CENTRAL UP GAS LIMITED (CUGL)

CITY GAS DISTRIBUTION PROJECT

BID DOCUMENT FOR

TENDER FOR PROCUREMENT OF 6” & 8” 3 LPE COATED LINE PIPES

BID DOCUMENT NO. REPL/CUGL/STP/002/18

SECTION – V

TECHNICAL SPECIFICATION

B. REMARKS / COMMENTS

1. GENERAL NOTES

SUPPLIER's compliance

Supplier 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 supplier of his responsibility to meet the specified performance.

2. COMPLIANCE WITH SPECIFICATION

The SUPPLIER 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

The inspection shall be carried out by TPIA / Purchaser representative at bidder's works / sub-contractor's works as per approved QAP and inspection charges will be borne by Purchaser (CUGL). However in case where ever inspection is to be carried out by supplier only then supplier will bear the inspection expenses. This requirement supersedes all other inspection requirement / conditions specified in tender document.

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4. APPLICABLE DOCUMENTS

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

5. SUPPLIER'S DOCUMENTS

Supplier shall supply the documentation as listed under point D of this Material

Requisition. All documents shall be supplied in English language.

Supplier 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	Document Index No.	Serial No.	Revision No.

Where,

Project No

Item is LPIPE for Line Pipe

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

Serial No. shall be 4 digit no. ranging from 0001 to 9999

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

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

	LPIPE	QAP	0001	R0

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**							
	A							
Documents	**Revision of documents**							
PTS – Line Pipe (HFW Pipes)	A							
PTS – Line Pipe (Seamless Pipes)	A							
PTS – 3LPE External coating	A							
GTS – Line Pipe	A							
GTS – 3LPE External coating for Line Pipes	0							
QCT - Line Pipe (HFW Pipes)	A							
QCT -3LPE External coating	A							

D. DOCUMENTS & DATA REQUIREMENTS

The table hereunder specifies the quantities and the nature of the documents to be submitted by the CONTRACTOR 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 CONTRACTOR. 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.	Code compliance certificate(Quality manual, ISO certificate, API License)	2	2	3 weeks	2	2 weeks after approval
2.	Duly filled & signed Technical Questionnaire & documents as per Appendix 1 of PTS.	2	- -	- -	- -	- -
3.	Compliance to tender QCT	2	2	3 weeks	2	2 weeks after approval
4.	Catalogues / References (for information)	2	- -	- -	- -	- -
5.	Production, test and delivery	- -	2	1 week	2	2 weeks

	schedule (per item)			+ monthly		
6.	Drawing/data submittal list and schedule	- -	2	1 week + monthly	2	2 weeks after approval
7.	Description of application and quality with technical data of 3LPE for external coating	- -	2	3 weeks	2	2 weeks after approval + with final techn. file
8.	QA/QC program (First Day Production + Regular production separately)	- -	2	2 weeks	2	2 weeks after approval
9.	Inspection and test procedures	- -	2	3 weeks	2	2 weeks after approval + with final techn. file
10.	A description with calculation for handling, storage, transportation procedure during total manufacturing cycle and long storage procedure	- -	2	4 weeks	- -	- -
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 availabl e	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	4	2 weeks before shipping
20.	Progress report	- -	2	Daily + weekly + monthly	- -	- -
21.	Final technical file	- -	- -	- -	6	With shipping

NOTES:

1) Documents listed in column A is required to be submitted during bid time (1 original+ 1

copy). Durations in column B (Required date) are weeks after Purchase order / LOA date or as indicated in Table. Durations in column C (Required date) are weeks after document approval or as indicated in Table. 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 3 (three) CD-ROMs to CUGL.

PTS - LINE PIPE (HFW)

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A. INTRODUCTION

The present «Particular Technical Specification» relates to the manufacture of "HFW Line Pipes" for Central UP Gas Limited (CUGL) under City Gas Distribution Project in Kanpur & Bareilly.

The present Specification shall be read in conjunction with General Technical Specification (the GTS) and **API 5L 45th edition** which it amends and/or complements.

Thus, API 5L 45th Edition is the governing standard for the purchase of line pipe. All clauses of API 5L, 45th 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.

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 : 10 – 50 °C
- Maximum Design Temperature : 60 °C
- Steel grade : Refer table below
- Pipe Size : Refer table below
- Wall Thickness (Minimum) **WT** : Refer table below
- Maximum yield strength : Refer table below (*)
- Minimum ultimate tensile strength : Refer table below (*)
- Type of Pipe : HFW
- **Length of the Pipes** : Acceptable length shall be 12 ± 0.5 meter. For sampling pipe, the minimum length of

11.0 meter is acceptable.

Table: 1

Sr. No.	Outside Dia.	Material Grade as per API 5L, PSL 2	Min. Yield Strength (*)	Max. Yield Strength	Min. Ultimate Tensile Strength (*)	Minimum Wall thickness (mm)	Quantity (M)
1.	8" (219.1 mm)	API 5L Gr. X42	290 MPa	495 MPa	415 MPa	6.4	10,000
2.	6" (168.3 mm)	API 5L Gr. X42	290 MPa	495 MPa	415 MPa	6.4	10,500

Note:

1. No Negative tolerance shall be allowed on Wall thickness.
2. Pipe Delivered in Quenched & Tempered heat treatment condition are not allowed.
3. (*) 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 and PTS – Clause 9.3, relating to ratio between both values.

AMENDMENTS TO THE GTS

The present specification has to be read in conjunction with the specification API 5L, 45th 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.

3.0 NORMATIVE REFERENCES

ADD :

API 5L	Specification for Line pipe (45th Edition, December 2012).
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.

4.0 TERMS AND DEFINITIONS

API 5L	means " API 5L — Specification for Line Pipes " (issued by the American Petroleum Institute) — (45th Edition, December 2012).
GTS	means " General Technical Specification and all documents it refers to.
PTS	means the present " Particular Technical Specification and all its appendices, if any.
OWNER	Shall mean Central UP Gas Limited (CUGL)", being the Purchaser of Line Pipes.
TPIA	means the Third Party Inspection Agency.

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

6.0 PIPE GRADE, STEEL GRADE AND DELIVERY CONDITION

The Properties of Pipe manufactured as per this PTS, shall be as listed in clause B & Table 1 of this PTS.

- Steel grade : API 5L Grade X42, PSL 2
- Delivery Condition : Quenched & Tempered is not allowed

The minimum required mechanical properties of the delivered steel shall be as per clause B & Table 1 of this PTS.

7.0 INFORMATION TO BE SUPPLIED BY THE PURCHASER

GENERAL INFORMATION:

Refer Clause No.4 'PROPERTIES OF THE PIPES' above and Section 6, for basic requirements of Line Pipe for City Gas Distribution Project in Kanpur & Bareilly.

ADD:

The following additional detail shall apply to the pipes manufactured City Gas Distribution Project in Kanpur & Bareilly, as per this PTS:

- Product Specification Level PSL 2 as per API 5L
- Type of Pipe HFW
- Manufacturing Process As per API 5L 45th Edition, GTS & PTS.

8.0 MANUFACTURING

8.1. Process of Manufacturer

Only the High Frequency Welding (HFW) Process will be accepted for Pipe Manufacture and the WPS/PQR for the same shall be submitted after award of the agreement.

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 (7 or finer as per ASTM E112) low hydrogen practice.

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 and put the acceptance stamp on each steel coils in order to issue EN 10204, 3.2 certificates.EN 10204, 3.2 certificates shall be arranged by the bidder and cost involved for testing and inspection etc. shall be born by the bidder.

Only duly stamped (by TPIA) material (steel coils), will be shipped to line pipe manufacturer, which will be verified before starting the production at pipe mill.

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.

8.9 Cold sizing andcold expansion

Not Applicable

ACCEPTANCE CRITERIA

8.5. Chemical Composition

The Chemical Composition of the Pipe material shall confirm to Table – 5 of clause 9.2 of API 5L, 45th Edition.

8.6. Tensile Properties

ADD:

The Tensile Properties of the Pipe shall confirm to Table – 7 of clause 9.3 of API 5L, 45th Edition.

For Grade X 60 and lower Pipe material, the ratio between the yield strength (Y) and ultimate tensile strength (UTS) shall not exceed 0.90 (maximum).

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.

8.5. Reverse Bend Test :

ADD:

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

8.6. 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° & 90°. In case of weld stop, 1 sample from each crop end shall be tested at 90°.

9.8 CVN Impact Test for PSL 2 Pipe

MODIFICATION:

CVN Impact test shall be carried out at 0ºC. For base material, HAZ & Weld, one set of three specimens for each, shall be taken from coupon.

Acceptance Criteria (At 0°C): For all base material, welds and HAZ – As per API 5L Table-8.

8.9. Dimensions, Mass and Tolerances

Add:-

Dents in any form shall not be permitted.

INSPECTION

ADD :

General

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

8.2. 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 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.

10.2.6 Hydrostatic Test

ADD:

The hydrostatic test pressure shall be such as to create a hoop stress of 90% of the Specified Minimum Yield Strength (SMYS) of the Pipe Material.

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.

Calibration Frequency of Equipment

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

to be minimum 1.5 times and maximum 4 times of test pressure. The pressure gauges used should have a minimum least count of 2 kg/ cm2. The pressure gauges accuracy should be minimum ± 1% of 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:

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 tube lengths tested after the previous equipment check shall be retested after the testing system has been recalibrated.

Ultrasonic and Electromagnetic Inspection

Base Material Inspection

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

ADD:

Residual Magnetism

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.

10.2.11 Reprocessing

Add :

Reprocessing shall not be permitted.

MARKING

8.7. Pipe Marking

Die Stamping by low stress punch on end of pipe and stencil marking on the outside surface of pipe on both sides shall be used for marking on pipes. In case pipe size is 12" and above inside marking shall also be done in addition to external marking.

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

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 to differentiate thickness of pipes shall be provided at each extremity (50cm 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.

Barcode identification system shall be provided by the pipe supplies, 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.

COATING AND END PROTECTION

8.8. Coating

The pipes shall be coated externally as per PTS – External Coating of Line pipe (P.009355 M11097 011), GTS for Pipeline Coating (740 GTS 404 Rev.0) and applicable code.

Coating and/or adhesive shall terminate 110mm [(+) 10 mm, (-) 0 mm] from pipe ends. ADD:

Internal coating

Not required.

8.9. End Protectors

ADD:

Pipe Bevel ends shall be protected using Bevel protectors, to be supplied by Pipe Manufacturer. In addition, Plastic end caps are required for pipes, as per GTS requirement.

10.0 PIPE LOADING

The Transportation, Unloading & Stacking of Coated Line Pipes at CUGL's store located at Kanpur shall be in the scope of the Pipe 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.

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 is 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.

16.0 TECHNICAL QUESTIONNAIRE LINE PIPE SUPPLIER (NEW CLAUSE)

A technical questionnaire (Appendix-1 to this PTS) must be completed, dated, validated by a company stamp, and signed by a responsible person according to the rules of the companies Quality Management System.

THE FOLLOWING ANNEXURES OF API 5L 45TH EDITION, ARE APPLICABLE FOR PIPES MANUFACTURED AS PER THIS PTS:

Annex B (normative): Manufacturing procedure qualification for PSL 2 pipe

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 one 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 pipe of 3 different coils of 3 different heats shall be selected. All destructive tests shall be performed on each selected pipes.

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).

ADD:

BURST TEST

Burst test to be done for each size and thickness 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. The following formulae shall be used for calculating the minimum rupture pressure (in Kg/Cm2):

$$P = (2xSxT) / D \times 10.197$$

Where, P = Minimum rupture pressure in kg/cm2

S = Specified Minimum Tensile Strength in MPa T = Wall thickness (in mm)

D = OD in mm

VISUAL EXAMINATION

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

NON DESTRUCTIVE EXAMINATION

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

MECHANICAL PROPERTIES TEST

Following test shall be carried out as per QCT / approved QAP.

- Tensile test (Base & Weld Transverse).
- Reverse bend test
- Flattening test
- Impact test
- Hardness test
- Drop weight tear test
- Macro and micro examination,

Annex C (normative) : Treatment of surface imperfections and defects

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.

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

<u>In Addition:</u>

Annexure Q of GTS : 'Client Indicative Inspection and Quality Plan', has been replaced by QCT for HFW Pipes – Document No: P.009355 M11098 016. The same shall be applicable for HFW pipes.

APPENDIX 1

TECHNICAL QUESTIONNAIRE FOR EVALUATION OF THE BIDS

1.0 Scope

Pipe ND - 6" & 8" and Grade X42, with 3LPE externally coated line Pipe as specified in MR. Applicable Documents:

- API 5L forty-five Edition, December, 2012
- REPL Specification & documents. (Including PTS, GTS and MR)
- 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)

……

……

- API approvals

……

……

- Safety approvals

……

……

- Third party approvals

……

……

- Client approvals

……

……

- Other approvals

……

……

2.3. References for the manufacture/supply of API 5L Grade X42 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 2013 :

……..

……..

  - Year 2014 :

……..

……..

  - Year 2015:

……..

……..

  - Year 2016:

……..

……..

  - Year 2017 :

……..

……..

  - Year 2018 (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 Ingot/Billets/Blooms 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 9001:2008), 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 Resonance energy as confidential information and will only be used for technical evaluation of the companies tender for the supply of line pipes for CNG & City Gas Distribution Project in in Kanpur & Barielly.

PTS - LINE PIPE (SEAMLESS)

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A. INTRODUCTION

The present «Particular Technical Specification» relates to the manufacture of "SEAMLESS Line Pipes" for Central UP Gas Limited (CUGL) under City Gas Distribution Project in Kanpur & Bareilly.

The present Specification shall be read in conjunction with «General Technical Specification» (the **GTS**) and **API 5L Latest edition** which it amends and/or complements.

Thus, API 5L, Latest Edition is the governing standard for the purchase of line pipe. All clauses of API 5L, Latest 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.

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 : 10 – 50 °C
- Maximum Design Temperature : 60 °C
- Steel grade : Refer table below
- Pipe Size : Refer table below
- Wall Thickness (Minimum) **WT** : Refer table below
- Maximum yield strength : Refer table below (*)
- Minimum ultimate tensile strength : Refer table below (*)
- Type of Pipe : SEAMLESS
- **Length of the Pipes** : Acceptable length shall be 12 ± 0.5 meter. For sampling pipe, the minimum length of 11.0 meter is acceptable.

Table: 1

Sr. No.	Outside Dia.	Material Grade as per API 5L, PSL 2	Min. Yield Strength (*)	Max. Yield Strength	Min. Ultimate Tensile Strength (*)	Minimum Wall thickness (mm)	Quantity (M)
1.	8" (219.1 mm)	API 5L Gr. X42	290 MPa	495 MPa	415 MPa	6.4	Refer MR

2.	6" (168.3 mm)	API 5L Gr. X42	290 MPa	495 MPa	415 MPa	6.4	
3.	4" (114.3 mm)	API 5L Gr. X42	290 MPa	495 MPa	415 MPa	6.4	

Note:

1. No Negative tolerance shall be allowed on Wall thickness.
2. Pipe Delivered in Quenched & Tempered heat treatment condition are not allowed.
3. (*) 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 and PTS – Clause 9.3, relating to ratio between both values.

AMENDMENTS TO THE GTS

The present specification has to be read in conjunction with the specification API 5L, 45th 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 (45th Edition, December 2012).
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.
BS 672	Wet Magnetic Particle inspection.
EN 10204	Metallic Products - Types of inspection Documents.

4. TERMS AND DEFINITIONS

API 5L	means " API 5L — Specification for Line Pipes " (issued by the American Petroleum Institute) — (Latest Edition, December 2012).
GTS	means " General Technical Specification" and all documents it refers to.
PTS	means the present " Particular Technical Specification." and all its appendices, if any.
OWNER	Shall mean "Central UP Gas Limited (CUGL)", being the Purchaser of Line Pipes.
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

The Properties of Pipe manufactured as per this PTS, shall be as listed in clause B & Table 1 of this PTS.

- Steel grade : API 5L Grade X42, PSL 2
- Delivery Condition : Quenched & Tempered is not allowed

The minimum required mechanical properties of the delivered steel shall be as per clause B & Table 1 of this PTS.

7. INFORMATION TO BE SUPPLIED BY THE PURCHASER

GENERAL INFORMATION:

Refer Clause No.4 'PROPERTIES OF THE PIPES' above and Section 6, for basic requirements of Seamless Line Pipe for City Gas Distribution Project in Kanpur & Bareilly

ADD:

The following additional detail shall apply to the pipes manufactured for City Gas Distribution Project in Kanpur & Bareilly, as per this PTS:

- Product Specification Level — PSL 2 as per API 5L
- Type of Pipe — SEAMLESS
- Manufacturing Process — As per API 5L Latest Edition, GTS & PTS.

8. MANUFACTURING

8.1 Process of Manufacturer

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.

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 (7 or finer as per ASTM E112) low hydrogen practice.

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 Ingot/Billet/Bloom 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.

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. Further, all surfaces of Ingots/Billets/ Blooms shall be defect free.

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

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

Not Applicable.

9. ACCEPTANCE CRITERIA

9.2 Chemical Composition

The Chemical Composition of the Pipe material shall confirm to Table – 5 of clause 9.2 of API 5L, Latest Edition.

9.3 Tensile Properties

ADD:

The Tensile Properties of the Pipe shall confirm to Table – 7 of clause 9.3 of API 5L, 45th Edition.

For Grade X 60 and lower Pipe material, the ratio between the yield strength (YS) and ultimate tensile strength (UTS) shall not exceed 0.90 (maximum).

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.

9.5 Bend Test (Reverse):

Not Applicable

9.6 Flattening Test

Not Applicable

9.7 Guided Bend Test

Not Applicable

9.8 CVN Impact Test For PSL 2 Pipe:

MODIFICATION:

CVN Impact test shall be carried out at 0ºC. For base material, one set of three specimens for each, shall be taken from coupon.

Acceptance Criteria (At 0°C): For all base material– As per API 5L Table-8.

9.11 Dimensions, Mass and Tolerances

Add:-

Dents in any form shall not be permitted.

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.

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 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.

10.2.6 Hydrostatic Test

ADD:

The hydrostatic test pressure shall be such as to create a hoop stress of 90% of the Specified Minimum Yield Strength (SMYS) of the Pipe Material.

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.

Calibration Frequency of Equipment

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 to be minimum 1.5 times and maximum 4 times of test pressure. The pressure gauges used should have a minimum least count of 2 kg/ cm2. The pressure gauges accuracy should be minimum ± 1% of 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.

10.2.11 Reprocessing

ADD:

Reprocessing shall not be permitted.

11. Marking

11.2 PIPE MARKING

Die Stamping by low stress punch on end of pipe and stencil marking on the outside surface of pipe on both sides shall be used for marking on pipes. In case pipe size is 12" and above inside marking shall also be done in addition to external marking.

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

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 to differentiate thickness of pipes shall be provided at each extremity (50cm 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.

Barcode identification system shall be provided by the pipe supplies, 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.

12. COATING AND END PROTECTION

12.1 COATING

The pipes shall be coated externally as per PTS – External Coating of Line pipe, GTS for Pipeline Coating and applicable code.

Coating and/or adhesive shall terminate 110mm [(+) 10 mm, (-) 0 mm] from pipe ends.

ADD:

Internal coating

Not required.

12.2 THREAD (END) PROTECTORS

ADD:

Pipe Bevel ends shall be protected using Bevel protectors, to be supplied by Pipe Manufacturer. In addition, Plastic end caps are required for pipes, as per GTS requirement.

14. PIPE LOADING

The Transportation, Unloading & Stacking of Coated Line Pipes at CUGL's store located at at Kanpur/ Bareilly/ Unnao/ Jhansi shall be in the scope of the Pipe 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.

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.'

15. Technical Questionnaire Line Pipe Supplier (NEW CLAUSE)

A technical questionnaire (Appendix-1 to this PTS) must be completed, dated, validated by a company stamp, and signed by a responsible person according to the rules of the companies Quality Management System.

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 HFW pipes - Transverse CVN Transition curves for pipe body, at temperature range of -40°C, -20°C, 0°C, +10°C and +20°C for pipe body not weld & HAZ.	For information

B.7FIRST 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 pipe of 3 different heats shall be selected. All destructive tests shall be performed on each selected pipes.

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.

ADD:

BURST TEST

Burst test to be done for each size and thickness 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. The following formulae shall be used for calculating the minimum rupture pressure (in Kg/Cm2):

P = (2xSxT) / D 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

VISUAL EXAMINATION

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

NON DESTRUCTIVE EXAMINATION

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

MECHANICAL PROPERTIES TEST

Following test shall be carried out as per QCT / approved QAP.

- Tensile test (Base Transverse).
- Impact test
- Hardness test
- Drop weight tear test (for OD > 20" (508 mm))
- Macro and micro examination,

Annex C (normative) : Treatment of surface imperfections and defects

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.1QUALIFICATION 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.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.4. RADIOGRAPHIC INSPECTION OF WELD SEAMS

Not applicable for Seamless 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.7Residual 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

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

<u>In Addition:</u>

Annexure Q of GTS : 'Client Indicative Inspection and Quality Plan', has been replaced by QCT for Seamless Pipes – Document No: P.009718 M11098 018. The same shall be applicable for Seamless pipes.

APPENDIX 1

TECHNICAL QUESTIONNAIRE FOR EVALUATION OF THE BIDS

1. Scope

Pipe ND - 4", 6" & 8" and Grade X42, Pipe ND with 3LPE externally coated line Pipe as specified in MR.

Applicable Documents:

- API 5L forty-five Edition, December, 2012
- Resonance 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. 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 - 2008)

……

……

- API approvals

……

……

- Safety approvals

……

……

- Third party approvals

…… ……..

……

- Client approvals

…… ……

…… ……

- Other approvals

……

……

2.3. References for the manufacture/supply of API 5L X42 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 2013 :

    ……..

    ……..
  - Year 2014 :

    ……..

    ……..

- Year 2015:

……..

……..

- Year 2016:

……..

……..

- Year 2017 :

……..

……..

- Year 2018 (eventually orders to be executed remainder of the year)

……..

……..

3. 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. Material Suppliers

4.1 Provide commitment letter from at least two possible Ingot/Billets/Blooms 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 9001:2008), detailing the controls (audits?) performed on your suppliers. Also provide a copy of the planning of your supplier audits for last three years.

5. 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 RESONANCE as confidential information and will only be used for technical evaluation of the companies tender for the supply of line pipes for CNG & City Gas Distribution Project in Kanpur & Bareilly.

	QUALITY CONTROL TABLE LINE PIPES (SEAMLESS PIPE)						QCT No. :		
							Date :		
							Prepared by : Checked By :		
							Approved by :		

SR. No	DESCRIPTION	CHARACTERISTICS	QUANTUM OF CHECK	REF. DOC.	ACCEPTANCE NORMS	DOCUMENTATION	INSPECTION		REMARKS
							MANUF.	TPIA	
1.0	**Base material**								
1.1	Raw Material Inspection (Billet/Mother holow)	Marking and correlation with TC (Review of records & visual)	100%	API 5L 45th Edition / GTS / PTS	API 5L 45th Edition / GTS / PTS	Inspection report	P	R	
1.2		Chemical composition	One sample per heat			Inspection report	P	R	
1.3		Internal soundness (Macro etching)	One sample per heat			Inspection report	P	R	
1.4	Control Tensile test (Billet/Mother holow)	–	One sample per heat			Inspection report	P	W	
2.0	**First Day Production**	–	Each size (Total 3 pipes / size, one each from 3 different heat)	API 5L 45th Edition / GTS / PTS	API 5L 45th Edition / GTS / PTS	Inspection report	P	W	Preferably Witness by CA
2.1	**Burst Test**	–	One pipe per size per thickness per grade		Burst test pressure shall be higher than minimum specifie	Inspection report	P	W	

					d UTS of Raw material as per MTC, location of failure and pressure to be recorde d.				
3.0	**Pipe rolling Heating, Hot Rolling Straightening**	Process controls	As per internal QA plan	API 5L 45th Edition / GTS / PTS	API 5L 45th Edition / GTS / PTS	Inspection report	P	RW	
4.0	**Heat treatment** (if applicable) - Loading and Unloading shall be witness by TPIA.	HT cycle (Time & temperature)	100%	API 5L 45th Edition / GTS / PTS	API 5L 45th Edition / GTS / PTS	Heat Treatment report	P	W	
5.0	**Hydro Testing**								
5.1	Hydrostatic testing (showing pressure & holding time).	Leak check (Visual)	Each Pipe	API 5L 45th Edition / GTS / PTS	Test Duratio n - 15 seconds Minimu m, Test pressure - Calculat ed at 90 % of SMYS.	Hydro test report & graph	P	10%W & Balance 'R'	
5.2	Calibration of pressure gauge	Calibration	Each shift		Pressure gauge shall be calibrate d with a dead weight tester at start of each shift (max 12	Test report	P	W	

					hrs.)of work. Pressure Gauge range shall be 1.5 to 4 time of test pressure . Least Coung of Pressure Gauge should be 2 Kg/cm2 . PG accuracy ± 1% FSD.				
6.0	**Non destructive Testing**								
6.1	Ultrasonic testing	Surface & internal imperfections	Each Pipe & full length	API 5L 45th Edition / GTS / PTS	API 5L 45th Edition / GTS / PTS	Inspection report	P	10%W & Balance 'R'	
6.2	Electromagnetic (Flux Leakage) Test					Inspection report			
6.3	Residual Magnetism	-	1 pipe once in 4 hrs / shift		Avg. of 4 readings not exceed 20 Gauss, No reading shall exceed 25 Gauss.	Inspection report			
7.0	**PRODUCTION TESTS**								
7.1	**Chemical Analysis (Product)**		2 Pipes / 50 Pipes / Each HT lot / Each heat no / size	API 5L 45th Edition / GTS / PTS	API 5L 45th Edition / GTS / PTS	CHEMICAL TEST REPORT	H	W	

7.2	**Mechanical Properties & Testing**								
7.2.1	Tensile Test - Base Transverse metal - Weld Transverse metal		2 Pipes / 50 Pipes / Each HT lot / Each heat no / size	API 5L 45th Edition / GTS / PTS	API 5L 45th Edition / GTS / PTS	Test Report	H		
7.2.2	Impact Test at 0 ^{0}C (Base Metal)		PTS - Line pipe			Test Report	H	100%W	
7.2.3	Metallographic Examination & Hardness		2 Pipes / 50 Pipes / Each HT lot / Each heat no / size			Tets Report	H		
8.0	**WORKMANSHIP, VISUAL INSPECTION AND REPAIR OF DEFECTS**								
8.1	Visual Inspection	-	Each pipe	API 5L 45th Edition / GTS / PTS	API 5L - 45th edition, GTS & PTS	Visual & Dimensional Inspection Report	P	10%W & Balance 'R'	
8.2	Dents	-	Each pipe						
8.5	Cracks, sweats and Leaks	-	Each pipe						
8.6	Lamination	-	Each pipe						
9.0	**DIMENSIONAL INSPECTION**								
9.1	Wall Thickness		Each Pipe	API 5L 45th Edition / GTS / PTS	+10%, -0%	Dimensional Inspection Report	P	10%W & Balance 'R'	
9.2	Length Measurement		Each Pipe		Length = 11.5 - 12.5 meters, For sample pipes - 11.0 meters				
9.3	Straightness		Each Pipe		Shall not exceed 12 mm. Less than 4mm in 1 Meter				

					from each pipe end.				
9.4	Outside Diameter		Each Pipe		**For ≥ 2" to upto 6" :-** Pipe Ends :- - 0.4 mm, + 1.6 mm Pipe Body :- ± 0.0075 D **For > 6" to upto 24" :-** Pipe Ends :- ± 0.005 D, but maximum of ± 1.6mm Pipe Body :- ± 0.0075 D, but maximum of ± 3.2mm				
9.5	Out of Roundness (Difference between max. & Min. Diameters)		Each Pipe		**For ≤ 6" OD :- as per Table 10 of API 5L For > 6" OD :-** Pipe end - 3 mm max. Pipe				

					body - 5 mm max.				
9.6	Weight		Each Pipe		as per API 5L - 45th edition, GTS & PTS				
10.0	**PIPE END AND END PROTECTORS**								
10.1	Bevel by Gauge		Each pipe		Angle :- 30° (+5°, -0°) & Root Face :- 1.6 mm ± 0.8 mm	Visual & Dimensional Inspection Report	P	10%W & Balance 'R'	
10.2	End Squareness (Out-of-Squareness)		Each pipe		Max. 1.6 mm				
10.3	Bevel Protrectors		Each pipe		Both pipe ends shall be provided with Plastic end caps.				
10.0	**MARKING** - marking shall be paint stencilled at right angle to the pipe axis at 150 mm from one end with letter size 30mm min. on Outside & inside(for 8" & above).	Marking	One end of each pipe from inside(for 8" & above pipe size) & outside after coating	API 5L 45th Edition / GTS / PTS	Marking as per API 5L & GTS / PTS it will be in english using metric unit. It will include API monogram,		P	W	

					manufacturer's name, nom. Dia, grade, length, weight, hydro pressure, pipe no., Heat no., P.O.No., Item no., Thickness, Sr 5 a b & Sr 6, requirements.				
10.1	Die stamping	Marking	Each Pipe	API 5L 45th Edition / GTS / PTS	Pipe no. shall be die stamped at one end on bevel at the right side to the longitudinal weld seam. Or pipe no. Shall be die stamped at one end with low stress dot punches at the outside surface		P	RW	

					of the pipe at a distance of atleast 2 cm of the end of pipe on the right side of the weld.				
11.0	**FINAL DOCUMENTATIONS**	-	100%	API 5L 45th Edition / GTS / PTS	Mechanical, NDT, hydro test reports as per API 5L - 45th edition SR 15 & Steel mill TC etc. **as per 3.2 Certification as par EN 10204**	**3.2 Certification**	P	R	
LEGEND:									
	RT : Radiographic test	PT : Liquid penetrant test	MT : Magnetic particle test	HT : Heat treatment	VT : Visual test	RW : Random witness (Min. 10% witness)			
	P : Performed	R : Review	W : Witness	H : Hold	M : Monitor	TPIA : Third Party Inspection Agency, CA - Control Authority (Owner / Owner's representative)			

Note :

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 seprately which are prepared on the basis of above for approval of Owner/Owner's representative and TPIA.
3	Supplier shall submit Calibration certificates of all Instruments/Equipment to be used for Inspection and Testing to TPIA with relavant procedures and updated standards for TPIA reveiew/Approval.
4	Owner / Owner's representative including TPIA will have the right to inspect any activity of manufacturing at any time.

5	All the NDT/Leak testing/ Heat treatment/ Special manufacturing procedures have to be specially approved or only previously approved procedures have to be used, in case of conflict between specifications, more stringent condition shall be applicable.
6	Supplier shall issue detailed Production and Inspection schedule indicating the dates and the locations to facilitate Owner/Owner's representative and TPIA to organise Inspection.
7	All reference codes/ standards, documents, P.O. copies shall be arranged by manufacturer for reference of TPIA/Owner/Owner's representative at the time of inspection.
8	Certification requirement shall comply with 3.2 Certificatation European standard EN 10204, (latest edition)
9	Owner/Owner representative shall have right to review/witness any activity & all the documents related to QCT/Quality manuals/Drawings etc.submitted by supplier.
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.

3 LPE EXTERNAL COATING OF LINEPIPE

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1.0 GENERAL

The present document covers the technical specification for coating of line pipes as follows: Table-1 : PIPELINE COATING REQUIREMENT

Sl No	Line size (inch)	Type of pipes	Approx. Length in Km	External Coating	Internal Coating
1	8" NB	HFW	10,000	√	X
2	6" NB	HFW	10,500	√	X

Pipe length shall be between 11.5 to 12.5 m. Thickness wise average length of pipes supplied shall not be less than 12.0 m. For sampling pipes, minimum length of 11.0 m is acceptable.

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 both face of the square/bevel ends 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 of CUGL.

The present document covers the technical specification for coating of line pipes. The following sections cover the guidelines for:-

A) **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 :2011 'Petroleum and Natural Gas Industries-External Coatings for buried and submerged pipeline transportation systems-Part 1:Polyolefin Coatings', and the Internal epoxy coating conforming to ISO 15741:2001 "Friction reduction coatings for the interior of on and off shore steel pipe lines for non corrosive gases".

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 21809-1:2011 : Petroleum and Natural Gas Industries-External Coatings for buried and submerged pipeline transportation systems-Part 1:Polyolefin Coatings

ii. DIN EN 30670:2012 : Polyethylene Coating on Steel Pipes & Fittings – Requirement and Testing

iii. ISO 21809-2:2007 : Petroleum and Natural Gas Industries-External Coatings for buried and submerged pipeline transportation systems-Part 2: Fusion-bonded epoxy coatings.

iv. ISO 15741:2001 : Friction reduction coatings for the interior of on and off shore steel pipe lines 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

OWNER OR CLIENT	Shall mean "CENTRAL UP GAS LIMITED. (CUGL) ", being the Owner of Line Pipes.
CONSULTANT / OWNER REPRESENTATIVE	Shall means " Resonance Energy Pvt. Limited " / The company nominated by the owner to design the natural gas transport or distribution system and to specify the equipment
INSPECTION AGENCY OR THIRD PARTY INSPECTION AGENCY (TPIA)	means the Third Party Inspection Agency to be appointed by the Manufacturer.
MANUFACTURER	means the Manufacturer of the pipes as well as its sub-contractor(s).

API 5L	Means «API 5L- Specification for Line Pipes» (issued by the American Petroleum Institute) - 45th Edition, December 2012.
GTS	Means " General Technical Specification".
PTS	means the present " Particular Technical Specification" and all its appendices, if any.

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-21809-1:2011and 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)

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. Moisture 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
b. Manufacturing standard
c. Health, safety and environmental Instructions
d. Receiving inspection acceptance criteria
e. Data Sheets
f. Storage instruction.
g. Type of Material
h. Batch Number
i. Place and Date of Manufacture
j. Shelf Life/Expiry Date (if applicable)
k. Quantity

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

5.1 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 21809-1:2011.

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.

5.2.1 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.

5.2.1.1 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 ±	s	Within 20% of the nominal value	ISO 21809 – 1 Annexure J

	3˚C		specified by the manufacturer	
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.

5.2.1.2 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

5.2.2 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	≥ 0.930 (MDPE) ≥ 0.891 (HDPE)	ISO 1183
d.	Hardness at 23˚C	Shore D	≥ 55 (MDPE) ≥ 60 (HDPE)	ISO 868
e.	Water absorption, 24 hours at 23˚C	%	≤ 0.05	ASTM D 570 ISO 15512

f.	Volume Resistivity at 23˚C	Ohm – cm	≥ 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

5.2.3 Properties of Applied Coating System

Sl. No.	Properties	Unit	Requirement	Test Method
a.	Bond Strength (Peel Strength) • @23°C • @80 °C	N / mm	≥ 15 ≥ 3	ISO 21809-1 Annexure C C.5 hanging mass
b.	Impact Strength (Min. of 30 impacts on body along the length. No breakdown allowed when	Joules per mm of coating	≥ 7	ISO 21809-1 Annexure E

	tested at 25 KV)	thickness		
c.	Indentation Hardness • @ 23 +/- 2°C • @ 80 +/- 2°C	mm	≤ 0.2 ≤ 0.3	ISO 21809-1 Annexure F
d.	Elongation at Failure	%	≥ 400	ISO 527 – 3
e.	Coating Resistivity	Ohm – m^2	10^8 min.	DIN 30670
f.	Cathodic Disbondment • 23 °C/28d;-1.5V • 65 °C/24h;-3.5V • 80 °C/28d;-1.5V	mm Average radius of Cathodic disbondment	≤ 7 ≤ 7 ≤ 15	ISO 21809-1 Annexure H
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.

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 day's notice to witness all procedures and tests.

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.15 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.12 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.11 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. One test shall be carried out for 28 days, 23°C, second test for 24 hours@ 65°C duration and third test for 80 °C, 28 days. One sample at 80 ^{0}C for 28 days CD shall be sent to NABL approved external laboratory.

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 at the start of production shall prepare a sample and perform the test as per DIN30670:2012 and submit the report to the customer.

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% 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 2µ g/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 2µ g/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 2µ g/cm^2 shall be either reblasted or de- ionised water washed and then rechecked for salt contamination. In case salt level less than be 2µ g/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 50 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% 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 blueing 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. For LSAW line pipe required for HDD crossings, the minimum DFT of epoxy powder shall be 400 micron. 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 A3 class coating except otherwise specified. The total thickness of the applied coating for all diameters of pipes shall be minimum 3.0 mm as per ISO/DIS – 21809-1

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

In case HDPE material is used as top coat, 10% reduction in minimum coating thickness is permissible.

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 fluidised 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 recorded. The monitoring instruments shall be independent of the temperature control equipment. The instruments shall be calibrated prior to start of each shift.

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°.

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 colour 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 DIN VDE 0433 Part 2. The set voltage for inspection shall be minimum 25 kV. Travel speed shall not exceed 300 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 for cut back portions shall be every 2 hrs and for middle of pipe shall be 4 hrs. 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. 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 fifteen pipes, 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. 24 hours 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 2 Samples from total lot 1 for 28 days & 1 for 48 hrs.

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.

10.2.13 Cyclic test

One cyclic test shall be conducted after completion of coating followed by strip test of coating to locate any failure on disbondment, for cyclic test, the pipe to be pressurized to 1.5 times of design pressure and then dropped to 5% of design pressure and again re-pressurized to 1.5 times of design pressure, continuously for about 100 cycles, then check for coating disbondment by stripping the pipe coating.

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. Pre-Dispatch inspection shall be arranged by CUGL. 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.

11.4 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.

11.5 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.

11.6 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.

11.7 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.

11.8 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. 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 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.

ONSHORE SERVICE

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INTRODUCTION

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

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

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

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

The complete production cycle shall be supervised by the **Third Party Inspection Agency**.

A technical audit will be executed during a sample production run.

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

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

If during the production process problems concerning the quality arise, **Third Party Inspection Agency**

may request additional tests.

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

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

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

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

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

PROPERTIES OF THE PIPES

- Product Specification Level (PSL) : PSL2
- Max. operating pressure : See PTS
- Max. operating temperature : 60 ºC
- 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 >>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.

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 ≤ 5° C, gas cutting and scarfing of slabs shall be performed at temperature ≤ 120°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
≤ 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 1 1 2
Nb + V + Ti	0.15 Max	0.15 Max

Cu + Ni	0.50 Max	0.75 Max
CE (II W)	0.43 Max	0.43 Max
CE (PCM)	0.23 Max	0.23 Max

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

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

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

Additional notes;

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

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

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

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

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

9.3 Tensile Properties

9.3.2 Add:

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

9.3.3 Hardness tests (added)

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

Hardness shall conform to the following:

The Hardness (Hv 10) Base metal, weld metal, and HAZ non sour service steel grade ≤ X 70 (L485)) ≤ 260

steel grade ≤ X 80 (L555) ≤ 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 45th Edition.

9.8.2 Pipe body tests

9.8.2.1 Add;

For pipe body and base material the minimum average (of a set of three test pieces) for each pipe body (base material) for grade ≤ 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 arranged by the bidder and cost involved for testing and inspection etc. shall be born by the bidder.

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 ≥ 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 ≥ 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 ≤ 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 $\leq 3^{o}$ 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 (6th Edition, July 2002) regardless of D/t ratio. End gates lined with wood to a minimum nominal thickness of 25mm shall be provided in gondola cars and bulkhead flat cars.

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

For pipes shipped in skids. The skids should be placed directly on clean (no debris) car bottom.

Skid height shall be at least 25mm higher than any foreign material or integral projections on car bottom. Skids shall not be stacked, and skid height shall be limited to skid width or the loading gauge of the railway whichever is more stringent.

Barge and marine vessel shipping:

For barge and marine vessel shipping the pipes shall be loaded as per API RP 5LW latest edition (3nd 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.	≤ 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°F) to - 50^0C (-58°F) (≤ 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.	To document transition temperature. CVN: Section 9.8 of this specification at Ttest.

	For D≥ 323.9mm (12.75 in), pipe body DWT transition curve may be used to replace pipe body CVN transition curve.	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

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 ≤ 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 ≤ 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.

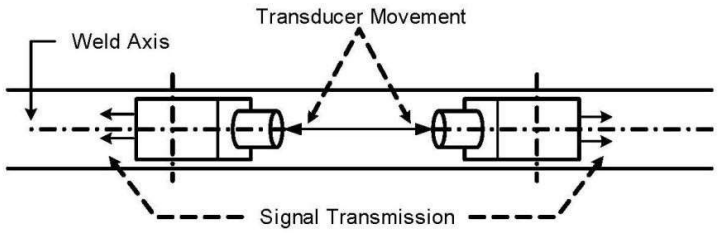
K.5.1.1 Longitudinal N5 notches shall be employed, as per ISO 9765 but are only to ensure that the sound beam is perpendicular to the weld seam and to indicate the edge of gate widths for probes inspecting the weld for longitudinal imperfections. Transverse N5 notches on the ID / OD weld crowns shall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

ONSHORE SERVICE

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INTRODUCTION

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

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

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

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

The complete production cycle shall be supervised by the **Third Party Inspection Agency**.

A technical audit will be executed during a sample production run.

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

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

If during the production process problems concerning the quality arise, **Third Party Inspection Agency**

may request additional tests.

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

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

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

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

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

PROPERTIES OF THE PIPES

- Product Specification Level (PSL) : PSL2
- Max. operating pressure : See PTS
- Max. operating temperature : 60 ºC
- 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 >>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 ≤ 5° C, gas cutting and scarfing of slabs shall be performed at temperature ≤ 120°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
≤ 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 1 1 2
Nb + V + Ti	0.15 Max	0.15 Max
Cu + Ni	0.50 Max	0.75 Max
CE (II W)	0.43 Max	0.43 Max
CE (PCM)	0.23 Max	0.23 Max

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

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

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

Additional notes;

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

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

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

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

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

9.3 Tensile Properties

9.3.2 Add:

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

9.3.3 Hardness tests (added)

Vickees Hardness (Hv 10) tests shall be conducted on the metallographic cross section required in table 18 of API 5L in accordance with clause H.7.3.3 "Hardness tests". Indent

locations shall conform to Annex H, Figure H.1.b. At least one HAZ hardness indent shall be positioned in the coarse grain structure immediately adjacent to the fusion line.

Hardness shall conform to the following:

The Hardness (Hv 10) Base metal, weld metal, and HAZ non sour service steel grade ≤ X 70 (L485)) ≤ 260

steel grade ≤ X 80 (L555) ≤ 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 45th Edition.

9.8.2 Pipe body tests

9.8.2.1 Add;

For pipe body and base material the minimum average (of a set of three test pieces) for each pipe body (base material) for grade ≤ 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 <u>At 0°C</u>

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).

<u>At - 20°C</u>

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. 3.2 certificate is to be arranged by the bidder and cost involved for testing and inspection etc shall be born by the bidder, 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 arranged by the bidder and cost involved for testing and inspection etc. shall be born by the bidder.

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 ≥ 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 ≥ 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 ≤ 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 $\leq 3^{o}$ 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 (6th Edition, July 2002) regardless of D/t ratio. End gates lined with wood to a minimum nominal thickness of 25mm shall be provided in gondola cars and bulkhead flat cars.

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

For pipes shipped in skids. The skids should be placed directly on clean (no debris) car bottom.

Skid height shall be at least 25mm higher than any foreign material or integral projections on car bottom. Skids shall not be stacked, and skid height shall be limited to skid width or the loading gauge of the railway whichever is more stringent.

Barge and marine vessel shipping:

For barge and marine vessel shipping the pipes shall be loaded as per API RP 5LW latest edition (3nd 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.	≤ CEPcm maximum of ordered grade + 0.03.
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 ($+68^oF$) 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.	To document transition temperature. CVN: Section 9.8 of this specification at Ttest.
	For D≥ 323.9mm (12.75 in), pipe body DWT transition curve may be used to replace pipe body CVN transition curve.	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

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 ≤ 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 ≤ 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.

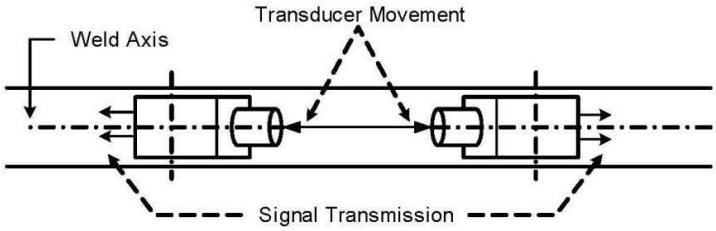
K.5.1.1 Longitudinal N5 notches shall be employed, as per ISO 9765 but are only to ensure that the sound beam is perpendicular to the weld seam and to indicate the edge of gate widths for probes inspecting the weld for longitudinal imperfections. Transverse N5 notches on the ID / OD weld crowns shall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

			QUALITY CONTROL TABLE LINE PIPES (HFW PIPE)			**QCT No**	:	
						Date	:	
						Author	: **Checked By:**	
						Appro.	:	
Sn	**INSPECTION AND TESTING**	**Ref. Docs (PTS/GTS/API 5L - 45th edition)**	**TESTING FREQUENCY (MINIMUM)**	**ACCEPTANCE CRITERIA / PROCEDURE (REFER CL. No of API 5L - 45th edition, GTS & PTS)**	**Documentation**	**Inspection**		**Remarks**
						MANUF.	**TPIA**	
1	**Base Material**							
1.1	Steel (Chemical, Mechanical & Impact Testing)	-	One Per Heat	As per API 5L - 45th edition Grade X42 Chemical & mechanical test shall be done to ensure conformance of steel for pipe manufacturing as per GTS / PTS	STEEL MILL TC WITH IMPACT TEST as 3.2 Certificate as par EN 10204.	P	R	
1.2	Control Tensile Test	-	One Per Heat	As per API 5L Gr. X42	_	P	W	
1.3	**Non- Destructive Examination (NDE)**							
1.3.1	**Ultrasonic testing**		Each Coil					
1.3.1.1	Edges	-	100% Examined over width of 50 mm min. From trimmed edges	as per API 5L - 45th edition, GTS & PTS	Test report	P	10%W & Balance'R'	
1.3.1.2	Remaining parts (along parallel line spacing a distance sufficient to cover area of 25% min. Including edges.)	-	Each plate along parallel line spaced max. 100 mm covering 20% area min.	as per API 5L - 45th edition, GTS & PTS	Test report	P	10%W & Balance'R'	
1.3.1.3	Calibration		At the beginning of shift &once in four hours and also in case of doubts of its efficiency.	as per API 5L - 45th edition, GTS & PTS	Test report	P	10%W & Balance'R'	
2.0	**FIRST DAY PRODUCTION TEST (COUNTED AS REGULAR PRODUCTION TEST)**		Each size (First & Last pipe from 3 different coils of 3 different heats i.e. total 6 pipes)	All below secified activity & production tests shall be done on these selected pipes. It also includes 100% visual & dimension check, 100% witness of hydrotest. In addition, charpy impact test at 0°c temp. Shall also be carried out for HAZ for first day production test only.		H	100% W	Prefarably witness by CA
2.1	**Burst Test**	-	One pipe per size per thickness per grade	Burst test pressure shall be higher than minimum specified UTS of Raw material as per MTC, location of failure and pressure to be recorded.	Test report	H	W	
3.0	**PIPE FORMING**		Each pipe	As per approved procedure	Forming report	P	10%W & Balance'R'	
4.0	**WELDING**							
4.1	Welding Parameter a. Temperature; b. Frequency; c. Current; d. Voltage; e. Speed	Cl.5.1.3.3.2, ASME Sec IX	Each pipe	-	Welding report	P	10%W & Balance'R'	
4.2	Seam Normalizing	Cl.5.1.3.3.2, 5.4, ASME Sec IX.	As per API 5L - 45th edition, ASME Sec-IX and approved WPS / PQR	As per approved procedure	Heat Treatment report	P	10%W & Balance'R'	

CUGL			QUALITY CONTROL TABLE LINE PIPES (HFW PIPE)			QCT No		
						Date		
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						Appro.	:	
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						MANUF.	**TPIA**	
6.0	**HYDRO TEST**							
6.1	Hydrostatic testing (showing pressure & holding time).	-	Each pipe	Test Duration - 15 seconds Minimum, Test pressure - Calculated at 90 % of SMYS.	Hydro test report & graph	P	10%W & Balance'R'	
6.2	Calibration of pressure gauge		Each shift	Pressure gauge shall be calibrated with a dead weight tester at start of each shift (max 12 hrs.)of work. Pressure Gauge range shall be 1.5 to 4 time of test pressure. Least Coung of Pressure Gauge should be 2 Kg/cm2. PG accuracy ± 1% FSD.	Test report	P	W	
7.0	**NON DESTRUCTIVE TESTING**							
7.1	Automatic Ultrasonic Inspection (Body, Weld & HAZ).	-	Each pipe over entire length	as per API 5L - 45th edition, GTS & PTS	Test Report	P	10%W & Balance'R'	
7.2	Manual Ultrasonic Inspection	-	- AUT indication, Untested area and any other indication in AUT.	as per API 5L - 45th edition, GTS & PTS	Test Report		10%W & Balance'R'	
		-	- Each Pipe End for Laminar Imperfaction.		Test Report			
7.3	Residual Magnetism	-	1 pipe once in four hrs / shift	Avg. of 4 readings not exceed 20 Gauss, No reading shall exceed 25 Gauss.	Test Report		10%W & Balance'R'	
8.0	**WORKMANSHIP, VISUAL INSPECTION AND REPAIR OF DEFECTS**							
8.1	Laminations & Visual Inspection	-	Each pipe	as per API 5L - 45th edition, GTS & PTS	Dimensional Inspection Report	P	10%W & Balance'R'	
8.2	Dents	-	Each pipe	as per API 5L - 45th edition, GTS & PTS				
8.3	Offsets of Plate Edges	-	Each pipe	as per API 5L - 45th edition, GTS & PTS				
8.4	Height of Weld beds	-	Each pipe	as per API 5L - 45th edition, GTS & PTS				
8.5	Cracks, sweats and Leaks	-	Each pipe	as per API 5L - 45th edition, GTS & PTS				
8.6	Lamination	-	Each pipe end	as per API 5L - 45th edition, GTS & PTS				
8.7	Under Cuts	-	Each pipe	as per API 5L - 45th edition, GTS & PTS				
8.8	Trim inside flash	-	Each pipe	as per API 5L - 45th edition, GTS & PTS				
9.0	**DIMENSIONS, WEIGHT & LENGTHS**							

			QUALITY CONTROL TABLE LINE PIPES (HFW PIPE)			**QCT No**	:	
						Date	:	
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						Appro.	:	
Sn	**INSPECTION AND TESTING**	**Ref. Docs (PTS/GTS/API 5L - 45th edition)**	**TESTING FREQUENCY (MINIMUM)**	**ACCEPTANCE CRITERIA / PROCEDURE (REFER CL. No of API 5L - 45th edition, GTS & PTS)**	**Documentation**	**Inspection**		**Remarks**
						MANUF.	**TPIA**	
9.1	Wall Thickness	-	Each pipe	+10%, - 0%	Dimensional Inspection Report	P	10%W & Balance'R'	
9.2	Length Measurement	-	Each pipe	Length = 11.5 - 12.5 meters, For sample pipes - 11.0 meters				
9.3	Straightness	-	Each pipe	Shall not exceed 12 mm. Less than 4mm in 1 Meter from each pipe end.				
9.4	Outside Diameter	-	Each pipe	**For ≥ 2" to upto 6" :-** Pipe Ends :- - 0.4 mm, + 1.6 mm Pipe Body :- ± 0.0075 D **For > 6" to upto 24" :-** Pipe Ends :- ± 0.005 D, but maximum of ± 1.6mm Pipe Body :- ± 0.0075 D, but maximum of ± 3.2mm				
9.5	Out of Roundness (Difference between max. & Min. Diameters)	-	Each pipe	**For ≤ 6" OD :- as per Table 10 of API 5L For > 6" OD :-** Pipe end - 3 mm max. Pipe body - 5 mm max.				
9.6	Weight	-	Each pipe	as per API 5L - 45th edition, GTS & PTS				
10.0	**PIPE END AND END PROTECTORS**							
10.1	Bevel by Gauge	-	Each pipe	Angle :- 30° (+5°, - 0°) & Root Face :- 1.6 mm ± 0.8 mm		P	10%W & Balance'R'	
10.2	End Squareness (Out-of-Squareness)	-	Each pipe	Max. 1.6 mm				
10.3	Bevel Protrectors	-	Each pipe	Both pipe ends shall be provided with metallic caps.				
11.0	**PRODUCTION TESTS**							
11.1	**Chemical Analysis (Product)**	-	2 PIPE / 50 PIPES / HEAT	as per API 5L - 45th edition, GTS & PTS	CHEMICAL TEST REPORT	H	W	
11.2	**Mechanical Properties & Testing**							
11.2.1	Control Tensile Test	-	1 plate/coil per heat (Not to be counted for regular production)	as per API 5L - 45th edition, GTS & PTS		H	100%W	
11.2.2	Tensile Test - Base Transverse metal	-	2 PIPE / 50 PIPES / HEAT	as per API 5L - 45th edition, GTS & PTS	Test Report	H		
	Tensile Test - Weld Transverse metal					H		
11.2.3	FlatteningTest	-	4 Samples per Coil (2 samples each from First & Last accepted pipe of the Coil. The samples shall be flattened at 0° & 90°. In case of weld stop, 1 sample from each crop end shall be tested at 90°.	A. Flatten to 1/2 of original OD without weld opening. B. Continue Flattening to 1/3 of specified OD without cracks other than in weld. C. No lamination on material on fullflat.	Test Report	H		
11.2.4	Reverse Bend Test	-	2 PIPE / 50 PIPES / HEAT	As per PTS	Test Report	H		
11.2.5	Metallographic Examination & Hardness	-	2 PIPE / 50 PIPES / HEAT	as per API 5L - 45th edition, GTS & PTS	Tets Report	H		
11.2.6	Impact Test at 0 ^{0}C (Base Metal, Weld & HAZ Transverse)	-	PTS - Line pipe	as per API 5L - 45th edition, GTS & PTS	Test Report	H	100%W	

CUGL	**QUALITY CONTROL TABLE LINE PIPES (HFW PIPE)**					**QCT No**	:	
						Date	:	
						Author	: **Checked By:**	
						Appro.	:	

Sn	INSPECTION AND TESTING	Ref. Docs (PTS/GTS/API 5L - 45th edition)	TESTING FREQUENCY (MINIMUM)	ACCEPTANCE CRITERIA / PROCEDURE (REFER CL. No of API 5L - 45th edition, GTS & PTS)	Documentation	Inspection		Remarks
						MANUF.	TPIA	
12.0	**RE-TESTING AND REJECTION**		Cl.9.9 and Cl.9.10	as per API 5L - 45th edition, GTS & PTS		H	100%W	
13.0	**MARKING & COATING** - marking shall be paint stencilled at right angle to the pipe axis at 150 mm from one end with letter size 30mm min. on Outside & inside(for 8" & above).	-	One end of each pipe from inside(for 8" & above pipe size) & outside after coating	Marking as per API 5L - 45th edition & GTS/PTS it will be in english using metric unit. It will include API monogram, manufacturer's name, nom. dia, grade, length, weight, hydro pressure, pipe no., Heat no., P.O.No., Item no., Thickness, SR 5 A, B & SR. 6, requirements.		P	100%R	
13.1	Die stamping	-	Each Pipe	Pipe no. Shall be die stamped at one end on bevel at the right side to the longitudinal weld seam. Or pipe no. Shall be die stamped at one end with low stress dot punches at the outside surface of the pipe at a distance of atleast 2 cm of the end of pipe on the right side of the weld.				
14.0	**FINAL DOCUMENTATIONS**			Mechanical, NDT, hydro test reports as per API 5L - 45th edition SR 15 & Steel mill TC etc. **as per 3.2 Certification as par EN 10204** shall be arranged by the bidder and cost involved for testing and inspection etc. shall be born by the bidder.	**3.2 Certificate**	H	H	

LEGEND:

RT : Radiographic test	PT : Liquid penetrant test	MT : Magnetic particle test	HT : Heat treatment		VT : Visual test
P : Performed	R : Review	W : Witness	H : Hold	M : Monitor	CA : Control Authority (Owner / Owner's representative)
TPIA: Third Party Inspection Agency					

Note:	**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 Technical specifications(PTS /GTS and API 5L), .
	2	The supplier shall submit their own detailed QAP/ITP for First Day production & Regular production seprately, which are prepared on the basis of above for approval of Control Authority and TPIA.
	3	Supplier shall submit Calibration certificates of all Instruments/Equipment to be used for Inspection and Testing to TPIA with relavant procedures and updated standards for TPIA review/Approval.
	4	Owner / Owner's representative including TPIA will have the right to inspect any activity of manufacturing at any time during production.
	5	All the NDT/Leak testing/ Heat treatment/ Special manufacturing procedures have to be specially approved or only previously approved procedures have to be used, in case of conflict between specifications, more stringent condition shall be applicable.
	6	Supplier shall issue detailed Production and Inspection schedule indicating the dates and the locations to facilitate Control Authority and TPIA to organise Inspection.
	7	All reference codes/ standards, documents, P.O. copies shall be arranged by manufacturer for reference of TPIA / Control Authority at the time of inspection.
	8	Certification requirement shall comply with 3.2 Certification of European standard EN 10204, (latest edition).
	9	Owner/Owner representative shall have right to review/witness any activity & all the documents related to QCT/Quality manuals/Drawings etc.submitted by supplier.
	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.

	QUALITY CONTROL TABLE 3 LPE EXTERNAL COATING OF LINEPIPE	QCT No	:		
		Date	:		
		Prepared by	: Checked by :		
		Approved by	:		

SR. No.	ACTIVITY	TEST FREQUENCY	ACCEPTANCE CRITERIA	DOCUMENTATION	REFERENCE DOCUMENT	INSTRUMENTS	INSPECTION		REMARKS
							MANUF.	TPIA	
A.	**PRIOR TO REGULAR PRODUCTION**								
1	Quality control test plan	Before production	---	---	GTS/PTS/Approved Procedure	---	H	R	
2	Repair procedure	---	---	---	GTS/PTS/Approved Procedure	---	H	R	
3	Handling, Storage & transportation of bare and coated pipes procedure	---	---	---	GTS/PTS/Approved Procedure	---	H	R	
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	Raw material manufacturer's test certificates.	As per PTS , Cl. no. 4, 5.3.1 & 5.3	VISUAL INSPECTION FOR MARKING	R	R	
5	Test of raw material (epoxy, adhesive & PE)	Each batch	As per material test certificate & PTS Cl. No. 4.3 (a,b & c)	Test report	As per PTS	--	H	W	
6	Storage	All materials	Manufacturer Recommendation	STOCK REGISTER	As per approved procedure	--	H	M	
7	Bare pipe receipt at mill, handling & storage etc.	Each pipe	As per PTS	PACKING LIST & Test report	As per PTS & approved procedure	VISUAL	H	M	
8	PROCEDURE QUALIFICATION TESTS :- BEFORE START OF REGULAR PRODUCTION 5 PIPES TO BE COATED (4 PIPES FULLY COATED WITH 3LPE , ONE PIPE COATED WITH PARTIALLY EPOXY & PARTLY WITH EPOXY & ADHESIVE.)								
8.1	Bare pipe stacking & handling in yard/plant	Each pipe.	PE sheet over sand row Teflon padded hooks	STOCK REGISTER	As per PTS & approved procedure	VISUAL	H	M	Preferably Witness By CA
8.2	Bare pipes receiving. Surface defect, Bevel damage, Grease / oil on surface	Each pipe.	No defects, damages, oil/grease on pipe surface etc.	Data sheet	As per PTS	Visual solvent Cleaning for pipes with oil grease	H	W	
8.3	Repair of Bare pipes defects	Pipes removed for defects	As per API 5L 45th edition & Pipe Specification		As per approved procedure	Bevel cutting m/c, Jacks etc.	H	W	
8.4	Pre heating	All pipes	65 – 85°C	Data sheet	Cl. no.8.4 & As per approved procedure	LPG Burner, contact thermometer	H	R/W	
8.5	**DOUBLE SHOT BLASTING**								
8.5.1	Ambient temp., Relative humidity, Dew point & Elapsed time	Each pipe	RH should be less than 85% (IF RH> 85% no shot blasting).	Data sheet	As per PTS & As per approved procedure	Thermo hygrometer, Dew point apparatus	H	R/W	
8.5.2	Phosphoric Acid treatment	Each pipe	pH = 1-2,Pipe temp prior to phosphoric acid treatment = 45-75°C or as manuf. Recommendation.	Data Sheet	Cl. no. 8.6 & As per approved procedure	PH paper, contact thermometer	H	R/W	

	QUALITY CONTROL TABLE 3 LPE EXTERNAL COATING OF LINEPIPE	QCT No	:		
		Date	:		
		Prepared by	: Checked by :		
		Approved by	:		

SR. No.	ACTIVITY	TEST FREQUENCY	ACCEPTANCE CRITERIA	DOCUMENTATION	REFERENCE DOCUMENT	INSTRUMENTS	INSPECTION		REMARKS
							MANUF.	TPIA	
8.5.3	DM water wash	Each pipe	pH = 6.5-7.5, pipe surface should be dried	Data sheet	As per PTS	PH paper	H	R/W	
8.5.4	Salt contamination test	Each pipe	As per PTS	Data sheet	As per PTS	_	H	R/W	
8.5.5	Cleanliness	Each pipe	SA 2½	Data sheet	Cl. no. 8.8 & As per approved procedure	ISO-8501-1	H	R/W	
8.5.6	Degree of dust	Each pipe	Rating 2 or Class 2	Data sheet	Cl. no. 8.8 & As per approved procedure	ISO: 8502-3	H	R/W	
8.5.7	Surface roughness	Each pipe	50 – 100 µm (Rz)	Data sheet	Cl. no.8.8 & As per approved procedure	Surface Profile gauge, Hand held 30X magnifying glass	H	R/W	
8.5.8	Chromate treatment	Each pipe Solution temp- each shift	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	Data sheet	Cl. no. 7.4.4.2 & As per approved procedure	Visual,Temp.indicator	H	R/W	
8.5.9	Bare pipe temp.	Every pipe	180-230°	Test report	As per PTS & As per approved procedure	Contact thermometer	H	R/W	
8.5.10	Bare pipe temp. after Epoxy application by IR thermometer	Every pipe by online pyrometer recording	190-230°C or as per powder manufacturer recommendation	---	As per PTS	IR Optical pyrometer	H	R/W	
9	**TEST ON COATED PIPES PARTLY WITH EPOXY AND PARTLY WITH EPOXY & ADHESIVE LAYERS**								
9.1	Epoxy layer thickness	One pipe at 3,6,9,12 positions	200 µm min.	Test report	Cl. no. 7.5.1 & As per approved procedure	Coating thk. gauge	H	W	
9.2	Adhesive layer thk.	One pipe at 3,6,9,12 positions	200 µm min.	Test report	Cl. no.7.5.1 & As per approved procedure	Coating thk. gauge	H	W	
9.3	Degree of cure	One pipe (one sample)	Δ Tg = +3, -2°C % cure = 95 % min.	Test report	Cl. no.7.5.1	DSC Machine	H	W	
9.4	Adhesion test (St. Andrews cross method)	One pipe	Rating – 1-3	Test report	Cl. no. 7.5.1	Utility knife	H	W	
10	**TEST ON COATED PIPES WITH ALL THREE LAYERS**								
10.1	Heat ageing, Light ageing, Coating resistivity	(each batch Test certificate typical value will be issued by manufacture)	Melt rate shall not deviate by more than 35 % of original value and Coat resistivity min10 10^8ohm-m^2	(Test certificate will be issued by manufacture)	ISO/DIS - 21809 PTS cl. no.5.3.2	----	R	R	

	QUALITY CONTROL TABLE 3 LPE EXTERNAL COATING OF LINEPIPE	QCT No	:		
		Date	:		
		Prepared by	: Checked by :		
		Approved by	:		

SR. No.	ACTIVITY	TEST FREQUENCY	ACCEPTANCE CRITERIA	DOCUMENTATION	REFERENCE DOCUMENT	INSTRUMENTS	INSPECTION		REMARKS
							MANUF.	TPIA	
10.2	Bond strength test at ends & middle	Three pipe	@ 20±5°C = 8 Kg/Cm @ 65±5°C = 5 Kg/Cm	Test report	cl. no. 7.5.2 & As per approved procedure	Peel test M/C by dynamometer (type-2)	H	W	
10.3	Degree of cure	One pipe (one sample)	DTg = +3, -2°C % cure = 95 % min.	Test report	cl. no.7.5.2	DSC Machine	H	W	
10.4	Impact strength	Three pipes	7 Joules/mm	Test report	cl. no. .7.5.2 & As per approved procedure	Impact tester	H	W	
10.5	Indentation test	Two sample for both temp. from 4 pipes	0.2 max. at 23± 2°C 0.3 max. at 70± 2°C	Test report	cl. no..7.5.2 & As per approved procedure	Controlled temp. bath, Dial gauge, weight	H	W	
10.6	Elongation at failure	Three PE coated pipes only (5 sample from each pipes)	300 % min.	Test report	DIN ISO & As per approved procedure	Tensile M/C	H	W	
10.7	Cathodic Disbondment test	**1.** One sample for 30 days at 65° ±3°C, One sample for 48 Hrs at 65° ±3°C	ECR =15 mm max. (for 30 days) -at 60° ±3°C 7 mm max. (for 48 hours) -at 65° ±3°C	Test report	cl. no. .7.5.2 ASTM G-42 & As per approved procedure	CD. Test assembly	H	W	
10.8	Holiday test at 25 kv	All pipes	Max. One holiday Surface area < 0.01 sq.mtrs. (repair as per approved procedure)	Test report	cl. no. .7.5.2 & As per approved procedure	Holiday detector	H	W	
10.9	Over all Coating Thickness	All pipes	as per DIN 30670 (S-v)	Test report	cl. no. 4.2.1	Coating thk. Gauge	H	W	
10.10	Air entrapment at 30X magnification	All pipes	Polyethylene and adhesive layers shall have no more than 10% of the observed area.	Test report	cl. no. 7.2	30 X magnification hand-held microscope	H	W	
10.11	Visual inspection	All pipes	No defect (Blisters, pinholes scratches, wrinkles etc.)	Test report	cl. no. 10.2.1 etc.	Visual	H	W	
10.12	Cut back length	All pipes	110mm [(-) 0 mm, (+) 10 mm] with bevel 30° -45°	Test report	cl. no. 9.2.11	Steel scale	H	W	
B.	**REGULAR PRODUCTION**								
	BARE PIPES AT INLET								
1	Bare pipe stacking & handling in yard/plant	Each pipe.	PE sheet over sand row Teflon padded hooks	STOCK REGISTER	As per PTS & As per approved procedure	VISUAL	H	M	
2	Bare pipes receiving. Surface defect, Bevel damage, Grease / oil on surface	Each pipe.	No defects, damages, oil/grease on pipe surface etc.	Data sheet	As per PTS & As per approved procedure	Visual solvent cleaning for pipes with oil grease	H	M	
3	Repair of Bare pipes defects	Pipes removed for defects	As per API 5L 45th edition & Pipe Specification	----	As per API 5L 45th edition & Pipe Specification	Bevel cutting m/c, Jacks etc.	H	W	

	QUALITY CONTROL TABLE 3 LPE EXTERNAL COATING OF LINEPIPE	QCT No	:		
		Date	:		
		Prepared by	: Checked by :		
		Approved by	:		

SR. No.	ACTIVITY	TEST FREQUENCY	ACCEPTANCE CRITERIA	DOCUMENTATION	REFERENCE DOCUMENT	INSTRUMENTS	INSPECTION		REMARKS
							MANUF.	TPIA	
4	Recording of pipe parameters and tick off against mill packing list.	Each pipe.	Clear visibility. OF STENCIL MARKING	Test report	Mill packing list	Visual & white paint	H	M	
5	Pre heating	All pipes	65 - 85°C	Data sheet	cl. no. 9.1.2 & As per approved procedure	LPG Burner, contact thermometer	H	R/W	
C.	**DOUBLE SHOT BLASTING STATION.**								
1	Ambient temp. , relative humidity, Dew point and Elapsed time.	Start of every shift thereafter every 1 hrs.	RH should be less than 85% (IF RH> 85% no shot blasting).	Data sheet	As per PTS , Cl. no. 9.3.2	Thermo hygrometer, Dew point apparatus	H	R/W	
2	Phosphoric Acid treatment	Each pipe	pH = 1-2, Pipe temp prior to phosphoric acid treatment = 45-75°C or as manuf. Recommend.	Data sheet	cl. no. 9.1.4 & & As per approved procedure	PH paper, contact thermometer	H	R/W	
3	DM water wash	Each pipe	pH = 6.0-7.0, pipe surface should be dried	Data sheet	As per PTS	PH paper	H	R/W	
4	Cleanliness	Each pipe	SA 2½	Data sheet	Cl. no. 8.8 & As per approved procedure	ISO-8501	H	R/W	
5	Degree of dust	Each pipe	Rating 2 or Class 2	Data sheet	cl. no. 9.1.3 & As per approved procedure	ISO: 8502-3	H	R/W	
6	Surface roughness	Each pipe & one in 50 pipes by press-o-film	50 – 70 µm (Rz)	Data sheet	cl. no. 9.1.3 & As per approved procedure	Surface Profile gauge, Hand held 30X magnifying glass	H	R/W	
D.	**COATING APPLICATION**								
1	Chromate treatment	Each pipe	Uniform coverage, temp of pipe before application	Data sheet	cl. no. 9.1.5	Visual, Temp	H	W	
		Solution temp= every shift	40-80°C or as manuf. Recom. & Solution temp. Not exceed 60°C or as per manuf.recommendation			.indicator			
2	Bare pipe temp.	Every pipe	180-230°C or as per powder manufacturer recom.	Test report	As per PTS & As per approved procedure	Contact thermometer	H	R/W	
3	Bare pipe temp. after Epoxy application by IR thermometer	Every pipe by online pyrometer. Recording every one hour	190-230°C or as per powder manufacturer recom.	---	As per PTS & As per approved procedure	IR Optical pyrometer,	H	R/W	
4	Adhesive film temperature.	Every hour.	200-240°C or as per manufacturer recom	Test report	As per PTS	Optical pyrometer/digital thermometer	H	R/W	
5	PE film temperature.	Every hour.	220-270°C or as per manufacturer's recommendation.	Test report	As per PTS	Optical pyrometer/digital thermometer	H	R/W	

	QUALITY CONTROL TABLE 3 LPE EXTERNAL COATING OF LINEPIPE	QCT No	:		
		Date	:		
		Prepared by	: Checked by :		
		Approved by	:		

SR. No.	ACTIVITY	TEST FREQUENCY	ACCEPTANCE CRITERIA	DOCUMENTATION	REFERENCE DOCUMENT	INSTRUMENTS	INSPECTION		REMARKS
							MANUF.	TPIA	
6	Recording of batch no.'s of Epoxy, adhesive polyethylene	Every batch	As per standard data	Test report	Manufacturer's test certificate	Visual	H	M	
E.	**ON LINE INSPECTION & TESTING**								
1	Epoxy & adhesive thickness	Every shift at 3,6,9,12 positions	Epoxy thk.– 0.15 mm min. Adhs. thk.– 0.22 mm min.	Test report	cl. no.9.3.1 & As per approved procedure	Coating thk. gauge.	H	R/W	
2	Holiday test at 25 kv	All pipes	Max. One holiday Surface area < 0.01 sq.mtrs. (repair as per approved procedure)	Test report	cl. no. 4.2.2 & As per approved procedure	Holiday detector	H	R/W	
3	Over all Coating Thickness	All pipes	2.7 mm (S-v) for 4" to 8" 2.9 mm (S-v) for 12"	Test report	cl. no. 4.2.1	coating thickness gauge	H	W	
F.	**OFF LINE TESTS**								
1	Impact test. (30 Impacts) at 30 mm intervals.	Two pipes per shift. That may be further reduced to one coated pipe per 2 weeks after consistency acceptable results	7J/mm Impact energy (No holiday shall be observed at 25KV at impact area.)	Test report	cl. no.4.2.4 & As per approved procedure	Impact test instrument	H	W	
2	Resistance to peel test at cut back ends.	One in 15 pipes, That may be further reduced to one coated pipe per 25 pipes after consistency acceptable results	Peel strength at 20 ± 5°C 8.0Kg./cm min. Peel strength at 65 ± 5°C 5.0Kg./cm min.	Test report	cl. no. 4.2.3 & As per approved procedure	Peel test machine, chisel etc.	H	W	
3	Resistance to peel test=1 samples. At middle	One in 60 pipes	Peel strength at 20 ± 5°C - 8.0Kg./cm min. Peel strength at 65 ± 5°C - 5.0Kg./cm min.	Test report	cl. no. 4.2.3 & As per approved procedure	Peel test machine, chisel etc.	H	W	
4	Resistance to indentation test (Two samples for each temp.)	Two pipes per shift , which may be further reduced to one test each on 2 coated pipes per week at random after 1 week of consistency acceptable results.	At 23 ± 2°C = 0.2mm At 70 ± 2°C = 0.3mm	Test report	cl. no. 4.2.5 & As per approved procedure	Indentation bath heater, dial gauge, thermostat	H	W	
5	Air entrapment at 30X magnification	One sample per Shift	Polyethylene and adhesive layers shall have no more than 10% of the observed area.	Test report	cl. no. 7.2	30 X magnification hand-held microscope	H	W	
6	Degree of cure	Once per shift	DTg = +3, -2°C % cure = 95 % min.	Test report	cl. no. 7.3	DSC M/C	H	W	
7	Adhesion test (St. andrews cross method)	Once per shift	Rating – 1-3	Test report	cl. no. 7.4	Utility knife	H	W	
8	Cathodic disbondment test	Once every 2 week or every batch no. of epoxy powder.	Max. Disbondment radius 7 mm (At 65°C ± 3°C for 48 hours	Test report	cl. no. 7.5, 8.5.1 & As per approved procedure	Test vessel, D.C. voltage supplier, electrodes etc.	H	W	

	QUALITY CONTROL TABLE 3 LPE EXTERNAL COATING OF LINEPIPE	QCT No	:		
		Date	:		
		Prepared by	: Checked by :		
		Approved by	:		

SR. No.	ACTIVITY	TEST FREQUENCY	ACCEPTANCE CRITERIA	DOCUMENTATION	REFERENCE DOCUMENT	INSTRUMENTS	INSPECTION		REMARKS
							MANUF.	TPIA	
G.	**FINAL INSPECTION**								
1	Cut-back length at ends.	Each pipe	110mm [(-) 0 mm, (+) 10 mm] with bevel 30° -45°	Test report	cl. no. 4.2.1	Measuring tape, scale etc. and visual	W	M	
2	Marking on coated pipes External color band	Each pipe	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. -----	As per PTS	Spray gun, stencil paper etc.		H	M	
			COATING No…,COLOUR BAND, ANY OTHER INFORMATION CONSIDERED RELEVANT BY COMPANY						
H.	**COATING REPAIR**								
1	Repair of Coating followed by holiday detection at 25 KV	All coating repair	All repairs as per approved procedure	Test report	cl. no. 10.0	Heating torch, chisel, scale etc.	H	W	
2	Peel test on repair area	One in 25 pipes	As per manufacturer's recommendation	Test report	Cust spec.	Spring balance	H	W	
I	**HANDLING & STORAGE**								
1	Handling	Each pipe	No damages on coated pipes. Support bed, min. 2 nos. support on trailor & securing by three wire rope covered with nylon rubber tubing	STOCK REGISTER	As per PTS	Crane with teflon padded hooks, trailor with rubber padded beds etc.	H	R/W	
2	Storage	Each pipe	Proper stacking on sand rows covered with PE sheets with stack identification & layer separator.	STOCK REGISTER	As per PTS	--do--	H	R/W	
J.	**CALIBRATION OF EQUIPMENT**								
1	Digital thermometer	Every month.	Add or subtract the observed value w.r.t. reference measurement.	Test report	Calibration procedure	Ref. Thermometers, water/ oil bath etc.	H	R/W	
2	Thickness gauge.	Every shift	--do--	Test report	Calibration procedure	Ref. Thickness foils, steel subtract etc.	H	R/W	
3	Roughness gauge	Every shift	--do--	Test report	Calibration procedure	Standard Roughness specimen etc.	H	R/W	

		QUALITY CONTROL TABLE 3 LPE EXTERNAL COATING OF LINEPIPE				QCT No Date Prepared by Approved by	: : : Checked by :		
SR. No.	ACTIVITY	TEST FREQUENCY	ACCEPTANCE CRITERIA	DOCUMENTATION	REFERENCE DOCUMENT	INSTRUMENTS	INSPECTION		REMARKS
							MANUF.	TPIA	
4	Holiday detector	Every 4 hours	By spark gap method	Test report	Calibration procedure	Spark gap assembly / Calibrated meter	H	W	
5	Hygrometer	Once in four month	By master hygrometer	Test report	Calibration procedure				
6	D Meter	Every time before use	By standard thickness block	Test report	Calibration procedure		H	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									
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/CUGL 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)								

SECTION - VI

FORMS AND FORMATS

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F-1

BIDDER'S GENERAL INFORMATION

To,

Central UP Gas Limited,
7th floor, UPSIDC complex
A-1/4, Lakhanpur
Kanpur-208024
India_____

TENDER NO:

SUB :

1	Bidder Name	
2	Status of Firm	Proprietorship Firm/Partnership firm/ Limited/Others If Others Specify:_____ [Enclose certificate of Registration]
3	Name of Proprietor/Partners/Directors of the firm/company	
4	Number of Years in Operation	
5	Address of Registered Office: *In case of Partnership firm, enclose letter mentioning current address of the firm and the full names and current addresses of all the partners of the firm.	
		City:
		District:
		State:
		PIN/ZIP:
6	Operation Address (if different from above)	
		City:
		District:
		State:
		PIN/ZIP:
8	Telephone Number	_____

		(Country Code) (Area Code) (Telephone No.)
9	E-mail address	
10	Website	
11	Fax Number:	_____ (Country Code) (Area Code) (Telephone No.)
12	ISO Certification, if any	{If yes, please furnish details}
13	Bid Currency	
14	Banker's Name	
15	Branch & IFSC Code	
17	Bank account number	
18	PAN No.	[Enclose copy of PAN Card]
19	Service Tax No.	[Enclose copy of Service tax Registration Certificate]
20	EPF Registration No.	[Enclose copy of EPF Registration Certificate]
21	ESI code No.	[Enclose copy of relevant document]
14	Banker's Name	

Place: [Signature of Authorized Signatory of Bidder]

Date: Name:

Designation:

Seal:

F-2

BID FORM

To,

Central UP Gas Limited,
7th floor, UPSIDC complex
A-1/4, Lakhanpur
Kanpur-208024
India
SUB:
TENDER NO:

Dear Sir,

After examining / reviewing the Bidding Documents for the tender of "_____ including "Specifications & Scope of Work", "General Conditions of Contract [GCC]", "Special Conditions of Contract [SCC]" and "Schedule of Rates [SOR]", etc. the receipt of which is hereby duly acknowledged, we, the undersigned, are pleased to offer to execute the whole part of the job and in conformity with the said Bid Documents, including Addenda / Corrigenda Nos. _____.

We confirm that this Bid is valid for a period of "three [03] months" from the date of opening of "Techno-Commercial / Un-priced Bid", and it shall remain binding upon us and may be accepted by any time before the expiry of that period.

If our Bid is accepted, we will provide the "Contract Performance Security / Security Deposit" equal to "_____ of the Contract Price" or as mentioned in Tender Document for the due performance within "thirty [30] days" of such Award.

Until a final Agreement/Letter of Award is prepared and executed, the tender document (including addenda/ corrigenda) together with the "Notification of Award" shall constitute a binding Agreement between us.

We understand that Bidding Document is not exhaustive and any action and activity not mentioned in Bidding Documents but may be inferred to be included to meet the intend of the Bidding Documents shall be deemed to be mentioned in Bidding Documents unless otherwise specifically excluded and we confirm to perform for fulfillment of Agreement and completeness of the Work in all respects within the time frame and agreed price.

We understand that you are not bound to accept the lowest priced or any Bid that you may receive.

Place: [Signature of Authorized Signatory of Bidder]

Date: Name:

Designation:

Seal:

Duly authorized to sign Bid for and on behalf of _____

[Signature of Witness]

Name of Witness:

Address:

F-3
LIST OF ENCLOSURES

To,

Central UP Gas Limited,
7th floor, UPSIDC complex
A-1/4, Lakhanpur
Kanpur-208024
India

SUB:

TENDER NO:

Dear Sir,

We are enclosing the following documents as part of the bid:

1. Power of Attorney of the signatory to the Bidding Document.
2. Document showing annual turnover for the last three years such as annual reports, profit and loss account, net worth etc. along with information as sought in enclosed format F-16
3. Document showing Financial Situation Information as sought in enclosed format F-16
4. Copy of Bidding Documents along with addendum/corrigendum duly signed and sealed on each page, in token of confirmation that Bid Documents are considered in full while preparing the bid and in case of award, work will be executed in accordance with the provisions detailed in Bid Documents.
5. Documentary Evidences showing the Bidder's claim of meeting Technical Criteria as mentioned in Clause 4 of ITB.
6. Bid Security/EMD*
7. Power of Attorney*
8. Duly certified document from chartered engineer and or chartered accountant.

Note: * In case of e-bidding the bidder has the option to submit specified documents in physical form on/before the bid due date or within seven days from the bid opening date. However, scanned copy of these (same) documents must be submitted on-line as part of e-bid before the bid due date/time.

Place: [Signature of Authorized Signatory of Bidder]

Date: Name:

Designation:

Seal:

FORMAT F-4

PROFORMA OF "BANK GUARANTEE" FOR "EARNEST MONEY / BID SECURITY"

(To be stamped in accordance with the Stamp Act)

Ref..... **Bank Guarantee No.....**

Date.....

To,

Central UP Gas Limited,
7th floor, UPSIDC complex
A-1/4, Lakhanpur
Kanpur-208024
India

SUB:
TENDER NO:
Dear Sir(s),
In accordance with Letter Inviting Tender under your reference No _____ M/s. _____ having their Registered / Head Office at _____ (hereinafter called the Tenderer), wish to participate in the said tender for _____

As an irrevocable Bank Guarantee against Earnest Money for the amount of _____ is required to be submitted by the Tenderer as a condition precedent for participation in the said tender which amount is liable to be forfeited on the happening of any contingencies mentioned in the Tender Document.
We, the _____ Bank at _____having our Head Office _____ (Local Address) guarantee and undertake to pay immediately on demand without any recourse to the tenderers by Central UP Gas Limited, the amount _____ _____ without any reservation, protest, demur and recourse. Any such demand made by CUGL, shall be conclusive and binding on us irrespective of any dispute or difference raised by the Tenderer.
This guarantee shall be irrevocable and shall remain valid up to _____ [this date should be two (02) months beyond the validity of the bid].If any further extension of this guarantee is required, the same shall be extended to such required period on receiving instructions from M/s. _____ whose behalf this guarantee is issued.

In witness whereof the Bank, through its authorized officer, has set its hand and stamp on this _____day of _____ 20__ at _____.

WITNESS:

(SIGNATURE) (SIGNATURE)
(NAME) (NAME)
Designation with Bank Stamp

(OFFICIAL ADDRESS) Attorney as per
Power of Attorney No. _____
Date: _____

INSTRUCTIONS FOR FURNISHING "BID SECURITY / EARNEST MONEY" BY "BANK GUARANTEE"

1. The Bank Guarantee by Bidders will be given on non-judicial stamp paper as per "Stamp Duty" applicable. The non-judicial stamp paper should be in the name of the issuing Bank. In case of foreign Bank, the said Bank's Guarantee to be issued by its correspondent Bank in India on requisite non-judicial stamp paper
2. The expiry date should be arrived at in accordance with "ITB: Clause-15.1".
3. The Bank Guarantee by bidders will be given from Bank as specified in "ITB".
4. A letter from the issuing Bank of the requisite Bank Guarantee confirming that said Bank Guarantee / all future communication relating to the Bank Guarantee shall be forwarded to the Employer at its address as mentioned at "ITB".
5. Bidders must indicate the full postal address of the Bank along with the Bank's E-mail / Fax / Phone from where the Earnest Money Bond has been issued.
6. If a Bank Guarantee is issued by a commercial Bank, then a letter to Employer confirming its net worth is more than Rs. 1,000,000,000.00 [Rupees One Hundred Crores] or equivalent alongwith documentary evidence.

F-4A
PROFORMA OF "LETTER OF CREDIT" FOR "EARNEST MONEY / BID SECURITY"

To,

Central UP Gas Limited,
7th floor, UPSIDC complex
A-1/4, Lakhanpur
Kanpur-208024
India

SUB:

TENDER NO:

Irrevocable and confirmed Letter of Credit No. …… Amount: Rs. _____Validity of this Irrevocable: …… (in India)Letter of Credit (2 months beyond validity of Offer)

Dear Sir,

1. You are here by authorized to draw on …….. (Name of Applicant with full address) for a sum not exceeding …… available by your demand letter (draft) on them at sight drawn for Rs. …… accompanied by a certificate by Central UP Gas Limited, with the Tender No. duly incorporated therein, that one or more of the following conditions has/have occurred, specifying the occurred condition(s):

(i) The Bidder withdraws its Bid during the period of Bid validity or any extension thereof duly agreed by the Bidder.

(ii) The Bidder varies or modifies its Bid in a manner not acceptable to CUGL (India) Limited during the period of bid validity or any extension thereof duly agreed by the Bidder.

(iii) The Bidder, having been notified of the acceptance of its Bids,

(a) Fails or refuses to execute the Supply Order/Contract

(b) Fails or refuses to furnish the Contract Performance Security within 30 days before expiry of Bid Security.

(c) Fails to accept arithmetic corrections as per tender conditions.

2. This Irrevocable Letter of Credit has been established towards Bid Security Tender No …… for …….. (Item)

3. We hereby guarantee to protect the Drawers, Endorsers and bonafide holders from any consequences, which may arise in the event of the non-acceptance or non-payment of Demand Letter (draft) in accordance with the terms of this credit.
4. This Credit is issued subject to the Uniform Customs and Practices for Documentary Credits International Chamber of Commerce brochure No. 600.
5. Please obtain reimbursement as under: …….
6. All foreign as well as Indian bank charges will be on the account of M/s. …… (Applicant)

FOR ……..

Authorized Signature
(Original Bank)

Counter Signature

F-5

LETTER OF AUTHORITY

[Pro forma for Letter of Authority for Attending Subsequent 'Negotiations' / 'Pre-Bid Meetings' /'Un-priced Bid Opening' / 'Price Bid Opening']

Ref: Date:

To,
Central UP Gas Limited,
7th floor, UPSIDC complex
A-1/4, Lakhanpur
Kanpur-208024
India

SUB:
TENDER NO:

Dear Sir,

I/We, _____ hereby authorize the following representative(s) for attending any 'Negotiations' / 'Meetings [Pre-Bid Meeting]', 'Un-priced Bid Opening', 'Price Bid Opening' and for any subsequent correspondence / communication against the above Bidding Documents:

[1] Name & Designation _____ Signature _____
Phone/Cell:
Fax:
E-mail: …….. @ ……
[2] Name & Designation _____ Signature _____
Phone/Cell: Fax: E-mail: …….. @ ……

We confirm that we shall be bound by all commitments made by aforementioned authorised representative(s).

Place: [Signature of Authorized Signatory of Bidder]
Date: Name:
Designation:
Seal:

Note: This "Letter of Authority" should be on the **"letterhead"** of the Firm / Bidder and should be signed by a person competent and having the 'Power of Attorney' to bind the Bidder. Not more than 'two [02] persons per Bidder' are permitted to attend "Techno-commercial / Un-priced" & "Price Bid" Openings. Bidders authorized representative is required to carry a copy of this authority letter while attending the un-priced and priced bid opening, the same shall be submitted to CUGL.

F-6
"NO DEVIATION" CONFIRMATION

To,

Central UP Gas Limited,
7th floor, UPSIDC complex
A-1/4, Lakhanpur
Kanpur-208024
India

SUB:
TENDER NO:

Dear Sir,

We understand that any 'deviation / exception' in any form may result in rejection of Bid. We, therefore, certify that we have not taken any 'exception / deviation' anywhere in the Bid and we agree that if any 'deviation / exception' is mentioned or noticed, our Bid may be rejected.

Place: [Signature of Authorized Signatory of Bidder]

Date: Name:

Designation:

Seal:

F-7

DECLARATION REGARDING HOLIDAY/BANNING AND LIQUIDATION, COURT RECEIVERSHIP

To,
Central UP Gas Limited,
7th floor, UPSIDC complex
A-1/4, Lakhanpur
Kanpur-208024
India

Dear Sir,

We hereby confirm that we are not on 'Holiday' by CUGL or banned by Government department/ Public Sector on due date of submission of bid.

We also confirm that we are not under any liquidation, court receivrship or similar proceedings or 'bankruptcy'.

In case it comes to the notice of CUGL that the bidder has given wrong declaration in this regard, the same shall be dealt as 'fraudulent practices' and action shall be initiated as per provision of tender document.

Further, we also confirm that in case there is any change in status of the declaration prior to award of contract, the same will be promptly informed to CUGL by us.

Place: [Signature of Authorized Signatory of Bidder] Date:
Name:
Designation:
Seal:

F-8

CERTIFICATE FOR NON-INVOLVMENT OF GOVT. OF INDIA

To,
Central UP Gas Limited,
7th floor, UPSIDC complex
A-1/4, Lakhanpur
Kanpur-208024
India

SUB:
TENDER NO:
Dear Sir,

If we become a successful Bidder and pursuant to the provisions of the Bidding Documents, award is given to us for the tender for " _____", the following Certificate shall be automatically enforceable:

"We agree and acknowledge that the Employer is entering into the Agreement solely on its own behalf and not on behalf of any other person or entity. In particular, it is expressly understood & agreed that the Government of India is not a party to the Agreement and has no liabilities, obligations or rights thereunder. It is expressly understood and agreed that the Employer is authorized to enter into Agreement, solely on its own behalf under the applicable laws of India. We expressly agree, acknowledge and understand that the Employer is not an agent, representative or delegate of the Government of India. It is further understood and agreed that the Government of India is not and shall not be liable for any acts, omissions, commissions, breaches or other wrongs arising out of the Agreement. Accordingly, we hereby expressly waive, release and forego any and all actions or claims, including cross claims, VIP claims or counter claims against the Government of India arising out of the Agreement and covenants not to sue to Government of India as to any manner, claim, cause of action or things whatsoever arising of or under the Agreement."

Place: [Signature of Authorized Signatory of Bidder] Date:
Name:
Designation:
Seal:

FORM F-9

PROFORMA OF "BANK GUARANTEE" FOR "CONTRACT PERFORMANCE SECURITY / SECURITY DEPOSIT"

(ON NON-JUDICIAL STAMP PAPER OF APPROPRIATE VALUE)

To,

Central UP Gas Limited,

7th floor, UPSIDC complex

A-1/4, Lakhanpur

Kanpur-208024

India

PERFORMANCE GUARANTEE No.

Dear Sir(s),

M/s. _____ having registered office at _____ (herein after called the "contractor" which expression shall wherever the context so require include its successors and assignees) have been awarded the work of _____ vide LOA /FOA No. _____dated_____ for Central U.P. Gas Limited, Kanpur

The Contract conditions provide that the CONTRACTOR shall pay a sum of Rs. _____ (Rupees _____) as full Contract Performance Guarantee in the form therein mentioned. The form of payment of Contract Performance Guarantee includes guarantee executed by Nationalized Bank, undertaking full responsibility to indemnify CUGL, in case of default.

The said _____ has approached us and at their request and in consideration of the premises we having our office at _____ have agreed to give such guarantee as hereinafter mentioned.

1. We _____ hereby undertake to give the irrevocable & unconditional guarantee to you that if default shall be made by M/s. _____ in performing any of the terms and conditions of the tender or in payment of any money payable to Central U.P. Gas Limited we shall on first demand pay without demur, contest, protest and/ or without any recourse to the contractor to you in such manner as you may direct the said amount of Rupees _____ only or such portion thereof not exceeding the said sum as you may require from time to time.

2. You will have the full liberty without reference to us and without affecting this guarantee, postpone for any time or from time to time the exercise of any of the powers and rights conferred on you under the contract with the said _____ and to enforce or to forbear from endorsing any powers or rights or by reason of time being given to the said _____ and such postponement forbearance would not have the effect of releasing the bank from its obligation under this debt.

3. Your right to recover the said sum of Rs. _____ (Rupees _____) from us in manner aforesaid will not be affected or suspended by reason of the fact that any dispute or disputes have been raised by the said M/s. _____ and/or that any dispute or disputes are pending before any officer, tribunal or court and any demand made by you in the bank shall be conclusive and binding. The bank shall not be released of its obligations under these presents by any exercise by you of its liberty with reference to matter aforesaid or any of their or by reason or any other act of omission our commission on your part or any other indulgence shown by you or by any other matter or changed what so ever which under law would, but for this provision, have the effect of releasing the bank.

4. The guarantee herein contained shall not be determined or affected by the liquidation or winding up dissolution or changes of constitution or insolvency of the said contractor but shall in all respects and for all purposes be binding and operative until payment of all money due to you in respect of such liabilities is paid.

5. This guarantee shall be irrevocable and shall remain valid upto _____ (this date should be 90 days after the expiry of defect liability period) _____. The bank undertakes not to revoke this guarantee during its currency without your previous consent and further agrees that the guarantee. However,

if for any reason, the contractor is unable to complete the work within the period stipulated in the contract and in case of extension of the date of completion resulting extension of defect liability period of the contractor fails to perform the work fully, the bank hereby agrees to further extend this guarantee at the instance of the contractor till such time as may be determined by the owner. If any further extension of this guarantee is required, the same shall be extended to such required period on receiving instruction from

M/s._____ (contractor) on whose behalf this guarantee is issued.

6. The Bank Guarantee's payment of an amount is payable on demand and in any case within 2 working days of the presentation of the letter of invocation of Bank Guarantee. Any dispute arising out of or in relation to the said Bank Guarantee shall be subject to the jurisdiction of KANPUR Courts.

7. Therefore, we hereby affirm that we are guarantors and responsible to you on behalf of the Contractor up to a total amount of _____(amount of guarantees in words and figures) and we undertake to pay you, upon your first written demand declaring the Contractor to be in default under the contract and without caveat or argument, any sum or sums within the limits of (amounts of guarantee) as aforesaid, without your needing to prove or show grounds or reasons for your demand or the sum specified therein.

8. We have power to issue this guarantee in your favor under Memorandum and Articles of Association and the undersigned has full power to do under the Power of Attorney, dated _____ granted to him by the Bank.

Yours faithfully,

_____

Bank by its Constituted Attorney

Signature of a person duly

Authorized to sign on behalf of the Bank

INSTRUCTIONS FOR FURNISHING

"CONTRACT PERFORMANCE SECURITY / SECURITY DEPOSIT" BY "BANK GUARANTEE"

1. The Bank Guarantee by successful Bidder(s) will be given on non-judicial stamp paper as per 'stamp duty' applicable. The non-judicial stamp paper should be in name of the issuing bank. In case of foreign bank, the said Bank Guarantee to be issued by its correspondent bank in India on requisite non-judicial stamp paper and place of Bid to be considered as Delhi.

2. The Bank Guarantee by Bidders will be given from bank as specified in Tender.

3. A letter from the issuing bank of the requisite Bank Guarantee confirming that said Bank Guarantee and all future communication relating to the Bank Guarantee shall be forwarded to Employer.

4. If a Bank Guarantee is issued by a commercial bank, then a letter to Employer and copy to Consultant (if applicable) confirming its net worth is more than Rs. 100,00,00,000.00 [Rupees One Hundred Crores] or its equivalent in foreign currency alongwith documentary evidence.

F-10

AGREED TERMS & CONDITIONS

To,

Central UP Gas Limited,
7th floor, UPSIDC complex
A-1/4, Lakhanpur
Kanpur-208024
India

SUB:
TENDER NO:

This Questionnaire duly filled in, signed & stamped must form part of Bidder's Bid and should be returned along with Un-priced Bid. Clauses confirmed hereunder need not be repeated in the Bid.

Sl.	DESCRIPTION	BIDDER'S CONFIRMATION
1	Bidder's name and address	
2.	Please confirm the currency of quoted prices is in Indian Rupees.	
3.	Confirm quoted prices will remain firm and fixed till complete execution of the order.	
4	Rate of applicable Service Tax & Edu. Cess thereon	SEC----- Total %
5.	i) Confirm acceptance of relevant Terms of Payment specified in the Bid Document. ii) In case of delay, the bills shall be submitted after deducting the price reduction due to delay.	
6.	Confirm that Contract Performance Bank Guarantee will be furnished as per Bid Document.	
7.	Confirm that Contract Performance Bank Guarantee shall be from any Indian scheduled bank or a branch of an International bank situated in India and registered with Reserve bank of India as scheduled foreign bank. However, in case of bank guarantees from banks other than the Nationalised Indian banks, the bank must be a commercial bank having net worth in excess of Rs 100 crores and a declaration to this effect shall be made by such commercial bank either in the Bank Guarantee itself or separately on its letterhead.	

8.	Confirm compliance to Completion Schedule as specified in Bid document. Confirm contract period shall be reckoned from the date of Fax of Acceptance.	
9.	Confirm acceptance of Price Reduction Schedule for delay in completion schedule specified in Bid document.	
10.	a) Confirm acceptance of all terms and conditions of Bid Document (all sections). b) Confirm that printed terms and conditions of bidder are not applicable.	
11.	Confirm your offer is valid for 3 months from Final/Extended due date of opening of Techno-commercial Bids.	
12.	Please furnish EMD/Bid Security details : a) EMD/ Bid Security No. & date b) Value c) Validity	
13.	Confirm acceptance to all provisions of ITB	
14.	Confirm that Annual Reports for the last three financial years are furnished alongwith the Un-priced Bid.	
15.	Confirm that, in case of contradiction between the confirmations provided in this format and terms & conditions mentioned elsewhere in the offer, the confirmations given in this format shall prevail.	
16.	Confirm the none of Directors of bidder is a relative of any Director of Owner or the bidder is a firm in which any Director of Owner/ CUGL or his relative is a partner.	
17.	All correspondence must be in ENGLISH language only.	
18	Owner reserves the right to make any change in the terms & conditions of the TENDER/BIDDING DOCUMENT and to reject any or all bids.	
19	Confirm that all Bank charges associated with Bidder's Bank shall be borne by Bidder.	

Place: [Signature of Authorized Signatory of Bidder]

Date: Name:

Designation:

Seal:

F-11

ACKNOWLEDGEMENT CUM CONSENT LETTER

(On receipt of tender document/information regarding the tender, Bidder shall acknowledge the receipt and confirm his intention to bid or reason for non-participation against the enquiry /tender through e-mail/fax to concerned executive in CUGL issued the tender, by filling up the Format)

To,
Central UP Gas Limited,
7th floor, UPSIDC complex
A-1/4, Lakhanpur
Kanpur-208024
India

SUB:
TENDER NO:

Dear Sir,

We hereby acknowledge receipt of a complete set of bidding document along with enclosures for subject item/job and/or the information regarding the subject tender.

We intend to bid as requested for the subject item/job and furnish following details with respect to our quoting office:

Postal Address with Pin Code : .....
Telephone Number : .....
Fax Number : .....
Contact Person : .....
E-mail Address : .....
Mobile No. : .....
Date : .....
Seal/Stamp : .....

We are unable to bid for the reason given below:
Reasons for non-submission of bid:

Agency's Name : .....
Signature : .....
Name : .....
Designation : .....
Date : .....

Seal/Stamp : .....

F-12
UNDERTAKING ON LETTERHEAD

To,

Central UP Gas Limited,
7th floor, UPSIDC complex
A-1/4, Lakhanpur
Kanpur-208024
India

SUB:

TENDER NO:

Dear Sir

We hereby confirm that "The contents of this Tender Document No. _____ have not been modified or altered by M/s. ……(Name of the bidder with complete address). In case, it is found that the tender document has been modified / altered by the bidder, the bid submitted by M/s……(Name of the bidder) shall be liable for rejection".

Place: [Signature of Authorized Signatory of Bidder]

Date: Name:

Designation:

Seal:

F-13

BIDDER'S EXPERIENCE

To,

Central UP Gas Limited,
7th floor, UPSIDC complex
A-1/4, Lakhanpur
Kanpur-208024
India

SUB:

TENDER NO:

Sl. No	Description of the Services	LOA /WO No. and date	Full Postal Address & phone nos. of Client. *Name, designation and address of Engineer/ Officer-in-Charge (for cases other than purchase)*	Value of Contract/Order (*Specify* Currency Amount)	Date of Commencement of Services	Scheduled Completion Time (Months)	Date of Actual Completion	Reasons for delay in execution, if any
(1)	(2)	(3)	(5)	(6)	(7)	(8)	(9)	(10)

Place: [Signature of Authorized Signatory of Bidder]

Date: Name:

Designation:

Seal:

F-14
CHECK LIST

Bidders are requested to duly fill in the checklist. This checklist gives only certain important items to facilitate the bidder to make sure that the necessary data/information as called for in the bid document has been submitted by them along with their offer. This,
however, does not relieve the bidder of his responsibilities to make sure that his offer is otherwise complete in all respects.

Please ensure compliance and tick (√) against following points:

S. No.	DESCRIPTION	CHECK BOX	REFERENCE PAGE NO. OF THE BID SUBMITTED
1.0	Sign on each sheet of offer, original bidding document including SCC, ITB, GCC ,SOR drawings, addendum (if any)		
2.0	Confirm that the following details have been submitted in the Un-priced part of the bid		
i	Covering Letter, Letter of Submission		
ii	Bid Security		
iii	Signed and stamped original copy of bidding document along with drawings and addendum (if any)		
iv	Power of Attorney in the name of person signing the bid.		
v	Copies of documents defining constitution or legal status, place of registration and principal place of business of the company		
vi	Bidders declaration that regarding, Holiday/ Banning, liquidation court receivership or similar proceedings		
vii	Details and documentary proof required against qualification criteria along with complete documents establishing ownership of equipment as per SCC are enclosed		
viii	Confirm submission of document alongwith techno-commercial bid as per bid requirement.		
3.0	Confirm that all forms duly filled in are enclosed with the bid duly signed by authorised person(s)		
4.0	Confirm that the price part as per Price Schedule format submitted with Bidding Document.		
7.0	Confirm that annual reports for last three financial years & duly filled in Form 16 are enclosed in the offer for financial assessment (where financial criteria of BEC is applicable).		

(TO BE INCLUDED ONLY WHERE FINANICAL CRITERIA OF BEC IS APPLICABLE)

F-15

FORMAT FOR CERTIFICATE FROM BANK
IF BIDDER'S WORKING CAPITAL IS INADEQUATE

(To be provided on Bank's letter head)

Date:

To,
Central UP Gas Limited,
7th floor, UPSIDC complex
A-1/4, Lakhanpur
Kanpur-208024
India

Dear Sir,

This is to certify that M/s …….. (name of the bidder with address) (hereinafter referred to as Customer) is an existing customer of our Bank.

The Customer has informed that they wish to bid for CUGL's RFQ/Tender no. ..... dated …… for ……..(Name of the supply/work/services/consultancy) and as per the terms of the said RFQ/Tender they have to furnish a certificate from their Bank confirming the availability of line of credit.

Accordingly M/s …….. (name of the Bank with address) confirms availability of line of credit to M/s …….. (name of the bidder) for at least an amount of Rs. _____

It is also confirmed that the net worth of the Bank is more than Rs. 100 Crores (or Equivalent USD) and the undersigned is authorized to issue this certificate.

Yours truly,
for …… (Name & address of Bank)

(Authorized signatory)
Name of the signatory :
Designation :
Stamp

F-16

FORMAT FOR FINANCIAL CAPABILITY OF THE BIDDER

A. ANNUAL TURNOVER OF LAST 3 YEARS:

Year	Amount (Currency)
Year 1:	
Year 2:	
Year 3:	

B. FINANCIAL DATA FOR LAST AUDITED FINANCIAL YEAR :

Description	**Year _____**
	Amount (Currency)
1. Current Assets	
2. Current Liabilities	
3. Working Capital (Current Assets-Current liabilities)	
4. Net Worth (Paid up share capital and Free Reserves & Surplus)	

Place: [Signature of Authorized Signatory]

Name:

Date: Designation:

Seal:

Instructions:

1. The financial year would be the same as one normally followed by the bidder for its Annual Report.
2. The bidder shall provide the audited annual financial statements as required for this Tender document. Failure to do so would result in the Proposal being considered as non responsive.

For the purpose of this Tender document, (i) Annual Turnover shall be "Sale value/ Operating Income" (ii) Working Capital shall be "Current Assets less Current liabilities" and (iii) Net Worth shall be "Paid up share capital and Free Reserves & Surplus

SECTION-VII

Price schedule/Schedule of Rates (SOR)

Attached Separately