



**TENDER FOR PROCUREMENT OF
10" STEEL LINE PIPE (API 5L X-70)**



TENDER DOCUMENT NO
REPL/MNGL/NGLP/08/21

DATE:18-08-21

REV. NO- 00

LINE PIPES SPECIFICATION

**FOR GAS TRANSMISSION AND DISTRIBUTION PIPING
SYSTEM**

ONSHORE SERVICE



TENDER FOR PROCUREMENT OF 10” STEEL LINE PIPE (API 5L X-70)



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INTRODUCTION

The present Specification has to be read in conjunction with the API 5L forty-fifth edition, its addendum(December 2012) and the Particular Technical Specification (PTS) attached to the material requisition.

The present specification intends to clarify, confirm, complete or modify certain paragraphs of the API 5L specification. Clauses in API 5L specification not mentioned remain unaltered and are fully applicable. If only part of a clause in API 5L is altered by the present specification the remaining of any such clause shall remain applicable

Unless otherwise stated by the Purchaser, The Third Party Inspection is required during the manufacture, inspection and testing of the order. The Third Party Inspection Agency shall be approved by the Purchaser as qualified to monitor product quality and all other activities related to production of the order. The Owner's representative (quality inspector) shall have unrestricted access at all times while activities related including casting, rolling and other fabrication processes and testing works at assigned locations within Manufacturer facilities. Manufacturer shall provide suitable office space, fax telephone and broad band internet connection to the Owner's representative and the Third Party Inspection Agency. The Manufacturer shall provide to the inspector(s) all reasonable facilities, including dry and clean pipes to satisfy the inspector(s) that pipes are being fabricated in accordance with the API 5L and present GTS specifications. The Manufacturer shall provide reasonable advance notice of when production, inspection or testing shall be performed.

The Manufacturer shall clearly specify all modifications or alternatives to the present specification. Each modification has to be submitted for approval to the **Purchaser**. and to the **Third Party Inspection Agency**

The complete production cycle shall be supervised by the **Third Party Inspection Agency**. A technical audit will be executed during a sample production run.

The steel Manufacturer's specification, the manufacturing procedure itself and the test laboratories shall be approved and registered by the **Third Party Inspection Agency**.

The **Third Party Inspection Agency** shall verify the equipment test control of the Manufacturer, in particular the calibration status of the equipment.

If during the production process problems concerning the quality arise, **Third Party Inspection Agency** may request additional tests.

The Manufacturer has to specify whether or not his production process is certified according to "ISO" or other approved standard.

The Manufacturer shall be certified ISO 9001, ISO/TS 29001 or approved equivalent.

The Manufacturer shall be a certified API licensee and should and have obtained a valid API monogram license.

The Manufacturer has to provide a detailed flow chart of all manufacturing and inspection procedures and following information will be made available:

- Technical description of the production;
- Schedule of the fabrication operations;
- Inspection schedule during the manufacturing;
- Codes and Standards applicables for the inspection (or the reference numbers if the inspections are performed according to an internal QAM) and mentioning if the inspections are supervised or not by **Third Party Inspection Agency**;
- Level of the inspector (see Annex E § E.1 Qualification of personnel in API 5L 45th edition);
- Inspection report.



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PROPERTIES OF THE PIPES

- Product Specification Level (PSL) : PSL2
 - Max. operating pressure : See PTS
 - Max. operating temperature : 60 °C
 - steel grade : See PTS
 - Ø outside (Nominal) : See PTS
 - wall thickness (Nominal) (WT) : See PTS
- Calculation according to ASME B31.8 with :
- γ design factor : See PTS
 - γ negative tolerance for WT : zero millimeter (0 mm)
 - γ corrosion allowance : zero millimeter (0 mm) See PTS
 - γ yield strength : See PTS
 - γ weld efficiency level : 100%
- lengths of the pipes : Nominal length shall be at least twelve metres (12 m) but not more than transportable by Road Trucks or railroad according to prevailing legislation. (See PTS).



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1. SCOPE

ADD:

The present specification is applicable to steel grade < X 80 (L555) / and for operating pressure < 100 bar (1450 PSI). All Line Pipes shall exclusively comply with “Specification Level PSL 2” and to all requirements thereof.

2. CONFORMITY

2.1 Units of measurement

All data related to this specification should be expressed in SI units.

3. NORMATIVE REFERENCES

ADD:

API RP 5L1, Recommended Practice for Railroad Transportation of Line Pipe.

API RP 5LW, Recommended Practice for transportation of Line Pipe on Barge and Marine Vessels.

4. TERMS AND DEFINITIONS

GTS: means the present <<General Technical Specification 740/GTS/404>>and all documents it refers to.

Inspection Agency or

Third Party Inspection Agency (TPIA): means the Inspection agency to be appointed by Manufacturer.

Manufacturer:

means the Manufacturer of the pipes as well as its sub-contractor(s) including the applicator(s) of coating(s).

Normative:

Indicates mandatory requirement.

Owner or Purchaser:

shall mean the CLIENT, being the Purchaser of pipes.

PTS:

means <<Particular Technical Specifications>> and all its appendices, if any.

Single Step SAWH Pipe:

Production of helical pipe where forming and final welding occur on the pipe-making machine.

Shall:

Used to indicate that a provision is mandatory.

Should:

Used to indicate that a provision although non-mandatory is recommended as good practice. Approval is required from Purchaser to deviate from the provision.

Two-step SAWH Pipe:

Production of helical pipe where forming and tack welding are performed on a pipe –making machine and final welding is performed as a separate downstream process.



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4.9 COW pipe

Combination welded pipe

ADD: "The validity of the qualification procedures shall be approved by the Purchaser and the inspection agency".

Clause should amended as: The double seams (two longitudinal seams) produced by a combination of gas metal-arc and submerged-arc welding is not allowed.

4.11 COWL pipe

Combination longitudinal welded pipe

ADD: "The validity of the qualification procedures shall be approved by the Purchaser and the inspection agency".

Clause should amended as: The double seams (two longitudinal seams) produced by a combination of gas metal-arc and submerged-arc welding is not allowed.

4.17 EW pipe

Electric welded pipe

Only high frequency electric-welding is permissible

4.23 HFW Pipe

High Frequency Welding Pipe

The welding current shall be performed with a minimum frequency of 100 kHz.

4.34 LFW Pipe

Low Frequency Electric Welded Pipe

The welding current shall be performed with a minimum frequency of 100 kHz.

4.53 SAWH pipe

Submerged-arc helical welded pipe

ADD:

At end of Clause, add:

Prior to welding, each edge of the strip shall be ultrasonically examined for laminations over a width of 25 mm along its longitudinal edges.

Welds shall be inspected on their full length by ultrasonic method according to § 9.8.5.

The transition between parent metal and weld deposit shall not display undercutting.

The over thickness of the weld deposit shall not exceed the requirement of table below.



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Specified wall thickness mm	Over thickness of weld deposit in mm
$T \leq 15$	2
$T > 15$	3,2

Table: Maximum over thickness of the weld deposit of spiral welded pipes

The edges of joints shall be held during welding so that the tolerances of table below are not exceeded in the completed joint.

Section thickness mm	Tolerance
Up to 13 mm (0.512 in)	$\frac{1}{4} t$
Over 13 mm (0.512 in)	3,2

Table: Maximum offset of edges of completed joint.

4.59 Submerged-arc welding

SAW

Add: “The whole weld shall be done by automatic welding”

5. SYMBOLS AND ABBREVIATED TERMS

ALL CLAUSES ARE APPLICABLE

6. PIPE GRADE, STEEL GRADE AND DELIVERY CONDITION

All clauses related to pipe grade for PSL 2 are applicable and the present specification is applicable to pipe / steel grade $\leq X 80$ (L 555).

7. INFORMATION TO BE SUPPLIED BY THE PURCHASER

All clauses related to pipe grade for PSL 2 are applicable refer also to purchase order for additional requirement

8. MANUFACTURING

8.1 Process of Manufacture

GENERAL ADDITIONAL REQUIREMENTS:

The pipe manufacturer, the pipe-mill and all potential subcontractors (such as steel Manufacturer, rolling-mill, heat treatment, weld fabrication...) shall necessarily be indicated in the tender.

No changes will be accepted after eventual order except in case of justified Force Majeure. In that case the asked changes will be supported by a technical file transmitted to the Purchaser for approval.

A description of the pipe manufacturing process shall be included in the tender.



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The Third Party Inspection Agency reserves himself the right to audit for agreement the manufacturing process and control method of the Manufacturers and subcontractors. All the costs resulting from such audit shall be taken over by the Manufacturer with the exception of wages and travel expenses.

All welding operations are subject to prior qualification of applicable welding procedures, weld operators and/or welders.

The validity of the qualification procedures shall be submitted for approval to the Purchaser and the Third Party Inspection Agency.

The Manufacturer shall give a technical description of the manufacturing method, which may have an influence on the quality of the pipe.

Welding Parameters records

All basic welding parameters actually used during the welding process shall be continuously recorded by automatic devices for each length of pipe.

These records shall be at disposal of the Third Party Inspection Agency and Purchaser for review at discretion of Third Party Inspection Agency and Purchaser before acceptance of the pipe.

Length of Pipes without records shall be rejected.

8.3 Starting Material

8.3.1 At the end of this paragraph add the following;

Except otherwise specified on the purchase order the pipe delivered to this specification as normalized or quenched and tempered is not allowed.

“The steel manufacturing method shall be given in the tender and, has to be approved by the Purchaser and the inspection agency”.

“Only fully killed steel is acceptable”.

8.3.3 The clause should be modified as followed:

“For PSL 2 pipe, only fully killed made according to fine practice is acceptable”.

8.3.5 The minimum width of the coil or plate for the manufacture of helical seam pipe shall be more than 1.2 times the specified outside diameter of pipe.



8.3.8 Add;

The producers of slab/skelp/coil used for the production of pipe require Purchaser approval. The approval may include pre-qualification, production, inspection, or testing of slab/skelp/coil.

When niobium is $\geq 0.020\%$ and when the ambient temperature is $\leq 5^\circ\text{C}$, gas cutting and scarfing of slabs shall be performed at temperature $\geq 120^\circ\text{C}$ to minimize the risk of thermal cracking.

Skelp/coil thickness shall be controlled by continuous gamma or X-ray devices. Skelp/coils rolling and accelerated cooling shall be adequately instrumented to ensure proper control of furnace/rolling temperature, rolling reduction and post-rolling cooling rate

8.4 Tack Welds

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Add;
Tack welding as applicable in SAHW pipe shall be continuous.

8.6 Weld seams in SAHW pipe

All pipe production shall employ fully automatic equipment. For single –step SAHW pipe, automatic seam tracking and gap control should be employed and electrical grounding shall not be through the machine body.

The longitudinal edges of the skelp / coil shall be machined to remove a minimum width of material equal to one times the skelp/coil thickness from each edge in preparation for welding. Run-on and run-off weld tabs shall be of sufficient length so that the weld arc is stable prior to entering the pipe length and the complete weld pool has left the pipe length prior to weld stop.

A program of moisture control of the welding flux shall be maintained through the use of moisture proof sealed storage and/or by baking and/or by holding the flux at a temperature recommended by the flux manufacturer in order to maintain the flux moisture content below 0.05% or diffusible hydrogen in the weld ≤ 5 ml/100 g of the weld metal. All welding consumables shall be identifiable and traceable to manufacturer’s batch certificate.

The use of recycled crushed flux slags (previously melted) is not permitted.

A Welding Procedure Specification (WPS) and a Procedure Qualification Record (PQR) shall be submitted with the Manufacturing Procedure Specification for approval. The WPS and PQR shall be established in accordance with ASME SEC IX. Previously qualified WPS and PQR are valid provided all essential variables identified in Annex D, D.2.2 of API SPEC 5L are within the stated limits. The following essential variables shall also apply:

- a) Increase in parent metal carbon of more than 0.02%.
- b) Change in parent metal supplier.
- c) Change on groove dimensions outside tolerances in qualified WPS,
- d) Change in aim ratio of recycled to new flux greater than 15%.
- e) Change in alignment and/or groove configuration.
- f) Change in manufacturer of welding consumables (wire and flux) or in combination.
- g) Number of wires or change in welding equipment.
- h) Change in method or temperature of preheat and/or interpass.

Once the PQR has been approved any variation regarding any essential variables, shall be subject to a new PQR and qualified WPS to be approved by Purchaser.

8.9 Cold Sizing and Cold Expansion

The pipe manufacturing method shall be given in the offer and has to be approved by the Purchaser and Third Party Inspection Agency.

- 8.9.1 When cold sizing / expansion is applied, it shall be mechanically cold expanded for the full length. The expansion measured on the circumference shall range between 0.3 to 1.5 percent of the value measured before expansion. The amount of expansion shall be measured on at least 3 pipes per 8 hour shift.
- 8.9.3 At the end of this paragraph add the following;



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“Pipe furnished to this specification shall be either non expanded or cold expanded at the option of the Manufacturer, unless otherwise specified on the purchase order. Suitable provision shall be incorporated to protect the weld from contact with the internal expanding mechanical device during mechanical expansion”.

8.10 Coil / Plate End Welds

- 8.10.2 The clause should be modified as followed;
No skelp end weld is permitted in finished pipes and, if existing, shall be cut out perpendicularly to axis of pipe so that the “new” pipe end(s) shall be at minimum 304.8 mm (12”) from said skelp end weld before its elimination.
- 8.10.4 Not applicable
- 8.10.5 Not applicable

9. ACCEPTANCE CRITERIA

9.1 General

The delegate of the inspection agency reserves the right to select the pipes to be tested.

re-test can only be made after approval of the Purchaser and the inspection agency.

All non conforming chemical or mechanical tests shall be immediately reported to the Purchaser.

- 9.1.2 The clause should be modified as followed;
Substitution of pipe manufactured as Grade higher than grade specified in the purchase order is not allowed

9.2 Chemical Composition

Add;

For each pipe diameter, grade and wall thickness combination a single aim chemistry shall be followed. Table 5 (modified) Chemical composition for X70 & X80 steel grade PSL2 welded pipes (Themomechanical-rolled coil or plate and cold forming “M”).

Table 5 (Modified)

PSL 2 Chemical requirement		
Product analysis by percentage of weight % maximum		
Element (1)	X70M steel grade	X80M steel grade
C ^b	0.12 Max	0.10 Max
Si	0.45 Max	0.45 Max
Mn ^b	1.70 Max	1.85 Max
P	0.025 Max	0.025 Max
S	0.015 Max	0.015 Max
Cu	0.35 Max	0.50 Max
Ni	0.30 Max	0.70 Max

Cr	0.30 Max	0.40 Max
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Mo	0.15 Max	0.35 Max
V	0.08 Max	0.10 Max
Nb	0.06 Max	0.06 Max
Ti	0.06 Max	0.06 Max
Other	h, l, j 1 2	j 1 1 2
Nb + V + Ti	0.15 Max	0.15 Max
Cu + Ni	0.50 Max	0.75 Max
CE (II W)	0.43 Max	0.43 Max
CE (PCM)	0.23 Max	0.23 Max

All footnotes of the table 5 of API 5L are applicable except otherwise noted.

Notes:

b- applicable for X70 and X80 grade. For each reduction of 0.01% below the specified maximum for carbon an increase of 0.05% subject to reduction in C to level 0.08 max

j- Boron content shall be considered in CE (PCM) formula even if it is less than 0,004%.

Additional notes;

(1) Any coil/skelp/plate material supplier will have to propose their best chemical composition to achieve the required mechanical properties of the final product.

(2) Ti/N ratio shall not exceed 3.0.

9.2.3 For pipe with $t > 25.00$ mm (0.984 m) the chemical composition shall be specified in the Particular Technical Specification (PTS).

9.2.5 For PSL 2 pipe with a product analysis carbon mass fraction greater than 0.12% the carbon equivalent, CEIIW, shall be determined using equation;

$$CE = C + \frac{Mn}{6} + \frac{Cu + Ni}{15} + \frac{Cr + Mo + V}{5} \quad (\text{limited to } 0.43\%)$$

9.3 Tensile Properties

9.3.2 Add:

The ratio ($R_{t0.5}/R_m$) between the measured values of yield strength (Y) at 0.5% elongation of the gauge length as determined by an extensometer and ultimate tensile strength (T) for the body of each test pipe (product pipe) on which, yield strength and ultimate tensile strength are determined shall not exceed 0.85 for Grades X60 and lower. For Grades X65 to X80 included, the same ratio may reach the value of 0.90.

9.3.3 Hardness tests (added)

Vickees Hardness (Hv 10) tests shall be conducted on the metallographic cross section required in table 18 of API 5L in accordance with clause H.7.3.3 “Hardness tests”. Indent locations shall conform to Annex H, Figure H.1.b. At least one HAZ hardness indent shall be positioned in the coarse grain structure immediately adjacent to the fusion line.

Hardness shall conform to the following:



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The Hardness (Hv 10) Base metal, weld metal, and HAZ non sour service
steel grade \leq X 70 (L485) \leq 260
steel grade \leq X 80 (L555) \leq 270

9.8 CVN IMPACT TEST FOR PSL 2 PIPE:

9.8.1.3 Modification

For all base materials and welds:

The CVN Impact test shall be conducted at both (-) 20⁰ C & 0⁰ C. Impact test value (For all base material and weld) shall conform to requirement of Table 8 of Cl. No. 9.8 (CVN Impact test for PSL 2 pipe) API 5L 45th Edition.

9.8.2 Pipe body tests

9.8.2.1 Add;

For pipe body and base material the minimum average (of a set of three test pieces) for each pipe body (base material) for grade \leq X80 (L555) shall be as per table 8 of API 5L with an absolute value not less than 35j/cm². In addition the lowest individual value of only one of the three specimens shall not be less than 80% of the average value (I.E.28J/CM²).

For the base material, 3 sets of 3 specimens shall be taken per coupon. 2 sets shall be tested at (-) 20°C and 1 at 0°C.

9.8.2.2 For all pipes the clause is applicable and the shear fracture arc shall be at least 85% based upon a test temperature of -20⁰c. (-4⁰ F)

9.8.3 Pipe weld and HAZ tests

For pipe weld and HAZ, 3 sets of 3 transverse specimens shall be taken transverse to the weld.

One set shall be taken with the notch in the HAZ (= Heat Affected Zone) and shall be tested at (-) 20°C

Two sets shall be taken with the notch in the weld, one shall be tested at (-) 20°C and one at 0°C.

In the case of electric welded pipe, only 2 sets will be taken with the tip of the notch in the fusion line. One set shall be tested at (-) 20°C and one at 0°C. Its location is verified after metallographic etching.

Acceptance criteria

At 0°C

For all base material, welds and HAZ:

The average value of a set of 3 specimens from a pipe length shall be as per table 8 but with an absolute value not less than 35J/cm². In addition, the lowest individual value of only one of the three specimens shall not be less than 80% of the specified average value (i.e. 28 J/cm²).

At - 20°C

For all base material, welds and HAZ:

The average value of a set of 3 specimens from a pipe length shall be as per table 8 with an absolute value not less than 35 J/cm². In addition, the lowest individual value of only one of the three specimens shall not be less than 80% of the specified average value (i.e. 28 J/cm²).



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9.10 Surface condition imperfections and defects

9.10.2 Undercuts

Undercuts can best located visually and to be tested in accordance with API 5L. The resultant cavity shall not extend into the pipe body by more than 3 mm (0,125 in).

9.10.3 Arc burns

9.10.3.2 Repair of arc burn shall be approved by Purchaser's representative. Ground areas shall be inspected by magnetic particle or dye penetrant methods.

9.10.6 Hard spots

The maximum hard spot hardness shall not exceed 300 Hv10.

9.11 Dimensions, Mass, and Tolerances

9.11.1 Dimensions

9.11.1.1 Except otherwise started in the PTS

Pipe length shall be between 10.0 and 14.0 m. Thickness wise average length of pipes supplied shall not be less than 12.5 m. The average length shall be cumulative as measured at Pipe Mill despatch note.

Overall length tolerance shall be (-) zero and (+) 1 pipe length to complete the Owner's quantity.

9.11.3 Tolerances for diameter, wall thickness, length and straightness

9.11.3.1 The clause is modified as followed;

For specified outside diameter > 6 inch (168.3mm) the out of roundness at pipe ends will be limited to 3mm and 5mm at pipe body (maximum difference between minimum and maximum diameter).

For outside diameter ≤ 6 inch (168.3mm) the value of table 10 shall prevail.

9.11.3.2 The clause is modified as followed;

No negative tolerance is permitted

9.11.3.3 Modification

d) Joints are not permitted. Annex A "Specification for welded joints" of the API 5L 45th edition is not applicable.

9.11.3.4 The tolerances for straightness shall be modified as follows;

The deviation from a straight line for all pipes sizes shall not exceed 12 mm.

9.12 Finish of pipe ends

9.12.1 General

Except otherwise stated in the purchase order the pipes shall be supplied plain ends with end beveled as per clause 9.12.5.2.

Automatically, the 100 following shall apply



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9.13 Tolerances for the Weld Seam

9.13.2.2 For SAW and COW pipes, the following shall apply.

Additionally, the following shall apply:

- c) For pipes supplied plain end non beveled (beveled at site) the internal weld bead reinforcement shall be removed for 100 mm from the pipe ends
- d) For girth welds that will be ultrasonically inspected during pipe installation, the outside weld bead reinforcement shall be removed for 180 mm from the pipe ends.
- f) Peaking; deviation from circular arc at the weld seam at pipe ends shall not exceed 1.6 mm. Each pipe shall be checked for conformance of above requirement.

9.13.3 Misalignment of the weld beads of SAW and COW pipes

Modified as followed;

For pipes with specified wall thickness > 20 mm the misalignment of weld beads shall not exceed 3.5 mm. The misalignment shall be measured on radiographic film.

All pipes shall be checked for misalignment of weld beads. Any pipe found with misalignment of weld beads exceeding the permissible values shall be rejected.

10. INSPECTION

10.1 Type of Inspection and Inspection Documents

10.1.1 General

The Third Party Inspection Agency and the Purchaser must be notified in writing or by mail at least five working days before the start of the fabrication and testing as well by the Manufacturer as his approved subcontractors.

Raw material shall be checked for mechanical and chemical properties at steel mill.

Raw material of pipe shall be tested one test per heat at steel mill (all tests as per Annex Q "Purchaser Initiative Inspection and Quality Plan").

TPIA shall witness all mechanical / chemical testing on all heats and put the acceptance stamp on each coil / plate.

For X70 & X80 GRADE MATERIAL: Line Pipe manufacturer shall depute this Approved TPIA expert at steel mill to control the mechanical and chemical properties of all coils and plates as per requirement of Annex Q and API 5L PSL 2. Moreover the approved TPIA shall issue the 3.2 certification for all supplied material. Only duly stamped (By TPIA) material (coils / plates), will be shipped to line pipe Manufacturer.

Pipes shall be tested as one pipe per inspection lot of 50 pipes per heat (all tests as per Annex Q).

Burst test to be done for each size and thickness at the time of first day production test.

Minimum inspection requirements are further described for Line pipes in Annex Q.

10.1.2 Inspection documents for PSL 1 pipe



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Approved Electronic Data Interface (EDI) documentation is acceptable. The following documents shall be provided in English language.

- Manufacturing Procedure Specification,
- LOFC (List of Operations of Fabrication and Controls)
- Mill certificates, Certified Material Test Reports,
- Inspection reports, including hydrotest reports,
- Copies of Equipment Calibration Certificates,
- Packing and Shipping reports,

10.1.3 Inspection documents for PSL 2 pipe

Unless otherwise specified (3) paper copies of the Inspection Certificates 3.2 in accordance with EN 10204 latest edition (2004) shall be furnished to the Purchaser.

10.1.3.2 The Inspection Certificate issued by the Manufacturer shall also include:

- Name of the Purchaser
- Purchase order number,
- Mill order number,
- Quantity produced,
- Statement of compliance with API 5L and this specification (GTS)

10.2 Specific Inspection

10.2.5 Macrographic and metallographic tests

The weld sections selected for macrographic/metallographic inspection testing shall be taken from a different OD (outside diameter) welding machine for each succeeding set of tests in order to sample all internal and external welding machines.

10.2.5.1 Add:

For welded pipe grade B (L245) and higher at least one metallographic examination of a weld cross section per each welding line and each working shift shall be performed. such examinations shall be performed more frequently where grade, diameter or wall thickness changes are made, or where significant excursions from operating such as heat treatment and welding parameters are encountered.

10.2.6 Hydrostatic test

Test pressures for all types of pipes and all diameters shall be held for not less than 15 seconds on each and every pipe.

The hydrotest testing master gauge shall be calibrated by means of a dead weight tester, or equivalent before the start of the production order at the end of production order and at least once per month during production. The working pressure gauge range and the pressure chart shall be verified against the master gauge at the start of each working shift and at the middle of the shift. The pressure gauge shall have a range



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minimum 1.5 times and maximum 4 times of test pressure. All hydrostatic pressure tests shall be chart recorded and traceable. The working pressure gauge and chart shall be calibrated after any expansion in pipe or hydrotest failure.

- 10.2.6.1 The hydrostatic test pressure shall be such as to create a hoop stress between 95% and maximum 100% of the specified minimum yield strength. Hydraulic pumps shall not activate during the 15 second test duration. Hydrostatic testing shall be carried out on each pipe prior to final visual and final non-destructive inspection, except that cutting to length, beveling may take place after hydrostatic testing.

11. MARKING

11.1 General

The pipe Manufacturer will ensure that all the documents pertaining to traceability of pipe are handed over to coating contractor along with soft copy of packing list & history sheet indicating pipe no., heat no., acceptance no. and length of pipe which will further be completed by the coating contractor in continuation.

The accepted pipes will have pipe no. at both face of the square ends along with TPIA stamp which will be preserved by the coating contractor up to the last stage till the pipes are handed over to pipe laying contractor.

Pipe Manufacturer shall submit detail pipe traceability and die stamping procedure for Purchaser approval.

All dimensions and hydrostatic test pressure markings shall be in SI units.

11.1.2 Add:

The minimum information to be die-stamped shall be:

- The name or mark of the Manufacturer of the pipe,
- The specified outside diameter,
- The specified wall thickness,

Die-stamping or vibro etching:

Die stamping is made by a mechanical low stress method approved by the Third Party Inspection Agency and the Purchaser. Die stamping shall be done with rounded or blunt dies which do not result in notch effects. The depth of stamping after shot-blasting is 0.3 mm max. The Manufacturer shall guarantee that the die stamping remains perfectly legible after shot-blasting. The height of letters and numbers is 3 mm. For the location see also clause 11.2.1. die is stamping shall not be permitted on the pipe body.

11.2 Pipe Marking

- 11.2.1 Pipe markings shall additionally include the Third Party Inspection Agency monogram this paragraph is completed as followed:

Pipe individual number shall contain: the first two numbers to indicate the year of the purchase order and maximum five numbers specified in the purchase order and if those are not specified, they must be requested from the Purchaser.

If the pipe Manufacturer suspects any problems in meeting this requirement, he shall submit for approval to the Purchaser the proposed sequence of numbers and marking.

The monogram of the third party inspection agency shall be always manually die stamped in the bevel of the pipe in front of the markings on the pipe wall or after the markings on the bevel. This marking shall only be made after complete approval of the pipe material and tests certificates.



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If this way of proceeding is not possible the Manufacturer shall submit his procedure for approval to the Purchaser and to the third party inspection agency.

In any case the final acceptance of the fabrication can only be given by the third party inspection agency if all tests and controls are acceptable.

If stamped pipes which turn to be unacceptable for reason attributable to pipe Manufacturer should have left the Manufacturer facilities they will be returned at his cost and the monogram of the third party inspection agency is removed by grinding in the presence of the third party inspection agency and at the Manufacturers cost.

The pipe Manufacturer shall submit for approval to the Purchaser a scheme of intern and extern markings on the pipe and on the coating. marking on coating shall be conformity with the GTS coating.

11.2.2 The location of the required markings shall be as follows:

- For 2 3/8" nominal size and smaller, die stamping with low stress equipment shall be put at the surface of the pipes parallel to the pipe axes at a distance of at least 2 cm of the end of the pipe, in such a way that it will not be covered by the coating. If no low stress equipment is available die stamping shall be put in the bevel at the right side of the weld.
- For nominal size higher than 2 3/8", die stamping with low stress equipment shall be put at the surface of the pipes perpendicular to the pipe axes at a distance of at least 2 cm of the end of the pipe, in such a way that it will not be covered by the coating and for welded pipe on the right side of the weld. If no low stress equipment is available die stamping shall be put in the bevel at the right side of the weld".10.3.

12. COATINGS AND THREAD PROTECTION

Refer to General Technical Specification (GTS) for coatings.

12.1 Coatings and Lining

Add:

After coating of pipe (external) a corrosion protection will be applied by the Manufacturer on the both extremities of the pipes.

The same corrosion protection shall be applied on the entire length of the pipe by the Manufacturer on pipes delivered as bare pipes.

The product shall meet the following criteria:

- guarantee a corrosion protection for a storage period in open air for at least 6 months;
- shall be easily removable by wire brushing/grinding or blasting;
- it shall not produce toxic vapour or smoke when heated by flow torches or during welding;
- shall not affect the welding process.

The description of this product shall be clearly indicated in the tender (by Supplier).

12.2 Thread Protectors

Add:



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All Line Pipes supplied plain ends with beveled ends shall be protected by closed high impact plastic end caps suitable for hook loading. Those closed plastic caps should minimize the ingress of dirt, moisture trash, wildlife etc...shall be approved by Purchaser. Bevel protector if applied shall not be removed until pipe is being prepared for eliding.

Caps shall be adequately fastened to line-pipes so not to detach during transportation and storage.

13. RETENTION RECORDS

Add.

- m. check-list with the individual numbers of the pipe (see par. 10.3. of this ADDENDUM) in numerical order with their length, their weight, their heat number and coil number.
- n. for each heat number : the individual numbers of the pipe who are part of it.

In addition:

All parameters records shall be duly and univocally identified towards each length of pipe. The records shall be kept by Manufacturer during the warranty period as specified in the Purchase Order.

Records shall be at disposal of the Third Party Inspection Agency and Purchaser at their discretion at any time during the manufacture process and during the warranty period.

At end of the warranty period, Manufacturer shall request in writing to the Purchaser if the records have to be handed over to the Purchaser or may be destroyed. Manufacturer shall not destroy except if duly authorized in writing.

One copy of these documents including records & other mandatory documents has to be transmitted to the Third Party Inspection Agency and one original and one copy to Purchaser. All documents shall be in English language.

After final approval, the Third Party Inspection Agency shall provide to the Purchaser and to the Manufacturer a Quality Release Note (QRN). The manufacturer shall send a copy of the QRN with the material and the invoice.

14. PIPE LOADING

Add:

"For pipe OD \geq 36" handling with hook after bevelling is not permitted. The loading and handling methods (vacuum lift, etc.) shall be described in the tender.

For coated/bare pipe with OD \geq 24", the Manufacturer/supplier shall necessarily specify in the tender:

- A description with calculation and sketch of the handling (loading/unloading), storage at all points (e.g. pipe yard, trailer, warehouse at port before loading the ship) and transportation procedures during the total manufacturing cycle (including pipe transportation by road, railroad or ship to the final delivery on the site),

A description with calculation of long period (> 6 months) storage procedure, including the number and spacing of bearing strips and the number of layers.

- If pipes have to stored for a long period \geq 6 months Purchaser may required the supplier to take additional measures to protect the pipes against the sun and other elements.
- End hooks shall be lined with padding material such as rubber, polyethylene or a non-ferrous metallic material such as aluminium.
- Lifting slings shall be made of non-abrasive material such as nylon webbing,
- All dimensional tolerances and pipe surface conditions as specified under this API 5L standard and this specification shall apply to the pipe condition as received by the Purchaser at the shipping destination (hand over/take over contractual location).



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- Discovery of any transit fatigue cracking shall be ground for rejection of the entire load, until absence of cracking on the balance load is proven.
- Where steel to steel contact has fretted the pipe surface, magnetic particle or dye penetrant inspection shall be performed to ensure absence of cracking
- The forks of the forklifts shall be lined with rubber pads or other Purchaser approved material.
- All pipes shall be picked up clear from the ground without dragging or ripping. Pipes shall not be subjected to impact or jarring.
- Bare pipes in outside storage shall be stacked off the ground on berms covered with plastic sheeting material or on timbers with a minimum 150 mm wide bearing surface.
- The berms or timbers shall be of sufficient to prevent the pipes from coming into contact with the ground and to keep clear of any water or mud. Wedges or similar device shall be used to prevent the pipe from falling off the stack.
- All pipes shall be stacked at an angle $\geq 3^\circ$ to ensure water drainage of the pipes
- Pipes shall be stored at warehouse, thickness wise and diameter wise.
- Any shipping damage caused by improper loading/unloading shall be considered mill damage.
- Except otherwise stated in the purchase order the entire handling of pipe is under the scope of the pipe Manufacturer/supplier. The shipping including loading and unloading of pipes is also in the scope of the contract, only unloading at final pipe yard will be done by other.

Railroad Shipping:

For railroad transportation the pipes shall be loaded on or in the rail cars in accordance with all clauses of the API RP 5L1 latest edition (6th Edition, July 2002) regardless of D/t ratio. End gates lined with wood to a minimum nominal thickness of 25mm shall be provided in gondola cars and bulkhead flat cars.

Rail cars should be clean and inspected prior to loading. The third party inspector shall be given reasonable notice prior to loading and shipping so each rail car can be inspected prior to loading. Same inspection shall be done again before it is released to the railroad Authority.

For pipes shipped in skids. The skids should be placed directly on clean (no debris) car bottom. Skid height shall be at least 25mm higher than any foreign material or integral projections on car bottom. Skids shall not be stacked, and skid height shall be limited to skid width or the loading gauge of the railway whichever is more stringent.

Barge and marine vessel shipping:

For barge and marine vessel shipping the pipes shall be loaded as per API RP 5LW latest edition (3rd Edition September 2009), with mandatory wood bearing strips and side wood bearing strips. All clauses of the API-RP-5LW are applicable regardless of actual D/t ratio. The maximum load stress shall be limited to 80% SMYS.

Barges and marine vessels loading and unloading are subject to supervision by an inspector. A licensed marine surveyor shall also approve the marine equipment and procedures. The pipes shall not be shipped on deck of an oceanic going vessels and shall not be exposed to salt water or salt water spray during transportation. Testing for salt contamination and treatment may be required by the Purchaser. For transoceanic shipping, when permitted ship's log shall be made available to Purchaser on request when pipes are unloaded

All pipes beveled or not shall be equipped with closed plastic caps to minimize the ingress of dirt, moisture trash, salt water wildlife etc...to be approved by Purchaser. No pipe end shall overhang any underlying pipe



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end by more than 1.0m. Over stowage is not permitted and lashing shall be padded to prevent metal to metal contact with the pipes.

Road shipping (Truck):

For road transportation the pipes shall be loaded on truck in accordance with all clauses of the API RP 5L1 latest edition (6th Edition, July 2002). Lowboy step bed or pole trailers shall not be used.

Metallic uprights on trailers shall be completed padded with minimum 3.2mm thickness of PVC or equivalent.

Dunnage shall be arrange to avoid contact between pipes and nails and/or staples. Skids shall not be stacked, and their heights shall not exceed the skids width.

Non metallic hold down shall be used. Steel strapping may be used for belly banding, providing straps are free of burrs. Metallic chains are prohibited.

15. WARRANTY (NEW CLAUSE)

Except otherwise stated in the purchase order, the Manufacturer shall supply a copy of his warranty with other documentation required by the Purchaser. This warranty shall cover manufacturing defects as defined in the API 5L standard and this specification. Purchaser shall be reimbursed by Manufacturer under his warranty for any pipe supplied that fails under field hydrostatic test (strength test), if such failure is caused by material defect in pipe. The reimbursement cost shall include pipe, labour and equipment rental for finding, excavating, cutting out and installation of replaced pipe position including new hydrostatic test (strength test).

The pipe Manufacturer/supplier if so desires will be advised at least two weeks in advance so that his representative may witness the hydrostatic testing (strength test) in field, however the testing and leak (if any) finding and repair operation shall not be postponed because of non presence of Manufacturer/supplier representative.



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Annex A

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Specification for welded jointers

Not applicable



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Annex B

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Manufacturing procedure qualification for PSL 2 pipe

B.1 INTRODUCTION

Manufacturing procedure qualification is required for pipes produced to this specification

B.3 CHARACTERISTICS OF THE MANUFACTURING PROCEDURE (MPS)

As part of the technical bid, a generic MPS is acceptable if it provides sufficient detail for Company to determine process and procedure acceptability. The Manufacturer shall submit a job-specific MPS for Purchaser approval prior to production.

- a) The MPS shall include the following:
 1. Process Flow Diagram,
 2. Steel plate/skelp producer,
 3. Target chemical composition and tolerances for each element, limits on heat and product analysis to be placed on steel maker,
 4. Steelmaking and casting techniques, including transition slab practice,
 5. Ladle treatments including degassing,
 6. Slab caster centerline segregation mitigation and monitoring procedures, including test frequency and photographs of macro etch rating system and the identification of maximum macro etch ratings for heats produced to the order,
 7. Slab reheat temperature and soak time, start and stop temperatures for finishing mill and accelerated cooling. Allowable variations for these parameters,
 8. Hydrogen control procedures for skelp > 20 mm thick,
 9. End cropping process and procedures,
 10. Ultrasonic testing of plate/skelp and pipes using automatic and manual equipment including details of equipment, techniques and scanning pattern, probe frequency, scanning sensitivity, reference standard for calibration, dynamic and frequency of calibration procedure, method of marking defects, inspection and recording,
 11. Pipe manufacturing process,
 12. Procedures for run-on and run-off weld tabs,
 13. Slab/coil/pipe identification and traceability procedures,
 14. Procedures for weld wire and flux storage and handling, including moisture control, The use of recycled crushed flux (previously melted) is not permitted,
 15. Welding Procedure Specification and Welding Procedure Qualification Record for SAW welding and repair welding,
 16. If required, post weld heat treatment details including proposed temperature range, time-at-temperature and methods of temperature monitoring and control to ensure through wall heat treatment,



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17. Methods of weld defect removal and repair welding procedures,
18. Method for cold expansion / sizing / pipe end dimensional correction, Aim sizing ratio,
19. Hydrostatic test procedures, including calibration / verification,
20. Dimensional control procedures and frequency of checking, including corrective ‘jacking’ for out-of roundness,
21. NDT procedures, including for skelp,
22. Full details of radiographic testing equipment including radiographic films
23. Mechanical tests – sampling and testing procedure,
24. Procedures for testing or reworking material that does not conform to MPS process tolerances.
25. Calibration intervals for instruments and equipment used in processing, measuring and testing,
26. Marking, handling, loading and shipping procedures,
27. Production report formats and complete details of computerized pipe tracking system,
- b) Re-qualification of the MPS shall be required if any of the essential variables below are exceeded
 1. Any change in steel supplier or type of steelmaking / casting,
 2. Changes beyond the allowable variation for rolling and accelerated cooling processes,
 3. Change in ladle analysis beyond ± 0.03 CE_{PCM} and / or + 0.02% carbon,
 4. Change in type of pipe forming,

B.4 CHARACTERISTICS OF THE INSPECTION TEST PLAN

The inspection and test plan shall be approved by Purchaser before the start of production

B.5 MANUFACTURING PROCEDURE QUALIFICATION TESTS

B.5.1 The testing and inspection identified in Table 18, “Inspection frequency for PSL 2 pipe,” of API SPEC 5L and this specification and the MPQT tests in Table B.1 below shall be applied as First Day production testing and shall meet the requirements of this specification.

B.5.2 In order to qualify the proposed manufacturing procedures, two pipes from each pipe size, wall thickness and grade representing two separate heats will be selected by Company for MPQ testing. Sufficient notice (at least 14 days) shall be given of the time when the production run is to begin. For small quantity orders, the qualification of the manufacturing procedure for pipe with similar wall thickness may be combined provided the procedure is otherwise identical – the order with greater wall thickness shall be tested. No pipes on this order shall be accepted until the MPQT results are approved by the Purchaser. Changes to the MPS shall be approved by Company.

Table B.1 (added) – Additional manufacturing procedure qualification tests

Item	Test Requirement	Acceptance Criteria
1.	Macro etch of slab / skelp representing head, middle and tail of all stands to be used for production heats.	Table B of this specification
2.	Chemical analysis of weld metal.	\leq CEPcm maximum of ordered grade + 0.03.



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Item	Test Requirement	Acceptance Criteria
3.	All weld metal tensile test (longitudinal) per ISO 5178. For WT > 25 mm (0.984 in), test both OD and ID welds.	R0.5t shall be \geq SMYS
4.	Transverse CVN tests – pipe body, weld centerline. FL, FL+2 mm (0.079 in) and FL + 5mm (0.197 in) at Ttest – per Figure 7 of this specification.	Section 9.8 of this Specification
5.	Transverse CVN transition curves for pipe body, weld centerline and HAZ; temperature range of +20 ⁰ C (+68°F) to -50 ⁰ C (-58°F) (\geq 5 temperatures). One HAZ notch location shall be tested – the location that gives the lowest values when performing the tests in item 4 of this table. For D \geq 323.9mm (12.75 in), pipe body DWT transition curve may be used to replace pipe body CVN transition curve.	To document transition temperature. CVN: Section 9.8 of this specification at Ttest. DWT: Section 9.9 of API SPEC 5L and this specification at Tmin.
6.	For pipe with wall thickness > 13mm (0.512 in) to be used for gas service, CTOD of weld metal at Tmin.- minimum of three “NP” samples in accordance with BSI BS7448. Sample size should be B X 2B, with B dimension as close to t as possible.	CTOD \geq 0.20 mm (0.0079 in).
7.	For single – step SAWH pipe, cross section macro specimen, documented with a photo, from the weld at a position 150 mm (6 in) from each end, polished and etched to disclose weld geometry.	Section 9.13 of API SPEC 5L and this specification.

B.5.4

Add

Weldability of PSL2 pipes

Manufacturer shall ensure, and demonstrate the weldability of the pipes in accordance with this specification and under normal operational site condition.

The Manufacturer shall advise the Purchaser on welding procedure should special precautions be considered necessary for field welding of the supplied material.

Where for a given order the Manufacturer proposes to supply more than one aim chemistry for pipe of the same in diameter, grade and wall thickness combination the agreement of Purchaser will be subject to consideration of any implications for weldability and the possible need for additional weld procedure qualification testing.

For pipes with specific minimum yield strength > 485N/mm², the Manufacturer shall propose in the offer a field welding procedure and give proof of Good Weldability by performing test welds on pipes equivalent to those of the Purchaser (equivalent mechanical and chemical properties). The tests weld and testing of the same (NDT & DT) will always be performed in the presence and under the supervision of the TPIA and the Purchaser’s representative. These test welds shall be subject to agreement between the Manufacturer and the Purchaser’s representative at the time of the offer.

The test welds will be performed on full length pipes (Min 11 m).



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B.6 INSPECTION AND TEST PLAN (ITP) (ADDED)

Prior to commencement of any production work, the Manufacturer shall submit a job-specific ITP for Purchaser review and approval. The ITP format shall include the following (refer also to Annex Q):

1. The complete sequence of operations shall be submitted for approval to the Third Party inspection Agency and the Purchaser,
2. The specific activity and associated procedure or specification reference governing the activity.
3. Acceptance criteria.
4. Responsible organization performing the activity.
5. Verifying document to be used for recording inspection and test results.
6. Manufacturer shall show designated monitor, witness or hold points in manufacturing process.
7. Provisions for Purchaser to designate third party monitor, witness and hold points,
8. Purchaser participation for each activity to be completed by Purchaser.
9. The designated responsible (Purchaser representative) for witness or hold points has to be notified 2 weeks in advance by the Manufacturer,
10. The designated responsible of Purchaser present during manufacturing of pipes must have full access to the manufacturing sites and will determine on daily base the inspection points he plan to attend.

B.7 FIRST DAY PRODUCTION (ADDED)

First day production shall be sampled and inspected to cover each size, thickness and heat. [In case of multiple heat nos., at least 3 (three) heats shall be covered]. All the tests of approved QAP are applicable to first day production test moreover weldability test is also included.

The tried and internationally accepted welding consumables are to be used and vendor has to submit record of these tests prior to start of first day production test.

All weld tensile tests shall be carried out as per ASME Section IIC to ensure the properties of welding consumables.



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Treatment of Surface imperfections and defects

C.4. REPAIR OF DEFECTS BY WELDING

C.4.2 Repairs to the weld shall only be performed prior to cold expansion and hydrostatic testing. Repairs on pipe shall be made using a Purchaser approved WPS. The following restrictions also apply;

- a) Repair welding shall be executed only after specific approval of Purchaser,
- b) No through thickness repair,
- c) An interruption of a SAW welding is not considered as a repair unless unacceptable defects are found
- d) No back-to-back repair,
- e) Maximum of 3 weld seam repairs per pipe length are allowed,
- f) Repair welding of crack is not allowed,
- g) Repair of a repair shall not be allowed,
- h) Manual metal-arc repairs shall not be completed in a single pass a minimum of 2 passes is required,
- i) In case of SMAW (Shield Metal Arc Welding) weld repair only low hydrogen electrodes shall be used
- j) If carbon arc gouging is used for defect removal, at least 3.2 mm additional metal shall be removed by chipping or grinding to completely remove any carburized area prior to making the repair weld,
- k) Minimum length between weld repairs shall be not less 100 mm or one pipe diameter whichever is higher,
- l) No weld repair within 300 mm or one diameter (whichever is higher) of pipe end,
- m) The maximum length of any repair shall be 300 mm,
- n) The properties of the weld repair shall meet the specification requirements for the longitudinal / helical seam weld,

C.4.3 The total length of repaired zones on each pipe shall be $\leq 3\%$ of total length of weld.

C.4.6 The complete removal of defects prior to weld repair shall be verified by magnetic particle or liquid penetrant methods. The total area of the weld repair shall be inspected by ultrasonic and radiographic methods to the acceptance levels of this specification. Radiographic film exposure shall extend at least 100 mm beyond each end of the weld repair.

C.4.7 Repair of defects by welding

Arc stops during welding shall be repaired according to the qualified weld repair procedure.



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Annex D

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Repair welding procedure

D.2. REPAIR WELDING PROCEDURE QUALIFICATION

D.2.1 General

All welding (longitudinal) and repair welding shall be performed according to written procedures. This welding procedure shall be qualified according to the requirements of the ASME Boiler and Pressure Vessel Code, Section IX.

The welding procedure tests will be performed on one of this first pipes produced.

The Manufacturer shall maintain a record of the procedure and performance-test results. Test welds are only performed on pipe and not on plates.

The test shall be carried out as specified in the table below and only one retest is allowed.

WELDING AND REPAIR PROCEDURE

TABLE

		Specific Test	Number	Acceptance criteria
NDT (Non Destructive Test)				
X Ray		API 5L Annex E clause E.4.	1	API 5L Annex E clause E.4
DT (Destructive Test)				
All specimens shall taken transverse to the weld				
Tensile Test		API 5L Fig. 5C	2	At least equal to the specified base metal tensile strength (U.T.S.)
Bend Test	FACE	API 5L clause 10.2.4.6.	2	API 5L
	ROOT	API 5L clause 10.2.4.6.	2	
Impact	WELD	Charpy V – 20°C	1set of 3 specimens	API 5L & present specification clause 10.2.5
	HAZ	Charpy V – 20°C	1set of 3 specimens	API 5L & present specification clause 10.2.5
Macrographic examination			1	
Hardness test on macro		HV 10	1	



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Micrographic examination: the etched surface of the macro test specimen viewed macroscopically must display the image of a well performed welded joint with sufficient penetration free from linear defects and important inclusions. In case of doubt the etched surface must be examined microscopically and additional macroscopically examinations of other areas may be required.

The hardness will not exceed the values measured in the parent metal by more than: 80 points for the weld and 100 points for the HAZ with an absolute maximum value in informity with clause 9.3.3 of the present specification.

The instrument used for the hardness test has to be specified by the Manufacturer and submitted for approval by the third party inspection agency.



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Annex E

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Non-destructive inspection for other than sour service or offshore service

E.1 QUALIFICATION OF PERSONNEL

Final non-destructive inspection shall be performed by level 2 or 3 personnel. All level 2 personnel shall be qualified and certified for the specific NDT method by a Certification Body or Level 3 in accordance with BSI BS EN 473 or the ASNT CP 189 or Purchaser approved equivalent. A current list of qualified NDT personnel is to be presented to Purchaser prior to using the personnel.

For Ultrasonic Testing, at least one level 3 qualified inspectors shall be available full time to the mill for overall supervision. A level 2 inspector is required for shift supervision, manual weld inspection and calibration of all systems (both manual and automated).

For all items order the entire provision of Annex shall apply.

E.2 STANDARD PRACTICE FOR INSPECTION

Ultrasonic equipment, electronic signal suppression and damping shall not be used during calibration, sensitivity checking or scanning.

All final automatic UT equipment shall incorporate a fully automatic monitoring and recording system to indicate the location of unacceptable imperfections and loss of coupling that encompasses an area greater than the allowable imperfection size. Alarms, lack of coupling or signal transmission shall be accompanied by an audible alarm, and automatic or manual paint systems so that areas of the pipe that have valid alarms due to an imperfection and / or loss of coupling are clearly indicated on the pipe.

Probe shoe or wear face surfaces shall have their radius conform to the diameter of the pipe surface, or the shape of the weld bead, to ensure intimate contact between the surface to be inspected and the transducer wear face.

E.2.1 AUTOMATIC STRAIGHT BEAM UT INSPECTION (ADDED)

Through – transmission type probe systems should not be used for lamination detection.

For lamination detection, probes should be dual element with element size as per ISO 10124 or ISO 12094.

For detection of laminar imperfections by manual and automatic systems, initially, the signal height from the backwall in the reference standard should be set from 60% to 90% of Full Screen Height (FSH). Reference to the backwall is necessary to verify signal perpendicularity and sound coupling during scanning. The gain should then be increased to set the signal from the respective edge or body reflector at 100% FSH. Automatic equipment shall have a minimum of two independent gates so that the flaw gate shall be set with positive logic ($\geq 50\%$ FSH), and the backwall gate shall be set with negative logic ($> 20\%$ of FSH). Loss of backwall – defined as backwall signal height $< 20\%$ FSH – greater in size than an acceptable imperfection shall be regarded as a rejectable condition. Indications greater than primary reference level in the flaw gate are rejectable even if there is no loss of backwall.



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E.2.2 Automatic Angle Beam UT Inspection (*added*)

For angle beam inspection of weld seams, the primary reference level should be set at 80 % FSH. Any areas of the pipe producing signals greater or equal to the primary reference level shall be considered suspect. For production scanning, the gain shall be increased by ≥ 3 dB to compensate for signal variation, difference between artificial reflectors and actual imperfections and equipment drift. For calibration / sensitivity verification and prove-up of suspect areas, the additional gain is not required.

Angle beam UT transducer frequency and element size shall be selected so that inspection does not occur in the near field. For automatic inspection, maximum element sizes should be 13 mm (0.512 in) for inspection by angle beam transducers. Element size shall always be smaller than wall thickness.

Maximum drift of probes from the centerline of the weld shall be ± 3.2 mm (0.126 in). For inspection of weld zones, UT equipment should utilize an electronic weld seam tracking / centering system to ensure accuracy of probe locations. This drift shall be compensated for by extension of the leading and trailing edge of gate widths by an amount equivalent to the amount of drift.

For angle beam scanning of the weld zone, the maximum number of legs of beam travel shall be 3 (1.5 skips) for detection of imperfections.

Wheeled angle beam ultrasonic inspection systems are not acceptable for weld seam angle beam inspection.

For angle beam inspection of weld seams, sound transmission should be verified using the inspection probes in a paired cross-talk mode. Verification with close proximity straight beam transducers is not acceptable.

For angle beam inspection of the longitudinal / helical weld seam, the maximum speed of travel, when taking into account the alarm filter setting and the operational pulse repetition rate, shall be such that there will be at least 3 pulses on the applicable 1.6 mm (0.063 in) through drilled hole.

Guidelines for probe frequency for automatic angle beam inspection are provided in Table E.9, below.

Table E.9 (*added*) – Guidance for angle beam probe frequency

Wall Thickness t	Frequency Range
$t \leq 12.7$ mm (0.500 in)	3.5 – 5 MHz
12.7 mm (0.500 in) $\leq t \leq 20$ mm (0.75 in)	3 - 4 MHz

Guidelines for probe frequency for automatic angle beam inspection are provided in Table E.10. below:

Table E.10 (*added*) – Guidance for probe angle – automatic UT inspection

Imperfection	Wall Thickness t	Zone to be inspected	Probe Angle ($\pm 5^\circ$)
Longitudinal	$t \leq 12.7$ mm (0.500 in)	ID, Midwall	60° or $70^{(1)}$
	12.7 mm (0.500 in) $< t \leq 20$ mm (0.75 in)	ID	OD ≤ 762 mm (30 in) : 45° or 60° OD > 762 mm (30 in) : 60° or 70°
		Midwall	60° or $70^{(1)}$



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	All	OD	45 ⁰ or 60 ⁰
	All	All	45 ⁰
Note ¹ : When $t/D > 0.02$, use 60 ⁰			

E.3 METHODS OF INSPECTION

E.3.1.1 General

To ensure the weld quality, the Manufacturers shall cover about 5% of manufactured pipes to “Spot Radiography – (min 200 mm)” at least one on middle of the pipe. This is apart from requirement of pipe end radiography. However, an interruption (Start/Stop point) of SAW shall also be 100 % radiographed, which will not be the part of requirement of 5% additional radiograph.

A reflector (s) shall be placed at the ends of the reference standard to identify length of pipe on the end not inspected by UT probes. In order to identify length, all appropriate probes shall alarm on the reflector (s), both entering and exiting the reference standard.

The weld seam cap shall be retained on all reference standards used for weld seam inspection.

E.3.1.3 a) NDT of weld seams shall take place after cold expansion, heat treatment, hydrostatic testing and rotary straightening of pipe.

E.3.1.4 Manual ultrasonic testing (MUT) (added)

E.3.1.4.1 For production scanning, gain shall be ≥ 6 dB over the primary reference level. For prove – up of suspect areas no additional gain shall be used.

E.3.1.4.2 Manual ultrasonic inspection of weld seams shall be in accordance with ISO 17640, Testing Level B. Probe frequency should be as indicated in Table E.9.

Inspection for longitudinal imperfections should be performed with probe angle as provided in Table E.11 below. For prove-up of suspect areas when $t > 20$ mm (0.787 in), inspection by two probe angles is required. The probe that produces the highest amplitude response shall be used for acceptance / rejection of the imperfection.

During angle beam scanning, a slight swiveling motion of angle of about 10⁰ on each side of the nominal beam directions shall be applied to the probe. Maximum probe movement speed for angle beam inspection of welds shall be ≤ 50 mm / sec (2 in/sec).

Table E.11 (added) – Guidance for probe angle – manual UT inspection

Pipe Diameter D	Wall Thickness t	Probe Angle
≤ 610 mm (24 in)	≤ 12.7 mm (0.500 in)	70 ⁰⁽¹⁾
	> 12.7 mm (0.500 in)	60 ⁰
> 610 mm (24 in)	All	70 ⁰⁽¹⁾

Note ¹: When $t/d > 0.02$ angle = 60⁰ When $t/d > 0.06$, angle = 45⁰

Inspection for transverse imperfections in SAW welds shall be performed with a 45⁰ probe, with the probe “on-bead”. If ‘on-bead’ scanning is not feasible due to weld cap configuration, X or K scan patterns may be used, however, the maximum angle from the weld axis for the probe position shall be 15⁰



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E.3.1.4.3 Manual ultrasonic inspection of pipe ends for vertical imperfections shall be in general accordance with ASTM A 577/A 577 M, but using the same acceptance level as for automatic inspection. Manual ultrasonic inspection of the pipe body shall be performed in accordance with ISO 9303 or ISO 9305. Maximum probe movement speed shall be $\leq 50\text{mm / sec}$ (2 in / sec).

E.3.1.4.4 Manual ultrasonic inspection pipe body or ends for laminar imperfections shall be in accordance with ISO 12094 or ISO 10124 or ISO 11496. Sizing should be performed in accordance with ISO 12094, Annex A. Maximum probe movement speed for lamination inspection shall be $\leq 150\text{ mm /sec}$ (6 in/sec).

E.3.2.4 PIPE END INSPECTION – WELDED PIPE (ADDED)

Where the ends of the pipe have been cold sized, or the roundness corrected by jacking, the affected surface area of the long / helical OD seam weld shall be inspected for longitudinal imperfections by magnetic particle inspection in accordance with ISO 13665 or ASTM E709, or liquid penetrant inspection according to ISO 12095. There shall be no linear indications greater than 3.0 mm (0.118 in) in length. This inspection shall be performed after hydrostatic testing.

E.4 RADIOGRAPHIC INSPECTION OF WELD SEAMS

E.4.2 RADIOGRAPHIC INSPECTION EQUIPMENT

E.4.2.1 Gamma radiation sources require Company approval. If gamma radiation is approved, then the acceptable sensitivity level shall be reduced (smaller wire) by one level in the IQI. Image intensifiers shall not be used.

E.4.2.2 When using film techniques, fine grain film (ISO 11699-1, Class T1 or T2) shall be used. Filmless techniques shall be subject to Company approval, and must have equivalent sensitivity and overall image quality as film techniques. Filmless techniques shall utilize CR or DR methods, qualified as per ASTM E 2445, with single wall exposure. The Manufacturer shall demonstrate that the software for filmless technique radiography does not electronically selectively enhance the contrast or definition to achieve image quality.

Film density through the weld seam shall be 1.8 – 4.0 (Hunter and Driftfield).

E.4.3 Image Quality Indicators (IQIs)

E.4.3.4 IQIs shall be placed on the source side during exposure, otherwise Purchaser approval is required. If film side IQIs are approved for use, equivalency to source sensitivity shall be demonstrated by the Manufacturer and approved by Purchaser on the first two pipes of the order. In addition, equivalency to source side sensitivity shall be verified on the first pipe of every working shift and on one pipe every 4 hours during the shift.

E.4.3.5 for Film and filmless techniques, at least 2 IQIs shall be placed across the weld on the radiographic image (one at each end of the radiographic image) for the 200 mm of the pipe ends. In addition, on the first pipe of every working shift and on one pipe every 5 hours during the shift, a hole type IQI shall be placed on the base material at the approximate middle of the image to verify that the source is perpendicular.

E.4.5 Acceptance limits for imperfections found by radiographic inspection

No indications (e.g. surface discontinuities, film, stains, or blemishes larger than applicable acceptance limit) that could mask a defect or be interpreted to be a welding type defect are permitted within the 200 mm (8.0 in) inspection length. Any single or accumulated welding type imperfection equal to or exceeding 1.6 mm (0.063 in) within 50 mm (2.0 in) of the end of the pipe shall be cause for rejection.

E.5 ULTRASONIC AND ELECTROMAGNETIC INSPECTION



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E.5.3 Ultrasonic and electromagnetic inspection references standards

E.5.2.3 Add

NDT Reference Standards

Clause E.5.2.3 of API 5L is complemented as follow:

If the “notches” method is selected, the reference notch shall have a depth of 5 % (± 15 %) with a minimum of 0,012 in ± 0,002 in (0,3 mm ± 0,05 mm) except, that the “V” notch type may be used, at discretion of the Manufacturer, when the notch depth is less than or equal to 2/100 in. (0.5 mm) or maximum 5% t whichever is the smallest.

If the “holes” method is selected, the radially drilled hole shall have a diameter of 1/16 in (1.6 mm).

E.5.3 Instrument Standardization

All UT sensitivity checks shall be performed dynamically at the same or greater speed as that used for production scanning. Sensitivity checks shall be performed at the gain setting as used for production inspection. The sensitivity check is successful if all appropriate channels alarms, within the gate, on the required target reflector in the reference standard – without any alteration of any setting. All sensitivity checks are independent of each other.

The 3 dB allowance in Paragraph 8.5 in ISO 9765 and Paragraph 7.5 in ISO 10124, ISO 12094 and ISO 13663 shall not be allowed for digital equipment.

E.5.5.2 Acceptance limits

Suspect areas shall be accepted / rejected using the same NDT method employed to find the original imperfection, except as allowed in c).

a) Radiography approval of ultrasonic indications that exceed the applicable acceptance limit in Table E.8, “ Acceptance Limit,” of API SPEC 5L is allowed provided the indication is confirmed to be a slag-inclusion or gas-pocket that meets the requirements of API SPEC 5L Tables E.5, “Elongated Slag-Inclusion –Type Imperfections,” and / or Table E.6, “Circular Slag – Inclusion-Type and Gas-Pocket-Type imperfections. “RT shall meet the requirements of Sections E.4.2 and E4.3 of this specification. Cracks, lack of fusion, incomplete penetration and UT indications with radiographic images that display no imperfections shall be classified as defects.

E.5.7 Weld Repair

Real time radiography (fluoroscopic) inspection of weld repairs is not allowed.

E.6 MAGNETIC PARTICLE INSPECTION

E.6.2 Equipment

Magnetic particle testing shall be performed with active (continuous) field, unless otherwise approved by Company. (*Field strength shall not be verified with pie field indicators – pie field indicators may be used to identify field direction*).

Electromagnetic AC yokes shall have a minimum lifting force of 5 kg at maximum leg spread. Verification is required at the start of each operating shift.

Permanent magnets shall not be used. DC yokes require Purchaser approval.



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E.7 RESIDUAL MAGNETISM

E.7.3 If other than Hall-effect measurement devices are used, the Manufacturer shall verify at least once per shift, that the measurements are within ± 2 Gs (0.2 mT) of Hall-effect gaussmeter readings.

E.7.6 The average of the four readings shall be ≤ 20 Gs (2 mT) with one reading as high as 25 Gs (2.5 mT) allowed.

E.8 LAMINAR IMPERFECTIONS IN THE PIPE BODY OF EW, SAW, and COW pipes

E.8.2 Base material inspection

Add the following paragraph:

The base material of welded pipe shall be non-destructively inspected in accordance with Requirements of this paragraph.

Ultrasonic testing of the base material is carried out for 100% area of plates/skelks by the pipe Manufacturer or by the plate/skelp Manufacturer who delivers a certificate stating that the inspection has been performed in accordance with the following procedure:

A. Inspection method:

The inspection shall be performed either in the plate or coil. If non destructive inspection is performed on line pipe, the procedure shall at least cover the areas as specified below and shall be submitted for approval to the purchaser/third party inspection agency. The examination method (extent and nature of waves), the type and size of the transducers (probes) as well as the ultrasonic examination equipment used are to be approved by the purchaser/third party inspection agency.

B. Scanning procedure:

Plate of coil material is examined along the edges and in the remaining part.

- 1) Edges: the plate or coil edges shall be 100% examined over a width of at least 50 mm, for Electrical Welded pipe for at least over a width of 25 mm. If for spiral welded pipe the edges are not examined before welding, the acceptance criteria for the zone of 50 mm on both sides of the weld are the same as those specified under C1.
- 2) Remaining part: the scanning procedure for examination of the middle of the plate or coil is left to the choice of the Manufacturer but shall be submitted for approval to the Inspection Agency. It must be adequate to detect non acceptable defects as specified under C2.

C. Acceptance criteria:

1) Edges:

Any defect with length ≥ 40 mm in any direction is unacceptable.

Defects with length < 40 mm are acceptable provided:

- Their number does not exceed 3 per m of edge length,
 - The defect does not extend up to the edge of the plate (bevel); in the latter case, the maximum acceptable defect length is 6.35 mm.
- 2) Remaining part in conformance with SEL 072-77 class 2.

Determination of the defect surface in case of dispute:

In case of dispute, the details of the examination are determined in accordance with the standard SEL 072-77, Appendix : "Ultrasonic tested heavy plate material -Technical conditions for supply", ref. "Stahl-Eisen Lieferbedingungen des Vereins Deutscher Eisenhütteleute".



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Annex G

(normative)

PSL 2 Pipe with resistance to ductile fracture propagation

G.1 INTRODUCTION

This annex shall apply to gas service pipe applications where resistance to ductile fracture propagation in the pipe body is required.

G.6 Guidance for determining CVN absorbed energy values in buried onshore gas pipelines

G.6.1 The minimum CVN values started in annex G of API 5L specification are valid for operating pressure up to 100 HPa (1450 psi).



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Annex J

(normative)

PSL 2 Pipe Ordered for offshore service

J.1 INTRODUCTION

Although this annex in API SPEC 5L is for offshore line pipe applications, certain clauses of Annex J of API SPEC 5L are required by this specification for onshore pipe – these requirements are noted in the main body of this specification.



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Annex K (normative)

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

K.1 INTRODUCTION

Annex K of this specification shall be implemented for the Manufacturer of onshore gas transmission non-sour service line pipe.

K.2 General non-destructive inspection requirements and acceptance criteria

K.2.1 Lamellar imperfections at the pipe ends

K.2.1.1 Sensitivity shall be based on a 6 mm (0.25 in) flat bottomed hole.

K.2.1.3 If the girth welds will be inspected by automatic ultrasonic testing during installation, then ultrasonic inspection of the 100 mm (4.0 in) wide zone from each pipe end shall be performed.

K.2.1.4 Magnetic particle inspection of the end bevel face is required for grades \geq X 80 (L555), except that if the pipe ends will be re-beveled during pipe installation in the field, then end face inspection is not required. Wet fluorescent magnetic particle inspection should be used.

K.2.2.4 Suspect Pipe

Where dressing is carried out as a result of imperfections disclosed by NDT or the NDT alarm is the result of a visible surface imperfection, the removal of the defect shall be confirmed by MT or PT inspection. The repaired area shall then be re-examined by the original NDT method.

K.5 NON-DESTRUCTIVE INSPECTION OF SAWH PIPE

K.5.1 Ultrasonic inspection for longitudinal and transverse imperfections in seam welds

The following requirements apply to final ultrasonic inspection.

Acceptance level ISO 9765, Table 2, Acceptance Level L2 (1.6 mm through drilled hole) shall be used for longitudinal inspection at the weld centerline and toes, and for transverse inspection at the weld centerline. This applies to both automatic and manual UT inspection. Refer to Tables J and K of this specification for probe frequency and angle.

K.5.1.1 Longitudinal N5 notches shall be employed, as per ISO 9765 but are only to ensure that the sound beam is perpendicular to the weld seam and to indicate the edge of gate widths for probes inspecting the weld for longitudinal imperfections. Transverse N5 notches on the ID / OD weld crowns shall be employed to verify that the sound beam is perpendicular and to identify the leading and trailing edges of the gate widths for the transverse probes.

In order to locate the centre of the weld, one = 3.2 mm (0.126 in) side drilled hole shall be placed at mid-wall thickness in the center of the weld and parallel (\leq 1.6 mm (0.063 in) to the long axis of the pipe. For SAWL pipe, the hole should be at the end of the reference standard. For SAWH pipe, it is recommended that the side drilled hole be placed in an area of the spiral weld seam (approx. 150 mm x 150 mm (6 in x 6 in) removed from the reference standard and then welded back into the window in the reference standard.

Probes used to detect transverse imperfections in the weld should be positioned over the weld cap ('on – bead') and shall examine the weld in the both directions – i.e., probes shall face toward or away from each other per Figure B, below. Probe angle shall be 45°



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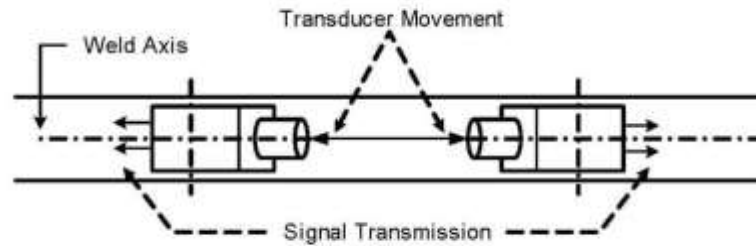


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Figure K.1 (added) — UT inspection of weld seam - On-bead transducers



UT Inspection of Weld Seam: On-bead Transducers

Alternatively, if on-bead inspection is not performed, then the following program shall be implemented on MPQT pipes and on one production pipe per shift, sequencing welding lines:

- In addition to automatic long seam UT inspection, perform on-bead manual UT inspection for transverse imperfections on the pipe at least 48 hours after completion of welding. If MUT does not find defects, then continue with pipe production. If MUT finds defects then all pipe since the last successful inspection shall be automatically or manually inspected 'on-bead' for transverse imperfections.

K.5.1.1.1 Added:

Ultrasonic inspection for longitudinal and transverse imperfections in seam welds

Where possible, when using agglomerated flux, final ultrasonic inspection of SAWH welds on pipe should be performed at least 24 hours after the completion of welding. For Grade \geq X70M (L485), if this is not practical due to production considerations, flux moisture content or weld diffusible hydrogen shall be measured on a regular basis, as identified in section 8.6; or on-bead UT inspection for transverse imperfections on at least one pipe per production day per welding line shall be performed at least 48 hours after the completion of welding.

K.5.1.1.2 Added:

Areas of the longitudinal / helical weld seam that display a visual sharp deviation from the weld axial line $>$ 5 mm (0.197 in) shall be identified and shall be manually UT inspected to the same criteria and acceptance level as the automatic UT inspection.

K.5.1.4 Added:

Two – step SAWH pipe

A minimum of 6 separate probes shall be used to examine the entire weld zone for longitudinal imperfections. At least one probe on each side of the weld shall examine the center of the weld. Each OD and ID toe area shall be examined by least one probe.

K.5.1.5 Added:

Single – step SAWH pipe

For single – step SAWH pipe, at least 8 probes shall scan the weld seam for longitudinal imperfections. The following weld seam zones shall be inspected from both sides of the helical weld seam by dedicated angle beam probes:

- A) ID weld centerline 60° and 70° probes shall be used. The weld shall be inspected with the 60° probe leg coming from the ID surface and the 70° probe leg coming from the OD surface.



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- B) ID and OD weld toe areas to the approximate center of the respective weld. For pipe wall thickness \leq 12.7 mm (0.500 in), the probe angle should be 70° . For pipe wall thickness $>$ 12.7 mm, the probe angle should be 60° . There shall be at least one probe aiming at each toe-to-centerline area for a total of 4 probes.

In addition, for single-step SAWH pipe mills without automatic seam tracking/gap control for welding, there shall be probes focusing on the difference in circumferential distance between the OD weld toe signal and the ID weld toe signal. This difference shall be set to ensure that weld seam misalignment does not exceed the maximum identified in API SPEC 5L Section 9.13.3, "Misalignment of the Weld beads of SAW and COW pipes."

K.5.2 Lamellar imperfections in the pipe body and on the strip/coil edges

K.5.2.1 Ultrasonic inspection shall be used to verify that the skelp/pipe body is free of lamellar imperfections greater than those permitted by Table K.1, Acceptance Criteria for Lamellar imperfections, "for "Sour" service. For pipe grades $>$ X60 (L415), coverage during inspection shall be 100% of the skelp/pipe surface.

K.5.2.2 The longitudinal strip/plate edges shall be ultrasonically inspected over a width of at least 50 mm (2.0 in). Sensitivity shall be based on a 6 mm (0.25 in) flat bottomed hole. Acceptance limits shall be as per standard "Sour" service condition in Table K. 1 of API SPEC 5L.

K.5.3 Non – destructive inspection of the weld seam at the pipe ends / repaired areas

The weld seam not inspected (dead zone) by the automatic UT inspection system at the pipe ends shall be inspected by UT methods for longitudinal and transverse imperfections to the same acceptance level as for automatic inspection.



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Annex Q
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Purchaser Indicative Inspection and Quality Plan

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