طرح نگهداشت و افزایش تولید 27 مخزن

SPECIFICATION FOR WELDING OF PLANT PIPING SYSTEM & NDT

نگهداشت و افزایش تولید میدان نفتی بینک

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REVISION RECORD SHEET

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0. 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 CLIENT (NISOC)
PROJECT:	Binak Oilfield Development – General Facilities
EPD/EPC CONTRACTOR:	Petro Iran Development Company (PEDCO)
EPC CONTRACTOR:	Joint Venture of : Hirgan Energy – Design & Inspection(D&I) Companies
VENDOR:	The firm or person who will fabricate the equipment or material.
EXECUTOR:	Executor is the party which carries out all or part of construction and/or commissioning for the project.
THIRD PARTY INSPECTOR (TPI):	The firm appointed by EPC CONTRACTOR and approved by GC & COMPANY (in writing) for the inspection of goods.
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 COMPANY rather than by an EPC/EPD CONTRACTOR, supplier or VENDOR.
MAY:	Is used where a provision is completely discretionary.

1. SCOPE (MOD.)

This specification gives amendment and supplement IPS-C-PI-290(1), "Construction standard for welding of plant piping systems “for shop and field fabrication of carbon, alloy steel and stainless s teel piping in this project.

(IPS-C-PI-290 (1) contains the minimum for welding work to be carried out for installation of o n-plot piping in oil, gas and petrochemical industries.

The Standard relates to the requirements pertaining to welding techniques to be used, the qualific ation of welder/welding operator and welding procedure together with testing and recording i nvolved.

It also deals with inspection, testing, limit of acceptability and heat treatment of production weld, if required.

Facilities to which this Standard applies are indicated in scope of ANSI/ASME B31.3 and B31.8.

2. NORMATIVE REFERENCES (MOD.)

2.1 LOCAL CODES ANDSTANDARDS

D01

- IPS-C-PI-270 Construction standard for welding of transportation pipeline
- IPS-M-GM-375 Arc welding equipment and accessories
- IPS-C-PI-140 Construction standard for transportation pipelines
- IPS-M-PI-150 Material standard for flanges and fittings
- IPS-M-PI-190 Material and equipment standard for line pipe
- IPS-M-PI-110 Material and equipment standard for valves
-

2.2 INTERNATIONAL CODES AND STANDARDS (ADD.)

- ASTM A833 Indentation Hardness of Metallic Materials by Comparison
- ASTM E110 Standard Test Method for Indentation Hardness of Metallic Materials by Potable Hardness Testers
- ASTM E140 Standard Hardness Conversion Tables for Metals
- ASTM E562 Boiler and Pressure Vessel Code - Non-Destructive Examination Boiler and Pressure Vessel Code - Welding and Brazing Qualifications
- ASTM G48 Standard Test Methods for Pitting and Crevice Corrosion Resistance of Stainless Steels and Related Alloys by Use of Ferric Chloride Solution
- AWS American Welding Society

- ISO 10474 Steel and Steel Products - Inspection Documents
- NACE MR 0175 /ISO 15156 Petroleum and Natural Gas Industries. Materials for use in H2S Containing Environments in Oil and Gas Production

D01

- ASME B36.10 Welded and Seamless Wrought Steel Pipe
- ASME B36.19 Stainless Steel Pipe
- ASME B31.4 Pipeline Transportation Systems for Liquid Hydrocarbons
- ASME Section II, Part A Ferrous material specification
- ASME Section II, Part C Welding Rods, Electrodes, and Filler Metals
- API 1104 Welding of pipelines and related facilities

2.3 THE PROJECT DOCUMENTS (ADD.)

- BK-SSGRL-PEDCO-320-PI-SP-0001 Piping & Pipeline Material Specification
- BK-PPL-PEDCO-320-PI-SP-0001 Piping & Pipeline Material Specification
- BK-GCS-PEDCO-120-PI-SP-0001 Piping Material Specification

2.4 ENVIRONMENTAL DATA (ADD.)

Refer to "Process Basis of Design; Doc. No. BK-GNRAL-PEDCO-000-PR-DB-0001".

3. DEFINITIONS AND TERMINOLOGY

No amendments or supplements are to state.

4. ABBREVIATIONS

No amendments or supplements are to state.

5. UNITS

No amendments or supplements are to state.

6. QUALIFICATION OF WELDING PROCEDURE AND WELDER PERFORMANCE AND TEST RECORDS

D01

No production welding shall be carried out before Welding Procedure Specification (WPS), Procedure Qualification Record (PQR) And Welder Performance Qualification (WPQ) are qualified in accordance with requirements of ASME B31.3, Section IX and this specification. (Mod.)

Welding consumable manufacturer/trade mark specially for Iranian manufacturer and AWS designation shall be classified as an essential variable for the purposes of welding procedure qualification. (Add.)

6.1 WELDING PROCEDURE

No amendments or supplements are to state.

6.2 PROCEDURE QUALIFICATION RECORD

6.2.1.6

All welds undertaken using non-approved or unqualified procedures or unqualified welders/welding operators shall be requalified. (Add.)

D01

6.3 WELDER PERFORMANCE AND TEST RECORDS

No amendments or supplements are to state.

6.4 WELDING CONSUMABLES (ADD.)

6.4.1 Filler materials and fluxes

6.4.1.1 Selection of Filler Materials and Fluxes

Welding consumables or combination of them used for the work shall produce welds with strength and ductility properties (especially notch toughness) in the final heat treated condition (if applicable) at least equal to the minimum specified equivalent properties of the base material. For welding carbon steel materials with minimum specified yield strength of 60,000 psi or 420 MPa and above, the selected consumables shall produce welds with tensile strength property not exceeding by more than 25% the specified minimum tensile strength properties, measured at the time of welding procedure qualification tests on an all-weld tensile test specimen taken from the weld metal.

a) For carbon steel materials, EN 10204 type 2.2 test reports shall be submitted to the Inspection Agency for all consumables and shall be available at site at the time of welding. For all other materials, EN 10204 type 3.1.B inspection certificates shall be submitted to the Inspection Agency for all consumables and shall be available at site at the time of welding.

b) Filler metal for welding similar materials shall be as shown in Table 1. 9% Ni materials shall be welded using filler materials complying with one of the following classifications of the AWS A 5.11: ENi Cr Fe - 3, or ENi Cr Mo - 3. Guaranteed strength levels are required for mechanical design.

c) Filler metals for welds joining dissimilar materials shall be in accordance with Table 2. Filler metals for combination of materials other than those shown in Table 2 shall be submitted to the Company for approval.

Welds joining carbon steel materials of different grades shall give the same strength as that specified for the higher grade of material and shall have ductility and notch toughness properties equal to the higher values specified for the grades of steel being joined.

d) In welding processes other than SMAW or FCAW, the bare filler wire shall contain all the alloying elements; no elements shall be added via the flux.

e) All welding products shall be used within the limits recommended by their Manufacturer and the welding variables used for fabrication shall be within the range used for the procedure qualification.

f) ASME SA 251 (AWS A 5.2.69) filler wire is not permitted for use with the inert gas tungstan arc process.

D01 g) Welding electrode may be re-cured maximum two times and 4 hours after second curing it cannot be used any more.

6.4.1.2 Supply

Low hydrogen electrodes and fluxes shall be supplied in sealed moisture proof containers.

6.4.1.3 Storage

Electrodes, filler wires and fluxes shall be kept clean, dry and properly stored according to Supplier's recommendations. Storage of open containers shall be in accordance with Supplier's instructions but at a minimum temperature of 75°C in any case. No electrodes, filler wires or fluxes that are damaged, damp, greasy or oxidized may be used.

Manufacturer's facilities shall include a temperature and humidity controlled welding consumable and flux store, including holding and drying ovens.

Low hydrogen electrodes and fluxes shall be placed in a holding oven and held at a minimum temperature of 150°C for at least one hour prior to use. Welding electrodes shall be issued for production from holding ovens only and shall be placed in heated quivers capable of maintaining a minimum temperature of 70°C. After four hours, the remaining unused electrodes in the quivers shall be placed in a drying oven and held at 250-300°C for four hours or as recommended by the Supplier if at a higher temperature, and then transferred to a holding oven prior to reissue.

Low hydrogen electrodes which have been in direct contact with water shall be definitely rejected and removed from the fabrication site.

Base material		Covered electrodes			Welding rods	
		ASME spec	Preferred electrode	Alternative Electrode	ASME Spec	Classification
Carbon Steel	(1)	SFA5.1	E70XX (3, 4, 9)	E60XX (3, 4)	(6, 7, 8)	-
	(2)	SFA5.1	E70XX (3, 4, 9)	E80XX	(6, 7, 8)	-
Austenitic Stainless Steels	AISI Type 316L	SFA5.4	E316L-15	E316L-16	SFA5.9	ER316L

Notes to Table 1 (Numbers in parentheses in Table 1 refer to the following notes):

1. Minimum specified ultimate strength not exceeding 420 MPa or 60,000 Psi.

2. Minimum specified ultimate tensile strength greater than 420 Pa or 60,000 Psi.

3. Low hydrogen electrodes and fluxes, or a low hydrogen weld process shall be used where any of the following requirements or conditions applies:

- Impact testing of weld metal
- The carbon content of the base material exceeds 0.22%
- The base material thickness exceeds 12 mm
- The specified minimum yield strength of the base material exceeds 260 MPa.

4. The following classifications are not acceptable for use in pressure containing welds: E6012, E6013, E6022, EXX14 and EXX24. However, these classifications may be used for tank roof and bottom fillet welds after prior approval of the Company.

5. Where no ASME material specification exists for wire or rods, wire or rods of the same nominal composition as the base material with substantially neutral flux or inert gas may be used if they have been qualified in accordance with the applicable code and specification requirements.

6. Gas Metal Arc Welding (GMAW) wire shall conform to ASME SFA 5.18 and 5.20.

7. Submerged Arc Welding (SAW) wire and flux shall conform to ASME SFA 5.17 or SFA 5.23; however, equivalence under these standards shall not be considered adequate for substitution between different Manufacturers or between a single Manufacturer's grades without requalification.

8. For Gas Tungsten Arc Welding (GTAW), ASME SFA 5.18 ER70S-2 is the preferred welding wire.

9. ASME SFA 5.1 E6010 welding electrode is acceptable for the root pass in piping welding only, if the procedure has been qualified to the appropriate code and specification requirements.

Base material Number	Base material type	Base material number	
		1	2
1	Carbon Steel	A	C
2	AISI Type 316 L		M

Filler material AWS classification:

A: E-XX16 or E-XX18

C: E309-15 or E309-16

M: E316L-15 or E316L-16

7. USE OF BACKING RINGS AND CONSUMABLE INSERTS

No amendments or supplements are to state.

8. PRODUCTION WELDING

No amendments or supplements are to state.

8.1 END PREPARATION FOR WELDING

No amendments or supplements are to state.

8.2 ALIGNMENT

8.2.5 All welding preparation details must be in accordance with Company approved Drawings, and WPS. (Add.)

8.2.6 All welds bevels surfaces shall be free from cracks, porosity, and slag inclusions. (Add.)

8.3 PRODUCTION WELDING OPERATION

8.3.5 All materials shall be new and identifiable by means of certified authentic material certificates. Certification for pressure retaining parts is to ISO 10474 (Type 3.2) as a minimum. (Add.)

8.3.6 All welding shall comply with the requirements of this Specification and ASME B31.3. (Add.)

8.3.7 Welding Processes

8.3.7.1 General

The following welding processes are approved for use: (Add.)

- Shielded Metal Arc Welding (SMAW)
- Gas Tungsten Arc Welding (GTAW)
- Submerged Arc Welding (SAW)
- Gas Metal Arc Welding (GMAW) Spray/Pulse Transfer Only
- Gas Shielded Flux Cored Arc Welding (GSFCAW)

- The use of an alternative welding process is subject to Company approval. Executor should clearly identify the proposed welding process, work experience, level of automation and metal transfer mode. (Add.)

- Gas shielding processes should be restricted to shop welding, but may be used in the field provided sufficient protection is provided from wind. (Add.)

- For classes designated for Sour Service, the Root and Hot pass of each weld shall be undertaken using GTAW, unless written Company approval is given for an alternative process. Autogenously GTAW is NOT permitted. (Add.)
- Generally SAW shall not be used for repair welding unless the original weld was by that process and the removed weld defect is sufficiently large to justify the use of the process for repair. (Add.)

- SAW flux should be stored in accordance with consumable vendor's recommendations, and recycling of flux shall be permitted subject to Company approval. (Add.)

- Use of SMAW in the downhill direction is restricted to utility lines; any other vertical welding shall be done vertical up. (Add.)
- The maximum width of weave shall not exceed two times the bare electrode (core) diameter.

- The maximum individual layer thickness for submerged arc welds shall not exceed 10 mm. recycling of fluxes shall not be permitted for use on materials other than carbon steels. (Add.)

- Gas metal arc welding with solid wire electrodes may only be used in the spray transfer current range. Short circuit transfer process shall not be used. (Add.)

8.3.7.2 Stainless Steels Welding (Add.)

Stainless steels shall not come in contact with unalloyed or low alloy steels. Fabrication of stainless steels shall be done separately in a work area and with tools only to be used for the fabrication of stainless steels.

Austenitic stainless steels are susceptible to hot cracking caused by the high coefficient of thermal expansion of the material in combination with the high affinity of nickel to the pickup of impurities like sulphur, forming low melting nickel sulphides. To avoid this problem a high level of cleanliness is required when welding austenitic stainless steels.

Selection of the welding consumables depends on the type of austenitic SS and the intended service. To prevent any problems during fabrication, heat treatment, welding and service, the following rules shall apply:

- Tack welds shall be made at small intervals.

- Heat input per weld run should be low to avoid too high an interpass temperature and overheating of the weld area.

- Cleanliness is very important; special attention shall be paid to the weld area to avoid carbon pick-up, hardening and hot cracking.

- For GMAW or GTAW welding, backing gas shall be applied to prevent oxidation of the HAZ and weld.

- After heavy oxidation of the weld and HAZ, the corrosion resistance can be restored by pickling

and passivation or by chemical cleaning followed by passivation.

- For most applications a weld consumable is used with a low susceptibility to hot cracking in the weld metal, e.g. a weld metal with 3-8% ferrite.

- To prevent sensitization and weld decay at the grain boundaries, the carbon content for corrosive service is kept below 0.03% C or the parent metal is stabilized with Nb or Ti.

- **Shielding Gases for GTAW (Add.)**

  Austenitic stainless steels Materials are not susceptible to hydrogen embrittlement or hydrogen porosity. The gases Argon (99.99% vol.), Pure Helium (99.995% vol.), Helium/Argon (70/30% vol.), Argon/Helium (70/30% vol.) or gas mixtures consisting of Ar and H2 (95/5 or 90/10% vol.) can also be applied. These gas mixtures will give higher penetration and a lower weld pool viscosity, limiting welding to the down hand position.

- **Shielding Gases for GMAW (Add.)**

  For heat and corrosion resistant high-alloyed steels, e.g. austenitic stainless steel, gas mixtures of Ar with small amounts of O2 and max. 5% CO2 can be used.

  Care must be taken to avoid excessive oxidation of the base/weld metal and carburization due to CO2. Shielding gas mixtures with 99/1, 98/2 and 97/3% vol. Ar/O2 are available. With increased oxygen content, the viscosity of the weld pool decreases and the burn-off rate of the alloying elements increases. The decreased viscosity produces a smooth weld bead appearance but limits the weld position to the horizontal position only.

  To reduce the burn-off rate, an Ar/CO2 (98/2% vol.) gas mixture can be used for the heat resisting alloys. Also adding 1% vol. H2 to either Ar/O2 or Ar/CO2 will reduce the burn off rate. Addition of hydrogen also increases the arc energy (better penetration, better width/ wall thickness ratio and higher welding speed).

- **Backing Gases for Welding (Add.)**

  When welding the root and the first pass, the backside of the weld can be protected to prevent oxidation. The following backing gas applications can be distinguished.

MATERIAL	GAS COMPOSITION
STAINLESS STEEL	N2/H2 (95%/5% - 85%/15%) or Ar (99.99%)

8.4 SEAL WELDS

No amendments or supplements are to state.

8.5 CONTROL OF WELDING CONSUMABLES DURING PRODUCTION WELDING

All welding electrodes/consumables shall be subject to Company approval as part of the WPS. (Add.)

All welding consumables shall be supplied with vendor's Batch Certification – Type certificates for sour service applications are not acceptable. (Add.)

For Sour Service, the maximum level of nickel in deposited weld metal shall be 1.0% mass fraction for all carbon steel and low alloy materials in accordance with NACE MR0175 /ISO 15156. (Add.)

The electrode/consumable chemistry shall meet the requirements of the base material, and shall be selected such that the deposited weld metal exhibits mechanical properties equal to or in excess of the base material. (Add.)
All welding electrodes/consumables shall be stored and used in accordance with the vendors' recommendations. Executor shall demonstrate that there is sufficient control and storage of all welding electrodes/consumables. (Add.)

Carbon steel and alloy electrodes/consumables shall be stored separately.
Low hydrogen electrodes shall be used for carbon steel in sour service, and shall be capable of achieving a maximum hydrogen level of less than 5ml/100g in weld metal. (Add.)

For submerged arc welding, alloying is not permitted via the flux. (Add.)

Welding consumables for austenitic stainless steels shall provide weld deposits with ferrite content in the range 3 to 7 %. (Add.)

Shielding and purging gases shall be welding grade, with a dew point of less than or equal to minus 40ºC, with the essential variables of composition, purity and flow rate stated on the WPS. (Add.)
Active shield gases shall only be used with specific Company approval. (Add.)

9. INSPECTION OF PRODUCTION WELD

9.1 VISUAL INSPECTION

Visual examination shall be performed on all welds. 100% of all weldolet to pipe joints shall be inspected in the root area using mirrors and/or endoscope as required. Examination shall be reported. (Add.)

9.2 INSPECTION BY NON-DESTRUCTIVE TESTING

9.2.1.8 All nondestructive examinations shall be approved by a LEVEL III inspector (Add.) D01

9.2.3 Magnetic particle examination

9.2.3.8 (Del.)

9.2.5 Radiographic examination

9.2.5.16

Radiographic examination for field weld of these pipes shall be performed as per table 9.2.5. (Mod.)

9.2.5.17

Field welds of these pipes shall be examined by radiography rate as per table 9.2.5.

TABLE 9.2.5- RATE OF RADIGRAPHY ON PIPING SYSTEM

ITEM	CONDITION	150 #	300#	600#	900#	1500#	2500#
1	P NO. 1 on Category Normal Fluid Services	10	15	20	50	75	100
2	P NO. >1 on Category Normal Fluid Services	100	100	100	100	100	100
3	P NO. 1 on Category M Fluid Services	20	50	75	100	100	100
4	P NO. >1 on Category M Fluid Services	100	100	100	100	100	100
5	Severe Vibration Services	100	100	100	100	100	100
6	Category D Fluid Services	5	-	-	-	-	-

CONSIDERATION:

1- Field welds of following items shall be examined by radiography of the rate of 100%.

- Crossings of roads
- Changing in wall thickness
- The welds which are not in hydrostatic pressure test.
- Repair welds
- Before and after of each repair welds
- The welds which would be heat treated.
- For each welder quality control in start of welding (Minimum the 10 first welds)
- Changing in welders group

2- According the above table where the rate of radiography has been specified 100% then filet welds or socket welds shall be tested with other non- destructive examinations.

9.2.6 Brinell hardness test

9.2.6.1 Submerged arc welding procedure qualifications for P-1 group materials shall have a hardness not exceeding 225 Brinell in the weld deposit. (Mod.)

9.2.6.2 (Del.)

9.2.6.3 The Brinell hardness testing shall be limited to piping greater than DN 100 (NPS 4) and a wall thickness over 6.35 mm. (Mod.)

10. WELD DEFECTS AND ACCEPTANCE CRITERIA

10.5 Defects, which are outside of the limits of the applicable codes and standards, this specification, project specifications and other requirements stated in the contract/purchase order, shall be cause for rejection. Executor shall take such remedial action as is necessary to secure acceptance. Such work shall be subject to Company approval, and shall be undertaken at the sole expense of Executor. (Add.)

10.6 Welds containing cracks shall be completely removed and the reason for the cracking determined to the satisfaction of Company, before repair welding is permitted. (Add.)

10.7 Unacceptable defects shall be removed by chipping, grinding, machining and/or arc-air gouging. When arc-air gouging is applied all carbon, copper, and other debris, including carburized material, shall be completely removed by grinding, or other mechanical means, until sound material is achieved. A minimum 5mm shall be removed by such mechanical means. (Add.)

11. WELD REPAIR

11.6 Should two or more welder participate in making a defective weld, the Executor and Engineer shall together decide which welder or welder is responsible for the defective work. The Engineer shall have the right to cut out welds for further test (Mod.)

D01

11.7 Welders found to be producing continuously defective work shall be suspended from production welding and subject to re-training, and re-qualification. Such re-training and re-qualification shall be subject to Company review/witness. (Add.)

11.8 All repairs shall be re-inspected in accordance with this specification at Executor's expense. Additionally, additional radiographs of two welds previously performed by the same welder shall be undertaken. These additional welds shall be selected by Company. (Add.)

11.9 Only one repair shall be permitted for non-carbon steel welds, and only 2 repairs for carbon steel welds. (Add.)

11.10 Complete repair of a weld shall include the removal of the weld, re-beveling of new weld

preparations, and re-welding. Weld overlays, which are found to be defective, shall be completely removed and replaced. (Add.)

11.11 All repairs shall be fully documented, including, but not limited to, repair method, welding procedure and qualification, welder qualification, and shall be in accordance with this specification and shall be subject to Company approval. (Add.)

11.12 For partial repairs, the cut-out portion shall be sufficiently deep and long to remove the defect. The ends of the cut-out shall be a gradual taper from the base of the cut to the surface of the weld metal. The width and profile of the cut shall provide adequate access for re-welding to Company satisfaction. (Add.)

11.13 Prior to re-welding NDE shall be applied to confirm complete defect removal. For repairs, the preheat shall be increased by 50ºc. (Add.)

11.14 All welds undertaken using non-approved or unqualified procedures, or unqualified welders/welding operators shall be completely removed and reinstated using only approved and qualified procedures and welders/operators. (Add.)

11.15 Gouging of quenched and tempered steels or other high strength steels shall not be permitted. (Add.)

12. PRE - AND POST - WELD HEAT TREATMENT

12.1 GENERAL REQUIREMENTS

12.1.7 No Post Weld Heat Treatment shall be performed on Austenitic Stainless Steel materials. (Add.)

12.2 PREHEAT REQUIREMENTS

No amendments or supplements are to state.

12.3 POST-WELD HEAT TREATMENT (PWHT)

12.3.2 P.W.H.T. requirements

12.3.2.7 (Del.)

12.3.2.9 (Del.)

12.3.2.10 (Del.)

12.3.2.11 (Add.)

D01 For materials which are in contact with sour services to be welded are more and equal than 12.7mm in thickness post weld heat treatment shall be required. However, the hardness testing and metallographic testing of HAZ and Weld metal must be considered in WPS and PQR for necessity of PWHT to ensure that welds are fully stress relieved.

12.3.4 Hardness Test

For sour carbon steel welds only, production hardness tests shall be carried out using a calibrated portable hardness tester in accordance with a written procedure approved by Company. The maximum permitted hardness reading shall be 248Hv10 (237HB) for carbon steel and low alloy materials for sour service applications and 275Hv10 for non-sour applications. (Add.)
Hardness indentations shall be a taken at a maximum spacing of 0.5mm within the HAZ.

For sour service carbon steel pipe welds, where production harnesses exceed the above limits (but are less than or equal to 275Hv10), Executor may undertake 3 additional hardness tests on the same weld at an adjacent location, all of which shall satisfy the specification requirements. Failure to achieve the requirements will result in the weld being rejected. Executor has the option to remove (cut-out) the affected weld, or subject to Company approval and suitable welding procedure qualification, may undertake post weld heat treatment of the joint, after which all NDE and hardness testing shall be repeated. (Add.)

12.3.5 Charpy Impact Tests (ADD.)

Charpy Impact tests for CS components in contact with sour services shall be carried out in accordance with the minimum design metal temperature (MDMT) stipulated in the line list. The acceptance criteria shall be to ASME B31.3 code.

- Charpy Impact tests shall be carried out for Thickness > 6mm up to < 40mm.
- Minimum required charpy V-notch impact values would be as per table 1.

Table 12.3.5-Minimum Required Charpy V-Notch Impact Values

Specified Minimum Tensile Strength	No. of Specimens	Energy	
		Fully Deoxidized Steels	Other Than Fully Deoxidized Steels
		Joules	Joules
Carbon Steels			
448 MPa (65 ksi) and less	Average for 3 specimens	18	14
	Minimum for 1 specimen	16	10

13. NON-DESTRUCTIVE EXAMINATION OF WELDINGS (ADD.)

Non- destructive tests shall also meet requirements of procedure provided by NISOC in attachment 1.

ATTACHMENT 1

NON DESTRUTIVE TESTS