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Guidance on Practice for Linepipe Material Selection and Procurement

GP 43-31

BP GROUP
ENGINEERING TECHNICAL PRACTICES

Foreword

This is the first issue of Engineering Technical Practice (ETP) BP GP 43-31. This Guidance on Practice (GP) is newly created and is not derived from any heritage documents from the merged BP companies.

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1. Scope

This ETP provides overview guidance for the selection, procurement, and inspection of steel linepipe and associated bends, fittings and flanges. This ETP also provides guidance and limitations for the use of the Global Linepipe Agreement.

2. Normative references

The following normative documents contain requirements that, through reference in this text, constitute requirements of this technical practice. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this technical practice are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to apply.

American Petroleum Institute (API)

API Spec 5L	Specification for Line Pipe.
API Spec 5LC	CRA Clad Pipe.
API Spec 5LD	Specification for CRA Clad or Lined Steel Pipe.

International Organisation for Standardisation (ISO)

ISO 15156-1*	Petroleum and natural gas industries – Materials for use in H ₂ S-containing environments in oil and gas production. Part 1 General principles for selecting cracking resistant materials.
ISO 15156-2*	Petroleum and natural gas industries – Materials for use in H ₂ S-containing environments in oil and gas production. Part 2 Cracking-resistant carbon and low alloy steels and the use of cast irons.
ISO 15156-3*	Petroleum and natural gas industries – Materials for use in H ₂ S-containing environments in oil and gas production. Part 3 Cracking-resistant CRAs (corrosion-resistant alloys and other alloys).

* Marketed as NACE MR0175/ISO 15156

European Standards (EN)

EN 10208-1	Steel pipes for pipelines for combustible fluids - Technical delivery conditions: Part 1. Pipes of requirement class A.
EN 10208-2	Steel pipes for pipelines for combustible fluids - Technical delivery conditions: Part 2. Pipes of requirement class B.

Canadian Standards Association (CSA)

CSA Z245.1	Steel Line Pipe.
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Det Norske Veritas (DNV)

DNV OS-F101	Submarine Pipeline Systems.
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BP

GN 65-706	Dynamic Riser Materials Guidance Note.
GP 36-20	Guidance on Practice for Materials Selection for Subsea Equipment.
GP 43-03	Guidance on Practice for Contracting and Procurement Strategies for Pipelines.



GP 43-32	Guidance on Practice. Pipe handling, Storage and Transportation.
GP 43-33	Guidance on Practice for Welding of pipelines.
GP 43-34	Guidance on Practice for Automatic Ultrasonic Testing of Pipeline Girth Welds.
GIS 43-311	Guidance on Industry Standard for the Manufacture of Longitudinal or Helically Welded Seam Submerged Arc Welded Linepipe in Grades up to X80.
DS 43-311	Data Sheet for Line Pipe (SAW).
GIS 43-312	Guidance on Industry Standard for the Manufacture of High Frequency Induction (HFI) or Electric Resistance Welded (ERW) Linepipe in Grades up to X70.
DS 43-312	Data Sheet for Line Pipe (HFI or ERW).
GIS 43-313	Guidance on Industry Standard for the Manufacture of Seamless Linepipe in Grades up to X80.
DS 43-313	Data Sheet for Line Pipe (Seamless).
GIS 43-314	Guidance on Industry Standard for the Manufacture of 13% Cr Seamless Linepipe.
DS 43-314	Data Sheet for Line Pipe (13% Chromium Stainless Steel Seamless).
GIS 43-315	Guidance on Industry Standard for the Manufacture of 22%Cr and 25% Cr Duplex Stainless Steel Seamless Linepipe.
DS 43-315	Data Sheet for Line Pipe (22% and 25% Chromium Duplex Stainless Steel Seamless).
GIS 43-316	Guidance on Industry Standard for the Manufacture of CRA Clad or Lined Steel Pipe.
DS 43-316	Data Sheet for Line Pipe (CRA Clad or Lined).
GIS 43-317	Guidance on Industry Standard for the Manufacture of Carbon Steel Induction Bends for Pipelines to ISO 15590-1 in Grades up to X80.
DS 43-317	Data Sheet for Induction Bends.
GIS 43-318	Guidance on Industry Standard for the Manufacture of Carbon Steel Fittings for Pipelines to ISO 15590-2 in Grades up to X80.
GIS 43-319	Guidance on Industry Standard for the Manufacture of Carbon Steel Flanges for Pipelines to ISO 15590-3 in Grades up to X80.
GIS 43-331	Guidance on Industry Standard for API 1104 Pipeline Welding.
GIS 43-332	Guidance on Industry Standard for ISO Pipeline Welding.
GIS 43-333	Guidance on Industry Standard for BS EN 4515 Pipeline Welding.
GIS 43-334	Guidance on Industry Standard for the Welding of Corrosion Resistant Alloy, Internally Clad, or Mechanically Lined Pipelines.

3. Terms and definitions

For the purposes of this GP, the following terms and definitions apply:

Approve

As applied to BP, is used if BP wishes an action by the Supplier to be notified and agreed in writing, before the subject action is implemented. This does not imply that all details of a document have been considered by BP and does not mitigate the responsibilities of the Supplier, which are covered separately by BP, as appropriate in the Conditions of Contract.



BP

BP p.l.c. and their associates.

BP Materials/ Corrosion Engineer

A BP specialist engineer appointed to advise on the performance and/or protection of the proposed linepipe material in a pipeline operating under specified corrosion conditions.

BP Pipeline Engineer

A BP specialist engineer appointed to design or approve the design of the pipeline.

BP Technical Representative

A BP specialist engineer, appointed to produce the linepipe specification appropriate for the pipeline design and application and to resolve queries concerning application.

J-Lay

A marine pipe-lay technique for deepwater pipe-lay and the deployment of deepwater steel catenary risers in which the pipe exits the lay barge and enters the water at a near vertical angle and finally curves at lower depths to lie horizontally on the sea bed.

Manufacturer

A Pipemill accepting a Purchase Order or Contract from BP to supply linepipe (in which case Manufacturer and Supplier are one and the same entity) or a trading house or steel merchant to whom BP have awarded a Contract. The duties of a Manufacturer may include responsibility for technical and quality matters relating to steelmaking and the supply of coil, blooms, or billets from which the pipe is manufactured.

Pipemill

The company manufacturing, testing, finishing, and supplying linepipe to BP and the facilities at which these activities are conducted.

S-Lay

Marine pipe-lay techniques for use in shallow or medium depth water where the pipeline exits the lay-barge stinger and enters the water at a shallow angle, forming an S-profile between the lay-barge and the sea-bed.

SAW-JCOE

A variant of SAW-UOE where the stages of pipe forming before welding are J, C, and O.

SAW-UOE

A form of linepipe formed from rolled plate pressed into a U and then an O shape prior to longitudinal seam welded from the outer and inner surfaces using submerged arc welding and finally expanded. Usually referred to as simply UOE, the SAW being implied

Steelmaker

The company manufacturing, refining, and casting steel slabs, blooms, or billets for subsequent pipe manufacture and the premises where these activities are carried out.

Supplier

A Tenderer, whose tender has been accepted and to whom a Purchase Order or Contract to supply linepipe has been awarded.



Tenderer

A Steelmaker, Pipemill or their agent, or trading house acting on behalf of the Manufacturer or Pipemill, to whom an enquiry has been issued.

Will

Applies to an action by BP.

4. Symbols and abbreviations

For the purpose of this GP, the following symbols and abbreviations apply:

CE Carbon Equivalent

CRA Corrosion Resistant Alloy

CTOD Crack Tip Opening Displacement

CVN Charpy V Notch (impact test)

DWTT Drop Weight Tear Test

ECA Engineering Critical Assessment

EPRG European Pipeline Research Group

ERW Electric Resistance Welded

Pipe manufactured from strip or coil by progressively forming a tubular profile in a pipe mill and making a solid phase longitudinal seam weld by bringing the abutting edges together under pressure and resistance heating by the passage of an electric current.

GLPA Global Linepipe Agreement

GPT Global Procurement Team

GMAW Gas metal arc welding

HAZ Heat Affected Zone

The region of parent metal in close proximity to a weld in which the metallurgical structure and material properties have been altered by the thermal cycle and/or strain effects associated with the welding operation.

HIC Hydrogen induced cracking

HFW High Frequency Welding

An improved variant of ERW in which the electric current is at high frequency usually in excess of 100 MHz

HSC Hydrogen stress cracking

HSSE Health, Safety, Security, and Environment

MAOP Maximum Allowable Operating Pressure (of pipeline)

MPS Manufacturing Procedure Specification



MDT	Minimum Design Temperature
NDT	Non-Destructive Testing
Pcm	Ito-Bessyo weldability formula
PDS	Pipeline Data Sheet
PRCI	Pipeline Research Council International
PSL	Product Specification Level
SAW	Submerged arc welding
SAWH	Submerged arc welding (helical)
	Welded pipe formed by spirally (helically) forming in a purpose designed mill and containing a helical weld seam made by submerged arc welding. This type of pipe may also contain skelp-end welds. Skelp-end welds may be made by SAW or other welding processes and are situated transverse to the helical seams.
SAWL	Submerged arc welding (longitudinal)
	Welded pipe press-formed or pyramid rolled from plate and containing one longitudinal seam weld made by submerged arc welding.
SCC	Stress corrosion cracking
SCR	Steel Catenary Riser
SMLS	Seamless pipe
	Pipe manufactured from a solid billet or bloom by piercing and hot rolling radially in a plug or mandrel type mill or by forging the pipe (Pilger process)
SMYS	Specified minimum yield strength
SOHIC	Stress oriented hydrogen induced cracking
SSC	Sulphide stress cracking
SWC	Stepwise Cracking
TMCP	Thermomechanical controlled processing
	An advanced technique for steel plate rolling to produce plates of high strength, toughness, and weldability with relatively lean composition steels.

5. Pipe selection

5.1. Process of pipe selection

5.1.1. General

- a. The material, type, and grade of linepipe to be used in pipeline construction shall be specified by the pipeline designer who shall take into account factors such as:
 1. The nature and characteristics of the fluid to be transported through the pipeline,



2. The throughput of the fluids,
 3. The maximum allowable operating pressure of the pipeline,
 4. The corrosivity of the fluid to be transported by the pipeline for which a corrosion allowance may be required to be added to the normal design wall thickness or the material may need to be upgraded to a corrosion resistant alloy. Service conditions requiring the selection of CRAs are discussed in detail in GP 36-20.
- b. The pipeline design and the grade and type of linepipe selected may also be influenced by:
1. Geotechnical factors such as ground foundation stability,
 2. Seismic activity which may impose large strains on the pipeline,
 3. Corrosivity of soils which may cause environmental SCC.
- c. In the design of sub-sea pipelines the following shall also be taken into account:
1. The ability of the selected linepipe to withstand the strains arising from marine pipe-lay operation including the sequence of reeling and unreeling if this method of pipe-lay is used,
 2. The choice of pipe grade for sub-sea pipelines may also need to take into account high operational strains which cause local movement of the pipeline (particularly for small diameter sub-sea flowlines). Movement may be caused by fluctuating sea-bed foundations arising typically from scour, sea current activity, or the passage of icebergs.
- d. For all pipelines;
1. The minimum and maximum design temperatures shall be specified,
 2. The required mechanical properties of the type and grade of linepipe selected shall meet the specified design parameters,
 3. The selection process shall ensure that the specified linepipe toughness and tensile ductility provide adequate resistance to brittle fracture at all temperatures down to the MDT and, in the case of gas pipelines, sufficient toughness to arrest a running ductile longitudinal fracture,
 4. Tensile ductility requirements assume great importance in limit state design pipelines and post-yield ductility (shape of the tensile stress strain curve) shall be taken into account,
- The yield strength/ tensile strength ratio is an important parameter for the selected linepipe,*
5. Linepipe materials shall exhibit good field weldability.
- e. At all stages of the pipeline design process, the relevant BP engineers specializing in areas such as linepipe procurement, materials, corrosion, and welding shall be consulted.
- f. GIS 43-311, GIS 43-312, GIS 43-313, GIS 43-314, GIS 43-315, or GIS 43-316 (as appropriate) shall be attached to each purchase requisition together with an appropriate associated PDS (DS 43-311, DS 43-312, DS 43-313, DS 43-314, DS 43-315, or DS 43-316), an example of which is given in Figure 1, summarising the essential characteristics together with any additional or modified requirements for each grade and wall thickness of linepipe to be procured.
- g. Any changes to the requirements defined in the applicable GIS shall be endorsed by the relevant authorities i.e. SPU Engineering Authority, and Segment Technical Authority.

