each end of the radiographed span and one in the approximate centre of the span, are required.

(8) When an array of components in a circle is radiographed, at least one IQI shall show on each component image.

(9) In order to maintain the continuity of records involving subsequent exposures, all radiographs exhibiting IQIs that qualify the techniques permitted in accordance with (1) through (7) above shall be retained.

Shims under Hole-Type IQIs

For welds, a shim of material radiographically similar to the weld metal shall be placed between the part and the IQI, if needed, so that the radiographic density throughout the area of interest is no more than minus 15% from (lighter than) the radiographic density through the designated IQI adjacent to the essential hole. The shim dimensions shall exceed the IQI dimensions such that the outline of at least three sides of the IQI image shall be visible in the radiograph.

6. Surface Condition

Weld to be examined shall be free of irregularities such as weld ripples, spatter, grinding or chipping marks or other irregularities, which may mask successful interpretation of the radiographs. Before RT examination all surfaces are visually checked for weld ripples or irregularities & if there is, that will be removed by polishing or fine grinding.

7. Equipment

Gamma-ray apparatus with remote control will be used.

8. Film Type

Extra fine grain film Agfa D4 or equivalent shall be used.

Facilities for Viewing of Radiographs:

- Radiographs shall be viewed in subdued background lighting.

The viewer shall have sufficient intensity to view areas of interest on the radiograph with an even diffused light to the maximum density required and any extraneous areas of illumination shall be glare masked to avoid or distraction. During viewing film will be handled by the edges to avoid finger marks on the films and they will be kept in folders to avoid scratches.

Equipment used to view radiographs for interpretation shall provide a variable light source sufficient for the essential IQI hole or designated wire to be visible for the specified density range.

Processing. Standard Guide for Controlling the Quality of Industrial Radiographic Film Processing, SE-999, or paragraphs 23 through 26 of Standard Guide for Radiographic Examination SE-94 shall be used as a guide for processing film.

9. Intensifying Screen

Back & front lead screens, 0.13 mm thick will be used. Fluorescent intensifying screen shall not be used.

ASTM E94 and ASME Sec. V, Article 22.

10. Exposure Condition

Depending on diameter & wall thickness, minimum source to film distance (SFD) shall be 200 mm. For using of radioactive isotopes, the recommendation of ASME Sec. V article 2, part T-272.2 shall be considered.

11. Number of Exposure

As a minimum, 3 exposures shall be made (120° to each other).

12. Overlap

30 mm on each side of film

13. Penetrameter

One wire type according to DIN 54109 (ASTM E747) Penetrameter shall be set at the beginning & the end of film location. The Penetrameter shall be placed on the welds so that the wire is perpendicular to the welds. Whenever source side is not feasible, IQI shall be identified as a film side penetrameter by placing lead letter "F" adjacent to it.

For component where one or more film is used for an exposure at least one IQI shall appear on each radiograph unless advised by client report (According to table T-276 in ASME Sec. V Article 2).

• Sensitivity of films shall be verified by the use of wire-type Image Quality Indicator (IQI) placed transversely to the weld on the source side, for each exposure.

14. Radiographic Location & Identification Markers

Lead numbers and letters are used to designate the part number and location number. The size and thickness of the markers shall depend on the ability of the radiographic technique to image the

markers on the radiograph. As a general rule, markers 1⁄16 in. (1.58 mm) thick will suffice for most low energy (less than1 MeV) X-ray and Iridium-192 radiography; for higher energy radiography it may be necessary to use markers that are 1⁄8 in. (3.17 mm) or thicker.

15. Scattered Radiation

When performing radiography near to the ground or close to other structures scattered radiation may cause a reduction in film quality, thus a lead symbol "B" of min. size 1/2" H x 1/16" THK shall be attached to the back of the film cassette if the white symbol "B" is evident, then adequate precautions should be taken by shielding the cassette with lead sheets. Dark symbol "B" image shall be disregarded, as long as the image does not mask any indications of weld imperfections.

16. Calibration

Densitometer and Step Wedge Comparison Film

Densitometers:

(a) Densitometers shall be calibrated at least every 90 days during use as follows:

A national standard step tablet or a step wedge calibration film, traceable to a national standard step tablet and having at least 5 steps with neutral densities from at least 1.0 through 4.0, shall be used. The step wedge calibration film shall have been verified within the last year by comparison with a national standard step tablet unless, prior to first use, it was maintained in the original light tight and waterproof sealed package as supplied by the manufacturer. Step wedge calibration films may be used without verification for one year upon opening, provided it is within the manufacturer's stated shelf life.

(b) The densitometer manufacturer's step-by-step instructions for the operation of the densitometer shall be followed.

(c) The density steps closest to 1.0, 2.0, 3.0, and 4.0 on the national standard step tablet or step wedge calibration film shall be read.

(d) The densitometer is acceptable if the density readings do not vary by more than ± 0.05 density units from the actual density stated on the national standard step tablet or step wedge calibration film.

Step Wedge Comparison Films

Step wedge comparison films shall be verified prior to first use, unless performed by the manufacturer, as follows:

(a) The density of the steps on a step wedge comparison film shall be verified by a calibrated densitometer.

(b) The step wedge comparison film is acceptable if the density readings do not vary by more than ±0.1 density units from the density stated on the step wedge comparison film.

Determination of Source Size

When manufacturer's or supplier's publications are not available, source size may be determined as follows: Iridium-192 Sources. For Iridium-192, the source size may be determined in accordance with SE-1114, Standard Test Method for Determining the Focal Size of Iridium-192 Industrial Radiographic Sources.

17. Film Processing

Type:	Manual
Developing bath:	Agfa gevaert G 127 or equivalent
Developing temperature:	20-24 °C
Fixing bath	Agfa gevaert G 335 or equivalent
Fixing time:	8 minutes
Washing:	In running water
Drying:	Using suitable drier
Agitation:	agitation after each step
Wetting agent:	apply after washing

18. Examination Report

Attached form will be used to record examination results.

19. Personnel Qualification

Personnel shall qualified/certified in accordance to SNT-TC-1A of American society for non-destructive testing.

Personnel level I shall be assigned to NDE only under the supervision of personnel level II or level III.

All welded joint shall be visually inspected before commencement of any non-destructive examination.

Final approval of the document will be done after approval of third-party inspector.

20. Documentation

Documentation shall be done in accordance with ASME Sec V T-490

21. Reporting

Operator/Interpreter shall provide a test report after test performing and film interpretation and give it to client authorized inspector for approval.

The report shall include those records indicated inT-291andT-292 of ASME Sec V.

22. Identification and Marking of Radiographs

Each film shall be identified as per following items to avoid any confusion and mismatching in the reports and relevant films.

1) Item No.
2) Joint No.
3) Welder Stamp
4) Weld Thick
5) Location Mark
6) Penetrameter
7) Date of Shooting
8) GR. No.
9) Project Name

For possible repair, reshoot and retake, following abbreviation shall be added to joint No.:

Reshoot = NX

Retake = RX

Repair = NR

Note: A dimensional map of marker placement will accompany the radiographs to show that full coverage has been obtained & will be submitted with RT report.

• The geometrical un-sharpness shall not exceed 0.2 mm unless otherwise approved by the Inspection Agency in particular cases

• Radiography of welds in pipe having a nominal diameter of 3" or less may be performed by the elliptical projection technique. At least two separate exposures are required at locations 90° apart.

23. Acceptance Criteria

For acceptance of radiography films the requirements of ASME Sec. VIII, Div.1, APPENDIX 4 and UW 51 or UW 52 shall be followed.

Quality of Radiographs

All radiographs shall be free from mechanical, chemical, or other blemishes to the extent that they do not mask and are not confused with the image of any discontinuity in the area of interest of the object being radiographed.

Such blemishes include, but are not limited to:

(a) Fogging;

(b) Processing defects such as streaks, watermarks, or chemical stains;

(c) Scratches, finger marks, crimps, dirtiness, static marks, smudges, or tears;

(d) False indications due to defective screens.

24. Attachment

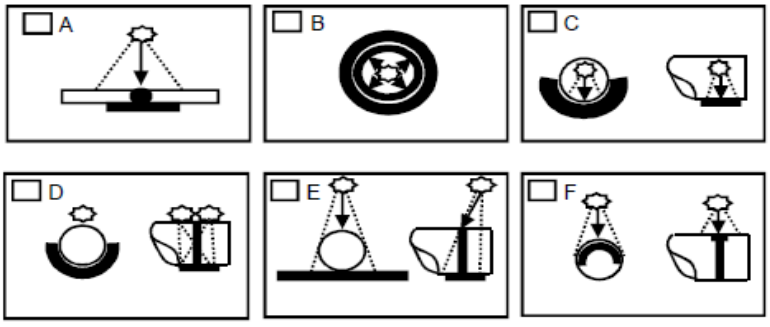
Format of examination report

Attachment 1:

AAC	Quality Control	Code No : QF-QC-09
		Date & Rev :0-1386/2/10
	RADIOGRAPHY EXAMINATION REPORT	Report No.:
		Date Of Exam. :

Project Name : W / O No.		Item. No.	
Material :		Dwg. No.	
Exposure Tech.	☐ single ☐ double ☐ panoramic	Penetrameter	ASTM#1A S.Side ☐ F.Side ☐
View Method	☐ single ☐ double	Sensitivity	
Product Form	WELDMENT	Shim Thickness	N / A inch ☐ mm ☐
Radioistope	Ser . No. ☐ Ir - 192 ☐ Co - 60	Source Size: Source Strength:	
Focal Spot Size	☐ inch ☐ mm	Film Brand / Class	
Mat'l Thikness & Reinforcement	☐ inch ☐ mm	Film Size	☐ inch ☐ mm
SFD-Ug	☐ inch ☐ mm	Screen	Front: ☐ inch ☐ Lead Back: ☐ mm ☐ Fluo
Exposure Time.		Film in Cassette	
		Development	
Density	☐ single ☐ double	Code/Standard	
Surface Condition	☐ As Ground ☐ As Welded ☐ As Casted ☐ As Machined	Procedure No.	

Remarks (Shooting Sketch)



	Examiner	Interpreter	Vendor	purchaser	TPI/OWNER
NAME					
SIGNATURE					
DATE					

Attachment 2:

	Quality Control	Code No : QF-QC-09
		Date & Rev :0-1386/2/10
	RADIOGRAPHY EXAMINATION REPORT	Report No.:
		Date Of Exam. :

Type of Defect	Item No.	Weld location and No.	Gr. NO.	Welder ID	Sector	Step	Accept	Reshoot	Repair	Reject	Result	Remark

type of defects :

Spherical Porosity -Cluster Porosity-Worm Hole-Hollow Bead-Excess Penetration-Burn Through-Lack of Fusion(LOF)-Cold Lap
Lack of Penetration(LOP)-Root Concavity-Slag Inclusion-Slag Line-Tangstan Inclusion-Longitudinal Crack-Transverse Crack-Crater Crack
Shrinkage Cavity-Root Undercut-Cap Undercut-Film Mark

	Examiner	Interpreter	Vendor	Purchaser	TPI/Owner
NAME					
SIGNATURE					
DATE					

5. ULTRASONIC TEST PROCEDURE

1. Scope

The following procedure describes the all requirement which are to be used in performance of ultrasonic test. The purpose of ultrasonic testing is to determine and evaluate the severity of internal discontinuities in welds and base metal. This test shall be done after finishing of satisfactory visual inspection by appointed shop inspector. The extent of examination shall be in accordance with approved NDT maps.

Any conflict between reference codes and this document, the requirements of mentioned reference codes are in priority to this document.

2. Responsibility

All non-destructive examinations shall be performed by personnel certified in accordance with level II of American society for non-destructive testing (SNT-TC-1A). Interpretation shall be carried out by inspectors qualified to SNT-TC-level II or equivalent.

3. Reference Standard

ASME Sec. V, Article 4, Ed. 2013

ASME Sec. VIII, Div. 1, Appendix 12, Ed. 2013

4. Description

Type of equipment: USM35X SLEMO Krautkramer

Test probe: variable

Frequency: 2-5 MHz

Coupling agent: Sonagel W1 or grease or oil or wallpaper paste or detergent liquid, water

Method:

Contact: Yes

Immersion: No

Shoes: No

Wedge: No

5. Surface preparation:

The examination surface shall be free of irregularities, loose foreign matter, or coatings which interfere with UT wave transmission.

6. Test Object

Longitudinal corner weld, connection corner welds

7. Method of Calibration

Calibration block: refer to appendix B standard reference block in ultrasonic testing all discontinuity indications are compared to a reference standard.

Ultrasonic standard reference blocks, often called test block, are used in ultrasonic testing not only to calibrate the ultrasonic equipment but principally to evaluate the discontinuity indication.

Standardization means two things: it verifies that the combination is performing as required calibration. It establishes a sensitivity (or gain) level.

Evaluation of discontinuities with a piece is accomplished by comparing them with an artificial discontinuity indication of known size, at the same depth & same material in a standard reference block.

DAC calibration curve shall be drawn as follow:

1) To make calibration block as per appendix B
2) Find the hole that give the highest amplitude & set in 80% of the full screen height.
3) Mark the peak of indication from 1/4, 1/2, 3/4, & connect all point to each other for drawing of distance amplitude corrective on curve.

Angle beam calibration: As applicable, the calibration shall provide the following measurements:

1- Sweep range calibration;

2- Distance amplitude correction;

3- Position calibration;

4- Echo amplitude measurement from the surface notch in the basic calibration block. When an electronic distance-amplitude correction device is used, the primary reference responses from the basic calibration block shall be equalized over the distance range to be employed in the examination. The response equalization line shall be at a screen height of 40% to 80% of full screen height.

Straight beam calibration: The calibration shall be providing the following measurements:

(a) Sweep range calibration;

(b) Distance amplitude correction;

When an electronic distance-amplitude correction device is used, the primary reference responses shall be equalized on the basic calibration block.

IIW Block and IIW Reference

Blocks may be used to calibrate the sweep range displayed on the instrument screen.

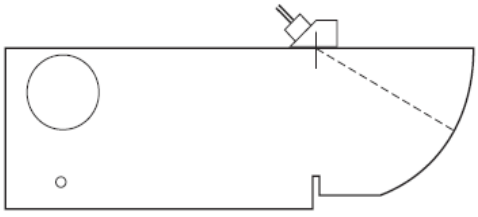
They have the advantage of providing reflectors at precise distances that are not affected by side-drilled hole location inaccuracies in the basic calibration block or the fact that the reflector is not at the side-drilled hole centerline.

These blocks are made in a variety of alloys and configurations. Angle beam range calibrations are provided from the 4 in. (100 mm) radius and other reflectors. The calibration block shown in Fig. B-461.2 provides an indication at 4 in. (100 mm) and a second indication from a reflection from the vertical notches at the center point 8 in. (200 mm) back to the radius and returning to the transducer when the exit point of the wedge is directly over the center point of the radius.

Other IIW blocks provide signals at 2 in. (50 mm) and 4 in. (100 mm) and a third design provides indications at 4 in. (100 mm) and 9 in. (225 mm).

Screen height between 40% & 80% of full screen height over the distance range to be employed in the examination.

FIG. B-461.2 SWEEP RANGE (IIW BLOCK)



8. Extent of Examination

According to welding & NDT plan (document Nos. 1071-O2ME011-ME-VDWG-E5116-043, 1071-O2ME011-ME-VDWG-E5117-044, 1071-O2ME011-ME-VDWG-E5128-045 and 1071-O2ME011-ME-VDWG-E5140-059)

Rate of Search Unit Movements

The rate of search unit movement for examination shall not exceed 6 in. /sec (152 mm/s) unless calibration is verified at scanning speed

9. Limitation

This procedure is limited to ferritic materials.

This method cannot be a replacement for RT unless advised by client.

The method is for detection of internal flaw.

10. Screen Height Linearity

The UT instrument shall provde linear vertical presentation within + 5% of the full screen height for 20%-80% of calibrated screen height (base line to maximum calibrated screen point).

ASME SEC V, Appendix I

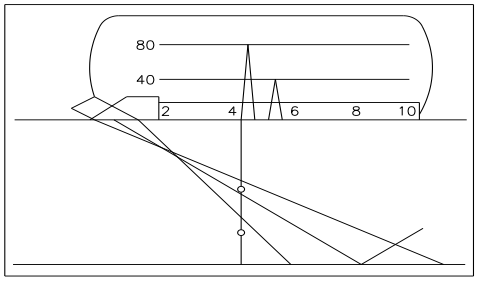


Figure 2. Screen Height Linearity

The setting & readings must be estimated to nearest 1% of full screen.

It shall be performed at the beginning of each period of extended use (or each 3 months, whichever is less).

The result will be documented on the form "ultrasonic equipment calibration" record.

11. Amplitude Control Linearity

The UT instrument shall utilize an amplitude control accurate over its useful range to +20% of the nominal amplitude ratio to allow measurement of indications beyond the linear range of the vertical display on the screen. (ASME, SECV, APPENDIX II, Article 5.)

It shall be performed at the beginning of each period of extended use (or each 3 months, whichever is less).

12. System Calibration

12.1) Angle beam calibration: As applicable, the calibration shall provide the following measurements:

(a) Sweep range calibration;

(b) Distance amplitude correction;

(c) Position calibration;

(d) Echo amplitude measurement from the surface notch in the basic calibration block. When an electronic distance-amplitude correction device is used, the primary reference responses from the basic calibration block shall be equalized over the distance range to be employed in the examination. The response equalization line shall be at a screen height of 40% to 80% of full screen height.

12.2) straight beam calibration: The calibration shall be provided the following measurements:

(a) Sweep range calibration;

(b) Distance amplitude correction;

When an electronic distance-amplitude correction device is used, the primary reference responses shall be equalized on the basic calibration block at a screen height between 40% & 80% of full screen height over the distance range to be employed in the examination.

13. Scanning

Straight beam

The scanning of the adjacent base metal min. 75mm either side of weld shall be performed to defect reflectors that might affect interpretation of angle beam result, and is not be used as an acceptance rejection examination. Location & areas of such reflectors shall be recorded.

It shall be performed at a gain setting of but 2XPRL but evaluation shall be done as per PRL.

Angle beam scanning for reflectors oriented parallel to the weld

The angle beam shall be directed at approximate right angles to the weld axis from two directions where possible. the search unit shall be manipulated so that UT volume of the welds & adjacent base metal. the scanning shall be performed at a gain setting at least two times the primary reference level. Evaluation shall be performed with respect to the primary reference.

Angle beam scanning for reflectors-oriented transverse to the weld

The angle beam shall be directed essentially parallel to the weld axis.

The search unit shall be manipulated so that the angle beam passes through the required volume of weld & adjacent base metal specified by referencing code section. The scanning shall be performed at a gain setting at least two times the primary reference level. Evaluation shall be performed with respect to the primary reference.

The probe shall be rotated 180 o & examination be repeated.

- Each pass of the search unit shall overlap a minimum of 10% of the transducer (piezoelectric element) dimension parallel to the direction of scan indexing.

14. Examination

Overlap

Obtain data from successive scans at increments no greater than nine-tenths of the transducer dimension measured parallel to the scan increment change (10% overlap). Record data for the end points as determined by 50% of DAC.

Records/Documentation

Record all reflectors that produce a response equal to or greater than 50% of the distance-amplitude correction (DAC). However, clad interface and back wall reflections need not be recorded. Record all search unit position and location dimensions to the nearest tenth of an inch.

Evaluation of Laminar Reflectors

Reflectors evaluated as laminar reflectors in base material which interfere with the scanning of examination volumes shall require the angle beam examination technique to be modified such that the maximum feasible volume is examined, and shall be noted in the record of the examination (T-493) in ASME SEC.V.

15. Indication Discrimination

Flaw Indications

All suspected flaw indications should be evaluated considering the following typical indication characteristics. These characteristics should not be considered as mandatory criteria for reporting indications as flaws, but are listed as significant points of interest for the examiner to consider during the exam.

a) Inside Surface Connected Crack (ID Crack)

b) Outside Surface Connected Crack (OD Crack)

- Unique, significant, and sharp amplitude response with defined start and stop positions
- Unique and significant signal travel or “Walk”
- Multiple points of reflection (flaw base, flaw tip, faceting, etc.)
- Similar response from opposite scan direction
- Plots correctly to expected ID or OD crack location from both directions (correct sound path, surface distance, and flaw positioning from both directions)

c) Embedded Centre Line Cracking (CL Crack)

- Unique, significant, and sharp amplitude response with defined start and stop positions
- Unique and significant signal travel or “Walk”
- Similar response from opposite scan direction (comparable amplitude, surface position, significant response from each scan direction)
- Does not connect to either the inside or outside surfaces
- Plots correctly to centreline area of weld volume from both directions (similar and correct sound path, surface distance, and flaw positioning from both directions)

d) Lack of Root Penetration (LOP)

Unique, significant, and sharp amplitude response with defined start and stop positions

Unique and significant signal travel or “Walk”

Similar response from opposite scan direction

Plots correctly to centreline of weld form both directions (comparable and correct sound path, surface distance, and signal response from both directions)

Through wall dimension supported by component design

e) Lack of Side Wall Fusion (LOF)

- Unique, significant, and sharp amplitude response with defined start and stop positions
- Unique and significant signal travel or “Walk”
- Indication may provide unique upper and lower tip responses from favourable angles and scan directions
- Response from opposite scan direction may be significantly reduced in amplitude or observable from much different sound path and surface distance position
- Plots correctly near the fusion line of weld

f) Porosity

- Multiple less significant signal responses or signal clusters varying randomly in amplitude and position
- Plot correctly to weld volume
- Start and stop positions “blend in” with background responses

g) Slag Inclusion

- Unique signal responses which plot correctly to weld volume
- Amplitude responses dependent upon the size, shape, and orientation of inclusion
- Typical detectable using several examination angles from both sides of the weld

Length Sizing

- Length sizing should generally be performed using the search unite(s) that provide the most significant signal responses.
- Length sizing should be performed in a manner similar to the technique identified below. Multiple search unite angles should be evaluated in order to properly discriminate flaw responses from surrounding metallurgical and geometrical responses.

a) Optimize the signal response from the flaw indication

b) Scan the indication area with specific focus on the flaw signal response, (e.g. signal shape, walk, orientation, effect of skew, etc.). Adjust the system gain as needed to optimize the flaw response.

c) Scan an adjacent unflawed area in close proximity to the flaw area with specific focus on the surrounding geometrical responses (weld noise, root, weld cap response, etc.)

d) Scan along the length of flaw in each direction until the signal response has diminished into the background noise

16. Acceptance Criteria

As per ASME code Sec. VIII Div.1 appendix 12

Acceptance - Rejection Standard

Imperfections 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 & location of all such imperfections & evaluate them in terms given below:

a) Indications characterized as cracks, lack of fusion or incomplete penetration are unacceptable regardless of length.

b) Other imperfections are unacceptable if the indication exceed:

1) 1/4 in. (6mm) for t up to 3/4 in. (19 mm)

2) 1/3 t for t from 3/4 in to 2 1/4 In. (19 mm to 57 mm)

3) 3/4in. (19 mm) for t over 2 1/4in. (57 mm)

where t is the thickness of the weld excluding any allowable reinforcement for a butt weld joining two members having different thickness at weld, t is the thinner of these two thicknesses. if a full penetration weld includes a fillet weld, the thickness of the throat of fillet shall be included in t.

17. Documentation

Original report remains in quality department. One copy of this procedure shall be retained by the manufacturer until the manufacturer's data report has been signed by the inspector.

Documentation shall be done in accordance with ASME Sec V T-490

18. Reporting

Operator/Inspector shall provide a test report after performing each test and send to client authorized inspector for approval.

Rejectable indications

Rejectable indications shall be recorded. As a minimum, the type of indication (i.e., crack, non-fusion, slag, etc.), location, and extent (i.e., length) shall be recorded.

Examination Records

For each ultrasonic examination, the following information shall be recorded:

(a) procedure identification and revision;

(b) ultrasonic instrument identification (including manufacturer’s serial number);

(c) search unit(s) identification (including manufacturer’s serial number, frequency, and size);

(d) beam angle(s) used;

(e) Couplant used, brand name or type;

(f) search unit cable(s) used, type and length;

(g) special equipment when used (search units, wedges, shoes, automatic scanning equipment, recording equipment, etc.);

(h) computerized program identification and revision when used;

(i) calibration block identification;

(j) simulation block(s) and electronic simulator(s) identification when used;

(k) instrument reference level gain and, if used, damping and reject setting(s);

(l) calibration data [including reference reflector(s), indication amplitude(s), and distance reading(s)]; (m) data correlating simulation block(s) and electronic simulator(s), when used, with initial calibration;

(n) identification and location of weld or volume scanned;

(o) surface(s) from which examination was conducted, including surface condition;

(p) map or record of Rejectable indications detected or areas cleared;

(q) areas of restricted access or inaccessible welds;

(r) examination personnel identity and, when required by referencing Code Section, qualification level;

(s) date of examination.

19. Attachments

Format of examination

Appendix A

AAC	Quality Control	Code No : QF-QC-09
		Date & Rev :0-1386/2/10
	ULTRASONIC EXAMINATION REPORT	Report No.:
		Date Of Exam. :
		P.O. No. :

Project Name : Client:	Project No. :	Procedure No. : WPS No.:
Doc No. / Dwg No. :	Material :	Code :
Thickness :	Surface Condition :	Screen Height / Amplitude control
Test Equip. :	Calibration & Reference Block : Calibration sheet Identity:	Method : ☐Contact ☐ Immersion

Test Product : ☐ Mat. ☐ Weld	Welding Process:	Couplant : ☐glycerin ☐oil ☐detergent liquid ☐water		Test sensitivity :

	Type	Angle	Frequency	Size	std Db	Type	Angle	Frequency	Size	std Db
Transducer										

Map or record of rejectable indications per T-491:

type: crack □ nonfusion □ slag □ location:

extent (length):

ITEM No. / EX. No.	Acc.	Rep.	Weld No.	Echo Amplitude (db)	Location	Length	Height	DAC max.	After Repair Acc.	After Repair Rep.	Date

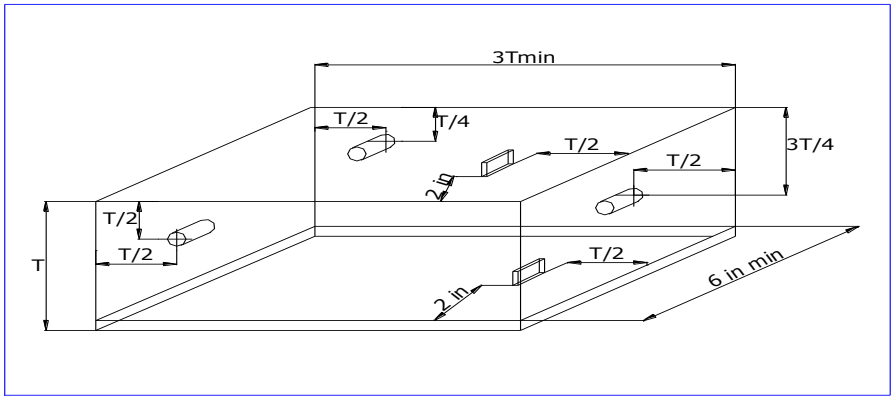
Remark :

A.A.C. INSPECTOR	T.P.A	CLIENT
SIGNATURE Name:	SIGNATURE Name:	SIGNATURE Name:
DATE:	DATE:	DATE:

Appendix B

	Quality Control	Code No : QF-QC-09
		Date & Rev :0-1386/2/10
	ULTRASONIC PROCEDURE APPENDIX 2	Report No.:
		Date Of Exam. :

CALIBRATION BLOCK



WELD THICKNESS t	BASIC CALIBRATION BLOCK THICKNESS T	HOLE DIAMETER	NOTCH SIZE
1 in. or less	3/4 in. or t	3/32 in.	Width=1/8 in. to 1/4 in.
over 1 in. through 2 in.	1-1/2 in. or t	1/8 in.	
over 2 in. through 4 in.	3 in. or t	3/16 in.	Depth=2% T or 0.04 in.
over 4 in. through 6 in.	5 in. or t	1/4 in.	whichever is greater into the base metal
over 6 in. through 8 in.	7 in. or t	5/16 in.	
over 8 in. through 10 in.	9 in. or t	3/8 in.	
over 10 in.	t ± 1 in.	Note(1)	Length=2 in. min.

Note: For each increase in weld thickness of 2" or fraction thereof over 10" the hole diameter shall increase 1/16" .