
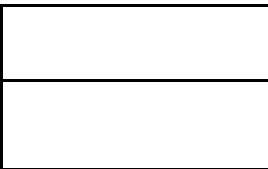
	20000m3 FUEL OIL STEEL STORAGE TANK			Vendor:  MACHINE SAZI PARS CO. (MSP)
	NDT Procedure			
	Vendor Doc No: VD-ST-PR-003		Rev.: 01	
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ITEM NO. : **NDT Procedure**

TOTAL Sheets : **45** (Excluding Attachments)

<input type="checkbox"/>	NO COMMENT: Documents/ Drawings Were Checked By Purchaser And Further Steps Can Be Followed.									
<input type="checkbox"/>	COMMENTS AS MARKED: Documents/Drawings Were Checked By Purchaser And Marked Comments Must Be Considered By Vendor. Vendor Shall Revise Documents/ Drawings As Per Comments And The New Revision Of Documents/ Drawings Must Be Reissued Prior To Fabrication.									
<input type="checkbox"/>	REJECTED: Documents/ Drawings Were Checked And It Is Not Comply With Purchase Order Requirements At All.									
<input type="checkbox"/>	ACCEPTABLE WITH COMMENTS: Documents/Drawings Were Checked By Purchaser And Comments Must Be Considered By Vendor. Fabrication Can Proceed Accordingly. Revised Document To Be Issued Either For Review Or As Final Certified. However Purchaser Will Check The Revised Document For Proper Incorporation Of Comments.									
<input type="checkbox"/>	NOT RETURNED: Document Was Received For Information And Not Returned To The Vendor.									
<table border="1" style="width: 100%;"> <tr> <td style="width: 33%;">Name :</td> <td style="width: 33%;">Req. No.:</td> <td style="width: 33%;">Seq. No.:</td> </tr> <tr> <td>Signature :</td> <td></td> <td></td> </tr> <tr> <td>Date:</td> <td></td> <td></td> </tr> </table>		Name :	Req. No.:	Seq. No.:	Signature :			Date:		
Name :	Req. No.:	Seq. No.:								
Signature :										
Date:										
Purchaser review & comments does not absolve the vendor of the responsibility for the correct design, manufacturing and operation of the equipment										

D01	Issue for Approval	M.B	E.SHAKOURI	M.TAVSOLI FAR	M.Ghaleie	06.Jan.2026
D00	Issue for Comment	M.B	M.GH	M.A.SH	-	20.Aug.2025
Rev.	DESCRIPTION	Pre.	Checked	Approved	AUTHD	Date



20000m3 FUEL OIL STEEL STORAGE TANK

NDT Procedure

Vendor Doc No: VD-ST-PR-003

Client Doc No. :-----



Rev.: 01

Vendor:





Revision Index

Sheet	Revision						Sheet	Revision					
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1	X						31	X					
2	X	X					32	X					
3	X	X					33	X					
4	X						34	X					
5	X	X					35	X					
6	X						36	X					
7	X	X					37	X	X				
8	X						38	X					
9	X	X					39	X	X				
10	X						40	X	X				
11	X						41	X					
12	X						42	X	X				
13	X						43	X					
14	X						44	X					
15	X						45	X	X				
16	X						46						
17	X						47						
18	X	X					48						
19	X						49						
20	X	X					50						
21	X						51						
22	X						52						
23	X						53						
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25	X						55						
26	X						56						
27	X						57						
28	X						58						
29	X						59						
30	X						60						

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NDT Procedure

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Contents: (PENETRATION TEST PROCEDURE)

1. Scope
2. Reference
3. Technique
4. Pre-Examination Cleaning & Drying
5. Liquid Penetrant Application
6. Method Of Removing Excess Penetrant
7. Developing
8. Evaluation Of L.P Examination
9. Post Cleaning
10. Personnel Qualification
11. Acceptance Criteria
12. Attachment (Examination Report)

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1- SCOPE

Examination of Storage Tank and main steel structure weld seams of According to ITP & NDE map

2- REFERENCES

- API 650 standard, 14th. Ed. AUG.2025
- ASTM E165
- ASME SEC. VIII Div.1 APPENDIX 8 (Edition 2015)
- ASME SECTION V-ARTICLE 6



3- TECHNIQUE

Color contrast penetrate, using solvent removable penetrates. (According to ASTM E165)

3-1 Equipment:

Using 3 special kind of liquid sprays are essential to do the P.T which detail as below.

1-cleaner is a transparent liquid spray that would be used for cleaning the surfaces of the joint.

2-“penetrate” is a red color liquid spray, which indeed shows the defects of weld areas.

3-”developer” is a white liquid spray, which indeed shows the defects of weld areas.

4- PRE-EXAMINATION CLEANING & DRYING

The surface to be examined (within at least 25 mm) shall be clean & free of 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 of moisture or wet surface. PT shall be applied after visual check and inspector approval. The proper solvent for degreasing is Magna flux - SKC - S or equivalent. (According to ANNEX A1 OF ASTM E165)

5- LIQUID PENETRANT APPLICATION

Type of dye penetrates: Visible penetrate examination method. Application: By thoroughly and uniformly spraying on the part to be examined penetration time: 5 minutes, but not exceeding 15 Min Temperature of surface: 15 - 50°C

6- METHOD OF REMOVING EXCESS PENETRANT

Removing will be performing by special solvent and clean clothes. (Magna flux SKC - S or equivalent.) Solvent shall not be spray directly to the weld.

Residential total chlorine (hydrogen, fluorine) sulfur shall not exceed one percent by weight .It's range of applicability is 0.001-5 % using either of The Alternative micrometric procedure.

If one solvent is used to degrease the surface to examine, wait at least 5 minute the solvent & application of the penetrate.

7- SAFETY PRECAUTIONS



7-1 The area of the test should be completely cleaned and covered to avoid the wind.

7-2 avoids contact with skin and eyes. In case of contact with eyes, rinse and seek medical advice. When using, do not eat, drink or smoke. Wear suitable gloves and eye/face protection. Contains no CFC propellant. Non-flammable propellant. Protect from sunlight and don't expose to temperature in excess of 50°C. According to ASTM E-165, minimum temperature for PT is 15° C.”

8- DEVELOPING

The developer shall be applied as soon as possible after penetrate removal; the time interval shall not exceed that established in this procedure. Insufficient coating thickness may not draw the penetrate out of discontinuities; conversely, excessive coating thickness may mask indications. With color contrast penetrates, only wet developer shall be used. With fluorescent penetrates, a wet or dry developer may be used.

8-1- Wet Developer Application

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Prior to applying suspension type wet developer to the surface, the developer must be thoroughly agitated to ensure adequate dispersion of suspended particles.

- a) Aqueous Developer Application. Aqueous developer may be applied to either a wet or dry surface; it shall be applied by dipping, brushing, spraying, or other means, provided a thin coating is obtained over the entire surface being examined. Drying time may be decreased by using warm air, provided the surface temperature of the part is not raised above 125°F. Blotting is not permitted.
- b) Non aqueous Developer Application. Non aqueous developer shall be applied only to a dry surface. It shall be applied by spraying, except where safety or restricted access precludes it. Under such conditions, developer may be applied by brushing. Drying shall be by normal evaporation.

8-2- Developing time for final interpretation begins immediately after the application of a dry developer as soon as a wet developer coating is dry. The minimum developing time shall be 10 min.

9- EVALUATION OF L.P. EXAMINATION

Final interpretation shall be made within 10 to 60 min after the requirements of procedure are satisfied with 1000 lux light. All relevant indications shall be recorded and evaluated as per ASME sec. VIII Div. 1 appendix 8, Repair shall perform under supervision of inspector. Attached form will be used for examination report.

10- POST CLEANING

After evaluation of L.P. examination the remaining material to be removed by Proper solvent or water and clean clothes.

11- PERSONAL QUALIFICATION

Liquid penetrate examination will be performed and result will be evaluated by Technicians qualified and certified as level II for dye penetrate method. Personnel shall be qualified in accordance to ASNT –SNT-TC - 1A of American society For Non - destructive testing or trained and examined personnel.

12- ACCEPTANCE CRITERIA

The acceptances criteria for above mentioned method will be according to API 650 eleventh edition are as below:

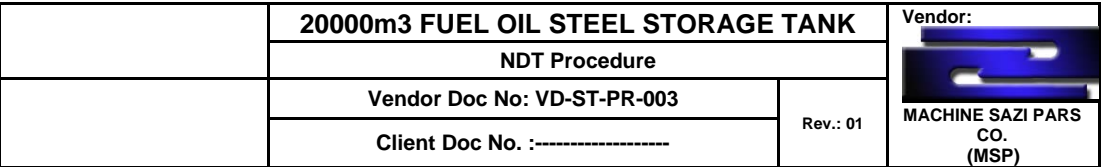
Only indications with major dimensions greater than 1/16 in (1.5mm) shall be considered relevant.

- A) A linear indications one having a length greater than three times of the width.
- B) A rounded indication is one of circular or elliptical shapes with the legend



Any questionable or doubtful indications shall be reexamined to determine whether or not they are relevant.

13- ATTACHMENT

Examination report





SKETCH		
Contractor QC Inspector	Inspector	Third Party Inspector

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Contents (Radiographic Test Procedure)

1. Relevant Standard
2. Procedure to Be Used
3. Surface Preparation
4. Densitometer
5. Facilities for Viewing Film
6. Geometric Un-sharpness
7. Radiation Source
8. Technique
9. Equipment
10. Film Type
11. Intensifying Screen
12. Film Artifact
13. Exposure Condition
14. Number of Exposure
15. Over Lap
16. Penetrometer
17. Back Scatter Radiation
18. Sensitivity
19. Film Density
20. Film Processing
21. Identification & Marking of Radiographs
22. Acceptance Criteria
23. Examination Report
24. Personnel Qualification
25. Reporting
26. Film Storage

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1- SCOPE

The following procedure covers the general requirement for radiography test of RT Applicable weld in Storage Tank.

2- RELEVANT STANDARD



Radiography performance and interpretation of radiograph shall be done accordance with API 650 standard, 14th. Ed. AUG.2025

3- PROCEDURE TO BE USED FOR

Examination of all Butt-weld joints According to NDT MAP and API 650.

4- SURFACE PREPARATION

All welded joint shall be visually inspected before commencement of any non-destructive examination also the requirement of ASME Sec.V, Para. T.222 for surface preparation shall be met.

Any irregularities that can mask or be confused with discontinuities shall be removed by any suitable process to a degree that the applicable material spec., the referencing code and the other requirements.

5- DENSITOMETER

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

6- FACILITIES FOR VIEWING FILM

To provision of best viewing condition, the illuminator must provide sufficient light of an intensity that will illuminate the average density. (From 1.8 to 3)

- Identification markers:

- The permanent identification (see attachment) shall be produced on the radiograph traceable to the contract, component, weld seam, or part number, as appropriate. In any case this information shall not obscure the area of interest. Repair or reshoot radiographs shall be identified by R1, R2, R/S, as applicable.

7- GEOMETRIC UNSHARPNESS

7.1. GEOMETRIC UNSHARPNESS DETERMINATION

Geometric unsharpness of the radiograph shall be determined in accordance with:

$$U_g = Fd/D$$

Where U_g = geometric unsharpness

F= source size: maximum projected dimension of the radiating source (or effective focal spot) in the plane perpendicular to the distance D from the weld or object radiation, in.



D= distance from source of the radiation to weld or object being radiographed, in.

d= distance from source side of weld or object being radiographed to the film

D and d shall be measured to the approximate center of the area of interest

Note: Refer to Standard Guide for Radiographic Testing SE-94 for a method of determining geometric unsharpness. Alternatively, a nomograph as shown in Standard Guide for Radiographic Testing SE-94 may be used.

7.2. The actual or maximum source size (effective focal spot size) and source to film distance shall be recorded in the report, and the geometric unsharpness shall meet the requirements of para. 7.3 in below.

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7.3. GEOMETRIC UNSHARPNESS LIMITATIONS

Recommended maximum values for geometric un-sharpness are as follows:

Material	U _g
Thickness, in. (mm)	Maximum, in. (mm)
Under 2 (50)	0.020 (0.51)
2 through 3 (50-75)	0.030 (0.76)
Over 3 through 4 (75-100)	0.040 (1.02)
Greater than 4 (100)	0.070 (1.78)

NOTE: Material thickness is the thickness on which the IQI is based.

8- RADIATION SOURCE

Iridium 192-size 3x2 mm.

9- TECHNIQUE

Double wall exposure/single wall viewing (or single image). Or SWSI if applicable Source-weld-film arrangement shall be indicated as per ASME Sec.V. Care should be exercised to ensure that the required geometric un-sharpness is not exceeded. If the geometric un-sharpness requirement cannot be met for double wall viewing technique, then single wall viewing shall be used. (if applicable)

10- EQUIPMENT

Gamma-ray apparatus (sentinel) with remote control or equivalent.

11- FILM TYPE

Agfa D4 or Kodak AA400 or equivalent fine grain film, strip type, 70/100 mm width.

12- INTENSIFYING SCREEN

Back & front lead screens.0.13 mm thick. Fluorescent intensifying screen shall not be used. Lead intensifying screen shall be in direct contact with the film.

13- FILM ARTIFACT

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:

- Fogging;
- Processing defects such as streaks, watermarks, or chemical stains;
- Scratches, finger marks, crimps, dirtiness, static marks, smudges, or tears;
- False indications due to defective screens.

14- EXPOSURE CONDITION

Depending on diameter & wall thickness .Minimum source to film distance shall be 200 mm. For using of radioactive isotopes the recommendation of ASME Sec.v article II, part T-272 and API650 shall be considered.

15- NUMBER OF EXPOSURE

Minimum 3 Exposures taken120°, to each other shall be made. For welds on Nozzles with nominal diameter 3" or less, may be performed by the elliptical projection technique. At least two separate exposures are required at location 90° apart.

16- OVER LAP



30 mm on each side film.

17- PENETRAMEETER

Wire type according to ASTM E142 or per European Norm EN-462-1

The Penetrometer shall be set at the end of film location.

The Penetrometer shall be placed on the welds (on film side) so that the wire is perpendicular to the welds.

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18- BACK SCATTER RADIATION

A lead symbol "B" with minimum dimensions of 1/2 in. (13mm) in height and 1/16 in. (1.5mm) in thickness, shall be attached to the back of each film holder during each exposure to determine if backscatter radiation is exposing the film and if a light of the "B" appears on a darker background of the radiograph, protection from backscatter is insufficient and the radiograph shall be considered unacceptable. a dark image of the "B" on a lighter background is not cause for rejection.

19- SENSITIVITY

Radiograph's sensitivity is here the extent to which radiography is able to show clearly details of a given (thinnest) defect. Sensitivity shall be derived by the following equation. Where S is sensitivity, ΔT is wire type thickness and T Is nominal thickness Min. $2T$ $S = \Delta T / T \times 100$

20- FILM DENSITY

The calibration of densitometer is considered valid as long as the unit is not switched Off during a series of measurement. Film density shall be according to ASME Sec .V, Article II-Part-T-282. & shall be limited to viewer capacity 2 to 3.5

21- FILM PROCESSING

- Type: Manual Agfa gevaert G 127 or equivalent.
- Developing bath:
Developing temperature around 20° C (approximately 5 minutes).
Agfa gevaert G 335 or equivalent.
- Fixing bath: Fixing time 10 minutes (approximately 20°C).
- Washing: In running water + melting agent.
- Drying: Using suitable drier.
- Viewing: Light intensity adjustable viewer suitable to view 1.8 to 4

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. Marking shall clear the outer edges of the weld.

- 1) Project identifier manufacture name
- 2) Equipment NO.
- 3) Joint No.
- 4) Welder Stamp
- 5) Weld Thick
- 6) Location Mark
- 7) Pentameter
- 8) Date of Shooting
- 9) XR No.
- 10) Specify Reshoot, Repair, retake and

23- ACCEPTANCE CRITERIA

23.1. For acceptance interpretation of weld the requirements of API 650.



(a)Image Density.

Density within the image of the indication may vary and is not a criterion for acceptance or rejection.

(b) Relevant indications.

Only those rounded indications which exceed the following dimensions shall be considered relevant.

- 1) 1/10 t for t less than 1/8 in.(3mm)
- 2) 1/64 in. for t from 1/8 in .to 1/4 in. (3mm to 6mm),inch.
- 3) 1/32in. for t greater than 1/4 in. to 2 in.(6mm to 50mm),inch.
- 4) 1/16 in for t greater than 2 in.(50mm)

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(c) Maximum Size of Rounded Indication.

The maximum permissible size of any indication shall be $1/4 t$, or $5/32$ in. (4mm), whichever is smaller ; except than an isolated indication separated from an adjacent indication by 1 in. (25mm) or more may be $1/3 t$, or $1/4$ in. (6mm), whichever is less. For t greater than 2 in. (50mm) the maximum permissible size of an isolated indication shall be increased to $3/8$ in. (10mm).

(d) Aligned Rounded Indications.

Aligned indications are acceptable when the summation of the Diameters of the indications is less than t in a length of $12t$. See Fig.1-1. The length of groups of aligned rounded indications and the spacing between the groups shall meet the requirements of Fig.1-2.

(e) Spacing.

The distance between adjacent rounded indications is not a factor in determining acceptance or rejections, except as required for isolated indications or groups of aligned indications.

(f) Rounded Indication Charts

The rounded indications characterized as imperfections shall not exceed that shown in the charts. The charts in Figs.1-3 through 1-8 illustrate various types of assorted. Randomly dispersed and clustered rounded indications for different weld thicknesses greater than $1/8$ in. (3mm). These charts represent the maximum acceptable concentration limits for rounded indications. The charts for each thickness range represent full-scale 6 in. (150mm) radiographs, and shall not be enlarged or reduced. The distributions shown are not necessarily the patterns that may appear on the radiograph, but are typical of the concentration and size of indication permitted.

(g) Weld Thickness t less than $1/8$ in. (3mm).

For t less than $1/8$ in. (3mm) the maximum number of rounded indications shall not exceed 12 in a 6 in. (150mm) length of weld. A proportionally fewer number of indications shall be permitted in welds less than 6in. (150mm) in length.

(h) Clustered Indications.

The illustrations for clustered indications show up to four items as many indications in a local area, as that shown in the illustrations for random indications. The length of an acceptable cluster shall not exceed the lesser of 1 in. (25mm) or $2 t$. Where more than one cluster is present. The sum of the lengths of the clusters shall not exceed 1 in. (25mm) in a 6 in. (150mm) length weld.



(I) Elongated indication:

(1) Any other elongated indication on the radiograph which has length greater than:

- (a) $1/4$ in. (6mm) for t up to $3/4$ in. (19mm)
- (b) $1/3 t$ for t from $3/4$ in. (19mm) to $2 1/4$ in. (57mm)
- (c) $3/4$ in. (19mm) for t over $2 1/4$ in. (57mm)

Where t = the thickness of the weld excluding any allowable reinforcement .For a butt weld joining two members having different thicknesses at the weld. t is the thinner of these two thicknesses. If a full penetration weld includes a fillet weld. the thickness of the throat of the fillet shall be included in t .

(2) Any group of aligned indications that have an aggregate length greater than t in a length of $12 t$, except when the distance between the successive imperfections exceeds $6L$ where L is the length of the longest imperfection in the group.

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<i>SI Units</i>			
Thickness t, <i>Mm</i>	Maximum Size of Acceptable Rounded Indication ,mm		Maximum Size of No relevant Indication, mm
	Random	Isolated	
Less than 3	1/4 t	1/3 t	1/10 t
3	0.79	1.07	0.38
5	1.19	1.60	0.38
6	1.60	2.11	0.38
8	1.98	2.64	0.79
10	2.31	3.18	0.79
11	2.77	3.71	0.79
13	3.18	4.27	0.79
14	3.61	4.78	0.79
16	3.96	5.33	0.79
17	3.96	5.84	0.79
19.0 to 50 ,incl.	3.96	6.35	0.79
Over 50	3.96	9.53	1.60

24- EXAMINATION REPORT

Attached form will be used to record examination results.

25- PERSONNEL QUALIFICATION

All operators, must be qualified to SNT-TC1A level I, European norm: EN 473 entitled “Qualification and Certification of NDT Personnel” As a minimum, Interpretation must be carried-out by inspectors holding at least Valid Certificate to SNT-TC-1A level II, European norm: EN 473 entitled “Qualification and Certification of NDT Personnel”.

General Note:



All welded joint shall be visually inspected before commencement of any Non –destructive examination.

26- REPORTING

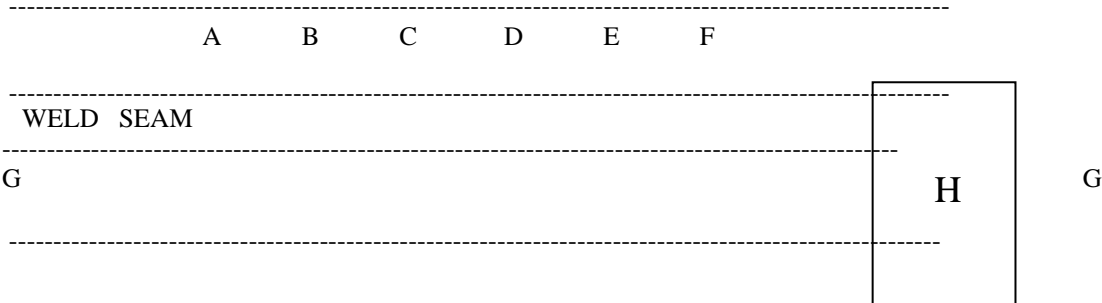
Operator/Interpreter shall provide a test report (attachment No. 1) after test Performing and film interpretation and give it to client authorized inspector for review & Approval.

27- FILM STORAGE

Exposed films shall be stored in accordance with ASME SEC V article2 Appendix3 standard.

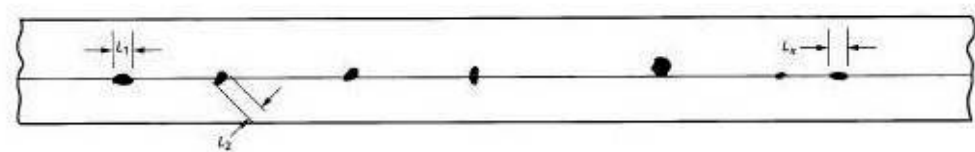
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DENTIFICATION SYSTEM

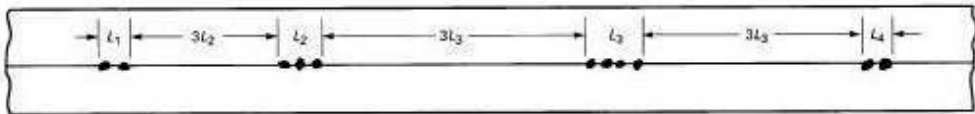


- A: Project identifier manufacture name
- B: Item No.
- C: Joint No.
- D: Welder Stamp
- E: Weld Thick
- F: Date of Shooting
- G: Location Mark
- H: Penetrometer

Arrangements of identification markers above are not necessarily in order.



GENERAL NOTE: Sum of L_1 to L_x shall be less than t in a length of $12t$.
FIG.1-1 ALIGNED ROUNDED INDICATIONS



GENERAL NOTE: Sum of the group lengths shall be less than t in a length of $12t$.

Maximum Group Length	Maximum Group Spacing
$L = \frac{1}{4}$ in. (6mm) for t less than $\frac{3}{4}$ in. (19mm)	$3L$ where L is the length of the
$L = \frac{1}{3}t$ for $t\frac{3}{4}$ in. (19mm) to $2\frac{1}{4}$ in. (57mm)	longest adjacent group being
$L = \frac{3}{4}$ in. (19mm) for t greater than $2\frac{1}{4}$ in. (57mm)	evaluated.

FIG.1-2 GROUPS OF ALIGNED ROUNDED INDICATIONS

FIG 1-3 CHARTS FOR t EQUAL TO $\frac{1}{8}$ in. to $\frac{1}{4}$ in. (3 mm to 6 mm), INCLUSIVE

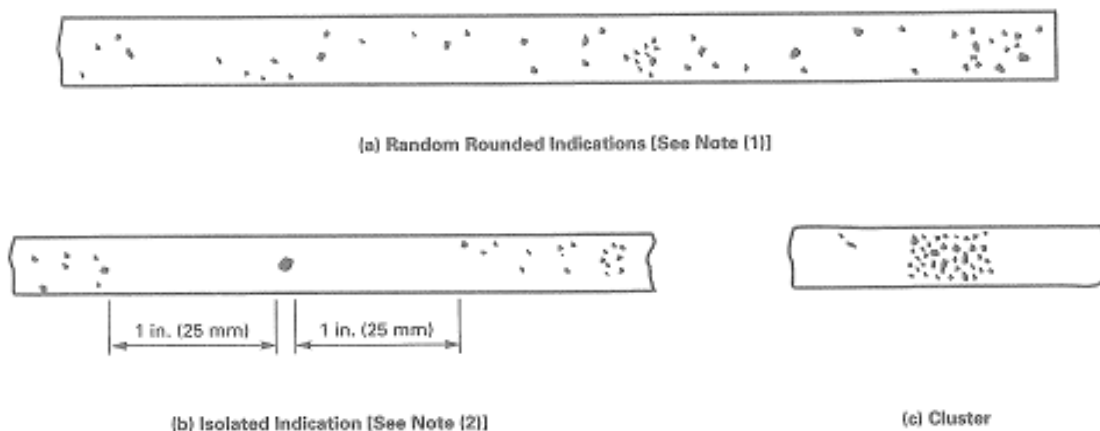
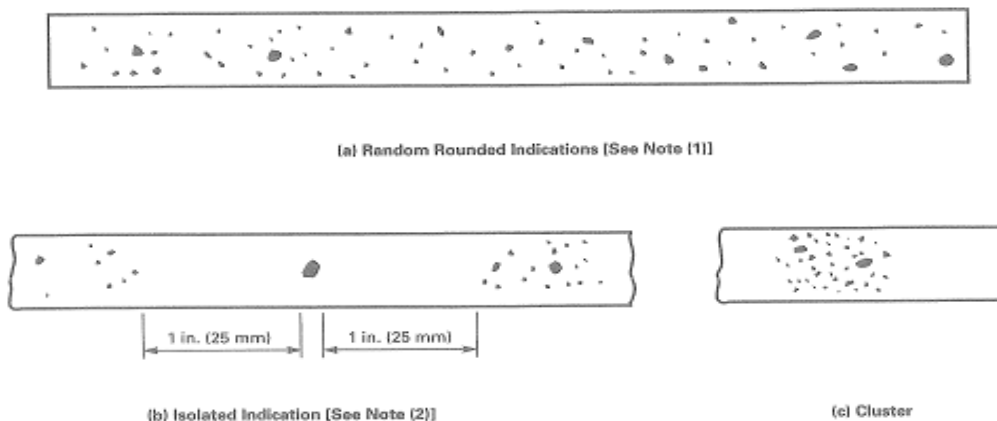


FIG 1-4 CHARTS FOR t OVER TO $\frac{1}{4}$ in. to $\frac{3}{8}$ in. (6 mm to 10 mm), INCLUSIVE





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FIG 1-5 CHARTS FOR t OVER TO $3/8$ in. to $3/4$ in. (10 mm to 19 mm), INCLUSIVE

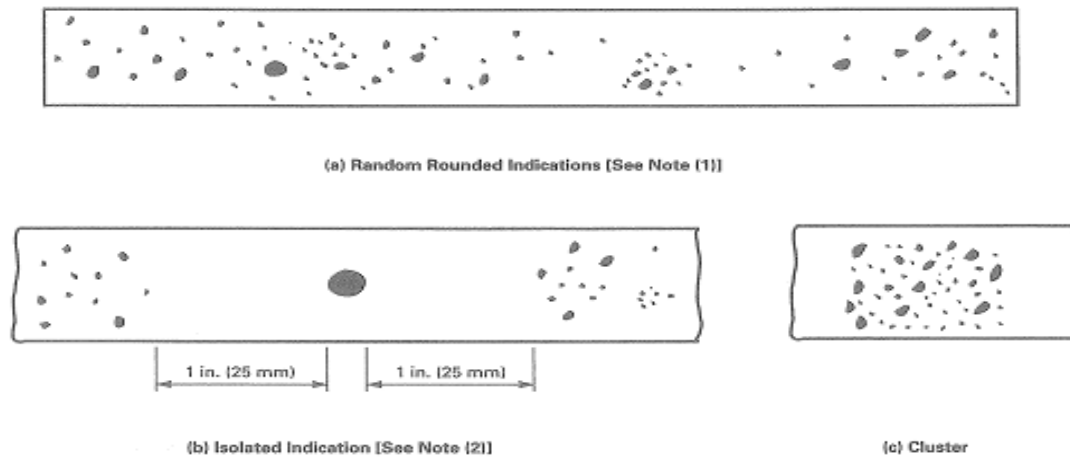


FIG.1-6 CHARTS FOR t OVER $3/4$ in. to 2 in. (19 mm to 50 mm), INCLUSIVE

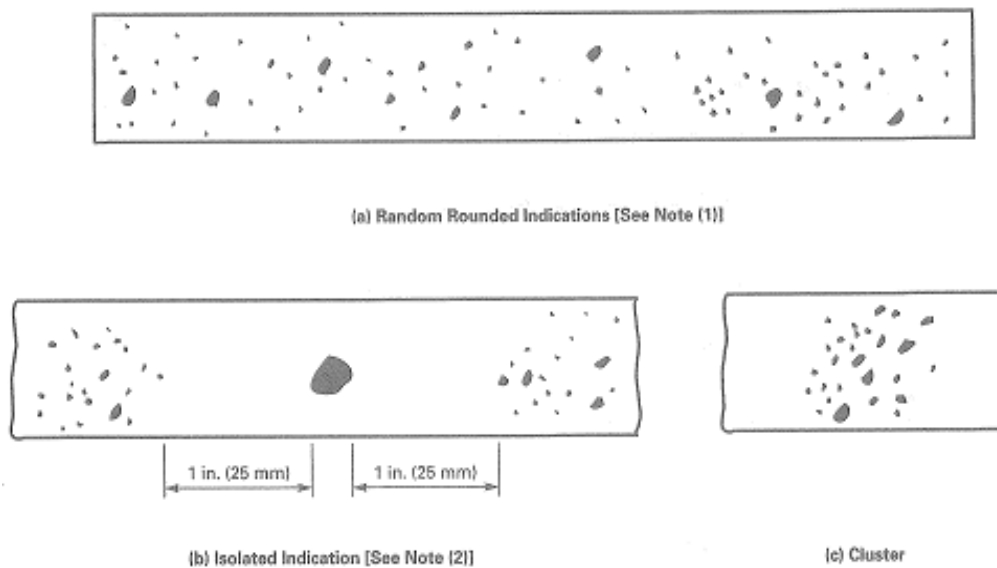


FIG.1-7 CHARTS FOR t OVER 2 in. to 4 in. (50 mm to 100 mm), INCLUSIVE

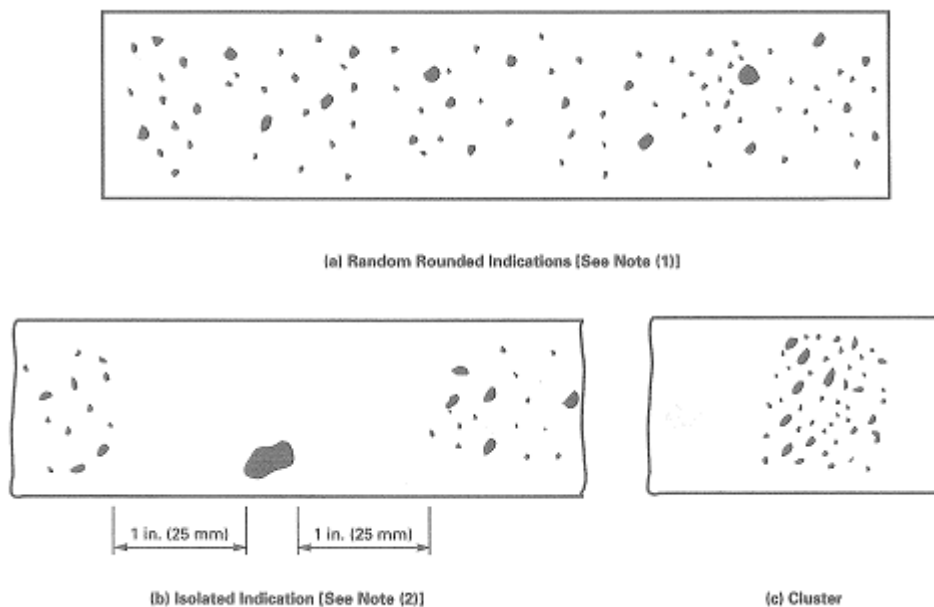
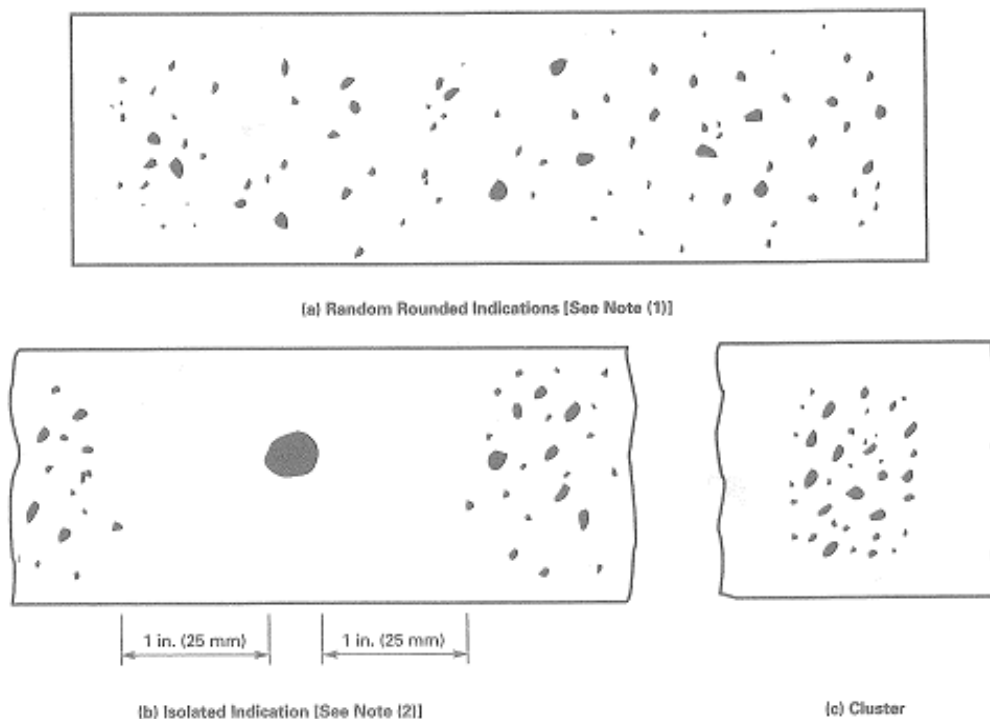





FIG.1-8 CHARTS FOR t OVER 4 in. (100 mm)





NOTES:

- (1) Typical concentration and size permitted in any 6 in. (150 mm) length of weld.
- (2) Maximum size per Table 1-1



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 Mashin Sazi Pars		RADIOGRAPHIC EXAMINATION REPORT Report No: Date of report:			
Source Type :Ir 192 / Xray		Exposure Tech:		SFD:	IQI:
Strength:	KV:	Sensitivity:		Ug:	
Film type: D4 <input type="checkbox"/> D7 <input type="checkbox"/>	Min Density:	Film Size:		Film No:	
Mx125 <input type="checkbox"/> AA400 <input type="checkbox"/>	Max Density:	Source Size :		Thickness:	
Procedure No:		Rev:	Acc. Std. / Spec:		
Film. NO	Film location	Type of weld Discontinuity, size and location	Result		
			RS	RP	ACC
Legends : CR : Crack		IS : Isolate Slag	Acc : Acceptable		
LOF : Lack of fusion		SL : Slag Line	Rp : Repair		
LOP : Lack of penetration		IP : Isolated Porosity	FM: Film mark		
UC : Under Cut		CP : Cluster porosity	RS : Reshoot		
			RC : Root concavity		
Detail of Density measurement, Sensitivity and Ug calculation are on the back side of this report.					
Remarks & Sketch:					
Name : Contractor QC Inspector Inspector Third Party Inspector Sign: Date:					

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CONTENT: (VACUUM BOX TEST PROCEDURE)

1. SCOPE
2. APPLICATION
3. REFERENCE
4. VACUUM TEST PERFORMANCE
5. TEST RECORD

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1- SCOPE

This procedure covers the general requirement for vacuum test of fix roof storage tanks.

2- APPLICATION

This procedure is based on the API 650 and specification to assess leak test for covered bottom and roof welding seam of storage tanks.

3- REFERENCE



- API 650 standard, 14th. Ed. AUG.2025
- IPS-G-ME-100

4- VACUUM TEST PERFORMANCE

4-1) All bottom and roof plates weld shall be tested by using a vacuum box which enables to detect any leak in the seams to be positively located by visual examination.

4-2) This test shall preferably be made as soon as possible after welding of the bottom removal of slag and wire brushing, but before any surface coating is applied. The bottom plates shall in any case be tested before water is let into the tank for Hydrostatic testing.

4-3) Vacuum testing is conveniently performed using a metal testing box 150 mm (6in) wide by 750 mm (30in) long, with a glass window in the top which provides proper visibility to view the area under inspection. During testing, illumination shall be adequate for proper evaluation and interpretation of the test. The open bottom shall be sealed against the tank surface by a suitable gasket. Suitable connection, valves, lighting and gauges shall be provided. A soap film solution or commercial leak detection solution, applicable to the conditions, shall be used.

4-4) Vacuum testing shall be performed according to this procedure with below sequence:

4-4-1) Performing a visual examination of the bottom and welds prior to performing the vacuum box test.

4-4-2) Verifying the condition of the vacuum box and its gasket seals.

4-4-3) Verifying that there is no quick bubble or spitting response to large leaks.



4-4-4) Applying the film solution to a dry area, such that the area is thoroughly wetted and a minimum generation of application bubbles occurs.

4-5) A partial vacuum of 21 Kpa (3 Lbf/in²/6 in. Hg) to 35 Kpa (5 Lbf/in²/6 in. Hg) gauge shall be used for the test. If specified by the purchaser, a second partial vacuum test of 56 Kpa (8 Lbf/in²/6) to 70 Kpa (10 Lbf/in²/6) shall be performed for the detection of very small leaks.

4-6) All of the vacuum box operator shall be meet the following requirements:

4-6-1) Has vision (with correction, if necessary) to be able to read a Jaeger Type 2 standard chart at a distance of not less than 300 mm (12 in). Operators shall be checked annually to ensure that they meet this requirement.

4-6-2) Is competent in the technique of the vacuum box testing, including performing the examination and interpreting and evaluating the results; however, where the examination method consists of more than on operation, the operator performing only a portion of the test need only be qualified for that portion the operator performs.

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4-7) The vacuum box test shall have at least 50 mm overlap of previously viewed surface on each application.

4-8) The metal surface temperature limits shall be between 4° C and 52° C, unless the film solution is proven to work at temperatures outside these limits, either by testing or manufacturers recommendation.

4-9) A minimum light intensity of 1000 Lux (100 fc) at the point of examination is required during the application of the examination and evaluation for leaks.

4-10) The vacuum shall be maintained for the greater of either at least 5 seconds or the time required to view the area under test.

4-11) The presence of a through-thickness leak indicated by continuous formation or growth of a bubble(s) or foam, produced by air passing through the thickness, is unacceptable. The presence of a large opening leak, indicated by a quick brushing bubble or spitting response at the initial setting of the vacuum box is unacceptable. Leaks shall be repaired and retested.

4-12) A record or report of the test including a statement addressing temperature and light intensity shall be completed and furnished to the customer upon request.

4-13) As an alternate to vacuum box testing, a suitable tracer gas and compatible detector can be used to test the integrity of welded bottom joints for their entire length. Where tracer gas testing is employed as an alternate to vacuum box testing, it shall meet the following requirements:

4-13-1) Tracer gas testing shall be performed in accordance with a written procedure which has been reviewed and approved by the purchaser and which shall address as a minimum: the type of equipment used, surface cleanliness, type of tracer gas, test pressure, soil permeability, soil moisture content, satisfactory verification of the extent of tracer gas permeation, and the method or technique to be used including scanning rate and probe standoff distance.

4-13-2) The technique shall be capable of detecting leakage of 1×10^{-4} Pa m³/s or smaller.

4-13-3) The test system parameters (detector, gas, and system pressure, i.e. Level pf pressure under bottom) shall be calibrated by placing the appropriate calibrated capillary leak, which will leak at a rate consistent with item b, in a temporary or permanent fitting in the tank bottom away from the tracer gas pressurizing point. Alternatively, by agreement between purchaser and manufacturer, the calibrated leak may be placed in a separate fitting pressurized in accordance with the system parameters.

4-13-4) While testing for leaks in the welded bottom joints, system parameters shall be unchanged from those used during calibration.

4-14) All leakage seam after repair shall be tested according to the above mentioned procedure.

5- TEST RECORD

The vacuum test result shall be record and approved by purchaser inspector. (see the vacuum test report)



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Vacume Test Report





MSP Co.

Machine SAZE PARS	Storage Tanks	Code: API 650 Report NO: Date :
	Vacuum Testing Report	
Tank No:		
Gauge No:		Range: Bar
Calibration Date		Valid
Surface Condition:		Temperature. C°
Actual Pressure:		Test Material
Location:		
Results		

Sketch:



MSP Inspector
Date:
Sign:

Contractor:
Sign:
Date:

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CONTENT: (ULTRASONIC TEST PROCEDURE)

1. Scope
2. Surface preparation
3. Equipment
4. Coupling medium
5. Basic calibration block
6. System calibration
7. Calibration checks
8. Scanning procedure
9. Reportable indications and evaluation
10. Acceptance standards
11. Removal defects
12. Cleaning after examination
13. Certification
14. Personnel qualification

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1- Scope

- 1.1 This procedure describes the technique to be used for ultrasonic test (UT) on storage tank and components, which will fabricate in shop.
- 1.2 This specification meets entirely the requirements of ASME code Sec.V, Sec.VIII, Div. 1 and project specifications.

2- Surface preparation

- 2.1 The weld surface may be in as welded condition. Where the weld surface interfered with the examination, the weld shall be conditioned as needed to permit examination.
- 2.2 Butt weld joint with thickness up to 80mm.
 - 2.2.1 The finished weld surface and adjacent area for a width at least 4 times the thickness being examined on both sides (2 times on each side) of weld shall be adequately smoothed in order to obtain a sufficient coupling with the search unit.
 - 2.2.2 The weld surface may be as welded condition if the coupling with the search unit is assured.
- 2.3 Butt-weld joint with thickness over 80 mm.
 - 2.3.1 The finished weld surface and adjacent area for a width at least 2 times the thickness being examined on both sides of welds and both surfaces shall be adequately smoothed in order to obtain a sufficient coupling with the search unit.
 - 2.3.2 The weld surface may be as welded condition if the coupling with the search unit is assured.
 - 2.3.3 When the examination of the weld joint is impractical from both surfaces, the surface preparation shall be according to par.2.2.1.
- 2.4 Nozzle welds SET-IN and SET-ON
 - 2.4.1 The weld surfaces shall be conditioned as required in fig.4 and fig5.

3- Equipment



- 3.1 The equipment used must be calibrated at least each 3 months for linear vertical presentation (Screen high linearity) and amplitude control linearity according to manufacturer recommendation.
- 3.2 The search units to be used shall have the following characteristics:
 - 3.2.1 Angle beam search units:
 - Max crystal dimensions: 20 x 22mm
 - Frequency: from 2 to 4 MHz
 - Angle and scanning positions: see fig. 2 ~ 5
 - 3.2.2 Straight beam search units (single or twin crystal):
 - Max crystal dimensions: diameter 24 mm
 - Frequency: from 2 to 5 MHz
 - Scanning position: see fig. From 2 ~ 5
 - 3.2.3 The examination of welded joint having curved surfaces or complex geometry, may require the use of miniature transducers to get proper coupling.

4- Coupling medium

- 4.1 The coupling medium shall be oil or paste consisting of glycerin, water and glue.

5- Basic calibration block

- 5.1 These basic calibration reflectors shall be used to establish a primary reference response of the equipment. The dimensions of basic calibration blocks shall be met the article 5 of ASME Sec.V.
- 5.2 Where the block thickness $\pm 1"$ spans, two of the weld thickness ranges shown in article 5. The block's use shall be acceptable in those portions of each thickness range covered by 1".
- 5.3 Where two or more base material thicknesses are involved, the calibration block thickness shall be determined by average thickness of the weld.
- 5.4 Basic calibration blocks material.

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5.4.1 The material from which the block is fabricated shall be of the same product form, and material specification or equivalent p-number grouping as one of the material being examined. For calibration blocks for dissimilar metal welds, the material selection shall be based on the material on the side of the weld from which the examination will be conducted. If the examination will be conducted from both sides, calibration reflectors shall be provided in both materials.

5.4.2 Clad

Where the component material is clad, the block shall be clad by the same welding production as the production part.

5.4.3 Heat treatment

The calibration block shall receive at least the minimum tempering heat treatment required by the material specification for the type and grade, and also a post weld heat treatment of at least 2 hrs, if the calibration block contains welds other than cladding.

5.4.4 Surface finish

The finish on the surfaces of the block shall be representative of the surface to be examined.

5.4.5 Block quality

The calibration block material shall be completely examined with a straight beam search unit. Areas that contain an indication exceeding the remaining back reflection shall be excluding from the beam paths required reaching the various calibration reflectors.

5.5 Basic calibration reflectors

The basic calibration block shall use side-drilled holes as calibration reflectors (see Article 5 of Sec.V). Additional reflectors may be installed; these reflectors shall not interfere with establishing the primary reference.

5.6 Curvature of surfaces

5.6.1 For examination of circumferential welds in exchangers with contact surface diameter smaller than 20 in. (508mm), the basic calibration block contact surface shall be curved.



A single curved basic calibration block may be used to calibrate the examination of exchanger contact surfaces in the range of curvature from 0.9 to 1.5 times the basic calibration block diameter. The curvature range from 0.94 to 20 in. (24 to 508mm) diameter requires six blocks.

5.6.2 For examination of welds in exchangers with contact surface curvature having diameter greater than 20 in. (508mm), flat basic calibration block or a block of essentially a same curvature shall be used.

5.6.2.1 When examining a welded joint by straight beam contact technique from convex side of contact surface having diameter greater than 20 in. (508mm), and the flat block is used for calibration, it is required to increase the examination gain by a gain correction factor. The gain correction shall apply to the far field portion of the sound beam.

5.6.2.2 The determination of gain correction must be evaluated as follows:

- a. When the ratio of R/RC , the radius of curvature of the material (R) divided by critical radius of the transducer (RC) from table A-10 and diagram of fig. A-10 (a) (Article 5) is equal to or greater than 1.0, no gain correction is required.
- b. When the ratio of R/Rc is less than 1.0, the gain correction must be obtained from fig A-10 (b) of article 5.

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6- System calibration

6.1 General requirements:

Calibration shall include the complete ultrasonic examination system. The original calibration must be performed on the basic calibration block. In all calibrations, it is important that, maximum indications be obtained with the sound beam oriented perpendicular to the axis of the side-drilled holes and notches. The centerline of the search unit shall be at least 1 ½" (38mm) from the nearest side of the block. (Rotation of the beam into the corner formed by the hole and the side of the block may produce high amplitude at a long beam path; this beam path shall not be used for calibration.).

For contact examination, the temperature of the examination and basic calibration block surfaces shall be within 25°F (14°C). Each calibration shall be performed from the surface (clad or unclad) corresponding to the surface of the component from which the examination will be performed.

6.2 Angle beam calibration

The following calibrations shall be performed:

- Angle beam search unit checking
- Sweep range calibration
- Distance amplitude correction
- Position calibration
- Echo amplitude measurement from the surface notch in the basic calibration block.

6.2.1 Angle beam search unit checking

Prior to start with its use, each angle beam search unit has to be checked on the international institute of welding block type V1 as per fig.1 for:

6.2.1.1 Exact location of beam point placing the search unit over the check mark and positioning for maximum response checks the location of the beam exit point. The check mark on the block then coincides with the true point of exit of the central beam ray into the search unit.

6.2.1.2 Placing the search unit on the angle scale and using the large hole with Perspex insert checks the angle of incident. In position of maximum response, the true point of beam centerline shall coincide with the true mark of angle scale.

6.2.2. Sweep range calibration

The sweep range may be calibrated in terms of units of metal path, projected surface distance or actual depth to the reflector, it is anyway preferable the calibration in terms of eight of V-path. (see fig 1-1 in article 5).

6.2.2.1 Position the search unit for the maximum first indication from the 1/4 T side drilled hole. Adjust the left edge of this indication to line 2 on the screen with the delay control.



6.2.2.2 Position the search unit for the maximum indication from the 3/4T hole. Adjust the left edge of this indication to line 6 on the screen with the range control.

6.2.2.3 Repeat delay and range control adjustments until the 1/4 T and 3/4 T hole reflections start at sweep lines 2 and 6.

6.2.2.4 Position the search unit for maximum response from the square notch on the opposite surface. The indication will appear near sweep line 8.

6.2.2.5 Two divisions on the sweep equal 1/4 T.

6.2.3 Distance-amplitude correction (for primary reference level see fig C-20 on article 4)

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6.2.3.1 Calibration from the clad side

- 6.2.3.1.1 Position the search unit for maximum response from hole, which gives the highest amplitude.
- 6.2.3.1.2 Adjust the sensitivity control to provide an 80% ($\pm 5\%$ of full screen height) of full screen indication from the hole. Mark the peak of the indication on the screen.
- 6.2.3.1.3 Position the search unit for maximum response from another whole indication.
- 6.2.3.1.4 Mark the peak of the indication on the screen
- 6.2.3.1.5 Position the search unit for maximum amplitude from the third whole indication and mark the peak on the screen.
- 6.2.3.1.6 Position the search unit for maximum amplitude from the 3/4 T holes indication after the beam has bounced from the opposite surface. The indication should appear at sweep line 10. Mark the peak on the screen for the 5/4 T position.
- 6.2.3.1.7 Connect the screen marks for the side drilled holes to provide the distance amplitude curve DAC.

6.2.3.2 Calibration from the unclad side

- 6.2.3.2.1 From the clad side of the block, determine the dB change in amplitude between the 3/4 T and 5/4 T position.
- 6.2.3.2.2 From the unclad side, perform calibration as noted in 3.1.1 to 3.1.5.
- 6.2.3.2.3 Position the search unit for maximum amplitude from the 3/4T hole, to determine the amplitude for the 5/4 T hole. Decrease the signal amplitude by the number of dB determined in 3.2.1. mark the height of this signal amplitude at sweep line 10.
- 6.2.3.2.4 Connect the screen marks to provide the distance-amplitude curve. This will permit evaluation of indications down to the clad surface (near sweep line 8).
- 6.2.3.2.5 For calibration correction for perpendicular planar reflectors near the opposite surface, refer to par.5.



6.2.3.3. Distance-amplitude correction (DAC) exemption

- 6.2.3.3.1 A DAC is not required where the examination is limited to one-half V path in a material less than 1 in thick, in which case the amplitude level from a single calibration shall be used.

6.2.4 Position calibration (see fig. B-40 in article 4)

The following measurements may be made with a ruler, scale, or marked on an indexing strip.

- 6.2.4.1 Position the search unit for maximum response from the 1/4 T hole. Place one end of the indexing strip against the front of the search unit, the other end extending in the direction of the beam. Mark the number 2 on the indexing strip at the scribe line which is directly above the hole. (If the search unit covers the scribe line, the marks may be made on the side of the search unit).

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6.2.4.2 Position the search unit for maximum indications from the 1/2 T and 3/4T holes. Keep the same end of the indexing strip against the front of the search unit. Mark the numbers 4, 6 and 10 on the indexing strip at the scribe line.

6.2.4.3 Position the search unit for the maximum opposite surface notch indication. Mark the number 8 on the indexing strip at the scribe line.

6.2.4.4 The calibration numbers on the indexing strip indicate the position directly over the reflector in sixteenths of the V-path.

6.2.4.5 The depth from the examination surface to the reflector is T at 8, 3/4 T at 6 (and 10), 1/2 T at 4 (and 12), 1/4T at 2 (and 14) and 0 at 0 (and 16). Interpolation is possible for smaller increments of depth. The radius of the hole may correct this measurement if the radius is considered significant to the accuracy of reflector's location.

6.2.5 Calibration correction for planar reflectors perpendicular to the examination surface at or near opposite surface (see fig. B-50 in article 4).

6.2.5.1 Position the search unit for maximum amplitude from the square notch on the opposite surface. "X" marks the peak of the indication of the screen near sweep line 8.

6.2.5.2 The opposite surface square notch may give an indication 2 to 1 above DAC at 45deg. And 1/2 DAC at 60deg. Therefore, the indications from the square notch must be considered when evaluating reflectors at the opposite surface.

6.3 Straight beam calibration

The calibration shall provide the following measurements:

- Sweep range calibration
- Distance-amplitude correction

6.3.1 Sweep range calibration (fig. C-10 in article 4)

6.3.1.1 Position the search unit for the maximum first indication from the 1/4 T side drilled hole. Adjust the left edge of this indication to line 2 on the screen with the delay control.

6.3.1.2 Position the search unit for the maximum indication from 3/4 T hole. Adjust the left edge of this indication to line 6 on the screen with the range control.



6.3.1.3 Repeat delay and range control adjustments until the 1/4 T and 3/4 T hole reflections start at sweep lines 2 and 6.

6.3.2 Distance-amplitude correction (fig. C-20 in article 4)

6.3.2.1 Position for maximum response from the hole which gives the highest amplitude.

6.3.2.2 Adjust the sensitivity control to provide an 80 % (±5% of full screen height) of full screen indication on the screen with a grease pencil or other suitable marker.

6.3.2.3 Position the search unit for maximum response from another whole indication

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6.3.2.4 Mark the peak of the indication on the screen.

6.3.2.5 Position the search unit for maximum amplitude from the third whole indication and mark the peak on the screen.

6.3.2.6 Connect the screen marks and extend through the thickness to provide the distance-amplitude curve for the side drilled holes.

6.3.2.7 When examining curved surface from convex side having diameter greater than 508mm and calibration performed on flat basic reference block, the sensitivity level of DAC shall be increased of gain correction value.

7- Calibration checks

7.1 Calibration confirmation

Calibration shall be performed prior to use of the system in the thickness range under examination. Before start of examination, a calibration check shall verify the sweep angle calibration according to par. 6.2.2 and 6.2.3 or par 6.3.1 or 6.3.2; as applicable. The check must satisfy the requirements of par.7.3. and 7.4.

7.2 Calibration check

The calibration check during production welds examination must be performed on basic calibration block according to par. 6.2.2 and 6.2.3 or 6.3.1 and 6.3.2 to verify that 1/4, 1/2 and 3/4 T points on the sweep and DAC are correct.

Calibration checks shall be performed When an element of the examination system is changed (cable, transducer, or equipment)

- When examination personnel is changed during examination
- After each hour of examination
- At the finish of each examination or series of similar examination, the check shall satisfy the requirements of par. 7.3 and 7.4

7.3 Sweep range correction

If a point on the DAC curve has moved on the sweep line more than 10% of the sweep reading or 5% of full sweep, whichever is greater, correct the sweep range calibration and note the correction in the examination record. If reflectors are recorded on the data sheets, those data sheets shall be voided; a new calibration shall be recorded. All recorded indications since the last valid calibration or calibration check shall be re-examined with the corrected calibration and their values shall be changed on the data sheets.



7.4 DAC correction

If a point on the distance-amplitude correction (DAC) curve has decreased 20% or 2 dB of its amplitude, all data sheets since the last calibration or calibration check shall be marked void. A new calibration shall be made and recorded and the area covered by the voided data shall be re-examined. If any point of the distance-amplitude correction (DAC) curve are increased more than 20% or 2 dB of its amplitude, all recorded indications since the last valid calibration or corrected calibration and their values shall be changed on the data sheets.

8- Scanning procedure

8.1 The weld joint plus 10mm of base material adjacent to H.A.Z shall be 100% examined which straight and angle beam search unit.

8.2 During the scanning the response from basic calibration block hole shall be magnified increasing the gain setting value of 6dB. The gain setting shall be placed at true value of reference response for the evaluation of the indications.

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8.3 The search unit shall be moved as so to obtain a complete exploration of the weld. Each pass of the search unit shall overlay a minimum of 10% of transducer width. The rate of manual scanning shall not exceed 6" per second.

8.4 Butt weld joints shall be basically examined according to fig.2 and 3.

8.5 Nozzle weld joints shall be examined basically according to fig.4 and 5.

8.6 Angle beam scanning

- 8.6.1 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.
- 8.6.2 Weld joints with thickness up to 50mm, shall be covered by first and second beam paths from both sides and from one surface of weld (see fig 2).
- 8.6.3 Weld joints with thickness over 50mm, may be covered by first beam path from both sides and surface of weld, when both sides and surface of weld are accessible (see fig.3).
- 8.6.4 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 rotated 180 deg. and the examination repeated.

8.7 Longitudinal beam scanning

- 8.7.1 The scanning shall be performed on weld and base metal
- 8.7.2 The scanning of the adjacent base metal shall be performed to detect reflectors that might affect interpretation of angle beam results, and is not to be used as an acceptance rejection examination. Locations and areas of such reflectors shall be recorded.

9- Reportable indications and evaluation



- 9.1 All indications, which produce a response greater than 20% of reference level, shall be investigated to the extent. The operator can evaluate the shape, identity and location of all such reflectors in terms of acceptance standards of par.10.
- 9.2 All indications in excess 50% of primary reference level shall be recorded.
- 9.3 The length of discontinuities shall be determined placing the search unit at two border points, in which the response is half the maximum value given by the local discontinuity.

10- Acceptance standards

- 10.1 Acceptance criteria should be according to appendix 12 of ASME sec. VIII, Div.1

11- Removal of defects

- 11.1 Indications or discontinuities in excess to standards shall be removed by mechanical means and repaired by qualified welding procedure, where necessary.
- 11.2 The repaired area shall be re-inspected using the ultrasonic examination procedure according to this specification

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12- Cleaning after examination

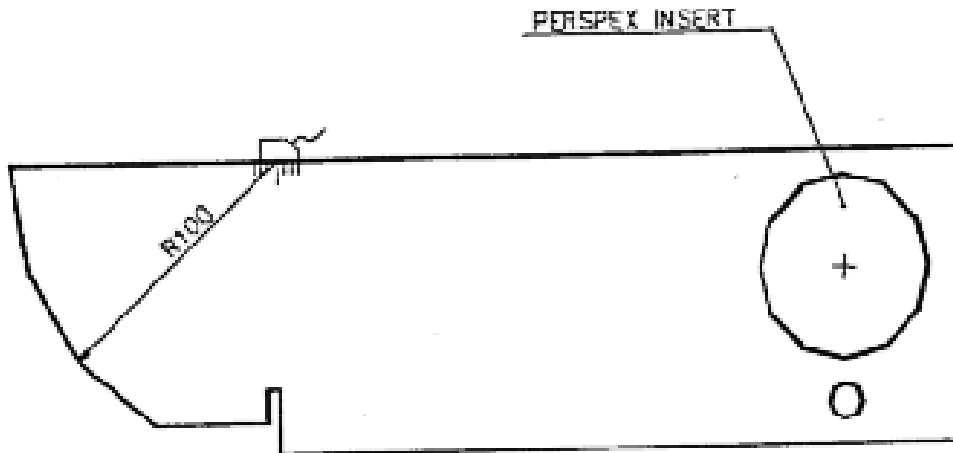
After examination, the coupling medium used for the ultrasonic examination shall be removed.

13- Certification

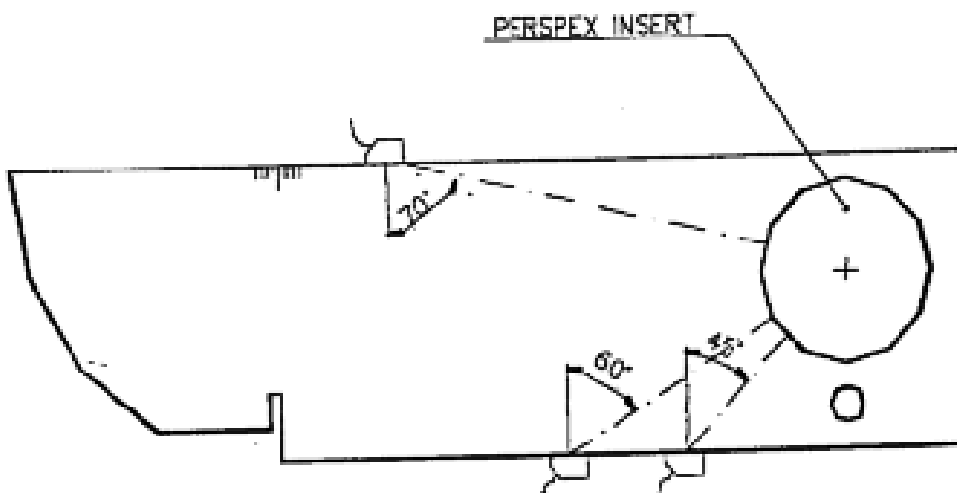
After inspection, an ultrasonic examination report shall be filled out, according to par. T-492 of ASME code Sec.V latest edition.

14- Personnel qualification

All personnel performing ultrasonic examination according to this specification shall be qualified as per requirements of applicable edition of SNT-TC-1A" Recommended practice for Nondestructive Testing Personnel Qualification and Certification".





BEAM EXIT POINT CHECKING



BEAM INCIDENCE ANGLE CHECKING

FIG. 1

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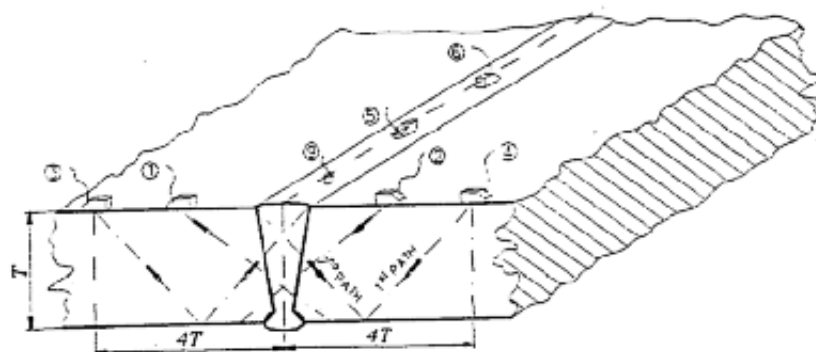


FIG. 2

Scanning positions for butt welds with thickness up to 80 mm .

NOTE :

- Scanning positions from 1 to 6 : Angle beam search unit of 45 ° and 60 ° or 70 ° .
- Scanning position 9 : Straight beam search unit .

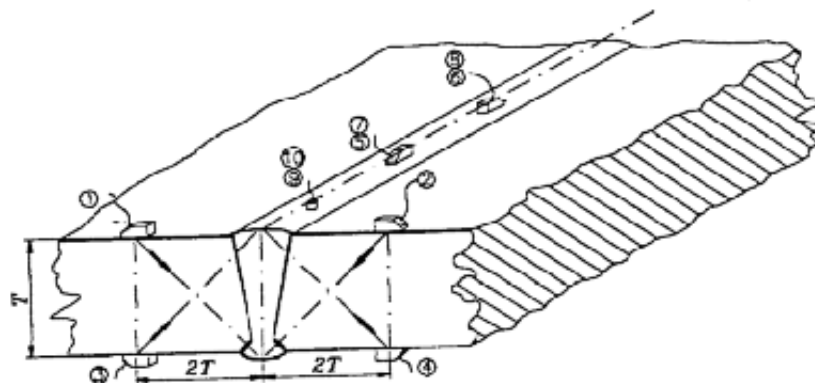
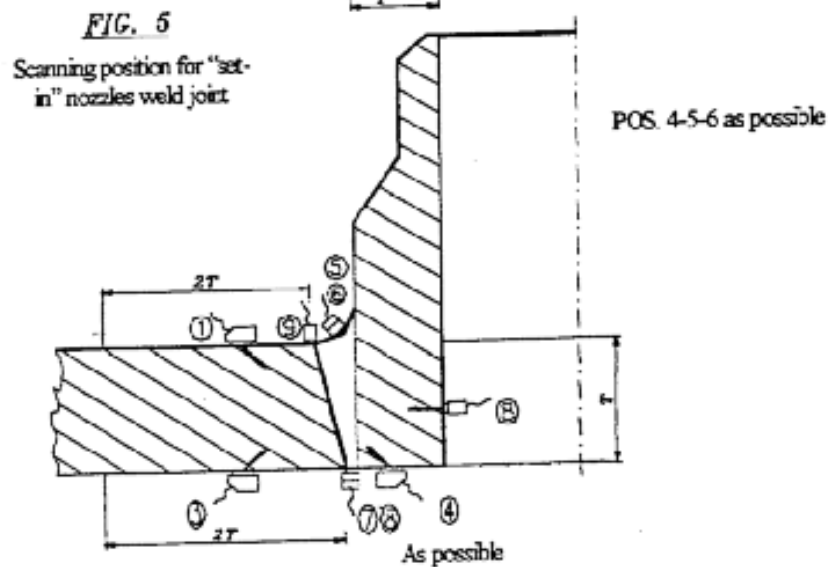
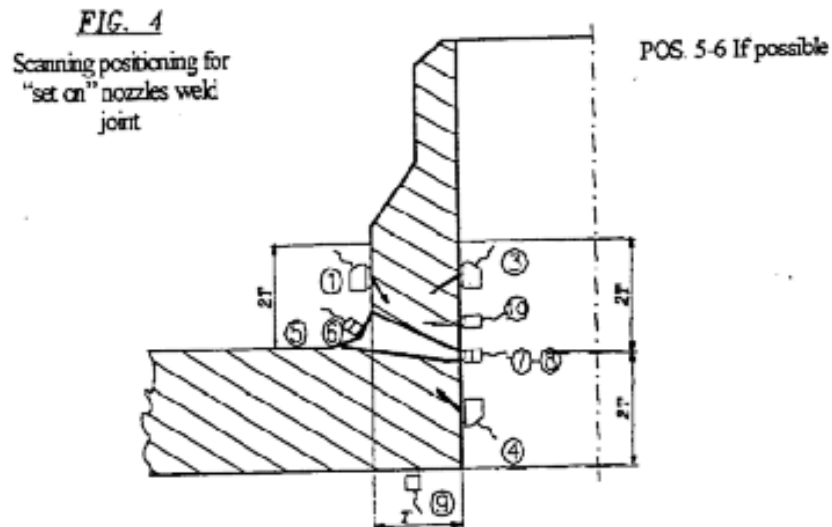


FIG. 3



Scanning positions for butt welds with thickness over 80 mm .

NOTE :

- Scanning positions from 1 to 3 : Angle beam search unit of 45 ° and 60 ° .
- SCANNING POSITION 9 AND 10 : SETRAIGHT BEAM SEARCH UNIT .





Scanning pos. from 1 to 3 : Angle beam search unit: of 45 ° , 60 ° or 70 °
SCANNING POS. 9-10 : STRAIGHT BEAM SEARCH UNIT .

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ULTRASONIC EXAMINATION REPORT

Company:				Report No:						
SPECIMEN NO:				Date:						
Equipment:				Attachment Yes <input type="checkbox"/> No <input type="checkbox"/>						
Maker:				Welding Precess:						
Model:				Material :						
Calibration Block:				Search Unit Straight <input type="checkbox"/> Angle <input type="checkbox"/>						
Couplant:				Probe Specification	Probe Angle	Freq. (MHz)	Primary Reference	Scanning Sensitivity	Range Of cali.	
					1					
					2					
					3					
					4					
Procedure No.:										
ACCEPTANCE CRITERIA:					Transfer Correction :					
					Discontinuity & avaluation					
No	Weld No:	Wall THK. (mm)	Tested Length (Cm)	Amplitude Level % DAC	Locati on	Type of Defct	Length (mm)	Depth (mm)	Helght	Result
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Sketch:										
UT Operator				Qc.Representative				Third Party Representation		
Name :										
Date :										
Sign :										

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CONTENT (MAGNETIC PARTICLE TEST PROCEDURE)

1. SCOPE
2. APPLICABLE CODE AND STANDARD
3. APPLICABLE PARTS
4. SURFACE PREPARATION
5. EXAMINATION MEDIUM
6. MAGNETIZATION METHOD
7. DEMAGNETIZATION
8. MAGNETIZATION FILED CHECKING
9. METHOD OF EXAMINATION
10. INTERPRETATION
11. INDICATIONS EVALUATIONS
12. ACCEPTANCE CRITERIA
13. REPAIRS
14. POST CLEANING
15. PERSONNEL QUALIFICATION
16. CERTIFICATION

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1- SCOPE

This procedure describes the technique to be used for a magnetic particle inspection (MPI).

2- APPLICABLE CODE AND STANDARD AND PROJECT TECHNICAL SPECIFICATION;



ASME CODE section V Article 7 And SE 709-2025

ASME CODE Section VIII, Div1.-2025

3- APPLICABLE PARTS;

3-1- As per contract, standard and project specification (fabrication and erection documents) including:

- Weld bevel inspection.
- The reverse side of double welded butt joints after back gouging and grinding.
- Removing parts of temporary elements.
- To check the complete removal of defects detected on the base metal.

3-2- However extra MT will be done as requested by authorized inspector.

4- SURFACE PREPARATION

- a. Satisfactory results are usually obtained when the surfaces are as welded conditions .however, surface preparation by grinding or machining may be necessary where surface irregularities could mask indication due to discontinuities.
- b. Prior to magnetic particle examination, the surface to be examined and all adjacent area within at least 25.4 mm shall be dry and free of all dirt, grease, welding flux and spatter, oil or other extraneous matter that could interfere with the examination.
- c. Cleaning may be accomplished using detergents, organic solvents, paint remover, vapor degreasing, sand or grit blasting, or ultrasonic cleaning methods.
- d. If coatings are left on the part in the area being examined, it must be demonstrated that indication can be detected through the existing maximum coating thickness applied.

5- EXAMINATION MEDIUM

The magnetic particles used for finding discontinuities will be wet method:

Powders for wet test are fluorescent or non- fluorescent.

- 1) The powders used will be as liquid suspension, they shall have a high permeability and a low capacity of keeping magnetization.
- 2) The following particles can be used :
 - i. Fluorescent particles.
 - ii. Particles visible under normal light.
- 3) Liquid carrier

Two types can be used:

1- Oil – bath

- i. The oil used in preparing the bath shall be light oil or refined oil having a low sculpture and chloride limits content:

Further it shall completely with the requirement of the ASME regulations.

- ii. When using oil as carrier of fluorescent particles, it shall be controlled by black light so that is gets only minimum quantity of natural fluorescence.

2- Water – bath

The water shall contain wetting substances and corrosion inhibitors.

a) Bath concentration

The bath concentration shall be in compliance with the applicable standard.



- b) The temperature of the wet particle suspension and the surfaces of the part shall not exceed 52 °C.

- c) The following powders and / or similar will be used :

Natural light black (magnaflux or equivalent)

Red (magnaflux or equivalent)

Fluorescent (magnaflux or equivalent)

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6- MAGNETIZATION METHOD;

The method with yoke shall be used.

Method with the yoke;

- a. This method shall be used only to detect some surface discontinuities.
- b. The AC magnetizing technique will be used provided that it has a 4.5 kg lifting capacity at the max pole spacing.
The DC technique will be used provided that it has 18 kg lifting capacity at the max. Pole spacing.
This test shall be performed before use; non-record of this test is required.
- c. Two examinations at least shall be carried out in every area where the prods are placed so that the flux lines result approximately perpendicular.
- d. Two examination at least shall be carried out with a sufficient overlapping (MIN. 15% overlapped) so as to ensure the 100% covering of the surface to be tested.
- e. The following equipment and /or similar can be used :
MAGNAFLUX – Y6
TIDE – GWM 220

7- DEMAGNETIZATION;

When residual magnetism in the part could interfere with subsequent or usage, the part shall be demagnetized any time after completion of the examination.

8- MAGNETIC FIELD CHECKING

Whenever starting or completing an MT examination, direction and suitability of the magnetic field shall be checked by using the field indicator.

9- METHOD OF EXAMINATION

Examination shall be done by continuous method: that is the magnetizing current remains on while the examination medium in being applied and while excess of the examination medium is being removed.

10- INTERPRETATION

10.1 Non – fluorescent particles:

For this method the examination is performed using visible light. A minimum light intensity of 50 fc (500 Lx) is required to ensure adequate sensitivity during the examination and evaluation of indication.

10.2 Fluorescent particles:



For this method the examination is performed using an ultraviolet lamp.

- a. The examination shall be performed in a darkened area.
The examiner shall be in the darkened area at 5 min prior to performing the examination to enable his eyes to adapt to dark viewing. If the examiner wears glasses or lenses, they shall not be photosensitive.
- b. The ultraviolet light shall be allowed to warm up for a minimum of 5 minute prior to use or measurement of the intensity of the ultraviolet light emitted.
- c. The ultraviolet light intensity shall be measured with an ultraviolet light meter. A minimum of 1000 uw/cm² the surface of the part to be examined shall be required. The black light intensity shall be measured at least once every 8 hr, and whenever the workstation is changed

11- INDICATION EVALUATIONS

- 11-1- All indication shall be evaluated in terms of the acceptance of the referencing code section.
- 11-2- Discontinuities on or near the surface indicated by retention of the examination medium.
- 11-3- Broad areas of particle accumulation, which might mask indication from discontinuities, are prohibited and such areas shall be cleaned and re-examined.
- 11-4- Only indications, which have any dimensions greater than 1/16in, shall be considered relevant.

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

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- b. A rounded indication is one of circular or elliptical shape with a length equal to or less than three times the width.
- c. Any questionable or doubtful indication shall be re-examined to determine whether or not they are relevant.

12- ACCEPTANCE CRITERIA

12-1- The acceptance criteria shall be according to the following:

Section VIII Div.1 Appendix 6
per. T753.1. field indicator usage

12-2- In any case all surface to be examined shall be free of:

- a. Relevant linear indications.
- b. Relevant rounded indication greater than 3/16 in.
- c. Four or more relevant rounded indication in a line by 1/16in .or less, edge to edge.
- d. 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.

13- REPAIRS

13.1 Discontinuities exceeding the above mentioned limits shall be removed, and the part will be repaired according to the applicable procedure.

13.2 The area under repairing, plus 50mm per each side, shall be checked as per the starting procedure condition.

14- POST CLEANING;

Post-test cleaning for particle removal is required where particle interfere with subsequent processing or with service requirements.

The techniques employed are:

Compressed air to blow off unwanted dry magnetic particle.

Drying of wet particles and subsequent removal by brushing or compressed air.

Removal of wet particles by flushing with proper solvent.

Other suitable techniques may be used if they will not interfere with subsequent requirements.

15- PERSONNEL QUALIFICATION;





Personnel involving in this examination in compliance with this procedure shall be qualified according to SNT-TC-1A 2020 edition.


- Level 1 for operator
- Level 2 for examiner



16- CERTIFICATION;

For each a report shall be issued. The report shall contain all necessary information for defines: (see attached report)

- Parts to be examined.
- Contractual documents
- Magnetic examination system
- Date examination was performed.
- Surface condition.
- Post examination cleaning.
- Inspection results.

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 Mashin Sazi Pars		MAGNETIC PARTICLE INSPECTION REPORT Report No. : Date of Issue :		
PROCEDURE NO:		ACCEPTANCE CRITERIA:		
CONSUMABLES: MANUFACTURER: TEMPERATURE:		EQUIPMENT: PERMANET MAGNET A.C YOKE <input type="checkbox"/> FLUX INDICATOR: <input type="checkbox"/>		
STAGE OF EXAMINATION : AS PREPARED EDGE <input type="checkbox"/> AS WELDED <input type="checkbox"/>		TECHNIQUE OF MAGNETIZATION:		
SURFACE PREPARTION: GRINDING <input type="checkbox"/> MACHINING <input type="checkbox"/> BRUSHING <input type="checkbox"/>				
SPECIMEN NO:		THICKNESS:		
SL. NO.	TYPE OF DISCONTINUITY, SIZE AND LOCATION	ACC.	REP.	REMARKS
Sketch & Description				
Contractor QC Inspector		Inspector		Third Party Inspector
TEHNICIAN NAME: SIGNATURE: DATE:				

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CONTENT (VISUAL TEST)

1- VISUAL TEST

- 1-1- SCOPE
- 1-2- CODES AND STANDARDS
- 1-3- GENERAL
- 1-4- PERFORMANCE SEQUENCE
- 1-5- EVALUATION
- 1-6- INSTRUMENTS
- 1-7- RECORDS

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1- VISUAL TEST

1-1- SCOPE

This Part of manual describes the method and requirements for visual welding inspection, before, during and after welding to ensure that there are no apparent material defects in weldment and adjacent area.

1-2- CODES AND STANDARDS

The following specifications shall be used as per this specification



- API 650 standard, 14th. Ed. AUG.2025 Welded Steel Tanks for Oil Storage
- ASME SEC. VIII DIV.1 Rules for Construction of Pressure Vessels
- ASME Sec. V Nondestructive Examination

1-3- GENERAL

Visual inspection involved in interpretation of the various nondestructive test methods is not intended to be included in this part, since such visual examinations are described in other parts of this manual.

1-4- PERFORMANCE SEQUENCE


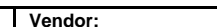
Visual inspection shall be carried out in following stages:

- Before welding
- During welding
- After welding

1-4-1- Before Welding

The welding inspector shall check the following to be in accordance with codes and procedures before weld performing:

- 1-4-1-1- Pipe body appearance for corrosion, damage, wall thickness, laminations & Seams
- 1-4-1-2- Quality of pipe
- 1-4-1-3- Welders extraction systems, goggles and all safety equipment
- 1-4-1-4- Check grinders, chipping hammers, wire brush and all hand tools
- 1-4-1-5- Power sources
- 1-4-1-6- Electrode holders
- 1-4-1-7- Holding ovens
- 1-4-1-8- Cables, earth connects and torches
- 1-4-1-9- Electrode name, code and sizes
- 1-4-1-10- Electrodes humidity
- 1-4-1-11- Bevels face for:
 - a- Mechanical damages
 - b- Oxides
 - c- Oil and other contaminant
 - d- Bevel angle
 - e- Root face
- 1-4-1-12- Fit up for:
 - f- Root gap
 - g- Misalignment

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1-4-1-13- That the joint and seam is in the correct position

1-4-2- During Welding

The welding inspector shall explain the nature of the process and check that the welder understands the WPS, and then check:

- 1-4-2-1- That joint has been correctly prepared and tacked, or jigged.
- 1-4-2-2- Pre-Heating. (If applicable), Method and control
- 1-4-2-3- Welding run sequence and inter-pass cleaning
- 1-4-2-4- Minimum/maximum Inter-pass temperatures
- 1-4-2-5- Speed of travel be same for two welder of joint
- 1-4-2-6- That the welder carries out the root run, fill and cap as per the WPS.
- 1-4-2-7- Inter pass PT (if necessary)

1-4-3- After Welding

After completion of a weld, inspector shall check:

- h- That the ID No. of weld marked near of the weld.
- i- That the surface of weld and adjacent area are free from slag and spatter

And then check the followings to full compliance with all elements given on the WPS and specification:

- 1-4-3-1- Toe blend
- 1-4-3-2- Cap height
- 1-4-3-3- High-Low
- 1-4-3-4- Under cut
- 1-4-3-5- Under fill and cap concavity
- 1-4-3-6- Bulbous, or irregular contour
- 1-4-3-7- Arc strikes
- 1-4-3-8- Distortion
- 1-4-3-9- Any surface damage caused by:
 - a- Grinding
 - b- Hammering/chisel marks
 - c- Slag chipping hammers marks



1-5- EVALUATION

After complete inspection and noting the necessary data, inspector shall compare the dataset with the minimum requirements that mentioned in related specification (API 1104 or approved procedures) and decide for accept or reject of the material, fit up or weld.

1-6- INSTRUMENTS

Inspector may utilise the following specialised equipment:



- Welding gauges (Cambridge style, or high low gauges etc.)
- A tape measure and scale
- A wire brush
- A magnifying glass


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- A torch and mirror
- A specification, pen and report, or note paper

1-7- RECORDS

- 1-7-1- Welding inspector shall keep a record in welding field that contains the information about number of welders and welding facilities and the amount of work progression. And result of visual or NDT examinations that carried out.
- 1-7-2- A final welding history record also shall be kept that identifies the visual inspection result, NDT result, stamp number of welders, WPS number, and other essential information.
- 1-7-3- When NDT is necessary, a NDT request shall be filled and submitted to NDT team.

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 Mashin Sazi Pars			Report No: Date of report:		
VISUAL EXAMINATION REPORT					
Specimen No.					
Procedure No:		Rev:	Acc. Std./Spec:		
Specimen No.	Discontinuity			Result	
	Location	Type of weld Discontinuity, and size		Acc	Rp
					Remarks
Legends : CR : Crack ER- Excess Reinforcement AS – Arc Strike Acc- Acceptable LOF: Lack of fusion EP-Excess Penetration UF - Under fill Rp - Repair LOP: Lack of penetration IP : Isolated porosity URT- Unremoved tacks UC : Under Cut CP: Cluster porosity RC - Root concavity					
Attachments : Yes / No					
Remarks:					
Name : Sign: Date:	Contractor QC Inspector		Inspector		Third Party Inspector