SUPPLY OF 3LPE COATED CARBON STEEL LINE PIPE FOR CUGL GA'S IN KANPUR, UNNAO, BARELLY AND JHANSI IN THE STATE OF UTTAR PRADESH

Project No. P.014714
Document No. P.014714 G 11031 R004
Tender No. P.014714 G 11031 R004

CENTRAL UP GAS LIMITED (CUGL)
KANPUR | INDIA

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TECHNICAL DOCUMENTATION
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CENTRAL UP GAS LIMITED

(CUGL)

CITY GAS DISTRIBUTION PROJECT IN

TRACTEBEL ENGINEERING PVT. LTD.

INTRODUCTION

0	08.01.2020	Issued for Procurement	Anurag Shrotriya	Parampreet Singh/Gunja Gupta	Nitish Nandi
Rev.	**Date**	**Description**	**Prepared By**	**Checked By**	**Approved By**

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1. INTRODUCTION

Central UP Gas Ltd. (CUGL), (hereinafter referred as Purchaser), is supplying Piped Natural Gas (PNG) to domestic, commercial and Industrial consumers and Compressed Natural Gas (CNG) to automobiles in Kanpur, Unnao, Bareilly & Jhansi cities in the State of UP. CUGL is in the process of increasing its compression capacity for CNG distribution in these cities.

TRACTEBEL ENGINEERING pvt. ltd. (Tractebel) has been appointed as the Project Management Consultant (hereinafter referred as Consultant), by CUGL for providing Design, Engineering & PMC services for aforementioned project.

Tractebel Engineering pvt. ltd. is now inviting tenders for procurement of **"3LPE Coated Line Pipes"** of 6-inch size for this project.

The present document covers the technical specifications for the enquiry.

2. TECHNICAL SPECIFICATIONS

The technical specifications for this present enquiry are as listed in Material Requisition (Ref. No. P.014714 G11071 R004).

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CENTRAL UP GAS LIMITED

(CUGL)

CITY GAS DISTRIBUTION PROJECT

TRACTEBEL ENGINEERING PVT. LTD.

MATERIAL REQUISITION
FOR 3LPE COATED LINE PIPES

0	08.01.2021	Issued for Procurement	Anurag Shrotriya	Parampreet Singh/Gunja Gupta	Nitish Nandi
Rev.	**Date**	**Description**	**Prepared by**	**Checked by**	**Approved by**

A. MATERIAL DESCRIPTION

Project:	City Gas Distribution Project in Kanpur, Unnao, Bareilly & Jhansi cities in the State of UP
Subject:	3LPE COATED LINE PIPES

Item no.	Size		Type of Pipe	Pipe Grade	Quantity (M)	Requirement of Coating
	Specified Outside diameter, Inch (mm)	Wall thickness (mm)				External
1.	6” (168.3 mm)	6.4	HFW / SMLS	API 5L X42 PSL 2	32500	3LPE

Notes:

1. The above quantities are indicative only and are subject to change at the time of ordering.
2. Overall length tolerance shall be (-) one and (+) zero pipe length to complete the Owner’s quantity.

B. REMARKS / COMMENTS

1. GENERAL NOTES

Vendor's compliance

Vendor must include the following statement in his bid:

We certify that our bid is fully complying with your enquiry dated……., and referenced……..

Compliance with this material requisition in any instance shall not relieve the Vendor of his responsibility to meet the specified performance.

2. COMPLIANCE WITH SPECIFICATION

The Vendor shall be completely responsible for the design, materials, fabrication, testing, inspection, and preparation for shipment, transport of the above equipment or part thereof as relevant to his offer strictly in accordance with the Material Requisition and all attachments thereto.

3. INSPECTION

Vendor shall appoint a TPIA for inspection purpose and issuance of 3.2 certificates in a manner described below:

The successful vendor shall purpose minimum two (02) Nos. of TPIA's from the below list within (02) weeks from the date of FOA for Purchaser / Purchaser's consultant approval. Vendor shall appoint approved TPIA for inspection purpose."

a) AMERICAN BUREAU SERVICES
b) BUREAU VERITAS
c) CERTIFICATION ENGINEERS INTERNATIONAL LIMITED (CEIL)
d) DNV GL
e) LLOYD REGISTER OF INDUSTRIAL SERVICES
f) MEENAAR GLOBAL CONSULTANTS LLP
g) SGS
h) TUV – NORD
i) TUV – SUD

Apart from inspection by TPIA, inspection shall also be performed by Purchaser / Purchaser's consultant Representative, as set out and specified in the codes and particular documents forming this MR.

4. APPLICABLE DOCUMENTS

General descriptions, requirements and information are listed under point C of this Material Requisition.

5. VENDOR'S DOCUMENTS

Vendor shall supply the documentation as listed under point D of this Material Requisition.

All documents shall be supplied in English language.

Vendor shall strictly follow the document numbering procedure in their document as illustrated below:

Document numbering shall consist of Maximum 20 Characters.

Document No. :

Project No.	Item	Vendor Name	Document Index No.	Serial No.	Revision No.

Where,

Project No. is **P.014714**

Item is **LPIPE** for Line Pipe

Document Index No. will be of three characters as indicated under point D of this MR;

Vendor Name shall be 3 Letter Alphabets i.e. xxx

Serial No. shall be 3 digit no. ranging from **001 to 999**

Revision No. is Revision of the document starting with R0, R1 …..;

Example: For QA/QC program, the document no. will be

P.014714	LPIPE	XXX	QCT/QAP	001	R0

C. LIST OF ATTACHMENTS

The table here below lists the documents which are integral part of this Material Requisition. The applicable revision index of each document is mentioned in the column below the current Material Requisition revision index. When the Material Requisition revision index is "A" or "0", all listed documents are attached. For other Material Requisition revision index, only modified or new documents are attached.	**Material Requisition revision**							
	0	1	2	3				
Documents	**Revision of documents**							
PTS – Line Pipe (HFW) (Doc. No. P.014714 G11077 M015)	0							
PTS – Line Pipe (SMLS) (Doc. No. P.014714 G11077 M016)	0							
PTS – 3LPE External coating (Doc. No. P.014714 G11077 M017)	0							
GTS – Line Pipe (Doc. No. 740/GTS/404	5							
QCT for Steel plate/ Coil (P.014714 G 11013 M004)	0							
QCT for Line Pipe (HFW) (P.014714 G 11013 M005)	0							
QCT for Line Pipe (SMLS) (P.014714 G 11013 M006)	0							
QCT for 3LPE External coating (P.014714 G 11013 M007)	0							
Recommended Vendor List (P.014714 G 11040 001)	0							

D. DOCUMENTS & DATA REQUIREMENTS

The table hereunder specifies the quantities and the nature of the documents to be submitted by the MANUFACTURER to the ENGINEER.

The documents required at the inquiry stage and to be included in the bid are listed under column A.

The documents required after award of the AGREEMENT and subject to the written approval of the ENGINEER are listed under column B.

The final and certified documents are listed under column C.

Any document, even when preliminary, shall be binding and therefore duly identified and signed by the MANUFACTURER. It shall bear the ENGINEER's Project reference, the Material Requisition number and the identification number.

THE DOCUMENTS ARE FULLY PART OF THE SUPPLY WHICH SHALL BE COMPLETE ONLY IF AND WHEN THE DOCUMENTS COMPLYING FULLY WITH THE MATERIAL REQUISITION REQUIREMENTS ARE RECEIVED BY THE ENGINEER.

Item	Documents and Data	A	B		C	
		Number of copies	Number of copies	Required date	Number of copies	Required date
1.	Drawing/data submittal list and schedule	2	2	1 week + monthly	2	2 weeks after approval
2.	Production, test and delivery schedule (per item)	2	2	1 week + monthly	2	2 weeks
3.	Progress report	- -	2	Daily + weekly + monthly	- -	- -
4.	Catalogues / References	2	- -	- -	- -	- -
5.	Description of application and quality with technical data of 3LPE for external coating	2	2	3 weeks	2	2 weeks after approval + with final techn. file
6.	Code compliance certificate(Quality manual, ISO certificate, API License)	2	2	3 weeks	2	2 weeks after approval
7.	QA/QC program (First Day Production + Regular production separately)	2	2	2 weeks	2	2 weeks after approval
8.	Inspection and test procedures	2	2	3 weeks	2	2 weeks after approval + with final techn. file
9.	A description with calculation for handling, storage, transportation procedure during total manufacturing cycle and long storage procedure		2	4 weeks	- -	- -
10.	Duly filled & signed Technical Questionnaire & documents as per Appendix 1 of PTS.	2	- -	- -	- -	- -

Item	Documents and Data	A	B		C	
		Number of copies	Number of copies	Required date	Number of copies	Required date
11.	List of fabrication and control operations (LOFC)	- -	2	2 weeks	2	2 weeks after approval
12.	NDE reports & Procedure	- -	2	When available	2	2 weeks after approval + with final techn. file
13.	Heat treatment reports (When available)	- -	2	When available	2	2 weeks after approval + with final techn. file
14.	Hydrotest and air test report (When available)	- -	2	When available	2	2 weeks after approval + with final techn. file
15.	Material certificate	- -	2	1 week after test	2	With final techn. file
16.	List of subcontractors with their scope	- -	2	2 weeks	- -	With final techn. file
17.	Copy of purchase orders to subcontractors	- -	2	2 weeks	- -	With final techn. file
18.	Copy of purchase order	- -	- -	- -	- -	With final techn. file
19.	Packing/shipping list w/weights and dimensions	- -	2	4 weeks	2	2 weeks before shipping
20.	Final technical file	- -	- -	- -	2	With shipping

NOTES

1) Durations in column B (Required date) are weeks after Purchase Order date.

   Durations in column C (Required date) are weeks after document approval.
   Due date of each document may be proposed.

2) Latest submittal time for:

   - Test procedure : 2 weeks before test
   - Test report : 2 weeks after test

3) Final technical file shall be supplied in hard copy as indicated, and in electronic format (.PDF Acrobat files) on two (2) CD-ROMs.

CENTRAL UP GAS LIMITED

(CUGL)

CITY GAS DISTRIBUTION PROJECT

TRACTEBEL ENGINEERING PVT. LTD.

PARTICULAR TECHNICAL SPECIFICATION –

LINE PIPES -

HIGH FREQUENCY WELDING (HFW)

0	08.01.2021	Issued for Procurement	Anurag Shrotriya	Parampreet Singh/Gunja Gupta	Nitish Nandi
Rev.	**Date**	**Description**	**Prepared By**	**Checked By**	**Approved By**

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1.0 INTRODUCTION

The present « Particular Technical Specification » relates to the manufacture of "HFW (High Frequency Welded) Steel Line Pipes" for Central UP Gas Ltd. (CUGL), under City Gas Distribution Project in Kanpur, Unnao, Bareilly & Jhansi cities in the State of UP.

The present Specification shall be read in conjunction with General Technical Specification **740/GTS/404 Rev. 5** (the GTS) and **API 5L 46th edition** which it amends and/or complements. A new edition of API 5L: **"Forty Sixth Edition, April 2018"** will become effective from May 2019. Thus this new edition of API 5L is the governing standard for purchase of line pipe. All clauses of new edition and tests should be followed scrupulously.

The clauses of the present PTS & GTS are either more stringent or supplementary to the API 5L requirements, and confirm, complete or modify certain sections/paragraphs of API 5L. All these clauses will be followed scrupulously.

The present specification can confirm, complete or modify certain sections/paragraphs of said «General Technical Specification». The PTS will govern the requirements for all such sections. Clauses of GTS specification, which are not mentioned in PTS, remain unaltered and are fully applicable.

The manufacturer shall have a valid license to use **API Monogram** in accordance with the requirements of **API 5L Specification, 46th edition** on line pipe as Product Specification Level (PSL) 2.

Only the clauses of present PTS & GTS which are more stringent or supplementary to the API 5L new edition will prevail.

2.0 PROPERTIES OF THE PIPES

The Properties of Pipe manufactured as per this PTS, shall be as listed below:

- Product Specification Level : PSL 2 as per API 5L
- Design Pressure : 49 barg
- Operating Temperature : 0 – 55 °C
- Design temperature
  - Underground Services : 0 °C to 60 °C
  - Aboveground Services : 0 °C to 65 °C
- Steel grade : Refer below Table 1
- Pipe size & Wall Thickness (Minimum) : Refer below Table 1
- **Length of the Pipes** : Length of Pipe supplied shall be as per Clause 9.11.3.3 of this document. Overall length tolerance shall be (-) One and (+) Zero pipe length to complete the ordered Quantity.

Table: 1

Sr. No.	Outside Dia. (Inch)	Material Grade as per API 5L, PSL 2	Minimum Wall thickness (mm)	Quantity (M)
1.	6	X 42M	6.4	As per MR

Calculation according to ASME B 31.8 with following notes:

- Negative tolerance for WT = ZERO mm (0 mm).
- Corrosion allowance = 1.6 mm
- Specified Minimum Yield strength (SMYS) = X 42M - 290 MPa
- Weld efficiency level = 100%.

AMENDMENTS TO THE GTS

The present specification has to be read in conjunction with the specification API 5L, 46th edition, and the GTS. All the Clause Nos. mentioned below, correspond to the respective Clause Nos. of the API 5L, 46th edition and of the GTS.

3. NORMATIVE REFERENCES

ADD:

API 5L	Specification for Line pipe (46th Edition, April 2018).
API RP 5L3	Recommended Practice for Conducting DWTT on Line Pipe.
ASME V	Boiler and Pressure Vessel Code, Section V Non Destructive Examinassions
ASME IX	Welding and Brazing Qualifications (Boiler and Pressure Vessels Codes).
ASTM A 370	Standards Method and Definitions for Mechanical Testing of Steel Products.
ASTM E 112	Standard Methods for Determining Average Grain Size.
ASTM A 578	Standard Specification for Straight-beam Ultrasonic Examination of Plain and Clad Steel Plates for Special Application.
ASTM E 23	Notched Bar Impact Testing of Metallic Materials.
AWS A5.17	Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding.
BS 672	Wet Magnetic Particle inspection.
EN 10204	Metallic Products - Types of inspection Documents.

4. TERMS AND DEFINITIONS

ADD:

GTS	Means “General Technical Specification 740/GTS/404 Rev.5” and all documents it refers to.
PTS	Means the present “Particular Technical Specification and all its appendices, if any.
OWNER	Shall mean the Purchaser of Line Pipes.
CONSULTANT / OWNER REPRESENTATIVE	Shall means “TRACTEBEL Engineering Pvt. Limited” / The company nominated by the owner to design the natural gas transport or distribution system and to specify the equipment.
TPIA	Means the Third Party Inspection Agency.

MANUFACTURER Means the Manufacturer of the pipes as well as its sub-contractor(s).

6. PIPE GRADE, STEEL GRADE AND DELIVERY CONDITION

Modified:

Table 1 of API 5L : Pipe Grade, Steel Grades and acceptable delivery conditions

The Pipe Grade for this pipeline Project shall be as given below:

- Product Specification Level : PSL 2 as per API 5L
- Steel grade : L290 or X42M, PSL 2,
- Pipe starting material : Thermo mechanical-rolled Coil

The suffix (M) for PSL2 grades belongs to steel grade.

The minimum required mechanical properties of the delivered steel shall be as given below:

Sr. No.	Outside Dia. Inch (mm)	Material Grade as per API 5L, PSL 2	Min. Yield Strength (*)	Max. Yield Strength	Min. Ultimate Tensile Strength (*)	Max. Ultimate Tensile Strength (*)
1.	6" (168.3 mm)	API 5L X-42M	290 MPa	495 MPa	415 MPa	655 MPa

(*): Values indicated for yield strength and ultimate tensile strength are minimum. Due attention shall be paid to the mandatory additional clause as per GTS - Clause 9.3.2 relating to ratio between both values.

8. MANUFACTURING

8.1 Process of Manufacturer

Add:

Pipe furnished to this specification shall be manufactured in accordance with the applicable requirements and limitations given in table 2 of API 5L and Table 3 of this specification.

Modified:

Table 3 of API 5L : Acceptable manufacturing routes for PSL 2 pipe

Type of pipe	Pipe starting material	Pipe forming	Pipe Heat Treatment	Delivery Condition
HFW (High Frequency Welded)	Thermomechanical-rolled coils	Cold Forming	Heat treating of welding area only.	M

Only the High Frequency Welding (HFW) Process will be accepted for Pipe Manufacture and the welding parameters shall be submitted after award of the agreement and same shall be established during First day production test.

8.3 Starting Material

ADD:

The steel used shall be fully killed and manufactured by the electric furnace or basic oxygen process and made to fine grain (8 or finer as per ASTM E112) low hydrogen practice.

Mill Certification for Raw material supply (slab/skelp/coil etc.) of Line pipes is essential and shall be subjected to approval of Owner/Consultant.

Line pipe manufacturer shall depute Approved TPIA expert at steel mill to monitor and control the mechanical and chemical properties of all steel coils as per requirement of QCT, PTS, GTS and API 5L PSL2. TPIA shall witness all mechanical and review the chemical testing results on all heats of each steel coils in order to issue EN 10204, 3.2 certificates

Pipes delivered in quenched and tempered heat treatment condition are not permitted. The steel supplied for manufacture of pipes shall have uniform fine ferrite grain structure to the finished Steel. Further, all surfaces of the coil shall be defect free.

ADD:

Modified:

Centre Slitting of coils shall be avoided because of high segregation zone at centre. If required because of size limitation, then offset slitting in 2 parts or 3 parts shall be preferred, in any avoidable condition line pipe manufacturer can slit coils from centre. Shearing of coil to plate (Cut-to-length) shall be done under monitoring of TPIA as per QCT.

Further, Clause Nos. 8.4 to 8.7 are Not Applicable.

8.8 Treatment of Weld seams in EW & LW Pipe

8.8.1 The weld seam and entire Heat Affected Zone (HAZ) shall be heat treated so as to stimulate a normalizing heat treatment in order to control the grain structure so that no untampered martensite remains in the weld seam and the HAZ, and the mechanical properties of heat treated zone approximate that of the parent metal.

Heat treatment temperature of the weld seam and the entire HAZ shall be continuously measured and recorded.

8.9 Cold sizing and cold expansion

Pipes furnished to this specification shall be non-expanded. Mechanical jacking after hydro testing of pipes is not allowed.

8.13 Traceability data

8.13.2 ADD:

The manufacturer shall establish and follow procedures for maintaining heat and test unit identity of all pipes as per requirement of API Spec. 5L and as modified in this specification. The same shall be submitted for Owner/Consultant approval before implementation. Bar code shall be applied from the coil/forming stage to internal (if applicable) and external coating stage for each and every pipe. Pipes shall not be accepted without bar code.

9. ACCEPTANCE CRITERIA

9.2 Chemical Composition

The Chemical Composition of the Pipe material shall confirm to:

For Pipe upto X-65 - Table – 5 & clause 9.2 of API 5L.

For Pipe Grade X70 & Higher - Table – 5 of clause 9.2 of GTS.

9.3 Tensile Properties

ADD:

The Tensile Properties of the Pipe shall confirm to Table – 7 of clause 9.3 of API 5L, 46th Edition.

For Grade X 70 and lower Pipe material, the ratio between the yield strength (Y) and ultimate tensile strength (UTS) shall not exceed 0.90 (maximum).

The minimum elongation of base metal shall be determined in accordance with the formula given in foot note (f) of Table-7 of API 5L. However elongation in no case shall be less than values specified in below table.

Sr. No.	Grade	Minimum % Elongation
1	Gr-B to X46	25
2	X52 to X56	24
3	X60 to X70	22
4	X80	20

Control tensile test on one sample per heat shall be performed as per API 5L & present GTS/PTS requirement. These tests shall be additional to the tensile test required for each heat/lot as applicable.

9.3.3 Hardness tests

ADD:

The hardness of Base metal, weld metal and HAZ non sour service for steel grade $\leq$ X70 (L485) $\leq$ 248 Hv 10.

9.5 Bend Test (Reverse):

ADD:

Reverse Bend test for Pipes shall be carried out as per requirements Part –II [sec 3(i)], Annexure III of PNGRB Notification, 2008.

9.6 Flattening Test

ADD:

Flattening test shall be conducted on 4 Samples per Coil (2 samples each from First & Last accepted pipe of the Coil). The samples shall be flattened at 0^{o} & 90^{o}. In case of weld stop, 1 sample from each crop end shall be tested at 90^{o}. Acceptance criteria shall remain as per API 5L.

9.8 CVN Impact Test for PSL 2 Pipe

9.8.1 Modification:

For all Base Material and welds:

The CVN Impact test shall be conducted at 0^{o}C. Impact test value (For all base material and weld) shall conform to requirement below requirements.

9.8.2 Pipe body tests

9.8.2.1 Modify Para 2:

For all base material, 2 sets of 3 specimens (for each temperature) shall be taken per coupon and shall be tested at 0 °C.

Acceptance Criteria (At 0°C): For all base material– As per Annex G Table-G.

9.8.2.2 Modify:

For all pipe sizes this clause is applicable Shear fracture area for each test shall be at least 90% average & 80% individual, based upon a test temperature of 0 °C.

9.8.2 Pipe weld and HAZ tests

Modify:

For pipe Weld and HAZ (FL), 2 sets of 3 transverse specimens shall be taken transverse to the weld.

One (1) set shall be taken with the notch in the Weld centre and shall be tested at 0 °C.

One (1) set shall be taken with the notch in the HAZ (Heat Affected Zone) i.e. at FL and shall be tested at 0 °C.

Acceptance Criteria (At 0°C): For all Welds and HAZ – As per Annex G Table-G.

9.9 Drop Weight Tear Test:

Modify:

Drop Weight Tear Test (DWT Test) shall be carried out for pipe size 16" and above each heat, size, grade and thickness of Pipe at 0°C. The DWT test shall exhibit an average shear fracture area of 85% as per requirement specified in API 5L and present GTS/PTS.

The test (DWT Test) shall be tested at temp. -50 °C, -40 °C, -20 °C, 0°C & 10°C for shear area average shear fracture area shall be 85% minimum at -20°C (testing at different temperature is only to establish transition curve) full transition curve shall be established heat out of three with a minimum of one.

9.10 Surface condition imperfections and defects

9.10.2 Undercuts

Modify:

b. Undercuts which cannot be classified as mentioned in clause 'a' of API 5L shall be considered as defect. Disposition of such defect shall be as follows:

   Undercut defects defined in clause 'b' shall be removed by grinding in accordance with API 5L and as modified in this specification. Complete removal of defects shall be verified by local visual inspection and by suitable ND inspection method. After removal of defects the minus tolerance specified in 9.11.3.1 & 9.11.3.2 shall apply in the ground area.

d. Disposition of undercuts exceeding the limits specified in clause 'b' shall be in accordance with (c) or (d) of E10 (annexure-E) of API Spec 5L.

9.10.4 Lamination

ADD:

Any lamination or inclusion either extending into the face or face of bevel & pipe body (100%) or present within 50 mm from pipe ends is considered defect and pipe containing such defects shall be cut back until such defects are eliminated.

The disposition of lamination and other type of defects on the skelp/plate shall be as per Annexure-E of GTS, API Spec 5L and as modified in this specification.

9.10.5 Geometric Deviations

9.10.5.2 ADD:

Dents in any form shall not be permitted.

9.10.7 Other Surface Imperfections

ADD:

Any imperfection (measured from the surface) with a depth greater than 5% of the specified wall thickness of the pipe shall be considered a defect and shall be disposed-off in accordance with clause C.3 and as modified in this specification.

9.11 Dimensions, Mass and Tolerances

9.11.3 Tolerances for Diameter, Wall Thickness, Length and Straightness

9.11.3.1 Diameter

Modify:

Tolerance for diameter and out-of-roundness shall be as under and Table 10 of API Spec 5L stands modified accordingly.

	Diameter Tolerances (mm)		Out of Roundness (mm)	
	OD ≤ 6”	OD > 6” to 24”	OD ≤ 6”	OD > 6” to 24”
Pipe Body	± 0.0075 D	± 0.0075 D but maximum of ± 3.0 mm	Tolerances indicated in Table 10 of API 5L shall be applicable.	5 mm max.
Pipe Ends	- 0.4 to +1.6 mm	± 0.005 D but maximum of ± 1.6 mm		3 mm max.

Note (1) : The inside diameter, based on circumferential measurement, over a length of 100 mm from the end shall comply with the tolerances specified in API Spec 5L. Inside diameter is defined as ID = (OD-2WT.) where ID, OD & WT are the inside diameter, specified outside diameter and specified wall thickness respectively.

9.11.3.2 Wall Thickness

Modify:

The tolerances on specified wall thickness shall be (+) 10% and (-) 0%. Wall thickness shall be measured and recorded for each pipe.

9.11.3.3 Length

ADD:

All pipes shall be supplied with length between 11.5 m and 12.5 m. Thickness wise average length of pipes shall be 12.0mm. The average length shall be cumulative as measured at pipe mill despatch note for 95% of ordered quantity. For mechanical sampling pipes, minimum length of 10.0 m is acceptable for a maximum of 5% of ordered quantity.

API Spec 5L, clause no. 9.11.3.3 & Table 12 shall not be applicable. Overall length tolerance shall be (-) one and (+) Zero pipe length to complete the ordered quantity.

9.11.3.4 Modified:

The Tolerance for straightness shall be modified as follows:

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

b) The local deviation from straight line in the 1.5 m portion at each pipe end shall be $\leq$ 3.0 mm as shown in fig. 2 of API 5L spec.

9.12 Finish of Pipe Ends

9.12.1 The second sentence “Automatically, the 100 following shall apply” shall be read as:

“Automatically, the following shall apply”.

9.12.5 Plain Ends

ADD:

Pipes shall be furnished with Plain ends. Unless specified otherwise, the pipe ends shall be machine bevelled as per API Spec. 5L.

In removing the inside burrs at the pipe ends, care shall be taken not to remove excess metal and not to form an inside cavity or bevel. Removal of excess metal beyond the minimum wall thickness as indicated in para 9.11.3.2 of this specification, shall be a cause for re-bevelling. In case root face of bevel is less than that specified, the pipe ends shall be re-bevelled and rectification by filing or grinding shall not be done.

10 INSPECTION

10.1.1 General

ADD:

In case of any contradiction between API 5L, GTS and PTS, the following order of priority shall be followed.

1. Quality Control Table (QCT)
2. Particular Technical specification (PTS)
3. General Technical Specification (GTS)
4. API 5L

This document shall read in conjunction with tender QCT / GTS / API 5L / relevant standards and codes.

ADD IN PARA 3:

Single TPIA shall be appointed by pipe manufacturer at steel mill & pipe mill for material inspection and certification as per project requirements.

The QCT for Steel HR Plates/Coils shall be prepared by the Steel Manufacturer as per actual requirements specified in the bid document, line pipe specification & QCT. The same shall be submitted for Owner/Consultant's approval. Testing of Raw material (Steel HR Plates/Coils) at steel mill shall be witness by TPIA.

ADD:

Testing Frequency: The frequency for all the tests shall be strictly as per the QCT attached with this specification. In case of any conflict in requirements of QCT and PTS/GTS & API 5L, the more stringent requirement shall prevail.

10.2 Specific Inspection

10.2.1 Add:

Sampling Frequency

The manufacturer shall carry out analysis of two samples per 50 pipes representing each heat of steel used for production of pipes.

Product analysis shall be carried out from finished pipe. The specimen shall be taken from finished pipe.

10.2.3 Samples and Test Pieces for Mechanical Tests

Add:

Tensile Test Specimens

The specimen shall be taken from finished pipe. Transverse specimens shall be taken as far as possible. If size constraint does not allow then longitudinal specimens shall be acceptable.

Transverse Tensile Tests

The transverse tensile properties shall be determined on flattened rectangular specimen.

10.2.5 Metallographic Test

Add:

A test specimen for metallographic shall be taken transverse to the weld from one finished pipe from each lot per heat or at least once per operating shift whichever is stringent.

The specimen shall be suitably ground, polished and etched to reveal the macro structure. The specimen shall be visually examined using a minimum 40X magnification to facilitate proof that proper fusion has been achieved for the full thickness and there is proper interpretation of passes, their alignment and texture of welding zone. The metallographic examination shall be documented on micrographs (at 10X or 20X magnification). In case imperfections or defects are observed, it will become a cause of re-evaluation of welding parameters and heat treatment as deemed necessary by Owner's representative.

Grain size shall be 8 or finer as per ASTM E112.

10.2.6 Hydrostatic Test

ADD:

The hydro test pressure shall be such that hoop stress generated is at least 95% of SMYS of the Pipe Material, computed based on the formula mentioned in API Spec 5L. Test pressure shall be held for a minimum period of 15 seconds.

Duly calibrated pressure gauge shall be installed both at the test bay as well as at the control cabin and graphical records with respect to both the pressure gauges shall be maintained for each pipe.

The test pressure measuring device shall be calibrated by means of a dead weight tester, or equivalent at the beginning of each shift.

Pressure gauge range shall have a minimum range of 1.5 times and maximum 4 times of test pressure. The pressure gauges used should have a minimum least count of 2 kg/ cm2. Calibration of pressure gauge shall be done at start of an each shift (12 hours max.). Accuracy of pressure gauges used shall be within 1% FSD (full scale deflection).

Information to Bidders

In case manufacturer so desires, he will be advised at least 2 weeks in advance so that his representative may witness the hydrostatic test in field. However, the testing & leak finding (if any) and repair operation shall not be postponed for the absence of manufacturer's representative.

10.2.10 Non Destructive Inspection

ADD:

Base Material Inspection:

Ultrasonic testing shall be carried out for 100% area of Coils during manufacturing of pipes.

10.2.11 Reprocessing

Add:

Reprocessing shall not be permitted.

10.2.12 Deleted

11 MARKING

11.2 Pipe Marking

Add:

Paint used for stencil marking shall withstand up to 250 °C expected to be experienced during further external anti-corrosion coating operations of line pipe by coating applicator. The following marking shall be done on pipes:

11.2.1 ADD:

DIE STAMPING

- Pipe no. shall be punch by cold die stamping (Low Stress dotted punch) at the distance of 50mm right side of weld seam and 50mm from the pipe end.
- Height of Die stamping shall be 6mm minimum.

- If Line pipe size constraints Die Stamping, then Pipe numbers & length marked by paint shall be acceptable instead of Die Stamp

STENCIL

- Stencil marking confirming to API 5L in English shall be done at a distance of 300 mm on the both ends of pipe - one inside & one outside at 90 degree. In case pipe size is below 12" outside marking shall be done on both ends of pipes at 90 degree.
- The marking of finished line pipe should also contain the Pipe No, Heat No, Coated Pipe No, Inspection mark by TPI, Diameter of pipe and wall thickness (to be marked in white color).
- A colour band of 50 mm wide to differentiate thickness of pipes shall be provided at each extremity (150mm from the end) of the pipe after coating of pipe by the coating applicator.

  In addition to the marking requirements of GTS, the coater shall also transfer the marking details appearing on the bare pipe

11.2.2 Modify para / bullet#2: Die Stamping with Low stress dot punch only shall be allowed on pipe surface OD on each accepted pipe.

11.2.9 BARCODE (Add)

Based on the details provided below, Barcode (QR) identification system shall be provided by the pipe suppliers, which shall have a life of 5 years over and above the conventional marking as per API 5L. The Manufacturer shall propose marking system to clearly identify the type of pipes.

11.2.9.1 Scope

This procedure defines to identify the pipes through barcode label scanning. This procedure covers the application of 2D type bar code and pipe marking on Bare Pipe and 3LPE coated pipes after the final coating of bare pipes. Bar code to be applied after clearance from TPIA upon final acceptance of external coated pipes/Bare pipe. Barcode should have the information like Pipe no., Type (3LPE/ERW), Coat No., Dia., Unit, Length, Wall thickness, Heat No. and item code. TPIA shall verify barcode with hand held reader during inspection of pipe.

Pipe Supplier to supply one BARCODE READER for each dumpsite & each Store.

11.2.9.2 Method:-

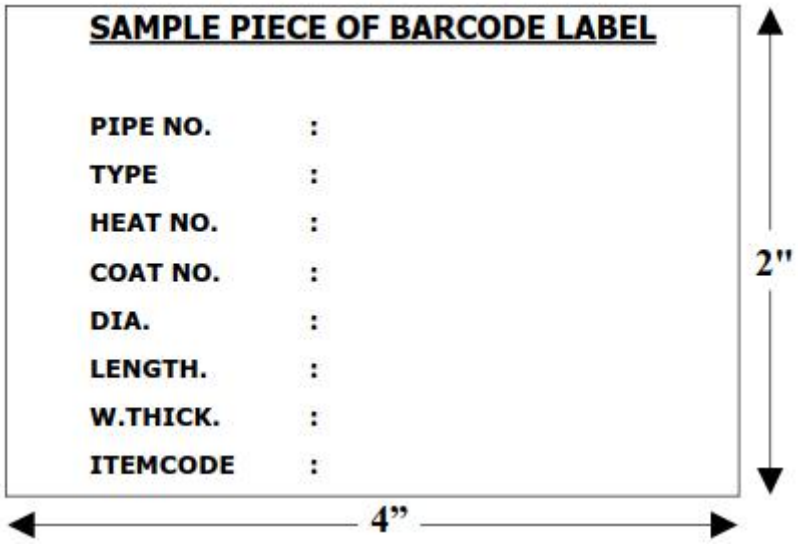
ON BARE / EXTERNAL 3LPE COATED PIPES

Modify:

Pipe marking (stencil) shall be made from both end of the pipe opposite to the weld line. Pipe no shall be printed on barcode at the bottom. VENDOR has to ensure physical correction of the pipe as per stencil & barcode before applying barcode. One 2D type barcode sticker shall be pasted at an angle of 180° from the stencil side at a distance of 200 mm from the cutback area at both pipe end (INSIDE)."In case any unfit pipes found for coating or for any reason pipes are cut, the actual length of pipe shall be given in barcode sticker.

PRINTING OF BARCODE LABELS

The barcode labels will be printed at the time of final inspection (label size 2"x 4") and will be printed by using printer. The pipe number and other details will be taken from the Final Visual and Dimension inspection report system. The label shall have details as per Client/TPIA. The barcode and item code as per sample attached. The label details contains PIPE No, Coat No., ASL No, Item Code up-to 10 Digit Max.



The barcode standard is symbology and the paper material used is 2D and tear-able.

FIXING OF LABELS ON PIPES

Modify:

Ensure that the surface area in which labels are pasted should be clean, dry and free from dust.For each pipe, two (2) labels shall be fixed, one for each end (INSIDE) at paint marking side (fixed approx. 200 mm from the cutback / bevel area and 180° on each end) .All barcode shall be oriented perpendicular to the weld seam. The barcode label shall be put on completely finished pipe. Barcode label should not be overlapped with stenciling or any other marking inside the pipe. (i.e. internal pipe surface)

.VERIFICATION OF BARCODE LABELS

At the time of dispatching of pipes, QC personnel shall verify the barcode labels visually. If the barcode labels found damaged, missing or illegible for the purpose same shall be replaced by new one and applied as described above.

SCANNING OF BARCODES

The barcode can be read by scanning the codes by scanner provided by supplier at pipe mill and site. When the code is scanned the pipe number will be visually seen on the scanners monitor and same will be saved in its memory. The full details of the pipe can be obtained by connecting the computer with the scanner having database for these pipes.

1. First connect the scanner to the computer.
    a. One cable from CPU to scanner
    b. Second cable from power line to scanner for charging.
2. Make the data file in which details of the pipes are available.
3. Copy the data file and paste in the scanner.
4. The data will be loaded in scanner
5. Scan the barcode by scanner.
6. If the code matches with the available data in the scanner, it shows all the details of the barcode.
7. Scanner also shows the number of the data available in scanner and out of which how many are scanned.
8. If the data scanned does not matches with the available data, the scanner shows NA i.e. Not Available.

11.2.2 ~~Modify para / bullet#2: Die Stamping with Low stress dot punch only shall be allowed on pipe surface OD on each accepted pipe~~.

12 COATING AND THREAD PROTECTION

12.1 Coating

The pipes shall be coated externally & internally. The Coating shall in line with the requirements of the below mentioned Pipeline Coating Specifications:

· External 3LPE Coating : as per PTS for Line pipe External coating as per MR Section-C.

12.2 Thread (End) Protectors

ADD:

Pipe Bevel ends shall be protected using Metallic Bevel protectors as per Manufacturer's standard, to be supplied by Pipe Manufacturer. In addition, Plastic end caps, mentioned in the GTS, are not required for pipes. Bevel protectors shall be of a design such that they can be re-used by coating applicator after providing anti-corrosion coating of line pipe.

14. PIPE LOADING

In case of Indian Manufacture/Supplier - The Loading, Unloading and Transportation of Pipes on Trailer (for final transportation to the site) shall be in the scope of the Pipe Manufacturer.

In case of foreign manufacturer/supplier – Pipes will be despatched to Indian port as per terms and conditions of contract.

Pipe Manufacturer shall ensure that there is no damage of any kind to the Pipes before despatch. Any defect/damage detected in Pipe before or during loading to the Trailer /Marine Vessel shall be rectified by the Manufacturer as per the requirements of the code. The TPIA can reject the pipe, if found not conforming to the requirements of the codes and GTS/PTS/QCT.

Pipes supplied from Foreign manufacturer/supplier :

The manufacturer/supplier shall submit calculations and sketch for loading/unloading & stacking at all points, e.g. pipe yard, trailers, warehouse at port before loading on ship, on the ship for the sea journey & on trailer at port as per API RP 5LW.

Pipes supplied from Indian manufacturer:

The manufacturer shall submit calculations and sketch for loading/unloading & stacking at all points, e.g. Supplier’s Warehouse (ex-works) before loading on the trailers as per API RP 5L1.

The Transportation, Unloading & Stacking of Coated Line Pipes at BGRL’s storage yard located at District…… of Maharashtra State shall be in the scope of the Pipe Manufacturer including arrangement & maintenance of storage yard, as per the tender terms & conditions The manufacturer shall submit calculations and sketch for loading/unloading & stacking at all points, e.g. Supplier’s Warehouse (ex-works) before loading on the trailers as per API RP 5L1.

ADD:

· Manufacturer shall get written approval from Owner/Owner’s representative for the acceptable stacking height for Line Pipe before storage in Warehouse / dump yard.

· Pipes shall be stacked using wooden blocks or other suitable separator strips.

- The Manufacturer shall be responsible for any damage occurring to the pipes during loading / unloading and transportation by the relevant transportation means.
- Line Pipe Manufacturer shall ensure that no bevel protectors can be lost during transportation.
- The Manufacturer shall provide a description with calculation of the handling, storage and transportation procedures during the total manufacturing cycle.
- The Manufacturer shall provide description with calculation of long period (> 4 months) storage procedure, including the number and spacing of bearing strips and the number of layers".

The Manufacturer shall consequently:

- Inspect the bare pipes upon delivery to check that they have suffered no previous damage.
- All repairs and inspections shall be at the Manufacturer expense.
- The pipes shall be handled without causing damage to the pipe bevels and coating.
- Direct contact with steel or hemp slings or with any material whose shape or nature may deteriorate the pipe coating shall be strictly prohibited. Polyamide slings or hooks fitted with thermoplastic protection shall be used.
- The manufacturer shall submit calculations and sketch for loading/unloading & stacking at all points.
- Pipe Supplier to supply one BARCODE READER for each dumpsite & each Store.

16 ONLINE PIPE TRACKING DATA (NEW CLAUSE)

The pipe manufacturer shall establish and follow procedures for maintaining heat and lot identity of all pipes during production. Also, it is required to have traceability of each day production.

In order to establish traceability of pipes, the system should have minimum of following information:

- Heat / Coil Number
- Traceability of pipe at each station
- Final status of pipe
- Reason for each rejection

Σ Σ Σ

THE FOLLOWING ANNEXURES OF API 5L 46TH EDITION, ARE APPLICABLE FOR PIPES MANUFACTURED AS PER THIS PTS:

Annex B
(Normative)

MANUFACTURING PROCEDURE QUALIFICATION FOR PSL 2 PIPE

B.5.2 Modify: Column 3 of Table B.1 i.e. *"Acceptance Criteria"* for Item No. 1 and "*Test requirements"* for item no. 5.

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

Item	Test Requirement	Acceptance Criteria
1	**Modified:** Macro etch of slab / skelp representing head, middle and tail of all stands to be used for production heats. This test has to be performed at steel mill	For information
2	**Deleted:** Chemical analysis of weld metal – This is not applicable for HFW Pipes.	< CE Pcm maximum of ordered grade +0.03.
5	**Modified:** For HFW pipes - Transverse CVN Transition curves for pipe body and weld centreline only not for the HAZ; temperature range of +20°C to -50°C, (≥ 5 temperatures). For D ≥ 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 5L Spec. and this specification at Tmin.

B.5.4 WELDABILITY TEST

Weldability test has to be performed for Grade X70 pipes as required in GTS. Previously done weldability tests are not acceptable.

B.7 FIRST DAY PRODUCTION

ADD:

In addition to any other tests specified in API 5L (amended from time to time by GTS and/or present PTS) for each production in same type, size and grade and notwithstanding any other provision, the entire production of the first day shall be subjected to each and all destructive tests on two specimens per test selected by the Inspector at his discretion. Such tests shall be performed in presence of the Inspector and Owner/ Owner's Representative.

For first day production test, **first and last accepted pipe of 3 different coils of 3 different heats shall be selected.** for testing to verify that the manufacturing procedure results in the quality of pipes which are in complete compliance with this specification.

All the tests of approved QAP shall be performed on each selected pipes for first day production.

All testing equipment shall be duly certified for compliance with calibration and verified specially during that day for possible deviation towards calibrated value. Such verification shall be achieved in presence of the Inspector and Owner/ Owner's Representative.

Raw material of pipe shall be tested one test per heat at steel mill (all tests as per GTS/PTS/QCT).

All the tests of approved QCT are applicable to first day production. The acceptance limit shall be in accordance with API 5L (Latest Edition) with a change as depicted in the GTS (740/GTS/404 Rev.5).

B 7.1 BURST TEST

ADD:

Burst test to be done for each size, Grade and thickness per steel manufacturer at the time of first day production test. Burst pressure and location of failure shall be recorded. The actual rupture pressure shall be equal to or above the minimum rupture pressure on the basis of minimum specified UTS as per raw material test certificate of that particular heat. The following formulae shall be used for calculating the minimum rupture pressure (in Kg/Cm2):

$P = (2xSxT)/ D \quad x\ 10.197$

Where, P = Minimum rupture pressure in kg/cm2

S = Specified Minimum Tensile Strength in MPa

T = Wall thickness (in mm)

D = OD in mm

Burst test pressure shall be such that hoop stress generated is equivalent to 125% of SMYS (minimum). Burst test pressure & location shall be recorded. If burst pipe fails below 125% of SMYS then manufacture shall investigate the root cause & submit the report to the client before retesting & restarting of the regular production.

B 7.2 VISUAL EXAMINATION

Each pipe shall be checked for visual defect and dimensional checks as per QCT / approved QAP.

B 7.3 NDT EXAMINATION

Each pipe after completion of welding shall be inspected as per QCT / approved QAP.

B 7.3.1 Ultrasonic Testing

Ultrasonic testing shall be done after 24 hrs. of submerged arc welding.

B 7.3.2 Radiographic Examination

Radiographic examination shall be as per Cl. E.4 of this specification.

B 7.3.3 Magnetic Particle Inspection

Residual Magnetism shall be as per Cl. E.6 of this specification.

B 7.3.4 Residual Magnetism

Residual Magnetism shall be as per Cl. E.7 of this specification**.**

B 7.4 PHYSICAL TESTING

In addition to the following test, other tests specified in QCT /approved QAP shall be carried out :

- Flattening test (at 0 & 90 deg.)
- Chemical Test
- Tensile Test for pipe base & weld (Transverse & Longitudinal)
- Reverse Bend Test
- Impact test
- Macro and micro examination,
- Hardness test

"Drop weight Tear Test (Table B.1 item 5)."

All destructive tests on two specimens per test selected.

Annex C
(normative)

Treatment of surface imperfections and defects

C.4.2 Add:

o) Repair of pipe body by welding is not permitted.

Annex D (normative) : Repair welding procedure

Annex E
(normative)

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

Following standards have been replaced by new standards:

Standard mentioned in GTS	New Standard
ISO 10124, ISO 12094, ISO 9303, ISO 9305, ISO 11496	**ISO 10893-8, ISO 10893-9, ISO 10893-10**
SEL 072-77	**EN 10160**
ISO 13665	**ISO 10893-5**
ISO 12095	**ISO 10893-4**

E.1 QUALIFICATION OF PERSONNEL

Modify Para 1:

All personnel performing NDT activities shall be qualified in the technique applied, in accordance with latest edition of ISO 11484 or ASNT SNT-TC-1A or equivalent.

Staff in charge with the NDT shall be duly qualified according to International Standards like, but not limited to:

- The American Standard ASN-TC-1A (published by the ASNT) and all Codes it refers to, at least one UT-Level III shall be available with Manufacturer.
- European Standard « EN 473 » titled « Non-destructive testing - Qualification and certification of NDT personnel - General principles » and all the Codes it refers to.

At least one no. of ASNT Level III inspector shall be made available by the manufacturer on permanent basis (for 24 hrs) during all production at Manufacturer's works.

E.2.1 Automatic Straight Beam UT inspection

ADD:

The height of indication having amplitude beyond the reference accepted signal height (100% at 80% FSH) is considered as defective indication. Locations showing indications above the acceptance limits may be re-examined by manual ultrasonic method. Acceptance criteria, Calibration standard & Frequency shall be as per QCT for both automatic & Manual UT.

E.2.2 Automatic Angle Beam UT inspection

ADD:

Ultrasonic and Electromagnetic Inspection Reference Standards

The reference standard (calibration pipe) shall have the same specified diameter and wall thickness as specified for the production pipe being inspected and shall be of sufficient length to permit calibration of ultrasonic inspection equipment at the speed to be used in normal production. The reference standard (calibration pipe) shall also be of the same material, type and have the same surface finish as the pipe being inspected.

The reference standard for weld UT shall contain machined notches/holes as given below:

- Two longitudinal notches of type N5 at the Centre of the weld seam, one outside and one inside.
- A drilled hole in the Centre of the weld seam, of diameter equal to 1.6 mm.

Reference standard for the ultrasonic inspection of Plate/Coil & plate edges/pipe ends shall be as per QCT.

The calibration shall be performed at following intervals:

a) At the beginning of each operating shift (12 hours maximum) and subsequently every 4 hours.

b) Every time there is change in probes or working condition of the UT machine.

c) Every time the running of the system gives rise to doubts on its efficiency.

If during the above calibration verification, it is found that the equipment has not functioned satisfactorily in the opinion of the Owner/Owner's Representative/TPIA, all the pipes or skelp already inspected after the previous verification shall be inspected again at Manufacturer's cost.

E.3.1.4 Manual Ultrasonic Testing (MUT)

E.3.1.4.2 Modify:

Manual ultrasonic inspection of weld seams shall be in accordance with ISO 10893-11 as per API 5L Annex-E Cl. nr. E2 (a).

Table E.11 (Modify)

Pipe Diameter D	Wall Thickness *t*	Probe Angle
≤ 610 mm (24 in)	≤ 12.7 mm (0.500 in)	70° & 45°

E.3.1.4.5 ADD:

The weld at any pipe ends not covered by automatic ultrasonic equipment shall be inspected by manual ultrasonic equipment with same sensitivity and capability as automatic equipment.

E.3.1.4.6 ADD:

Full circumference of both ends of each pipe shall be 100% manual ultrasonically tested over a circumferential width of at least 100 mm with angular probes to detect cracks. In case of non-availability of angular probes at the mill, the full circumference of both ends of each pipe shall be inspected with magnetic particle technique over a circumferential width of at least 100 mm to detect surface cracks.

E.4. RADIOGRAPHIC INSPECTION OF WELD SEAMS

Not applicable for HFW pipes.

E.5. ULTRASONIC AND ELECTROMAGNETIC INSPECTION

Add:

Base Material Inspection - Ultrasonic testing shall be carried out for 100% area during manufacturing of pipes.

E.5.4.3 Add:

General

Calibration of Testing Equipment

All equipment used for non-destructive inspection shall be checked for possible deviation towards its calibrated value(s). The following check shall be performed:

- at the start & end of every working shift or at the time of running if any doubt arises.
- at every change-over of an equipment operator,
- at the start and end of a production shift,

- every time the running of the testing system is interrupted or when any doubt arises, Whichever occurs first.

If on checks of the testing systems, the calibration requirements are not satisfied (even after increasing the sensitivity for ultra-sonic equipment by 3db for allowance to system drift), then all pipes lengths tested after the previous equipment check shall be retested after the testing system has been recalibrated.

E.6 E.6 MAGNETIC PARTICLE INSPECTION

ADD:

Each pipe end upto 300 mm, OD weld seam, ID weld seam & both the bevel end shall be magnetic particle inspected as per QCT. Acceptance limit, Calibration standard & Calibration frequency shall be as per QCT.

E.7 RESIDUAL MAGNETISM

ADD:

The residual magnetic field created by ultrasonic or electromagnetic scanning device shall be released and such residual magnanimity shall be inspected and accepted by TPIA and/ or Owner/ Owner's Representative.

The average of the four readings shall not exceed 20 Gauss and no reading shall exceed 25 gauss when measured with a hall-effect gauss meter, or equivalent values when measured with other type of instruments.

Annex G (normative) : PSL 2 pipe with resistance to ductile fracture propagation

Table G – Minimum CVN absorbed energy requirements

Specified outside diameter, D Mm (inch)	Full-size CVN average absorbed energy, Minimum KvT [a,b] (J/cm2)						
	B to X42	> X42 to X46	> X46 to X52	> X52 to X56	> X56 to X60	> X60 to X65	> X65 to X70
≤ 457.0 (18)	40	40	40	40	40	45	50
508.0 (20)	40	40	40	40	42	47	53
610.0 (24)	40	40	40	41	46	51	58
711.0 (28)	40	40	40	45	49	56	62
813.0 (32)	40	40	42	48	53	59	66
914.0 (36)	40	40	45	51	56	63	70
1016.0 (40)	40	40	47	54	59	66	74
1118.0 (44)	40	42	50	56	62	70	78
1219.0 (48)	40	44	52	59	64	73	81

a The required KvL (longitudinal direction specimens) values shall be 50% higher than the required KvT values for BM, weld and HAZ.

b Testing shall be performed at a temperature of 0 °C (32 °F) or at a lower temperature as specified in the purchase order.

c For intermediate specified outside diameter, CVN average absorbed energy value (KvT) shall be same value as given in the table for next higher specified outside diameter.

Annex J (normative) : **PSL 2 pipe ordered for offshore service**

Annex K (normative) : **Non-destructive inspection for pipe ordered for sour service and/or offshore service**

Annex O (informative) : **Use of the API Monogram by Licensees**

Annex P (informative) : **Equations for Threaded and Coupled Pipe and Background Equations for Guided Bend and CVN Test Specimens**

In Addition:

The following Annexures of 'GTS' (Doc No: 740 GTS 404) shall be applicable:

Annex K (normative) : **Annexure 'K' of 'GTS' (Doc No: 740 GTS 404) shall be followed, in view of the rigorous requirement of AUT of weld seam specified therein.**

Annexure Q of GTS : **'Purchaser Indicative Inspection and Quality Plan', has been replaced by Quality Control Table for Line Pipes (HFW) attached with this specification. The same shall be applicable for HFW pipes.**

APPENDIX 1

TECHNICAL QUESTIONNAIRE FOR EVALUATION OF THE BIDS

1.0 Scope

External (3LPE) coated line pipe as specified in MR.

Applicable Documents:

- API 5L Latest Edition
- Tractebel Specifications (PTS, GTS) & documents.
- The information requested below shall be answered fully and wherever required necessary attachments must be added. All information shall be relevant to the scope of the tender as stated above. No blank space shall be left. If the part is not applicable, it should be written so.

2.0 General Information

2.1. Organization

Give a detailed description (organization structure, number of technical (job specific) people, facilities, equipment...).

Concerning:

- Overall Structure of the organization

  ……

  ……

- Line Pipe production facilities and capacities:

  ……

  ……

- Laboratories (in-house or sub-contractor):

  ……

  ……

- QA and/or QC department:

  ……

  ……

- Non Destructive Testing department (in-house or subcontractors)

  ……

  ……

- R&D department (In house or Research Institutes)

  ……

  ……

- Other relevant departments or services (In house or subcontractors)

  ……

  ……

2.2. Certificates and Approvals

Give type of approvals, date of issue and validity, for the scope of present tender

- ISO certification (ISO 9001 - 2015)

  …….

  …….

- API approvals

  ……

  ……

- Safety approvals

  ……

  ……

- Third party approvals

  …… ……..

  …….

- Client approvals

  …… ……

  …… ……

- Other approvals

……

……

2.3. References for the manufacture/supply of API 5L Grade (as per MR) or above, Line pipe and coating separately for each part

Give for the last five years

- Name of client or project (eventually name of contact person)
- Number of kilometers produced
- Inspection Agency (eventually name of contact person)
  - Year 2015 :

    ……..

    ……..

  - Year 2016 :

    ……..

    ……..

  - Year 2017:

    ……..

    ……..

  - Year 2018:

    ……..

    ……..

  - Year 2019 :

    ……..

    ……..

- Year 2020 (eventually orders to be executed remainder of the year)

……..

……..

3.0 Fabrication and Inspection Procedures

3.1 Give a detailed description of the fabrication process utilized for these types of pipes

- Forming (how many steps).
- Body testing
- Cold expansion or other intervention
- Type of testing along the line
- Maximum length of pipe that can be supplied for pipe sizes as per MR.

3.2 Give a detailed description of the production line(s), including type and location of the testing facilities. Explain all relevant operations which you consider important for obtaining a high quality product.

3.3 Provide a relevant example (which will be applicable in case of an order) of a LOFC (List of fabrication and control) as specified in ANNEX B of the GTS.

3.4 Provide a copy of all relevant NDT procedures (including acceptance criteria) that will be utilised in case of an order, such as UT, RX, MT, PT, …….

3.5 Provide a list of the NDT personal, with their qualifications in each technique (Level 1, 2 or 3 according to ASNT or other qualification authority) Specify if these operators are on your pay-roll or from a sub supplier.

3.6 Provide a copy of the applicable external coating procedures, including the preparation of the pipes before coating.

3.7 Provide a copy of the applicable marking procedure.

3.8 Provide a list of all equipment used for the mechanical testing, chemical analysis (in house or subcontractors) and tools for dimensional controls, including the date of calibration and the validity period of these calibrations.

3.9 Provide your procedure concerning “Control of non-conforming products” and the procedure concerning “Corrective and Preventive Actions” (See ISO 9001:2015).

4.0 Material Suppliers

4.1 Provide commitment letter from at least two possible plate/coils suppliers (from purchaser’s approved vendor list).

4.2 Provide a procedure or any other document, which gives details concerning the characteristics of the material, production controls, testing, certificates….required by you.

4.3 Provide a procedure or any other document, which gives details concerning the incoming testing and controls of these materials, performed by your QA/QC department.

4.4 Provide your procedure concerning Supplier Evaluation (section 7.4 of ISO 9001:2015), detailing the controls (audits?) performed on your suppliers. Also provide a copy of the planning of your supplier audits for last three years.

5.0 Conformity with the requirements

Please confirm specifically that you will be confirming to the requirements stipulated in these tender documents.

The issues in particular under consideration are:

- Materials
  - Chemical composition and analysis
  - Mechanical properties and testing requirements
  - Dimensions and tolerances
- Hydrostatic Testing
- Marking
- Inspection
  - Inspection procedure
  - Personnel qualifications
- External coating
- Procedures and reports

The supplier must testify that all information given is correct and complete, and that they agree with an eventual audit of these issues by purchaser, a designated auditing company and/or the appointed Inspection Agency.

The reply to this questionnaire must be dated and validated by a company stamp, and signed by a responsible person according to the rules of the companies Quality Management System.

All information given by the company will be treated by TRACTEBEL as confidential information and will only be used for technical evaluation of the companies tender for the supply of line pipes for this Pipeline project.

S S S

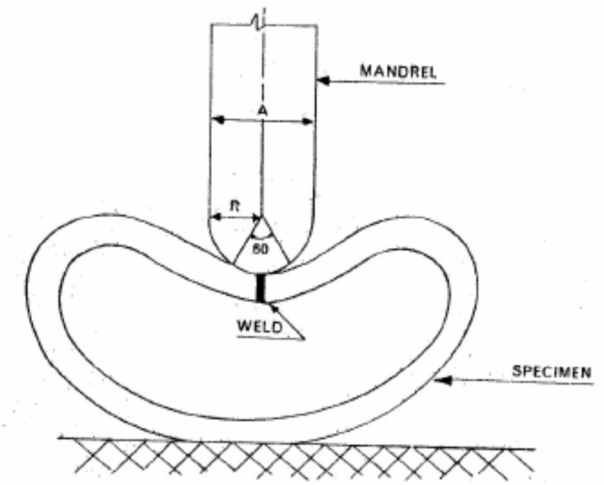
Annexure - III

Additional Requirements for Electric Welded Pipes

Electric Welded pipes shall meet following requirements.

Reverse Bend Tests

Reverse bend tests shall be performed on the pipe piece cut from the crop end, selected from the front end of the first length and the back end of the last length produced from each coil. The specimen shall be 100 mm to 115 mm long and shall be reverse bend tested in accordance with procedure given below:



Selection of Mandrel

The reverse bend test shall be carried out with a mandrel, whose radius (R), width (A) shall be calculated for any combination of diameter, wall thickness and grade with the formula:

$$A = 2R = \frac{1.4(D-t)t}{e(D-t) - 1.4t} - t$$

Where, D - Outside diameter of pipe

t - Wall thickness of pipe

1.4 - Peaking factor

e - Strain

Minimum values of 'e' shall be as follows:

Grade of Steel	Min 'e' value
API 5L B	0.1375
API 5L X-42	0.1375
API 5L X-46	0.1325
API 5L X-52	0.1250
API 5L X- 56	0.1175
API 5L X- 60	0.1125
API 5L X- 65	0.1100
API 5L X- 70	0.1025
API 5L X- 80	0.0950

Procedure

The mandrel is to be plugged into the specimen, with the weld in contact with mandrel, to such a depth that the angle of engagement between mandrel and specimen reaches 60^0 (see Fig. above). If the combination of diameter and wall thickness of pipe and radius of mandrel is such that the angle of engagement does not reach 60^0, the mandrel shall be plugged into the specimen until opposite walls of the specimen meet.

Acceptance Criteria

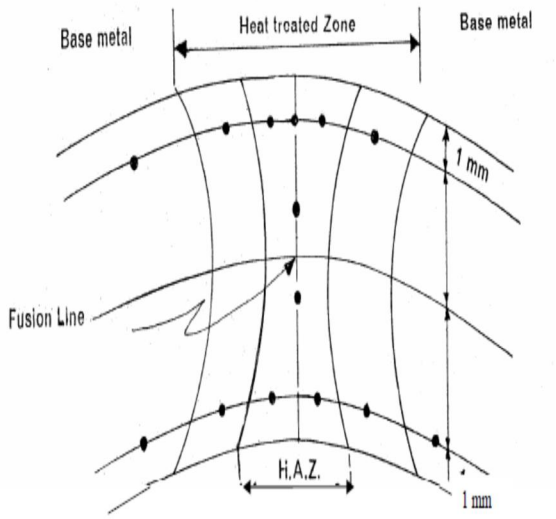
A specimen which fractures completely prior to the specified engagement of mandrel and specimen, or which reveals cracks and ruptures in the weld or heat affected zone longer than 4 mm, shall be rejected. Cracks less than 6 mm long at the edges of the specimen shall not be cause for rejection.

Micrographic and Hardness Examination

A test specimen shall be taken across the longitudinal weld from one length of finished pipe from each lot of maximum 100 lengths from the same heat manufactured from the same process.

These specimens shall be polished and etched for micro-examinations. The examinations shall provide evidence that heat treatment of weld zone is adequate and there is no untempered martensite left.

The Manufacturer shall make hardness measurements on each specimen as indicated in Fig. below in accordance with ASTM E-32. The maximum difference in hardness between base material and any reading taken in the heat affected zone shall be less than 80 points Vicker's HV_{10}.



Location where hardness measurement to be carried out

Annexure - IV

List of Applicable Standards and References

Standard Number	Title of Standard
ASME B31.4 : 2009	Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids.
API 1102 : 2007	Steel Pipelines Crossing Railroads and Highways.
API 1104 : 2013	Welding of Pipelines and Related Facilities.
API 1109 : 2010	Marking Liquid Petroleum Pipeline Facilities.
API 1110 : 2013	Recommended Practice for the Pressure Testing of Steel Pipelines for the Transportation of Gas, Petroleum Gas, Hazardous Liquids, Highly Volatile Liquids, or Carbon Dioxide.
API RP 500 : 2012	Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Division I and Division 2(viii) API- 5L 2012, Standard Specification for Line pipes.
API SPEC 6D : 2014	Specification for Pipeline and Pipeline Valves(x) ASME Section VIII; , 2013, Boiler and Pressure Vessel Code Division 1 Pressure Vessels Division 2 Alternate Rules for Pressure Vessels
ASME Section IX : 2013	Welding, Brazing, and Fusing Qualifications: Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing and Fusing Operators.
MSS-SP-58 : 2009	Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation. NACE-SP 01-69; 2013, Control of External Corrosion on Underground or Submerged Metallic Piping Systems.
NACE-SP-01-06 : 2006	Control of Internal Corrosion in Steel Pipelines Systems.
ISA S-75.01 : 2012	Flow evaluation for sizing control valve
ISA S-75.02 : 1996	Control valve test procedure
IEC – 60079 : 2011	Electrical Apparatus for Explosive Gas Atmosphere.
IEC – 60529 : 2013	Degree of protection Provided by Enclosures.
OISD-STD- 118 : 2008	Layouts for Oil and Gas Installations.
OISD-STD-141 : 2012	Design and Construction requirements for cross country hydrocarbon pipelines.
IS-5572 : 2009	Classification of hazardous areas (other than mines) having flammable gases and vapours for electrical installation.
IS – 5571 : 2009	Guide for selection of Electrical Equipment for Hazardous Area (other than mines).
IS 3043 : 1987	Code of practice for earthing
IS:2309 : 1989	Code of practice for the protection of buildings and allied structures against lightning [ETD 20: Electrical Installation].
ISO 14313 : 2007	Petroleum and natural gas industries -Pipeline transportation systems - Pipeline valves.
NACE SP-0177 : 2014	Mitigation of Alternating Current and Lightning Effects on Metallic Structures and Corrosion Control System.

UPAMANYU CHATTERJEE, Secy.

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CENTRAL UP GAS LIMITED

(CUGL)

CITY GAS DISTRIBUTION PROJECT

TRACTEBEL ENGINEERING PVT. LTD.

PARTICULAR TECHNICAL SPECIFICATION –

LINE PIPES – SEAMLESS (SMLS)

0	08.01.2021	Issued for Procurement	Anurag Shrotriya	Parampreet Singh/Gunja Gupta	Nitish Nandi
Rev.	**Date**	**Description**	**Prepared By**	**Checked By**	**Approved By**

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A. INTRODUCTION

The present « Particular Technical Specification » relates to the manufacture of "SEAMLESS Steel Line Pipes" for the service of natural gas.

The present Specification shall be read in conjunction with General Technical Specification **740/GTS/404 Rév. 5** (the GTS) and **API 5L 46th edition** which it amends and/or complements. A new edition of API 5L: "Forty Sixth Edition, April 2018" will become effective from May 2019. Thus this new edition of API 5L is the governing standard for purchase of line pipe. All clauses of new edition and tests should be followed scrupulously.

The clauses of the present PTS & GTS are either more stringent or supplementary to the API 5L requirements, and confirm, complete or modify certain sections/paragraphs of API 5L. All these clauses will be followed scrupulously.

The present specification can confirm, complete or modify certain sections/paragraphs of said «General Technical Specification». The PTS will govern the requirements for all such sections. Clauses of GTS specification, which are not mentioned in PTS, remain unaltered and are fully applicable.

The manufacturer shall have a valid license to use API Monogram in accordance with the requirements of API 5L Specification, 46th edition on line pipe as Product Specification Level (PSL) 2.

Only the clauses of present PTS & GTS which are more stringent or supplementary to the API 5L new edition will prevail.

B. PROPERTIES OF THE PIPES

The Properties of Pipe manufactured as per this PTS, shall be as listed below:

- Product Specification Level : PSL 2 as per API 5L
- Design Pressure : 49 barg
- Operating Temperature : 0 - 55 °C
- Design temperature
  - Underground Services : 0 °C to 60 °C
  - Aboveground Services : 0 °C to 65 °C
- Steel grade : Refer MR
- Pipe size & Wall Thickness (Minimum) : Refer MR
- **Length of the Pipes** : Length of Pipe supplied shall be as per Clause 9.11.3.3 of this document. Overall length tolerance shall be (-) One and (+) Zero pipe length to complete the ordered Quantity.

Calculation according to ASME B 31.8 with following notes:

- Negative tolerance for WT = ZERO mm (0 mm).
- Corrosion allowance = 1.6 mm
- Specified Minimum Yield strength (SMYS) = As per API 5L latest edition

AMENDMENTS TO THE GTS

The present specification has to be read in conjunction with the specification API 5L, 46th edition, and the GTS. All the Clause Nos. mentioned below, correspond to the respective Clause Nos. of the API 5L, 45th edition and of the GTS.

3. NORMATIVE REFERENCES

ADD:

API 5L	Specification for Line pipe (Latest Edition).
API RP 5L3	Recommended Practice for Conducting DWTT on Line Pipe.
ASME V	Boiler and Pressure Vessel Code, Section V Non Destructive Examination
ASME IX	Welding and Brazing Qualifications (Boiler and Pressure Vessels Codes).
ASTM A 370	Standards Method and Definitions for Mechanical Testing of Steel Products.
ASTM E 112	Standard Methods for Determining Average Grain Size.
ASTM A 578	Standard Specification for Straight-beam Ultrasonic Examination of Plain and Clad Steel Plates for Special Application.
ASTM E 23	Notched Bar Impact Testing of Metallic Materials.
AWS A5.17	Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding.
BS 672	Wet Magnetic Particle inspection.
EN 10204	Metallic Products - Types of inspection documents.

4. TERMS AND DEFINITIONS

ADD:

GTS	Means “General Technical Specification 740/GTS/404 Rev.5” and all documents it refers to.
PTS	Means the present “Particular Technical Specification and all its appendices, if any.
OWNER	Shall mean the Purchaser of Line Pipes as mentioned in “Introduction” chapter.
CONSULTANT / OWNER REPRESENTATIVE	Shall means “TRACTEBEL Engineering Pvt. Limited” / The company nominated by the owner to design the natural gas transport or distribution system and to specify the equipment.
TPIA	Means the Third Party Inspection Agency.
MANUFACTURER	means the Manufacturer of the pipes as well as its sub-contractor(s).

6. PIPE GRADE, STEEL GRADE AND DELIVERY CONDITION

Modified:

Table 1 of API 5L: Pipe Grade, Steel Grades and acceptable delivery conditions

Product Specification Level (PSL)	Delivery Condition	Pipe Grade / Steel Grade
PSL 2	Normalised (N) (As-Rolled and Quenched & Tempered is not allowed)	L290 or X42M
a Deleted b The suffix (M) for PSL2 grades belongs to steel grade.		

The minimum required mechanical properties of the delivered steel shall be as given below:

		L290 or X42M
· Specified Minimum Yield strength (SMYS)	:	245 MPa (*)
· Max yield strength as per PSL 2	:	450 MPa.
· Ultimate tensile strength	:	415 MPa. (*)

(*): Values indicated for yield strength and ultimate tensile strength are minimum. Due attention shall be paid to the mandatory additional clause as per GTS - Clause 9.3.2 relating to ratio between both values.

8. MANUFACTURING

8.1 Process of Manufacturer

Add:

Pipe furnished to this specification shall be manufactured in accordance with the applicable requirements and limitations given in table 2 of API 5L and Table 3 of this specification.

Modified:

Table 3 of API 5L : Acceptable manufacturing routes for PSL 2 pipe

Type of pipe	Pipe starting material	Pipe forming	Pipe Heat Treatment	Delivery Condition
SMLS (SEAMLESS)	Ingots, bloom or billet	Normalizing forming, Hot Forming or Hot Forming & Cold Finishing (As-Rolled not allowed)	Normalizing (Quenched & Tempered is not allowed)	N

Only the seamless process will be accepted for Pipe Manufacture and the manufacturing procedures for the same shall be submitted after award of the agreement and same shall be established during First day production test.

8.3 Starting Material

Add:

The steel used shall be fully killed and manufactured by the electric furnace or basic oxygen process and made to fine grain (8 or finer as per ASTM E112) low hydrogen practice.

Mill Certification for Raw material supply (Ingots/Blooms/Billets etc.) of Line pipes is essential and shall be subjected to approval of Owner/Consultant.

Line pipe manufacturer shall depute Approved TPIA expert at steel mill to monitor and control the mechanical and chemical properties of all Ingots/Blooms/Billets as per requirement of QCT, PTS, GTS and API 5L PSL2. TPIA shall witness all mechanical and review the chemical testing results on all heats and put the acceptance stamp on each Ingots/Blooms/Billets in order to issue EN 10204, 3.2 certificates. Only duly stamped (by TPIA) material (Ingots/Blooms/Billets), will be shipped to line pipe manufacturer, which will be verified before starting the production at pipe mill.

Pipe delivered in quenched and tempered heat treatment condition are not permitted.

The steel supplied for manufacture of pipes shall have uniform fine ferrite grain structure. Further, all surfaces of the Ingots/Blooms/Billets shall be defect free.

Sub Clause Nos. 8.3.4 to 8.3.8 are Not Applicable.

Further, Clause Nos. 8.4 to 8.8 are Not Applicable.

8.9 Cold sizing and cold expansion

Pipes furnished to this specification shall be non-expanded. Mechanical jacking after hydro testing of pipes is not allowed.

8.13 Traceability data

8.13.2 Add:

The manufacturer shall establish and follow procedures for maintaining heat and test unit identity of all pipes as per requirement of API Spec. 5L and as modified in this specification. The same shall be submitted for Owner/Consultant approval before implementation. Bar code shall be applied from the coil/forming stage to internal and external coating stage for each and every pipe. Pipes shall not be accepted without bar code.

9. ACCEPTANCE CRITERIA

9.2 Chemical Composition

The Chemical Composition of the Pipe material shall confirm:

For Grade BM to Grade X65M : Table – 5 & clause 9.2 of API 5L.

For Grade X70M and above : Table – 5 of clause 9.2 of GTS.

9.3 Tensile Properties

Add:

The Tensile Properties of the Pipe shall confirm to Table – 7 of clause 9.3 of API 5L, 46th Edition.

For Grade X 70 and lower Pipe material, the ratio between the yield strength (Y) and ultimate tensile strength (UTS) shall not exceed 0.90 (maximum).

The minimum elongation of base metal shall be determined in accordance with the formula given in foot note (f) of Table-7 of API 5L. However elongation in no case shall be less than values specified in below table.

Sr. No.	Grade	Minimum % Elongation
1	Gr-B to X46	25
2	X52 to X56	24
3	X60 to X70	22
4	X80	20

Control tensile test on one sample per heat shall be performed as per API 5L & present GTS/PTS requirement. These tests shall be additional to the tensile test required for each heat/lot as applicable.

9.3.3 Hardness tests

Add:

The hardness of Base metal, weld metal and HAZ non sour service for steel grade ≤ X70 (L485) ≤ 248 Hv 10.

9.5 Bend Test

Not Applicable.

9.6 Flattening Test

Not Applicable.

9.7 Guided Bend Test

Not Applicable.

9.8 CVN Impact Test for PSL 2 Pipe

9.8.1.3 Modification:

For all Base Material :

The CVN Impact test shall be conducted at 0ºC. Impact test value (For all base material) shall conform to below requirements.

Acceptance Criteria (At 0°C): For all base material – As per Annex G Table-G.

9.8.2 Pipe body tests

9.8.2.2 Modification:

For all pipes this clause is applicable, and the shear fracture area shall be at least 85% based upon a test temperature off 0 °C.

9.8.2.3 Modify Para 2:

For all base material, 2 sets of 3 specimens (for each temperature) shall be taken per coupon and shall be tested at 0 °C.

Acceptance Criteria (At 0°C): For all base material– As per Annex G Table-G.

9.8.2.4 Modify:

For all pipe sizes this clause is applicable Shear fracture area for each test shall be at least 90% average & 80% individual, based upon a test temperature of 0 °C

9.8.3 Pipe weld and HAZ tests

Not Applicable.

9.9 Drop Weight Tear Test:

Not Applicable.

9.10 Surface condition imperfections and defects

9.10.2 Undercuts

Not Applicable.

9.10.4 Lamination

ADD:

Any lamination or inclusion either extending into the face or face of bevel & pipe body (100%) or present within 50 mm from pipe ends is considered defect and pipe containing such defects shall be cut back until such defects are eliminated.

The disposition of lamination and other type of defects on the skelp/plate shall be as per Annexure-E of GTS, API Spec 5L and as modified in this specification.

9.10.5 Geometric Deviations

9.10.5.2 ADD:

Dents in any form shall not be permitted.

9.10.7 Other Surface Imperfections

ADD:

Any imperfection (measured from the surface) with a depth greater than 5% of the specified wall thickness of the pipe shall be considered a defect and shall be disposed-off in accordance with clause C.3 and as modified in this specification.

9.11 Dimensions, Mass and Tolerances

9.11.3 Tolerances for Diameter, Wall Thickness, Length and Straightness

9.11.3.1 Diameter

Modify:

Tolerance for diameter and out-of-roundness shall be as under and Table 10 of API Spec 5L stands modified accordingly.

	Location	**Diameter Ranges in Inches**	
		OD ≤ 6”	**OD > 6” to 18”**
Diameter Tolerances (mm)	Pipe Body	OD ± 0.0075D	OD ± 0.0075D but maximum of ±3.0 mm
	Pipe Ends	-0.4 mm +1.6 mm	± 1.6 mm (Welded)
Out of Roundness (mm)	Pipe Body	Tolerances indicated in Table 10 of API 5L shall be applicable.	5 mm max.
	Pipe Ends		3 mm max.

Note (1): The inside diameter, based on circumferential measurement, over a length of 100 mm from the end shall comply with the tolerances specified in API Spec 5L. Inside diameter is defined as ID = (OD-2WT.) where ID, OD & WT are the inside diameter, specified outside diameter and specified wall thickness respectively.

9.11.3.2 Wall Thickness

Modify:

The tolerances on specified wall thickness shall be (+) 27.5% and (-) 0%. Wall thickness shall be measured and recorded for each pipe.

9.11.3.3 Length

ADD:

All pipes shall be supplied with length between 11.5 m and 12.5 m. Thickness wise average length of pipes shall be 12.0 m. The average length shall be cumulative as measured at pipe mill despatch note for 95% of ordered quantity. For mechanical sampling & cut-off pipes, minimum length of 10.0 m is acceptable for a maximum of 5% of ordered quantity.

API 5L Spec, clause no. 9.11.3.3 & Table 12 shall not be applicable. Overall length tolerance shall be (-) One and (+) Zero pipe length to complete the ordered quantity.

9.11.3.4 Modified:

The Tolerance for straightness shall be modified as follows:

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

b) The local deviation from straight line in the 1.5 m portion at each pipe end shall be $\leq$ 3.0 mm as shown in fig. 2 of API 5L spec.

9.12 Finish of Pipe Ends

9.12.1 The second sentence “Automatically, the 100 following shall apply” shall be read as :

“Automatically, the following shall apply”.

9.12.5 Plain Ends

ADD:

Pipes shall be furnished with Plain ends. Unless specified otherwise, the pipe ends shall be machine bevelled as per API Spec. 5L.

In removing the inside burrs at the pipe ends, care shall be taken not to remove excess metal and not to form an inside cavity or bevel. Removal of excess metal beyond the minimum wall thickness as indicated in para 9.11.3.2 of this specification, shall be a cause for re-bevelling. In case root face of bevel is less than that specified, the pipe ends shall be re-bevelled and rectification by filing or grinding shall not be done.

10. INSPECTION

10.1.1 General

ADD :

In case of any contradiction between API 5L, GTS and PTS, the following order of priority shall be followed.

1. Quality Control Table (QCT)
2. Particular Technical specification (PTS)

3. General Technical Specification (GTS)
4. API 5L

This document shall read in conjunction with tender QCT / GTS / API 5L / relevant standards and codes.

ADD IN PARA 3:

Single TPIA shall be appointed by pipe manufacturer at steel mill & pipe mill for material inspection and certification as per project requirements.

The QCT for Steel (Ingots/Blooms/Billets) shall be prepared by the Steel Manufacturer as per actual requirements specified in the bid document, line pipe specification & QCT. The same shall be submitted for Owner/Consultant's approval. Testing of Raw material (Ingots/Blooms/Billets) at steel mill shall be witness by TPIA.

ADD:

Testing Frequency: The frequency for all the tests shall be strictly as per the QCT attached with this specification.

In case of any conflict in requirements of QCT and PTS/GTS & API 5L, the more stringent requirement shall prevail.

10.2 Specific Inspection

10.2.1 Inspection Frequency

Add:

Sampling Frequency

The manufacturer shall carry out analysis of two samples per 50 pipes representing each heat of steel used for production of pipes.

Product analysis shall be carried out from finished pipe. The specimen shall be taken from finished pipe.

For sizes ≤ 12" - Test frequency for routine production shall be as per API 5L Table-18.

10.2.3 Samples and Test Pieces for Mechanical Tests

Add:

Tensile Test Specimens

The specimen shall be taken from finished pipe. Transverse specimens shall be taken as far as possible. If size constraint does not allow then longitudinal specimens shall be acceptable.

Transverse Tensile Tests

The transverse tensile properties shall be determined on flattened rectangular specimen.

For sizes ≤ 12" - Test frequency for routine production shall be as per API 5L Table-18.

10.2.5 Metallographic Tests

Add:

A test specimen for metallographic shall be taken transverse from one finished pipe from each lot per heat or at least once per operating shift whichever is stringent.

The specimen shall be suitably ground, polished and etched to reveal the macro structure. The specimen shall be visually examined using a minimum 40X magnification to facilitate proof that proper fusion has been achieved for the full thickness and there is proper interpretation of passes, their alignment and texture. The metallographic examination shall be documented on micrographs (at 10X or 20X magnification). In case imperfections or defects are observed, it will become a cause of re-evaluation of welding parameters and heat treatment as deemed necessary by Owner's representative.

Grain size shall be 8 or finer as per ASTM E112.

10.2.6 Hydrostatic Test

Add:

The hydrotest pressure shall be such that hoop stress generated is at least 95% of SMYS of the Pipe Material, computed based on the formula mentioned in API Spec 5L. Test pressure shall be held for a minimum period of 15 seconds.

Duly calibrated pressure gauge shall be installed both at the test bay as well as at the control cabin and graphical records with respect to both the pressure gauges shall be maintained for each pipe.

The test pressure measuring device shall be calibrated by means of a dead weight tester, or equivalent at the beginning of each shift. Calibration of pressure gauge shall be done at start of an each shift (12 hours max.).

Pressure gauge range shall have a minimum range of 1.5 times and maximum 4 times of test pressure. The pressure gauges used should have a minimum least count of 2 kg/ cm2. Calibration of pressure gauge shall be done at start of each shift (12 hours max.). Accuracy of pressure gauges used shall be within 1% FSD (full scale deflection).

Information to Bidders

In case manufacturer so desires, he will be advised at least 2 weeks in advance so that his representative may witness the hydrostatic test in field. However, the testing & leak finding (if any) and repair operation shall not be postponed for the absence of manufacturer's representative.

10.2.10 Non Destructive Inspection

ADD:

Non-destructive Inspection shall be performed in accordance with Annexure-E of GTS & API 5L.

10.2.11 Reprocessing

Add:

Reprocessing shall not be permitted.

10.2.12 Deleted

11. MARKING

11.2 Pipe Marking

Paint used for stencil marking shall withstand upto 250 °C expected to be experienced during further external anti-corrosion coating operations of line pipe by coating applicator.

The following marking shall be done on pipes:

11.2.1 Add:

DIE STAMPING

- Pipe no. shall be punch by cold die stamping (Low Stress dotted punch) at the distance of 50mm right side of weld seam and 50mm from the pipe end.
- Height of Die stamping shall be 6mm minimum.
- If Line pipe size constraints Die Stamping then Pipe numbers & length marked by paint shall be acceptable instead of Die Stamp

.**STENCIL**

- Stencil marking confirming to API 5L in English shall be done at a distance of 300 mm on the both ends of pipe - one inside & one outside at 90 degree. In case pipe size is below 12" outside marking shall be done on both ends of pipes at 90 degree.
- The marking of finished line pipe should also contain the Pipe No, Heat No, Coated Pipe No, Inspection mark by TPI, Diameter of pipe and wall thickness (to be marked in white color).
- A colour band of 50 mm wide to differentiate thickness of pipes shall be provided at each extremity (150mm from the end) of the pipe after coating of pipe by the coating applicator.

In addition to the marking requirements of GTS, the coater shall also transfer the marking details appearing on the bare pipe.

11.2.2 Modify para / bullet#2: Die Stamping with Low stress dot punch only shall be allowed on pipe surface OD on each accepted pipe.

11.2.9 BARCODE (Add)

Based on the details provided below, Barcode (QR) identification system shall be provided by the pipe suppliers, which shall have a life of 5 years over and above the conventional marking as per API 5L. The Manufacturer shall propose marking system to clearly identify the type of pipes.

11.2.9.1 Scope

This procedure defines to identify the pipes through barcode label scanning. This procedure covers the application of 2D type bar code and pipe marking on Bare Pipe and 3LPE coated pipes after the final coating of bare pipes. Bar code to be applied after clearance from TPIA upon final acceptance of external coated pipes/Bare pipe. Barcode should have the information like Pipe no., Type (3LPE/SMLS), Coat No., Dia., Unit, Length, Wall thickness, Heat No. and item code. TPIA shall verify barcode with hand held reader during inspection of pipe.

Pipe Supplier to supply one BARCODE READER for each dumpsite & each Store.

11.2.9.2 Method:-

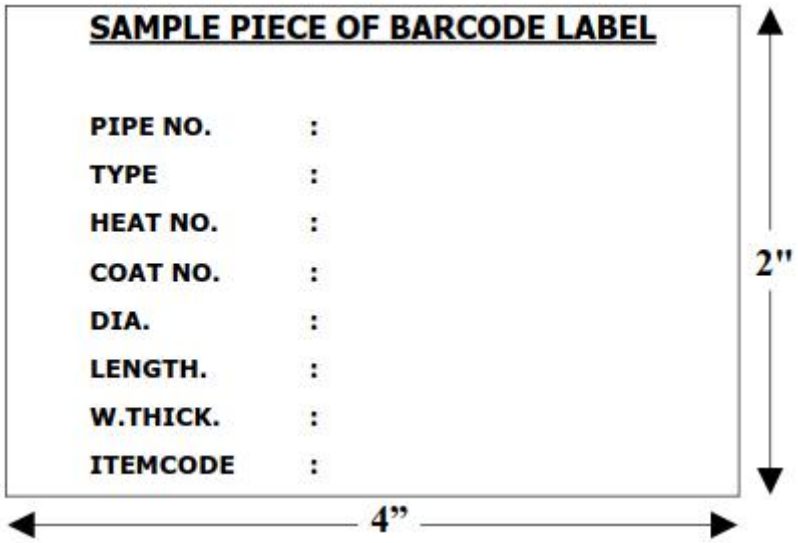
ON BARE / EXTERNAL 3LPE COATED PIPES

Pipe marking (stencil) shall be made from both end of the pipe opposite to the weld line. Pipe no shall be printed on barcode at the bottom. VENDOR has to ensure physical correction of the pipe as per stencil & barcode before applying barcode. One 2D type barcode sticker shall be pasted at an angle of 180° from the stencil side at a distance of 200 mm from the cutback area.

a) In case any unfit pipes found for coating or for any reason pipes are cut, the actual length of pipe shall be given in barcode sticker.

PRINTING OF BARCODE LABELS

The barcode labels will be printed at the time of final inspection (label size 2"x 4") and will be printed by using printer. The pipe number and other details will be taken from the Final Visual and Dimension inspection report system. The label shall have details as per Client/TPIA. The barcode and item code as per sample attached. The label details contains PIPE No, Coat No., ASL No, Item Code up-to 10 Digit Max.



The barcode standard is symbology and the paper material used is 2D and tear-able.

FIXING OF LABELS ON PIPES

Ensure that the surface area in which labels are pasted should be clean, dry and free from dust. For each pipe, four (4) labels shall be fixed, two for each end at one inside & one outside (fixed approx. 200 mm from the cutback / bevel area and 180° on each end). All bar code shall be oriented perpendicular to the weld seam. The barcode label shall be put on completely finished pipe. Barcode label should not be overlapped with stenciling or any other marking outside coated pipe. (i.e. external coated pipe surface).

VERIFICATION OF BARCODE LABELS

At the time of dispatching of pipes, QC personnel shall verify the barcode labels visually. If the barcode labels found damaged, missing or illegible for the purpose same shall be replaced by new one and applied as described above.

SCANNING OF BARCODES

The barcode can be read by scanning the codes by scanner provided by supplier at pipe mill and site. When the code is scanned the pipe number will be visually seen on the scanners monitor and same will be saved in its memory. The full details of the pipe can be obtained by connecting the computer with the scanner having database for these pipes.

1. First connect the scanner to the computer.
   a. One cable from CPU to scanner
   b. Second cable from power line to scanner for charging.
2. Make the data file in which details of the pipes are available.
3. Copy the data file and paste in the scanner.
4. The data will be loaded in scanner
5. Scan the barcode by scanner.
6. If the code matches with the available data in the scanner, it shows all the details of the barcode.
7. Scanner also shows the number of the data available in scanner and out of which how many are scanned.
8. If the data scanned does not matches with the available data, the scanner shows NA i.e. Not Available.

In addition to the marking requirements of GTS, the coater shall also transfer the marking details appearing on the bare pipe.

12. COATING AND THREAD PROTECTION

12.1 Coating

The pipes shall be coated externally & internally. The Coating shall in line with the requirements of the below mentioned Pipeline Coating specifications:

- External 3LPE Coating : as per PTS for Line pipe External coating as per MR Section-C.
- Internal Epoxy Coating : as per PTS for Line pipe Internal coating as per MR Section-C.

12.2 Thread (End) Protectors

Add:

Pipe Bevel ends shall be protected using Metallic Bevel protectors for ≥ 6" and Plastic Bevel Protectors for 4" pipe sizes as per Manufacturer's standard, to be supplied by Pipe Manufacturer. In addition, Plastic end caps, mentioned in the GTS, are not required for pipes. Bevel protectors shall be of a design such that they can be re-used by coating applicator after providing anti-corrosion coating of line pipe.

14. PIPE LOADING

In case of Indian Manufacture/Supplier - The Loading, Unloading and Transportation of Pipes on Trailer (for final transportation to the site) shall be in the scope of the Pipe Manufacturer.

In case of foreign manufacturer/supplier – Pipes will be despatched to Indian port as per terms and conditions of contract.

Pipe Manufacturer shall ensure that there is no damage of any kind to the Pipes before despatch. Any defect/damage detected in Pipe before or during loading to the Trailer /Marine Vessel shall be rectified by the Manufacturer as per the requirements of the code. The TPIA can reject the pipe, if found not conforming to the requirements of the codes and GTS/PTS/QCT.

Pipes supplied from Foreign manufacturer/supplier :

The manufacturer/supplier shall submit calculations and sketch for loading/unloading & stacking at all points, e.g. pipe yard, trailers, warehouse at port before loading on ship, on the ship for the sea journey & on trailer at port as per API RP 5LW.

Pipes supplied from Indian manufacturer:

The manufacturer shall submit calculations and sketch for loading/unloading & stacking at all points, e.g. Supplier's Warehouse (ex-works) before loading on the trailers as per API RP 5L1.

The Transportation, Unloading & Stacking of Coated Line Pipes at HPCL's storage yard inside the geographical area of Panipat (Haryana) in close vicinity to Jind - Sonipat (GA) (Exact delivery location will be intimated to bidder after award) shall be in the scope of the Pipe Manufacturer including arrangement & maintenance of storage yard, as per the tender terms & conditions.

The manufacturer shall submit calculations and sketch for loading/unloading & stacking at all points, e.g. Supplier's Warehouse (ex-works) before loading on the trailers as per API RP 5L1.

Add:

- Manufacturer shall get written approval from Owner/Owner's representative for the acceptable stacking height for Line Pipe before storage in Warehouse / dump yard.

- Pipes shall be stacked using wooden blocks or other suitable separator strips.
- The Manufacturer shall be responsible for any damage occurring to the pipes during loading / unloading and transportation by the relevant transportation means.
- Line Pipe Manufacturer shall ensure that no bevel protectors can be lost during transportation.
- The Manufacturer shall provide a description with calculation of the handling, storage and transportation procedures during the total manufacturing cycle.
- The Manufacturer shall provide description with calculation of long period (> 4 months) storage procedure, including the number and spacing of bearing strips and the number of layers".

The Manufacturer shall consequently:

- Inspect the bare pipes upon delivery to check that they have suffered no previous damage.
- All repairs and inspections shall be at the Manufacturer expense.
- The pipes shall be handled without causing damage to the pipe bevels and coating.
- Direct contact with steel or hemp slings or with any material whose shape or nature may deteriorate the pipe coating shall be strictly prohibited. Polyamide slings or hooks fitted with thermoplastic protection shall be used.
- The manufacturer shall submit calculations and sketch for loading/unloading & stacking at all points.
- Pipe Supplier to supply one Barcode Reader for each dumpsite & each store.

16. ONLINE PIPE TRACKING DATA (NEW CLAUSE)

The pipe manufacturer shall establish and follow procedures for maintaining heat and lot identity of all pipes during production. Also, it is required to have traceability of each day production.

In order to establish traceability of pipes, the system should have minimum of following information:

- Heat / Coil Number
- Traceability of pipe at each station
- Final status of pipe
- Reason for each rejection

Σ Σ Σ

THE FOLLOWING ANNEXURES OF API 5L LATEST EDITION, ARE APPLICABLE FOR PIPES MANUFACTURED AS PER THIS PTS:

Annex B
(normative)

Manufacturing procedure qualification for PSL 2 pipe

B.5.2 Modify: Column 3 of Table B.1 i.e *"Acceptance Criteria"* for Item No. 1 and "*Test requirements"* for item no. 5.

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.	For information
5	**Add:** For SEAMLESS pipes - Transverse CVN Transition curves for pipe body not for weld & HAZ, at temperature range of +20°C to -50°C (≥ 5 temperatures). For D ≥ 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 5L Spec. and this specification at Tmin

B.5.4 WELDABILITY TEST

Weldability test has to be performed for Grade X70 (or greater) pipes as required in GTS. Previously done weldability tests are not acceptable.

B.7 FIRST DAY PRODUCTION

ADD :

In addition to any other tests specified in API 5L (amended from time to time by GTS and/or present PTS) for each production in same type, size and grade and notwithstanding any other provision, the entire production of the first day shall be subjected to each and all destructive tests on TWO specimens per test selected by the Inspector at his discretion. Such tests shall be performed in presence of the Inspector and Owner/ Owner's Representative.

For first day production test, **3 pipes of 3 different heats** shall be selected for testing to verify that the manufacturing procedure results in the quality of pipes which are in complete compliance with this specification.

All the tests of approved QAP shall be performed on each selected pipes for first day production.

All testing equipment shall be duly certified for compliance with calibration and verified specially during that day for possible deviation towards calibrated value. Such verification shall be achieved in presence of the Inspector and Owner/ Owner's Representative.

Raw material of pipe shall be tested one test per heat at steel mill (all tests as per GTS/PTS/QCT).

All the tests of approved QCT are applicable to first day production. The acceptance limit shall be in accordance with API 5L (Latest Edition) with a change as depicted in the GTS (740/GTS/404 Rev.5).

B 7.1 BURST TEST

ADD:

Not Applicable for Seamless pipes.

B 7.2 VISUAL EXAMINATION

Each pipe shall be checked for visual defect and dimensional checks as per QCT / approved QAP.

B 7.3 NDT EXAMINATION

Each pipe after completion of welding shall be inspected as per QCT / approved QAP.

B 7.3.1 Ultrasonic Testing

Ultrasonic testing shall done as per Cl. E.5 of this specification and as per API 5L.

B 7.3.2 Radiographic Examination

Radiographic examination is not applicable for Seamless pipes.

B 7.3.3 Magnetic Particle Inspection

Magnetic Inspection shall be as per Cl. E.6 of this specification and as per API 5L.

B 7.3.4 Residual Magnetism

Residual Magnetism shall be as per Cl. E.7 of this specification and as per API 5L**.**

B 7.3.5 Electro Magnetic Inspection

Electromagnetic inspection shall be done as per Cl. E.5 of this specification and as per API 5L

B 7.4 PHYSICAL TESTING

In addition to the following test, other tests specified in QCT /approved QAP shall be carried out :

- Chemical Test
- Tensile Test for pipe base (Transverse)
- Impact test
- Macro and micro examination,
- Hardness test
- "Drop weight Tear Test (Table B.1 item 5)."

All destructive tests on two specimens per test selected.

Annex C
(normative)

Treatment of surface imperfections and defects

C.4.2 Add:

o) Repair of pipe body by welding is not permitted.

Annex D (normative) : Deleted.

Annex E (normative) : Non-destructive inspection for other than sour service or offshore service

Following standards have been replaced by new standards:

Standard mentioned in GTS	New Standard
ISO 10124, ISO 12094, ISO 9303, ISO 9305, ISO 11496	**ISO 10893-8, ISO 10893-9, ISO 10893-10**
SEL 072-77	**EN 10160**
ISO 13665	**ISO 10893-5**
ISO 12095	**ISO 10893-4**

E.1 QUALIFICATION OF PERSONNEL

Modify Para 1:

All personnel performing NDT activities shall be qualified in the technique applied, in accordance with latest edition of ISO 11484 or ASNT SNT-TC-1A or equivalent.

Staff in charge with the NDT shall be duly qualified according to International Standards like, but not limited to:

- The American Standard ASN-TC-1A (published by the ASNT) and all Codes it refers to, at least one UT-Level III shall be available with Manufacturer.
- European Standard « EN 473 » titled « Non-destructive testing - Qualification and certification of NDT personnel - General principles » and all the Codes it refers to.

At least one no. of ASNT Level III inspector shall be made available by the manufacturer on permanent basis (for 24 hrs) during all production at Manufacturer's works.

E.2.1 Automatic Straight Beam UT inspection
ADD:

The height of indication having amplitude beyond the reference accepted signal height (100% at 80% FSH) is considered as defective indication. Locations showing indications above the acceptance limits may be re-examined by manual ultrasonic method. Acceptance criteria, Calibration standard & Frequency shall be as per QCT for both automatic & Manual UT.

E.2.2 Automatic Angle Beam UT inspection
ADD:

Ultrasonic and Electromagnetic Inspection Reference Standards

The reference standard (calibration pipe) shall have the same specified diameter and wall thickness as specified for the production pipe being inspected and shall be of sufficient length to permit calibration of ultrasonic inspection equipment at the speed to be used in normal production. The reference standard (calibration pipe) shall also be of the same material, type and have the same surface finish as the pipe being inspected.

The reference standard for weld UT shall contain machined notches/holes as given below:

- N10 notch.
- A flat bottomed hole (FBH) of diameter equal to 6.4 mm and depth ½ t, where "t" is specified wall thickness.

Reference standard for the ultrasonic inspection of edges/pipe ends shall be as per QCT.

The calibration shall be performed at following intervals:

a) At the beginning of each operating shift (12 hours maximum) and subsequently every 4 hours.

b) Every time there is change in probes or working condition of the UT machine.

c) Every time the running of the system gives rise to doubts on its efficiency.

If during the above calibration verification, it is found that the equipment has not functioned satisfactorily in the opinion of the Owner/Owner's Representative/TPIA, all the pipes or skelp already inspected after the previous verification shall be inspected again at Manufacturer's cost.

E.3.1.4 Manual Ultrasonic Testing (MUT)

E.3.1.4.2 Modify:

Manual ultrasonic inspection of weld seams shall be in accordance with ISO 10893-11 as per API 5L Annex-E Cl. nr. E2 (a).

Table E.11 (Modify)

Pipe Diameter D	Wall Thickness *t*	Probe Angle
≤ 610 mm (24 in)	≤ 12.7 mm (0.500 in)	70° & 45°

E.3.1.4.5 ADD:

The weld at any pipe ends not covered by automatic ultrasonic equipment shall be inspected by manual ultrasonic equipment with same sensitivity and capability as automatic equipment.

E.3.1.4.6 ADD:

Full circumference of both ends of each pipe shall be 100% manual ultrasonically tested over a circumferential width of at least 100 mm with angular probes to detect cracks. In case of non-availability of angular probes at the mill, the full circumference of both ends of each pipe shall be inspected with magnetic particle technique over a circumferential width of at least 100 mm to detect surface cracks.

E.3.3 Pipe End Inspection – SMLS pipe

As per Annexure E of API 5L.

E.4. RADIOGRAPHIC INSPECTION OF WELD SEAMS

Not applicable for Seamless pipes.

E.5. ULTRASONIC AND ELECTROMAGNETIC INSPECTION

E.5.4.3 Add:

General

Calibration of Testing Equipment

All equipment used for non-destructive inspection shall be checked for possible deviation towards its calibrated value(s). The following check shall be performed:

- at the start & end of every working shift or at the time of running if any doubt arises.
- at every change-over of an equipment operator,
- at the start and end of a production shift,
- every time the running of the testing system is interrupted or when any doubt arises, Whichever occurs first.

If on checks of the testing systems, the calibration requirements are not satisfied (even after increasing the sensitivity for ultra-sonic equipment by 3db for allowance to system drift), then all pipes lengths tested after the previous equipment check shall be retested after the testing system has been recalibrated.

E.6 MAGNETIC PARTICLE INSPECTION

ADD:

Each pipe end upto 300 mm (OD & ID) & both the bevel end shall be magnetic particle inspected as per QCT. In addition, any grinded body of pipe shall be tested by Magnetic particle inspection. Acceptance limit, Calibration standard & Calibration frequency shall be as per QCT.

E.7 Residual Magnetism

ADD:

The residual magnetic field created by ultrasonic or electromagnetic scanning device shall be released and such residual magnanimity shall be inspected and accepted by TPIA and/ or Owner/ Owner's Representative.

The average of the four readings shall not exceed 20 Gauss and no reading shall exceed 25 gauss when measured with a hall-effect gauss meter, or equivalent values when measured with other type of instruments.

Annex G (normative) : PSL 2 pipe with resistance to ductile fracture propagation

Table G – Minimum CVN absorbed energy requirements

Specified outside diameter, D Mm (inch)	Full-size CVN average absorbed energy, Minimum KvT [a,b] (J /cm2)						
	B to X42	> X42 to X46	> X46 to X52	> X52 to X56	> X56 to X60	> X60 to X65	> X65 to X70
≤ 457.0 (18)	40	40	40	40	40	45	50
508.0 (20)	40	40	40	40	42	47	53
610.0 (24)	40	40	40	41	46	51	58
711.0 (28)	40	40	40	45	49	56	62
813.0 (32)	40	40	42	48	53	59	66
914.0 (36)	40	40	45	51	56	63	70
1016.0 (40)	40	40	47	54	59	66	74
1118.0 (44)	40	42	50	56	62	70	78
1219.0 (48)	40	44	52	59	64	73	81

a The required KvL (longitudinal direction specimens) values shall be 50% higher than the required KvT values for BM, weld and HAZ.

b	Testing shall be performed at a temperature of 0 °C (32 °F) or at a lower temperature as specified in the purchase order.
c	For intermediate specified outside diameter, CVN average absorbed energy value (KvT) shall be same value as given in the table for next higher specified outside diameter.

Annex J (normative) : **PSL 2 pipe ordered for offshore service**

Annex K (normative) : **Non-destructive inspection for pipe ordered for sour service and/or offshore service**

Annex O (informative) : **Use of the API Monogram by Licensees**

Annex P (informative) : **Equations for Threaded and Coupled Pipe and Background Equations for Guided Bend and CVN Test Specimens**

In Addition:

The following Annexures of 'GTS' (Doc No: 740 GTS 404) shall be applicable:

Annex K (normative) : **Annexure 'K' of 'GTS' (Doc No: 740 GTS 404) shall be followed, in view of the rigorous requirement of AUT of weld seam specified therein.**

Annexure Q of GTS : **'Purchaser Indicative Inspection and Quality Plan', has been replaced by Quality Control Table for Line Pipes (SEAMLESS) attached with this specification. The same shall be applicable for SMLS pipes.**

APPENDIX 1

TECHNICAL QUESTIONNAIRE FOR EVALUATION OF THE BIDS

1.0 Scope

External (3LPE) coated line Pipe as specified in MR.

Applicable Documents:

- API 5L Latest Edition.
- Tractebel Specifications (PTS, GTS) & documents.
- The information requested below shall be answered fully and wherever required necessary attachments must be added. All information shall be relevant to the scope of the tender as stated above. No blank space shall be left. If the part is not applicable, it should be written so.

2.0 General Information

2.1. Organization

Give a detailed description (organization structure, number of technical (job specific) people, facilities, equipment, …..).

Concerning:

- Overall Structure of the organization

  ……

  ……

- Line Pipe production facilities and capacities:

  ……

  ……

- Laboratories (in-house or sub-contractor):

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  ……

- QA and/or QC department:

  ……

  ……

- Non Destructive Testing department (in-house or subcontractors)

  ……

  ……

- R&D department (In house or Research Institutes)

  ……

  ……

- Other relevant departments or services (In house or subcontractors)

  ……

  ……

2.2. Certificates and Approvals

Give type of approvals, date of issue and validity, for the scope of present tender

- ISO certification (ISO 9001 - 2008)

  …….

  …….

- API approvals

  ……

  ……

- Safety approvals

  ……

  ……

- Third party approvals

  …… ……..

  …….

- Client approvals

  …… ……

  …… ……

- Other approvals

……

……

2.3. References for the manufacture/supply of API 5L X60 or above, Line pipe and coating separately for each part

Give for the last five years

- Name of client or project (eventually name of contact person)
- Number of kilometers produced
- Inspection Agency (eventually name of contact person)
  - Previous Year-1 :

    ……..

    ……..

  - Previous Year-2 :

    ……..

    ……..

  - Previous Year-3 :

    ……..

    ……..

  - Previous Year-4 :

    ……..

    ……..

  - Previous Year-5 :

    ……..

    ……..

- Current Year : (eventually orders to be executed remainder of the year)

……..

……..

3.0 Fabrication and Inspection Procedures

3.1 Give a detailed description of the fabrication process utilized for these types of pipes

- Forming (how many steps).
- Body testing
- Cold expansion or other intervention
- Type of testing along the line
- Maximum length of pipe that can be supplied for pipe sizes as per MR.

3.2 Give a detailed description of the production line(s), including type and location of the testing facilities. Explain all relevant operations which you consider important for obtaining a high quality product.

3.3 Provide a relevant example (which will be applicable in case of an order) of a LOFC (List of fabrication and control) as specified in ANNEX B of the GTS.

3.4 Provide a copy of all relevant NDT procedures (including acceptance criteria) that will be utilised in case of an order, such as UT, RX, MT, PT, …….

3.5 Provide a list of the NDT personal, with their qualifications in each technique (Level 1, 2 or 3 according to ASNT or other qualification authority) Specify if these operators are on your pay-roll or from a sub supplier.

3.6 Provide a copy of the applicable external coating procedures, including the preparation of the pipes before coating.

3.7 Provide a copy of the applicable marking procedure.

3.8 Provide a list of all equipment used for the mechanical testing, chemical analysis (in house or subcontractors) and tools for dimensional controls, including the date of calibration and the validity period of these calibrations.

3.9 Provide your procedure concerning “Control of non-conforming products” and the procedure concerning “Corrective and Preventive Actions” (See ISO 9001:2008).

4.0 Material Suppliers

4.1 Provide commitment letter from at least two possible plate/coils suppliers (from purchaser’s approved vendor list).

4.2 Provide a procedure or any other document, which gives details concerning the characteristics of the material, production controls, testing, certificates….required by you.

4.3 Provide a procedure or any other document, which gives details concerning the incoming testing and controls of these materials, performed by your QA/QC department.

4.4 Provide your procedure concerning Supplier Evaluation (section 7.4 of ISO 9001:2015), detailing the controls (audits?) performed on your suppliers. Also provide a copy of the planning of your supplier audits for last three years.

5.0 Conformity with the requirements

Please confirm specifically that you will be confirming to the requirements stipulated in these tender documents.

The issues in particular under consideration are:

- Materials

- Chemical composition and analysis
- Mechanical properties and testing requirements
- Dimensions and tolerances

· Hydrostatic Testing

· Marking

· Inspection

- Inspection procedure
- Personnel qualifications

· External coating

· Procedures and reports

The supplier must testify that all information given is correct and complete, and that they agree with an eventual audit of these issues by purchaser, a designated auditing company and/or the appointed Inspection Agency.

The reply to this questionnaire must be dated and validated by a company stamp, and signed by a responsible person according to the rules of the companies Quality Management System.

All information given by the company will be treated by TRACTEBEL as confidential information and will only be used for technical evaluation of the companies tender for the supply of line pipes for this Pipeline project.

S S S

CENTRAL UP GAS LIMITED

(CUGL)

CITY GAS DISTRIBUTION PROJECT

TRACTEBEL ENGINEERING PVT. LTD.

PARTICULAR TECHNICAL SPECIFICATION –

EXTERNAL COATING -3LPE

0	08.01.2021	Issued for Procurement	Anurag Shrotriya	Parampreet Singh/Gunja Gupta	Nitish Nandi
Rev.	**Date**	**Description**	**Prepared by**	**Checked by**	**Approved by**

TABLE OF CONTENTS

1.0 GENERAL

The present document covers the technical specification for coating of line pipes as specified in Material Requisition of this tender document.

Sl No	Line size (inch)	Type of pipes	Thickness of Line Pipe	Approx. Length in Meters	External Coating
1	4" (168.3 mm) 3LPE Coating	SMLS / HFW	6.4	As per MR	√

All pipes shall be supplied with length between 11.5 m and 12.5 m. Thickness wise average length of pipes shall be 12.0 m. The average length shall be cumulative as measured at pipe mill despatch note. For mechanical sampling & cut-off pipes, minimum length of 10.0 m is acceptable for a maximum of 5% of ordered quantity. The minimum average length of the entire ordered quantity in any case shall be 12.0m. The average length shall be cumulative as measured at Pipe Mill despatch.

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

The accepted pipe will have pipe no. on pipe ends as specified in PTS of bare line pipe along with TPIA stamp which will be preserved by the coating contractor upto the last stage till the pipes are handed over to the designated store.

The present document covers the technical specification for 3LPE external coating of line pipes.

The following sections cover the guidelines for:- **External Coating**

2.0 SCOPE

This specification covers the minimum requirements for supply/arrangement of all materials, plant, equipment, plant sites, consumables, utilities and application including all labour, supervision, inspection and tests, transportation, handling, coating integrity etc. for application of external anti-corrosion coating of pipes by using 3 Layer Side Extruded Polyethylene coating conforming to ISO 21809-1 'Petroleum and Natural Gas Industries-External Coatings for buried and submerged pipeline transportation systems-Part 1:Polyolefin Coatings'.

3.0 REFERENCE DOCUMENTS

Reference has also been made to the latest edition (edition enforce at the time of issue of enquiry) of the following standards, codes and specifications. The edition enforce at the time of floating the enquiry shall be termed as latest edition.

i. ISO 21809-1 : Petroleum and Natural Gas Industries-External Coatings for buried and submerged pipeline transportation systems-Part 1:Polyolefin Coatings

ii. DIN EN 30670 : Polyethylene Coating on Steel Pipes & Fittings – Requirement and Testing

iii. ISO 21809-2 : Petroleum and Natural Gas Industries-External Coatings for buried and submerged pipeline transportation systems-Part 2: Fusion-bonded epoxy coatings.

iv. ISO 15741 : Friction reduction coatings for the interior of on and off shore steel pipelines for non-corrosive gases.

v. ASTM D-149 : Standard Test Methods of Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Frequencies.

vi. ASTM D-257 : Standard Test Methods for D-C Resistance or Conductance of Insulating Materials.

vii. ASTM D-792 : Standard Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

viii. ASTM D-1238 : Test Method for Flow Rates of Thermoplastics by Extrusion.

ix. ASTM D-1603 : Test Method for Carbon Black in Olefin Plastics.

x. ASTM D-1693 : Test Method for Environmental Stress Cracking of Ethylene Plastics

xi. API RP 5L1 : Recommended Practice for Railroad Transportation of Line pipe.

xii. API RP 5LW : Transportation of Line Pipe on Barges and Marine Vessels.

xiii. API RP 5LT : Recommended Practice for Truck Transportation of Line Pipe.

xiv. BS EN 10204 : Metallic Products – Types of Inspection Documents.

xv. DIN 53735 : Testing of Plastics: Determination of Melt Index of Thermoplastics.

xvi. ISO 8501-1 : Preparation of Steel Substrates before Application of Paints and Related Products – Visual Assessment of Surface Cleanliness: Part 1-Representative Photographs of the Change of Appearance imparted to Steel when Blast Cleaned with different Abrasives.

xvii. ISO 8502 – 3 : Preparation of Steel Substrates before Application of Paints and Related Products – Part 3 – Assessment of Dust on Steel Surfaces Prepared for Painting (Pressure Sensitive Tape Method).

xviii. ISO 9002 : Quality Systems: Model for Quality Assurance in Production, Installation and Servicing.

xix. ISO 306 : Plastics-Thermoplastic materials-- Determination of Vicat softening temperature.

xx. ISO 15512 : Plastics - Determination of water content.

xxi. ISO 527-2 : Determination of tensile properties -- Part 2: Test conditions for moulding and extrusion plastics

xxii. ISO 527-3 : 3 Plastics - Determination of tensile properties - Part 3: Test conditions for films and sheets.

xxiii. ISO 868 : Plastics and ebonite -- Determination of indentation hardness by means of a durometer (Shore hardness).

xxiv. ISO 11357 : Plastics - Differential scanning calorimetry (DSC) - Part 7: Determination of crystallization kinetics.

xxv. ISO 11124 : Preparation of Steel Substrates Before Application of Paints and Related Products.

xxvi. ISO 1133 : Plastics –Determination of Melt mass- flow rate (MFR) and melt volume – flow rate (MVR) of thermoplastics.

xxvii. API 5L : Specification for Line Pipe

xxviii. ASME B31.8 : Gas Transmission and Distribution Piping Systems.

xxix. ASME B31.4 : Liquid Transportation Systems for Hydrocarbons, Liquid Petroleum Gas, Anhydrous Ammonia, and Alcohols

The Contractor shall be familiar with the requirements of these documents and shall make them readily available at the coating plant to all persons concerned with carrying out the works specified in this specification.

3.1 Terms And Definitions

GTS	means " General Technical Specification 740/GTS/404 Rev.0 " and all documents it refers to.
PTS	means the present " Particular Technical Specification and all its appendices, if any.
OWNER	Shall mean the Purchaser of Line Pipes
CONSULTANT / OWNER REPRESENTATIVE	Shall means " TRACTEBEL Engineering Pvt. Limited " / The company nominated by the owner to design the natural gas transport or distribution system and to specify the equipment
TPIA	means the Third Party Inspection Agency
MANUFACTURER	means the Manufacturer of the pipes as well as its sub-contractor(s).

4.0 MATERIALS

4.1 The three layer coating system shall comprise of a powder epoxy primer, polymeric adhesive and a medium density polyethylene topcoat. Coating materials shall be suitable for the service conditions and the pipe sizes involved. The coating materials i.e. epoxy powder; adhesive and polyethylene compound shall have proven compatibility. The coating system and materials shall be pre-qualified and approved by Owner in accordance with provisions of Annexure I of this specification. Contractor shall obtain prior approval from Owner for the coating system and coating materials.

4.2 The coating materials Manufacturer shall carry out tests for all properties specified in Para 5.3.1 and 5.3.2 for each batch of epoxy, adhesive and polyethylene compound. In addition, the Manufacturer shall also furnish Infra-red Scan for each batch of epoxy powder. The coating materials Manufacturer shall issue test certificates as per BS EN 10204, 3.1 for each batch of materials supplied to Contractor indicating all contents/ parameters required for batch certification as per clause 8.3 of ISO-21809-1 and the same shall be submitted to Owner for approval prior to their use.

4.3 In addition to Manufacturer's certificate, the Contractor shall draw samples from each batch of epoxy, adhesive and polyethylene in the presence of Owner Representative and test for the following properties at the coating yard at least one week prior to its use, to establish compliance with the Manufacturer's test certificates.

a. Epoxy Powder:

i. Density

ii. Gel Time

iii. Cure time

iv. Moisture content

v. Thermal Characteristics (Tg1, Tg2, H)

vi. Particle Size or Sieve Analysis

vii. Infrared Scan

b. Adhesive:

i. Specific Gravity

ii. Melt Flow Rate

iii. Vicat Softening Point

iv. Moisture content

c. Polyethylene:

i. Melt Flow Rate

ii. Specific Gravity

iii. Vicat Softening Point

iv. Water Absorption Content

v. Oxidative Induction Time

In case of failure of any of the above tests in a batch, that batch of material shall be tested for all other tests required as per Para 5.3.1 and 5.3.2 including the tests which failed. If all tests pass, the batch shall be accepted for coating. If any of the tests fail, entire batch of material shall be rejected and shall not be used for the coating.

4.4 All materials to be used shall be supplied in sealed, damage free containers and shall be suitably marked with the following minimum information:

a. Name of the Manufacturer (mark on Bag)

b. Type of Material (mark on Bag)

c. Batch Number (mark on Bag)

d. Place and Date of Manufacture (mark on Bag)

e. Shelf Life/Expiry Date (if applicable) (mark on Bag)

f. Quantity (mark on Bag)

g. Manufacturing standard (Batch Test Certificate)

h. Health, safety and environmental Instructions (Batch Test Certificate)

i. Receiving inspection acceptance criteria (Batch Test Certificate)

j. Data Sheets (Batch Test Certificate)

k. Storage instruction (Batch Test Certificate)

l. Instruction of application procedure with key parameters

All materials noted to be without above identification shall be deemed suspect and shall be rejected by Owner. Such materials shall not be used for coating and shall be removed from site and replaced by Contractor at his expense.

4.5 Contractor shall ensure that all coating materials are properly stored in accordance with the Manufacturer's recommendation at all times, to prevent damage and deterioration in quality prior to use.

4.6 Contractor shall be required to use all materials on a date received rotation basis, i.e. first in - first used basis.

5.0 FUNCTIONAL REQUIREMENTS AND PROPERTIES OF COATING

The coating shall be able to withstand a maximum in service operating temperature of 60°C and shall conform to 'Class B as per ISO 21809-1.

5.1 The topcoat polyethylene used shall be a black readymade compound, fully stabilized against influence of ultraviolet radiation (i.e. sunlight), oxygen in air and heat (due to environmental temperature as specified above). No appreciable changes shall occur during exposure to such environments up to at least a period of 6000 hours. The Contractor shall submit guarantee certificate from Manufacturer in this regard.

5.2 Properties

Properties of coating system and coating material shall comply the requirements indicated in subsequent paragraphs. In case the coating / material properties are tested as per test methods/standards other than specified herein below, the same may be accepted provided the test procedures and test conditions are same or more stringent than the specified.

5.3.1 Properties of Epoxy Powder and Adhesive

Contractor shall choose brand of epoxy powder and adhesive as per approved Contractor list that will achieve the functional requirements and properties of coating system as specified in clause no. 5.1 and 5.3.3 of this specification respectively.

5.3.1.1 Epoxy powder properties shall meet the properties listed below

Sl. No.	Properties	Unit	Requirement	Test Method
a.	Moisture Content	% mass	≤ 0.5	ISO 21809 – 1 Annexure K
b.	Minimum glass transition temperature (T_{g2})	˚C	≥ 95 and within manufacturer's specification	ISO 21809 – 1 Annexure D
c.	Gel time at 205˚C ± 3˚C	s	Within 20% of the nominal value specified by the manufacturer	ISO 21809 – 1 Annexure J
d.	Density	g/cm^3	Within ± 0.05 of the manufacturer's specified nominal value	ISO 21809 – 1 Annexure N

The colour of epoxy powder shall be either green or dark red or any other colour approved by Owner except grey colour.

5.3.1.2 Copolymer grafted adhesive shall have the following properties:

Sl. No.	Properties	Unit	Requirement	Test Method
a.	Melt flow rate (190˚C / 2.16 Kg)	g/10 minutes	≥1.0	ASTM D 1238
b.	Vicat softening point	˚C	≥ 100	ISO 306
c.	Specific Gravity	-	≥ 0.930	ASTM D 792
d.	Elongation at break at 23˚C	%	≥ 600	ISO 527 – 2
e.	Tensile yield strength at 23˚C	MPa	≥ 8	ISO 527 – 2
f.	Water content	%	≤ 0.1	ISO 15512

5.3.2 Properties of Polyethylene Compound

Sl. No.	Properties	Unit	Requirement	Test Method
a.	Tensile strength at 23˚C	N/mm^2	≥ 17	ISO 527-2 or ISO 527-3

b.	Melt flow rate (190˚C / 2.16 Kg)	g/10 minutes	≥ 0.25	ASTM D 1238
c.	Density at 23˚C	g/cm^3	≥ 0.940 (HDPE)	ISO 1183
d.	Hardness at 23˚C	Shore D	≥ 60 (HDPE)	ISO 868
e.	Water absorption, 24 hours at 23˚C	%	≤ 0.05	ASTM D 570 or ISO 15512
f.	Volume Resistivity at 23˚C	Ohm – cm	$\geq 10^{16}$	ASTM D 257
g.	Dielectric withstand, 1000 Volt / sec rise at 23˚C	Volts / mm	≥ 30,000	ASTM D 149
h.	Softening point	˚C	≥ 110	ISO 306
i.	Elongation at break at 23˚C	%	≥ 600	ASTM D 638 ISO 527-2 or ISO 527-3
j.	Oxidative induction time in oxygen at 220C, Aluminium pan, no screen	Minutes	10	ISO 11357
k.	Environmental Stress Crack Resistance (ESCR) (for F50) · Medium Density [Condition "C"] · High Density [Condition "B"]	Hours	 · 300 · 300	ASTM D 1693
l.	Carbon Black Content	%	≥ 2	ASTM D 1603
m.	UV resistance and thermal ageing	%	ΔMFR ≤ 35	ISO 21809 – 1 Annexure G

5.3.3 Properties of Applied Coating System

Sl. No.	**Properties**	**Unit**	**Requirement**	**Test Method**
a.	Bond Strength (Peel Strength) · @ 23°C +/- 3°C · @ Tmax. (80 °C) +/- 3°C	N / mm	· ≥ 15 · ≥ 3	ISO 21809-1 Annexure C
b.	Impact Strength (Min. of 30 impacts on body along the length. No breakdown allowed when tested at 25 KV)	Joules per mm of coating thickness	≥ 7	ISO 21809-1 Annexure E
c.	Indentation Hardness · @ 23 +/- 2°C · @ Tmax. (80 °C) +/- 2°C	mm	· ≤ 0.2 · ≤ 0.3	ISO 21809-1 Annexure F
d.	Elongation at Failure	%	≥ 400	ISO 527-2
e.	Coating Resistivity	Ohm – m^2	10^8 min.	DIN 30670
f.	Cathodic Disbondment · 23 +/- 3°C for 28d - 1.5V	mm	· ≤ 7	ISO 21809-1 Annexure H

	· 65 +/- 3°C for 24h - 3.5V · Tmax. (80 °C) +/- 3°C for 28d - 1.5V	Average radius of Cathodic disbondment	· ≤ 7 · ≤ 15	
g.	Degree of Cure of Epoxy · Percentage Cure, H · ΔTg	 · % · °C	 · 95 · ≤ 5	ISO 21809-1 Annexure D
h.	Hot Water Immersion test	mm	Average ≤ 2 And maximum ≤ 3	ISO 21809-1 Annexure M
i.	Flexibility		No cracking at an angle of 2.0 ° per pipe	ISO 21809-1 Annexure I

5.3 The acceptable combinations of coating material shall be as per Annexure-I.

6.0 MEASUREMENT AND LOGGING

The scope of the Contractor includes maintaining records containing all the relevant data of individual pipe and pipe coating including pipe number, heat number, diameter, length, wall thickness, defects, coating number, batches of materials, sampling, testing, damages, repairs, rejects and any other information that Owner considers to be relevant and required for all incoming bare pipes and Owner approved outgoing coated pipes as applicable. The records shall be maintained in MS excel for proper tracking and filter properties Contractor's documentation shall be designed to ensure full traceability of pipe and coating materials through all stages of coating and testing. Contractor shall submit this information in the form of a report at the agreed intervals.

7.0 COATING PROCEDURE AND QUALIFICATION

7.1 Upon award of the CONTRACT, the Contractor shall submit within two (2) weeks, for Owner approval, a detailed report including the below, but not limited to, the following:

a. Details of plant(s), location(s), layout, capacity and production rate(s).

b. Details of the equipment available to carry out the coating works including surface preparation, surface pretreatment comprising of de-ionized water wash, phosphoric acid wash and chromate treatment , epoxy powder application and its recycling system, adhesive & polyethylene extrusion, moisture control facilities available for coating materials.

c. Details of process control and inspection equipment required for the coating process such as surface preparation, surface pretreatment, temperature control during epoxy spray, thickness control, holiday testers, etc.

d. Facilities in the yard for unloading, handling, transport, production, storage, stockpiling, loading of bare and coated pipes and warehouses for storage of other coating materials.

e. Plant Organization Chart and availability of manpower including coating specialist

f. Details of utilities/facilities such as water, power, fuel, access roads and communication etc.

After Owner has given approval; no change in plant set-up shall be made. However, unavoidable changes shall be executed only after obtaining written approval from Owner.

7.2 At least two (2) weeks prior to the commencement of production coating, a detailed procedure of the Contractor's methods, material proposed, etc., shall be formulated by the Contractor and submitted for Owner

approval in the form of a bound manual. The procedure shall include, but not limited to, the following information and proposals:

a. Pipe inspection at the time of bare pipe receipt.

b. Steel surface preparation, including preheating, removal of steel defects, method of pipe cleaning, dust removal, abrasive blast cleaning and surface profile; methods of measurements and consumables.

c. Pipe heating, temperatures and control prior to epoxy application.

d. Complete details of raw materials including current data sheets showing values for all the properties specified together with quality control and application procedure recommendations from manufacturer(s).

e. Application of FBE powder, adhesive and polyethylene, including characteristics, temperature, line speed, application window, curing time, etc.

f. Quenching and cooling, including time and temperature.

g. Quality Assurance System, Quality Plan, Inspection and Test Plan and reporting formats, including instrument and equipment types, makes and uses, etc

h. Detailed method of repair of coating defects duly classified depending upon nature and magnitude of defects and repair thereof including coating stripping technique

i. Details of instrument and equipment calibration methods including relevant standards and examples of calibration certificates.

j. Complete details and inventory of laboratory and equipment for procedure qualification and regular production

k. Pipe handling and stock piling procedures including pipe tracking, traceability, pipe end protection and protection against adverse ambient conditions during storage.

l. Sample of recording and reporting formats, including laboratory reports, certificates and requirement as per clause 6.0 of this specification.

m. Complete details of test certificates for raw materials including test methods and standards used.

n. Test certificates from PE compound manufacturer for tests for thermal aging, coating resistivity and aging under exposure to light. These test certificates shall not be older than three years.

o. Health, Safety and Environment Plans.

p. Storage details of coating materials and chemicals.

q. Continuous temperature monitoring at various stages of coating Procedure Qualification Tests (PQT) shall be carried out only after obtaining written approval of the above procedure from Owner. No change in the procedure shall be made after the Owner has given approval. However, unavoidable changes shall be executed only after obtaining written approval from Owner.

7.3 Prior to start of production, the Contractor shall, at his expense, carry out a coating PQT for each pipe diameter on max. wall thickness, for each type of pipe, for each coating material combination and for each plant, to prove that his plant, materials, and coating procedures result in a quality of end product conforming to the properties stated in clause 5.3, relevant standards, specifications and material manufacturer's recommendations. Contractor shall give seven (7) working days' notice to witness all procedures and tests.

Procedure Qualification Tests (PQT) shall be carried out only after obtaining written approval of above procedure from company. No change in the procedure shall be made after the Company has given approval. However, unavoidable changes shall be executed only after obtaining written approval from Company.

A batch representing a normal production run, typically 15 pipes, shall be coated in accordance with the approved coating procedure and the coating operations witnessed by Owner Representative. Out of these pipes, at least one pipe at start & end of PQT shall be coated partly with epoxy and partly with both epoxy and adhesive layers.

At least 10 (ten) test pipes shall be selected by Owner Representative for coating procedure approval tests and shall be subjected to procedure qualification testing as described hereinafter. Owner Representative shall witness all tests. Out of 10 (ten) test pipes, 2 (two) pipe partly coated with epoxy and partly coated with both epoxy and adhesive layers shall be included. Remaining 8 (eight) test pipes shall have all three layers.

During PQT, the Contractor shall qualify various procedures forming a part of coating operations as detailed subsequently.

7.4 Qualification of Procedures

7.4.1 Epoxy Powder Application & Recycling

During pre-qualification, air pressure in the epoxy spray guns, satisfactory functioning of monitoring system, line speed v/s coating thickness, etc. shall be established. Dew point of air used to supply the fluidized bed, epoxy spray system and epoxy recycling system shall be recorded during the PQT.

Also, the Contractor shall remove samples of reclaimed powder from the reclamation system. These samples of reclaimed powder shall be subject to a detailed visual examination, thermal analysis and moisture content tests. The properties of the reclaimed powder shall be within the range specified by the Manufacturer of epoxy powder. In case the properties of the reclaimed powder are out of the range specified by the Manufacturer, Contractor shall not the use the reclaimed powder during the regular production.

7.4.2 Pipe Pre-heating

The Contractor shall establish the temperature variation due to in-coming pipe temperature, line speed variation, wall thickness variation, emissivity, interruptions, etc. and document the same during the PQT stage. During PQT, proper functioning of pipe temperature monitoring and recording system including alarm/hooter shall be demonstrated to the Owner Representative.

7.4.3 Surface Preparation

The procedure to clean and prepare the pipe surface shall be in accordance with the requirements of this specification. The ratio of shot to grit shall be established during procedure qualification testing, such that the resultant surface profile is not dished and rounded. The qualification shall be performed through a visual inspection, measurement of roughness and check of the presence of dust on the abrasive blast cleaned pipe surface.

7.4.4 Chemical Pre-treatment

7.4.4.1 Phosphoric Acid Wash followed by De-ionised Water Wash

The procedure to apply the chemical pre-treatment viz. phosphoric acid wash followed by de-ionised water wash shall result in intended cleaning requirements of this specification. Working solution preparation, maintaining concentration, application procedure including method of spreading, spreading rate, drying times, etc. depending upon the cleanliness/temperature of the incoming pipe and the line speed shall be established. Temperature of the chemical, pipe pre-heat temperature vs line speed vs dwell time, rinsing procedure, testing & control, rectificatory measures, drying procedure etc. shall be clearly established during PQT. Also the quality of the de-ionised water shall be established during PQT.

7.4.4.2 Chromate Treatment

The procedure to apply the chromate treatment shall result in intended cleaning requirements of this specification. Working solution preparation, maintaining concentration, application procedure including method of spreading, spreading rate, drying times, etc. depending upon the temperature of the incoming pipe and the line speed shall be established. Temperature of the chemical, pipe pre-heat temperature vs. line speed, pipe heating after chromating and time limit within which the pipe to be heated, testing & control, rectificatory measures, shall be clearly established during PQT.

7.4.5 Coating Application

The Owner Representative will check the correctness of each coating application operation, values of the main parameters of each operation, pre-heating pipe surface temperature prior to epoxy powder application temperature, line speed, fusion bonded epoxy curing time, temperature and flow rate of co-polymer adhesive

and polyethylene, etc. and the same shall be recorded. These values shall be complied with during regular production.

7.5 Qualification of Applied Coating

7.5.1 Tests on pipe coated partly with epoxy and partly with epoxy & adhesive layers

a. Degree of Cure

Epoxy film samples (minimum 4 no.) shall be scrapped from the coated pipe and the samples shall be taken for cure test using Differential Scanning Calorimetry (DSC) procedure mentioned in clause A8 of ISO 21809-2 Fusion bonded epoxy coating. Care shall be taken to remove the samples of full film thickness avoiding inclusion of steel debris. Glass transition temperature differential (Tg) and % cure (H) shall comply with the specified requirements.

b. Epoxy Layer Thickness

Epoxy layer thickness shall be checked at every one meter spacing at 3, 6, 9 and 12 o'clock positions. The thickness shall comply with the specified thickness requirements.

c. Adhesive layer Thickness

Adhesive layer thickness shall be checked at every one meter spacing at 3, 6, 9 and 12 o'clock positions. The thickness shall comply with the specified thickness requirements.

d. Holiday Inspection

Entire pipe shall be subject to holiday inspection and the test voltage shall be set to exceed 5 v/micron of epoxy thickness specified for the portion coated only with epoxy layer.

e. Dry Adhesion

Dry adhesion test shall be carried out as per clause A.4 of ISO 21809-2 Fusion bonded epoxy coating. The rating obtain shall be either 1 or 2.

f. 24 Hrs Adhesion Test.

Adhesion Test (24 hrs) shall be carried out on the epoxy coated pipe as per clause A.16 of ISO 21809-2 Fusion bonded epoxy coating. The rating obtained shall be from 1 to 3.

g. Flexibility test

2° flexibility test shall be carried out as per annexure A.13 of ISO 21809-2 Fusion bonded epoxy coating. No cracking should be observed.

h. Porosity Test

Cross section porosity and interface porosity tests shall be carried out on the epoxy coated pipe. Test method and acceptance criteria shall comply as per clause A.12 of ISO 21809-2 Fusion bonded epoxy coating

7.5.2 Tests on pipes coated with all three layers

a) Bond Strength (Peel Test):

Five test pipes shall be selected for bond strength tests. On each of the selected pipes, three peel tests shall be performed for each specified temperature i.e. one at each end and one in the middle of the pipe and specified requirements shall be complied with, i.e. bond strength as well as mode of separation. Length of peel shall be minimum 65 mm. None of these samples shall fail.

b) Impact Strength:

Three test pipes shall be selected for impact strength test and the test shall meet the specified requirements.

c) Indentation Hardness:

Two samples for both temperatures from all pipes shall be taken. If any one of these samples fails to satisfy the specified requirements, then the test shall be repeated on four more samples. In this case, none of the samples shall fail.

d) Elongation at failure:

Six samples each from three coated pipes i.e. 18 samples in all shall be tested and the test shall comply the specified requirement. Only one sample per pipe may fail.

e) Cathodic Disbondment Test:

Three CD tests shall be carried out for the total lot of test pipes having all three layers.

During PQT:

i. One test sample shall be carried out for 28 days at 23 ±3 °C.

ii. One test sample shall be carried out 24 hrs, at 65 ±3 °C.

iii. One test sample shall be carried out 28 days, at Tmax (80) ±3 °C.

Regular production:

i. One test sample per 2 week or once per every batch of epoxy powder whichever is more frequent shall be carried out for 24 hrs, at 65 ±3 °C to be performed.

f) Holiday Inspection

All the pipes shall be subject to holiday inspection. The test voltage shall be as specified in Para 10.2.3(b). The pipes shall pass the test at 25 kV.

g) Coating Thickness Measurement

All pipes shall be subject to coating thickness measurements. Acceptance criteria shall be as per Para 10.2.2.

h) Air Entrapment

One sample each from pipe body and on weld (if applicable) shall be taken from all four coated pipes and the specified requirements shall be complied with.

i) Degree of Cure

Epoxy film samples (minimum 4 no., equally spaced) shall be scrapped from one coated pipe and the samples shall be taken for cure test using Differential Scanning Calorimetry (DSC) procedure. Silicon coated sulphite paper shall be placed between the epoxy layer and adhesive layer immediately after epoxy application, to ensure physical separation of epoxy & adhesive as well as to prevent contamination of epoxy with adhesive layer, at a location from where the epoxy samples are to be removed for the test. Care shall be taken to remove the samples of full film thickness avoiding inclusion of steel debris. Glass transition temperature differential (Tg) and % cure (H) shall comply with the specified requirements.

j) Hot Water Immersion :

One test pipe shall be selected for hot water immersion test. The test method and acceptance criteria shall be as per annexure M of ISO 21809 Part 1- Polyolefin Coatings.

k) Flexibility:

One test pipe shall be selected for Flexibility test. The test method and acceptance criteria shall be as per annexure I of ISO 21809 Part 1- Polyolefin Coatings.

l) Coating Resistance test

The contractor shall submit Coating Resistance test report before start of production. Test shall be performed as per DIN30670 by the raw material manufacturer in an international lab DVGW Germany/ KTH Germany, Exova UK, Salzitter or Charter Coating Canada. The test report should not be older than Five years from the date of FOA and should be of the same grade of raw material offered for the project.

7.5.3 Inspection of all test pipes

All pipes shall be subject to the following inspections:

a. Surface cleanliness, surface roughness measurements and dust control immediately after second abrasive blast cleaning and salt test.

b. Visual inspection of finished coating, cut back dimension, internal/external cleanliness, end sealing and bevel inspection.

Acceptance criteria for all inspection and testing shall be as specified in clause no. 5.3.3

7.6 After completion of the qualification tests and inspection as per para 7.4 and 7.5 above, the Contractor shall prepare and issue to Owner for approval a detailed report of the above tests and inspection including test reports/certificates of all materials and coatings tested. Only upon written approval from Owner, Contractor shall commence production coating.

7.7 On successful completion of PQT, coating of all test pipes shall be removed and completely recycled as per the approved coating procedure specification, at Contractor's expense. Remaining pipes will be accepted by Owner provided they meet the requirements of this specification and need not be stripped and re-cycled.

7.8 The Contractor shall re-establish the requirements of qualification and in a manner as stated before or to the extent considered necessary by Owner, in the event of, but not limited to, the following:

- Every time there is a change in the previously qualified procedure.
- Every time there is a change in the manufacturer and change in formulation of any of the raw materials and change in location of raw material manufacture.
- Every time the coating yard is shifted from one location to the other or every time the critical coating equipments (induction heater, epoxy spray system, extruder, etc) are shifted.
- Any change in line speed during coating application.
- Any time when in Owner's opinion the properties are deemed to be suspect during regular production tests.

7.9 Owner reserves the right to conduct any or all the test required for qualification through an independent laboratory or agency at the cost of Contractor when in Owner's opinion, the results are deemed suspect. Owner's decision shall be final.

8.0 PIPE SURFACE PREPARATION

8.1 Unless specified otherwise, the pipes shall be supplied free from mill applied oils but may be subject to contamination occurring during transit.

8.2 Prior to cleaning operation, Contractor shall visually examine the pipes and shall ensure that all defects, flats and other damages have been repaired or removed. The Contractor shall also remove marking stickers, if any, present within the pipe. Record shall be kept of such marking on the stickers to ensure traceability of pipe after coating.

8.3 Any oil, grease, salt or other contaminants detrimental to the formation of a good coating bond or coating quality shall be removed prior to coating application. Contaminants may be removed by the use of non-oily solvents. Gasoline or kerosene shall not be used for this purpose. Visible oil and grease spots shall be removed by solvent wiping. Solvent cleaning shall be in accordance with SSPC-SP1. Steel surface shall be allowed to dry before abrasive cleaning.

8.4 All pipes shall be preheated to a temperature of 65°C to 85°C prior to abrasive blast cleaning. The external surface of the pipe shall be cleaned using 2 no. dry abrasive blast cleaning units to achieve the specified surface cleanliness and profile. After first abrasive blast cleaning, chemical pre-treatment with phosphoric acid solution as per clause no. 8.6 shall be carried out prior to second abrasive blast cleaning. However, at the option of Contractor, chemical pre-treatment with phosphoric acid solution as per clause no. 8.6 may be carried out after the second abrasive blaster.

The abrasive blast cleaning units shall have an effective dust collection system to ensure total removal of dust generated during blast cleaning from the pipe surface. The equipment used for abrasive blast cleaning shall meet the specified requirements and shall be free from oil, water soluble salts and other forms of

contamination to ensure that the cleaning process is not impaired. Traps, separators and filters shall be checked for condensed water and oil at the start of each shift and emptied and cleaned regularly. During abrasive blast cleaning, the metallic abrasive shall be continuously sieved to remove "fines" and "contaminants" and the quality checked at every four hours. Abrasives used for blast cleaning shall comply ISO-11124.

8.5 Suitable plugs shall be provided at both pipe ends to prevent entry of any shot/grit into the pipe during blast cleaning operations. These plugs shall be removed after blast cleaning. Alternatively the Contractor may link the pipes suitably together to prevent the entry of any short/grit into the pipe.

8.6 Chemical Pre-treatment with Phosphoric Acid Solution

8.6.1 All pipes shall be provided chemical pre-treatment with phosphoric acid solution. 10% (+2%) solution of phosphoric acid, Oakite 31 / 33 or equivalent, shall be used to remove all soluble salts and other soluble contaminants.

8.6.2 The Contractor shall provide data sheets and supporting documentation for the phosphoric acid to be used. The documentation shall verify that the phosphoric acid is suitable for the treatment of line pipe prior to the application of the specific fusion bonded epoxy powder being applied and the final coating will meet fully the requirements of this specification.

8.6.3 The pipe temperature immediately prior to the phosphoric acid treatment shall be in the range of 45 to 75°C. Phosphoric acid treatment shall be followed immediately by washing with de-ionised water. De-ionised water used shall conform to the following requirements:

Sl. No.	Properties	Unit	Requirement
a.	Turbidity	NTU	1 max
b.	Conductivity	µmho/cm	5 max
c.	Hardness	-	Nil
d.	Total Alkalinity as $CaCO_3$	mg / l	2 to 3
e.	Chloride as Cl^-	mg / l	1 max
f.	Sulphate as SO_4	mg / l	1 max
g.	pH	-	6.5 to 7.5

Tests to determine the above properties shall be carried out in accordance with "Standard Methods for the Examination of Water and Wastewater" published jointly by American Public Health Association, American Water Works Association and Water Pollution Control Federation.

Quality of the de-ionised water shall be monitored at the start of each shift and at every four hours interval. Non-compliance of de-ionised water w.r.t. the above requirements shall cause stoppage of the operations.

8.6.4 The pH of the pipe surface shall be determined both before and after the de-ionised water rinse initially on each pipe and in case of consistent results, the frequency may be relaxed to once per hour at the discretion of Owner's Representative. The measured pH shall be as follows:

Before de-ionised water wash : 1 to 2

After de-ionised water wash : 6 to 7

8.6.5 After the de-ionised water wash, the pipe shall be dried with dry air and preheated to a temperature of 65°C to 85°C.

8.6.6 The salt tests shall be carried out after de-ionised water rinse. One test shall be carried out at one end of each pipe. The acceptance criteria shall be 2µg/cm2. An approved salt meter (SCM 400 or equivalent) shall be used to carry out salt tests and shall be calibrated in accordance with the equipment manufacturer's recommendations.

8.7 All pipes shall be tested for salt contamination after blast cleaning unit. One test shall be carried out on each pipe. The acceptance criteria shall be 2µg/cm^2. An approved salt meter (SCM 400 or equivalent) shall be used to carry out salt tests and shall be calibrated in accordance with the equipment manufacturer's recommendations. Any pipe having salt contamination exceeding be 2µg/cm^2 shall be either reblasted or de-ionised water washed and then rechecked for salt contamination. In case salt level less than be 2µg/cm^2 is consistently achieved, the frequency of salt contamination testing may be relaxed to at least one pipe per hour at the sole discretion of the Owner Representative.

8.8 Abrasive cleaning carried out shall be such that the resultant surface profile is not dished and rounded when viewed with 30X magnification. The standard of finish for cleaned pipe shall conform to near white metal finish to Sa 2 ½ of ISO 8501-1. Surface of pipe after abrasive blast cleaning shall have an anchor pattern of 75 to 100 microns (RZ). This shall be measured for each pipe by a suitable instrument such as surface profile depth gauge. In addition the pipe surface after blast cleaning shall be checked for the degree of cleanliness (Sa 2½), degree of dust and shape of profile. Degree of dust shall comply the requirements of ISO 8502 – 3. Acceptance limit shall be either quality rating 2 or Class 2. Tape used for assessment of degree of dust shall comply IEC 454-2. Pressure shall be exerted on the applied tape using a 4 kg roller, prior to peeling-off to assess the degree of dust.

8.9 All pipes shall be visually examined for presence of any shot/grit/loose material left inside the pipe during blast cleaning. Suitable mechanical means (stiff brush) shall be employed to remove the same before the pipes are processed further. In addition, inside surface of the pipe shall also be visually inspected for presence of any foreign material or shots and grit (free or embedded/sticking to pipe inside surface). The pipe inside surface shall be examined using sharp floodlight focused at the middle of the pipe at one end while inspection is carried out visually from other end. Any foreign material or shots/grit present in the pipe shall be completely removed by mechanical brush, high pressure air jets, by tilting of pipe, etc.

8.10 At no time shall the blast cleaning be performed when the relative humidity exceeds 85%. The Contractor shall measure the ambient conditions at regular intervals during blast cleaning and coating operations and keep records of prevailing temperature, humidity and dew point.

8.11 The blast cleaned surface shall not be contaminated with dirt, dust, metal particles, oil, water or any other foreign material, nor shall the surface or its anchor pattern be scarred or burnished. All blast cleaned pipe surface shall be kept in dust free enclosure prior to coating. After blast cleaning, all surfaces shall be thoroughly inspected under adequate lighting to determine anchor pattern, quality of blasting and identify any surface defects prior to coating application. All surface defects such as slivers, scab, burns, laminations, welds spatters, gouges, scores, indentations, slugs or any other defects considered injurious to the coating integrity made visible during blast cleaning shall be reported to the Owner Representative and on permission from Owner Representative, such defects shall be removed by filing or grinding. After any grinding or mechanical repairs, the remaining wall thickness shall be checked and compared with specified thickness. The method employed to remove surface defects shall not burnish or destroy the anchor pattern or contaminate the surface. Pneumatic tools shall not be used unless they are fitted with effective air/oil and water traps. Where burnishing results in destruction of anchor pattern, the anchor pattern shall be restored by suitable means. Pipes that have damages repaired by grinding and have ground areas more than 50mm in diameter shall be reblasted.

Any dust or loose residues that have been accumulated during blasting and/or during filing/grinding operations shall be removed by vacuum cleaning.

If contamination of surface occurs, the quality of blast cleaning method and process shall be examined. If the surface roughness is outside the specified limit, the blast cleaning material shall be checked and replaced.

8.12 Upon Completion of the blasting operations, the quality control supervisor shall accept the pipe for further processing or return for re-blasting after removal of defects/imperfections. In case imperfections are considered detrimental to the coating quality, the same shall be reported to Owner's Representative for final decision on rejection or re-blasting/removal of defects. Re-blasting/removal of defects or returning pipe to the yard shall be at the Contractor's cost.

Owner's Representative, in additions, reserves the right to initiate any of the above actions during periodic inspections for oil, dust, salt, imperfections, surface defects, lack of white metal finish, etc.

8.13 In order to ensure that pipe with defects are not processed further, provisions shall be available to lift the pipes from inspection stand.

8.14 Chemical Pre-treatment with Chromate Solution.

8.14.1 Following completion of abrasive blast cleaning, all pipe surface shall be chemically pretreated with a 10% (+2%) strength chromate solution.

8.14.2 The Contractor shall provide data sheets and supporting documentation for the chemical to be used. The documentation shall verify that the chemical is suitable for the treatment of line pipe prior to the application of the specific fusion bonded epoxy powder being applied and the final coating will meet fully the requirements of this specification.

8.14.3 The chemical pre-treatment shall be applied fully in accordance with the chemical suppliers' instructions and in a manner that ensures 100% uniform coverage of the pipe surface without introducing surface contamination.

8.14.4 The Contractor shall check that the concentration of the chemical pre-treatment solution remains within the range recommended by the chemical manufacturer for the pipe coating process. The concentration shall be checked at the make-up of each fresh solution and once per hour, using a method approved by the chemical manufacturer. The Contractor shall also ensure that the chemical pre-treatment solution remains free from contamination at all times. Recycling of chemical pre-treatment solution is not permitted.

8.14.5 The Contractor shall ensure that the temperature of the substrate is maintained between 40°C and 80°C and the chromate solution temperature does not exceed 60° or as recommended by the manufacturer.

8.14.6 The chromate coating shall be smooth, even, free from runs, drips or excessive application and lightly adherent with no flaking of the coating. The chromate coated steel must be thoroughly dried immediately after application and shall be achieved by boiling off any residual solution on the surface.

8.15 The total allowable elapsed time between completion of the blasting operations and commencement of the pre-coating and heating operations shall be such that no detectable oxidation of the surface occurs. Relative humidity readings shall be recorded every half an hour during the blasting operations in the immediate vicinity of the operations. The maximum elapsed time shall not exceed the duration given below:

Relative Humidity %	Maximum elapsed time
> 80	2 hours
70 to 80	3 hours
< 70	4 hours

Any pipe not processed within the above time-humidity requirement shall be completely reblasted. Any pipe showing flash rusting shall be re-blasted even if the above conditions have not been exceeded. The dew point shall be 3°C less than the pipe temp. & RH shall be less than 85%.

8.16 Pipe handling between abrasive blasting and pipe coating shall not damage the surface profile achieved during blasting. Any pipe affected by the damage to the surface exceeding 200mm² in area and/or having contamination of steel surface shall be rejected and sent for re-blasting.

9.0 COATING APPLICATION

The external surface of the cleaned pipe conforming to clause 8.0 of this specification shall be immediately coated with 3-layer extruded polyethylene coating in accordance with the procedures approved by Owner, relevant standards and this specification. In general the procedure shall be as follows:

9.1 Pipe Heating

9.1.1 Immediately prior to heating of pipe, all dust and grit shall be removed from inside of the pipe by a combination of air blast, brushing and vacuum cleaning. Suitable arrangement shall be made to protect the bevel ends from getting damaged during the coating operation.

9.1.2 Induction heater shall be used for heating the pipe. The method shall be capable of maintaining uniform temperature along the total length of the pipe and shall be such that it shall not contaminate the surface to be coated. In case of induction heating, appropriate frequency shall be used to ensure 'deep heating' and intense

skin heating is avoided. This shall be demonstrated on bare pipes prior to start of PQT. Oxidation of the cleaned pipe surfaces prior to coating (in the form of bluing or other apparent oxide formation) is not acceptable.

9.1.3 External surface of the pipe shall be heated to about 190 °C or within a temperature range (min. to max.) as recommended by the powder manufacturer. Required pipe temperature shall be maintained as it enters the coating chamber.

9.1.4 Temperature of the pipe surface shall be continuously monitored & recorded by using suitable instruments such as infrared sensors, contact thermometers, thermocouples etc. The recording method shall allow to correlate each line pipe. The monitoring instrument shall be able to raise an alarm/activate audio system (hooter) in the event of tripping of induction heater/gas fired heater or in the event of pipe temperature being outside the range recommended by the manufacturer. Any deviation from the application temperature range recommended by manufacturer shall be rectified. If immediate rectification is not feasible, the production shall be stopped until cause of deviation has been removed. Any pipe coated during the duration of temperature deviation shall be identified by marking and rejected. Such rejected pipes shall be stripped, re-cleaned and recoated.

9.1.5 Temperature measuring & monitoring equipment shall be calibrated twice every shift and/or as per Owner Representative's instruction.

9.1.6 Contractor shall ensure that pipe surface emissivity variations are minimized during pipe heating. To avoid significant variance, more than once blasted joints should be coated at the same time and not mixed with joints blasted only once.

9.2 Pipe Coating

9.2.1 Subsequent to pipe heating, coating consisting of following layers shall be applied onto the pipe.

i. Electrostatic application of epoxy powder of minimum dry film thickness 0.200 mm, unless otherwise specified. The maximum thickness shall not exceed the epoxy thickness specified by epoxy powder manufacturer.

ii. Grafted co-polymer adhesive application by extrusion, minimum thickness 0.250 mm.

iii. Polyethylene application by extrusion.

The coated pipe shall be subsequently quenched and cooled in water for a period that shall sufficiently lower the temperature of pipe coating to permit handling and inspection.

9.2.2 Minimum total thickness of finished coating shall be as under:

The polyethylene coating shall conform B3 class coating except otherwise specified. The total thickness of the applied coating for all diameters of pipes shall be as mentioned as per ISO/DIS – 21809-1.

For OD 6" = 3.1 mm

Negative tolerance in total coating thickness on pipe body & weld seam shall not be allowed.

9.2.3 Coating materials shall be inspected in accordance with the manufacturer's recommendation prior to coating application and it shall be ensured that the materials are moisture free. In case the relative humidity exceeds 80%, the adhesive and polyethylene material shall be dried using hot dry air as per the directions of Owner's Representative.

9.2.4 Prior to starting the application of fusion bonded epoxy powder, the recovery system shall be thoroughly cleaned to remove any unused powder remaining from a previous line pipe coating application. The use of recycled powder shall be permitted subject to:

a) Satisfactory qualification of the reclaimed system during PQT stage.

b) The proportion of the reclaimed powder in the working mix does not exceed 20% at any one time.

c) The quality of the recycled powder being routinely checked during production, at a minimum frequency of once per shift and consistently meets the requirements stated at para 5.3.1.

9.2.5 Dry air, free of oil and moisture shall be used in the coating chamber and spraying system and filters, dehumidifier/dryer as required along with control & monitoring system shall be provided for this purpose. Dew point of air used to supply the fluidized bed, epoxy spray system and epoxy recycling system shall be at least (–) 40°C and this shall be shall be monitored during the regular production.

9.2.6 Air pressure in the epoxy spray guns shall be controlled, continuously monitored and recorded by using suitable instruments. The air pressure shall be controlled within the limits established during coating procedure qualification. The monitoring system shall be able capable of raising an alarm / activate audio system (hooter) in the event of change in air pressure beyond the set limits. Any deviation from the pre-set limits shall be rectified. If immediate rectification is not feasible, the production shall be stopped until cause of deviation has been removed. Any pipe coated during the duration of air pressure deviation shall be identified by suitable marking and rejected. Such rejected pipes shall be stripped and recoated.

9.2.7 Extruded adhesive layer shall be applied before gel time of the epoxy coating has elapsed and within the window recommended by the manufacturer. The Contractor shall establish, to the satisfaction of the Owner's Representative, that the adhesive is applied within the gel time window of epoxy and at the temperature recommended by the adhesive manufacturer. The Contractor shall state the minimum and maximum time interval between epoxy and adhesive application at the proposed pre-heat temperature and line speed.

9.2.8 Extruded polyethylene layer shall be applied over the adhesive layer within the time limit established during PQT stage and within the time/temperature range recommended by the manufacturer. The extrusion temperatures of the adhesive and polyethylene shall be continuously monitored however, recording shall be done once/30 min. The monitoring instruments shall be independent of the temperature control equipment. "The instruments shall be verified for correctness of working, prior to start of each shift. Records of valid calibration in NABL accredited laboratory shall be produced for review of inspection authorities".

9.2.9 Contractor shall ensure that there is no entrapment of air or void formation along the seam weld (where applicable) during application of coating. Air entrapment below the coating and also along the coating overlap shall be prevented by forcing the coating on to the pipe using high pressure roller of suitable design during coating application. In case it is not adequately achieved, Contractor shall supplement by other methods to avoid air entrapment. The methods used shall be witnessed and approved by Owner.

9.2.10 Resultant coating shall have a uniform gloss and appearance and shall be free from air bubbles, wrinkles, holidays, irregularities, discontinuities, separation between layers of polyethylene & adhesive, etc.

9.2.11 Coating and/or adhesive shall terminate at the below mentioned distance from pipe ends:

S. No.	Pipeline Size	Coating cut back length
1	Above 24" NB	150 mm +10 mm / (-)0 mm
2	4" NB to 24" NB	110 mm +10 mm / (-)0 mm

The adhesive shall seal the end of applied coating. Contractor shall adopt mechanical brushing for termination of the coating at pipe ends. Edge of the coating shall be shaped to form a bevel angle of 30° to 45°.

A single coat of varnish of minimum 50 micron shall be applied on external cut back area of both ends in order to prevent rust on pipe surface during transportation and storage.

9.2.12 Failure to comply with any of the above applicable requirement and of the approved procedure shall be cause for the rejection of the coating and such coating shall be removed in a manner approved by Owner at Contractor's expense.

10.0 INSPECTION AND TESTING

10.1 Plant Scale and Installation

10.1.1 Contractor shall size coating plant(s) after evaluating the scale of work and the time schedule required for the works. For this purpose the Contractor shall ensure non-stop work execution owing to prohibitive adverse weather conditions and install requisite equipment and plant in roofed and adequately weather-protected areas.

10.1.2 Plant equipment, machinery and other facilities shall be in first class operating condition to at least meet the job requirements of quality and production. Worn out and improvised plants are not acceptable.

10.1.3 The Contractor shall, at his own responsibility and cost, provide and prepare all necessary area for the storage of bare and coated pipe and all other materials, for coating yard, stock-piling and other temporary installation.

10.1.4 The Contractor shall at its own responsibility and cost, provide for water and power supply and other utilities and consumables and obtain authorization regarding access roads and other permits required for the execution of works conforming to all the requirements of the governing Authorities.

10.1.5 The Contractor shall at its own expense provide a fully equipped laboratory and test facilities with adequate inventory to carry out tests required for the procedure qualification and regular production. Outside testing for qualification and regular production is not acceptable to Owner.

10.1.6 The Contractor shall be fully responsible for adherence to all statutory regulations applicable for handling and disposal of the hazardous chemicals during the coating works. Also, he shall be responsible for obtaining all statutory approvals/clearances from relevant Authorities including Pollution Control Board, as applicable for the coating plant(s).

10.1.7 The Contractor has to select the Applicator from the Vendor list specified elsewhere in the Tender document

10.2 Coating

The Contractor shall establish and maintain such quality assurance system as are necessary to ensure that goods or services supplied comply in all respects with the requirements of this specification. The minimum inspection and testing to be performed shall be as indicated subsequently herein. All the inspection & testing shall be performed under the supervision of NACE level-II certified inspector. Applicator's QA/QC in-charge shall be an engineering graduate having at least 5 years of experience in 3LPE coating application.

10.2.1 Visual Inspection

Immediately following the coating, each coated pipe shall be visually checked for imperfections and irregularities of the coating. The coating shall be of natural color and gloss, smooth and uniform and shall be blemish free with no dust or other particulate inclusions. The coating shall not show any defects such as blisters, pinholes, scratches, wrinkles, engravings, cuts, swellings, disbonded zones, air inclusions, tears, voids or any other irregularities. Special attention shall be paid to the areas adjacent to the longitudinal weld (if applicable), adjacent to the cut-back at each end of pipe and within the body of the pipe.

In addition inside surface of the pipe shall also be visually inspected for presence of any foreign material or shots and grit (free or embedded/sticking to pipe inside surface). The pipe inside surface shall be examined using sharp floodlight focused at the middle of the pipe at one end while inspection is carried out visually from other end.

10.2.2 Coating Thickness

a. The coating thickness shall be determined by taking at least 10 measurements at locations uniformly distributed over the length and periphery of each pipe. In case of welded pipes, five of the above readings shall be made at the apex of the weld seam, uniformly distributed over the length of the coated pipe. All readings must meet the minimum requirements.

b. Thickness of epoxy and adhesive shall be measured at the beginning of each shift and whenever the plant re-starts after any stoppage for compliance. Coating of epoxy and adhesive on portion of pipe required for this purpose, stripping and recoating of such partly coated pipes shall be at Contractor's expense.

c. Coated pipes not meeting the above requirements shall be rejected. Rejected coated pipes shall be stripped and re-coated in accordance with approved procedure, at Contractor's expense.

10.2.3 Holiday Detection

a. Each coated pipe length shall be checked over 100% of coated surface by means of a "holiday detector" of a type approved by Owner for detecting holidays in the finished coating.

b. The holiday detector shall be a low pulse D.C. full circle electronic detector with audible alarm and precise voltage control complying with Annex B of ISO 21809-1. The set voltage for inspection shall be minimum 25 kV. Travel speed shall not exceed 200 mm/s.

c. Contractor shall calibrate the holiday detector at least once every 4 hours of production. Contractor shall have necessary instruments or devices for calibrating the holiday detector.

d. Any pipe coating shall be rejected if more than 1(one) holiday & area more than 100 cm^2 in size are detected in its length attributable to coating process.

e. Holidays, which are lesser in size than those mentioned in (d) above, shall be repaired in accordance with an approved procedure and shall be at Contractor's expense.

f. All pipes leaving coating plant shall have sound external coating with no holiday or porosity on 100% of the surface.

10.2.4 Bond Strength (Peel Test)

a. Contractor shall conduct bond strength test for composite coating as per sl. no. (a) of table in clause no. 5.3.3 of this specification. A minimum of 65 mm length shall be peeled. First 20 mm and last 20 mm shall not be counted for assessment of bond strength.

b. The frequency of test shall be one pipe in every fifteen (15) pipes coated. On each selected pipe, bond strength shall be performed for each specified temperature. Test shall be performed at each cut back portion and one in the middle of pipe. The system shall disbond/separate cohesively either in adhesive layer or in polyethylene layer as described in ISO 21809-1 Table 7, Note C. Majority of the peeled off area on the pipe shall show presence of adhesive. Disbondment/separation at epoxy to steel interface or epoxy / adhesive interface or adhesive / polyethylene interface shall not be permitted. The failure mode shall be recorded for each test.

c. In case the test fails to comply the specified requirement, the Contractor shall test the preceding and succeeding coated pipe. If both pipes pass the test, then the remainder of the pipe joints in that shift shall be deemed satisfactory. If either pipe fails to meet the specified requirements, all pipes coated during that shift shall be tested until the coating is proved acceptable. Rejected coated pipes shall be stripped and re-coated in accordance with approved procedure, at Contractor's expense.

d. Depending upon the consistency of result, the frequency of bond strength test as per Para 10.2.4 (b) for cut back portion may be reduced to one pipe in every twenty five (25) instead of every 2 hrs, at the sole discretion of the Owner’s Representative.

10.2.5 Impact Strength

a. Impact strength test shall be conducted as per sl. no. (b) of table in clause no. 5.3.3 of this specification. Initially the frequency of test shall be two (2) coated pipes per shift as per approved QAP.

b. Minimum thirty (30) impacts located equidistant along the length of coated pipe shall be performed.

c. Immediately after testing, the test area shall be subjected to holiday detection at the same voltage as used prior to impact strength test. The pipe shall be rejected if any holiday is noted in the test area.

Impact Strength Test shall be carried out at every change in batch of PE.

In case of test failure, retesting and disposal of coated pipe shall be as per Para 10.2.4 (c) above.

10.2.6 Indentation Hardness

a. Indentation hardness test shall be as per clause sl. no. (c) of table in clause no. 5.3.3 of this specification. The frequency of test shall be initially 2 (two) coated pipes per shift as per approved QAP. Two samples for each temperature shall be taken from the cut back portion of coated pipe and one in the middle of the pipe for this test.

b. Indentation Hardness Test shall be carried out at every change in batch of PE.

c. In case of test failure, retesting and disposal of coated pipe shall be as per Para 10.2.4(c) above.

10.2.7 Air Entrapment Test

a. Strips from bond strength tests (peel test) or coated pipe may be used to help determine the porosity of the finished coating. Strip shall be also cut from longitudinal weld (if applicable) at cut back portion and examined for the presence of voids.

b. Bond strength strip shall be viewed from the side and at the failure interface. At the pipe bond strength test location, utility knife shall be used to cut the edge of the coating to a 45° angle and view with a microscope. Similar examination shall be done in the coating cut back area.

c. One sample each either on the bond strength strip or coated pipe and strip cut from the longitudinal weld (if applicable) shall be examined for air entrapment per shift. Strips shall be viewed from the side.

d. All examination shall done using a 30X magnification hand-held microscope. The polyethylene and adhesive layers shall have no more than 10% of the observed area taken up with air entrapment (porosity or bubbles). Air entrapment shall not occupy more than 10% of the thickness in each case. Bubbles shall not link together to provide a moisture path to the epoxy layer.

e. In case of test failure, retesting and disposal of coated pipe shall be as per Para 10.2.4 (c) above.

10.2.8 Degree of Cure

a. Epoxy film samples shall be removed from cut back portion of the coated pipe using hammer and cold chisel and the samples shall be taken for cure test using DSC procedure. Silicon coated sulphite paper shall be placed between the epoxy layer and adhesive layer immediately after epoxy application, to ensure physical separation of epoxy & adhesive as well as to prevent contamination of epoxy with adhesive layer, at a location from where the epoxy samples are to be removed for the test. Care shall be taken to remove the samples of full film thickness avoiding inclusion of steel debris. Glass transition temperature differential (Tg) and % cure (H) shall comply the specified requirements.

b. 1st pipe shall be subjected to this test and thereafter frequency shall be once per shift. Pipe shall be selected randomly by Owner Representative during the middle of a shift. Suitable provisions/arrangements as per the instructions of Owner's Representative shall be made by the Contractor for this purpose

c. In case of test failure, production carried out during the entire shift shall be rejected, unless the Contractor proposes a method to establish the compliance with the degree of cure requirements of all pipes coated during that shift.

10.2.9 Epoxy Layer Adhesion Test

a. Adhesion of epoxy layer shall be determined at ambient temperature using method specified in clause 7.5.1 (e)

b. Frequency of this test shall be once per shift. The test shall be carried out at the cut back portion on the pipe from which the Degree of Cure test has been carried out as per Para 10.9 above

c. In case of test failure, retesting and disposal of coated pipe shall be as per Para 10.2.8(c) above.

10.2.10 Cathodic Disbondment Test

a. CD test shall be conducted as per sl. no. (f) of table in clause no. 5.3.3 of this specification.

b. The frequency of this test shall be

<u>During PQT</u>:

i. One test sample shall be carried out for 28 days at 23 ± 3°C.

ii. One test sample shall be carried out 24 hrs, at 65 ± 3°C.

iii. One test sample shall be carried out 28 days, at Tmax (80) ±3°C.

<u>Regular production:</u>

ii. One test sample per 2 week or once per every batch of epoxy powder whichever is more frequent shall be carried out 24 hrs, (65±3) °C to be performed.

c. In case the test fails to conform to the specified requirement, all pipes coated after the previous acceptable test and prior to next acceptable test shall be rejected or the test shall be repeated using two additional samples taken from the same end of the affected pipe.

d. When both retests conform to the specified requirement, the lot of pipes shall be accepted. When one or both the retests fail to conform to the specified requirement, all coated pipes after previous acceptable test and prior to next acceptable shall be rejected. All rejected pipes shall be stripped, re-cleaned and re-coated. Owner may consider a further retest program to determine whether any of the affected pipe meet the criteria for acceptance upon written request by the Contractor.

10.2.11 Elongation at break

a. Elongation at break shall be carried out as per sl. no. (d) of table in clause no. 5.3.3 of this specification.

b. The test frequency shall be once for each batch of PE.

c. In case the test fails to comply with the specified requirement, the Contractor shall test the two preceding and two succeeding coated pipe. If both pairs of pipes pass the test, then the remainder of the pipes in that batch shall be deemed satisfactory. If any of these four (4) pipes fails to meet the specified requirements, all pipes coated with that batch of PE shall be tested until the coating is proved acceptable. Rejected coated pipes shall be stripped and re-coated in accordance with approved procedure, at Contractor's expense.

10.2.12 Hot water immersion

a. Hot water immersion shall be carried out as per requirement of clause sl. no. (h) of table in clause no. 5.3.3 of this specification.

b. The test frequency shall be once per day.

c. In case the test fails to comply with the specified requirement, the Contractor shall test the two preceding and two succeeding coated pipe. If both pairs of pipes pass the test, then the remainder of the pipes in that day shall be deemed satisfactory. If any of these four (4) pipes fails to meet the specified requirements, all pipes coated in that day shall be tested until the coating is proved acceptable. Rejected coated pipes shall be stripped and re-coated in accordance with approved procedure, at Contractor's expense.

10.3 Damages occurring to pipe coating during above tests shall be repaired in accordance with approved coating repair procedure.

10.4 Repairs occurring on account of the production tests are however excluded from above mentioned limitations at Para 10.2.3(d) above.

10.5 Owner reserves the right to perform inspection and witness tests on all activities concerning the pipe coating operations starting from bare pipe to finished coated pipe ready for dispatch and also testing of raw materials. Contractor shall give reasonable notice of time and shall provide without charge reasonable access and facilities required for inspection to the Owner’s representative. Inspection and tests performed or witnessed by Owner’s representative shall in no way relieve the Contractor’s obligation to perform the required inspection and tests.

10.6 In case rate of defective or rejected pipes and/or samples tests are 10% or more for a single shift (typically 8 hours), Contractor shall be required to stop production and carry out a full and detailed investigation and shall submit findings to Owner for approval. Contractor shall recommence the production only after getting the written permission from Owner.

Under no circumstances any action or omission of the Owner’s Representative shall relieve the Contractor of his responsibility for material and quality of coating produced. No pipes shall be transported from the coating plant unless authorised by Owner in writing.

11.0 HANDLING, TRANSPORTATION AND STORAGE

11.1 The Contractor shall be fully responsible for the pipe and for the pipe identification.

All pipes shall be checked for bevel damages, weld seam height, dents, gouges, corrosion and other damages. Owner Representative shall decide whether pipe defects / damages are suitable for repair. Damage to the pipes that such as dents, flats, or damage to the weld ends shall be cut off or removed and pipes rebevelled and repaired again as necessary. All such works shall be carried out after written approval of the Owner. Any reduction in length shall be indicated in the Contractor's pipe tracking system.

11.2 The Contractor shall stockpile the bare pipes at the storage area of the coating plant. They shall prepare and furnish to Owner a procedure/calculation generally in compliance with API RP-5L1 & API RP 5LT and prevailing guidelines/rules of statutory bodies (Road/ rail) for stacking of pipes of individual sizes, which shall be approved by Owner prior to commencement.

11.3 Coated pipes may be handled by means of slings and belts of proper width (minimum 60 mm) made of non-abrasive/non-metallic materials. Pipes to be stacked shall be separated row by row to avoid damages by rubbing the coated surface in the process of taking off the slings. Use of round sectional slings is prohibited. Fork lifts may be used provided that the arms of the forklift are covered with suitable pads, preferably rubber.

11.4 Bare/coated pipes at all times shall be stacked completely clear from the ground, at least 500 mm, so that the bottom row of pipes remain free from any surface water. The pipes shall be stacked at a slope so that driving rain does not collect inside the pipe. Bare/coated pipes may be stacked by placing them on ridges of sand free from stones and covered with a plastic film or on wooden supports provided with suitable cover. This cover can be of dry, germ free straw covered with plastic film, otherwise foam rubber may be used. The supports shall be spaced in such a manner as to avoid permanent bending of the pipes.

Stacks shall consist of limited number of layers such that the pressure exercised by the pipe's own weight does not cause damages to the coating. Contractor shall submit calculations for Owner approval in this regard. Each pipe section shall be separated by means of spacers suitably spaced for this purpose. Stacks shall be suitably secured against falling down and shall consist of pipe sections having the same diameter and wall thickness. The weld seam of pipes shall be positioned always in a manner so as not to touch the adjacent pipes.

The ends of the pipes during handling and stacking shall always be protected with bevel protectors.

11.5 The lorries used for transportation shall be equipped with adequate pipe supports having as many round hollow beds as there are pipes to be placed on the bottom of the flat bed type lorry/ trailer. Total width of the supports shall be at least 5% of the pipe length and min. 4 nos. support shall be provided. These supports shall be lined with a rubber protection and shall be spaced in a manner as to support equal load from the pipes. The rubber protection must be free from all nails and staples where pipes are in contact. The second layer and all following layers shall be separated from the other with adequate number of separating layers of protective material such as straw in plastic covers or mineral wool strips or equivalent, to avoid direct touch between the coated pipes.

All stanchions of lorries used for transportation shall be covered by non-abrasive material like rubber belts or equivalent. Care shall be exercised to properly cover the top of the stanchions and other positions such as reinforcement of the truck body, rivets, etc. to prevent damage to the coated surface. Slings or non-metallic straps shall be used for securing loads during transportation. They shall be suitably padded at the contact points with the pipe.

11.6 Materials other than pipes and which are susceptible of deteriorating or suffering from damages especially due to humidity, exposure to high thermal excursions or other adverse weather conditions, shall be suitably stored and protected. Deteriorated materials shall not be used and shall be replaced at Contractor's expenses. These materials shall always be handled during loading, unloading and storage in a manner so as to prevent any damage, alteration and dispersion. When supplied in containers and envelopes, they shall not be dropped or thrown, or removed by means of hooks, both during the handling operations till their complete use. During

unloading, transport and utilization, any contact with water, earth, crushed stone and any other foreign material shall be carefully avoided.

Contractor shall strictly follow Manufacturer's instructions regarding storage temperature and methods for volatile materials that are susceptible to change in properties and characteristics due to unsuitable storage. If necessary the Contractor shall provide for a proper conditioning.

11.7 In case of any marine transportation of steel plates/bare/coated line pipes involved, the same shall be carried out in compliance with API RP 5LW. Contractor shall furnish all details pertaining to marine transportation including drawings of cargo barges, storing/stacking, sea fastening of pipes on the barges/marine vessels to the Owner for approval prior to undertaking such transportation works. In addition Contractor shall also carry out requisite analyses considering the proposed transportation scheme and establish the same is safe and stable. On-deck overseas shipment shall not be allowed.

12.0 REPAIR OF COATING

Contractor shall submit to Owner, its methods and materials proposed to be used for executing a coating repair and shall receive approval from Owner prior to regular production. In open storage the repair coating materials must be able to withstand a temperature of at least (+) 80°C without impairing its serviceability and properties. Contractor shall furnish manufacturer's test certificates for the repair materials clearly establishing the compliance of the repair materials with the applicable coating requirements indicated in this specification.

All pipe leaving coating plant, shall have sound external coating with no holiday or porosity on 100% of the surface.

Defects, repairs and acceptability criteria shall be as follows:

- Pipes showing porosities or very small damage not picked up during holiday test and having a surface less than 0.5 cm2 or linear damage (cut) of less than 3 cm shall be repaired by PE/PP stick using material of same quality.
- Damages caused to coating by handling such as scratches, cuts, dents, gouges, not picked up during holiday test, having a total reduced thickness on damaged portion not less than 2 mm and an area not exceeding 10 cm2 shall be rebuild by heat shrink patch only and without exposing to bare metal.
- Defects of size exceeding above mentioned area or holidays of width less than 300 mm shall be repaired with heat shrink repair patch by exposing the bare metal surface.
- Defects exceeding the above and in number not exceeding 1 per meter length of pipe and not exceeding 500 mm shall be repaired using heat shrinkable sleeves of HTLP 80 or equivalent.
- More than two (02) repairs are not allowed in single length of pipe and cumulative area for these repairs shall not exceed 100cm2 per pipe.
- Pipes with bigger damage shall be stripped and recoated.
- No Circumferential sleeve (full encirclement) repair is permitted within 100 mm length of the coating cut back area.

Irrespective of type of repair, the maximum numbers of repair of coating shall be as follows:

- Holiday repair of size 100 cm2 attributable to process of coating application shall be maximum one number per pipe.
- In addition to the above, defects to be repaired by heat shrink patch/sleeve shall be maximum 1 (two) per pipe.

Defects exceeding the above limits shall cause pipe coating rejection, stripping and recoating. The above is exclusive of the repairs warranted due to testing as per this specification.

All repairs carried out to coating for whatever reason shall be to the account of Contractor.

Cosmetic damages occurring in the polyethylene layer only need not be repaired by exposing up to steel surface, as deemed fit by the Owner Representative. In any case the Contractor shall establish his material,

methods and procedure of repair that result in an acceptable quality of product by testing and shall receive approval from Owner prior to use.

Testing of repairs shall be in the same form as testing coating. All repairs shall result in a coating thickness no less than the parent coating thickness. Contractor shall test repairs to coating as and when required by Owner.

Repair procedures/ process shall be qualified during PQT.

Only qualified insulator shall allowed to conduct the repair work and all repaired pipes shall be identified by indicating alphabet 'R' after the coating number.

13.0 MARKING

Contractor shall place marking on the outside surface of the coating at one end of the coated pipe, and marking shall indicate, but not limited to the following information:

a. Pipe number, Heat number

b. Pipe diameter, material grade, length & wall thickness

c. Coated pipe number

d. Colour band

e. Any other information considered relevant by Owner.

f. Pipe Manufacturer Name

g. Inspection Mark/Punch

Contractor shall obtain prior approval on marking procedure to be adopted from the Owner.

14.0 QUALITY ASSURANCE

14.1 The Contractor shall have established within his organization and, shall operate for the contract, a documented Quality System that ensures that the requirements of this specification are met in all aspects. The Quality System shall be based upon ISO 9001 or equivalent.

14.2 The Contractor shall have established a Quality Assurance Group within its organization that shall be responsible for reviewing the Quality System and ensuring that it is implemented.

14.3 The Contractor shall submit the procedures that comprise the Quality System to the Owner for agreement.

14.4 The Contractor's Quality System shall pay particular attention to the control of Suppliers and Sub-contractors and shall ensure that the requirements of this specification are satisfied by the Suppliers and Sub-contractors operating Quality system in their organization.

14.5 The Contractor shall, prior to the commencement of work, prepare and issue a Quality Plan for all of the activities required to satisfy the requirements of this specification. The plan shall include any sub-contracted work, for which the sub-contractors Quality Plans shall be submitted. The plan shall be sufficiently detailed to indicate sequentially for each discipline the requisite quality control, inspection, testing and certification activities with reference to the relevant procedures and the acceptance standards.

14.6 The Contractor's Quality system and associated procedures may, with due notice, be subject to formal audits. The application of quality control by the Contractor will be monitored by the Owner Representatives who will witness and accept the inspection, testing and associated work required by this specification.

14.7 The coating pipe mill shall have internal tracking system for pipe traceability during regular coating to reduce manual interference. SAP/ERP base system is preferred.

ANNEXURE-I

LIST OF ACCEPTABLE COMBINATIONS OF COATING MATERIALS

The following combinations of coating materials are considered acceptable. In case any of the combinations listed below are offered, details regarding properties of the offered materials need not be furnished with bid. However, In the event of award of contract, Contractor shall furnish the combination(s) proposed and re-confirmation of compatibility of the proposed combination (s) from the raw materials Manufacturers.

Epoxy Powder (Manufacturer)	**Adhesive (Manufacturer)**	**PE Compound (Manufacturer)**
CORRO-COAT EP-F 2001 (JOTUN)	FUSABOND 158D (DUPONT)	SCLAIR 35 BP HDPE (NOVACOR)
CORRO-COAT EP-F 2002HW (JOTUN) or SCOTCHKOTE 226N (3M)	LUCALEN G3710E (LYONDELLBASELL)	LUPOLEN 4552 D SW 00413 (LYONDELLBASELL)
PE 50-6109 (BASF) or CORRO-COAT EP-F 2001/2002HW/1003HW (JOTUN) or SCOTCHKOTE 226N (3M)	ME 0420 (BOREALIS)	HE 3450 (BOREALIS / BOROUGE)
CORRO-COAT EP-F 2001 (JOTUN)	LE – 149 V (HYUNDAI ENGINEERING PLASTICS)	ET 509 B (HYUNDAI ENGINEERING PLASTICS)

Although the above combinations would be acceptable to Owner, the responsibility of suitability for application, performance and compliance to the coating system requirements shall unconditionally lie with the Contractor.

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ANNEXURE-2

LOFC: LIST OF OPERATION OF FABRICATION AND CONTROL

Each LOFC must contain the following information as a minimum (all clearly marked and separated):

a) Company name and references relating to the order;
All technical and other information required in order to define the items covered.

- The area of application will be limited to that item or those items considered in fabrication and control as a natural unity.
- Details of plants, layout, capacity, production rate, testing equipment, yard facility.

A numerical sequence of operations with description will be built-up in a logical way of work progress.

- The first operation will be the control over the incoming material(s) and documents.
- The last operation will be the control over the final documentation.

The following operations have to be included (not limited to):

- Procedure prior to the commencement of production shall be approved by PURCHASER
- Each step which calls for own quality control (eventually QA);
- Each applicable examination as part of this specification;
- Document controls – stamping and final documentation

Each operation will be followed by the applicable specification or procedure number (with the latest revision).

Columns to be provided for possible interventions of :

The Coater's fabrication control;

The Coater's quality control (eventually QA);

Third Party Inspection Agency;

And place of intervention if not by the Coater.

The interventions will be indicated per operation with H or W and/or R.

H = hold point – no further steps may be undertaken before the intervention of the designated responsible takes place.

W = witness point – the designated responsible has to be notified of the operation in advance, but production will continue whether the intervention took place or not.

R = point for which a control report or a recording has to be made.

The Coater will fill in his own H, W and R Points. The inspection Agency will do the same in its designated column, but this will not implicate a relaxation or wearing of the requirements of the Coater's controls.

Each intervention has to be signed and dated by the person acting as controller. Only the original documents will be presented for this purpose.

One column to be provided for report or record numbers (points marked R) and one for the review of these documents by the Third Party inspection Agency.

Two extra columns may give reference to a non-conformity report if any ad to the resolution given to it.

Completion of the LOFC does not automatically rise to a release of the material or it must be stipulated otherwise I the contract.

The steps indicated in the LOFC must be executed following the sequence as stipulated in the LOFC.

--Z-Z-Z

ANNEXURE-3

TECHNICAL SPECIFICATIONS FOR PIPE END PROTECTION

1.0 PURPOSE

The purpose of this specification is to ensure protection of cut back portion of 3LPE coated line pipes.

The specification defines the requirement of cut back protection, application of primer/ varnish, materials and the procedure for application of End Seal Tape in the plant or in field, metallic bevel end protector and pipe end cap.

2.0 SPECIFICATION

1) FBE band : A 20 ±5 mm band of epoxy Coating to be maintained in cut-back portion.

2) End Seal tape on transition area.

The main purpose of the system is to prevent external pipe coating systems from absorbing moisture and UV-radiation at the cutback area and decrease the risk of coating disbandment from coating/steel transition area during storage period.

a. Coverage:

End Seal Tape to be applied over the coating/steel transition area with minimum 50 mm (2 inch) overlap on coating and 50 mm (2 inch) beyond the cutback or FBE toe on steel portion. i.e total 75 mm(3 inch) considering 20±5 mm FBE toe on steel portion.

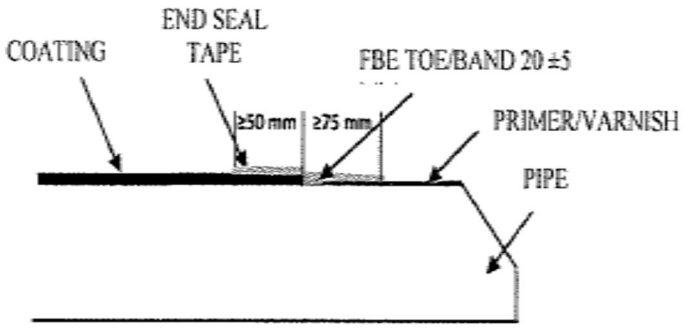


Fig 1 : End seal tape, FBE and primer/ varnish arrangement

b. Method of application:

- The coating cutback and the pipe end shall be dry and clean, and free from any visible contaminants. All moisture must be expelled from the pipe surface prior to the application of the End Seal System. For this if required the steel surface shall be warmed above the dew point temperature for a sufficient period of time as to expel all moisture on the pipe.

- The bare steel pipe on which end seal tape is to be applied shall be free of mud, mill lacquer, wax, oil, grease, rust, mill scale, and any other foreign material that prevents the system from bonding to the steel surface. Prior to surface cleaning, the pipe surface shall be inspected and, if required, pre-cleaned according to SSPC-SP-1 specification to remove oil, grease, and/or loosely adhering deposits. Visible oil and grease shall be removed by use of a suitable solvent.

- It shall be ensured that end seal tape at pipe transition area is applied as soon as possible after creation of cut back of 150 mm +25/ (-) 0 mm on each pipe end so that there is no rusting and minimal requirement of cleaning before application of end seal tape. If required before application of end seal tape the pipe surface shall be cleaned to achieve a minimum surface finish as per SSPC-5P3 or Swedish Standard St3.

- The end seal tape shall be applied on the transition area directly to the steel pipe surface. A tight, smooth, wrinkle-free coating shall be maintained throughout the application. At the time of application the steel or coating temperature shall not be above 50°C.

- The End Seal Tape shall be applied at least 50mm (2") from coating cutback to at least 50mm (2") beyond the cutback or the FBE toe, i.e. minimum total length of 125 mm (5"), considering 20 ±5 mm FBE toe on steel portion. Apply 2 full wraps at start and end, with an spirally applied overlap of at least 50% at body.

- The end lap of the splice of each new roll shall overlap the end of the preceding roll by a minimum of 6 inches (153 mm). The end lap splice shall be mechanically applied to insure a wrinkle free splice which maintains the continuity of the anticorrosion layer. The spiral angle of the new roll shall parallel the previous roll's spiral angle.

- Use standard tape application with moderate tension. Ensure that no air is trapped under the tape during installation. Void or entrapped air underneath the tape, if any, shall be worked out using gloved hand or a roller in order to enhance contact. Repair any damage or puncture to the tape during application, handling or the storage of taped pipes by removing and replacing the tape. This is done by removing and replacing the tape or over coating with additional tape if no water penetration has occurred.

c. Specification:

The tape should be of PVC make and should have adhesive which adheres quickly to most surfaces yet can be removed leaving little or no traceable residue. The tape should meet following requirements:

SL. NO.	DESCRIPTION	REQUIREMENT	TEST METHOD / REMARKS
1	Material	PVC (Polyvinylchloride)	
2	Adhesive Type	Rubber-based	
3	Thickness (min)	≥0.15 mm	
4	Width	50 – 75 mm	
5	Adhesion to Steel	≥0.01 kgf/ mm	ASTM D-3330
6	Tensile Strength	≥0.20 kgf/ mm	ASTM D-3759
7	Elongation	≥150 %	

d. Inspection & repair:

· The end seal tape system shall be electrically tested for flaws in the coating with a suitable holiday detector conforming to NACE SP0188-2006.

· Electrical holiday inspection shall be performed on the system upon completion of the coating operation but prior to storage in the coating yard. All holidays electrically detected shall be marked and immediately repaired.

e. Prior to use the applicator/ contractor shall submit the data sheet and type test report for the end seal tape being used.

f. Manufacturer's guidelines on storage and handling of tape shall be followed.

g. Following are the approved manufacturer for the end seal tape:

1) M/s Dhatec

2) M/s Seal For Life (Formerly Berry Plastics)

In case other equivalent make/ manufacturer are proposed by applicator / contractor the equivalent make should comply with the requirement of this specification and credentials of manufacturer for previous application for pipe coating cut back protection in hydrocarbon industry, date sheet, details, tape application & removal procedure, test reports, etc. are to be submitted for prior approval.

h. Removal of end seal tape:

· If the end seal tape is required to be removal the same should be done when the pipe temperature is below 35°C with the aid of spatula or as per manufacturer's recommendations, low temp during removal should ensure minimal trace of adhesive residue. Any trace of adhesive resides on pipe/ coating should be readily removable by a solvent wipe, wire brush, or by blasting prior to the field joint coating application.

· If adhesive residual removal is required prior to blasting, it can be readily achieved by natural weathering (tape removed two weeks prior to field – jointing), mechanical means or with the use of an appropriate solvent or detergent (should weathering not be an option).

i. Manufacturer's recommendation on application and removal procedure of end seal tape should be submitted by applicator/contractor.

3.0 Primer/Varnish on cut back area

The uncoated ends shall be protected with compatible primer/ varnish. Applicator/Contractor shall furnish details for the same for approval of Owner and/or TPIA. The pipe surface shall be free of mud, mill lacquer, wax, oil, grease, rust, mill scale, and any other foreign material that prevents the system from bonding to the steel surface. If required the pipe surface shall be cleaned to achieve a minimum surface finish as per SSPC-SP3 or Swedish Standard St3.

4.0 Metallic Bevel Protector

All line pipe ends should be protected by fitting metallic bevel end protectors, so that adequate protection is given to the pipe ends. The bevel protector should be designed for absorbing impact forces and offer protection to bevel end in the handling process. Some additional quantity of bevel protector shall be made available at each storage location, which can be used in case of missing protectors before loading/unloading. The bevel protector should have minimum clamping depth of 45 mm and shall be suitable for tightening and clamping the pipe plug. The bevel protector should have a minimum thickness of 1 mm. The bevel protector should have an arrangement of clamping clip for proper tightening.

5.0 Pipe Plug

A recessed PVC plug is to be provided at both ends of the pipe. The plug should be suitable for dusty and rainy conditions. The plug on application along should not allow ingress of dust or water inside the pipe.

ERRATA to

GENERAL TECHNICAL SPECIFICATION (GTS) No : 740/GTS/404 – LINE PIPES SPECIFICATION

Para 4.53: Replace § 9.8.5 by § 9.8.3

Para 9.11.3.3: Typo - the word API %L to be replaced by API 5L

Para 9.12.1.: Typo - the “100” to be deleted

Para 12.2: Typo – the word eliding to be replaced by welding

LINE PIPES SPECIFICATION

FOR GAS TRANSMISSION AND DISTRIBUTION PIPING SYSTEM

ONSHORE SERVICE

Rev.	Date	Subject of revision	Author	Checked	Approved
5	21/06/13	Updated in conformity with API 5L 45th edition December 2012	MRT	NC	MRT
4	14/09/09	Logo Changed	VA	DNS	NC
3	15/09/08	Logo Changed	PK	DNS	NC
2	06/10/04	Updated in conformity with API 5L edition March 2004	GAR	DKB	DKB
1	04/10/04	Updated in conformity with API 5L edition March 2004	GAR	DKB	DKB
0	03/08/04	Change Company logo and numbering of document	MRY	DKB	MRY

TABLE OF CONTENTS

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.

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 :

  - design factor : See PTS
  - negative tolerance for WT : zero millimeter (0 mm)
  - corrosion allowance : zero millimeter (0 mm) See PTS
  - yield strength : See PTS
  - 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 railwroad according to prevailing legislation. (See PTS).

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.

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.

Specified wall thickness mm	Over thickness of weld deposit in mm
T≤ 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)	¼ 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 ≤ 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.

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 ≥ 0.020 % and when the ambient temperature is $\leq 5^{o}$ C, gas cutting and scarfing of slabs shall be performed at temperature $\geq 120^{o}$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

Add;

Tack welding as applicable in SAHW pipe shall be continuous.

8.6 Weld seams in SAWH pipe

All pipe production shall employ fully automatic equipment. For single –step SAWH 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 $\leq$ 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;

"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
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 l 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;

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

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:

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 (-) 20^0 C & 0^0 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 45^{th} 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 $35j/cm^{2.}$ 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.$28J/CM^2$).

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 -20^0c. (-4^0 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 $35J/cm^2$ .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. $28\ J/cm^2$).

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 $35\ J/cm^{2.}$ 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. $28\ J/cm^2$).

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) Jointers are not permitted. Annex A "Specification for welded jointers" of the API %L 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

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 cheked 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**

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 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 maximun 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.

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:

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).

- 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 $\geq 3^{o}$ to ensure water drainage of the pipes
- Pipes shall be stored at warehouse, thicknesswise and diameterwise.
- 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 (6^{th} 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 (3^{nd} 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 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.

Annex A

(normative)

Specification for welded jointers

Not applicable

Annex B

(normative)

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 sensivity, 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,

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 $\pm$ 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, refer also to Annex Q **"**Purchaser Indicative Inspection and Quality Plan".

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.

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 ≥ 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 ($+68^o$F) to -50^0C (-58^oF) (≥ 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≥ 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≥ 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/mm^2, 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).

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.

Annex C

(normative)

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.

C4.6 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.

C4.7 Repair of defects by welding

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

Annex D

(normative)

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 – 20^0C	1set of 3 specimens	API 5L & present specification clause 10.2.5
	HAZ	Charpy V – 20^0 C	1set of 3 specimens	API 5L & present specification clause 10.2.5
Macrographic examination			1	
Hardness test on macro		HV 10	1	

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.

Annex E

(normative)

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 form 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.

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 $\geq$ 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 $\pm$ 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 ($\pm 5^0$)**
Longitudinal	$t \leq$ 12.7 mm (0.500 in)	ID, Midwall	60^0 or $70^{0(1)}$
	12.7 mm (0.500 in) < $t \leq$ 20 mm (0.75 in)	ID	OD$\leq$ 762mm (30 in) : 45^0 or 60^0 OD>762mm (30 in) : 60^0 or 70^0
		Midwall	60^0 or $70^{0(1)}$

	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 $\geq$ 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 10^0 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 $\leq$ 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
$\leq$ 610 mm (24 in)	$\leq$ 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 = 60^0 When *t*/d > *0.06,angle* = 45^0		

Inspection for transverse imperfections in SAW welds shall be performed with a 45^0 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 15^0

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 $\leq$ 50mm / 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 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

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.

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 $\pm$ 2 Gs (0.2 mT) of Hall-effect gaussmeter readings.

E.7.6 The average of the four readings shall be $\leq$ 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 $\geq$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”.

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).

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.

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 Laminar 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 ≥ 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.

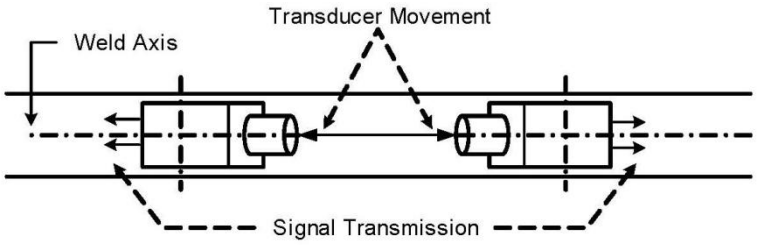
Acceptance level ISO 9765, Table 2, Acceptance Level L2 (1.6 mm through drilled hole) shall be used for longitudinal inspection at the weld centerline and toes, and for transverse inspection at the weld centerline. This applies to both automatic and manual UT inspection. Refer to Tables J and K of this 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 (≤ 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 45^0

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 ≥ 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 60^0 and 70^0 probes shall be used. The weld shall be inspected with the 60^0 probe leg coming from the ID surface and the 70^0 probe leg coming from the OD surface.

B) ID and OD weld toe areas to the approximate center of the respective weld. For pipe wall thickness ≤ 12.7 mm (0.500 in), the probe angle should be 70^0. For pipe wall thickness > 12.7 mm, the probe angle should be 60^0. 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 Laminar 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 laminar imperfections greater than those permitted by Table K.1, Acceptance Criteria for Laminar 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.

Annex Q

(normative)

Purchaser Indicative Inspection and Quality Plan

Σ Σ Σ

TRACTEBEL ENGIE	QUALITY CONTROL TABLE STEEL PLATE / COIL FOR API LINEPIPE (This has to be prepare by the steel manufacturer)	QCT No: P.014714 G11013 M015	
		Date: 30.12.2020	Rev.: 0
		Prepared :AS	Checked : PS
		Approved : NN	

SR. NO.	CONTROL TEST / INSPECTION DESCRIPTION	REFRENCE DOC. / APPLICABLE Spec.	PROCEDURE TEST FREQUENCY	ACCEPTANCE CRITERIA	FORMAT OF RECORD	INSPECTION		
						VENDOR	TPIA	CA
1	MANUFACTURING OF HR COIL / PLATE (STEEL)	API 5L & PTS/GTS.	100%	–Steel shall be made in a basic oxygen or electric arc furnace and shall be continuous cast, fully killed, and fine grained with a grain size of ASTM E-8 or finer as per ASTM - E112. –Carbon Steel Plates as per API 5L(PSL-2) & Owner's Spec.	Manufacturing Procedure & MTC	P	R	R
2	HEAT TREATMENT - HEAT TREATMENT CYCLE	API 5L & PTS/GTS.	100%	As per approved procedure (MPS).	HT Graph	P	RW	R
3	CHEMICAL ANALYSIS a) Ladle Analysis b) Product Analysis	API 5L & PTS/GTS.	LADLE: One per heat PRODUCT:One per heat & Thickness	**CHEMICAL PROPERTIES AS PER API 5L (PSL2) LATEST EDITION. PIPE (MATERIAL) GRADE AS PER MR**	Chemical Analysis report	P	Ladle:R Product:W	Ladle:R Product: R / W
4	TENSILE TEST	API 5L & PTS/GTS.	One per heat & Thickness	**MECHANICAL PROPERTIES AS PER API 5L (PSL2) LATEST EDITION. PIPE (MATERIAL) GRADE AS PER MR.** **For All Grade** **YS/UTS** = 0.87 (However 0.9 MAX) **% EL** = As per MR.	Test Report	P	W	R / W
5	HARDNESS TEST	API 5L & PTS/GTS.	One per heat & Thickness	Hardness shall not exceed 248HV10	Test Report	P	W	R / W
6	FERRITIC GRAIN SIZE	API 5L & PTS/GTS.	One per heat & Thickness	Grain size 8 and finer as per ASTM E112. Optical microphotograph required on magnification of X200, X400	Test Report	P	W	R / W
7	IMPACT TESTING	API 5L & PTS/GTS.	One per heat & Thickness	**ABSORBED ENERGY, MINIMUM** For Base (Refer Note : 9) Test Temp. 0°C, - Average. Value = 60J/cm2 & Individual value = 48J/cm2 **SHEAR AREA FOR BODY:** Average. 85% & INDI. 80% Min.	Test Report	P	W	R / W
8	DROP WEIGHT TEAR TEST	API 5L & PTS/GTS.	One per heat & Thickness	Sample shall be tested at temp.-50°C, -40°C, -20°C, 0°C & 10°c for shear area avg. Shear fracture area shall be 85% minimum at -20°C. (Testing at different temperature is only to establish transition curve)	Test Report	P	W	R / W

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SR. NO.	CONTROL TEST / INSPECTION DESCRIPTION	REFRENCE DOC. / APPLICABLE Spec.	PROCEDURE TEST FREQUENCY	ACCEPTANCE CRITERIA	FORMAT OF RECORD	INSPECTION		
						VENDOR	TPIA	CA
9	ULTRASONIC TEST	API 5L & PTS/GTS.	100% Coil Area Coverage	Plate UT will be carried out as per PTS / GTS / API 5L PSL2 & ISO-10893-9. The entire width and length of HR Coil/Plate shall be Ultrasonic tested by placing array probes on the HR Coil/Plate surface in such a way that it cover 100% of the surface area. The height of indication having amplitude beyond the reference accepted signal height (100% at 80% FSH) is considered as defective indication. All such AUT indication shall be cross checked by manual UT for confirmation. Audio & visual paint mark. Auto UT records shall be maintained in computer. Any lamination exceeding the following will be considered as a defect. **A) For Edge** - any defect with ≥ 40 mm in any direction is unacceptable. - defect with length < 40 mm are acceptable provided the number does not exceed 3 per meter of edge length. Acceptance as per ISO-10893-9 acceptance level U2. **B) For Body** - the requirement for remaining portion of HR Coil/Plate shall be evaluation for their acceptance as per ISO-10893-9 acceptance level U2. **Calibration Block shall be from same grade metal / plate.** **Calibration Block for Plate/Coil** - Slot (8 X 1/2 thick / full width of HR. Coil/Plate). **Calibration Block for Edges/Pipe ends** - shall have 6.4mm dia. FBH of depth 0.5t where "t" is specified wall thickness. **Calibration Frequency** - At the beginning of each operating shift and subsequently than every 4hrs during continuous equipment operation. Every time during the running of system gives rise to doubts on its efficiency.	UT Report	P	W	R / W
10	RETEST	PTS/GTS	If any	In case any of the test specimens fails to conform to specification requirment, a retest of two additional samples from the same heat shall be made. If all the tests give positive results pertaining to all the parameters related to the test then the coil/ plate shall be accepted, otherwise the respecive coil/ plate, which gave negative results, shall be rejected. In case the results of one of the test specimen is negative than at the option of purchaser/ owner either heat may be rejected or each of the remaining coil shall be individually tested. Only those coil/plate, Which satisfy the requirments of this specification shall be accepted.	Retest Report	P	W	R / W
11	**VISUAL & DIMENSIONAL INSPECTION**							
11.1	VISUAL	API 5L & PTS/GTS.	Two Plate per Thickness and Heat.	- Free from defect. - No repair shall be permitted. - Straightness and waviness shall not be acceptable.	Visual Inspection Report	P	RW	R / W
11.2	WIDTH	API 5L & PTS/GTS.	Two Plate per Thickness and Heat.	–0.0/+20 MM	Dimesion Report	P	RW	R / W
11.3	THICKNESS	API 5L & PTS/GTS.		–0.0/+10.0 % (no negative tolerance) by calibrated Ultrasonic Thickness Gauge.				
11.4	CAMBER	API 5L & PTS/GTS.		15 mm per 10 meter for 85% coil length & 25 mm per 10 meter for balance 15% max coil length (head end & tail end).				

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						VENDOR	TPIA	CA
11.5	SURFACE & EDGE	API 5L & PTS/GTS.	100%	no edge cracking permitted.	Test Report	P	RW	R / W
12	MARKING	API 5L & PTS/GTS.	Each Coils at Both Ends	– Bar code sticker on each coil – Manufacturers name, steel grade, size, weight, coil no., heat no., Owner name, TPIA mark etc. –The marking shall be legible. –A color code for grade identification & different colours for thickness identification shall be applied. –Die stamp (Hard Stamp) of TPI/CLIENT of the plates on the side of stenciling.	-	P	W	R / W
13	PROCESS PARAMETER OF CASTING ROLLING	-	100%	Review of data sheet of casting parameters (heat no, date of casting, average casting speed) and rolling parameter (date of rolling, slab no, heat no, steel internal grade , finish rolling temperature, coiling temperature, average . Coil thickness and average Width of coil).	-	P	R	R
14	**FINAL DOCUMENTS**							
14.1	QAP, PO, MTC, IR, PACKING LIST, COMPLIANCE CERTIFICATES	PTS/GTS	Each Dispatched Coil	As per PTS/GTS & QAP.	Compliance Certificate	P	H	R
14.2	INSPECTION RELEASE NOTE, MDCC	PTS/GTS	Each Dispatched Coil	As per EN 10204 3.2 Certification	Compliance Certificate	H	H	R

Legend:	P-Perform, R-Review, RW - Random 10% Witness, W-Witness, H-Hold	M- Monitor, TPIA-Third Party Inspection Agency, CA- Control Authority (Owner / Owner's representative)
	PTS - Particular Technical Specification, GTS - Technical Specification,	MDCC - Material Dispatch Clearance certificate,
	Hold point = No further steps may be undertaken before the intervention of the appointed responsible takes place.	
	Witness point = The appointed responsible has to be notified of the operation in advance, but production will continue whether the intervention took place or not.	

NOTE :	1. Material & Type shall be as Per GTS/PTS/Data Sheet.
	2. TPIA Shall Issue 3.2 Certificates as Per EN 10204.
	3. All measuring instrument shall have valid calibration certificates.
	4. TPIA has to review and sign the process parameters per shift (as recommended sheet) & to send with DPR on daily basis to CLIENT/ PMC.
	6. Damage portion, tongue / tail shall be removed while slitting process.
	8. MPS of Steel Rolling, NDT, transportation and mechanical testing etc. procedure shall be reviewed & approved by TPIA in line with tender specification, pre-bid reply & approved QAP.
	9. This document describes generally the minimum requirements pertaining to all types of the item. Steel manufacturer to generate detailed QAP and submit for review & approval.

TRACTEBEL ENGIE

QUALITY CONTROL TABLE
(ANNEXURE - Q - PURCHASER INDICATIVE INSPECTION AND QUALITY PLAN)
LINE PIPES - HIGH FREQUENCY WELDING (BARE)

QCT No.: QCT No: P.014714 G 11013 016	
Date: 30.12.2020	**Rev.: 0**
Prepared : AS	**Checked : PS**
Approved : NN	

SR. No.	CONTROL TEST/INSPECTION DESCRIPTION	REFF. DOCS./ APPLICABLE SEPC.	PROCEDURE TEST FREQUENCY		ACCEPTANCE CRITERIA	FORMAT OF RECORD	INSPECTION				REMARKS
			PQT/ FDPT	REGULAR PRODUCTION			MANUF. / SUPPLIER	TPIA PQT/ FDPT	TPIA REG. PROD.	CONTROL AUTHORITY (CA)	
0	**CONTROL BEFORE FABRICATION / MANUFACTURING (PROCEDURES)**										
0.1	LOFC (List of operations for Fabrication & Control) procedures (pipe)	PTS / GTS / Standard procedure	-	-	As per PTS / GTS / API 5L.		P	R	R	R & A	
0.2	Technical audit during a sample run	PTS / GTS / API 5L / Standard procedure	-	-	As per PTS / GTS / API 5L.	Audit Report	P	R	R	H	
0.3	Equipment test control / Calibration of manufacturer		-	-	All Instruments shall have valid calibration during pipe manufacturing.	Calibration records	P	R	R	R & A	
0.4	Audit of process of sub-contractor if any		-	-	As per PTS / GTS / API 5 / Vendor specific procedure.	Audit Report	P	R	R	R & A	
0.5	Steel manufacturing procedure		-	-	As per PTS / GTS / API 5 / Approved Steel MPS.	MPS	P	R	R	R & A	
0.6	Heat Treatment procedure (if applicable)		-	-	As per PTS / GTS / API 5 / Approved Steel MPS.	Procedure	P	R	R	R & A	
0.7	Establishment of WPS, PQR (if applicable)	ASME SEC IX & API 5L	-	-	ASME SEC.IX / API 5L Annex-C & D. Weld procedure for GMAW + SAW & repair weld as per approved WPS.	WPS, PQR and Lab test report.	P	R	R	R & A	
0.8	Welders Performance Qualification (if applicable)		-	-	ASME SEC.IX / API 5L Annex-C & D. Weld procedure for GMAW+ SAW / SMAW.	Welder cards	P	R	R	R & A	
0.9	Non Destructive Tesing procedures (RT, UT, MPT, DPT)	As per PTS / GTS / API 5L	-	-	As per PTS / GTS / API 5L.	Approved Procedures	P	R	R	R & A	
0.10.	Hydro Test procedures		-	-	As per PTS / GTS / API 5L.	Approved Procedures	P	R	R	R & A	
0.11	NDE Operators		-	-	As per PTS / GTS / API 5L.	Certificate & Experience Log.	P	R	R	R & A	
0.12	Procedure for Handling, storage and Transport of piles	PTS / GTS / API 5L / Standard procedure	-	-	Each pipe shall be handled with as per standard handling procedure	Handling procedure	P	R	R	R & A	
0.13	Burst Test Procedure		-	-	As per PTS / GTS / API 5L.	Approved Procedures	P	R	R	R & A	
0.14	Sampling Procedure		-	-	As per PTS / GTS / API 5L.	Approved Procedures	P	R	R	R & A	
	First Day Production Test	**PTS / GTS / API 5L**	**3 pipes from 3 different heats shall be selected at random covering each welding line to be selected for testing for each size, grade and wall thickness.**			MPQT report	**P**	**H**	**-**	**H**	
1	**RAW MATERIAL**										
	B. REVIEW OF QAP, MPS.	PTS / GTS / API 5L	----	----	QAP / MPS of steel coil from steel mill shall be submitted after reviewed at Pipe Mill for review & approval of Owner / Owner's representative.	Coil MILL TC & IRN	P	R	R	A	
	A. MANUFACTURING OF HR STEEL	PTS / GTS / API 5L	----	----	Steel Shall Be Made in a Basic oxygen or Electric Arc Furnace and shall be continuous cast, Fully Killed, and fine grained with a grain size of ASTM E-8 or Finer as per ASTM - E112	Coil MILL TC & IRN	P	R	R	R	
	B. REVIEW OF RAW MATERIAL T.C. (Certificate 3.2 as per EN 10204), IRN, IR INCLUDING PACKING LIST	PTS / GTS / API 5L	Each Heat		Raw Material Testing shall Be Witnessed & Reviewed By TPIA at Steel Mill & also same to be reviewed at Pipe Mill.	Coil MILL TC & IRN	P	RW	RW	R / W	
	C. QMS	PTS / GTS / ISO 9001			MPS / WPS / PQT / EQT ETC.		P	R	R	A	
	D. INSPECTION & IDENTIFICATION	----	Each Coil / Plate		Physical verification of coil no. & heat no. according to raw material TC & dimension check. Verification of TPIA stamp of coil.	Inspection Report	P	W	W	R / W	

TRACTEBEL ENGIE	QUALITY CONTROL TABLE (ANNEXURE - Q - PURCHASER INDICATIVE INSPECTION AND QUALITY PLAN) LINE PIPES - HIGH FREQUENCY WELDING (BARE)	QCT No.: QCT No: P.014714 G 11013 016	
		Date: 30.12.2020	Rev.: 0
		Prepared : AS	Checked : PS
		Approved : NN	

SR. No.	CONTROL TEST/INSPECTION DESCRIPTION	REFF. DOCS./ APPLICABLE SEPC.	PROCEDURE TEST FREQUENCY		ACCEPTANCE CRITERIA	FORMAT OF RECORD	INSPECTION				REMARKS
			PQT/ FDPT	REGULAR PRODUCTION			MANUF. / SUPPLIER	TPIA		CONTROL AUTHORITY (CA)	
								PQT/ FDPT	REG. PROD.		
2	UNCOILING & COIL SHEARING / SLITING	PTS / GTS / API 5L	Each Coil		Checking of material size, heat, and coil no and visual & dimension check , free from defect Thickness and width (by d-meter and tape) Width: -0 + 20mm W.t.: +10%, no negetive tolerance is allowed. - Shearing of coil to plate (cut-to-length) shall be done under the monitoring of TPIA. - Centre slitting of Coil is not recomended. - TPIA Hard Stamp shall be done on Slitted coils.	Inspection Report	P	W	W	R / W	
3	ONLINE UT OF HR COIL / PLATE	PTS / GTS / API 5L	Each Coil	Each Coil (100% area coverage)	The entire width and length of HR Coil/Plate shall be tested by placing array probes on the HR Coil/Plate surface in such a way that it cover 100% of the surface area.The height of indication having amplitude beyond the reference accepted signal height (100% at 80% FSH) is considered as defective indication. All such aut indication shall be cross checked by manual ut for confiormation. Audio visual & paint mark. Any lamination exceeding the following will be considered as a defect. A) **For Edge**- any defect with ≥ 40 mm in any direction is unacceptable defect with length < 40 mm are acceptable provided the number does not exceed 3 per meter of edge length. B) **For Body**- the requirement for remaining portion of HR Coil/Plate shall be evaluation for their acceptance as per iso 10893-9 acceptance level U2. **Calibration stands for Plate/Coil**- Slot (8 X 1/2 thick / full width of HR Coil/Plate) **Calibration stands for Edges/Piep ends** - shall have 6.4mm dia. FBH of depth 0.5t where "t" is specified wall thickness. **Calibration Frequency -** At the beginning of each operating shift and subsequently than every 4 hrs during continuous equipment operation. Every time during the running of system gives rise to doubts on its efficiency.	Online AUT Report	P	W	W	R / W	
4	MANUAL UT FOR CROSS-CHECKING ONLINE UT INDICATIONS	PTS / GTS / API 5L	Untested & Suspected area which is marked by AUT.	Untested & Suspected area which is marked by AUT.	All the indication from the online coil UT shall be cross checked by manual UT using TR probe for their evaluation and acceptance - same as mentioned for online coil UT **CALIBRATION FREQUENCY -** At the beginning of each shift and subsequent at every 4 hours.	MUT Report	P	W	W	R / W	
5	PIPE FORMING	PTS / GTS / API 5L	Each Pipe	Each Pipe	As per approved procedure.	FORMING REPORT	P	W	RW	R / W	
6	WELDING PARAMETERS	PTS / GTS / API 5L & ASME SEC IX	Each Pipe	Each Pipe	Following Welding Parameters be qualified during first day production test. a. Temperature; b. Frequency; c. Current; d. Voltage; e. Speed Acceptance criteria as per ASME SEC IX.	WPS	R	W	W	R / W	
7	SEAM NORMALIZING	PTS / GTS / API 5L	Each Pipe	Each Pipe	As per approved procedure.	Heat Treatment report	P	W	RW	R / W	
8	FLATTENING TEST	PTS / GTS / API 5L	2 sets / Pipes	Each Coil	4 Samples per coil (2 samples each from 1st & last accepted pipes of the coil). Falttening will be done at 0° & 90°. In case of weld stop, a sample from each crop end shall be tested at 90°. Acceptance as per cl. no. 9.6 of PTS & API 5L 1. No opening in weld at distance 50% of OD. 2. No Opening in material at distance 33% of OD. 3. No Lamination or Burnt metal in material at full flattening.	Test Report	P	W	W	R / W	
9	VISUAL SURFACE INSPECTION	PTS / GTS / API 5L	Each Pipe	Each Pipe	Each pipe after completion of welding shall be inspected visually from inside & outside for any visual weld defects, bead height, and bead off-set.	Inspection Report	P	W	RW	RW	

TRACTEBEL ENGIE	QUALITY CONTROL TABLE (ANNEXURE - Q - PURCHASER INDICATIVE INSPECTION AND QUALITY PLAN) LINE PIPES - HIGH FREQUENCY WELDING (BARE)	QCT No.: QCT No: P.014714 G 11013 016	
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			PQT/ FDPT	REGULAR PRODUCTION			MANUF. / SUPPLIER	TPIA		CONTROL AUTHORITY (CA)	
								PQT/ FDPT	REG. PROD.		
10	HYDROTESTING	PTS / GTS / API 5L	Each Pipe	Each Pipe	Each pipe is hydrostatically tested. Test pressure = 95% of SMYS. Min. Holding time of 15 sec. **PRESSURE GAUGE CALIBRATION:** Pressure gauge of min. least count of 2 kg/ cm2 shall be calibrated with a dead weight tester. Accuracy of PG +/- 1% of FSD. FREQUENCY - At the beginning of each working shift. No leakage / burst / deformation on weld and body. No pressure drop on gauge and chart recorder / gragh during holding time.	Hydrotest Reoprt / Chart Record / Calibration Report /Graph	P	W	W	R / W	
11	BURST TEST	PTS / GTS / API 5L	One pipe for each size, Grade and thickness per steel manufacturer	Nil	–Burst pressure shall be more than minimum rupture pressure on the basis of minimum specified UTS as per raw material test certificate. –Burst pressure & location shall be record –if burst pipe fail then manufacture shall investigate the root cause & submit the report to the client before retesting & restarting of the regular production.	Burst Test Report & Graph	P	W	W	H	
12	END BEVELLING	PTS / GTS / API 5L	Both Ends of Each Pipe	Both Ends of Each Pipe	Both end of pipe are machined in accordance with API 5L. Bevel angle 30º to 35º & Root Face 1.6mm ± 0.8mm Thickness shall not be less than minimum specified wall thickness. Inside weld Reinforcement shall be removed up to 100MM at both ends of pipes. Manufactures shall verify with client for special application like AUTOWELDING IN FIELD, Then the BEVEL ANGLE shall as per the confirmation from CLIENT.	Dimensional Inspection Report	P	W	RW	R / W	
13	AUT OF WELD SEAM	PTS / GTS / API 5L	Each Pipe	Each Pipe	After hydrotest full length of weld seam is checked in "I-I-X" mode with 45º, 60º & 70º probes in order to detect longitudinal and transverse defect in the weld by a microprocessor based ultrasonic testing system. Weld seam tracking are applied to autoweld (Laser) tracking system for correct positioning of probe with respect to the weld center. The entire longitudinal edges of hr coils /plates are tested during online UT. The height of acceptance limit signal in percent of height of the test signals produced by 1.6 mm hole and N5 notch as per API 5L / customer requirement. Any indication greater than the above reference level will be marked by AUT over pipe surface. all the auto indications shall be cross checked by manual UT **CALIBRATION STANDARD FOR WELD SEAM:** N5 notches and 1.6mm dia. through drill hole for longitudinal and transverse defects **CALIBRATION FREQUENCY:** At the beginning of each operation shift and subsequently than in every 4hrs during continuous equipment operation every time the running of system gives rise to doubts on its efficiency. **DECOUPLING CHECKS:** Audio Visual Alarm & Paint Marking On Pipe Surface. **PERSONNELS:** Level II AS PER ASNT'S SNT-TC-1(A) DOC.OR EQ. over all supervision by Level III.	Ultrasonic Testing Report	P	W	W	R / W	

TRACTEBEL ENGIE	QUALITY CONTROL TABLE (ANNEXURE - Q - PURCHASER INDICATIVE INSPECTION AND QUALITY PLAN) **LINE PIPES - HIGH FREQUENCY WELDING (BARE)**	**QCT No.: QCT No: P.014714 G 11013 016**	
		Date: 30.12.2020	**Rev.: 0**
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							MANUF. / SUPPLIER	TPIA		CONTROL AUTHORITY (CA)	
			PQT/ FDPT	REGULAR PRODUCTION				PQT/ FDPT	REG. PROD.		
14	MANUAL UT	PTS / GTS / API 5L	1) Untested & Suspected area which is marked By AUT. 2) Both End 250 mm Circumferential	1) Untested & Suspected area which is marked By AUT. 2) Both End 250 mm Circumferential	Indication by AUT given by angle beam as well as straight beam (TR probe) examinations and untested areas of pipe end weld (250 mm) shall be cross checked by manual UT by 45°, 60° & 70° angle beam probes and TR probes shall be used for cross checking the corresponding auto indication. Repaired location shall also be checked by MUT. Indications confirmed by manual UT shall be re-examined by radiography for their acceptance as per API 5L. **CALIBRATION STANDARD** Same as those for automatic test **CALIBRATION FREQUENCY** At the beginning of each operation shift and subsequently than in every 4hrs during continuous equipment operation. Every time the running of system gives rise to doubts on its efficiency.	Manual UT Report	P	W	W	R / W	
15	MAGNETIC PARTICALE INSPECTION	PTS / GTS / API 5L	Each Pipe	Each Pipe	**BOTH BEVEL END:** - Bevel ends of each pipe. Any imperfections detected on the weld bevel shall cause of re-beveling and the bevel re-inspection by 100% MPI. Average flux density at ends shall not exceed 20 Gauss. **RESIDUAL MAGNETISM** - max. 20 Gauss. (Avg. of 4 reading), no individual reading shall exceed 25 gauss.	MPT Reports	P	W	W	R / W	
16	**PRODUCT TESTING**										
	A.REVIEW OF SAMPLING PLAN FOR PRODUCT TESTING	PTS / GTS / API 5L	Each Pipe	Each Pipe		Sampling Plan	P	R	R	R	
	B. CHEMICAL ANALYSIS OF PRODUCT (SPECTRO)	PTS / GTS / API 5L	2 Sample / Pipe	2 Sample/ 50 Pipe / Heat (One at start of heat & One at end of heat of pipe)	**CHEMICAL PROPERTIES** **For Grade as specified in MR, % Element required shall be as per PTS.**	Spectro Analysis Report	P	R	R	R	
	C. TENSILE TEST (Transverse base & weld)	PTS / GTS / API 5L	2 set / pipe (set shall consist of 2 samples, one for weld & one for body)	2 Set / 50 Pipes / Heat / Size (set shall consist of 2 samples, one for weld & one for body)	**MECHANICAL PROPERTIES** YS, UTS, **YS/UTS ratio and % EL shall be as per PTS**	Mechanical Test Report	P	W	W	R / W	
	D. REVERSE BEND TEST	PTS / GTS / API 5L	2 sets / Pipes	2 sets / 50 Pipe / Heat	Reverse Bend test for Pipes shall be carried out as per requirements Part –II [sec 3(i)], Annexure III of PNGRB Notification, 2008.	MECHANICAL TEST REPORT	P	W	W	R / W	
	E. CHARPY IMPACT TEST (BODY, WELD CENTRE & HAZ (FL))	PTS / GTS / API 5L	2 Set /Pipe/Temp (Set shall consist of three specimen each from Body, Weld center & FL in Transeverd Orientation)	1 Set/ 50 Pipe/ Heat/ Temp. (Set shall consist of three specimen each from Body, Weld center, FL & Body in Transeverd Orientation)	ABSORBED ENERGY, **MINIMUM (NOTE 11)** **FOR BASE :** TEST TEMP 0°C , - AVG. VALUE - 60J/Cm2 & INDI. VALUE - 48J/Cm2 **FOR WELD CENTER & HAZ (FL) :** TEMP 0°C , - AVG. VALUE & INDI. VALUE as per PTS Table G **SHEAR AREA FOR BODY:** AVG. 90% & INDI. 80% MINIMUM at TEST TEMP -20°C, **TRANSITION CURVE :** **Transverse CVN transition curves** at temp. range of -50 °C, -40 °C, -20 °C, 0°C & 10°C.	Charpy Impact Report	P	W	W	R / W	

TRACTEBEL ENGIE

QUALITY CONTROL TABLE
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SR. No.	CONTROL TEST/INSPECTION DESCRIPTION	REFF. DOCS./ APPLICABLE SEPC.	PROCEDURE TEST FREQUENCY		ACCEPTANCE CRITERIA	FORMAT OF RECORD	INSPECTION				REMARKS
							MANUF. / SUPPLIER	TPIA		CONTROL AUTHORITY (CA)	
			PQT/ FDPT	REGULAR PRODUCTION				PQT/ FDPT	REG. PROD.		
	F. DROP WEIGHT TEAR TEST	PTS / GTS / API 5L	2 Set of 2 pieces / pipe	1 Set / 50 Pipe/ Heat/ Temp	- shear area avg. shear fracture area shall be 85% minimum at 0 °C. (testing at different temperature is only to establish transition curve) full transition curve shall be established heat out of three with a minimum of one.	TEST REPORT	P	W	W	R / W	
	G. MACRO ANALYSIS	PTS / GTS / API 5L	6 Sample / Pipe	1 Sample / 50 Pipe/ Heat or min. One Sample per operating shift	Proper fusion of each layer and free from liner defect and importance inclusion	Test Report	P	W	W	R / W	
	H. MICROSCOPIC ANANLYSIS	PTS / GTS / API 5L	6 Sample / Pipe	1 Sample/ 50 Pipe / Heat	No untempered Martensite remains & uniformly distributed ferrite structure shall be established and fusion line shall be clearly visible. Grain size shall be 8 or finer as per ASTM E 112. Optical microphotograph for each heat shall be provided by the manufacturer.	Metallographic Examination report	P	W	W	R / W	
	I. HARDNESS (VICKERS)	PTS / GTS / API 5L	2 Sample / Pipe	1 Sample/ 50 Pipe / Heat	Hardness value shall not be exceeds 248 HV10 The maximum difference in hardness between base material & any reading taken on weld or HAZ shall be less than 80HV10.	Hardness Test Report	P	W	W	R / W	
17	**FINAL INSPECTION**										
	1. DIMENSIONAL & VISUAL INSPECTION	PTS / GTS / API 5L	Each Pipe	Each Pipe	Each pipe is checked for visual defect and dimensional checks as follows	Inspection Report	P	W	W	R / W	
	2. OUT SIDE DIAMETER AT PIPE BODY	PTS / GTS / API 5L	Each Pipe	Each Pipe	Measured by using diameter tape / calipers location 2mtr. interval along the pipe. For 2" to 6.625" OD pipe ± 0.0075 D For 6.625" to 24" OD pipe ± 0.0075 D but maximum of ± 3.0 mm		P	W	W	R / W	
	3. OUT SIDE DIAMETER AT PIPE END	PTS / GTS / API 5L	Each Pipe	Each Pipe	Both ends of each pipe shall be checked & measured by using diameter tape / caliper. For 2" to 6.25" OD pipe - 0.4 to +1.6 mm For 6.625" to 24" OD pipe ± 0.005 D but maximum of ± 1.6 mm		P	W	W	R / W	
	4. OUT OF ROUNDNESS	PTS / GTS / API 5L	Each Pipe	Each Pipe	**Pipe ends:** For 2" to 6.25" OD pipe : Max. 0.015 D For 6.625" to 24" OD pipe : Max. 3 mm **For Body:** For 2" to 6.25" OD pipe : Max. 0.020 D For 6.625" to 24" OD pipe : Max. 5 mm		P	W	W	R / W	
	5. WALL THICKNESS	PTS / GTS / API 5L	Each Pipe	Each Pipe	Wall thickness measure by d-meter / micrometer + 10%, -0% of nomimal W.T (minimum 8 nos. of reading per pipe)		P	W	W	R / W	
	6. OFFSET OF PLATE EDGES	PTS / GTS / API 5L	Each Pipe	Each Pipe	Offset of plate edges for Thk $\leq$ 15mm : 1.5 mm, and for Thk > 15 to 25mm 0.1WT Measured by gauge three time per shift.		P	W	W	R / W	
	7. FLASH HEIGHT	PTS / GTS / API 5L	Each Pipe	Each Pipe	Flash height (inside pipe & outside pipe) Measured by Flash height gauge shall be as per API 5L.		P	W	W	R / W	
	8. LENGTH	PTS / GTS / API 5L	Each Pipe	Each Pipe	All pipe between 11.5 to 12.5 m (max.) For Sample pipes min. 11.0 m Min. avg. length of entire order qty. (per WT) shall be 12.0 m.		P	W	W	R / W	
	9. OUT OF STRAIGHTNESS	PTS / GTS / API 5L	Each Pipe	Each Pipe	Measured by using string with steel scale max. Total deviation from straight line over the entire pipe length shall be maximum 12.0 mm. Less than 4mm in 1 Meter from each pipe end.		P	W	W	R / W	
	10. PIPE ENDS / BEVEL & ROOT FACE	PTS / GTS / API 5L	Each Pipe	Each Pipe	Bevel angle 30° to 35° , Root face shall be in the range of 1.6 mm ± 0.8mm		P	W	W	R / W	
	11. OUT OF SQUARENESS	PTS / GTS / API 5L	Each Pipe	Each Pipe	1.5 mm Max.		P	W	W	R / W	
	12. PEAKING & FLATNESS	PTS / GTS / API 5L	Each Pipe	Each Pipe	Deviation from the circular arc of 0.25D or 200mm whichever is less at the weld seam at pipe ends and pipe body shall not exceed 1.6mm.		P	W	W	R / W	

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			PQT/ FDPT	REGULAR PRODUCTION				PQT/ FDPT	REG. PROD.		
	14. DENT	PTS / GTS / API 5L	Each Pipe	Each Pipe	Dents not permitted.	Inspection Report	P	W	W	R / W	
	17. LAMINATION	PTS / GTS / API 5L	Each Pipe	Each Pipe	Lamination shall not accepted irrespective of their length and size in pipe end / bevel end		P	W	W	R / W	
18	**MARKING & COATING**										
	A. STENCILING MARKING & BARCODE	PTS / GTS / API 5L	Each Pipe	Each Pipe	Marking conforming to API 5L Appendix it will be in English sing metric unit it will include manufacturer name, nominal outside diameter, nominal wall thickness, weight, grade, length, hydro pressure, pipe no., heat no., acceptance no. purchaser name process of manufacturing supplementary requirements etc. marking shall be white pen stencil to the pipe axis at a distance of 300mm from both end of pipe (one inside & one outside at 90 degree). Bar code on pipe identification shall be provided as per approved procedure.	Inspection Report	P	W	RW	R / W	
	B. COLOR BAND for each thickness (Of 50 mm width from 150 mm of pipe ends).	PTS / GTS / API 5L	Each Pipe	Each Pipe	Of 50 mm width from 150 mm of pipe ends.						
	C. DIE STAMPING with Low Stress dotted punch.	PTS / GTS / API 5L	Each Pipe	Each Pipe	pipe no. shall be placed by cold die stamping (Low Stress dotted punch) at the distance of 50mm right side of weld seam and 50mm from the both pipe end.	Inspection Report	P	W	RW	R / W	
	D. COATING	PTS / GTS / API 5L	Each Pipe	Each Pipe	Surface shall be free from any oil, grease & foreign material etc., only marked area shall be varnish coated.	Inspection Report	P	W	RW	R / W	
	E. BEVEL PROTECTORS	PTS / GTS / API 5L	Each Pipe	Each Pipe	Metallic end protector with high impact bevel protection shall be provided at both ends.	Inspection Report	P	W	RW	R / W	
19	**DAILY PROGRESS REPORT**										
	RECORD OF WELDING PARAMETER & MILL START & STOPAGE, SPEED, BREAKDOWN & POWER FAILURE	PTS / GTS / API 5L	Each Pipe	Each Pipe	DPR & Rolling Report	Owner DPR Format	P	H		R / W	
20	**FINAL DOCUMENTS**										
	A. QAP / PO / MTC / IR / COMPLIANCE CERTIFICATES	PTS / GTS / API 5L	Each Dispatched Pipe	Each Dispatched Pipe	AS PER PTS/GTS & QCT	Compliance Certificate 3.2	P	R		R	
	B. INSPECTION RELEASE NOTE	PTS / GTS / API 5L	Each Dispatched Pipe	Each Dispatched Pipe	As per EN 10204 3.2 Certification	Compliance Certificate	H	H		R	
21	**FINAL DISPATCH**										
	PIPE LOADING	PTS / GTS / API 5L	----	----	As per GTS/PTS & Approved Procedure.	Dispatch Sheet	P	M	M	-	

Legend:	P-PERFORM, R-REVIEW, W-WITNESS, RW - RANDOM 10% WITNESS, H-HOLD, M- MONITOR, TPIA-THIRD PARTY INSPECTION AGENCY, CA - CONTROL AUTHORITY (Owner/Engineer or their Authorised Inspection Agency)
	Hold point = No further steps may be undertaken before the intervention of the appointed responsible takes place.
	Witness point = The appointed responsible has to be notified of the operation in advance, but production will continue whether the intervention took place or not.
NOTE :	1. Material & type shall be as per tender specs including all amendments & clarification till the date of First Day Production.
	2. Certification requirements to comply with EN 10204 - 3.2 certificate to be issues by TPIA.
	3. All measuring instrument shall have valid calibration certificates and no such instrument / equipment be used when there is no valid calibration.
	4. TPIA has to witness and sign the process parameters per shift (as recommended sheet) & to send with DPR on daily basis to CLIENT/ CONSULTANT.
	5. MPS, NDT etc. procedure shall be reviewed & approved by CLIENT/ CONSULTANT in line with tender specification, pre bid reply & approved QAP.
	6. When external coating is not applied for more than 30 days, necessary rust preventing paint to be applied.
	7. In case of bare pipe supply rust preventing paint of 100 micron shall be applied .
	8. In case of any variation in QAP and the technical specification, the most stringent requirement shall be complied.
	9. TPIA shall select the weld length for X-Ray to fulfill 5% of manufactured pipe requirements, in such a way that it should cover each heat as well as each shift.
	10. All clause of API 5L 45th edition and tests should be followed scrupulously. Only the clause of present PTS/GTS which are more stringent or supplementary to the API 5L - 45th edition new edition will prevail.

TRACTEBEL ENGIE

QUALITY CONTROL TABLE
(ANNEXURE - Q - PURCHASER INDICATIVE INSPECTION AND QUALITY PLAN)
LINE PIPES - SEAMLESS (BARE)

QCT No: QCT No: P.014714 G 11013 017	
Date: 30.12.2020	**Rev.: 0**
Prepared : AS	**Checked : PS**
Approved : NN	

SR. No.	CONTROL TEST/INSPECTION DESCRIPTION	REFF. DOCS./ APPLICABLE SEPC.	PROCEDURE TEST FREQUENCY		ACCEPTANCE CRITERIA	FORMAT OF RECORD	INSPECTION				REMARKS
			PQT/ FDPT	REGULAR PRODUCTION			MANUF. / SUPPLIER	TPIA		CONTROL AUTHORITY (CA)	
								PQT/ FDPT	REG. PROD.		
0	**CONTROL BEFORE FABRICATION / MANUFACTURING (PROCEDURES)**										
0.1	LOFC (List of operations for Fabrication & Control) procedures (pipe)	PTS / GTS / Standard procedure	-	-	As per PTS / GTS / API 5L.		P	R	R	R & A	
0.2	Technical audit during a sample run	PTS / GTS / API 5L / Standard procedure	-	-	As per PTS / GTS / API 5L.	Audit Report	P	R	R	H	
0.3	Equipment test control / Calibration of manufacturer		-	-	All Instruments shall have valid calibration during pipe manufacturing.	Calibration records	P	R	R	R & A	
0.4	Audit of process of sub-contractor if any		-	-	As per PTS / GTS / API 5 / Vendor specific procedure.	Audit Report	P	R	R	R & A	
0.5	Steel manufacturing procedure		-	-	As per PTS / GTS / API 5 / Approved Steel MPS.	MPS	P	R	R	R & A	
0.6	Heat Treatment procedure (if applicable)		-	-	As per PTS / GTS / API 5 / Approved Steel MPS.	Procedure	P	R	R	R & A	
0.9	Non Destructive Tesing procedures (UT, MPT, DPT etc.)	As per PTS / GTS / API 5L	-	-	As per PTS / GTS / API 5L.	Approved Procedures	P	R	R	R & A	
0.10.	Hydro Test procedures		-	-	As per PTS / GTS / API 5L.	Approved Procedures	P	R	R	R & A	
0.11	NDE Operators		-	-	As per PTS / GTS / API 5L.	Certificate & Experience Log.	P	R	R	R & A	
0.12	Procedure for Handling, storage and Transport of piles	PTS / GTS / API 5L / Standard procedure	-	-	Each pipe shall be handled with as per standard handling procedure	Handling procedure	P	R	R	R & A	
0.13	Burst Test Procedure		-	-	As per PTS / GTS / API 5L.	Approved Procedures	P	R	R	R & A	
0.14	Sampling Procedure		-	-	As per PTS / GTS / API 5L.	Approved Procedures	P	R	R	R & A	
	First Day Production Test	**PTS / GTS / API 5L**	**3 pipes from 3 different heats shall be selected at random to be selected for testing for each size, grade and wall thickness.**			MPQT report	**P**	**H**	**-**	**H**	
1	**RAW MATERIAL**										
	A. REVIEW OF QAP, MPS.	PTS / GTS / API 5L	----	----	QAP / MPS of steel (Ingots/Billet/Mother holow) from steel mill shall be submitted after reviewed at Pipe Mill for review & approval of Owner / Owner's representative.	Coil MILL TC & IRN	P	R	R	A	
	B. MANUFACTURING OF HR STEEL	PTS / GTS / API 5L	----	----	Steel Shall Be Made in a Basic oxygen or Electric Arc Furnace and shall be continuous cast, Fully Killed, and fine grained with a grain size of ASTM E-8 or Finer as per ASTM - E112	Coil MILL TC & IRN	P	R	R	R	
	C. REVIEW OF RAW MATERIAL T.C. (Certificate 3.2 as per EN 10204), IRN, IR INCLUDING PACKING LIST	PTS / GTS / API 5L	Each Heat		Raw Material Testing shall Be Witnessed & Reviewed By TPIA at Steel Mill & also same to be reviewed at Pipe Mill. Chemical composition, Internal soundness (Macro etching), Physical propoerties etc	Coil MILL TC & IRN	P	RW	RW	R / W	
	D. QMS	PTS / GTS / ISO 9001			MPS / WPS / PQT / EQT ETC.		P	R	R	A	
	E. INSPECTION & IDENTIFICATION	----	Each Coil / Plate		Physical verification of raw material no. & heat no. according to raw material TC & dimension check. Verification of TPIA stamp of raw material.	Inspection Report	P	W	W	R / W	
2	PIPE ROLLING HEATING, HOT ROLLING STRAIGHTENING etc.	PTS / GTS / API 5L	Each Pipe	Each Pipe	As per approved procedure.	Forming Report	P	W	RW	R / W	
3	HEAT TREATMENT (if applicable) - Loading and Unloading shall be witness by TPIA.	PTS / GTS / API 5L	Each Pipe	Each Pipe	As per approved procedure.	Heat Treatment Report	P	W	RW	R / W	

TRACTEBEL ENGIE

QUALITY CONTROL TABLE
(ANNEXURE - Q - PURCHASER INDICATIVE INSPECTION AND QUALITY PLAN)
LINE PIPES - SEAMLESS (BARE)

QCT No: QCT No: P.014714 G 11013 017	
Date: 30.12.2020	**Rev.: 0**
Prepared : AS	**Checked : PS**
Approved : NN	

SR. No.	CONTROL TEST/INSPECTION DESCRIPTION	REFF. DOCS./ APPLICABLE SEPC.	PROCEDURE TEST FREQUENCY		ACCEPTANCE CRITERIA	FORMAT OF RECORD	INSPECTION				REMARKS
			PQT/ FDPT	REGULAR PRODUCTION			MANUF. / SUPPLIER	TPIA		CONTROL AUTHORITY (CA)	
								PQT/ FDPT	REG. PROD.		
4	VISUAL SURFACE INSPECTION	PTS / GTS / API 5L	Each Pipe	Each Pipe	Each pipe after completion of welding shall be inspected visually from inside & outside for any visual weld defects, bead height, and bead off-set.	Inspection Report	P	W	RW	RW	
5	HYDROTESTING	PTS / GTS / API 5L	Each Pipe	Each Pipe	Each pipe is hydrostatically tested. Test pressure = 95% of SMYS. Min. Holding time of 15 sec. **PRESSURE GAUGE (PG) CALIBRATION:** PG range shall be 1.5 to 4 time of test pressure. PG of min. least count of 2 kg/ cm2 shall be calibrated with a dead weight tester. Accuracy of PG +/- 1% of FSD. FREQUENCY - At the beginning of each working shift. No leakage / burst / deformation on weld and body. No pressure drop on gauge and chart recorder / gragh during holding time.	Hydrotest Reoprt / Chart Record / Calibration Report /Graph	P	W	W	R / W	
6	BURST TEST	PTS / GTS / API 5L	One pipe for each size, Grade and thickness per steel manufacturer	Nil	–Burst pressure shall be more than minimum rupture pressure on the basis of minimum specified UTS as per raw material test certificate. –Burst pressure & location shall be record –if burst pipe fail then manufacture shall investigate the root cause & submit the report to the client before retesting & restarting of the regular production.	Burst Test Report & Graph	P	W	W	H	
7	END BEVELLING	PTS / GTS / API 5L	Both Ends of Each Pipe	Both Ends of Each Pipe	Both end of pipe are machined in accordance with API 5L. Bevel angle 30º to 35º & Root Face 1.6mm ± 0.8mm Thickness shall not be less than minimum specified wall thickness. Inside weld Reinforcement shall be removed up to 100MM at both ends of pipes. Manufactures shall verify with client for special application like AUTOWELDING IN FIELD, Then the BEVEL ANGLE shall as per the confirmation from CLIENT.	Dimensional Inspection Report	P	W	RW	R / W	
8	AUTOMATIC ULTRASONIC TESTING (AUT)	PTS / GTS / API 5L	Each Pipe	Each Pipe	After hydrotest full length of weld seam is checked in "I-I-X" mode with 45º, 60º & 70º probes in order to detect longitudinal and transverse defect in the weld by a microprocessor based ultrasonic testing system. Weld seam tracking are applied to autoweld (Laser) tracking system for correct positioning of probe with respect to the weld center. The height of acceptance limit signal in percent of height of the test signals produced by 1.6 mm hole and N5 notch as per API 5L / customer requirement. Any indication greater than the above reference level will be marked by AUT over pipe surface. all the auto indications shall be cross checked by manual UT **CALIBRATION STANDARD FOR WELD SEAM:** N5 notches and 1.6mm dia. through drill hole for longitudinal and transverse defects **CALIBRATION FREQUENCY:** At the beginning of each operation shift and subsequently than in every 4hrs during continuous equipment operation every time the running of system gives rise to doubts on its efficiency. **DECOUPLING CHECKS:** Audio Visual Alarm & Paint Marking On Pipe Surface. **PERSONNELS:** Level II AS PER ASNT'S SNT-TC-1(A) DOC.OR EQ. over all supervision by Level III.	Ultrasonic Testing Report	P	W	W	R / W	

TRACTEBEL ENGIE	QUALITY CONTROL TABLE (ANNEXURE - Q - PURCHASER INDICATIVE INSPECTION AND QUALITY PLAN) **LINE PIPES - SEAMLESS (BARE)**	**QCT No: QCT No: P.014714 G 11013 017**	
		Date: 30.12.2020	**Rev.: 0**
		Prepared : AS	**Checked : PS**
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SR. No.	CONTROL TEST/INSPECTION DESCRIPTION	REFF. DOCS./ APPLICABLE SEPC.	PROCEDURE TEST FREQUENCY		ACCEPTANCE CRITERIA	FORMAT OF RECORD	INSPECTION				REMARKS
			PQT/ FDPT	REGULAR PRODUCTION			MANUF. / SUPPLIER	TPIA		CONTROL AUTHORITY (CA)	
								PQT/ FDPT	REG. PROD.		
9	MANUAL ULTRASONIC TESTING (MUT)	PTS / GTS / API 5L	1) Untested & Suspected area which is marked By AUT. 2) Both End 250 mm Circumferential	1) Untested & Suspected area which is marked By AUT. 2) Both End 250 mm Circumferential	Indication by AUT given by angle beam as well as straight beam (TR probe) examinations and untested areas of pipe end weld (250 mm) shall be cross checked by manual UT by 45°, 60° & 70° angle beam probes and TR probes shall be used for cross checking the corresponding auto indication. Repaired location shall also be checked by MUT. Indications confirmed by manual UT shall be re-examined by radiography for their acceptance as per API 5L. **CALIBRATION STANDARD** Same as those for automatic test **CALIBRATION FREQUENCY** At the beginning of each operation shift and subsequently than in every 4hrs during continuous equipment operation. Every time the running of system gives rise to doubts on its efficiency.	Manual UT Report	P	W	W	R / W	
10	ELECTROMAGNETIC (Flux Leakage) TEST	PTS / GTS / API 5L	Each Pipe	Each Pipe	API 5L 45th Edition / GTS / PTS						
11	MAGNETIC PARTICALE INSPECTION (MPI)	PTS / GTS / API 5L	Each Pipe	Each Pipe	**BOTH BEVEL END:** - Bevel ends of each pipe. Any imperfections detected on the weld bevel shall cause of re-beveling and the bevel re-inspection by 100% MPI. Average flux density at ends shall not exceed 20 Gauss. **RESIDUAL MAGNETISM** - max. 20 Gauss. (Avg. of 4 reading), no individual reading shall exceed 25 gauss.	MPT Reports	P	W	W	R / W	
12	**PRODUCT TESTING**										
	A.REVIEW OF SAMPLING PLAN FOR PRODUCT TESTING	PTS / GTS / API 5L	Each Pipe	Each Pipe		Sampling Plan	P	R	R	R	
	B. CHEMICAL ANALYSIS OF PRODUCT (SPECTRO)	PTS / GTS / API 5L	2 Sample / Pipe	2 Sample/ 50 Pipe / Heat (One at start of heat & One at end of heat of pipe)	**CHEMICAL PROPERTIES** **For Grade as specified in MR, % Element required shall be as per PTS.**	Spectro Analysis Report	P	R	R	R	
	C. TENSILE TEST (Transverse base)	PTS / GTS / API 5L	2 set / pipe (set shall consist of 2 samples for body)	2 Set / 50 Pipes / Heat / Size (set shall consist of 2 samples for body)	**MECHANICAL PROPERTIES** **YS, UTS, YS/UTS ratio and % EL shall be as per PTS**	Mechanical Test Report	P	W	W	R / W	

TRACTEBEL ENGIE

QUALITY CONTROL TABLE
(ANNEXURE - Q - PURCHASER INDICATIVE INSPECTION AND QUALITY PLAN)
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SR. No.	CONTROL TEST/INSPECTION DESCRIPTION	REFF. DOCS./ APPLICABLE SEPC.	PROCEDURE TEST FREQUENCY		ACCEPTANCE CRITERIA	FORMAT OF RECORD	INSPECTION				REMARKS
							MANUF. / SUPPLIER	TPIA		CONTROL AUTHORITY (CA)	
			PQT/ FDPT	REGULAR PRODUCTION				PQT/ FDPT	REG. PROD.		
	D. CHARPY IMPACT TEST (BODY)	PTS / GTS / API 5L	2 Set /Pipe/Temp (Set shall consist of three specimen each from Body in Transeverd Orientation)	1 Set/ 50 Pipe/ Heat/ Temp. (Set shall consist of three specimen each from Body in Transeverd Orientation)	ABSORBED ENERGY, **MINIMUM (NOTE 11)** **FOR BASE :** TEST TEMP 0°C , - AVG. VALUE - 60J/Cm2 & INDI. VALUE - 48J/Cm2 **SHEAR AREA FOR BODY:** AVG. 90% & INDI. 80% MINIMUM at TEST TEMP 0°C, **TRANSITION CURVE :** **Transverse CVN transition curves** at temp. range of -50 °C, -40 °C, -20 °C, 0°C & 10°C.	Charpy Impact Report	P	W	W	R / W	
	E. DROP WEIGHT TEAR TEST	PTS / GTS / API 5L	2 Set of 2 pieces / pipe	1 Set / 50 Pipe/ Heat/ Temp	- shear area avg. shear fracture area shall be 85% minimum at 0 °C. (testing at different temperature is only to establish transition curve) full transition curve shall be established heat out of three with a minimum of one.	TEST REPORT	P	W	W	R / W	
	F. MACRO ANALYSIS	PTS / GTS / API 5L	6 Sample / Pipe	1 Sample / 50 Pipe/ Heat or min. One Sample per operating shift	Proper fusion of each layer and free from liner defect and importance inclusion	Test Report	P	W	W	R / W	
	G. MICROSCOPIC ANANLYSIS	PTS / GTS / API 5L	6 Sample / Pipe	1 Sample/ 50 Pipe / Heat	No untempered Martensite remains & uniformly distributed ferrite structure shall be established and fusion line shall be clearly visible. Grain size shall be 8 or finer as per ASTM E 112. Optical microphotograph for each heat shall be provided by the manufacturer.	Metallographic Examination report	P	W	W	R / W	
	H. HARDNESS (VICKERS)	PTS / GTS / API 5L	2 Sample / Pipe	1 Sample/ 50 Pipe / Heat	Hardness value shall not be exceeds 248 HV10 The maximum difference in hardness between base material & any reading taken on weld or HAZ shall be less than 80HV10.	Hardness Test Report	P	W	W	R / W	
13	**FINAL INSPECTION**										
	1. DIMENSIONAL & VISUAL INSPECTION	PTS / GTS / API 5L	Each Pipe	Each Pipe	Each pipe is checked for visual defect and dimensional checks as follows	Inspection Report	P	W	W	R / W	
	2. OUT SIDE DIAMETER AT PIPE BODY	PTS / GTS / API 5L	Each Pipe	Each Pipe	Measured by using diameter tape / calipers location 2mtr. interval along the pipe. For 2" to 6.625" OD pipe ± 0.0075 D For 6.625" to 24" OD pipe ± 0.0075 D but maximum of ± 3.0 mm		P	W	W	R / W	
	3. OUT SIDE DIAMETER AT PIPE END	PTS / GTS / API 5L	Each Pipe	Each Pipe	Both ends of each pipe shall be checked & measured by using diameter tape / caliper. For 2" to 6.25" OD pipe - 0.4 to +1.6 mm For 6.625" to 24" OD pipe ± 0.005 D but maximum of ± 1.6 mm		P	W	W	R / W	
	4. OUT OF ROUNDNESS	PTS / GTS / API 5L	Each Pipe	Each Pipe	**Pipe ends:** For 2" to 6.25" OD pipe : Max. 0.015 D For 6.625" to 24" OD pipe : Max. 3 mm **For Body:** For 2" to 6.25" OD pipe : Max. 0.020 D For 6.625" to 24" OD pipe : Max. 5 mm		P	W	W	R / W	
	5. WALL THICKNESS	PTS / GTS / API 5L	Each Pipe	Each Pipe	Wall thickness measure by d-meter / micrometer + 20%, -0% of nomimal W.T (minimum 8 nos. of reading per pipe)		P	W	W	R / W	
	7. LENGTH	PTS / GTS / API 5L	Each Pipe	Each Pipe	All pipe between 11.5 to 12.5 m (max.) For Sample pipes min. 11.0 m Min. avg. length of entire order qty. (per WT) shall be 12.0 m.		P	W	W	R / W	

TRACTEBEL ENGIE

QUALITY CONTROL TABLE
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LINE PIPES - SEAMLESS (BARE)

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Date: 30.12.2020	**Rev.: 0**
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SR. No.	CONTROL TEST/INSPECTION DESCRIPTION	REFF. DOCS./ APPLICABLE SEPC.	PROCEDURE TEST FREQUENCY		ACCEPTANCE CRITERIA	FORMAT OF RECORD	INSPECTION				REMARKS
							MANUF. / SUPPLIER	TPIA		CONTROL AUTHORITY (CA)	
			PQT/ FDPT	REGULAR PRODUCTION				PQT/ FDPT	REG. PROD.		
	8. OUT OF STRAIGHTNESS	PTS / GTS / API 5L	Each Pipe	Each Pipe	Measured by using string with steel scale max. Total deviation from straight line over the entire pipe length shall be maximum 12.0 mm. Less than 4mm in 1 Meter from each pipe end.		P	W	W	R / W	
	9. PIPE ENDS / BEVEL & ROOT FACE	PTS / GTS / API 5L	Each Pipe	Each Pipe	Bevel angle 30° to 35° , Root face shall be in the range of 1.6 mm ± 0.8mm		P	W	W	R / W	
	10. OUT OF SQUARENESS	PTS / GTS / API 5L	Each Pipe	Each Pipe	1.5 mm Max.		P	W	W	R / W	
	11. PEAKING & FLATNESS	PTS / GTS / API 5L	Each Pipe	Each Pipe	Deviation from the circular arc of 0.25D or 200mm whichever is less at the weld seam at pipe ends and pipe body shall not exceed 1.6mm.		P	W	W	R / W	
	12. DENT	PTS / GTS / API 5L	Each Pipe	Each Pipe	Dents not permitted.	Inspection Report	P	W	W	R / W	
	13. LAMINATION	PTS / GTS / API 5L	Each Pipe	Each Pipe	Lamination shall not accepted irrespective of their length and size in pipe end / bevel end.		P	W	W	R / W	
14	**MARKING & COATING**										
	A. STENCILING MARKING & BARCODE	PTS / GTS / API 5L	Each Pipe	Each Pipe	Marking conforming to API 5L Appendix it will be in English sing metric unit it will include manufacturer name, nominal outside diameter, nominal wall thickness, weight, grade, length, hydro pressure, pipe no., heat no., acceptance no. purchaser name process of manufacturing supplementary requirements etc. marking shall be white pen stencil to the pipe axis at a distance of 300mm from both end of pipe (one inside & one outside at 90 degree). Bar code on pipe identification shall be provided as per approved procedure.	Inspection Report	P	W	RW	R / W	
	B. COLOR BAND for each thickness (Of 50 mm width from 150 mm of pipe ends).	PTS / GTS / API 5L	Each Pipe	Each Pipe	Of 50 mm width from 150 mm of pipe ends.						
	C. DIE STAMPING with Low Stress dotted punch.	PTS / GTS / API 5L	Each Pipe	Each Pipe	pipe no. shall be placed by cold die stamping (Low Stress dotted punch) at the distance of 50mm right side of weld seam and 50mm from the both pipe end.	Inspection Report	P	W	RW	R / W	
	D. COATING	PTS / GTS / API 5L	Each Pipe	Each Pipe	Surface shall be free from any oil, grease & foreign material etc., only marked area shall be varnish coated.	Inspection Report	P	W	RW	R / W	
	E. BEVEL PROTECTORS	PTS / GTS / API 5L	Each Pipe	Each Pipe	Metallic end protector with high impact bevel protection shall be provided at both ends.	Inspection Report	P	W	RW	R / W	
19	**DAILY PROGRESS REPORT**										
	RECORD OF WELDING PARAMETER & MILL START & STOPAGE, SPEED, BREAKDOWN & POWER FAILURE	PTS / GTS / API 5L	Each Pipe	Each Pipe	DPR & Rolling Report	Owner DPR Format	P	H		R / W	
20	**FINAL DOCUMENTS**										
	A. QAP / PO / MTC / IR / COMPLIANCE CERTIFICATES	PTS / GTS / API 5L	Each Dispatched Pipe	Each Dispatched Pipe	AS PER PTS/GTS & QCT	Compliance Certificate 3.2	P	R		R	
	B. INSPECTION RELEASE NOTE	PTS / GTS / API 5L	Each Dispatched Pipe	Each Dispatched Pipe	As per EN 10204 3.2 Certification	Compliance Certificate	H	H		R	
21	**FINAL DISPATCH**										
	PIPE LOADING	PTS / GTS / API 5L	----	----	As per GTS/PTS & Approved Procedure.	Dispatch Sheet	P	M	M	-	

Legend: P-PERFORM, R-REVIEW, A- APPROVAL, W-WITNESS, RW - RANDOM 10% WITNESS, H-HOLD, M- MONITOR, TPIA-THIRD PARTY INSPECTION AGENCY, CA - CONTROL AUTHORITY (Owner/Engineer or their Authorised Inspection Agency)

Hold point = No further steps may be undertaken before the intervention of the appointed responsible takes place.

TRACTEBEL ENGIE	QUALITY CONTROL TABLE (ANNEXURE - Q - PURCHASER INDICATIVE INSPECTION AND QUALITY PLAN) **LINE PIPES - SEAMLESS (BARE)**	QCT No: QCT No: P.014714 G 11013 017	
		Date: 30.12.2020	Rev.: 0
		Prepared : AS	Checked : PS
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SR. No.	CONTROL TEST/INSPECTION DESCRIPTION	REFF. DOCS./ APPLICABLE SEPC.	PROCEDURE TEST FREQUENCY		ACCEPTANCE CRITERIA	FORMAT OF RECORD	INSPECTION				REMARKS
			PQT/ FDPT	REGULAR PRODUCTION			MANUF. / SUPPLIER	TPIA		CONTROL AUTHORITY (CA)	
								PQT/ FDPT	REG. PROD.		
	Witness point = The appointed responsible has to be notified of the operation in advance, but production will continue whether the intervention took place or not.										
NOTE :	1. Material & type shall be as per tender specs including all amendments & clarification till the date of First Day Production.										
	2. Certification requirements to comply with EN 10204 - 3.2 certificate to be issues by TPIA.										
	3. All measuring instrument shall have valid calibration certificates and no such instrument / equipment be used when there is no valid calibration.										
	4. TPIA has to witness and sign the process parameters per shift (as recommended sheet) & to send with DPR on daily basis to CLIENT/ CONSULTANT.										
	5. MPS, NDT etc. procedure shall be reviewed & approved by CLIENT/ CONSULTANT in line with tender specification, pre bid reply & approved QAP.										
	6. When external coating is not applied for more than 30 days, necessary rust preventing paint to be applied.										
	7. In case of bare pipe supply rust preventing paint of 100 micron shall be applied .										
	8. In case of any variation in QAP and the technical specification, the most stringent requirement shall be complied.										
	9. TPIA shall select the weld length for X-Ray to fulfill 5% of manufactured pipe requirements, in such a way that it should cover each heat as well as each shift.										
	10. All clause of API 5L 45th edition and tests should be followed scrupulously. Only the clause of present PTS/GTS which are more stringent or supplementary to the API 5L - 45th edition new edition will prevail.										

TRACTEBEL ENGIE	QUALITY CONTROL TABLE 3 LPE EXTERNAL COATING OF LINEPIPE	QCT No	: QCT No: P.014714 G 11013 018		
		Date	Date: 30.12.2020		Rev. 0
		Prepared by	: AS Checked by : PS		
		Approved by	: NN		

MANUFACTURER NAME: To be filled by vendor | **REF DOC.:** To be filled by vendor

TPIA / INSPECTION : To be filled by vendor | **PO NO.:** To be filled by vendor

SR. No.	ACTIVITY	TEST FREQUENCY		REFERENCE DOCUMENT	ACCEPTANCE CRITERIA	INSTRUMENTS	DOCUMENTATION	INSPECTION			
								MANUF.	TPIA		CA
		PQT	ROUTINE PROD.						PQT	ROUTINE PROD.	
A.	**PRIOR TO REGULAR PRODUCTION**										
1	Quality control test plan	Before production		PTS/ GTS/ Approved Procedure	---	---	---	H	R	R	A
2	Repair procedure	---		PTS/ GTS/ Approved Procedure	---	---	---	H	R	R	A
3	Handling, Storage & transportation of bare and coated pipes procedure	---		PTS/ GTS/ Approved Procedure	---	---	---	H	R	R	A
4	Raw material acceptance review of test certificates for Epoxy, Adhesive, PE	Each batch certificate.		As per PTS , Cl. no. 4, 5.3.1 & 5.3	As per PTS , Cl. no. 4, 5.3.1 & 5.3	VISUAL INSPECTION FOR MARKING	Raw material manufacturer's test certificates.	R	R	R	A
5	Test of raw material (Epoxy, Adhesive & PE)	Each batch		As per PTS	As per material test certificate & PTS Cl. No. 4.3 (a,b & c)	--	Test report	H	W	W	R
6	Storage	All materials		As per approved procedure	Manufacturer Recommendation	--	STOCK REGISTER	H	M	M	R
7	Bare pipe receipt at mill, handling & storage etc.	Each pipe		As per PTS & approved procedure	As per PTS	VISUAL	PACKING LIST & Test report	H	M	M	R
8	**PROCEDURE QUALIFICATION TESTS (PQT) :- BEFORE START OF REGULAR PRODUCTION 10 PIPES TO BE COATED (8 PIPES FULLY COATED WITH 3LPE, 1 PIPE COATED WITH PARTIALLY EPOXY & PARTLY WITH EPOXY + ADHESIVE AT THE START OF PQT & 1 AT THE END OF PQT). ALL THE TEST SPECIFIED BELOW IN "SECTION B" HAS TO BE CONDUCTED ON THESE SELECTED PIPES OF PQT.**							H	H	H	H
	FOLLOWING MATERIAL SHALL BE USED FOR THIS PROJECT										
	GENERIC NAME	**RAW MATERIAL GRADE**			**MANUFACTURER**						
A	EPOXY POWDER	As per specification			As per Specification						
B	ADHESIVE	As per specification			As per Specification						
C	POLYETHYLENE	As per specification			As per Specification						
B.	**REGULAR PRODUCTION**										
B.1	Bare pipe stacking & handling in yard/plant	Each pipe.		As per PTS & approved procedure	PE sheet over sand row Teflon padded hooks	VISUAL	STOCK REGISTER	H	M	M	R / W
B.2	Bare pipes receiving. Surface defect, Bevel damage, Grease / Oil on surface	Each pipe.		As per PTS	No defects, damages, oil/grease on pipe surface etc.	Visual solvent Cleaning for pipes with oil grease	Data sheet	H	W	M	R / W
B.3	Repair of Bare pipes defects	Pipes removed for defects		As per approved procedure	As per API 5L 45th edition & Pipe Specification	Bevel cutting m/c, Jacks etc.		H	W	W	R / W
B.4	Pre heating	All pipes		Cl. no. 8.4 & As per approved procedure	65 – 85 °C	LPG Burner, contact thermometer	Data sheet	H	R/W	R/W	R / W
B.5	**DOUBLE SHOT BLASTING**										R / W
B.5.1	Ambient temp., Relative humidity, Dew point & Elapsed time	Each pipe	Start of every shift thereafter every 1 hrs.	As per PTS & As per approved procedure	RH should be less than 85% (IF RH> 85% no shot blasting).	Thermo hygrometer, Dew point apparatus	Data sheet	H	R/W	R/W	R / W
B.5.2	Phosphoric Acid treatment	Each pipe		Cl. no. 8.6 & As per approved procedure	Pipe temp prior to phosphoric acid treatment = 45-75°C or as manuf. Recommendation.	PH paper, contact thermometer	Data Sheet	H	R/W	R/W	R / W
B.5.3	pH Checking	Each pipe		As per PTS	pH (after acid wash) = 1-2, pH (after water wash) = 6-7, pipe surface should be dried	PH paper	Data sheet	H	R/W	R/W	R / W
B.5.4	Salt contamination test	Each pipe		As per PTS	As per PTS	_	Data sheet	H	R/W	R/W	R / W

TRACTEBEL ENGIE	QUALITY CONTROL TABLE 3 LPE EXTERNAL COATING OF LINEPIPE	QCT No	: QCT No: P.014714 G 11013 018		
		Date	Date: 30.12.2020		Rev. 0
		Prepared by	: AS Checked by : PS		
		Approved by	: NN		

MANUFACTURER NAME: To be filled by vendor | **REF DOC.:** To be filled by vendor

TPIA / INSPECTION : To be filled by vendor | **PO NO.:** To be filled by vendor

SR. No.	ACTIVITY	TEST FREQUENCY		REFERENCE DOCUMENT	ACCEPTANCE CRITERIA	INSTRUMENTS	DOCUMENTATION	INSPECTION			
								MANUF.	TPIA		CA
		PQT	ROUTINE PROD.						PQT	ROUTINE PROD.	
B.5.5	Cleanliness	Each pipe		Cl. no. 8.8 & As per approved procedure	SA 2½	ISO-8501-1	Data sheet	H	R/W	R/W	R / W
B.5.6	Degree of dust	Each pipe		Cl. no. 8.8 & As per approved procedure	Rating 2 or Class 2	ISO: 8502-3	Data sheet	H	R/W	R/W	R / W
B.5.7	Surface roughness	Each pipe		Cl. no. 8.8 & As per approved procedure.	50 – 70 µm (Rz)	Surface Profile gauge, Hand held 30X magnifying glass	Data sheet	H	R/W	R/W	R / W
B.5.8	Chromate treatment	Each pipe Solution temp- each shift		Cl. no. 7.4.4.2 & As per approved procedure	Uniform coverage, temp of pipe before application 40-80°C or as manuf. Recom. & Solution temp. not exceed 60°C or as per manuf. Recommendation.	Visual, Temp. indicator	Data sheet	H	R/W	R/W	R / W
B.5.9	Bare pipe temp.	Every pipe		As per PTS & As per approved procedure	180-230 °C or as per powder manufacturer recommendation.	Contact thermometer	Test report	H	R/W	R/W	R / W
B.5.10	Bare pipe temp. after Epoxy application by IR thermometer	Every pipe by online pyrometer recording		As per PTS	190-230 °C or as per powder manufacturer recommendation	IR Optical pyrometer	---	H	R/W	R/W	R / W
B.6	**TEST ON COATED PIPES PARTLY WITH EPOXY AND PARTLY WITH EPOXY & ADHESIVE LAYERS**										R / W
B.6.1	Epoxy layer thickness	One pipe at 3, 6, 9, 12 positions		Cl. no. 7.5.1 & As per approved procedure	200 µm min.	Coating thk. gauge	Test report	H	W	W	R / W
B.6.2	Adhesive layer thk.	One pipe at 3, 6, 9, 12 positions		Cl. no. 7.5.1 & As per approved procedure	250 µm min.	Coating thk. gauge	Test report	H	W	W	R / W
B.6.3	Degree of cure	One pipe (one sample)		Cl. no. 7.5.1	Δ Tg = +3, -2°C % cure = 95 % min.	DSC Machine	Test report	H	W	W	R / W
B.6.4	Adhesion test (St. Andrews cross method)	One pipe		Cl. no. 7.5.1	Rating – 1-3	Utility knife	Test report	H	W	W	R / W
B.7	**TEST ON COATED PIPES WITH ALL THREE LAYERS**										R / W
B.7.1	Heat ageing, Light ageing, Coating resistivity	(each Batch test certificate typical value will be issued by manufacture)		ISO/DIS - 21809	Melt flow rate shall not deviate by more than 35 % of original value	----	(Test certificate will be issued by manufacture)	R	R	R	R / W
				PTS cl. no. 5.3.2	and Coat resistivity min10 10^8 ohm-m²						R / W
B.7.2	Bond strength test at ends & middle	Each pipe	1 in 15 pipes and than after consistency 1 in 25 pipes	cl. no. 7.5.2 & As per approved procedure	@ 20 ±3°C ≥ 15 N/mm @ 80 ±3°C ≥ 15 N/mm	Peel test M/C by dynamometer (type-2)	Test report	H	W	W	R / W
B.7.3	Degree of cure	Each pipe	1 pipes per shift.	cl. no.7.5.2	ΔTg = +3, -2°C % cure = 95 % min.	DSC Machine	Test report	H	W	W	R / W
B.7.4	Impact strength	Each pipe	2 pipes per shift per week.	cl. no. 7.5.2 & As per approved procedure	7 Joules/mm (No holiday shall be observed at 25 KV at impact area).	Impact tester	Test report	H	W	W	R / W

TRACTEBEL ENGIE	QUALITY CONTROL TABLE 3 LPE EXTERNAL COATING OF LINEPIPE	QCT No	: QCT No: P.014714 G 11013 018		
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		Prepared by	: AS Checked by : PS		
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MANUFACTURER NAME: To be filled by vendor | **REF DOC.:** To be filled by vendor

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SR. No.	ACTIVITY	TEST FREQUENCY		REFERENCE DOCUMENT	ACCEPTANCE CRITERIA	INSTRUMENTS	DOCUMENTATION	INSPECTION			
								MANUF.	TPIA		CA
		PQT	ROUTINE PROD.						PQT	ROUTINE PROD.	
B.7.5	Indentation test	2 sample for both temp. from 4 pipes	2 pipes for both temp. per shift	cl. no. 7.5.2 & As per approved procedure	0.2 max. at 23± 2°C 0.3 max. at 80± 2°C	Controlled temp. bath, Dial gauge, weight	Test report	H	W	W	R / W
B.7.6	Elongation at failure	3 PE coated pipes only (5 sample from each pipes)	---	DIN ISO & As per approved procedure	300 % min.	Tensile M/C	Test report	H	W	W	R / W
B.7.7	Cathodic Disbondment test	1 sample for 28 days at 23° ±3°C, 1 sample for 24 Hrs at 65° ±3°C, 1 sample for 28 days at 80° ±3°C	1 every 2 week or every batch no. of epoxy powder.	cl. no. .7.5.2 ASTM G-42 & As per approved procedure	During PQT • 23 +/- 3°C for 28d - 1.5V • 65 +/- 3°C for 24h - 3.5V • Tmax. (80 °C) +/- 3°C for 28d - 1.5V Regular production • at 65 ±3 °C for 24 hrs,	CD Test assembly	Test report	H	W	W	R / W
B.7.8	Holiday test at 25 KV	All pipes	All pipes	cl. no. .7.5.2 & As per approved procedure	Max. One holiday Surface area < 0.01 sq.mtrs. (repair as per approved procedure)	Holiday detector	Test report	H	W	W	R / W
B.7.9	Over all Coating Thickness	All pipes	All pipes	cl. no. 9.2.2	as per ISO 21809-1 (B3) For OD ≤ 10" = 2.7 mm	Coating thk. Gauge	Test report	H	W	W	R / W
B.7.10	Air entrapment at 30X magnification	All pipes	1 per shift	cl. no. 9.2.2	Polyethylene and adhesive layers shall have no more than 10% of the observed area.	30 X magnification hand-held microscope	Test report	H	W	W	R / W
B.7.11	Visual inspection	All pipes		cl. no. 10.2.1 etc.	No defect (Blisters, pinholes scratches, wrinkles etc.)	Visual	Test report	H	W	W	R / W
B.7.12	Cut back length	All pipes		cl. no. 9.2.11	110mm [(-) 0 mm, (+) 10 mm] with bevel 30° -45°	Steel scale	Test report	H	W	W	R / W
C	**FINAL INSPECTION**										R / W
C.1	Visual inspection	All pipes		cl. no. 10.2.1 etc.	No defect (Blisters, pinholes scratches, wrinkles etc.)	Visual	Test report	H	W	W	R / W
C.2	Cut-back length at ends.	Each pipe		cl. no. 4.2.1	110mm [(-) 0 mm, (+) 10 mm] with bevel 30° -45°	Measuring tape, scale etc. and visual	Test report	W	W	RW	R / W
C.3	Marking on coated pipes External color band	Each pipe		Spray gun, Stencil paper etc.	Proper information on coated surface (ME side) i.e. as follows. (1 mtr. From end PROJECT..... PIPE DIA .. WALL THK… PIPE NO. .. LENGTH…. HEAT No. ----- COATING No…, COLOUR BAND, ANY OTHER INFORMATION CONSIDERED RELEVANT BY COMPANY		As per PTS	H	M	M	R / W

TRACTEBEL ENGIE

QUALITY CONTROL TABLE
3 LPE EXTERNAL COATING OF LINEPIPE

QCT No	: QCT No: P.014714 G 11013 018		
Date	Date: 30.12.2020		Rev. 0
Prepared by	: AS Checked by : PS		
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MANUFACTURER NAME: To be filled by vendor

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PO NO.: To be filled by vendor

SR. No.	ACTIVITY	TEST FREQUENCY		REFERENCE DOCUMENT	ACCEPTANCE CRITERIA	INSTRUMENTS	DOCUMENTATION	INSPECTION			
		PQT	ROUTINE PROD.					MANUF.	TPIA		CA
									PQT	ROUTINE PROD.	
H.	**COATING REPAIR**										
1	Repair of Coating followed by holiday detection at 25 KV	All coating repair		cl. no. 10.0	All repairs as per approved procedure	Heating torch, chisel, scale etc.	Test report	H	W	W	R / W
2	Peel test on repair area	One in 25 pipes		Cust spec.	As per manufacturer's recommendation	Spring balance	Test report	H	W	W	R / W
I	**HANDLING & STORAGE**										
1	Handling	Each pipe		As per PTS	No damages on coated pipes. Support bed, min. 2 nos. support on trailor & securing by three wire rope covered with nylon rubber tubing	Crane with teflon padded hooks, trailor with rubber padded beds etc.	STOCK REGISTER	H	R/W	R/W	R / W
2	Storage	Each pipe		As per PTS	Proper stacking on sand rows covered with PE sheets with stack identification & layer separator.	--do--	STOCK REGISTER	H	R/W	R/W	
J.	**CALIBRATION OF EQUIPMENT**										
1	Digital thermometer	Every month.		Calibration procedure	Add or subtract the observed value w.r.t. reference measurement.	Ref. Thermometers, water/ oil bath etc.	Test report	H	R/W	R/W	R / W
2	Thickness gauge.	Every shift		Calibration procedure		Ref. Thickness foils, steel subtract etc.	Test report	H	R/W	R/W	R / W
3	Roughness gauge	Every shift		Calibration procedure		Standard Roughness specimen etc.	Test report	H	R/W	R/W	R / W
4	Holiday detector	Every 4 hours		Calibration procedure	By spark gap method	Spark gap assembly / Calibrated meter	Test report	H	W	W	R / W
5	Hygrometer	Once in four month		Calibration procedure	By master hygrometer		Test report				
6	D Meter	Every time before use		Calibration procedure	By standard thickness block		Test report	H	W	W	R / W

Raw Material Combination to be used During Production as per ANNEXURE – 1 of PTS)

LEGEND : W = WITNESS; H= HOLD; M = MONITORING; R = REVIEW OF DOCUMENTS; R/W = RANDOM WITNESS ; A = APPROVED; TPIA = THIRD PARTY INSPECTION AGENCY; CA - CONTROL AUTHORITY

Hold point = No further steps may be undertaken before the intervention of the appointed responsible takes place.

Witness point = The appointed responsible has to be notified of the operation in advance, but production will continue whether the intervention took place or not.

Notes: -

1. The Above Testing and acceptance criteria are minimum requirements, however, manufacturer shall ensure that the product shall also comply to the additional requirements as per Particular Technical specifications(PTS)
2. The supplier shall submit their own detailed QAP/ITP for First Day production & Regular production seperately which are prepared on the basis of above for approval of Owner/Owner's representative and TPIA.
3. Owner/Owner representative shall review/approve all the documents related to QCT/Quality manuals/Drawings etc.submitted by supplier.
4. Contractor shall in coordination with Supplier/Sub vendor issue detailed Production and Inspection schedule indicating the dates and the locations to facilitate Owner/Owner's representative and TPIA to organise Inspection.
5. Special manufacturing procedures have to be approved or only previously approved procedures have to be used, in case of conflict between specifications more stringent condition shall be applicable.
6. Owner / Owner's representative including TPIA will have the right to inspect any activity of manufacturing at any time.
7. All reference Codes/ Standards, Documents, P.O. Copies shall be arranged by vendor / supplier for reference of TPIA/OWNER at the time of Inspection
8. TPIA along with Owner/Owner representative shall review all the documents related to QCT/Quality manuals/Drawings etc.submitted by supplier.
9. At the time of deleivery of material in stores, vendor will submit copy of all related document of inspection along with release note & MTC.
10. Certification requirement shall comply with European standard EN 10204:3.2 (latest edition)

TRACTEBEL ENGINEERING PVT. LTD.

RECOMMENDED VENDOR LIST – STEEL COILS & PLATES

Rev.	Date	Description	Prepared by	Checked by	Approved by
00	08.01.2021	Issued for procurement	Anurag Shrotriya	Prampreet Singh	Nitish Nandi

LIST OF ACCEPTABLE STEEL PLATE / COIL MANUFACTURERS.

The following steel manufacturers are acceptable for the supply of Plate/Coil to be used in the manufacture of quoted line pipes.

1. FOR STEEL PLATES:

SR. NR.	VENDOR NAME
1	Arcelor Mittal, Romania/ France/ Germany
2	Azovstahl, Ukraine
3	Nippon Steel Corporation, Japan [Formerly known as Nippon Steel & Sumitomo Metal Corp. (NSSMC)]
4	Baoshan Iron & Steel Co. Ltd., Shanghai, China
5	Dillinger, Germany
6	Essar Steel, India
7	Ilva (Riva Group), Italy
8	JFE Steel, Japan
9	Jindal Steel & Power Ltd. (upto 20.6 mm)
10	JSW Steel, USA
11	Mannesmann Salzgitter Roehrenwerke, Germany
12	POSCO, South Korea
13	SAIL, Rourkela Steel Plant (up to 23.8 mm)
14	Usiminas, Brazil
15	Voestalpine, Austria
16	Welspun PCMD, India

2. FOR STEEL COILS:

SR. NR.	VENDOR NAME
1	AHMSA (Altos Hornos De Mexico), Mexico
2	Angang Steel Co.Ltd., China
3	Anyang Iron & Steel Group Co.Ltd. China
4	Arcelor Mittal,France/ Germany
5	Baoshan Iron & Steel Co. Ltd., Shanghai, China
6	Benxi Iron & Steel, China
7	Erdemir, Turkey
8	Essar Steel, India
9	Hadeed Saudi Iron & Steel Co., Saudi Arabia/ UAE
10	HBIS Hebei Iron & Steel Group Co.Ltd, China
11	Hunan Valin Lianyuan Steel Co. Ltd. China (Arcelor Mittal Group)
12	Hyundai Steel, South Korea
13	Jiangsu Shagang (Group), China
14	Jinan Iron & Steel Co. Ltd., China
15	JSW steel limited, Dolvi (earlier lspat (upto X-70, WT-11.7mm)
16	JSW, Bellary India
17	Lloyd Steel, India (upto X-70, WT-11.7mm)
18	Maanshan Iron & Steel Co. Ltd., China
19	Megasteel, Malaysia (upto X-70, WT-10.3mm)
20	POSCO, South Korea
21	SAIL, Bokaro (uptoX-70, WT-11.1mm)
22	Shou-gang Qian Iron & Steel Co. Ltd., China

23	ThyssenKrupp, Germany
24	TISCO (Group) Co. Ltd, China
25	US Steel Kosice, Slovak Republic
26	Wuhan Iron & Steel, China
27	Tata Steel Ltd., Jamshedpur (upto API 5L X-60 & WT upto 9.35 mm)
28	Tata Steel Ltd., Kalinganagar (upto API 5L X-60 & WT upto 13.0 mm)
29	Tata Steel BSL Ltd., Meramandali (upto API 5L X-70 & WT upto 12.7 mm)

NOTES:

1. Steel manufacturers indicated above are acceptable for the supply of steel plates/ coils to be used in the manufacture of quoted line pipes. The pipe manufacturer shall furnish specific confirmation for compliance to tender technical specifications from any of the proposed steel plate/ coil manufacturer(s).

2. In case pipe supplier proposes any steel manufacturer other than those listed above, such steel manufacturer must meet the following criteria:

   2.1 Steel plate/ coil manufacturer must have manufactured and supplied in a single order at least 5000 MT of steel plate/ coil for production of line pipe conforming to API 5L PSL-2 of same or higher grade, as quoted for in the last seven (07) years from the bid due date.

   2.2 Steel plate/ coil manufacturer must have manufactured plate/ coil for production of line pipe conforming to API 5L PSL-2 of same or higher wall thickness, as quoted for in the last seven (07) years from the bid due date.

   2.3 Steel plate manufacturer must have manufactured plates conforming to API 5L PSL-2, which are equal or higher in terms of plate width as quoted for, in case of SAWL option.

3. Pipe manufacturer shall submit the track record, along with the bid, in duly filled-up attached “Annexure-1” with documentary evidence (of Steel plate/ coil manufacturer) to establish the above qualification criteria indicated at (2.1), (2.2) & (2.3) such as purchase order/ work order, inspection release note/ completion certificates of relevant previous supplies, as per bid requirement.

4. Bidder to note that steel plate/ coil manufacturer shall be qualified at the bid stage only.

5. Bidder’s offer shall be unconditional irrespective of finally qualified steel plate/coil manufacturer.

ANNEXURE-1

REFERENCE LIST OF SUPPLY OF STEEL COIL/PLATE FOR THE LAST SEVEN YEARS

Steel Manufacturer: _____ Mill Name & Location: _____

Sl. No.	Project	Owner (Company name, Address, email ID, contact phone no.)	Pipe Manufacturer (Name, address, contact phone no., email ID etc.)	Coil Width (mm)	Plate Width (mm)	Billet	Grade API 5L X-	Product Specification Level (PSL-2)	Wall thickness (mm)	Quantity (MT) > 5000 MT	Pipe Diameter for which supplied NB (inch)	Year of supply	Purchase/ Work Order No. (Note-3)	Inspection Release Note/ Completion Certificate No. (Note-3)

To be filled, signed and stamped by Bidder.

Note:

1. **This form shall be submitted along with the bid.**
2. **This form shall be filled separately by line pipe manufacturer for each steel coil/ plate manufacturer proposed by the bidder.**
3. **Copy of Purchase/ work order(s) and Inspection Release Note(s)/ Completion Certificate(s) shall be enclosed.**

Bidder's seal **Signature of Bidder**

At the helm of the Energy Transition, Tractebel provides a full range of engineering and advisory services throughout the life cycle of its clients' projects, including design and project management. As one of the world's leading engineering and advisory companies and with more than 150 years of experience, it's our mission to actively shape the world of tomorrow. With about 5,000 experts and presence in more than 70 countries, we are able to offer our customers multidisciplinary solutions in energy, water and urban.

TRACTEBEL ENGINEERING PVT. LTD.

GURGAON OFFICE
Intec House, 37
Institutional Area, Sector 44
122002 - Gurgaon - INDIA
tractebel-engie.com

NITISH NANDI
tel. +91 124 469 8500
fax +91 124 469 8586
nitish.nandi@tractebel.engie.com