



Offshore Design Section
Engineering Services
ISO – 9001:2008

Functional Specification
for
Carbon Steel Seamless
Line Pipe for Submarine
Pipelines (Sour Service)


Spec. No.	2020B
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**SPECIFICATION
FOR
CARBON STEEL SEAMLESS LINE PIPE
FOR
SUBMARINE PIPELINES
(SOUR SERVICE)**

**OIL AND NATURAL GAS CORPORATION LTD.
INDIA**

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39	22.01.2015	5		
TOTAL NO. OF PAGES	DATE	REV.NO.		

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SCOPE

This specification establishes the minimum requirements for the materials, fabrication, inspection, testing and supply of seamless carbon steel line pipe to be used for submarine pipelines and risers transporting sour hydrocarbons. Line pipes furnished in accordance with this specification shall meet the requirements of **API Specification 5L, Forty-Fifth Edition** and the **supplementary requirements stated herein.**

All carbon steel pipes made according to this specification shall be PSL2. All material shall be suitable for sour service and shall be in accordance with NACE MR-01-75 / ISO 15156.

This specification covers seamless line pipes of pipe diameters up to 406.4 mm OD (16 inches) and grades up to Grade L450 (X65). The Manufacturer shall have the license to use API monogram for manufacturing of pipes in accordance with the requirements of API Spec 5L, **Forty-Fifth Edition.**

“COMPANY” means “Oil and Natural Gas Corporation Ltd.”, wherever used in this specification.

NOTE

The sections, paragraphs contained herein have the same numbering as the sections and paragraphs of API 5L, in order to facilitate reference.

In this Specification, amendments to API 5L fall into the following Categories:

ADD	Where additions have been made to the API 5L clause or paragraph.
AMEND	Where the API 5L clause has been modified. Only the modified portions will be detailed in this Specification
DELETE	Where the complete clause or paragraph is to be disregarded.
SUBSTITUTE	Where the text has been substituted for the complete clause or paragraph in API 5L.

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6 PIPE GRADE, STEEL GRADE AND DELIVERY CONDITION

6.1 Pipe Grade and Steel Grade

6.1.2 ADD

Maximum pipe grade shall be up to Grade L450 (X65), where 450 represents the Yield Strength in MPa.

6.2 Delivery Condition

6.2.2 ADD

The pipe shall be “normalized” or “normalized and tempered” or “quenched and tempered”.


7 INFORMATION TO BE SUPPLIED BY THE PURCHASER

7.1 General Information

The purchase order shall include the following information:

SUBSTITUTE

Sl. no	Information to be provided as per API 5L	Information provided by the COMPANY to be incorporated in PO/PS.
a)	quantity(e.g. total mass or total length of pipe)	As per provisions of the Contract.
b)	PSL (1 or 2)	PSL2
c)	type of pipe (see Table 2)	Seamless
d)	reference to API 5L	API Spec 5L, Forty-Fifth Edition
e)	steel grade (see 6.1, H.4.1.1 or J.4.1.1, whichever is applicable)	Refer Table 5 (Substituted) of this Specification for all the standard grades up to L450 (X65)
f)	outside diameter and wall thickness (see 9.11.1.2)	As per provisions of the Purchase Specification
g)	length and type of length random or approximate) (see 9.11.1.3, 9.11.3.3 and Table 12)	Refer J.6.3 of API 5L of Forty-Fifth Edition
h)	confirmation of applicability of individual annexes.	The applicable Annexes as shown in the following supplementary Table:

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Applicable Annexures:

Annex.	Service
Annex B (Substituted) -Manufacturing procedure qualification for PSL 2 pipe	Offshore and Sour Service both.
Annex C (Amended) - Treatment of surface imperfections and defects	Offshore and Sour Service both.
Annex H (Amended) - PSL 2 Pipe ordered for Sour Service	Offshore and Sour Service both.
Annex J (Amended) - PSL 2 pipe ordered for offshore service	Offshore and Sour Service both.
Annex K (Amended) - Non-destructive inspection for pipe ordered for sour service and/or offshore service	Offshore and Sour Service both.

7.2 ADDITIONAL INFORMATION

SUBSTITUTE

a)	Items that are subject to mandatory agreement, if applicable:	
Sl. no.	Information to be provided as per API 5L	Information by the COMPANY to be incorporated in PO/PS.
1	pipe designation for intermediate grades [see Table 1, footnote a)]	Not applicable
2	chemical composition for intermediate grades (see 9.2.1 and 9.2.2)	Not applicable
3	chemical composition for pipe with $t > 25,0$ mm (0.984 in) (see 9.2.3)	Refer 9.2.3 and Table 5 (substituted) along with its footnotes of this specification.
4	carbon equivalent limits for PSL 2 pipe in Grade L415N or X60N (see Table 5)	Refer 9.2.4 & 9.2.5 of this specification.
5	carbon equivalent limits for PSL 2 pipe in Grade L555Q or X80Q, L625Q or X90Q, and L690Q or X100Q (see Table 5),	Not applicable
6	carbon equivalent limits for PSL 2 SMLS pipe with $t > 20,0$ mm (0.787 in) [see Table 5, footnote a)],	Refer 9.2.4 & 9.2.5 of this specification.

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7	diameter and out-of-roundness tolerances for pipe with $D > 1422$ mm (56.000 in) (see Table 10)	Not applicable
8	diameter and out-of-roundness tolerances for the ends of SMLS pipe with $t > 25,0$ mm (0.984 in) [see Table 10, footnote b)]	Table 10 is not applicable. Refer J.6.1 of this specification.
9	standard applicable to jointer welds (see A.1.2)	Not applicable. Joints are not permitted.

b)	Items that apply as prescribed, unless otherwise agreed:	
Sl. no.	Information to be provided as per API 5L	Information by the COMPANY to be incorporated in PO/PS.
1	range of sizing ratio for cold-expanded pipe (see 8.9.2)	Not applicable.
2	equation for sizing ratio (see 8.9.3)	Not applicable.
3	chemical composition limits for PSL 1 pipe [see Table 4, footnotes c), e) and f)]	Not applicable.
4	chemical composition limits for PSL 2 pipe [see Table 5, footnotes c), e), f), g), h), i), k), and l)],	Refer Table 5 (substituted) along with its footnotes of this specification.
5	yield/tensile ratio for grades L625Q or X90Q, L690 or X100 and L830 or X120 [see Table 7, footnotes g and h or Table J.2, footnotes h and i],	Not applicable
6	estimation and reporting of Charpy shear area (see 9.8.2.3)	Not applicable
7	tolerances for random length pipe [see 9.11.3.3 a)]	Refer 9.11.3.3 of this specification. Table 12 of API 5L shall not be applicable.
8	type of thread compound (see 9.12.2.4)	Not applicable
9	type of end face (see 9.12.5.1 or 9.12.5.2)	Section 9.12.5.2 of API 5L shall be applicable.
10	International Standard applicable to Charpy testing (see 10.2.3.3, 10.2.4.3, D.2.3.4.2 and D.2.3.4.3)	Charpy V- notch testing shall be done in accordance with ASTM A370.

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11	product analysis method (see 10.2.4.1),	As per Section 10.2.4.1 of API 5L
12	alternate method for diameter measurement for $D \geq 508$ mm (20.000 in) (see 10.2.8.1),	Not Applicable
13	jointer welding type (see A.1.1),	Not applicable
14	offset of longitudinal pipe weld seams at jointer welds (see A.2.4)	Not applicable
15	repairs in cold-expanded pipe (see C.4.2)	Not applicable.
16	alternate IQI type (see E.4.3.1);	Not applicable.

c) Items that apply, if agreed:		
Sl. no.	Information to be provided as per API 5L	Information by ONGC to be incorporated in PO/PS.
1	delivery condition (see 6.2 and Table 1)	PSL 1 shall not be applicable. The pipe shall be “normalized” or “normalized and tempered” or “quenched and tempered”.
2	supply of quenched and tempered PSL 1 Grade L245 or B SMLS pipe (see Table 1),	Not applicable.
3	supply of intermediate grades [see Table 2, footnote a)]	Not applicable.
4	supply of double-seam SAWL pipe [see Table 2, footnote c)]	Not applicable.
5	alternative to specified seam heat treatment for PSL 1 pipe (see 8.8.1)	Not applicable.
6	supply of SAWH pipe with coil/plate end welds at the pipe ends (see 8.10.3),	Not applicable.
7	supply of jointers (see 8.11)	Not applicable .Jointers are not permitted
8	CVN impact test temperature lower than 0°C (32°F) (see 9.8.2.1, 9.8.2.2 and 9.8.3)	CVN impact test temperature lower than 0°C (32°F) is not applicable.
9	CVN impact test of the pipe body of PSL 2 welded pipe with $D < 508$ mm (20.000 in) for shear fracture area (see 9.8.2.2 and Table 18)	Not applicable.



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10	CVN impact test of the longitudinal seam weld of PSL 2 HFW pipe (see 9.8.3 and Table 18)	Not applicable.
11	DWT test of the pipe body of PSL 2 welded pipe with $D \geq 508$ mm (20.000 in) (see 9.9.1 and Table 18)	Not applicable.
12	DWT test temperature lower than 0°C (32°F) (see 9.9.1)	Not applicable.
13	fraction jointers comprising 2 or 3 pieces for 12 m (40 ft) nominal or 24 m (80 ft) nominal, respectively [see 9.11.3.3.c), d), and e)],	Not applicable.
14	power-tight make-up of couplings (see 9.12.2.3 and 10.2.6.1)	Not applicable.
15	special bevel configuration (see 9.12.5.3)	Not applicable.
16	removal of outside weld bead at pipe ends of SAW or COW pipe [see 9.13.2.2 e)]	Not applicable.
17	weldability data or tests for PSL 2 pipe (see 9.15)	Weldability data shall be provided. Refer Table 5(Substituted) read with 9.2.4(Substituted) /9.2.5(Substituted) of this Spec. For X65 Grade pipes, in addition to above requirements, weldability tests shall also be carried out.
18	type of inspection document for PSL 1 pipe (see 10.1.2.1)	Not applicable.
19	manufacturing information for PSL 1 pipe (see 10.1.2.2)	Not applicable.
20	alternative type of inspection document for PSL 2 pipe (see 10.1.3.1)	Refer 10.1.3.1 (Amended) of this Specification.
21	use of transverse test pieces for tensile tests of SMLS pipe, not cold-expanded [see Table 20, footnote c)]	<ul style="list-style-type: none"> For pipe OD > 219.1mm both transverse and longitudinal tensile test shall be carried out for each lot of 100 pipes or less, belonging to the same heat and manufactured by the same process.



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		<ul style="list-style-type: none">For pipe OD ≤ 219.1mm the test shall be carried out in longitudinal direction only; however longitudinal tensile testing frequency shall be as per this specification.
22	use of the ring expansion test for transverse yield strength determinations [see 10.2.3.2, Table 19 note c), and Table 20 note d)],	Not Applicable.
23	use of an alternative to macrographic examination (see 10.2.5.2)	Not applicable
24	hardness test during production of EW and LW pipe (see 10.2.5.3)	Not applicable
25	specific condition to be used for hydrostatic tests for threaded and coupled pipe (see 10.2.6.1)	Not applicable
26	alternate hydro test pressure (see Table 26),	Not Applicable. Refer 10.2.6 (Substituted) of this specification.
27	use of minimum permissible wall thickness to determine hydrostatic test pressure (see 10.2.6.7)	Applicable.
28	specific method to be used for determining pipe diameter (see 10.2.8.1)	Clause 10.2.8.1 is Applicable. Further, Caliper / properly sized go-no-go gauges shall be used to verify that diameter and out of roundness at pipe ends for each pipe is within the required tolerances J.6.1 (Substituted) of this specification.
29	use of inside diameter measurements to determine diameter and out-of-roundness for expanded pipe with $D \geq 219.1$ mm (8.625 in) and for non-expanded pipe [see 10.2.8.3 and Table 10, footnote c)].	Acceptable. Refer Cl. J.6.1 (Substituted) of this Specification) and Cl.10.2.8.3 of API 5L, 45th Edition).
30	specific method to be used for determining other pipe dimensions (see 10.2.8.7)	Proposed methods shall be subject to COMPANY approval.
31	paint-stencilled markings for couplings (see 11.1.2)	Not applicable

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32	additional markings specified by the purchaser (see 11.1.4)	For segregation of pipes additional markings/colour bands may be decided by the LSTK contractors.
33	specific surface or location for pipe markings [see 11.2.2 b) and 11.2.6 b)]	Applicable.
34	die-stamping or vibro-etching of pipe (see 11.2.3)	Only low stress die stamping shall be permitted on the pipe bevel face preferably at the opposite end to pipe stencilled markings. The low stress marking shall be the unique pipe number only. Cold die stamping is not permitted on the pipe body. In case low stress die-stamping on bevel face is technically not feasible, alternate measures shall be made for providing unique pipe number for ensuring traceability of pipes.
35	alternative location for marking the pipe (see 11.2.4)	Marking shall be carried out at the pipe mill. Further, for pipes intended for subsequent coating, LSTK contractor shall submit the procedure for marking at coating yard ensuring the traceability of pipes.
36	alternative format for pipe length marking locations (see 11.2.6a),	Not applicable.
37	colour identification for pipe (see 11.2.7)	As per 11.2.7 of API 5L.
38	multiple grade marking (see 11.4.1),	Not applicable.
39	temporary external coating (see 12.1.2)	Pipe shall be delivered with mill's standard temporary external coating throughout the external surface of pipe body to provide protection from rusting in storage and transit.
40	special coating (see 12.1.3)	Not applicable
41	lining (see 12.1.4),	Not applicable




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42	manufacturing procedure qualification for PSL 2 pipe, in which case, Annex B shall apply (see B.2),	Refer Annex B (Substituted) of this specification.
43	radiographic inspection of SAW seam or coil/plate end seam (see Table E.1)	Not applicable
44	non-destructive inspection of PSL 1 SMLS pipe (see E.3.1.2),	Not applicable
45	NDT of EW seam welds after hydrotest [see E.3.1.3 b)],	Not applicable
46	ultrasonic inspection of welded pipe for laminar imperfections at pipe ends (see E.3.2.3)	Not applicable
47	ultrasonic inspection of SMLS pipe for laminar imperfections at pipe ends (see E.3.3.2)	Refer Annex.K (Amended) of this Spec.
48	radiographic inspection in accordance with Clause E.4,	Not applicable
49	use of both holes and notches in ultrasonic reference standard (see Table E.7),	Acceptable
50	alternative re-inspection technique for COW seams (see E.5.5.5)	Not applicable
51	ultrasonic inspection for laminar imperfections in the pipe body of EW, SAW or COW pipe (see Clause E.8)	Not applicable
52	ultrasonic inspection for laminar imperfections along the coil/plate edges or the weld seam of EW, SAW or COW pipe (see Clause E.9)	Not applicable
53	supply of welded couplings on pipe with $D \geq 355,6$ mm (14.000 in) (see F.1.4)	Not applicable
54	application of Annex G to PSL 2 pipe where purchaser shall specify the toughness test temperature, the minimum energy for each test and the minimum average energy value required for the order (see G.2),	Refer 9.8.2.1 (Amended) of this specification
55	PSL 2 pipe for sour service, in which case, Annex H shall apply (see H.2),	Refer Annex H (Amended) of this specification.
56	TFL pipe, in which case, Annex I shall apply (see I.2),	Not applicable

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57	pipe for offshore service, in which case, Annex J shall apply (see J.2),	Refer Annex J (Amended) of this specification
58	any other additional or more stringent requirements.	As included within this document.

8 MANUFACTURING

8.1 Process of Manufacture

ADD

This specification is applicable for seamless pipe only. Other types of pipes specified in Table 2 and pipe for intermediate grades (refer footnote a) of Table 2 are not applicable in this specification. The pipe shall be “normalized” or “normalized and tempered” or “quenched and tempered”.

8.3 Starting Material

8.3.2 AMEND

Pipes furnished to this specification shall be made from basic-oxygen steel or electric arc furnace steel. Steel shall be vacuum degassed. The material shall be treated for inclusion shape control to increase resistance to hydrogen-induced (blistering and stepwise) cracking.

Steel shall be made by continuous casting only. Pipes shall be seamless construction. Manufacturing procedure as mentioned in Annex B (Substituted) of this specification shall be prepared and submitted to Company for approval prior to start of production.

8.3.3 ADD

The steel shall be fully killed and made with fine grain structure with a grain size of ASTM 7 or finer as per ASTM E 112.

8.9 Cold Sizing and cold expansion

SUBSTITUTE

Cold expansion shall not be permitted for seamless pipes.

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8.11 Jointers

AMEND

Jointers shall not be permitted.

8.12 Heat Treatment

ADD

The pipes shall be “normalized” or “ normalized and tempered” or “quenched and tempered”. Other types of heat treatment shall be agreed upon between the COMPANY and Manufacturer. Temperature of furnace shall be controlled and recorded and such records shall be accessible to Company.

9 ACCEPTANCE CRITERIA

9.2 Chemical Composition

9.2.2 & 9.2.3

AMEND

The chemical composition of each heat of steel on product analysis for all the standard grades up to L450 (X65) shall be in accordance with Table-5 (substituted) given below. Intermediate grades are not permitted.

TABLE 5 (SUBSTITUTED)

API 5L Table-5 including its notes is substituted as under:

C max. %	0.14
Mn max. %	1.55
Si max. %	0.45
P max. %	0.015
S max. %	0.003
Cr max. %	0.3
Ni max %	0.3
Al _{total} max. %	0.06
N max. %	0.01
Cu max %	0.35
Mo max. %	0.10
B max. %	0.0005
Nb max. %	0.05
Ti max. %	0.07
V max. %	0.09



NOTES :

- i) V + Nb + Ti shall not exceed 0.12%
- ii) For steel grade L245 NS & L245 NO, V + Nb shall not exceed 0.06%.
- ii) Cu + Ni shall not exceed 0.50 %.
- iii) Al/N ratio shall be minimum 2.0 (Not applicable to Titanium killed steel)
- iv) Ca concentration shall be ≤ 0.006 %.
- v) For steels with carbon content $\leq 0.12\%$, the PCM value based on product analysis shall not exceed 0.21, when calculated using the formula given in 9.2.4.
- vi) For steel with carbon content $> 0.12\%$, the CE value based on product analysis shall not exceed 0.40, when calculated using the formula given in 9.2.5.
- vii) If alloying elements other than those specified in Table 5 (Substituted) are added to the steel, limits of the additional components shall be agreed with the Company.

9.2.4 SUBSTITUTE

For steels with carbon content $\leq 0.12\%$, the PCM value based on product analysis shall not exceed 0.21, when calculated using the formula given below:

$$CE_{Pcm} = C + \frac{Ni}{60} + \frac{Si}{30} + \frac{Mn+Cu+Cr}{20} + \frac{Mo}{15} + \frac{V}{10} + 5B$$

9.2.5 SUBSTITUTE


For steel with carbon content $> 0.12\%$, the Carbon Equivalent (CE) based on product analysis shall be less than or equal to 0.40, when calculated using the formula given below:

$$CE_{IIW} = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$$

9.3 Tensile Properties

9.3.2 SUBSTITUTE

The minimum Yield strength, minimum Tensile strength and minimum % elongation of finished pipes (after all heat treatment and sizing operations) shall conform to the requirements of Table J.2 of API 5L. However, other requirements of Table J.2 are not applicable.

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The actual yield strength shall be as close as possible to the specified minimum yield strength but in no case it shall be more than 133% of the specified minimum yield strength.

The ratio between yield strength and ultimate tensile strength of finished pipes shall not be more than 0.90.

9.4 Hydrostatic Tests

9.4.1 SUBSTITUTE

The test pressure shall be held for a minimum period of 10 seconds for all sizes and grades of pipes.

9.8 CVN Impact Test for PSL 2 Pipe

9.8.1 General ADD

The Manufacturer shall perform the Charpy V-notch tests in accordance with the latest edition of ASTM A 370 using absorbed energy criteria and the requirements mentioned herein.

Flattening of specimens shall not be permitted. Specimens shall be taken in a transverse direction. When it is not feasible to secure even half-size specimens in transverse direction because of pipe size or wall thickness, test specimens shall be taken in a longitudinal direction to pipe axis. The energy requirements for longitudinal specimens shall be 1.5 times those of transverse specimens as detailed in 9.8.2.1(Amended) of this specification.

In addition, CTOD tests shall be carried out as per the requirement of the first day production tests. Refer Annex B (Substituted).

9.8.1.3 AMEND


Tests shall be conducted at 0°C (32°F)

9.8.2 Pipe Body Tests

9.8.2.1 AMEND

The minimum average absorbed energy and minimum individual absorbed energy for each pipe body test shall be 41 J and 31J respectively in the transverse direction for a set of three test pieces based upon full-size test pieces and a test temperature of 0 °C (32 °F). Test temperature lower than 0°C (32°F) is not applicable.

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9.10 Surface Conditions, Imperfections and Defects

9.10.4 Laminations

ADD

Refer Annex K (Amended).

9.10.5 Geometric Deviations

9.10.5.2 AMEND

Depth of dent shall not exceed 2 mm and length in any direction shall not exceed half of the pipe diameter, provided this dent does not give rise to a hard spot at the internal surface exceeding 250 HV10. Disposition of dents shall be carried out in accordance with API 5L para C.3.b) or C.3.c) of Annex C.

9.10.6 Hard Spots

SUBSTITUTE

Any hard spot larger than 50 mm (2.0 in) in any direction shall be classified as a defect if its hardness exceeds 250 HV10 based upon individual indentations. Sections of pipes where hardness is greater than the allowable value shall be cut off as per requirements of API 5L para C.3.b) or C.3.c) of Annex C(Amended).


9.10.7 Other Surface Imperfections

SUBSTITUTE

Other surface imperfections found by visual inspection shall be investigated, classified and treated as follows:

- Imperfections that have a depth $\leq 0.05t$ and do not encroach on the minimum permissible wall thickness shall be classified as acceptable imperfections and shall be treated in accordance with Clause C.1.
- Imperfections that have a depth $> 0.05t$ and do not encroach on the minimum permissible wall thickness shall be classified as defects and shall be dressed –out by grinding in accordance with Clause C.2 (Amended) or shall be treated in accordance with Clause C.3.
- Imperfections that encroach on the minimum permissible wall thickness shall be classified as defects and shall be treated in accordance with Clause C.3.

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9.11 Dimensions, Mass and Tolerances

9.11.3 Tolerances for Diameter, Wall Thickness, Length and Straightness

AMEND

Tables 10, 11 & 12 of API 5L shall not be applicable.

9.11.3.1 SUBSTITUTE

Tolerances for diameter and out-of-roundness shall be as per J.6.1 (Substituted) of this specification.

9.11.3.2 SUBSTITUTE

Wall thickness tolerance for all sizes shall be +17.5%,-5%.Table 11 shall not be applicable.

9.11.3.3 Refer J.6.3 of API 5L

9.11.3.4 SUBSTITUTE

The tolerances for straightness shall be as per J.6.4 of API Specification 5L

10 INSPECTION

10.1.3. Inspection documents for PSL 2 pipe

10.1.3.1 AMEND


Inspection certificate shall be issued and validated as per “3.1C” in accordance with ISO 10474 : 1991.

10.1.3.2 SUBSTITUTE

The manufacturer shall provide production report including acceptance test certificates as mentioned in 13 of API Specification 5L (as applicable for seamless pipe) in six copies, which shall include the results of all testing required as per this specification and performed on raw material and delivered pipes giving details of, but not limited to the following for each pipe length:

- COMPANY's Name and Order Number;
- SUPPLIER's Identification;

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- Name and location of facilities used for pipe manufacturing and steelmaking
- Pipe specified outside diameter, specified wall thickness, pipe grade
- Product Specification Level (PSL) and delivery condition;
- Steelmaking Process;
- Identification of Steel Type and Grade;
- Billet number, as applicable;
- Certificates of Product and Ladle Analysis;
- CE_{IIW} & Pcm for both Product and Ladle Analysis;
- Pipe Identification number, Heat number, Pipe length and Pipe weight
- Certified measurements for Dimensional measurements/ tolerance
- Mechanical Test Certificates, including hardness surveys;
- Yield/Tensile Ratio (based on R_{10.5});
- Pipe Elongation;
- Charpy Impact Results;
- Hardness Tests;
- Heat Treatment Condition
- Hydrostatic Test Certificate, or statement;
- NDT Procedures and Results;
- Surface Inspection;
- Dimensional Control Checks;
- Manufacturing Procedure Specification and Qualification Tests;
- HIC, including photomicrographs ; Four Point Bend Test , Hardness test and CTOD test records;
- Information on production & shipping
- All other reports and results as required as per this specification
- NDT Operator Qualification Certificates;
- Inspection certificate issued and validated by Authorized representative of Purchaser, as per “3.1C” of ISO 10474 : 1991, in accordance with this specification.
- COMPANY Authorized representative's Pipe Inspection and Release Note.

Such documents shall indicate pipe identification number, the origin of each individual test specimen etc. and shall be written in English only. International system of units (SI) shall be adopted. The certificates shall be valid only when signed by Company Representative. Only those pipes which have been certified by Company Representative shall be dispatched from the pipe mill.

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Manufacturer shall also provide information on test failure / rejected heats etc.

10.2 Specific Inspection

10.2.1 Inspection frequency

10.2.1.2 AMEND

For PSL 2 pipe, the inspection frequency shall be as given in Table 18 with following amendments:

Table 18 (Amended)

Type of Inspection	Frequency of inspection
Product Analysis	Two pipes per heat of steel shall be analyzed for all elements listed in Table-5 (substituted). When more than 100 pipes are manufactured from one heat, additional product analysis for one pipe shall be carried out for every 100 pipes or less of the same heat.
Tensile testing of the pipe body	A transverse and longitudinal tensile test once per test unit of not more than 100 lengths of the pipe. In case of pipe diameters 219.1 mm (8-5/8 inches) and smaller, only longitudinal tensile test shall be carried out.
CVN impact testing of the pipe body of pipe with specified outside diameter and specified wall thickness as given in Table 22.	Once per test unit of not more than 100 lengths of the pipe.
Pipe diameter and out-of-roundness for pipe with $D \leq 168,3$ mm (6.625 in)	At pipe ends, pipe diameter and out of roundness will be checked 100% by properly sized go-no go gauge/ caliper for verification of dimensions within tolerances as per Company's spec. However measurement frequency shall be once per test unit of not more than 100 lengths of pipe.
Pipe diameter and out-of-roundness for pipe with $D > 168,3$ mm (6.625 in)	At pipe ends, pipe diameter and out of roundness will be checked 100% by properly sized go-no go gauge/ caliper for verification of dimensions within tolerances as per Company's spec. Once per test unit of not more than 20 lengths of pipe
Non-destructive inspection	In accordance with Annex K (Modified)



CTOD test for seamless pipe of all Grades	As per Annex B (substituted).
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10.2.3 Samples and test pieces for mechanical tests.

SUBSTITUTE

- 10.2.3.1** For tensile tests, CVN impact tests and CTOD tests, the samples shall be taken and the corresponding test pieces shall be prepared, in accordance with the applicable reference standard.

Samples and test pieces for the various test types shall be taken from locations as shown in Figure 5 a) and as given in J.8 of this specification, taking into account the supplementary details in 10.2.3.2 to 10.2.3.3, 10.2.4. and J.8.2.2.

10.2.6 Hydrostatic Test

10.2.6.1 SUBSTITUTE

The test pressure for all sizes and grades of pipes shall not be less than the maximum pressure calculated based on either of the criteria mentioned at 10.2.6.5 (amended) and 10.2.6.6 (amended) .The test pressure shall be held for a minimum period of 10 seconds for all sizes and grades of pipes.

10.2.6.5 AMEND


The required test pressure shall produce a hoop stress of at least 90% of the specified minimum yield strength for all the grades and sizes.

10.2.6.6 AMEND

In case, pressure testing involves end sealing ram, the required test pressure shall produce a hoop stress of at least 95% of the specified minimum yield strength for all the grades and size.

10.2.7 Dimensional testing

10.2.8.1 ADD

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Caliper / properly sized go-no-go gauges shall be used to verify that diameter and out of roundness at pipe ends for each pipe is within the required tolerances J.6.1 (Substituted) of this **specification**.

10.2.10 SUBSTITUTE

Non-destructive inspections shall be in accordance with Annex K modified.

10.2.11 SUBSTITUTE

Reprocessing is not permitted.

10.2.12 Retesting (SUBSTITUTE)

10.2.12.1 Recheck Analysis

If any parts of the full product analysis on any one of the fully analyzed pipes fail to meet the requirements of H.4.1 of this specification, either the whole heat shall stand rejected or each individual pipe shall be fully analyzed and all pipes failing to meet the requirements of H.4.1 of this specification shall be rejected.

10.2.12.2 Tensile retest and Charpy retest

In case one of the test specimens fails to conform to the specified requirements, a retest on four additional pipes from the same lot shall be made. If all re-tests give positive result, then the pipe, which gave the negative result, shall be rejected and the balance lot shall be accepted.

In case of negative result of one of the re-test specimens, the lot may be rejected or each of the remaining lengths shall be tested individually. The pipes, which give results as per requirement of this specification, shall only be accepted.

11.2 Pipe markings

11.2.1 ADD

Marking shall be in English using SI units. Markings shall also include API monogram, purchase order number, item number, heat number, wall thickness (mm), pipe number, weight and grade. Weight marked shall be the actual weight of the pipe. All pipes shall be marked with API monogram.

11.2.7 AMEND

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Manufacturer shall apply a daub of approx. 50mm in diameter on inside surface of each length of pipe. The paint colour shall be as given in Table 27.

13 Retention of Records

ADD

In addition to the records indicated in clause 13, the manufacturer shall retain the records of all additional tests mentioned in this specification including the ultrasonic testing carried out on pipe as well as pipe ends.

ANNEXES OF API 5L (Substituted/ Amended)

Annex B - Manufacturing procedure qualification for PSL 2 pipe	Refer Annex B (Substituted) of this Specification.
Annex C - Treatment of surface imperfections and defects	Refer Annex C (Amended) of this Specification.
Annex H-PSL 2 Pipe ordered for Sour Service	Refer Annex H (Amended) of this Specification.
Annex J - PSL 2 pipe ordered for offshore service	Refer Annex J (Amended) of this Specification.
Annex K - Non-destructive inspection for pipe ordered for sour service and/or offshore service	Refer Annex K (Amended) of this Specification.

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Annex B (SUBSTITUTED)

Manufacturing Procedure Qualification for PSL 2 Pipe

Mill Qualification and First Day Production Test

Mill Qualification Tests

Prior to start of regular production, the following tests shall be carried out, in order to qualify the Mill for regular production of pipes.

Sulphide Stress Cracking Test.

Manufacturer shall carry out NACE standard tensile test (Method A) for Sulphide Stress Cracking Test in accordance with NACE standard TM-0177: 2005 using test solution A. The test shall be carried out at 60,72,80,90 and 100% SMYS stress levels to produce a curve. Minimum stress for failure after 720 hours shall be at least 72% of SMYS.

Hydrogen Induced Cracking Test.

The HIC test shall be carried out in accordance with NACE standard TM-0284, "Test Method of Pipeline Steel for Resistance to Stepwise Cracking" and as specified in H.7.3.1.1 of this specification. The acceptance criteria for crack sensitivity ratio (CSR) shall be 0.00%.

Four Point Bend Test

Manufacturer shall carry out Four Point Bend Test using NACE solution as specified in H.7.3.2.1 of this specification. The acceptance criteria shall be that the specimen shall not have any SSC cracks when examined visually as well as with wet magnetic particle method. Mills shall be considered qualified only subsequent to successful completion of all the tests as mentioned above. Requirement of these tests may be waived by mutual agreement between Company and the Manufacturer in case Manufacturer possess records of successful performance of this test on a previous supply of line pipes produced by the same method of manufacture, similar chemical composition and grade of steel and subjected to similar heat treatment provided such tests had been performed not earlier than two years prior to this enquiry. Such test certificates duly witnessed and approved by an internationally reputed independent

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Inspection Agency along with a description of the tests performed shall be furnished by the Manufacturer in case Manufacturer desires a waiver of this test.

FIRST DAY PRODUCTION TESTS

Two lengths of finished pipes (in case of only one heat on first day) or two lengths from the first two heats i.e. one pipe from each heat (in case of more than one heat on first day) of first day's production shall be selected at random for testing to verify that the manufacturing procedure results in the quality of pipes which are in complete compliance with this specification. The first day production tests shall be carried out on pipes of maximum diameter and minimum wall thickness. The pipes thus tested shall be considered to be the test pipes required per heat or per lot as required in the relevant paragraphs of this specification.

These first day's production tests shall be repeated upon any change in the manufacturing procedure or any change in the source of raw materials as deemed necessary by Company's Representative.

The Manufacturer shall submit to Company a report giving the results of all tests mentioned below. The report shall be agreed and signed by Company's Representative, prior to start of regular production.

The various tests to be conducted on each pipe shall be as follows.

a) Visual Examination


All pipes shall be examined visually for dimensional tolerances and apparent surface defects in accordance with 9,10 & 11 respectively of this specification.

b) Mechanical Properties

The mechanical properties of all pipes shall be tested and shall meet the requirements of the relevant sections of this specification.
The following tests shall be conducted:

- i) Tensile tests shall be conducted on two transverse and two longitudinal base material specimens.
- ii) At points selected by Company's Representative, three impact test specimens shall be removed from the base material. Specimens shall be tested at 0°C

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iii) Hardness tests shall be carried out on selected pipes as per requirement of H.4.4 this specification.

c) CTOD testing shall be carried out in accordance with the requirements of BS 7448. One set of three specimens shall be taken in transverse direction. The test shall be carried out at 0°C. Minimum acceptable critical CTOD value shall be 0.2 mm. Average CTOD value shall be reported. For Pipe size $\leq 219.1\text{mm}$, longitudinal specimens for CTOD test are acceptable.

In addition all the data on fatigue pre-cracking front are required. (Crack length at the following positions i.e. both surfaces, 25%, 50% and 75% of the specimen thickness, the minimum and the maximum angle between the crack and the plane of the notch).

d) **Corrosion Tests**

i) HIC test shall be carried out as per H.7.3.1.1 of this specification.

ii) Four point bend test shall be carried out as per clause H.7.3.2.1 of this specification.

e) In addition, all the tests and inspection required to be conducted on each pipe as per this specification shall be conducted on all the pipes selected for testing during first day production test.

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Annex C (AMENDED)

C.2 Treatment of surface imperfections and defects

- C.2.3** Complete removal of defects shall be verified by local visual inspection, aided, where necessary, by suitable non-destructive inspection methods. To be acceptable, the diameter, out of roundness and wall thickness in the ground area shall be in accordance with 9.11.3.1 and 9.11.3.2 of this specification; further, the sum of all ground areas for surface defect treatment shall not exceed 10% of total internal and external surface area of each pipe.

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Annex H (AMENDED)

PSL 2 pipe ordered for sour service

H.2 Additional information to be supplied by the purchaser

Information Requirement

	Information sought as per API 5L	COMPANY's Requirement
a)	steel casting method for strip or plate used for the manufacture of welded pipe (see H.3.3.2.1)	Not applicable
b)	ultrasonic inspection of strip or plate for laminar imperfections (see H.3.3.2.4)	Not applicable
c)	supply of helical-seam pipe containing coil/plate end welds (see H.3.3.2.5)	Not applicable
d)	chemical composition for intermediate grades (see H.4.1.1)	Not applicable
e)	chemical composition for pipe with $t > 25,0$ mm (0.984 in) (see H.4.1.2)	Refer Table 5 (substituted) with foot notes thereof.
f)	chemical composition limits [see Table H.1, footnotes c), d), e), f), i), j) and k)]	Refer Table 5 (substituted) with foot notes thereof.
g)	frequency of hardness testing of the longitudinal seam weld of HFW or SAW pipe (see Table H.3)	Not applicable
h)	SSC test for manufacturing procedure qualification (see Table H.3)	SSC test is required in accordance with Annex B (substituted) of this specification.
i)	alternative HIC/SWC test methods and associated acceptance criteria (see H.7.3.1.3)	Acceptance criteria shall be as per H.4.3 of this specification.
j)	photomicrographs of reportable HIC cracks (see H.7.3.1.4)	Photomicrographs of all the HIC test pieces shall be provided.
k)	alternative SSC test methods and associated acceptance criteria for manufacturing procedure qualification (see H.7.3.2.2)	SSC test is required in accordance with Annex B (substituted) of this specification. Alternate SSC



		test methods are not acceptable.
l)	deviation from hardness test (see H.7.3.3.2 and H.7.3.3.3);	Not applicable
m)	deviation from 4 hardness impressions [see H.7.3.3.2 c)];	Not applicable
n)	for pipe with $t \geq 5,0$ mm (0.197 in), ultrasonic inspection for laminar imperfections within extended length of 100 mm (4.0 in) at the pipe ends (see K.2.1.3)	Required
o)	supplementary end NDT lamination criteria (see K.2.1.3 and K.2.1.4);	Required
p)	magnetic particle inspection for laminar imperfections at each pipe end face/bevel (see K.2.1.4)	Required
q)	verification of lamination size/density (see K.3.2.2);	Required
r)	increased coverage for ultrasonic thickness measurements for SMLS pipe (see K.3.3)	Coverage shall be as per K.3.3 (amended) plus 100mm at each pipe end.
s)	application of one or more of the supplementary non-destructive inspection operations for SMLS pipe (see K.3.4)	UT in accordance with K.3.4.1 (amended).
t)	ultrasonic inspection of SMLS pipe for the detection of transverse imperfections (see K.3.4.1);	UT in accordance with K.3.4.1 (amended).
u)	full-body inspection of SMLS pipe the flux leakage method for the detection of longitudinal and transverse imperfections (see K.3.4.2);	Required
v)	full-body inspection of SMLS pipe by the eddy current method (see K.3.4.3);	Required
w)	full-body magnetic particle inspection of pipe (see K.3.4.4);	Required
x)	limitation of individual lamination size to 100 mm ² (0.16 in ²) (see Table K.1)	Required
y)	acceptance level U2/U2H for nondestructive inspection of the weld seam of HFW pipe (see K.4.1)	Not Applicable
z)	alternate ISO 10893-10 HFW weld seam UT acceptance criteria [see K.4.1 b)];	Not Applicable
aa)	ultrasonic inspection of the pipe body of	Not Applicable



	HFW pipe for laminar imperfections (see K.4.2)	
bb)	ultrasonic inspection of the strip/plate edges or areas adjacent to the weld for laminar imperfections (see K.4.3)	Not Applicable
cc)	non-destructive inspection of the pipe body of HFW pipe using the ultrasonic or flux leakage method (see K.4.4)	Not Applicable
dd)	use of fixed depth notches for equipment standardization [see K.5.1.1 c)]	Not Applicable
ee)	radiographic inspection of pipe ends (non-inspected ends) and repaired areas [see K.5.3 a)]	Not Applicable
ff)	magnetic particle inspection of the weld seam at the pipe ends of SAW pipe (see K.5.4)	Not Applicable

H.3 Manufacturing

H.3.1 Manufacturing procedure

SUBSTITUTE

All pipes shall be manufactured in accordance with a manufacturing procedure that has been qualified in accordance with Annex B (Substituted).

H.3.3 Pipe manufacturing

H.3.3.1 SUBSTITUTE

Steel shall be made by continuous casting only. Seamless pipes shall be non-expanded.


H.3.3.2 Not applicable

H.3.3.3 Joints

SUBSTITUTE

Joints are not permitted

H.4 ACCEPTANCE CRITERIA

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H.4.1 Chemical composition

SUBSTITUTE

Refer 9.2 [Table 5 (substituted)] with foot notes thereof.

Table H.1 SUBSTITUTE

Refer Table 5 (substituted) with foot notes thereof.

H.4.2 Tensile properties

H.4.2.1 SUBSTITUTE

The minimum Yield strength, minimum Tensile strength and minimum % elongation of finished pipes (after all heat treatment and sizing operations) shall conform to the requirements of Table J.2 of API 5L. However, other requirements of Table J.2 are not applicable.

The actual yield strength shall be as close as possible to the specified minimum yield strength but in no case it shall be more than 133% of the specified minimum yield strength.

The ratio between yield strength and ultimate tensile strength of finished pipes shall not be more than 0.90.

H.4.3 HIC/SWC TEST

AMENDED

The acceptance criteria for crack sensitivity ratio (CSR) shall be 0.00%.

H.4.4 Hardness test

SUBSTITUTE

Vickers hardness tests as per ASTM E-92 shall be carried out on samples of pipes at locations indicated in Figure H.1 a) to establish that the hardness of the pipe material is less than 250 HV10. Testing frequency shall be same as for tensile tests as specified in 10.2.1.2 of this specification. Modalities of retest shall be in accordance with 10.2.12 of this specification.

H.7 Inspection

H.7.1 Specific inspection

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SUBSTITUTE

The frequency of inspection shall be as given in 10.2.1.2, supplemented with the requirements of Table H.3 with following amendments:

Type of Inspection	Frequency of inspection
Hardness testing	Test shall be carried out for each lot of 100 pipes or less.
SSC test (mill qualification test)	Refer Annex B (Substituted)
Four Point Bend Test	One test for each of the first three heats applied; thereafter, one test for each test unit of not more than ten heats of steel.

H.7.3 Test method

H.7.3.2 SSC test


H.7.3.2.1 SUBSTITUTE

SSC tests shall be performed in accordance with NACE TM0177:2005, using test Solution A.

SSC test for mill qualification of 720 hrs test duration shall be in accordance with Annex B (Substituted).

Four Point Bend Test

Four point bend test specimen preparation and size shall be as per ASTM G 39 except that thickness shall be minimum 5 mm. One set of three specimens shall be machined from the middle of the pipe wall thickness. The specimen shall be machined transverse to pipe axis. However, if the pipe diameter and / or wall thickness is such that the transverse specimen cannot be obtained, the specimen is to be taken in longitudinal direction. The specimens shall be bent using Four point Loading jigs to reach a stress level of 72% SMYS and then immersed in NACE solution as per NACE standard TM-0177 for a period of 96 hours with the inner surface in tension. Testing sequence shall be in accordance with NACE TM 0177. The acceptance criteria shall be that the specimen shall not have any SSC cracks when examined visually as well as with wet magnetic particle technique. Four point bend test shall be carried out on one pipe from each of the first three heats and then on one pipe from every ten subsequent heats. The selection of

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the specific sample heat out of every ten heats shall be as per the decision of Company Representative.

If one specimen fails to meet the criteria, the retest and acceptance procedure shall be as mentioned in H.7.3.1.1 above.

H.7.3.2.2 DELETED

H.7.3.3 Hardness test

H.7.3.3.1 SUBSTITUTE

Hardness testing shall be performed using the Vickers test in accordance with ISO 6507-1 or ASTM E 384.

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Annex J (AMENDED)

PSL 2 pipe ordered for offshore service

J.2 Additional information to be supplied by the purchaser

Information Requirement

	Information sought by API 5L	COMPANY's Requirement
a)	steel casting method for strip or plate used for the manufacture of welded pipe (see J.3.3.2.1)	Not applicable
b)	ultrasonic inspection of strip or plate for laminar imperfections (see J.3.3.2.4)	Not applicable
c)	supply of helical-seam pipe containing coil/plate end welds (see J.3.3.2.5)	Not applicable
d)	chemical composition for intermediate grades (see J.4.1.1)	Not applicable
e)	chemical composition for pipe with $t > 25,0$ mm (0.984 in) (see J.4.1.2)	Refer Table 5 (substituted) with foot notes thereof.
f)	carbon equivalent limit for steel Grade L555QO or X80QO, L625QO or X90QO, and L690QO or X100QO (see Table J.1);	Not applicable
g)	Chemical composition limits [see Table J.1, footnote d]	Refer Table 5 (substituted) with foot notes thereof.
h)	Acceptance criteria for tensile properties if determined at other than room temperature (see J.4.2.2)	Not applicable
i)	for grades equal to or greater than Grade L555 or X80, a lower maximum tensile strength limit may be agreed [see Table J.2, footnote b)];	Not applicable
j)	Minimum average length other than 12,1 m (39.7 ft) and/or different range (see J.6.3)	Refer J.6.3 of API 5L.
k)	Diameter and out-of-roundness tolerances for SMLS pipe with $t > 25.0$ mm (0.984 in) [see Table J.3, footnote b)]	Tolerances shall be as per J.6.1(Substituted).
l)	Use of inside diameter to determine diameter and out-of-roundness tolerances for non-expanded pipe with $D \geq 219,1$ mm (8.625 in) [see Table J.3, footnote c)]	Acceptable



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m)	hardness test of the pipe body seam weld and HAZ of EW and SAW pipe (see Table J.7);	Not applicable
n)	hardness testing of pipe body for SMLS pipe (see Table J.7);	Required
o)	CTOD testing (see J.8.2.2 and Table J.6);	Refer Annex B (substituted) within this specification.
p)	use of the ring expansion test for transverse yield strength determinations [see Table J.7, footnote c)];	Not applicable
q)	additional longitudinal tensile testing for deep-water pipelay [see Table J.7, footnote d)];	Not applicable
r)	deviation from hardness test [see J.8.3.2.2 c) and J.8.3.2.3];	Not Applicable
s)	deviation from location of hardness test [J.8.3.2.2.c)];	Not applicable
t)	for pipe with $t \geq 5,0$ mm (0.197 in), ultrasonic inspection for laminar imperfections within extended length of 100 mm (4.0 in) at the pipe ends (see K.2.1.3);	Applicable
u)	supplementary end NDT lamination criteria (see K.2.1.3 and K.2.1.4);	Refer K.2.1.3(Amended) and K.2.1.4 (Amended)
v)	magnetic particle inspection for laminar imperfections at each pipe end face/bevel (see K.2.1.4);	Refer K.2.1.4(Amended)
w)	ultrasonic inspection to verify conformance with the applicable requirements given in Table K.1 (see K.3.2.2);	Applicable; Refer K.3.2.2 (Amended).
x)	verification of lamination size/density (see K.3.2.2);	Applicable ; Refer K.3.2.2 (Amended).
y)	increased coverage for ultrasonic thickness measurements for SMLS pipe (see K.3.3);	Applicable; refer K.3.3 (amended).
z)	application of one or more of the supplementary non-destructive inspection operations for SMLS pipe (see K.3.4);	K.3.4.1(Amended) is applicable
aa)	ultrasonic inspection of SMLS pipe for the detection of transverse imperfections (see K.3.4.1);	K.3.4.1(Amended) is applicable




bb)	full-body inspection of SMLS pipe the flux leakage method for the detection of longitudinal and transverse imperfections (see K.3.4.2);	Required
cc)	full-body inspection of SMLS pipe by the eddy current method (see .3.4.3);	Required
dd)	full-body magnetic particle inspection of pipe (see K.3.4.4);	Required
ee)	Acceptance Level U2/U2H for non-destructive inspection of the weld seam of HFW pipe (see K.4.1);	Not applicable
ff)	alternate ISO 10893-10 HFW weld seam UT acceptance criteria [see K.4.1 b)];	Not applicable
gg)	ultrasonic inspection of the pipe body of HFW pipe for laminar imperfections (see K.4.2);	Not applicable
hh)	ultrasonic inspection of the strip/plate edges or areas adjacent to the weld for laminar imperfections (see K.4.3);	Not applicable
ii)	non-destructive inspection of the pipe body of HFW pipe using the ultrasonic or flux-leakage method (see K.4.4);	Not applicable
jj)	use of fixed-depth notches for equipment standardization [see K.5.1.1 c)];	Not applicable
kk)	radiographic inspection of the pipe ends (non-inspected pipe ends) and repaired areas [see K.5.3 a)];	Not applicable
ll)	magnetic particle inspection of the weld seam at the pipe ends of SAW pipe (see K.5.4).	Not applicable
m m)	for grades L625QO or X90QO, and L690QO or X100QO, a lower $R_{t0,5}/R_m$ (see Table J.2).	Not applicable

J.3 Manufacturing

J.3.1 Manufacturing procedure

SUBSTITUTE

All pipes shall be manufactured in accordance with a manufacturing procedure that has been qualified in accordance with Annex B (Substituted).

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J.3.3 Pipe manufacturing

J.3.3.1 SUBSTITUTE

Steel shall be made by continuous casting only. Cold expansion shall not be permitted for seamless pipes.

J.3.3.2 Not applicable

J.3.3.3 Jointers

SUBSTITUTE

Jointers are not permitted

J.4 ACCEPTANCE CRITERIA

J.4.1 Chemical composition

SUBSTITUTE

Refer 9.2 [Table 5 (substituted)] with foot notes thereof.

Table J.1 SUBSTITUTE

Refer Table 5 (substituted) with foot notes thereof.

J.4.2 Tensile properties

J.4.2.1 SUBSTITUTE

The minimum Yield strength, minimum Tensile strength and Elongation of finished pipes (after all heat treatment and sizing operations) shall conform to the requirements of Table-J.2 of API 5L. However, other requirements of Table-J.2 are not applicable.

The actual yield strength shall be as close as possible to the specified minimum yield strength but in no case it shall be more than 133% of the specified minimum yield strength.

The ratio between yield strength and ultimate tensile strength of finished pipes shall not be more than 0.90.

J.4.2.2 DELETE

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J.4.3 Hardness test

SUBSTITUTE

Vickers hardness tests as per ASTM E-92 shall be carried out on samples of pipes at locations indicated in Figure H.1 a) to establish that the hardness of the pipe material is less than 250 HV10. Testing frequency shall be same as for tensile tests as specified in 10.2.1.2 of this specification. Modalities of retest shall be in accordance with 10.2.12

J.6 Tolerances for diameter, wall thickness, length and straightness

J.6.1 SUBSTITUTE

Tolerances for diameter shall be as per Table J.3 of API Specification 5L.

Tolerances on diameter for $D \geq 219.1\text{mm}$ based on measured inside diameter finalized by the manufacturer shall conform to Table J.3 of API 5L 45th Edition.

Tolerances for out-of-roundness shall be as under:

Pipe size	Tolerances for out-of-roundness	
	Pipe except the end	Pipe end
< 60.3 mm OD to 114.3 mm OD	as indicated in Table J.3.	as indicated in Table J.3 of API 5L 45 th Edition
$\geq 168.3\text{ mm OD}$ to 273.1 mm OD	2 mm	0.01D subject to 2 mm max.
> 273.1 mm OD	3.2 mm	0.01D subject to 3.2 mm max.


J.6.2 SUBSTITUTE

Wall thickness tolerance for all sizes shall be +17.5%,-5%.Table J.4 shall not be applicable.

J.6.3 ADD

In case of LSTK contract, length of pipes shall be mutually agreed between Line pipe manufacturer and Installation Contractor.

J.7 Not applicable

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J.8 Inspection

J.8.1 Specific inspection

SUBSTITUTE

The frequency of inspection shall be as given in 10.2.1.2 of this specification.

J.8.2 Samples and test pieces for mechanical and technological tests.

SUBSTITUTE

J.8.2.1.1 For tensile tests, CVN impact tests, CTOD tests the samples shall be taken and the corresponding test pieces shall be prepared, in accordance with the applicable reference standard.

J.8.2.1.2 Samples and test pieces for the various test types shall be taken from locations as shown in Figure 5 a) and as given in Table J.8 taking into account the supplementary details in 10.2.3.2 to 10.2.3.3, 10.2.4 and J.8.2.2 of this specification.

Both transverse and longitudinal tensile test shall be carried out for each lot of 100 pipes or less, belonging to the same heat and manufactured by the same process. In case of pipe diameters i.e. 219.1 mm (8-5/8 inches) and smaller, transverse tensile test is not required.

J.8.2.2 Test Pieces for CTOD tests

SUBSTITUTE

Test pieces shall be taken from the parent metal and shall be prepared in accordance with ISO 12135, ASTM E1290, or BS 7448. The sampling procedure and position of test piece notches shall be as agreed.

J.8.2.3 Samples for hardness tests

AMEND

Refer H.7.2.8.4 of this specification.

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J.8.3 Test method

J.8.3.1 CTOD Test

SUBSTITUTE

CTOD testing shall be carried out in accordance with the requirements of BS 7448. One set of three specimens shall be taken in transverse direction. However, in case of pipe OD \leq 219.1 mm; specimen may be taken in longitudinal direction. The test shall be carried out at 0°C. Minimum acceptable critical CTOD value shall be 0.2 mm. Average CTOD value shall be reported.


J.8.3.2 Hardness test

J.8.3.2.1 SUBSTITUTE

Vickers hardness tests as per ASTM E-92 shall be carried out on samples of pipes at locations indicated in Figure H.1 a) to establish that the hardness of the pipe material is less than 250 HV10. Testing frequency shall be same as for tensile tests as specified in 10.2.1.2 of this specification. Modalities of retest shall be in accordance with 10.2.12 of this specification.

J.8.3.2.2 Refer H.7.3.3.3

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Annex K (AMENDED)

Non-destructive inspection for pipe ordered for sour service and / or offshore service.

K2.1.3 (AMEND)

Ultrasonic inspection with automated/semi-automated systems in accordance with ISO 10893-8 or by manual methods, as specified in Annex A of ISO 10893-8 shall be used to verify that 100mm wide zone at each pipe end is free of laminar defects.

K2.1.4 (AMEND)

Bevel ends of each pipe shall be inspected by Magnetic Particle technique checking laminar imperfections or inclusions as per ISO 10893-5 or ASTM E709. Residual magnetism after MPI shall not exceed 20 Gauss measured by Hall Effect Gauss Meter. Laminar imperfections > 6.4 mm (0.25 in) in the circumferential direction shall be classified as defects.

K.3.2.1 & K.3.2.2 (AMEND)

Acceptance criteria for laminar imperfections shall be as per table K.1 for service condition “Sour, if agreed”. The coverage during automatic inspection shall be 100% of the pipe surface.

K.3.3 (AMEND)

The coverage during inspection shall be 100% of the pipe surface.

K.3.4.1 (AMEND)

The pipe shall be ultrasonically inspected for the detection of transverse imperfections in accordance with ISO 10893-10 acceptance level U2/C ,ASTM E213.

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