ADNOC GROUP PROJECTS AND ENGINEERING

SPECIFICATION FOR LINEPIPE

Specification

AGES-SP-10-001

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GROUP PROJECTS & ENGINEERING / PT&CS DIRECTORATE

CUSTODIAN	Group Projects & Engineering / PT&CS
ADNOC	Specification applicable to ADNOC & ADNOC Group Companies

Group Projects & Engineering is the owner of this Specification and responsible for its custody, maintenance and periodic update.

In addition, Group Projects & Engineering is responsible for communication and distribution of any changes to this Specification and its version control.

This specification will be reviewed and updated in case of any changes affecting the activities described in this document.

INTER-RELATIONSHIPS AND STAKEHOLDERS

a) The following are inter-relationships for implementation of this Specification:

   i. ADNOC Upstream and ADNOC Downstream Directorates and

   ii. ADNOC Onshore, ADNOC Offshore, ADNOC Sour Gas, ADNOG Gas Processing. ADNOC LNG, ADNOC Refining, ADNOC Fertilisers, Borouge, Al Dhafra Petroleum, Al Yasat

b) The following are stakeholders for the purpose of this Specification:

   ADNOC PT&CS Directorate.

c) This Specification has been approved by the ADNOC PT&CS is to be implemented by each ADNOC Group company included above subject to and in accordance with their Delegation of Authority and other governance-related processes in order to ensure compliance

d) Each ADNOC Group company must establish/nominate a Technical Authority responsible for compliance with this Specification.

DEFINED TERMS / ABBREVIATIONS / REFERENCES

"**ADNOC**" means Abu Dhabi National Oil Company.

"**ADNOC Group**" means ADNOC together with each company in which ADNOC, directly or indirectly, controls fifty percent (50%) or more of the share capital.

"**Approving Authority**" means the decision-making body or employee with the required authority to approve Policies & Procedures or any changes to it.

"**Business Line Directorates**" or "**BLD**" means a directorate of ADNOC which is responsible for one or more Group Companies reporting to, or operating within the same line of business as, such directorate.

"**Business Support Directorates and Functions**" or "**Non- BLD**" means all the ADNOC functions and the remaining directorates, which are not ADNOC Business Line Directorates.

"**CEO**" means chief executive officer.

"**Group Company**" means any company within the ADNOC Group other than ADNOC.

"Specification" means this Onshore Pipelines Design and Construction Specifica

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I Introduction

I.1 SCOPE

I.1.1 This Specification shall be read in conjunction with 'Line Pipe', API Specification 5L 46th edition. All other clauses of API Specification 5L which are neither modified nor supplemented shall be fully applicable as part of this Specification.

I.1.2 This document defines ADNOC minimum requirements for the seamless and single seam SAWL pipes manufactured in accordance with product specification level 2 (PSL 2).

I.1.3 Section II of this document consists of ADNOC quality assurance requirements

I.1.4 Section 0 amends/supplements various clauses of API Specification 5L. The clause numbering in this section is the same as in API.

I.1.5 This document replaces the following ADNOC line pipe specifications;

1. ES-30-99-00-0106
2. ES-30-99-00-0105
3. DGS-9510-001
4. DGS-9510-002
5. DGS-PU-623
6. DGS-PU-320
7. A0-ENG-M-STD-001
8. A0-ENG-M-STD-002

I.2 EXCLUSION

This Specification does not cover cast iron or non-metallic pipes.

PSL1 line pipe, double seam welded pipe, jointers, intermediate grades, couplings and end welds are also not applicable.

For HFW line pipe, refer to ADNOC specifications.

I.3 DEFINITIONS

The terms used in this document are defined as below.

Definitions	
Company	Abu Dhabi National Oil Company or any of its group companies. It may also include an agent or consultant authorized to act for, and on behalf of the COMPANY
Contractor	The party which carries out all or part of the design, engineering, procurement, construction, commissioning or management of the project.
Manufacturer /Vendor /Supplier	The party (parties) which manufactures and/or supplies materials, equipment, technical documents or drawings and/or services to perform the duties specified by the Company.
may /can	Is used where alternatives/actions are equally acceptable.
must	Indicates a legal or statutory requirement
shall	Indicates mandatory requirement
should	Indicates a strong recommendation to comply with the requirements of this document.
Technical deviation/ concession request	A deviation requested by the Contractor, Usually after receiving the contract package or purchase order. Often, it refers to an authorization to use, repair, recondition, reclaim, or release materials, components but doesn't comply with project requirements. A concession request is subject to Company approval.

II Quality Requirements

II.1 Quality control / assurance

II.1.1 The Manufacturer and its sub-suppliers shall operate a Quality Assurance system in accordance with ISO 9001 or ISO/TS 29001, approved by a Company recognized authority. The Quality Manual shall be submitted prior the start of work. It shall be in particular demonstrated that a continuous improvement program is in place.

II.1.2 Contractor and Supplier shall follow Company “Projects Quality System Requirements” and "Criticality Rating specs”.

II.1.3 Responsibility for quality control shall rest with the Manufacturer aided by such staff as may be required. Contractor (and/or Company) shall delegate second party inspection during the entire manufacturing.

II.1.4 The Manufacturer shall maintain quality records as documentary evidence of compliance with quality requirements. Quality records shall be available to the Inspector for analysis and review.

II.1.5 The Contractor shall employ competent supervisors to ensure that both the standard of workmanship and the quality of materials used comply with the requirements of this specification.

II.2 Start of production

II.2.1 Pipe production shall not start without the approval of the Company and until a pre-inspection meeting has been held between the Company, the Contractor, the Manufacturer and the Inspector.

II.2.2 Just before production starting, mill QA Representative accompanied by Inspector shall check at every production and inspection station, that the relevant working instructions and procedures are available, complete, conform to the procedures agreed by Company or to Company specification requirements. A report shall be issued by Supplier, signed by Inspector and enclosed with the final dossier.

II.3 Technical Queries / Non-Conformance Reports

II.3.1 After Contract award, any Supplier’s requests for clarifications to Company specifications shall be submitted only through Technical Queries (TQ).

II.3.2 Deviations shall not be accepted after awarding, supplier had to clarify all deviation during Bid stage.

II.3.3 Approval given by the Company to any Manufacturer’s work procedures, specifications, equipment, etc. shall not release in any way the Manufacturer from his obligation to meet the Company specifications.

II.3.4 Any work performance or test result which is found, at a later date, not in conformance with Company specifications or agreed procedure shall be subject to a Non-Conformance Report (NCR) to be issued by the Manufacturer for submission to Company. NCR report shall indicate corrective action intended by the Manufacturer.

II.4 Quality assurance

II.4.1 Heat treatment facilities and associated equipment shall be qualified and certified according to the requirements of NORSOK M-650, API SPEC 6A, and ASTM A991.

II.4.2 Recording of all quality heat treatment shall be available for review upon Company inspector request.

II.5 Certification Type

The following material test certificates as per BS EN 10204 shall be followed.

#	Equipment / Item Description	Criticality Rating	Sub-Component Certification (2.1 / 2.2 / 3.1 / 3.2)	Inspection Level	Product Certificate
1	Welded Line Pipe (SAW)	1	3.2 (Plates / Welding consumables)	I	3.2
2	Seamless Line pipe	1		I	Note-4

Notes: 1. Final surface inspection (Eddy Current) shall be conducted after heat treatment stage.
2. All 3.2 certificate shall be signed by manufacturer and third party (certifying body) only
3. IRNs shall be endorsed by Contractor / Company TPI before dispatch
4. 3.2 For Seamless Line pipe X-60 and above, X-52 and below size > 6in and 3.1 Seamless Line pipe X-52 and below (max. dia. 6in).

II.6 Documentation

Stage	Requested documentation
At the bid stage	• Name of steel mill, plate mill and pipe mill (if the pipe mill is not an integrated pipe mill) • Description of steel making process • Slab / billet casting method, sequences and weight • Nominal weight of each heat • Aimed chemical composition and its tolerance which are selected and guaranteed by Supplier for the Order • As-delivery condition of pipe base steel (heat treatment), typical metallurgical microstructure and grain size • Copy certificate of quality management system (ISO/TS 29001, API SPEC Q1, ISO 3834, etc.) • Preliminary Inspection and Test Plan (ITP) / Quality Control Plan (QCP) • A preliminary pipe Manufacturing Procedure Specification (MPS) • Details of offered fabrication Pipe History System (PHS) • Weldability test specification (when applicable) • Pipe supply track record as well as histograms of chemical and mechanical test results from previous orders of the same pipe grade and similar dimensions, as proof of capability to produce pipes according to this specification • The Supplier's deviations/qualifications to present specification. Where no deviations are stated in the bid, the potential Supplier shall be considered as fully accepting the requirements of present specification. • List of sub-Contractors (if any) and scope of work.
Before starting Pipe MPQT	Latest revised and Company approved documentation shall be submitted: • Inspection and Test Plan (ITP) / Quality Control Plan (QCP), • Manufacturing Procedure Specification • Scraps selection procedure. • Steel making and casting procedure

Stage	Requested documentation
	• Traceability procedure • Heat treatment procedure • NDT procedures (EMI, AUT, MPI, visual …) • Hydrostatic test procedure • Dimensional inspection procedure. • Drawings for specimens sampling for MPQT and production tests (CAD drawings shall be issued and transmitted to Company in a PDF format).
Before starting production	• Copy of MPQT report and test results • Quality control plan filled and stamped by all parties including NDT and dimensional reports (at this stage destructive tests report is not required).
After MPQT	• MPQT tests report except SSC and HIC tests reports shall be submitted to Company review and approval latest 2 weeks after production start.
During production	• As per inspector request and in accordance with the present specification. • Production test results shall be transmitted to Company. • Non conformity reports if any.
Before shipment.	3.2 Mill test certificates according to EN 10204 shall be issued by the pipe Manufacturer and signed, dated and stamped by the Third Party Inspector. Mill certificates shall make reference to API SPEC 5L the present Company specification and applicable PPS. Mill certificates shall state the following: 1. As-delivery condition of pipes with heat treatment conditions 2. Ladle analysis including Carbon Equivalent and PCM 3. Pipe no. with reference to heat no. (and billet no. where possible) 4. Mechanical test results and product chemical analysis (including CE and PCM) with reference to pipe no. 5. Results of dimensional inspections 6. Non-destructive tests performed with results 7. Any supplementary tests and inspections carried out.
Final dossier after pipe production (max. 1 month after the end of pipe production)	1. Record of pipe manufacturing procedure qualification test results 2. Weldability test specification and reports, if any 3. Mill hydrostatic test certificate of compliance 4. Mill certificates of pipes 5. Dimensional and NDT reports of pipes 6. Any other quality control reports or acceptance certificates 7. List of heat numbers showing pipe numbers, individual length and weight, total length and weight produced per cast 8. Pipe list with sequential numbers of produced pipes related to heat numbers 9. Records of wall thickness 10. Histograms of production test results (chemical and mechanical) and dimensions of pipes (length, as a minimum - if required in PPS) 11. Fabrication Pipe History 12. Compilation of all concessions/deviations, if any, granted by Company 13. Compilation of non-conformance and associated root cause analysis.

II.7 Inspection & Test Plan (ITP)

#	Description	Inspection Level - 1
1	**Operational planning and control activities**	
1.1	Quality plan	H
1.2	Inspection and test plan	H
1.3	Pre-Inspection / Pre-production planning	H
1.4	Pre-production start readiness review	H
2	**Design and development activities**	
2.1	**Manufacturing Procedure Specification (MPS)**	
2.1.1	Steelmaking and casting – for all pipe	H
2.1.2	Pipe Manufacturing – for all pipe	H
2.1.3	Hot rolling for welded pipe	H
2.1.4	Secondary processing (if applicable) - for welded pipe	H
2.1.5	Pipe manufacture – for welded pipe	H
2.1.6	Pipe manufacture – for SMLS pipe	H
2.1.7	Definition of essential variables	H
2.2	**Manufacturing Procedure Qualification Tests**	
2.2.1	Mandatory Tests as applicable	H
2.2.2	Welding Procedure Qualification (WPQR)	H
2.2.3	Weldability testing	H
2.2.4	plate tensile property variability analysis	H
2.2.5	Non-destructive testing process and personnel qualification	H
2.3	**Manufacturing Procedure Re-Qualification**	
2.3.1	MPS Revision reflecting changes in essential variables	H
2.3.2	MPS requalification, see 2.2 above	H
3	**Control of external supply**	
3.1	External supply scope, risk assessment and controls (ISO 9001, 8.4)	H
3.2	Nominated sub-suppliers of Steel (plate, billet) as per MPS	H
3.3	Nominated sub-suppliers of welding consumables as per MPS	H
3.4	Nominated sub-suppliers of NDE services as per MPS	H
4	**Production and service provision**	
4.1	**Starting Materials Verification** (surveillance against MPS)	
4.1.1	Starting Material (billet and plate) certification	S
4.1.2	Welding consumables certification	S
4.2	**Seamless Pipe Production** (surveillance against MPS)	

#	Description	Inspection Level - 1
4.1.1	Billet pre-processing, heating	S
4.1.2	Pipe rolling	S
4.1.3	Heat treatment	S
4.1.6	Straightening	S
4.1.7	Cropping / end facing-sizing	S
4.3	**Welded Pipe Production** (surveillance against MPS)	
4.3.1	**Pre-processing and Fabrication**	
a)	Plate pre-processing	S
b)	Tab welding (see 4.3.2 below)	S
c)	Edge preparation - cutting milling preforming- crimping	S
d)	Pipe forming	S
e)	Bevel cleaning and fit up	S
4.3.2	**Welding**	
a)	Welding equipment	S
b)	Welder qualifications	S
c)	Consumable control	S
d)	Tack welds	S
e)	Weld seams	S
f)	Weld repairs	S
4.3.3	**Post welding processing**	
a)	Cold expansion	S
b)	Heat treatment	S
c)	Straightening	S
d)	Cropping / end facing-sizing	S
4.4	**Production Inspection & Testing**	
4.4.1	Material Traceability	W
4.4.2	Mechanical Testing	W
4.4.3	Hydro testing	W
4.4.4	Hydro test Failure Investigation	H
4.4.5	Visual Inspection	W
4.4.6	Dimensions and Weight	H
4.4.7	Non-destructive inspection	H
4.4.8	Reprocessing	S
4.4.9	Retesting	H

#	Description	Inspection Level - 1
5	**Release of product or service**	
5.1	**Verify conformance to PO including as applicable**	
5.1.1	Manufacturer's certificates of conformance for shipment	H
5.1.2	Pipe Handling, preservation and loading	S
5.1.3	Final documentation review as per MRB Requirements.	H
5.1.4	Release Line pipe shipment	H

H	: Hold Point
W	: Witness Point
S	: Surveillance
R	: Review

III Technical Requirements

2 NORMATIVE REFERENCES

Add to the section

ASTM E112	Standard Test Methods for Determining Average Grain Size
BS 8701	Full ring ovalization test for determining the susceptibility to cracking of linepipe steels in sour service – Test method
GDL-040	Concession request

Unless otherwise specifically indicated in writing by the Company, the Supplier shall work in accordance with the requirements specified herein and the applicable requirements of the latest editions of the referenced codes, standards and technical documents, whenever indicated in this standard.

The requirements of this standard shall take precedence over the referenced codes, standards and technical documents. Where this standard states no overriding requirements, the referenced codes, standards and technical documents shall apply in full.

Standard documents equivalent to those referred to herein shall not be substituted without written approval from Company. Approval of equivalent standard documents shall not, in any way, remove responsibility from Contractor or third parties to meet the best practices and/or requirements of the technical standard documents referred to herein, in the event of conflict.

Any technical deviations to this document and referenced Company technical standard documents, international codes and standards and project documents, including, but not limited to, the data sheets and job specifications, shall be sought by the Vendor/Contractor as per Company GDL-040 for Company's review and approval, prior to the proposed technical changes being implemented. Any deviation based on non-technical basis, including cost and schedule, shall be rejected. Technical changes implemented prior to Company's approval are subject to rejection.

Where differences and/or conflicting issues occur between the referenced documents themselves or the requirements of this document, the requirements of this document shall overrule unless otherwise advised by Company. However, all differences/ conflicts shall be reported in writing to the Company standards team for arbitration/resolution before fabrication commences.

The following hierarchy of adherence to standards shall be followed:

a. Whenever Company technical standard documents relevant to the system, service and/or equipment design are available, the same shall be utilized first.

b. National or international standards (tailored to suit Company needs) shall be utilized, if the required subject is not covered by Company.

Contractors, Suppliers or third parties shall equip themselves with copies of all the referenced technical standard documents and shall make them readily available to all Company, or nominated representative, personnel involved in the work.

3 TERMS, DEFINITIONS, SYMBOLS, AND ABBREVIATIONS

3.3 Abbreviations

Add to the section

DWTT	Drop Weight Tear Test
ITP	Inspection and Test Plan
MPa	Mega Pascal
MPQ	Manufacturing Procedure Qualification
MPS	Manufacturing Procedure Specification
PWHT	Post Weld Heat Treatment
QA	Quality Assurance
QC	Quality Control
SMTS	Specified Minimum Tensile Strength
SMYS	Specified Minimum Yield Strength
SOHIC	Stress Orientated Hydrogen Induced Cracking
SSC	Sulphide Stress Cracking
TPA/I	Third Party Agency/Inspector
UTS	Ultimate Tensile Strength

4 CONFORMITY

4.1 Units of Measurement

Replace the section with

Metric units shall apply.

5 COMPLIANCE TO THIS SPECIFICATION

This standard adopts sampling as a method to determine batch compliance. Nevertheless, the Manufacturer is responsible to ensure and certify that all pipes meet the requirements of this standard.

5.1 Quality

Add to the section

See Section II for ADNOC quality requirements.

6 PIPE GRADES AND STEEL GRADES, AND DELIVERY CONDITION

6.1 Pipe Grades and Steel Grades

6.1.4 Product Specification Level

Add a new section

Where not otherwise modified by this standard, PSL2 shall apply (PSL1 shall not be used without Company approval (subject to meeting additional test requirements)).

6.1.5 Grades

Add a new section

This standard covers grades from API 5L Grade B up to and including grade X65. (SMYS = 65,000 psi, 450 MPa). Either of the new grade designations can be used (ie. Lxxx or Xyy etc) in addition to the delivery condition of the pipe (R, N, Q, T), see Table 1 (PSL2).

Higher grades with proven weldability and sour service compliance such as X70 or X80 may be considered subject to Company approval.

Additional higher grade pipe shall not be substituted for pipe ordered to a lower grade without the Company approval, irrespective of strength level (also refer to section 9.1.2).

6.2 Delivery Condition

6.2.2

Add to the section

Unless specified otherwise in the purchase order, all line pipes supplied conforming to this standard shall be in quenched and tempered condition. Pipes of lower grades shall be supplied either normalized or normalizing formed or quench & tempered.

Note: Normalizing forming is a forming process in which the final deformation is carried out in a certain temperature range leading to a material condition equivalent to that obtained after normalizing. When normalizing forming is chosen, the finishing temperature shall be greater than 780°C. Pipes finished at a lower temperature than 780°C shall be subject to a further normalizing heat treatment.

The material supplied must be suitable for induction forming into bends. If the CONTRACTOR wishes to supply material manufactured by the thermomechanically controlled rolling process, then supporting data shall be submitted at the bid stage showing that the material proposed can be hot formed in accordance with the Company hot induction bend specification and still retain the tensile, Charpy and hardness properties defined in this specification.

Pipes fabricated from thermomechanical rolled material may not be suitable for hot (induction) bending unless the chemistry is modified to increase strength, or specific post bend heat treatments are undertaken.

7 INFORMATION TO BE SUPPLIED BY THE PURCHASER

Add to the section

Purchaser information shall be summarized in the line pipe data sheet (Section IV) or as stated in the purchase order.

The Purchase Order shall include the following information:

a. Quantity (e.g. total mass or total length of pipe)

b. PSL (2) only

c. Type of pipe (see Table 2)

d. Reference to ISO 3183,

e. Steel grade (see 6.1, H.4.1.1 or J.4.1.1, whichever is applicable),

f. Outside diameter and wall thickness (see 9.11.1.2),

g. Length and type of length (random or approximate) (see 9.11.1.3, 9.11.3.3 and Table 12),

h. Confirmation of applicability of all individual annexes. Requirements of Annex J shall apply for the offshore service and the requirements of Annex H shall apply for the sour hydrocarbon service.

8 MANUFACTURING

8.1 Process of Manufacture

Add to the section

The steel shall be fully killed and manufactured by the electric furnace or basic oxygen process, and made to fine grain, low hydrogen and clean steel practice with a grain size of ASTM 7 or finer as defined in ASTM E 112. For quenched and tempered pipe, this grain size requirement shall not apply.

The steel shall be made to a clean steel practice using either the basic oxygen steel making process or the electric furnace process and shall be fully killed, and vacuum degassed while molten calcium treated for inclusion shape control to increase resistance to Hydrogen-Induced (blistering and stepwise) Cracking (HIC) (refer to Annex H section H.3.2.

The Supplier shall provide the Company at the bid stage with a technical specification giving full details of all the characteristics of the proposed steel, the plate source (if the Manufacturer does not have integral steel making facilities) the steel making process, castings, the plate manufacturing process and the inspection procedures.

The Supplier's specification shall include as a minimum the information listed below concerning the steel making process:

a. Name of billet/plate manufacturer and mill.

b. Audit record of steel plate supplier (if steel making is not integral).

c. Steel making process including description of desulphurization technique (s), inclusion shape control, methods of monitoring shape control and de-oxidation practice.

d. Aim chemical composition, minimum and maximum working limits (ladle and check) of chemical composition of base steel.

e. Delivery condition of pipe base steel (heat treatment), typical metallurgical microstructure.

f. Name of pipe manufacturing mill.

g. Pipe manufacturing procedure.

h. Suitability of material for field welding and weldability tests specification.

i. Previous test data on HIC and SSC from pipe body.

j. Histograms of past performance showing chemical and mechanical properties shall also be supplied as proof of capability to produce pipes according to this standard.

k. At Supplier's option, any other technical information related to the proposed pipe supply.

When the properties of plate material are dependent upon control of rolling temperature, the mill shall be adequately instrumented to ensure proper control and hence consistency in the physical properties of the product. The finish rolling temperature shall be part of the approved mill procedure.

Prior to rolling, all surfaces of the slab shall be inspected for defects. Hot scarfing, if deemed necessary, shall be carried out prior to hot rolling.

Note: The above steel making process shall apply to both sour and non-sour applications.

8.2 Processes Requiring Validation

Add to the section

Validation of the process for Manufacture of Seamless pipe shall be covered in the MPS & MPQ testing. See new clause 8.14.

8.3 Starting Material

8.3.1

Add to the section

The plates used as starting material for the manufacture of pipe shall be made from steel made by the basic oxygen or electric-furnace process. The steel shall be fully killed and made according to fine grain practice. The plate used for the manufacture of the pipe shall not contain any repair welds.

Plates shall be in any of the following heat treated conditions:

a. Normalized or normalized-rolled condition.

b. As rolled.

c. Thermo-mechanically rolled.

d. Quenched and tempered.

e. Normalizing forming

Note: Normalizing forming is a forming process in which the final deformation is carried out in a certain temperature range leading to a material condition equivalent to that obtained after normalizing. When normalizing forming is chosen, the finishing temperature shall be greater than 780°C. Pipes finished at a lower temperature than 780°C shall be subjected to a further normalizing heat treatment.

Plate edges shall be sheared, prior to preparation for welding, to remove a width of plate equal to the plate thickness.

Plates shall be subject to ultrasonic inspection for internal imperfections and thickness (refer to clause E.3.1.2).

8.6 Weld Seams in SAW Pipe

Add to the section

The pipe shall be manufactured from plates by cold forming (UOE, JCO or 3-roll bending) process and mechanical expansion. The full length of the weld seam shall be made by automatic submerged arc welding, using run-on and run-off tabs. After execution of the longitudinal seam, the run-on and run-off tabs shall be removed only by flame cutting or sawing.

The qualified welding procedure shall be approved by the Company and shall be submitted as part of the ITP.

Welding shall be checked at regular intervals to ensure that current, voltage and travel speed remain within the ranges of the welding procedure.

Welding consumables for both submerged arc and repair welding shall produce deposited weld metal with less than 1% Nickel.

Batch test certificates shall be supplied for all consumables and all batches used in production shall be recorded. Production testing shall represent each batch of welding consumables.

8.7 Weld Seams in Double-seam Pipe

Add to the section

This type of pipe is unacceptable, unless specifically requested by the Company.

8.9 Cold Sizing and Cold Expansion

8.9.4

Add new section

SAW pipe shall be cold expanded or cold formed. The permanent strain due to expansion shall be in the rnge 0.8 - 1.5%.

8.11 Jointers

Replace the section with

Jointers are not permitted.

8.12 Heat Treatment

Add to the section with

The quenching and tempering is required for all pipe grades as it helps in removing the residual stress that would prevent pipe failure or stress cracking.

8.14 Manufacturing Procedure Specification and Qualification

Add new section

The Manufacturer shall submit MPS for each product and manufacturing route. The minimum required contents of the MPS are listed in Annex B. The MPS shall be qualified by MPQ testing, as detailed in Annex B.

No change may be made to a successfully approved and qualified MPS without the approval of the Company. The Manufacturer shall submit the revised MPS and as part of the approval process, unless otherwise agreed by the Company, any change to the MPS shall require re-qualification. Details of final operations performed during pipe manufacturing shall be included (final reheating practice and hot sizing or stretch reducing, cold finishing, and heat treatment).

The Manufacturer shall propose a nominal product analysis in MPS. The range of acceptable variations in the product analysis is given in Table H.1 or J.1. This shall be applied to the chemical composition proposed by the Manufacturer in the manufacturing specification. The maximum variation on agreed composition is allowed provided that the final maximum alloy content given in Table H.1 or J.1 is not exceeded.

8.15 Mother Pipes for Bends

Add new section

Mother pipes should be from the same source and manufacturing procedure as the line pipes. Alternative sources or manufacturing methods of mother pipes shall be subject to the purchaser's acceptance. If bend supply is under the responsibility of the manufacturer, the chemical composition and the mother pipe wall thickness and MPS shall be accepted by the bend fabricator.

NOTE: If the bend supply is not within the manufacturer's scope, it is recommended that the purchaser validates the chemical composition and mother pipe MPS and wall thickness with the bend fabricator or by reviewing historical data.

The ratio of yield strength to tensile strength in base metal shall not exceed 0.90 in line with ASME B16.49 and as required in the Company hot induction bend specification.

9 ACCEPTANCE CRITERIA

9.1 General

9.1.2

Replace the section with the following

Substitution of the ordered specific grade by another grade is not allowed.

9.2 Chemical Composition

9.2.2

Replace the section with the following

For PSL 2 pipe with t ≤ 25.0 mm (0.984 in.), the chemical composition for standard grades shall be as specified in Table J.1.

For sour service, Table H.1 shall be used.

9.2.3

Replace the section with the following

For PSL 2 pipe with t > 25.0 mm (0.984 in.), the chemical composition shall be agreed with the purchaser, with the requirements of Table J.1 being amended as appropriate. For sour service, the amendments to Table H.1 shall be agreed.

9.2.4

Modification

Replace '(see Table 5)' with '(see Table J.1)'

9.2.5

Modification

Replace '(see Table 5)' with '(see Table J.1)'

9.2.6

Add new section

For Grade B pipe, only C, Mn, Si, S and P levels shall be determined. For higher grades, analysis for other elements in the following table shall also be performed. The intentional addition of elements not specified in Table J.1 or H.1 shall not be permitted without prior written approval from the Company.

For pipe grades other than Grade B, the elements listed in new Table 28, below, shall be determined for the first three heats (on product) and shall not exceed the limits indicated in this table.

Table 28 - Other Elements

Element	Product Analysis (Weight %)
Tin (Sn)	0.015
Antimony (Sb)	0.010
Bismuth (Bi)	0.005
Lead (Pb)	0.005
Arsenic (As)	0.020

Should the above analysis from the first three heats be below the maxima for all elements, the frequency of analysis for these elements may be reduced to one in ten heats.

9.3 Tensile Properties

9.3.2

Replace the section

For PSL 2 pipe, the tensile properties shall be as given in J.4.2 and Table J.2.

The required minimum tensile elongation shall not be less than 20% for a gauge length of 50mm.

To date, X65 is the highest grade used by ADNOC. X70 or higher grade shall not be used until trials and tests are carried out to ensure that all requirements for HIC/SSC, hardness, weldability and suitability are met.

9.4 Hydrostatic Test

9.4.3 Guarantee

Add new section

MANUFACTURER shall bear all costs to seek, find, and repair all leaks and/or ruptures which occur during field hydrostatic testing, and which result from defects traceable to the manufacture of the pipe. The field test will not exceed a pressure that will cause a circumferential fiber stress greater than 100 percent of the specified minimum yield strength of the pipe. The COMPANY may elect to raise and lower the field test pressure one or more times either as part of a planned testing routine, or as a consequence of a failure in the pipeline, or in the testing equipment; however, these pressure cycles shall in no way relieve the MANUFACTURER of its obligations.

9.8 CVN Impact Test for PSL 2 Pipe

9.8.2 Pipe Body Tests

9.8.2.1

Replace the section with

For a set of three test pieces, the minimum average absorbed energy for each pipe body test shall be as given in Table 8, based upon full-size test pieces and a test temperature as specified in the new Table 29 below.

For rich gas transmission, lean natural gas at pressures greater than 80 bar, and two phase pipe lines, higher absorbed energy may be required to avoid the risk of running fractures and the same may be specified in the data sheet (Section IV)

Replace Table 8 with

Table 8 – CVN Absorbed Energy Requirements for Pipe Body of PSL 2 Pipe

Specified Outside Diameter *D* mm (in.)	Full-size CVN Absorbed Energy, min *KV* J (ft·lbf)						
	Grade						
	≤ L415 or X60	> L415 or X60 to ≤ L450 or X65	> L450 or X65 to ≤ L485 or X70	> L485 or X70 to ≤ L555 or X80	> L555 or X80 to ≤ L625 or X90	> L625 or X90 to ≤ L690 or X100	> L690 or X100 to ≤ L830 or X120
≤ 508 (20.000)	54 (40)	60 (44)	60 (44)	60 (44)	60 (44)	60 (44)	60 (44)

> 508 (20.000) to 762 (30.000)	54 (40)	60 (44)	60 (44)	60 (44)	60 (44)	60 (44)	60 (44)
> 762 (30.000) to 914 (36.000)	54 (40)	60 (44)	60 (44)	60 (44)	60 (44)	60 (44)	60 (44)
> 914 (36.000) to 1219 (48.000)	54 (40)	60 (44)	60 (44)	60 (44)	60 (44)	60 (44)	68 (50)
> 1219 (48.000) to 1422 (56.000)	54 (40)	60 (44)	60 (44)	60 (44)	60 (44)	68 (50)	81 (60)
> 1422 (56.000) to 2134 (84.000)	54 (40)	68 (50)	68 (50)	68 (50)	81 (60)	95 (70)	108 (80)

NOTES:

i. Only one test piece is allowed to have an individual value less than the minimum average value.
ii. For grade B and X42, the value in the table shall be 27. For grade X52 it shall be 55 KVJ.

Table 8 is for full size (10mm x 10mm) transverse specimens. For other specimen sizes and orientations, the above values shall be multiplied by the following factors:

Size (mm)	**Orientation**	**Factor**
10 X 10	Longitudinal	1.5
10 X 7.5	Transverse	0.75
10 X 7.5	Longitudinal	1.125
10 X 5.0	Transverse	0.5
10 X 5.0	Longitudinal	0.75

Add new table

Table 29 – CVN Impact Testing Temperature T_O (°C) as a Function of T_{min} (°C)

Specified Wall Thickness *t* (mm)	**Pipelines**	
	Gas	**Liquid**
$t \leq 20.0$	$T_O = T_{min} - 10$	$T_O = T_{min}$
$20.0 < t \leq 40.0$	$T_O = T_{min} - 20$	$T_O = T_{min} - 10$
$t > 40$	T_O to be agreed in each case	

Notes:

1. T_{min} is the minimum design temperature.
2. Mixed gas and liquid(s) shall be regarded as gas.

3. Increasing thickness shall require lower test temperatures. Alternatively higher absorbed energy at the same temperature shall be required.

9.9 DWT Test for PSL 2 Welded Pipe

9.9.1

Replace the first paragraph with

Drop-Weight Tear Tests (DWTT) are required for pipelines of grade X52 or higher with a pipe diameter of DN 400 (16 inch) or greater designated for multiphase fluids, sour, rich gas or lean natural gas at pressures greater than 80 bar. The testing temperature shall be 0°C (or 10°C below the minimum design temperature, whichever is the lower) and the required minimum individual shear area shall be 85%.

9.10 Surface Conditions, Imperfections and Defects

9.10.1 General

9.10.1.1

Add to the section

The internal surface of all sour service seamless and SAW line pipes shall be free from scabs, laps, shells, slivers, burrs, metallurgical tears, laminations and sharp edged discontinuities that will influence pipeline integrity. Repairs of the internal surface defects are not permitted.

The external surface of line pipe shall comply with API Specification 5L requirements & external pipeline coatings applicator requirements to avoid any possible delay during the coating application.

9.10.1.2

Add to the section

The location of all cracks, sweats and leaks shall be clearly marked and the pipe length set aside for investigation by the Company.

9.10.1.3

Replace the section with

The acceptance criteria for imperfections found by nondestructive inspection shall be in accordance with Annex E or Annex K as applicable.

9.10.1.4

Add a new section

The manufacturer shall take all reasonable precautions to ensure that the pipe surface is free from imperfections that might interfere with the efficient application of an external coating. In addition, the metal surfaces shall be sufficiently clean and smooth to permit non-destructive examination. All loose scale shall be removed, and pitting and rough surfaces shall be removed by grinding. Pipe shall have a workmanlike finish, and the manufacturer shall remove by grinding, mechanical marks and abrasions, such as cable marks, scores, etc. Imperfections such as scabs, seams, laps, tears, and slivers shall also be removed. The remaining wall thickness shall be within the specified wall thickness tolerances.

The pipe shall contain no dents which affect the curvature of the pipe at the longitudinal weld or at the pipe ends. Pounding out or jacking out dents is prohibited.

All cold-formed dents with a sharp bottom gouge and all sharp gouges, without dents, deeper than one mm shall be considered defects which require repair or rejection. Repair shall only be permitted with the approval of the company representative.

The internal surface of the line pipe shall me made free from mill scale after quenching and tempering.

Blast cleaning and examination of surface imperfections and defects is required.

9.10.2 Undercuts

b)

Replace the clause with

Any undercut exceeding 0.5mm depth shall be removed by grinding. The final wall thickness after grinding shall not be less than the specified minimum wall thickness.

9.10.3 Arc Burns

9.10.3.1

Add to the section

Repair by welding is not permitted.

9.10.4 Laminations

Replace the section with

Surface and non-surface breaking laminations are not permitted on the prepared pipe ends. Any surface tears and slivers on the body of the pipe shall be removed by grinding. Where such defects penetrate into the body of the pipe (i.e. to a depth of greater than 5% of wall thickness) they shall be assessed by ultrasonic testing and, if they exceed the tolerance for laminations, the pipe shall be rejected.

9.10.5 Geometric Deviations

9.10.5.1

Replace the section with

Deviations from the original contour of the pipe shall not exceed 4mm in depth and shall not extend in any direction more than 1/3 of the pipe diameter. Gouges may be removed by grinding provided the wall thickness is not reduced below the specified minimum.

9.10.7 Other Surface Imperfections

Replace the section with

All surface imperfections not described by the previous subsections and clauses of the Specification shall be considered defects if they exceed the following depth:

Sharp – bottomed imperfections: 0.5mm.

Other imperfections: 5% of nominal wall thickness.

9.12 Finish of Pipe Ends

9.12.5 Plain Ends

9.12.5.3

Add to the section

No repairs are permitted on the machined bevel ends.

Pipe shall be delivered with pipe bevel protectors with close ends allowing handling with hooks. The type of end protectors proposed shall be submitted to the Company for approval at the tender stage. Bevel protectors shall be re-usable type.

9.13 Tolerances for the Weld Seam

9.13.1 Radial Offset of Strip/Plate Edges

Add to section

The offset shall be measured and recorded on the macros for the hardness specimen one pipe per batch.

Replace Table 14

Table 14 Maximum Permissible Radial Offset for SAW Pipe

Weld Thickness, t (mm)	Maximum permissible radial offset, mm
t ≤ 10	1.0
10 < t ≤ 20	0.1t
t > 20	2.0

9.13.2 Height of the Flash or Weld Bead/Reinforcement

9.13.2.2

Add to section

The height of the weld bead (internal and external), measured from the theoretical curved surface of the pipe, shall be between 0.5mm and 3mm for all wall thicknesses.

9.13.3 Misalignment of the Weld Beads of SAW Pipe

Replace the section with

The offset between the centre lines of the internal and external weld beads (see Figure 4 d) shall not exceed 3mm. The minimum interpenetration of the inner and outer weld beads shall be 2mm or 10% of wall thickness whichever is the greater.

9.15 Weldability of PSL 2 Pipe

Add to the section

Weldability tests are required on API 5L grade X60 and above only.

See Annex B for weldability requirements during manufacturing procedure qualification tests.

9.15.1 Welding Parameters

Add new section

The welding parameters used for production and repair welding shall be as specified in the MPS and as qualified in the MPQ. The following variations to the qualified parameter values are permitted:

Current, Voltage, Travel Speed: + 10%

Electrical stick out: + 5mm

Preheat: + 50°C, - 0°C (not to exceed the max interpass temperature of 250°C)

Variations outside these limits or variation to any other essential or supplementary essential variables as per ASME Section IX (Boiler and Pressure Vessel Code – Section IX: Welding and Brazing Qualifications) shall necessitate re-qualification by repeating the first-day production tests.

9.15.2 Welding Consumables

Add new section

Batch test certificates as per AWS A5.01 classifications shown below shall be supplied for all consumables and all batches used in production shall be recorded and documented by an inspection certificate in accordance with ISO 10474, Type 3.1 B. Production testing shall represent each batch of welding consumables.

SMAW consumables: C2

Solid electrodes: S2

Flux cored electrodes: T2

SAW fluxes: F2

For sour service, all consumables shall result in deposited weld metal complying with the requirements of ISO 15156-2 and deposited weld metal shall have ≤ 1% Nickel.

10 INSPECTION

10.2 Specific Inspection

10.2.1 Inspection Frequency

Replace the section with

Unless specified otherwise in the data sheet, a test unit is defined as a pipe lot coming from same size, same heat number and consists of maximum 100 pipes.

For PSL2 pipe, the inspection frequency shall be as given in Table 18 below.

Replace Table 18 with

Table 18 – Testing and Inspection Frequency for PSL 2 Pipe

Types of Test/Inspection	First-day Production Test		During Production	
	Frequency	Remarks	Frequency	Remarks
a. Visual Inspection				
a.1 Dimensions	All pipes		All pipes	
a.2 Out of roundness at weld	All pipes		All pipes	
a.3 Pipe end squareness	All pipes		3 pipes per shift	
a.4 Straightness	All pipes		Random	
a.5 Surface defects	All pipes	External	All pipes	External
b. Ultrasonic Examination				
b.1 Pipe ends	All pipes	25 mm of pipe ends	All pipes	25 mm of pipe ends
b.2 Welded pipe				
b.2.1 Plate/skelp	All plate/skelp	50 mm of trimmed plate material	All plate/skelp	50 mm of trimmed plate material
b.2.2 Weld Seam	All pipes	Pipe ends shall be radiographed	All pipes	Pipe ends shall be radiographed
b.3 Seamless pipe	All pipes	25% of surface	All pipes	25% of surface
c. Radiography				
c.1 Weld seam	All selected pipes	100% weld	All welds	End 200 mm
c.2 Weld repair areas on seam weld	All weld repairs		All weld repairs	

Types of Test/Inspection	First-day Production Test		During Production	
	Frequency	Remarks	Frequency	Remarks
d. MT				
d.1 Seam weld	All selected pipes			
d.2 Seamless pipe body	All selected pipes			
d.3 Bevel faces	All pipes	Only if ultrasonic testing is impossible	All pipes	Only if ultrasonic testing is impossible
e. Physical Tests				
e.1 Tensile test				
e.1.1 Welded pipe	2 pipes + 1 longitudinal test		2 pipes + 1 longitudinal test	
e.1.2 Seamless pipe	2 pipes		2 pipes	
e.2 Weld tensile test	All selected pipes	Welded pipes only	2 per inspection lot	
e.3 All weld tensile test	One pipe			
e.4 Charpy V-notch				
e.4.1 At temperature in section 9.8	All selected pipes		2 sets per inspection lot	
e.4.2 Transition curve				
e.5 Drop Weight Tear Test				
e.5.1 Transition curve	One pipe		One pipe per 10 inspection lots	
e.5.2 At minimum design temperature	All inspection lots		All inspection lots	
e.6 Weld manipulation test			One pipe per 50 pipes	
e.7 Macro, micro and hardness	One pipe (3 specimen)		One pipe per inspection lot or after each stop in production	

Types of Test/Inspection	First-day Production Test		During Production	
	Frequency	Remarks	Frequency	Remarks
e.8 Guided bend test	One pipe		One pipe per batch	
f. Hydrotest	All pipes		All pipes	
g. Chemical Composition				
g.1 Ladle analysis	Once per heat		Once per heat	
g.2 Product analysis - pipe	Twice per heat		Twice per heat	
g.3 Product analysis - plate	One per heat		One per heat	
g.4 Grain size	One per heat		One per heat	
h. Hydrogen Induced Cracking test	First three heats		One pipe per ten heats	
i. SSC Test	On one selected pipe	Each thickness		
j. Residual Magnetism	All pipes		10% of pipes	
k. Cold Expansion	All pipes		3 pipes per shift	

10.2.3 Samples and Test Pieces for Mechanical Tests

10.2.3.2 Test Pieces for the Tensile Test

Add to the section

Tensile properties shall be determined from specimens removed from pipe which has been subjected to all mechanical and heat treatment operations. Where stress relieving of pipe will be performed, e.g. for field welding, additional tensile testing of parent metal shall be performed on stress relieved specimens. The Purchaser shall specify on the purchase order (or line pipe data sheet) if this condition applies.

The testing procedure shall be in accordance with ASTM A370.

Tensile Testing Frequency

Two longitudinal tensile tests shall be required per inspection lot. For pipes of diameter 200 NB (8 inch NPS) and above, one longitudinal tensile test and one transverse tensile test shall be taken from the pipe body at a frequency of one per inspection lot. Longitudinal tensile test specimens shall be either non-flattened rectangular or round bar specimens. Transverse tensile properties shall be determined on flattened rectangular specimens.

Weld Tensile Tests

Weld tensile specimens shall be taken from the same part of the pipe used for preparing parent metal tensile specimens. The weld reinforcements shall be removed before tensile testing.

10.2.3.3 Test Pieces for the CVN Impact Test

Add to the section

A full Charpy V-notch transition curve shall be established on one pipe for the first day production tests.

Impact testing shall be carried out using 10x10, 10 x 7.5 or 10 x 5 mm cross section specimens. The largest possible specimen shall be used. Where the nominal pipe dimensions are insufficient to extract a 10 x 5mm specimen, impact testing is not required.

For pipes of DN 250 (10 inch) or less, impact test specimens shall be taken parallel to the axis of the pipe (i.e. longitudinal specimens shall be taken).

For pipes greater than DN 250 (10 inch), impact test specimens shall be taken transverse to the axis of the pipe, except where the wall thickness prevents extraction of a 10x5 mm specimen, in which case longitudinal specimens shall be taken.

Transverse impact test specimens shall be taken from the seam weld centre line, fusion line, HAZ and parent material. Weld, fusion line and HAZ (fusion line + 2mm) test pieces shall be taken in accordance with the new Figure 7 below. The parent material specimens shall be taken at 90° from the weld.

For pipe wall exceeding 20mm thickness three additional sets of impact test specimens shall be taken from the weld, fusion line and HAZ as shown in the new Figure 7 below.

Note: Where the MPQ testing indicates minimum toughness of the HAZ at the fusion line + 5mm position, the Purchaser may specify that HAZ impact tests be taken from this position.

The testing frequency for Charpy impact testing shall be twice per inspection lot.

Replace Figure 7 with

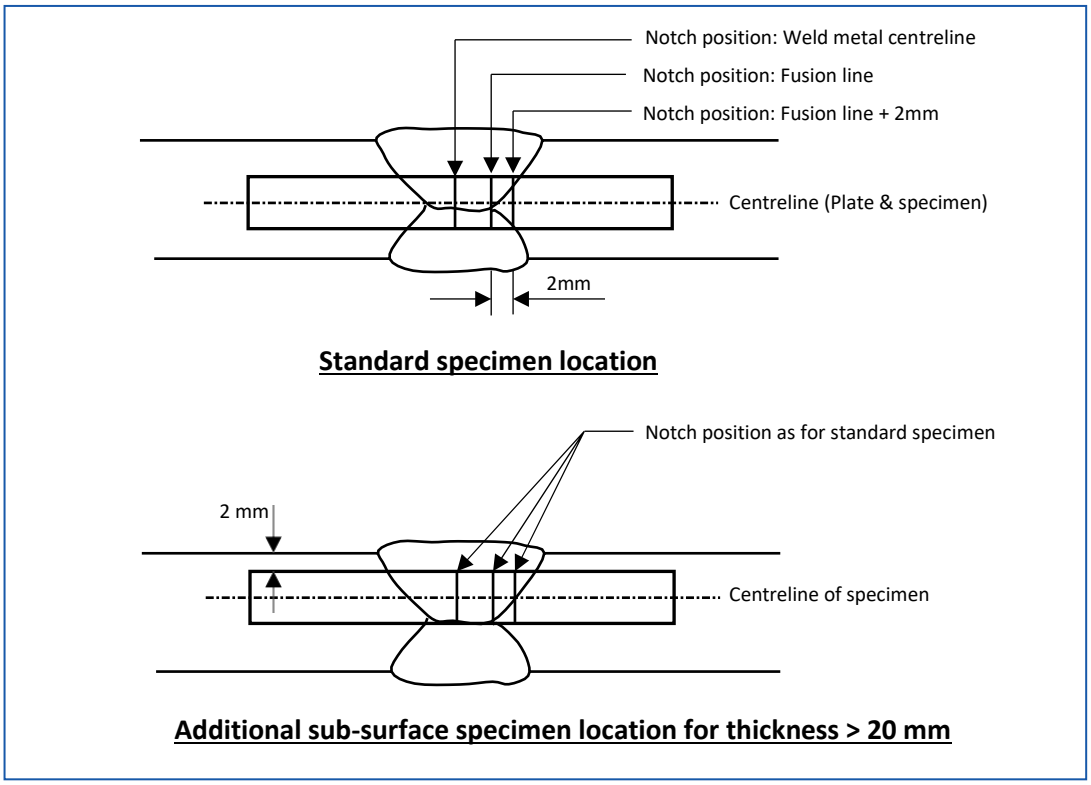

Figure 7 - Location of Charpy Test Specimens

10.2.3.4 Test Pieces for the DWT Test

Add to the section

Where required, drop weight tear tests shall be initially carried out on each inspection lot.

Drop weight tear tests are required on welded pipes of DN 400 or (16 inch) and greater for Grade X52 or higher grades for pipelines conveying gas or multiphase fluid. Two transverse DWTT specimens (see Table 20) shall be taken from one length of pipe from each heat supplied in the order. The specimens shall be taken at the locations shown in Figure 5.

Tests shall be performed at 0°C (or below the minimum design temperature, whichever is lower).

Full transition curves shall be established for one heat out of ten, with a minimum of one.

All specimens shall exhibit a minimum of 85% shear on the fracture surface.

The Manufacturer's certificate shall state that the pipe complies with this standard.

10.2.4 Test Methods

10.2.4.9 Fracture Toughness Test

Add new section

CTOD test temperature shall be the minimum design temperature or 0°C whichever is less.

10.2.6 Hydrostatic Tests

10.2.6.1 Hydrostatic Test Requirements

Replace the section with

Hydrostatic testing shall be performed after cold expansion. The test pressure shall be held for a minimum of 10 seconds for all pipe sizes.

10.2.6.5

Replace the section with

The test pressure shall be calculated such that the maximum combined stress equates to 96% SMYS or 84% SMTS whichever is the lower value.

10.2.8 Dimensional Testing

10.2.8.1

Add to the section

The internal diameter shall be measured at both ends of each pipe by tape or, with the agreement of the Company, a calliper gauge.

10.2.8.2

Add to the section

The out-of-roundness of pipe ends shall be checked by measurement of the minimum and maximum internal diameters using a rod or calliper gauge.

The ends of each pipe shall be tested for out of roundness using an internal ring gauge of diameter 5.0 mm less than the nominal internal diameter. The gauge shall pass freely into each end when held normal to the pipe axis.

10.2.8.4

Replace the section with

The ends of each SAW pipe and two positions along the length shall be checked for out-of-roundness at the position of the longitudinal weld. Templates with a minimum chord length of 75% of the pipe internal diameter shall be used for measurement of local irregularity in profile. For pipes 16 inch outside diameter and above, a template of 300 mm minimum chord length shall be used. The template profile shall have a radius equal to the nominal radius of the pipe outer or inner circumference for measurement of the outer or inner surface, respectively. The nominal inner radius shall be taken as the nominal outer radius minus the nominal wall thickness.

The template gauging surface shall have an appropriate cut-out to accommodate the weld bead of the pipe. The cut-out shall be at the centre of the gauging surface and shall have a width of less than 5 mm greater than the weld bead width. Any local irregularity shall be measured by a calibrated taper gauge inserted in any gap between the template and the pipe surface. The local irregularity shall not exceed 1.6 mm.

10.2.8.8 Gauging Pig

Add new section

A gauging pig shall be passed through each of the first twenty pipes produced and thereafter at a frequency of one pipe per inspection lot. Each pipe shall be in the finished condition. The gauging pig shall consist of two, parallel, circular plates separated by a rigid bar with a length twice that of the pipe internal diameter. Non-ferrous alloys such as copper, brass or bronze shall not be used for making the gauge plates. The gauge plate material selected should not gouge or scratch the pipe inner surfaces during gauging. The plates shall have a diameter equal to 98% of the minimum inside diameter and shall be 6mm thick. The gauging pig shall be able to pass through the pipe without deforming the plates.

The Manufacturer shall provide a sketch showing the arrangement of the plates and dimensional tolerances for all parts of the gauging pig to be used.

11 MARKING

11.1 General

11.1.2

Add to the section

For pipes DN100 and above, stencil markings required by this standard, shall be executed in white block capitals of minimum height 25 mm. For smaller pipe diameters, stencil marking height shall be a minimum 10 mm.

Marking of test pressures, size (diameter and wall thickness) and weight shall be in metric units.

11.2 Pipe Markings

11.2.1

Add to the section

External markings and labelling shall include but not limited to the following:

1. ADNOC
2. Purchase Order and Purchases Order item no
3. Length

Internal marking shall include:

1. Heat Number;
2. Unique pipe identification No.

Marking shall also include API monogram, test pressure, diameter and wall thickness in metric units.

11.2.3

Replace the section with

Unless specified otherwise in the purchase order, the marking shall be located as follows:

For pipe diameters DN450 (NPS18) and larger, all paint markings shall be on the inside surface. For smaller pipe diameters, the paint marking shall be on the outside surface.

11.2.4

Add to the section

Each pipe shall be low-stress die-stamped with its unique pipe number on the weld bevel at each end. No die stamping, hot or cold shall be permitted on pipe body.

The pipe shall be paint stenciled, at both ends, in accordance with API Specification 5L on the inside surface of the pipe within 200 mm of the ends. Internal Pipe markings shall show name or mark of the manufacturer, API Specification 5L, outside diameter, wall thickness, pipe steel grade with sour or non-sour, PSL-2, type of pipe, length, weight, unique pipe number, heat number and batch number, hydrostatic test pressure. Sizes, weights, lengths, and pressures shall be given in metric units. Outside diameter marking shall include diameter, wall thickness, length and grade at one end only.

Detailed marking procedure shall be submitted to COMPANY for approval prior to Pipe production. Locating weld seam to be marked inside each pipe with 50 mm daub heat resistant paint.

Pipes of the same diameter but of different wall thicknesses or material shall, in addition to any other requirements be color coded to provide visual identification. The proposals for the color coding shall be provided to COMPANY for approval.

12 COATINGS AND THREAD PROTECTORS

12.1 Coatings and Linings

Replace the section with

Unless otherwise stated in the purchase order, pipe shall not be coated. Protective coating or varnishing of the pipe identity markings is, however, permitted.

The pipe shall be delivered with a temporary external protection suitable for UAE environment to provide protection from rusting in transit and storage for a minimum period of one year. In general, internal protection is not required as the pipeline shall be installed with End Caps in sound condition (no tear / wear condition).

15 HANDLING AND STORAGE

Add new section

Packing, protection, preservation, identification, storage & handling of line pipe shall as a minimum meet the requirements stipulated by this standard. All pipes shall be handled, loaded and shipped in accordance with API RP 5L1, Recommended Practice for Railroad Transportation of Line Pipe and API RP 5LW, Recommended Practice for Transportation of Line Pipe on Barges and Marine Vessels.

The Contractor shall submit loading instructions and diagrams for approval for all pipe shipped by truck, rail, or marine, vessel, however approval of these shall not relieve the Contractor of his responsibility for any damage during shipment.

All dimensional tolerance and pipe surface conditions specified herein and in API Specification 5L shall apply to the pipe condition as received by the Company at the shipping destination. The line pipes shall not be shipped in the upper deck.

ANNEX B MANUFACTURING PROCEDURE QUALIFICATION FOR PSL 2 PIPE

B.3 Characteristics of Manufacturing Procedure Specification

Replace the section with

The Manufacturer, prior to production shall submit a manufacturing procedure specification to the Company for approval. As a minimum, the specification shall include the items listed below. All these items shall be individually approved by the Company.

B.3.1 Steel Supply

a. Steelmaker

b. Steel making and casting techniques including details of the following:

b1. Details of steel making process, including de-oxidation and desulphurisation practice, inclusion shape control method and the use of vacuum degassing,

b2. Details of casting process, i.e. ingot or continuous casting, including casting speed, vertical or curved caster, tundish superheat, gas shroud in tundish, segregation control measures.

b3. Details of slab reheating temperatures start and finish rolling temperatures and reduction ratios,

c. Heat treatment details,

d. Chemical composition:

d1 Target chemistry;

d2 Ranges for deliberately added elements;

d3 Maxima for other elements specified in (section 9.2) for combinations of element (e.g, CE (IIW)).

B.3.2 Pipe Manufacture

a. Plate manufacturing method including details of specialised cooling and heat treatment.

b. Procedures for non-destructive inspection of plate.

c. Pipe forming procedures.

d. Pipe heat treatment procedure including temperatures, holding time, method of quenching (external quenching or tank quenching), furnace type (batch furnace or walking beam furnace).

e. Seam welding procedure including the following details:

e1. Welding process;

e2. Brand name, classification, size and grade of filler metal and flux;

e3. Speed of welding;

e4. Number of electrodes and polarity for each electrode;

e5. Welding current for each wire;

e6. Welding voltage for each wire;

e7. Dimensions of welding preparation;

e8. Number of weld passes from inside and outside;

e9. Details of seam tracking system for both inside and outside welding and also the method for checking the set-up of the system;

e10. Limits on internal and external weld reinforcement;

e11. Repair welding procedures.

f. Hydrostatic test procedures.

g. Non-destructive inspection procedures.

B.3.3 Pipe Handling and Transportation

a. Pipe handling, preservation and storage.

b. Transportation (by ship rail road).

B.5 Manufacturing Procedure Qualification Tests

Replace the section with

B.5.1 Introduction

The MPS shall be qualified by a Manufacturing Procedure Qualification (MPQ). An MPQ shall be carried out for each diameter and thickness combination. Unless otherwise agreed by the Company, any change to the MPS shall require re-qualification, with the exception of welding procedure parameters which may vary within the limits given in new section 9.15.1. For Qualification of the manufacturing procedure, one pipe from among the first lot of 50 finished pipes produced from the same heat shall be selected by the Third Party Agency for inspection and tests. (Note, in the case of repeat orders of pipe of the same diameter and thickness, produced to the same MPS, the Company may agree a reduction in the level of MPQ testing).

MPQ testing with prior agreement shall be carried out on one pipe out of 5 pipes selected by the Company appointed inspector, from the first inspection lot of 50 pipes produced. If production qualification is to be carried out on a small, pre-production run, the pipe for MPQ testing shall be selected from this run.

Repair welding for qualification is to be carried out on this pipe before cold expansion. Each repair weld shall be at least 500mm in length (and shall be long enough for all required destructive tests) and shall be half the wall thickness in depth. Where internal repair is proposed, two repairs shall be carried out, one external and one internal.

Where the manufacturer requires to qualify more than one repair welder, all welders shall complete internal and external repair welds, as specified above, which shall be subject to the same non-destructive testing as for the principal welding procedure. Mechanical testing of repair welder qualification tests is as specified in Annex D.

B.5.2 Testing

B.5.2.1 General

The test pipe shall be subject to dimensional inspection to the requirements of Section 9.11, to non-destructive inspection as specified in Annex E/K and hydrostatic testing to Subsection 10.2.6.

The test pipe shall then be subject to the following:

B.5.2.2 Non-destructive Testing

The test pipe shall be subject to the following tests:

The entire weld seam shall be radiographed in accordance to Annex E/K as modified by this standard. Acceptance shall be to Annex E/K as modified by this standard. The entire external weld seam and 500mm of the internal seam from each end shall be subject to wet, magnetic particle inspection. No linear imperfections are permitted.

The pipe body shall be subject to full visual examination for surface imperfections which shall be reported, regardless of size. Local magnetic particle inspection shall be used to assist identification of imperfections. Acceptance shall be to Subsection 9.10 as modified by this standard.

The wall thickness shall be measured by ultrasonic inspection at intervals of one meter along the length of the pipe. Three readings, separated by 90°, shall be taken at each location. All readings shall be reported. The wall thickness shall not be less than the minimum specified wall thickness.

B.5.2.3 Weld Metal Tests

A round, all-weld metal tensile test specimen shall be taken from the weld seam. The elongation, 0.2% proof stress and UTS shall be reported. The proof stress shall be no lower than the specified minimum yield strength of the parent material. Tensile strength and elongation values shall meet the minimum specified requirements of the plate.

A sample of the seam weld metal shall be subject to chemical analysis for the elements listed in Table J.1 of this standard.

B.5.2.4 Tensile Testing

One rectangular transverse and one longitudinal parent material tensile specimens, together with one transverse weld specimen, shall be taken from each end of the test pipe and tested in accordance with the standard. The tests shall meet the requirements of Clause 9.3.2 as modified by this standard.

B.5.2.5 Charpy Impact Testing

B.5.2.5.1 Weld Seam

For pipe of wall thickness of 20mm or less, four sets of Charpy impact tests shall be taken from the weld seam at each end of the pipe with notches located at weld centre line, fusion line, fusion line + 2mm and fusion line + 5mm per Fig. 9.3.5.1a of this standard. For pipe of wall thickness greater than 20mm an additional four sets shall be taken from each end of the pipe per Fig. 9.3.5.1b. The testing temperature and energy requirements shall be as specified in Clause 9.8 as modified by this standard.

Note: It is expected that the HAZ would exhibit minimum impact energy at the fusion line + 2mm position. If lower impact energy values are exhibited at fusion line +5mm the reason shall be investigated by metallographic examination, review of previous test records and, if necessary, additional testing. If the lower impact energy values at fusion line +5 mm are found to be a consistent and result of the normal welding

procedure used, this position shall then be specified as the HAZ notch position for production testing (See modification to Clause 9.8).

B.5.2.5.2 Transition Curves

Sets of transverse Charpy impact tests with notches located in parent material, weld centre line and fusion line + 2mm (or + 5mm, if lower, see above) shall be taken per Fig. 9.3.5.1a or Fig. 9.3.5.1b (dependent on thickness) of this standard. They shall be tested at 10, 20 , and 30°C below the production test temperature to produce full transition temperature curves showing impact energy (in Joules) and percentage shear (fibrous) of the fracture surface plotted against temperature over a temperature range sufficient to reproduce fracture appearance from 10% to 100% fibrous shear for the material. The results are for information.

B.5.2.6 Macro Examination and Hardness Survey

Five weld macro sections shall be taken from the weld seam at equally spaced locations along the length of the pipe and prepared according to new clause 10.2.5.5. These shall be examined for freedom from defects and consistency of profile. All sections shall comply with the bead interpenetration requirements of Clause 9.10, as modified by this standard.

Three of the specimens shall be selected for hardness survey in accordance with New Clause 10.2.4.

B.5.2.7 Drop Weight Tear Tests

Where required in production, drop weight tear tests shall be carried out in accordance with Clause 9.9. The testing temperature shall be 0°C (or 10°C below the minimum design temperature, whichever is the less) and the acceptance standard 85% shear (minimum individual).

A full transition curve shall be established.

B.5.2.8 Testing of Repair Welds

All repair welds (internal and external) shall be subject to the following tests:

a. All weld metal tensile (per B.5.2.3).

b. Cross weld tensile test (per B.5.2.4).

c. Charpy impact tests (Four sets per B.5.2.5, Weld Seam).

d. One macro examination and hardness survey (per B.5.2.6).

e. SSC testing (per B.5.2.8.1).

All the above tests shall be carried out after cold expansion, non-destructive testing and hydrostatic test.

One macro examination section shall be taken from each repair welder qualification weld. The section shall be free from defects.

B.5.3 Weldability Tests

B.5.3.1 General

The weldability of the line pipe material produced by the Manufacturer shall be demonstrated to ensure that the as supplied material can be satisfactorily welded at site or on the lay barge without excessive precautions and preheat or post weld heat treatment. The steel mill shall submit past records of girth welding procedure

qualification test records and recommended Welding Procedure Specifications (WPS) for the grades of pipe supplied for Company records.

Weldability tests shall be carried out for pipes of Grade X60 and X-65 using a procedure similar to that used in the field girth welding.

Two 500mm long pieces, taken from the first day's production shall be welded together in accordance with the requirements given below.

The weld shall be made with cellulosic electrodes matching the strength of the material (i.e. E7010-G for X60 and E8010-G for X65) and capable of meeting the charpy acceptance criteria as per A0-IG-W-SP-003.

a. Welding position 5G, vertical down.

b. Bevel in accordance with API 5L.

c. Heat input 1kJ/mm ± 0.1 kJ/mm

d. Preheat shall be calculated in accordance with A0-IG-W-SP-002.

e. PWHT shall not be carried out for LSAW Pipes unless specified.

f. Welders shall be qualified in accordance with A0-IG-W-SP-003.

In case CONTRACTOR intends to use automatic welding in the field, additional. Weldability test shall be conducted with Automatic Welding using equipment intended to be used in the field.

Weldability test shall be carried out for the heaviest wall thickness of each diameter/material grade/pipe making process combination for each mill. The manufacturer shall guarantee that all remaining pipes would also pass these tests

Welding Specifications

The contractor shall submit a Weld Procedure Specification (WPS) outlining his proposals to the company for approval prior to welding the test pieces.

The test weld shall be subject to 100% Radiography, ultrasonic testing, such those areas containing defects are found and excluded from test pieces.

The test weld shall be subject to the following mechanical tests:

Two transverse tensile tests taken from the 2 o'clock, and 8 o'clock positions. The UTS shall meet the requirements as per A0-IG-W-SP-003.

Charpy tests in accordance with A0-IG-W-SP-003, with specimens taken from the 3 o'clock position with additional sets at root for FL, FL +2 and Weld metal.

Macro/hardness test in accordance with A0-IG-W-SP-003.

SSC tests for sour service welds.

For wall thickness greater than 19 mm, with prior approval from ADNOC, E8045-P2 can be used as an alternative to E8010-P1 for the welding of hot, fill and cap passes.

The details of testing and acceptance criteria shall be in accordance with ADNOC welding specification.

B.5.3.2 Material

The material selected for weldability trials shall be representative of the highest carbon equivalent of line pipe casts produced. The cast of material to be used for weldability trials shall be approved by the Company designated inspector. However, the steel cast used for weldability trials may have the production maximum carbon equivalent minus 0.02%.

ANNEX C TREATMENT OF SURFACE IMPERFECTIONS AND DEFECTS

C.1 Treatment of Surface Imperfections

Add to the section

The jacking out of dents is not permitted

C.2 Treatment of Dressable Surface Defects

C.2.3

Add to the section

In all cases where grinding repairs are made as a result of imperfections being disclosed by NDT, the part of the pipe containing such repairs shall be subjected to additional NDT using the same technique, and MT, after the grinding operation.

C.4 Repair of Defects by Welding

C.4.3

Add to the section

Repairs to the weld seam shall be limited to three per pipe.

C.4.4

Add to the section

Repair of the weld seam of SAW pipe is not acceptable within 200 mm of the bevel ends. The nature of any weld defect indicated by non-destructive inspection shall be ascertained before any repair is performed. Where necessary, complementary ultrasonic and radiographic inspections shall be carried out to characterise the defect. Repair welding to rectify pipe welds containing cracks is not permitted.

C.4.6

Add to the section

Weld repairs are not allowed out after cold expansion or hydrostatic testing of a pipe.

ANNEX D REPAIR WELDING PROCEDURE

D.1 General

D.1.2

Add to the section

Repairs to the weld seam by submerged arc welding are permitted provided the defect is fully excavated and the production welding procedure used.

Repairs to the weld seam by shielded metal arc are permitted provided they a carried out to a welding procedure qualified during the manufacturing procedure qualification tests (see Annex B)

D.1.6

Add new section

Each repair weld shall be half the wall thickness in depth. Where internal repair is proposed, two repairs shall be carried out, one external and one internal.

D.2 Repair Welding Procedure Qualification

D.2.1 General

D.2.1.1

Replace bullet point c) with the following

c) multiple repairs up to maximum of 4.

D.2.1.4

Add new section

All repair qualification tests shall be carried out after cold expansion, non-destructive testing and hydrostatic test.

D.2.1.5

Add new section

All repairs shall include a minimum preheat of 100°C, unless the qualification test shows that a higher temperature is necessary.

Each welding repair shall be qualified on a pipe section under realistic conditions.

Unless otherwise agreed with COMPANY, the following two repair types are to be qualified by tests.

a. One mid-thickness repair (or one 2/3 thickness repair) simulating a defect located on fusion line. The mid-thickness repair shall be subject to the following tests:

   - Charpy tests with sets removed from the following locations:-

     - repair weld centre line
     - fusion line between repair weld and original weld

- fusion line between repair weld and parent material.

– 1 macro/hardness test

– Other tests required by this Annex

– 100% UT and Radiography

b. One shallow repair with 2 weld passes minimum simulating a defect located at weld toe.

The shallow repair shall be subject to:

– 1 macro/hardness test

– 100% MPI

D.2.2 Essential Variables

Add to the section

The essential variables for repair welding procedures shall be identical to those specified for the manufacturing procedure qualification tests.

D.2.3 Mechanical Testing

Add to the section

Mechanical (and, where applicable, corrosion) testing shall be as specified in Annex B.

D.2.3.5 SSC Testing

Add new section

Weld repair procedure shall be qualified against SSC with the same test requirements and acceptance criteria as the pipe.

D.2.3.6 Macro Examination and Hardness Survey

Add new section

All repair welds shall be subject to one macro examination and hardness survey.

ANNEX E NONDESTRUCTIVE INSPECTION FOR PIPE NOT REQUIRED TO MEET ANNEX H, J, OR N

E.1 Qualification of Personnel

E.1.4

Add new section

All personnel performing NDT activities shall be qualified in the technique applied, in accordance with SNT-TC-1A or ISO 9712 or equivalent, subject to review and acceptance of the examination and training records by the Company.

For UT at least one level III qualified inspector shall be available to the mill (on call) for overall supervision.

A level II inspector is required for shift supervision and calibration of all systems (both manual and automated). A level I inspector is acceptable for all other NDT methods. A level II inspector is acceptable for supervision of all other NDT methods.

E.3 Methods of Inspection

Add to the section

All NDT shall be performed in accordance with written procedures. These procedures shall have the prior approval of the Company. NDT for acceptance of the pipe (final inspection) shall take place after all heat treating and expansion operations. It may, however, take place before cropping, bevelling and end sizing.

E.3.1 General

E.3.1.2

Replace the section with

The body and ends of all pipes shall be ultrasonically inspected for internal imperfections.

E.3.1.3

Add to the section

When grinding repairs are made because of imperfections found by nondestructive testing the section of the pipe containing such repairs shall be subjected to additional nondestructive testing using the same nondestructive testing techniques, and magnetic particle testing after the grinding operation.

All nondestructive inspection equipment shall be checked at least twice per eight (8) hour working shift to demonstrate effectiveness of calibration and operational procedure.

Such inspection equipment shall also be checked immediately following any equipment failure or equipment adjustment. These equipment checks shall either be regularly scheduled, or with enough notice so that the COMPANY's Representative may witness equipment checks each time.

All sensitivity adjustments shall be carried out dynamically. The dynamic calibration on the first day production pipe shall be witnessed by the COMPANY Inspector.

E.3.2 Pipe End Inspection – Welded Pipe

E.3.2.1

Replace the section with

After bevelling, the complete circumference of the pipe end shall be tested ultrasonically from the inside for laminations (this inspection shall cover a width of 100 mm). Alternatively the pipe may be tested from the outside prior to bevelling, in which case a band of at least 25 mm wide, to include the eventual bevelled area, shall be tested.

If UT has not been performed from the outside before cutting and if UT from the inside is not feasible because of dimensional limitations, then MT shall be applied to the bevel face in accordance with Clause 9.7.5.

For pipes previously subjected to 100% rotary ultrasonic inspection, the above requirements shall not apply.

Laminations are not acceptable in this area.

E.3.2.2

Replace the section with

Submerged arc welds shall be inspected over their entire length, for both longitudinal and transverse defects, using ultrasonic examination in accordance with sections 9.7.4.1 through 9.7.4.4. In addition, each end of the weld seam in SAW pipe shall be examined radiographically for a distance of at least 200 mm.

E.4 Radiographic Inspection of Weld Seams

Add to the section

Each end of the weld seam in SAW pipe shall be examined radiographically for a distance of at least 200 mm from the end of the pipe in accordance with Annex K.

E.4.2 Radiographic Inspection Equipment

Replace the section with

The radiographic examination shall be executed with X-ray equipment using the single wall, single image technique using fine-grain type film (e.g. Agfa Gaevert type D7 or equivalent) and lead intensifying screens.

For acceptance of the radiographic films, the technique used shall result in sensitivity equal to or better than that shown in table E.4.3 below. The relative film density shall be between 2.0 to 3.5 in the weld metal. Film must be processed so as to guarantee freedom from deterioration for two years.

The Manufacturer shall record on a review form accompanying the radiograph or within the mill computer system, the interpretation of each radiograph and disposition of the pipe inspected.

E.4.3 IQIs

E.4.3.1

Replace the section with

An ISO wire IQI shall be used on each radiograph. The following source-side sensitivity shall be achieved:

Table E.4.3 Radiographic Sensitivity

Weld Thickness, t (mm)	Required Sensitivity %
t < 10	2.0
10 < t < 20	1.8
t > 20	1.6

E.4.5 Acceptance Limits for Imperfections Found by Radiographic Inspection

Replace the section with

Individual slag inclusions shall be no greater than 6mm in length and 1.5mm in width. The accumulated length of slag inclusions shall be no greater than 6mm in any 100mm length of weld.

The maximum area fraction of porosity, taken in any 50mm length of weld, shall not exceed 1%.

Porosity and inclusions within 50mm of the pipe end shall be unacceptable.

E.5 Ultrasonic and Electromagnetic Inspection

Add to the section

After bevelling, the complete circumference of the pipe ends shall be ultrasonically tested from the inside for laminations. This inspection shall cover a width which includes the entire bevel. Alternately, the pipe ends may be tested from the outside prior to bevelling and in such cases, a band at least 25 mm wide, which shall include the eventual bevelled areas, shall be tested. Laminations are not acceptable in this area.

The weld seam shall be ultrasonically tested after hydrostatic testing. Acceptance criteria for weld discontinuities shall be in accordance with Annex K (applicable for both sour and non-sour service).

Submerged arc welds shall be inspected over their entire length, for both longitudinal and transverse defects, using ultrasonic examination

Calibration of ultrasonic equipment may be based upon either notches or holes; however, reference standards shall contain both notches and holes. The manufacturer shall furnish, for COMPANY approval, a complete description of their proposed procedures, including a description of the equipment; the number, size, angle, frequency, mode, and location of the transducers; continuity checking; scanning speed; method of weld tracking; defect marking methods; operator qualification; calibration reference standards, and acceptance limits. During the first day of production, the Manufacturer shall demonstrate to the satisfaction of the Company Representative, the effectiveness of this equipment and procedures, using an API 5L reference standard approved by the COMPANY's representative.

E.5.1 Ultrasonic Equipment

Replace the section with

The automatic ultrasonic equipment shall incorporate:

1. A device which monitors the effectiveness of the coupling. In the case where a zero degree compression wave probe is used to monitor coupling, loss of coupling exists when the sensitivity (echo height) decreases by more than 10 dB relative to the static calibration. A clear acoustic warning

system and an automatic paint spray system (or equivalent) shall be activated when loss of coupling occurs.

2. An automatic paint-spraying device, or equivalent system, which is activated when the received ultrasonic echo exceeds the preset acceptance limit. This alarm shall operate without any interference of the ultrasonic operator and shall be applied within 25 mm advancement past the detected defect. The reset time of the alarm system, after detection of a defect, to be again available for detection, shall be shorter than the time needed for 25 mm advancement in the scanning direction.

E.5.2 Ultrasonic and Electromagnetic Inspection Reference Standards

Add to the section

The reference standard shall include at least one transverse and one longitudinal notch on both the internal and external surfaces for detection of surface defects and defects in pipe body and ends. The notch depth, in all cases, shall be 5% of the nominal wall thickness.

Other notch dimensions shall conform to Table E.7. For lamination detection, flat bottomed hole with 6.3 mm diameter and drilled to the mid-wall position shall be used.

The reference (calibration) standard shall have the same specified diameter and thickness as the product being inspected and shall be of sufficient length to permit calibration of ultrasonic inspection equipment at the speed to be used in production. The reference standard shall also be of the same material type and have the same surface finish and heat treatment as the product to be inspected. It shall be free from discontinuities or other conditions producing indications that may interfere with detection of the reference reflectors. All sensitivity adjustments shall be carried out dynamically.

For SAW pipe, the calibration of the testing equipment shall be demonstrated at full inspection speed and the reference standard shall be of sufficient length to permit this.

The reference pipe shall also contain two 1.6 mm dia drilled holes located 4 mm from weld toes (one on each side of weld seam) for checking the ultrasonic gate width (gate setting).

The reference standard shall contain the following:

a. One, 1.6mm, radially drilled hole on the centre line.

b. Four, longitudinal N5 notches on each side of both internal and external weld seam.

c. Two, transverse N5 notches across the internal and external weld seam.

E.5.3 Instrument Standardization

D.5.3.5 Automatic Ultrasonic Inspection Procedure

New Section

The Manufacturer shall demonstrate the effectiveness of the nondestructive testing procedures to the satisfaction of the Company. In the case of automatic ultrasonic inspection this shall require the operation of the equipment at production scanning speed and recording of the appropriate response level from the discontinuities in the calibration standard or similar test piece. All sensitivity adjustments shall be carried out dynamically.

E.6 Magnetic Particle Inspection

E.6.1 Magnetic Particle Inspection of SMLS Pipe

Add to the section

Where the pipe ends were not previously inspected by automated UT or manual UT, all finished weld bevels shall be examined by wet magnetic particle inspection. The method of magnetization shall be approved by the Company. Any lamination on the weld bevel shall be considered a defect. Magnetic particle examination using current flow (prod) techniques shall not be used.

E.6.3 Magnetic Particle Inspection Reference Standard

Add to the section

MT shall be performed in accordance with the requirements of ASTM E 709. Prior to the inspection, the surface to be examined and all adjacent areas within 25 mm shall be dry and free of all dirt, grease, lint, scale, welding flux and spatter, oil or other extraneous matter that could interfere with the examination.

E.7 Residual Magnetism

Replace the section with

Pipe shall be checked subsequent to any inspection that uses a magnetic field, handling with any electromagnetic equipment and prior to shipment from the mill.

Pipe ends shall be checked for residual magnetism as follows:

Measurements shall be made on the root face using a Hall-effect gaussmeter or other type of instrument approved by the Company. However, in the case of dispute, measurements with the Hall-effect gaussmeter shall govern. The gaussmeter shall be operated in accordance with written instructions demonstrated to produce accurate results. The accuracy shall be verified at least once each day that the gaussmeter is used.

Measurements shall be made on each end of at least 10 percent of the pipes per working shift. As a minimum, one pipe shall be taken from the beginning of the shift, one from near the middle, and one from the end of the shift.

As a minimum, four readings shall be taken approximately 90 degrees apart around the circumference of each end of the pipe. No reading shall exceed 20 gauss when measured with a Hall-effect gaussmeter, or equivalent values, with other types of instruments.

Any pipe that does not meet the above requirements shall be considered defective.

In addition, all pipe produced between the defective pipe and the last acceptable pipe shall be measured. Alternately, if the pipe production sequence is documented, pipe may be measured in reverse sequence beginning with the pipe produced prior to the defective pipe until at least three (3) consecutive pipes meet the requirements. Pipe produced prior to the three consecutive acceptable pipes need not be measured. Pipe produced after the defective pipe shall also be measured until at least three (3) consecutive pipes meet the acceptance requirements.

All defective pipe shall be degaussed full length and remeasured or permanently rejected.

ANNEX H PIPE ORDERED FOR SOUR SERVICE

H.4 Acceptance Criteria

H.4.1 Chemical Composition

H.4.1.3

Add new section

The maximum percentages of residual elements shall be as follows:

a) Sn ≤ 0.0150 %
b) Sb ≤ 0.0100 %
c) Bi ≤ 0.005 %
d) Pb ≤ 0.005 %
e) As ≤ 0.0150 %
f) S ≤ 0.0030 %

ANNEX J PSL 2 PIPE ORDERED FOR OFFSHORE SERVICE

J.4 Acceptance Criteria

J.4.3 Hardness Test

Add to section

For sour service offshore applications, the maximum hardness in all areas shall not exceed 230 HV10 in the pipe body and 248 HV10 in the weld & HAZ of the longitudinally welded pipe.

J.7 Tolerances for the Weld Seam

J.7.1 Radial Offset of Strip/Plate Edges

Add to section

The offset shall be measured and recorded on the macros for the hardness specimen one pipe per batch.

Replace Table J.5

Table J.5 Maximum Permissible Radial Offset for SAW Pipe

Weld Thickness, t (mm)	Maximum permissible radial offset, mm
t ≤ 10	1.0
10 < t ≤ 20	0.1t
t > 20	2.0

J.8 Inspection

J.8.1 Specific Inspection

Add to section

The testing frequency for Charpy impact testing shall be twice per inspection lot.

ANNEX K NONDESTRUCTIVE INSPECTION FOR PIPE ORDERED FOR SOUR SERVICE, OFFSHORE SERVICE, AND/OR SERVICE REQUIRING LONGITUDINAL PLASTIC STRAIN CAPACITY

K.3 Nondestructive Inspection of SMLS Pipe

Add to section

All pipes shall be subject to the following ultrasonic inspection:

a. Inspection for internal and external surface defects.

b. Inspection for laminations and other, internal discontinuities.

c. Wall thickness measurement.

d. Ultrasonic thickness testing of the pipe body and ends of seamless pipe shall be performed by scanning along a helical or straight pattern in such a way that at least 10% of the pipe surface is covered.

e. The body and ends of all seamless pipes shall be 100% ultrasonically tested for inside and outside surface defects as well as transverse and longitudinal defects.

f. Ultrasonic lamination testing of each seamless pipe body shall be performed using a helical pattern with at least 25% scanning coverage of the pipe surface.

IV Line Pipe Datasheet

The following data sheet can be used as a template to summarise the key requirements for the line pipe. Any extra/special requirements not covered by the previous sections can be specified here.

This data sheet must be filled in by ADNOC/Contractor.

1	Project					
2	Project Number					
3	Applicable Codes and Standards	API Specification 5L (46th Edition)				
		Other ----------				
4	Line Pipe	----------	(e.g. Seamless or SAW)			
		Nominal Pipe Size	----------	in		
		Nominal Wall Thickness	----------	mm		
5	Material Grade	----------	(e.g. API 5L X60 .....)			
6	Product Specification Level	PSL-2				
7	Heat Treatment	Quenched and Tempered Condition				
8	Pipe Quantity	-----	m			
9	Internal Fluid Type	---------- (e.g. multiphase oil, gas, water or other)				
	Design Pressure	----------		psi or barg		
	Design Temperature	Minimum	----------	°C		
		Maximum	----------	°C		
10	Service (to apply API Annex H and/or Annex J)	----------	(Sour and/or Offshore if applicable)			
11	Hydro Test	Required				
	Hydro Test Pressure	Maximum combined stress equals 96% SMYS or 84% SMTS (whichever is less). Test pressure shall be held for 10 seconds for all pipes				
12	Heat and Product Analysis	Required				
	Chemical Composition	---------- (Refer to an attachment if applicable)				
		Maximum Carbon Equivalent (CE)	CE_{Pcm}		%	
			CE_{IIW}		%	
13	Hardness Test (body, weld, HAZ and hard spots)			Required		
	Hardness	max pipe body		HV10		
		max weld/HAZ		HV10		
14	Visual and Dimensional Test			Required		
	Tolerance checks	Inside Diameter		Required		
		Outside Diameter		Required		
		Wall Thickness WT		Required		
		Straightness		Required		
		Length L Note: Jointers not permitted		Required		

15	Corrosion Allowance	---------		mm
16	Pipe Required for Induction Bending		------- (Yes or No)	
17	PWHT	Required (required if wall thickness >32mm)	------- (Yes or No)	
		Temperature (if PWHT require)	----	°C
18	Tensile Test (pipe body and weld)		Required	
19	CVN Test (pipe, body and HAZ)	Required	Yes	
		For rich gas, multiphase and lean gas with pressure > 80bar — High Impact Energy Required	--- (yes or no)	
		For rich gas, multiphase and lean gas with pressure > 80bar — CVN Energy (kJ)	-------	
20	Guided Bend Test (longitudinal weld)		Required	
21	DWTT (required for grade >X52, dia>16in and carrying gas or multiphase)		Required	
22	CTOD Test (only for MPQ)		Required	
23	NDT		Required	
24	Macrographic Test		Required	
25	Pipe Ends	Bevel angle as per API STD (will be confirmed prior to purchase order). Bevel ends protected with high impact bevel protectors)		
26	Internal Surface	Free from loose mill scale Grit Blasting for Gas Service - free from mill scale		
27	Line Pipe Gauging	Gauging pig shall be pass through each of the first 20 pipes and thereafter 1 pipe per inspection lot		
28	Weldability Test (only for MPQ) – for Grade X60 and above	YES - Required. Welding Procedure will be provided by ADNO C		
29	Hydrogen Induced Cracking Test	Required		
30	SSC Tests (full ring and 4 point bend)	Required as per BS 8701		
31	Marking	Internal marking shall include 1. Heat Number, 2. Unique Pipe Identification Number.		
32	Pipe Protection Coating (temporary)	--------- (specify if temporary internal and/or external protection coating is required).		
33	Documentation & Certification	BS EN 10204 level 3.2 certification (Note: TPA will be appointed by ADNOC)		