

DEP SPECIFICATION

WELDABLE MARTENSITIC STAINLESS STEEL LINE PIPE FOR USE IN OIL AND GAS OPERATIONS (AMENDMENTS/SUPPLEMENTS TO API SPEC 5LC)

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DESIGN AND ENGINEERING PRACTICE

DEM1



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The information set forth in these publications is provided to Shell companies for their consideration and decision to implement. This is of particular importance where DEPs may not cover every requirement or diversity of condition at each locality. The system of DEPs is expected to be sufficiently flexible to allow individual Operating Units to adapt the information set forth in DEPs to their own environment and requirements.

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PART I INTRODUCTION**1.1 SCOPE**

This DEP specifies requirements and gives recommendations for the purchase of seamless weldable martensitic stainless steel (known generically as weldable 13Cr) line pipe for use in oil and gas operations. The requirements are considered necessary to maintain technical integrity of pipelines and to ensure that a suitable specification exists in the absence of standardised grades of these materials.

This DEP is based on API SPEC 5LC (Third Edition). Part III of this DEP amends, supplements and deletes various clauses of API SPEC 5LC and follows the clause numbering of API SPEC 5LC for easy reference.

All clauses of API SPEC 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; refer (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 purchase of line pipe for the construction of oil and gas production flowlines and pipelines. 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 Abbreviations

Term	Definition
CP	Cathodic Protection
CTOD	Crack Tip Opening Displacement
DEP	Design and Engineering Practice
DN	Nominal Diameter
HAZ	Heat-Affected Zone
HISC	Hydrogen induced stress cracking
HV	Hardness Vickers
ID	Internal Diameter
IGSCC	Intergranular Stress Corrosion Cracking
MPI	Magnetic particle inspection
NDT	Non-Destructive Testing
OD	Outside Diameter
PS	Process Safety
PWHT	Post Weld Heat Treatment
T	Thickness
TD _{MIN}	Minimum design temperature
UT	Ultrasonic Testing
WPS	Welding Procedure Specification(s)

1.3.2 Specific definitions

Term	Definition
Defect (in NDT)	An indication or group of indications that does not meet specified acceptance criteria.
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.
Pipe End	Complete pipe segment of 100 mm (4 in) length measured from the end face of the finished pipe.
Qualified Manufacturer	A Manufacturer whose product has been previously demonstrated to be suitable for the intended service, and formally accepted by the Principal.
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 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.

NOTE: In API SPEC 5LC, the term Vendor is used. In this DEP, the term Vendor shall be understood to mean the Manufacturer/Supplier.

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.

1.4 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 DEP is a revision of the DEP of the same number dated February 2013. The following are the main, non-editorial changes.

Section/Clause	Change
All	Restructured and clarified requirements, enforced shall/should.
8.1	Re-structured section and isolated SHALL [PS] requirement.
9.1	Re-structured section and isolated SHALL [PS] 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://sww.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 REQUIREMENTS

1.1 GENERAL

1. This DEP shall be applicable under non-sour conditions in absence of H₂S.
2. Where the application limits of the materials have not yet been completely determined, qualification testing shall be carried out if H₂S could be present, in consultation with subject matter experts (even if the expected H₂S partial pressure is below 3.5 mbar (0.05 psi).
3. This DEP shall be applicable only to titanium-alloyed, rich grade weldable martensitic stainless steels having nickel content above 5.0 wt%, and a molybdenum content above 2.0 wt%.

Exclusion of the lower alloyed lean grade and medium grade stainless steels is related to minimizing the susceptibility to intergranular stress corrosion cracking in the HAZ of girth welds.

4. Corrosion test data provided by the vendor shall be verified to ensure that the requirements in (Part III, 8.1) of this DEP are met.
 - a. In absence of satisfactory data, a pre-qualification testing should be carried out.
5. Resistance of the HAZ of the seam weld to intergranular stress corrosion cracking should be demonstrated to manage specific production issues that could arise for seam welded weldable martensitic stainless steel line pipe.
 - a. Expert advice should be sought when evaluating future applications of seam welded weldable martensitic stainless steel line pipe.
6. Post weld heat treatment (PWHT) shall be carried out to mitigate the risk intergranular stress corrosion cracking (IGSCC) in the HAZ.
 - a. Test requirements shall be as per (Part III, 8.1).
7. Weldable martensitic stainless steel lines are susceptible to hydrogen induced stress cracking (HISC) related to cathodic protection (CP) and should be prevented by design.
 - a. Expert advice should be sought to avoid HISC.

1.2 ITEMS TO BE SPECIFIED/AGREED BY THE PRINCIPAL

The following information should be provided by the Principal at the enquiry stage of the order (requirements specifically addressed in this DEP need not be repeated):

- a. quantity ordered;
- b. nominal ID (and whether constant ID is required);
- c. wall thickness requirements;
- d. minimum design temperature;
- e. maximum design temperature;
- f. design pressure;
- g. service environment (gas, oil, water, multiphase, non-sour);
- h. end preparation required if different from the standard API bevel;
- i. whether mechanical property restrictions for reeling are to be applied;
- j. whether elevated temperature tensile testing is required and the acceptance criteria;
- k. length requirements if different from (Part III, 10.5) of this DEP;
- l. which of the Manufacturer/Supplier's quality control procedures are to be submitted for agreement;
- m. time period for submission of contract quality plan;
- n. level of inspection to be deployed by the Principal;
- o. whether inspection reports in accordance with ISO 10474 type 3.2 are required instead of inspection certificates in accordance with ISO 10474 type 3.1.B;
- p. specific marking requirements;
- q. specific packaging requirements;
- r. other specific requirements amending or supplementing this DEP.

PART III AMENDMENTS/SUPPLEMENTS TO API SPEC 5LC**1 Scope****1.1 COVERAGE**

Delete this section and replace with the following:

This specification covers the supply of proprietary grades of seamless, weldable martensitic stainless steel line pipe by qualified Manufacturers/Suppliers. The primary product is bevelled pipe having a standard API bevel.

1. Pipe with end finish other than standard API bevel shall be clearly stated by the Principal in the contract document.

1.2 METRIC UNITS

Replace first paragraph with the following:

Metric units are used throughout this specification.

1.3 MEASURING DEVICES

Delete this section and replace with the following:

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

1.4 SPECIAL PROCESSES

Replace the existing table with the following:

Table 1.4 Special manufacturing processes

<i>Manufacturing condition: Seamless</i>	<i>Special Processes</i>
<i>As-rolled (non-expanded)</i>	<i>Final reheating and hot sizing or stretch reduction.</i> <i>Cold finishing (if applied).</i> <i>Nondestructive inspection.</i>
<i>As-rolled (expanded)</i>	<i>Expansion</i> <i>Non-destructive inspection</i>
<i>Heat-treated</i>	<i>Heat treatment</i> <i>Non-destructive inspection.</i>

Add the following text after the Table:

1. Applicable special processes shall include those identified and documented in the quality assurance system of the Manufacturer/Supplier.¹
2. Procedures for all special processes shall be produced by the Manufacturer/Supplier and supplied to the Principal when requested.

Refer (Part III, 15) for documentation requirement.

1.5 CERTIFICATION

Delete this section and replace with the following:

1. Inspection certificates in accordance with ISO 10474 type 3.1.B shall be supplied unless the Principal specifies inspection reports in accordance with ISO 10474 type 3.2.
2. In case of inspection certificate type 3.2, Manufacturer/Supplier shall issue and validate the inspection reports which are subject to be counter-validated by the Principal's authorised representative.
3. The Manufacturer/Supplier shall provide a listing of all pipes supplied detailing the following for for each pipe:
 - a. the unique pipe number;
 - b. heat number;
 - c. test number;
 - d. certificate number;
 - e. length and weight.
4. The data mentioned in (1.5 item 3) shall also be supplied to the Principal on a computer disc in an agreed format.

Add new section:

1.6 QUALITY SYSTEM

1. The Manufacturer/Supplier shall maintain and operate a quality management system in accordance with ISO 9001 or an alternative standard if approved by the Principal.
2. The quality assurance system shall employ statistical process control and have documented procedures for its application.

2 Referenced Standards

2.1 GENERAL

Add the following:

1. Refer to (Part IV of this DEP for additional standards referenced.

2.3 EQUIVALENT STANDARDS

Delete this section.

3 Definitions and Terms

3.1 Heat

Add the following at the end of the sentence:

1. Where the size of the secondary refining vessel is less than that of the primary steel producing vessel, the heat shall be measured to be the metal produced by a single cycle of the secondary refining vessel.