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Guidance on Practice for Onshore Pipeline System Design

GP 43-20

**BP GROUP
ENGINEERING TECHNICAL PRACTICES**

Foreword

This is the first issue of Engineering Technical Practice (ETP) BP GP 43-20. This Guidance on Practice (GP) is based on parts of heritage documents from the merged BP companies as follows:

British Petroleum

GS 118-10 Welding of transmission pipelines, Supplementary to BS 4515

Amoco

A PN-PL-5L-G Piping—Pipeline—API 5L Steel Line Pipe—Guide.
A PN-PLD-00-G Piping—Pipeline Design—Guide.

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1. Scope

This GP provides guidance on the design of onshore pipeline systems for transporting hydrocarbons and associated fluids. This Engineering Technical Practice is applicable to onshore flowlines, injection, export and distribution pipeline systems, and their associated facilities and equipment.

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 applies.

BP

GP 43-00	Guidance on Practice for Pipeline Systems (Overview Document).
GP 43-01	Guidance on Practice for Principles of Onshore Pipeline Design and Project Execution.
GP 43-04	Guidance on Practice for QA/QC.
GP 43-05	Guidance on Practice for Environmental and Social Impact Assessment of Pipelines.
GP 43-07	Guidance on Practice for Selection of Design Basis for Pipelines.
GP 43-08	Guidance on Practice for Selection and Use of Industry Codes and Standards for Pipelines.
GP 43-09	Guidance on Practice for Hydraulic Design of Pipelines.
GP 43-10	Guidance on Practice for Route Data Acquisition and Route Selection.
GP 43-17	Guidance on Practice for Risk Management for Pipelines.
GP 43-22	Guidance on Practice for Above Ground Facilities for Onshore Pipelines.
GP 43-25	Guidance on Practice for Onshore Surveys.
GP 43-26	Guidance on Practice for Offshore Surveys.
GP 43-27	Guidance on Practice for Managing Terrain Issues and Geohazards on Onshore Pipeline Projects.
GP 43-28	Guidance on Practice for Crossings for Pipelines.
GP 43-30	Guidance on Practice for ESIA Preparation.
GP 43-31	Guidance on Practice for Line Pipe Material Selection and Procurement.
GIS 43-317	Guidance on Industry Standard for Bends, Fittings, Flanges, and Wyes.
GP 43-33	Guidance on Practice for Welding of Pipelines.
GP 43-35	Guidance on Practice for Line Valves for Pipelines.
GP 43-36	Guidance on Practice for Pipe Protection.
GP 43-37	Guidance on Practice for Pipeline Control Systems.
GP 43-40	Guidance on Practice for Onshore Pipeline Construction.
GP 43-42	Guidance on Practice for Construction HSSE Practices for Pipelines.
GP 43-46	Guidance on Practice for Pipeline Pressure Testing and Pre-commissioning.
GP 43-47	Guidance on Practice for Pipeline Commissioning and Handover to Operations.



GP 43-50

Guidance on Practice for Pigging, Pig Launchers and Receivers.

International Organisation for Standardisation(ISO)

ISO 3183

Petroleum and natural gas industries – Steel pipe for pipelines – Technical delivery conditions.

American Petroleum Institute (API)

API Spec 5L

Specification for Line Pipe.

3. Terms and definitions

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

Basis of design (BoD)

Document containing a project design basis including the required design criteria, operating criteria, applicable regulations, selected industry codes and standards, conceptual drawings and other information that may aid in the design of a pipeline system

Design Life (Expected Operating Life)

Period selected for the purpose of verifying by design that a replaceable or permanent component is suitable for the anticipated duty

Design Pressure

The pressure selected as the maximum sustained pressure exerted by the pipeline contents to which a pipeline is to be designed. This pressure is normally determined by a combination of the pipe wall thickness, diameter, material grade, and design factor.

Distribution line

A low pressure pipeline that delivers processed oil or gas fluids to the end user or to other modes of transport e.g. shipping

Export line

A pipeline that transports liquid or gaseous fluids, partially or fully processed, between processing facilities, or between a processing facility and storage or pressure reduction station

Flowline

A pipeline that transports unprocessed fluids, typically at high pressure and temperature, from the wellhead to the first downstream process or collector component

Injection line

A pipeline that directs processed liquids or gases to a wellhead, for flow into a reservoir formation, via a wellhead, to support hydrocarbon production activity, or for environmentally acceptable disposal

MAOP

The maximum internal sustained pressure at which a pipeline system, or parts thereof, is allowed to be operated - Note: the MAOP $\leq$ the Design Pressure

Onshore pipeline

Piping that transports fluids between onshore wellheads and processing facilities or between processing facilities and refineries/tankage/distribution systems. Pipelines can be classified into four categories; flowlines, injection lines, export lines, and distribution lines. The use of the word “pipeline” in this GP applies to all four categories.



Pipeline

The installation through which fluids or gases are conveyed, including line pipe, pig trap, components and appurtenances up to and including the isolation valve(s) at the boundary limits

Pipeline system availability

The availability factor is the percentage of days of the year that a pipeline is available for transport of the full throughput capacity of the line. Some typical factors that decrease the availability factor are:

- planned outages for facility and/or pipeline maintenance
- unplanned outages due to facility or pipeline upsets
- power outages

Pipeline system

Pipeline with compressor or pump stations, pressure control stations, flow control stations, metering, tankage, supervisory control and data acquisition system (SCADA), and any other equipment, facility or building used in the transportation of fluids

Right of way

Corridor of land within which the pipeline operator has the right to conduct activities in accordance with the agreement(s) with the landowner(s)

Sour service

Natural gas containing hydrogen sulphide gas or carbon dioxide

Note: Definitions relating to CVP are given in the Major Projects Common Process (MPCP), available on the BP Intranet Projects website.

4. System design**4.1. General**

Design of an onshore pipeline cannot be undertaken without due consideration also being given to the requirements of, and impact on, the necessary pump/compressor facilities, terminals, and associated equipment and facilities.

- a. During the initial pipeline design phase, the pipeline system configuration shall be defined.
- b. Onshore pipeline design and project execution shall follow the principles as defined in GP 43-01. The design shall minimize risk and ensure that the pipeline is fit for its intended purpose and continued operation. The pipeline system project Appraise and Select phases shall be performed in accordance with GP 43-01.
- c. Key pipeline decisions made within these phases of the project shall include:
 1. Route selection.
 2. Pipeline hydraulics and flow assurance requirements.
 3. The number and location of the pump/compressor facilities.
 4. Pigging requirements.
 5. Risk evaluation and integrity management planning.
- d. Key facility decisions made within these phases of the project may also include:
 1. Driver and pump/compressor type, equipment configuration, fuel selection, and sparing.



2. Need for surge relief systems/tankage.
3. Number and size of storage tanks.

4.2. Facilities

4.2.1. General

Pipeline systems shall include some or all of the following:

- a. Pipeline.
- b. Block valves.
- c. Piping manifolds.
- d. Pumps/compressors.
- e. Pigging facilities.
- f. Metering and samplers.
- g. Surge relief systems.
- h. Corrosion monitoring coupons or probes.
- i. Leak detection system.
- j. Emergency shut down valves (ESDV).
- k. Terminal facilities with storage tanks.

4.2.2. Ancillary systems

Additional component parts of a pipeline system may include, but are not limited to:

- a. Injection lines and chemical lines.
- b. Supervisory control systems (SCADA).
- c. Power and communication systems.
- d. Separators/slug catchers.

5. System design basis

5.1. Codes

- a. The design basis shall be established in accordance with GP 43-01 and GP 43-07 to provide uniform and consistent data for the pipeline system design. The BoD should include the design data, governing design codes, and applicable standards necessary for performance of the design as defined in GP 43-01, clause 5.2.
- b. Selection of industry codes and standards for the project (referred as “the governing design codes”, hereafter) shall follow GP 43-08.
- c. Depending on the pipeline location where national and local requirements may dictate, the pipeline design and construction shall follow American and/or British codes and standards, selected to meet the requirements of the GP 43 series ETPs. GP 43-20, GP 43-22, and GP 43-40 shall be followed for onshore pipeline design and construction unless local requirements exceed those given in these GPs.

In particular, BP requirements for HSSE exceed those given in ASME B31.4 and ASME B31.8.

