

DEP SPECIFICATION

**WELDED AND SEAMLESS DUPLEX AND SUPER DUPLEX
STAINLESS STEEL LINE PIPE
(AMENDMENTS/SUPPLEMENTS TO API SPEC 5LC)**

DEP 31.40.20.34-Gen.

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DESIGN AND ENGINEERING PRACTICE

DEM1



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These views are based on the experience acquired during involvement with the design, construction, operation and maintenance of processing units and facilities. Where deemed appropriate DEPs are based on, or reference international, regional, national and industry standards.

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PART I INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for the manufacture and supply of seamless and longitudinally welded duplex and super duplex stainless steel line pipe for use in oil and gas operations under both sour and non-sour service conditions.

NOTE: Sour service is defined in DEP 39.01.10.12-Gen.

This DEP is based on API Specification 5LC, Third Edition, July 1998, reaffirmed August 2006. Part III amends, supplements and deletes various clauses of API Specification 5LC. Part III follows the clause numbering of API Specification 5LC for easy reference.

All clauses of API Specification 5LC not modified by this DEP remain valid as written.

This DEP contains mandatory requirements to mitigate process safety risks in accordance with Design Engineering Manual DEM 1 – Application of Technical Standards.

This is a revision of the DEP of the same number dated February 2013. See (1.5) regarding the changes.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by Shell GSI, the distribution of this DEP is confined to Shell companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them. Any authorised access to DEPs does not for that reason constitute an authorization to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in facilities related to oil and gas production, gas handling, oil refining, chemical processing, gasification, distribution and supply/marketing. This DEP may also be applied in other similar facilities.

When DEPs are applied, a Management of Change (MOC) process shall be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements could be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regards to the safety, environmental, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned, the objective being to obtain agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project and ultimately pays for it. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

NOTE: In API Spec 5LC, the term **Purchaser** is used. In this DEP, the term Purchaser shall be understood to mean the Principal.

The word **shall** indicates a requirement.

The capitalised term **SHALL [PS]** indicates a process safety requirement.

The word **should** indicates a recommendation.

The word **may** indicates a permitted option.

1.3.2 Specific definitions

Term	Definition
Defect (in NDT)	An imperfection or group of imperfections whose indication(s) do not meet specified acceptance limits.
Electric-Welded	Term used in API Spec 5LC which shall be understood to mean HFW.
Finished Pipe	Pipe passed through all stages of production and inspection.
Imperfection (in NDT)	An interruption, which may be either intentional or unintentional, in the physical structure or configuration of a pipe.
Indication (in NDT)	Evidence of an imperfection that requires interpretation to determine its significance.
Lot	A unit of pipes from the same heat and, for batch heat treatment, heat treatment batch, having the same dimensions. For pipes with OD < 508 mm (20 in), a lot shall be a maximum of 100 pipes. For other sizes, a lot shall be a maximum of 50 pipes.
Pipe End	Complete pipe segment of 100 mm (4 in) length measured from the end face of the finished pipe.
Plate or Coil	The flat starting material for welded pipe before forming into the shape of a pipe.
Radiological	Term used in API SPEC 5LC which has the same meaning as radiographic. The term radiographic is used in this DEP.

1.3.3 Abbreviations

Term	Definition
CRA	Corrosion Resistant Alloy
FL	Fusion Line
HAZ	Heat-Affected Zone
HFW	High Frequency Welded
ID	Inside Diameter
LBW	Laser Beam Welded
NDT	Non-Destructive Testing
OD	Outside Diameter
PREN	Pitting Resistance Equivalent Number
PT	Liquid Penetrant Testing
RT	Radiographic Testing
SSRT	Slow Strain Rate Test
T	Wall Thickness
T _{min}	Minimum Design Temperature
UNS	Unified Numbering System
UT	Ultrasonic Testing
WCL	Weld Centre Line

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section number is shown in brackets (). Other documents referenced by this DEP are listed in (Part IV).

1.5 SUMMARY OF MAIN CHANGES

This is a revision of the DEP of the same number dated February 2013. Refer to the table below for the main non-technical changes.

Section/Clause	Change
All	Restructured and clarified requirements, enforced use of shall/should/may for normative statements and separation of requirements.
5.1	Clarified and Restructured DEM1 Requirement
7.1	Clarified and Restructured DEM1 Requirement
7.22	Clarified and Restructured DEM1 Requirement
8.1	Clarified and Restructured DEM1 Requirement
16.2	Clarified and Restructured DEM1 Requirement

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be submitted to the Administrator using one of the following options:

Shell DEPs Online (Users with access to Shell DEPs Online)	Enter the Shell DEPs Online system at https://www.shelldeps.com Select a DEP and then go to the details screen for that DEP. Click on the "Give feedback" link, fill in the online form and submit.
DEP Feedback System (Users with access to Shell Wide Web)	Enter comments directly in the DEP Feedback System which is accessible from the Technical Standards Portal http://www.shell.com/standards . Select "Submit DEP Feedback", fill in the online form and submit.
DEP Standard Form (other users)	Use DEP Standard Form 00.00.05.80-Gen. to record feedback and email the form to the Administrator at standards@shell.com .

Feedback that has been registered in the DEP Feedback System by using one of the above options will be reviewed by the DEP Custodian for potential improvements to the DEP.

1.7 DUAL UNITS

This DEP contains both the International System (SI) units, as well as the corresponding US Customary (USC) units, which are given following the SI units in brackets. When agreed by the Principal, the indicated USC values/units may be used.

1.8 NON NORMATIVE TEXT (COMMENTARY)

Text shown in italic style in this DEP indicates text that is non-normative and is provided as explanation or background information only.

Non-normative text is normally indented slightly to the right of the relevant DEP clause.

PART II GENERAL

Part III of this DEP is written as amendments and supplements to API Specification 5LC, Third Edition, July 1998, reaffirmed August 2006. Wherever reference is made to API 5LC, it shall be understood to mean API Specification 5LC as amended/supplemented by this DEP.

For ease of reference, the clause numbering of API 5LC has been used throughout Part III of this DEP.

Unless specified otherwise in this DEP, all occurrences of the word “should” in API 5LC shall be replaced with the word “shall”.

Clauses in API 5LC, which are not mentioned in this DEP, shall remain valid as written.

PART III AMENDMENTS/SUPPLEMENTS TO API SPEC 5LC

1 SCOPE

1.1 COVERAGE

Delete the first two paragraphs of this clause and refer to (Part I, 1.1) of this DEP.

1.3 MEASURING DEVICES

Add to this clause:

1. The Manufacturer/Supplier shall control measuring devices within the requirements of ISO 10012.

1.5 CERTIFICATION

Replace this clause with:

1. Inspection certificates in accordance with ISO 10474, Type 3.1 shall be supplied as a minimum.
2. If inspection certificates in accordance with ISO 10474, Type 3.2 are specified or required, the Manufacturer/Supplier shall issue and validate the inspection reports as agreed with the Principal.
3. The Manufacturer/Supplier shall provide a listing of all pipes supplied in electronic format, detailing for each pipe the unique pipe number, heat number, test number, certificate number, length, and weight.

Add new clause:

1.6 QUALITY SYSTEM

1. The Manufacturer/Supplier shall maintain and operate a quality assurance system in accordance with ISO 9001 or an alternative standard as agreed with the Principal.

2 REFERENCED STANDARDS

Delete this clause 2.3:

2.4 REFERENCED STANDARDS

Add to this clause:

1. Refer (Part IV) for other standards and publications referenced in this DEP.

4 MISCELLANEOUS-RETENTION OF RECORDS

Replace this clause with:

1. Contract records, and any other records requiring retention by the Manufacturer/Supplier's quality assurance system, shall be retained by the Manufacturer/Supplier and made available to the Principal on request for a period of five years after completion of the order.

5 PROCESS OF MANUFACTURE AND MATERIAL

5.1 PROCESS OF MANUFACTURE

Add to the first paragraph of this clause:

1. Plates or coil shall be formed into pipe at ambient temperature.
2. Ingots or slabs to be used to fabricate plate shall be clearly identified so that traceability to mill certificates can be made throughout the plate/pipe production.
3. All plate or coil material shall be visually inspected to ensure that no cracks, laps, laminations or other planar defects are present.
4. Longitudinal weld seams SHALL [PS] be full penetration and double sided i.e., welded from both outside and inside the pipe.

Modify the following sections:

b. Welded processes

1. Without Filler Metal

Add to this clause:

1. Use of the electric welding process shall be subject to approval by the Principal.
2. Autogenous welding shall be subject to approval by the Principal.

2. With Filler Metal

Add to this clause:

1. The longitudinal seam welds SHALL [PS] be welded using a Principal approved welding procedure specification.
2. The following welding processes shall be used:
 - a. GTAW Gas Tungsten Arc Welding, or
 - b. PAW Plasma Arc Welding, or
 - c. SAW Submerged Arc Welding, or
 - d. GMAW Gas Metal Arc Welding.

c. Pipe-making Processes

Delete double seam column in Table 2:

6. Combination Welding

Delete "or double" in this clause.

Delete this clause 7:

7. Double Seam

d. Tack Welding

Add to this clause:

1. Tack welds shall be made using a continuous single pass.

5.2 COLD EXPANSION

Add to this clause:

1. Cold expansion for sizing shall be performed by mechanical means only.
2. The % expansion shall be defined as per equation 1:

$$\% \text{ expansion} = \frac{D_a - D_b}{D_b} \times 100 \quad \text{eqn1}$$

D_a OD (ID) after expansion

D_b OD (ID) before expansion

3. Alternative sizing methods may be considered by the Principal.

5.3 HEAT TREATMENT

Add to this clause:

1. All pipes SHALL [PS] be full body solution annealed and water quenched.
In case of direct water quenching after the hot forming operation (e.g., hot extrusion), a separate heat treatment is not necessary provided the minimum temperature before quenching is above the specified minimum annealing temperature.
2. The temperatures and times during the heat treatment operation shall be permanently recorded.

5.4 TRACEABILITY

Replace this clause with:

1. The Manufacturer/Suppliers documented procedure shall ensure that any length of pipe can be traced to the correct heat/lot and the associated certificates.
2. Each pipe shall be assigned a unique identification number stamped at one end, using low stress die stamps, vibro-etching or stencilled onto the pipes.

Add the following new clauses:

5.5 SURFACE FINISH

1. All internal and external surfaces shall be supplied free of scale, oxide film, oil, grease, and lacquers (except for paint marking characters).
2. Where the pipe is to be coated under a separate contract, the Principal may specify additional surface finish and roughness requirements.