



Participant Handbook

Sector
Hydrocarbon

Sub-Sector
Midstream

Occupation
Pipe Fitting (Oil & Gas)



Reference ID: **HYC/Q6103 Version-1.0**
NSQF Level 4

Pipe Fitter
(Oil & Gas)

Developed & Published by



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HYDROCARBON SECTOR SKILLS COUNCIL

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SKILLING CONTENT: PARTICIPANT HANDBOOK

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NIMI, set up by the Government of India to develop instructional material for the overall improvement in the standard of training in ITIs and skill development programmes is happy to widen the scope of its outreach by developing content for NSDC.

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About this book

Construction industry is the second largest employer in India. As one of the leading avenues for employment in the country, the role played by this industry in the economic development of India is pivotal. However, despite its vast potential, the construction industry faces challenge of shortage of skilled manpower. This hampers the progress of the industry, as the quality of constructed structure is poor and most projects fail to be completed in the stipulated time.

There is a vast difference between the required skill sets and available skills amongst workers in the industry today. To reduce the skill gap, appropriate skilling of the workforce is of paramount importance. It will not only empower the worker, but also benefit the construction framework.

This participant handbook is developed to impart skill training with appropriate and relevant knowledge required to work as an Pipe Fitter (Oil & Gas) in the Oil and gas industry. It is designed based on Pipe Fitter (Oil & Gas) Qualification Pack under the National Skill Qualifications Framework. It comprises the following NOS/ topics:

NOS code	Major function/Task
1. HYC/N6109:	Perform pipe fitting activity
2. HYC/N6110:	Perform pipe laying and joining activities
3. HYC/N6103:	Work effectively in a team
4. HYC/N6104:	Follow health, safety and security procedures

This book is designed considering the lower educational background of the construction worker. Therefore, special efforts have been taken to explain the concepts required for the job with ample visual support and illustrations.

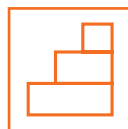
Units and symbols used in the book have been listed below:

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Symbols Used



Key Learning
Outcomes



Steps



Unit
Objectives



Notes



Tips



Exercise



Practical

Table of Contents

Sl. No.	Modules and Units	Page No.
1. Perform Pipe Fitting Activity (Oil & Gas)		
	Unit 1.1 - Introduction	3
	Unit 1.2 - Piping and Pipeline Layout Drawings	14
	Unit 1.3 - Mathematical Skills for Pipe Fitting	43
	Unit 1.4 - Different Types of Materials Used in Pipe Fitting	53
	Unit 1.5 - Preparation of Piping and Pipeline	65
	Unit 1.6 - Identify Tools and Tackles	121
	Unit 1.7 - Pipe Fitting Operation	141
2. Perform Pipe Laying and Joining Activities		
	Unit 2.1 - Pipeline Layout for Petroleum Product Distribution	179
	Unit 2.2 - Oil and Gas Product	189
	Unit 2.3 - Knowledge on Different Types of Joining in Piping and Pipeline	197
	Unit 2.4- Pipeline Laying	285
	Unit 2.5 - Physical Requirement	305
3. Work effectively in a team		
	Unit 3.1 - Team work	313
4. Follow health, safety and security procedures		
	Unit 4.1 - Knowledge and Practice Health and Safety	329
	Unit 4.2 - Fire safety	355
	Unit 4.3 - Safety System	362
	Unit 4.2 - Emergencies, Rescue and First aid Procedure	389





1. Perform Pipe Fitting Activity (Oil & Gas)

Unit 1.1 Introduction

Unit 1.2 Piping and Pipeline Layout Drawings

Unit 1.3 Mathematical Skills for Pipe Fitting

Unit 1.4 Different Types of Materials Used in Pipe Fitting

Unit 1.5 Preparation of Piping and Pipeline

Unit 1.6 Identify the Tools and Tackles

Unit 1.7 Pipe Fitting Operation



Key Learning Outcomes

At the end of this module, you will be able to:

1. wear proper PPE and exhibit proper safe working principles and practices duly implementing all HSE requirements
2. read and interpret drawings and approved work procedures
3. receive materials, ensure material release for construction and check for any material damage
4. carryout measuring, marking, cutting and transfer/maintain ensuring material identification and traceability
5. identify and make readily available appropriate consumables, tools and equipment for piping edge preparation and fit up work activities
6. prepare joints for edges of pipes to meeting drawing requirements and perform pipe fit up activities approved procedures requirements
7. perform / ensure functional checks of valves and other instruments / accessories and install them as per approved construction drawings
8. install gaskets, bolts / studs, nuts, washers, clamps, etc., and perform proper bolt tightening / torquing in sequence
9. perform pipe stringing, fitting activities at pipeline installation site
10. ensure proper trench preparation and pipe bedding and pipeline lowering
11. prepare for hydrotest / pneumatic test and perform the test with appropriate work permit duly complying with all safety precautionary requirements
12. perform depressurizing, dewatering and cleaning piping / pipeline systems.



Unit 1.1 Introduction

Unit Objectives

At the end of this unit, you will be able to:

1. identify the importance of pipe fitter training
2. recognise the organisation chart, pipe fitter roles
3. distinguish between piping and pipeline.

1.1.1 Introduction to the Training Program

Introduction to QP and NOS

This training program is based on Qualification Pack (abbreviated as 'QP') named as "Pipe-Fitter Oil and Gas Industry". The code for the QP is "HYC/Q6103". HYC stands for "HydroCarbon". This QP consists of a set of National Occupational Standards (NOS). NOS specifies the standard competency a pipe fitter must achieve when carrying out a function in the workplace. Under this QP, there are four NOS. They deal with the oil and gas pipes and pipelines related functions to be performed in worksite duly complying with all safety requirements.

NOS Code	Major Functions / Task
HYC/N 6109	Perform pipe fitting activity
HYC/N 6110	Perform pipe laying and joining activities
HYC/N 6103	Work effectively in a team
HYC/N 6104	Follow health, safety and security procedures

Benefits of this training

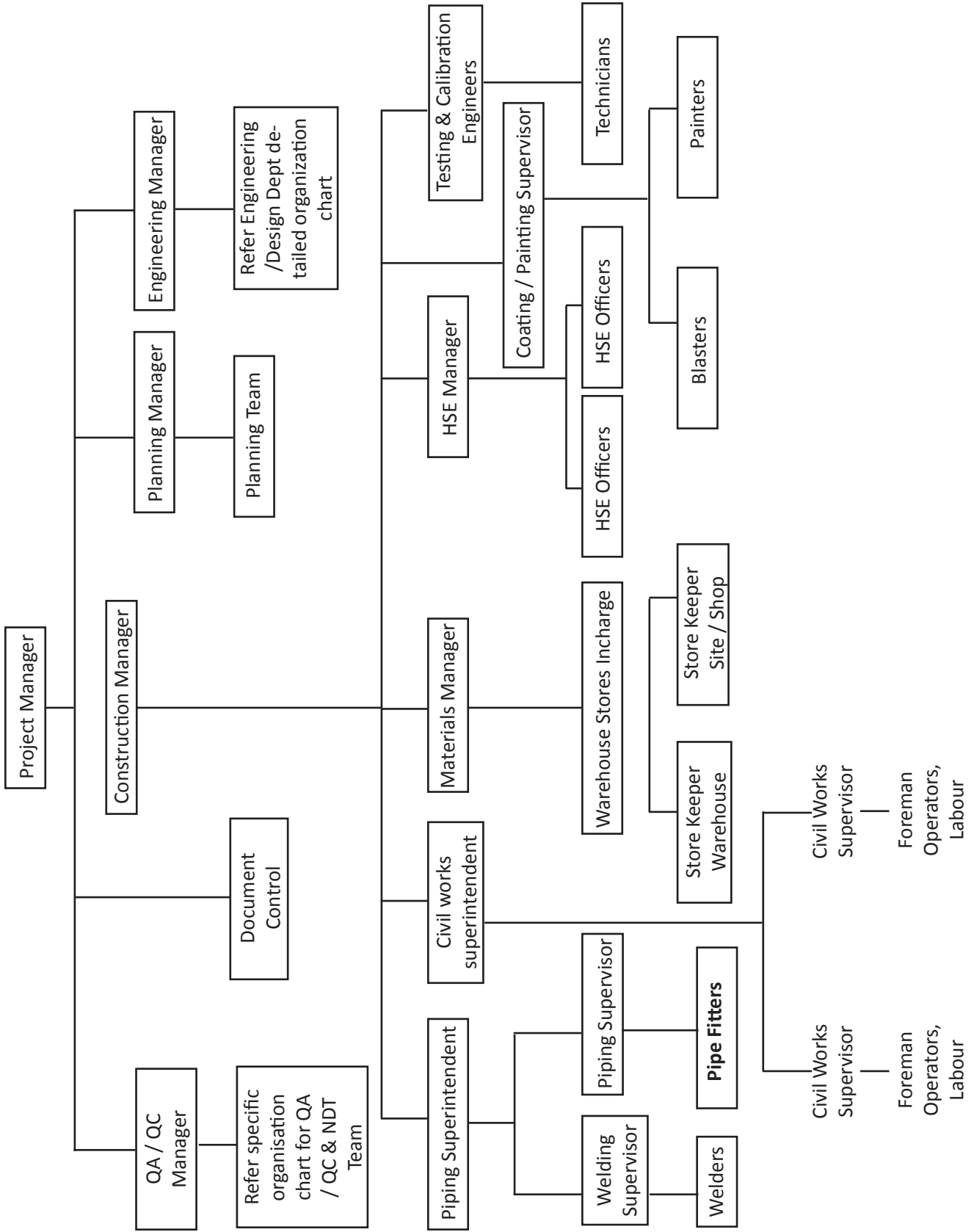
After successful completion of training and passing the assessment, the candidate will be issued a certificate. The certificate will help the candidate to get employment in fabrication, and construction industries in oil and gas sector. Oil and gas industries need a great number pipe fitters all over the world. Pipe fitter is not only trained on simple pipe fit up, but are trained in the basics of engineering drawings, pipe materials, pipe fitting materials, all type of joints related to oil and gas piping / pipeline. The oil and gas pipe fitters can be directly employed to perform pipe fitting activities without site / on the job training at the worksite. Oil & Gas industry pipe fitters are one of the highest paid of all the trades, with more job openings in the near future. Job growth for the pipe fitting industry is expected to expand in the forthcoming years in India as well as abroad. Satellite cities development in all over India needs more infrastructure for oil and gas transportation and distribution . Hence a lot of opportunities are getting lined up for Pipe fitters trained to oil and gas related facilities construction (including transportation and distribution) requirements.

1. Organization and its process

Oil and Gas pipe fitter shall have enough information / knowledge about the organization and its process to thoroughly understand the organization and its context. He / She shall go through the company policies on personnel management, duty reporting procedures and comply with the same duly maintaining discipline. Pipe fitter must be aware of and comply with the respective legislation, standards, policies, and procedures followed in the company mainly those relevant to his employment and performance conditions. He / She shall receive employment terms and entitlements from the employer along with job description, roles and responsibilities.

The pipe fitter shall receive adequate induction in problem escalation procedure and escalation matrix for reporting work and employment related issues. Pipe fitter shall have access to company standard operating procedures so as to refer and meet the respective procedures requirements while working. He shall be aware of documentation and related procedures applicable in the context of employment and work. Pipe fitter must have adequate information about his reporting structure within the organization and relevant people and their responsibilities within the workarea with whom he has to liaise for day-to-day work activities.

TYPICAL ORGANIZATION CHART



2. Health, Safety and Environment (HSE) System Requirements

Pipe fitter shall strictly adhere with relevant health and safety requirements applicable in the work place. Safety should be the top priority in any facility to keep productivity at its best and to avoid injury or health concerns. Pipe fitter shall be aware about importance of working in a clean and safe environment. One of the most effective ways to improve the safety of worksite is to make sure that it is cleaned properly maintained. Cleaner work environment reduces injuries on the job. Poorly cleaned / poorly maintained / faulty / broken equipment or slippery surfaces could lead to a potential fall /injury / accident. The cleaner the working facility is, the better the quality of products and services.

3. Importance and Purpose of Documentation

Documentation is a record of information which can be referred to or used, whenever required. Documents act as the store of collective organizational knowledge regarding the processes. They can be accessed by anyone whenever needed. Documented information shall be maintained to support the operation and its processes:

- to provide evidence of results achieved and contain statement of fact.
- to provide evidence of fitness for purpose of the monitoring and measuring activities
- to show conformity of products and services that meet the requirements.

Pipe fitter must know and follow the review and approval process of the requisition of materials/equipment by assigned employees. Pipe fitter shall be aware of required records to be prepared and maintained. Knowledge in preparing reports and recording repairs and successful completion of repair are important.

Pipe fitter shall be trained in implementation of inspection and test plans that includes inspection and test stages along with customer inspection and meeting quality standards requirements.

Pipe fitter roles, responsibilities and tasks include:

- a. reporting to foreman / supervisor and following their instructions for everyday pipe fitting work activities.
- b. duly discussing with supervisor / foreman, prioritising work schedule and process implications for own work and schedule of others.
- c. attending site daily Tool Box Talks and Safety Meetings without fail.
- d. reading and understanding organization procedures for necessary approval, work permit (PTW- Permit To Work) and for receiving materials.
- e. reading and interpreting piping drawings, specifications and work procedures.
- f. following all safe work practices and handling all piping works related equipment carefully.
- g. selecting pipe sizes, types and related materials and planning the fit up work sequence.
- h. ensuring that pipes and pipe fittings have been inspected on receipt and released for fabrication / installation.
- i. measuring, marking and cutting pipes duly maintaining identification and traceability.
- j. using appropriate tools, instruments and equipment for pipe edge preparation, cutting, fit up and tack welding / deburring tools.
- k. piping ends and edge preparation for for welding / jointing as required by the drawing / specification.
- l. for cutting and edge preparation employing appropriate methods such as gas cutting, hacksaw cutting, grinding, machining, etc.
- m. checking all pipes and fitting inside for cleanliness / any objects.
- n. aligning / joining pipes using various methods such as tack welding, brackets and wedging, clamping (internal & external).
- o. performing piping / pipeline stringing & alignment.

- p. assembling and securing pipes, tubes, fittings and related equipment according to specifications / drawings using techniques such as welding, bolting, threading joints.
- q. performing dimensional check and ensuring the correct size, length, orientation, position / location.
- r. checking piping / pipeline alignment, straightness, level and all other dimensional checks.
- s. assembling valves and other instruments / accessories by taking into account the flow directions.
- t. Marking the hole locations and cut / bore/ drill holes in structures / supports.
- u. install pipe supports as per drawing / specifications.
- v. performing bolting in sequence with required torque by the approved / permitted torque method. Some cases minimum torque will be specified. In some cases, torque may be limited to certain limit / range to avoid gasket / joint face damages.
- w. preparation for hydrotesting / pneumatic testing and reinstatement after test completion.

Exercise 

I. Answer the following questions.

1. List any two objectives of this training program.

.....

2. What is the need for oil and gas pipe fitter training?

.....

3. What are the benefits of pipe fitter training?

.....

4. Briefly describe organizational context and processes with respect to piping / pipeline works.

.....

5. Describe Pipe fitter roles, responsibilities and tasks.

.....

II. State whether the following statements are True or False.

1. Purpose of oil and gas pipe fitter training includes “familiarising with various pipe and pipe fitting materials.

True False

2. Pipe fitter need not perform piping / pipeline stringing activities.

True False

3. Safety standards are not relevant to pipe fitting activities.

True False

4. Welded pipe systems demand the least degree of excellence in materials and quality of work.

True False

5. Pipe fitters perform joints preparation.

True False

6. Oil and gas pipe fitter certificates issued to the trainee will not be useful for fabrication industries.

True False

7. Pipe fitter must be aware of and comply with the respective legislation, standards, policies, and procedures followed in the company.

True False

8. Ensuring clean and safe environment is not pipe fitter’s responsibility.

True False

Notes



1.1.2 Introduction to Piping and Pipeline

At the end of this topic, you will be able to:

1. define piping and pipeline construction methods in oil and gas industry
2. describe codes and standards
3. define terms and definitions.

Piping and pipeline: Oil and Gas piping / pipeline fitter shall have knowledge on various piping and pipeline systems and their standards / specifications so that they have proper understanding about what they are doing and the purpose. Pipe fitters need to know that the oil and gas industry is usually divided into three major sectors – midstream, upstream and downstream.

Upstream: The upstream sector also known as “Exploration and Production – E&P” includes finding underground or underwater crude oil and natural gas fields, locating exploratory wells, and subsequently drilling and operating the wells that recover and bring / lift the crude oil or raw natural gas to the surface and get it ready for transportation.

Midstream: The midstream sector involves transportation (by pipeline, rail, barge, oil tanker or truck), and storage of crude or refined petroleum products. Pipelines and other transport systems can be used to move crude oil from production sites to refineries and deliver the various refined products to downstream distributors. Natural gas pipeline networks aggregate gas from natural gas purification plants and deliver it to downstream customers such as local utilities.

Downstream: The downstream sector also known as “Refining and marketing- R & M” is further processing of crude oil and natural gas into useful final product or raw material for other industry. Downstream process includes refining of petroleum crude oil and the processing and purifying of raw natural gas as well as distribution of products derived from crude oil and natural gas. The downstream sector reaches consumers through products such as gasoline or petrol, kerosene, jet fuel, diesel oil, heating oil, fuel oils, lubricants, waxes, asphalt, natural gas, and liquefied petroleum gas (LPG) as well as hundreds of petrochemicals.

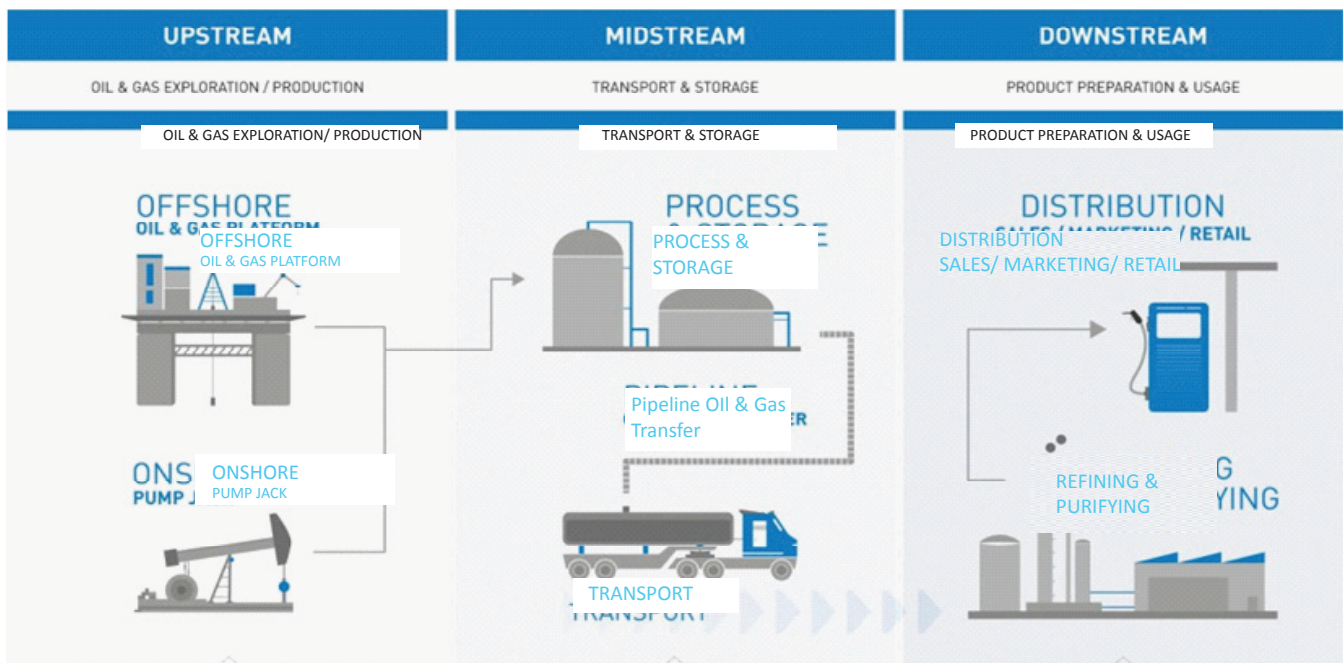


Fig. 1.1.1 Oil & Gas - upstream, Midstream, Downstream

Piping

Piping is the term normally used to describe plant or process piping or station piping in oil and gas industries. Process plant is a place where a series of activities are performed with various piping systems in an ordered manner to convert raw material into useful products or transfer fluid from one equipment to another within the plant boundary.

Piping is a complex network of pipe and fittings including pipe, pumps, equipment, valves, fittings, flanges, bolts, gaskets, regulators, pressure vessels, pulsation dampeners, relief valves / devices, appurtenances attached to pipe, compressor units, metering facilities, pressure regulating stations, pressure limiting stations, pressure relief stations and fabricated assemblies and pressure containing parts within the defined boundaries of the plant. It also includes hangers and supports, and other equipment necessary to prevent overstressing the pressure containing parts. Process plant piping is mostly above ground with very few underground services such as, sewage and drainage piping.

On plot piping: On plot is a location inside the designated plant boundaries and, generally, piping inside the on-plot boundaries comes under process piping.

Petroleum refinery is an industrial plant for processing or handling of petroleum and products derived directly from petroleum / oil and gas wells. Such a plant may be an individual gasoline recovery plant, a treating plant, a gas gathering and compression plant, gas processing plant (including liquefaction), or an integrated refinery having various process units and attendant facilities.

Large series and networks of pipes are within the well defined boundaries of the plant/plot with all fittings and equipment like pump, valves, instruments, equipment, unions and other miscellaneous items with an intention to transfer fluid from one facility to another within those boundaries as required.

Pipeline

The pipeline is series of straight pipes, welded together over a long distance for conveying oil or gas over long distances. A system of pipes and other components are used for the transportation of fluids, between (but excluding) plants. A pipeline extends from pig trap to pig trap (including the pig traps) or, if no pig trap is fitted, to the first isolation valve within the plant boundaries. Pipelines used in the oil and gas industry vary according to many factors, such as the product to be transported, the delivery stage and whether it is part of the upstream, midstream or downstream sector. Natural gas is transported through the transmission pipeline system, which is composed of large diameter steel pipes.

Pipelines are mostly large in diameter and transport bulk liquid or gas from one place to another sometimes along 1000 kilometre long distances. Pipeline system comprise all parts of physical facilities through which liquid or oil / gas moves in for transportation. Included within this definition are transmission and gathering lines, which transport liquid / oil / gas from production facilities to onshore locations and storage area.

Other Pipeline Components are Pig launcher / Pig receivers, Barred Tees, Isolation Joints, Pig signallers, Corrosion monitoring fittings, Shrink sleeves / External coatings / Cathodic protection for buried lines. The pipelines are laid underground, above the ground and underwater such as a subsea pipelines.

Table 1 Piping and pipeline comparison

Sl. No.	Pipe / Piping System	Pipeline / Pipeline system
1.	Series and networks of pipes and fittings within the defined boundaries of the plant	Many straight pipes are welded together for conveying / transporting oil or gas, over long distances.
2.	These are plants or process piping, generally not exceeding 400 meter in length.	Mostly transporting bulk liquid or gas from one place to another. Sometimes 1000 kilometers long distances.
3.	Wide range of many pipefittings are used.	Pipe fittings are comparatively very less in pipeline system.
4.	Mostly above the ground with very few underground services.	Pipelines are laid underground, above the ground and underwater such as subsea pipeline.
5.	Piping system includes very small size piping to large diameters from ½" to 36" in diameter.	Comparatively and mostly larger size pipes are installed.
6.	Comprise many equipment within the piping system.	Few equipment are used within the pipeline system.
7.	Piping system design code includes ASME B31.1, ASME B31.3	Pipeline system design code includes ASME B31.4, ASME B31.8
8.	In general on plot	In general Off plot.

III. Types of Pipeline in Oil & Gas Industry

Gathering lines: Pipelines form network and are connected from the wells to processing facilities. Gathering pipelines are used to deliver the oil or gas product from the source to processing plants or storage tanks. These are commonly fed by 'flow lines', each connected to individual wells in the ground.

Transmission Pipelines: Transmission pipelines are used to transport crude oil, natural gas and refined products for long distances across states, countries and continents. They are used to move the product from the production regions to distribution centres or refineries.

Flow lines: Flow line is a pipeline transporting untreated hydrocarbons and other reservoir fluids. Pipelines from the well are sent to the nearest processing facility / gathering station when is also called flow lines. Their purpose includes moving the raw product from the well to the gathering lines. They carry a mixture of oil, gas, water and sand and are normally no more than 12" diameter in size.

Loading lines / Export lines: Loading / exporting pipeline is a pipeline between an onshore facility and an offshore loading facility. In other words, this is the pipeline from the processing facility to the loading or export point.

Trunk lines / Inter field lines: This is also a main transmission pipeline to which spurlines and offtake lines may be connected. Pipelines between two processing facilities or from pig trap to pig trap or from block valve station to block valve station are also called trunk line.

Spur lines / Transfer lines: It is the branch line exiting into trunk line or export line. That is, Spurline is a pipeline transporting fluid into a larger pipeline.

Injection lines: Injection lines are pipelines, injecting water / steam / polymer / gas into the wells to improve the lift by injected fluid pressure.

Off plot piping: Off plot is a location outside the designated plant boundaries and, generally, comes under the category of pipelines.

Disposal lines: Pipeline which disposes (normally water) into disposal wells (shallow / deep).

Subsea pipelines: Pipelines connecting the offshore production platforms to onshore processing facilities. Pipelines under deep seawater of floating platform facilities are also called subsea pipelines.

Distribution pipelines: They are a system made up of 'mains' and 'service' lines, used by distribution companies. Together they deliver natural gas to the neighbourhoods of homes and cities.

Mains pipelines: Distribution pipelines classed as 'mains' are the step between high pressure transmission lines and low pressure service lines. Materials used for these pipes include steel, polyethylene, cast iron, plastic and copper.

Feeder pipelines: Feeder pipelines are used to move the product from processing facilities and storage tanks to the long distance transmission pipelines.

Service pipelines: Service pipelines connect to a meter and deliver natural gas to individual customers. Materials used for service pipes include plastic, polyethylene, steel or copper. Pressure of the gas in these pipes is low at around 60 psi.

Piping and pipeline codes / standards

1. ASME B31.1 Power Piping

Piping that is typically found in electric power generating stations, in industrial and institutional plants, geothermal heating systems, heating and cooling plants.

2. ASME B31.3 Process Piping

Piping that is typically found in petroleum refineries, chemical, pharmaceutical, textile, cryogenic plants and related processing plants and terminals.

3. ASME B31.4 Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids

B31.4 prescribes requirements for the design, materials, construction, assembly, inspection, and testing of pipeline transporting liquids between production facilities, between plants and terminals and within terminals, pumping, regulating, and metering stations, tank farms, natural gas processing plants, refineries, ammonia plants, terminals (marine, rail, and truck), and other delivery and receiving points.

4. ASME B31.5 Refrigeration Piping

Piping for refrigerants and secondary coolants.

5. ASME B31.8 Gas Transportation and Distribution Piping Systems

Piping transporting products which are predominately gas between sources and terminals including compressor, regulating and metering stations, gas gathering pipelines. This code covers the design, fabrication, installation, inspection, and testing of pipeline facilities used for the transportation of gas.

6. ASME B31.9 Building Services Piping

Piping that is typically found in industrial, institutional, commercial and public buildings and in multi-unit residences which does not require the range of sizes, pressures and temperatures covered in B 31.1 (power piping).

7. Pipeline related ISO standards include

- ISO 3183 – Petroleum and Natural gas industries – Steel Pipe
- ISO 14692 – Petroleum and Natural gas industries – Glass Reinforced plastic piping

- ISO – 15590 – 1, 2 and 3 Pipeline fittings
- ISO 14313 – Petroleum and Natural gas industries – Pipeline valves

Abbreviations and Definitions

Many abbreviations are used in piping and pipeline works. The pipe fitter shall be familiar with those abbreviations and definitions as he/she may encounter these abbreviations in his routine work. Important abbreviations and corresponding definitions are listed herewith.

Abbreviations	Definitions
Abs	Absolute
AFC	Approved For Construction (Mostly specified in drawings & procedures)
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Standard for Testing Materials
Assy	Assembly
BIS	Bureau of Indian Standard
BLDG	Building
Btu	British thermal unit(s)
BOM	Bill Of Material
BOP	Bottom of pipe
BW	Butt Weld
CI	Cast Iron
CS	Carbon Steel
°C	Degrees Centigrade
°F	Degrees Fahrenheit
Dia / ϕ	Diameter
Drg	Drawing
DSS	Duplex Stainless Steel
EL	Elevation
EN	European Norms (Standards)
ERW	Electric Resistance Weld
FCAW	Flux Cored Arc Welding
FLG	Flange
FF	Flat Face (of Flange)
G	Gage or Gauge
GA	General Arrangement
GAIL	Gas Authority of India Limited
GALV	Galvanised
Gr	Grade
GTAW	Gas Tungsten Arc Welding
HDPE	High Density Poly Ethylene
Hex	Hexagonal
HSE	Health Safety and Environment
IBR	Indian Boiler Regulation
ID	Inside Diameter
IFC	Issued For Construction
INS	Insulation
IS	Indian Standards
ISO	International Organization for Standardisation
Kw	Kilowatt(s)
LC	Lock Closed
LO	Lock Open

LR	Long Radius
Max	Maximum
MFG	Manufacturing
Min	Minimum
mm	Millimeter
MSS	Manufactures Standardization Society
MT / MPT	Magnetic Particle Testing
NDT	Non Destructive Testing
NPS	Nominal pipe size
OD	Outside Diameter
ONGC	Oil and Natural Gas Corporation
PCD	Pitch Circle Diameter
P&ID	Piping & Instrumentation Diagram
PNGRB	Petroleum and Natural Gas Regulatory Board
PPE	Personnel Protective Equipment
PQR	Procedure Qualification Record
PRV	Pressure Relief Valve
Psi	Pounds per square inch
PSV	Pressure Safety Valve
PT	Penetrant Testing
PVC	Polyvinyl Chloride
RED	Reducer
RF	Raised Face
RT	Radiographic Testing
RTJ	Ring Type Joint
SMAW	Shielded Metal Arc Welding
SAW	Submerged Arc Welding
Sch	Schedule
SMLS	Seamless
Spec	Specification
SO	Slip On
SQ	Square
SR	Short Radius
SS	Stainless Steel
Std	Standard
STL	Steel
SWG	Swage
Temp	Temperature
T.O.C	Top Of Concrete
TOS	Top Of Steel
TYP	Typical
UT	Ultrasonic Testing
VT	Visual Testing
WN	Weld Neck
WT	Weight
XS	Extra strong
XXS	Double extra strong

Exercise

I. Answer the following questions.

1. Explain process piping.

2. What do you understand by the term “onplot” piping?

3. Explain oil and gas major sectors – upstream, midstream and downstream.

4. Distinguish piping and pipeline system.

5. Explain the purpose and significance of ASME B31.4 Pipeline Transportation Systems.

6. Write down the expansions for the following abbreviations related to piping and pipelines.

AFC, ASTM, BOM, ERW, NPS, PRV, SMLS, T.O.C, XXS

II. State whether the following statements are True or False.

1. Off plot is a location inside the designated plant boundaries and for generally piping inside the plant boundaries.

True False

2. Pipeline is series of straight pipes, welded together over a long distance, for conveying oil or gas.

True False

3. Exploration and production is a “midstream stream process” in oil and gas industry.

True False

4. Further processing of crude oil and natural gas into useful final product is a “downstream process”.

True False

5. Pipelines comprise many equipment and accessories within the pipeline system.

True False

6. Pipeline system design code includes ASME B31.4.

True False

7. Pipelines used to move the product from the production regions to distribution centres or refineries are called gathering lines.

True False

8. Transmission pipeline is a pipeline from the processing facility to the loading or export point.

True False

Notes

UNIT 1.2 Piping and Pipeline Layout Drawing

Unit Objectives

At the end of this unit, you will be able to:

1. read and interpret basics of engineering drawings and symbols
2. read, interpret piping isometric drawings, pipeline layout drawings, hangers and pipe support drawings and related engineering drawings
3. draw and illustrate pipeline system and bill of materials
4. describe various pipe supports.

1.2.1. Piping and Pipeline Drawings- Basics of Engineering

At the end of this topic, you will be able to:

1. describe basics of engineering drawings
2. read and interpret engineering drawings / projections
3. prepare simple drawings both in 1st angle and 3rd angle projections.

Introduction

Transmission of oil and gases subjects the pipe to intense stresses and strains and this demands the highest quality throughout the construction process from material sourcing, fitup, welding till installation. All pipework must be designed and fabricated in a way that ensures the safety of plant operators, the plant, the public and the environment and to the medium being transmitted.

Process piping is designed, constructed and installed in accordance with ASME B31.3 code. Power plant piping is designed, constructed and installed in according with ASME B 31.1.

In Oil and Gas Industries, a pipeline is designed in accordance with ASME B31.4 code for Liquid Transportation Systems for Hydrocarbons, Liquid Petroleum, Anhydrous Ammonia, and Alcohol and ASME B31.8 that is the governing code for Gas Transmission and Distribution Piping Systems. Pipelines are laid above the ground, below the ground, river and in subsea.

Basics of Engineering Drawings

- a. Drawings are prepared in grids with title blocks and coordinates.
- b. Bill of materials, notes and instructions, if any, are incorporated into the applicable drawings.
- c. Drawings may be prepared with or without scales.
- d. Different types of drawings are prepared for piping and pipelines. They include GA – General Arrangement Drawings, Assembly drawings, plot plan, layout drawings, pipeline drawings, PID – Piping and Instrument Diagram, PEFS – Process Engineering Flow Scheme Isometric drawings, detailed drawings etc.
- e. Drawings may be prepared in projectional view or isometric view.

Drawing line indications need to be:

- Visible continuous lines to depict edges directly visible from a particular angle and represent the features that can be seen in the current view.
- hidden / dotted or short dashed lines indicate the features that cannot be seen in the current view, representing edges that are not directly visible.