



NATIONAL PETROCHEMICAL COMPANY
STANDARDS

ENGINEERING STANDARD
FOR
PIPING SYSTEM DESIGN

NPCS-ES-PI-01

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CONTENTS

- 1 GENERAL
 - 1.1 SCOPE
 - 1.2 REFERENCE CODES AND STANDARDS
- 2 DESIGN
 - 2.1 GENERAL ARRANGEMENT
 - 2.2 CLEARANCES AND ACCESSIBILITY
 - 2.3 MATERIALS
 - 2.4 JOINTING
 - 2.5 INSULATION AND PROTECTION
 - 2.6 CORROSION AND CORROSION ALLOWANCES
 - 2.7 COLOR CODING
 - 2.8 LINE NUMBERING AND IDENTIFICATION
 - 2.9 DESIGN PRESSURE AND TEMPERATURE
- 3 DESIGN DETAILS
 - 3.1 PIPE
 - 3.2 FITTINGS
 - 3.3 FLANGES
 - 3.4 VALVES
 - 3.5 BOLTS AND GASKETS
 - 3.6 SUPPORTS AND ANCHORS
 - 3.7 EXPANSION AND FLEXIBILITY
 - 3.8 VENTS AND DRAINS
 - 3.9 UTILITY STATIONS

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- 4 PIPING AT EQUIPMENT
 - 4.1 CENTRIFUGAL PUMP PIPING
 - 4.2 EXCHANGER PIPING
 - 4.3 VESSEL PIPING
 - 4.4 TANK FARM PIPING
 - 4.5 COMPRESSOR PIPING
 - 4.6 FIRED HEATERS PIPING
- 5 REQUIREMENTS FOR INDIVIDUAL PIPING SYSTEMS
 - 5.1 PROCESS, PUMP-OUT AND BLOWDOWN LINES
 - 5.2 STEAM AND CONDENSATE LINES
 - 5.3 PLANT AIR AND INSTRUMENT AIR LINES

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1 GENERAL

1.1 SCOPE

1.1.1 This standard covers the general requirements for the design of process and utility piping systems and supplements the requirements of the codes under which the piping systems are to be designed.

1.1.2 No variations from this standard is permitted unless approved in writing by client.

1.2 REFERENCE CODES AND STANDARDS

NPCS-ES-GC-09	E.S. for Underground Piping System.
NPCS-ES-GN-02	E.S. for Project Coding and Numbering.
NPCS-ES-PI-02	E.S. for Piping Material Specification.
NPCS-ES-PI-03	E.S. for Steam Tracing.
NPCS-ES-PI-04	E.S. for Package Unit Piping System.
NPCS-ES-TP-01	E.S. for Painting and Color Coding.
NPCS-ES-TP-02	E.S. for External Insulation.
NPCS-CS-PI-01	C.S. for Welding and Heat Treatment.
NPCS-CS-PI-02	C.S. for Piping Fabrication and Erection.
NPCS-CS-PI-04	C.S. for Testing, Flushing & Reinstatement of Piping.
NPCS-CS-PI-05	C.S. for Pi-e-Commissioning Chemical Cleaning.
NPCS-CS-ST-02	C.S. for Steel Structural.
ANSI B 16.5	Pipe Flanges and Flanged Fittings.

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ASME B 16.9	Factory-Made Wrought Steel Buttwelding Fitting.
ASME B 16.10	Face-to-Face and End-to-End Dimensions of Ferrous Valves.
ANSI B 16.11	Forged Steel Fittings Socket Welding and Threaded.
ANSI B 16.20	Ring-Joint Gaskets and Rooves for Steel Pipe Flanges.
ANSI B 16.21	Nonmetallic Flat Gaskets for Pipe Flanges.
ASME B 16.25	Buttwelding Ends.
ANSI B 16.34	Valves, Flanged and Buttwelding E n d .
ANSI B 18.2	Square and Hex. Bolts and Screws.
ANSI B 2.1	Pipe Threads.
ANSI/ASME B 31.1	Power Piping.
ANSI/ASME B 31.3	Chemical Plant and Petroleum Refinery Piping
ANSI/ASME B 31.5	Refrigeration Piping.
ASTM B 36.10M	Welded and Seamless Wrought Steel Pipe.
ASTM B 36.19M	Stainless Steel Pipe.
API 593	Ductile Iron Plug Valves, flanged ends.
API 594	Wafer Check Valves.
API 597	Steel Venturi Gate Valves Flanged or Butt Welding Ends.
API 598	Valve Inspection and Test.
API 599	Steel Plug Valves, Flanged or Buttwelding Ends.
API 600	Steel Gate Valves, Flanged or Butt welding Ends.

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API 601	Metallic Gasket for Piping, Double-Jacketed Corrugated and spiral Wound.
API 602	Compact Carbon Steel Gate Valves.
API 603	Class 150, Corrosion Resistant Gate Valves.
API 604	Ductile Iron Gate Valves, Flanged Ends.
API 605	Large Diameter Carbon Steel Flanges.
API 606	Compact Carbon Steel Gate Valves Extended Body.
API 607	Fire Test for Soft-seated Ball Valves.
API 609	Butterfly valves Lug-Type and Wafer-Type.
AWWA C207	Steel Pipe Flanges for Water Work Service, 4 inch Through 144 inch.
AWWA C504	Rubber Seated Butterfly Valves.
MSS SP-6	Standard Finishes for Contact Faces of Pipe Flanges and Connecting-End Flanges of Valves and Fittings.
MSS SP-25	Standard Marking System for Valves, Fittings, Flanges and Unions.
MSS SP-43	Wrought Stainless Steel Buttwelding Fittings.
MSS-SP-44	Steel Pipe Line Flanges.
MSS-SP-48	Steel Butt-welding Fitting (26 inch and larger).
BS-1868	Flanged Steel Check Valves for Petroleum Industry,

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BS-1873	Flanged Steel Globe Valves for Petroleum Industry.
BS-5146	Inspection and Test for Steel Valves.
BS-5150	Cast Iron Wedge and Double Disc Gate Valves.
BS-5152	Cast Iron Globe and Globe Stop and Check Valves.
BS-5153	Cast Iron Check Valves.
BS-5154	Copper Alloy Globe, Globe Stop and, Check and Gate Valves.
BS-5155	Cast Iron and Carbon Steel Butterfly.
BS-5156	Screw Down Diaphragm Valves.
BS-5351	Steel Ball Valves for Petroleum Industry.
BS-5352	Forged Steel Gate, Globe, Check Valves. .
BS-5353'	Specification for Plug Valves. EJMA Expansion Joints.

In addition, all governmental regulations and codes of the jurisdiction, within which the piping systems are to be installed, shall be met. In case of conflict, the most severe requirements shall govern.

NOTE : All codes and standards referred to, shall be of the latest revision.

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2 DESIGN

2.1 GENERAL ARRANGEMENT

2.1.1 All piping shall be designed to have an economical lay-out, the shortest possible run and minimum number of fittings.

2.1.2 Provisions, like cold strain, expansion bends or other approved means will be made to prevent excessive stresses in piping and bolting due to expansion.

2.1.3 All valves, manifolds, control valves, motor-operated valves, etc., shall be located in an accessible way; accessible from platform or grade. Any exception must be approved by client.

2.1.4 All lines in process type areas shall preferably run side by side on overhead pipe rack at common supporting elevations for bottom of pipe. Hot lines on pipe racks shall be grouped and expansion loops shall be nested together. The number of expansion loops shall be kept to a minimum. Piping handling corrosive fluids shall be run under piping handling non-corrosive fluids, and shall not, where possible, be run overhead across walkways or normal passages for personnel. Piping shall run on sleepers in the tankage area.

2.1.5 When mechanically or economically necessary, intersecting main pipe runs shall be routed at different levels to facilitate changing direction and/or crossing of pipelines.

2.1.6 Vent and drain hookup, sample points with or without sample cooler and pressure instrument points, etc, shall be designed in accordance with the NPC piping standard drawings.

2.1.7 Lines in hydrocarbon service under pressure which need to run below grade, shall be run in concrete trenches.

2.1.8 Sleeper ways are preferred above trenches.

2.1.9 Above-ground lines which have to be buried locally (passing roads, etc.), shall run in pipe sleeves, tunnels, culverts or bridges.

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- 2.1.10 Where this standard is in contradiction with piping and instrument flow diagram and utility flow sheet, the diagrams shall govern.
- 2.1.11 Pipe bridges, sleeper ways, road crossings and racks shall be designed with an extra spare space of at least 20% for future lines.
- 2.1.12 Connections for flushing chemical cleaning and other requirements shall be shown on the P&ID.
- 2.1.13 For requirements for winterization see Engineering standard for Steam Tracing, NPCS-ES-PI-03.
- 2.1.14 Consideration shall be given to space allocated for instrument and electrical cable trays in the pipe racks and sleepers.
- 2.1.15 Pockets shall be avoided in lines, particularly those carrying corrosive chemicals, slurries, vents, blow-down lines, those which may congeal or freeze, etc. .
- 2.1.16 The shortest and most direct layout possible shall be provided for lines in which gravity flow is required, especially when the fluid handled is subject to solidification and when available differential pressure is small.
- 2.2 CLEARANCES AND ACCESSIBILITY
- 2.2.1 For the minimum clearance required over roads, walk-ways and platforms, see NPC Piping Standard Drawings.
- 2.2.2 The piping designer shall locate platforms, ladders and stair-ways in accordance with Construction Standard for Steel Structural Design, NPCS-CS-ST-02, for accessibility to equipment or valves for operation or maintenance. On piping arrangement drawings, the elevation of platforms shall be shown as follows:

&Platform TO
EL.....

The installation of platforms shall be kept to a minimum and should only be used when justified for operation or maintenance.



2.2.3 Sufficient clearance shall be **allowed** between parallel lines to permit access for removal, repairing and maintenance of any line. In no instance shall the side clearance be less than 50 mm, including allowance for expansion and 50 mm between a pipe and the outside of the largest flange of fitting in the adjoining pipe. The insulation thickness shall be taken in consideration in determining pipe spacing. Lines routed in pipe trenches shall be located so that bottom of flange or insulation is at least 75mm above highest point of trench bottom. The clearance of lines above grade when supported on sleepers is 300 mm.

2.2.4 The minimum horizontal distance for walk aisles and access ways between piping and/or mechanical equipment like pumps, compressors, motors, etc., shall be approximately 1000 mm. Piping around equipment shall be arranged to permit access and removal of equipment.

2.2.5 The minimum free distance above a control valve and minimum clearance under the control valve, in accordance with ISA RP4.2.

2.2.6 Adequate spacing shall be provided for removal and reinstallation of equipment or piping/structural components for maintenance.

2.3 MATERIALS

2.3.1 Materials of construction for each piping system with specific operating conditions shall conform to the service classification and pipe classes in the Engineering Standard for Piping Material Specification, NPCS-ES-PI-02.

2.3.2 The "C" content in Carbon Steel materials to be welded, shall not exceed 0.23%.

2.4 JOINTING

2.4.1 Jointing in all piping systems shall preferably be done by welding; flanged joints and valves shall be used for all connections to equipment where the service classification specifies flanged connection. The minimum distance between welds shall be 50 mm.

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