

GENERAL STANDARD
FOR
PIPE SUPPORTS

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1. SCOPE

This Standard covers the requirements for selection, design, fabrication and erection of supports and supporting elements used for on-plot and off-plot piping in oil, gas and Petrochemical Industries.

Both insulated and uninsulated piping are covered by this Standard.

2. REFERENCES

Throughout this Standard the following standards and codes are referred to. The edition of these standards and codes that are in effect at the time of publication of this Standard shall, to the extent specified herein, form a part of this Standard. The applicability of changes in standards and codes that occur after the date of this Standard shall be mutually agreed upon by the Company and the Vendor:

IPS (IRANIAN PETROLEUM STANDARDS)

IPS-E-CE-200	"Concrete Structures"
IPS-D-PI-130	"Pipe Supports"
IPS-E-PI-240	"Plant Piping Systems"

MSS (MANUFACTURERS STANDARDIZATION SOCIETY)

SP-58	"Pipe Hangers and Supports Materials, Design and Manufacturer"
SP-89	"Pipe Hangers and Supports Fabrication and Installation Practices"
SP-90	"Guidelines on Terminology for Pipe Hangers and Supports"

ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS)

ASTM A 6/A6M-88c	"Specification for General Requirements for Rolled Steel Plates, Shapes, Steel Piling, and Bars for Structural Use"
ASTM A 153-80	"Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware"
ASTM A 165-80	"Specification for Electrodeposited Coating of Cadmium on Steel"
ASTM A 386-78	"Specification for Zinc Coating (Hot-Dip) on Assembled Steel Products"
ASTM A 403/A403M-88a	"Specification for Wrought Austenitic Stainless Steel Piping Fittings"
ASTM A 526/A526M	"Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Commercial Quality"
ASTM B 454-76	"Specification for Mechanically Deposited Coatings of Cadmium and Zinc on Ferrous Metals"
ASTM B 633-78	"Specification for Electrodeposited Coatings of Zinc on Iron and Steel"

ANSI/ASME (AMERICAN NATIONAL STANDARD INSTITUTE/AMERICAN SOCIETY OF MECHANICAL ENGINEERS)

ANSI/ASME B31.3	"Chemical Plant and Petroleum Refinery Piping"
ANSI/ASME B31.4	"Liquid Transportation Systems for Hydrocarbons, Liquid Petroleum Gas, Anhydrous Ammonia, and Alcohol"
ANSI/ASME B31.8	"Transmission and Distribution Piping Systems"

ANSI/UL (AMERICAN NATIONAL STANDARD INSTITUTE/UNDERWRITERS LABORATORIES)

ANSI/UL 203 "Pipe Hanger Equipment"

ASME (AMERICAN SOCIETY FOR MECHANICAL ENGINEERS)

ASME Section IX "Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators"

BSI (BRITISH STANDARD INSTITUTION)

BS 3974 Parts 1&2 "Pipe Supports"

3. DEFINITIONS AND TERMINOLOGY

For the purpose of this Standard the definitions and terminology given in MSS-SP-90 shall apply. In addition, the following definitions and terminology shall hold.

3.1 Constraint

A device which restrains the pipe from displacement and/or rotation.

3.2 Cradle or Pipe Shoe

A device placed between the pipe and the supporting structure. Usually made from plate or cut from sections, welded or clamped to the pipe.

3.3 Dummy Support

A support welded to an elbow of the prefabricated pipe. The pipe dummy will rest on the support structure and so support the pipe at the change of direction. A pipe dummy is made from pipe, usually of a smaller diameter than the pipe to which it is welded.

3.4 Engineer

A person who shall be appointed time to time by the Company to exercise the functions entrusted to him under the contract and whose appointment has been notified by the Company in writing to the Executor.

3.5 Executor

The Executor is the party which carries out all or part of construction and/or commissioning of the project.

3.6 Pipe Stanchion

A tubular supporting element with base plate, being part of the prefabricated pipe. When considerable site adjusting is required, the pipe stanchion may be of the 2-piece type, welded together after adjustment. In the latter case, the upper part shall be part of the prefabricated pipe.

3.7 Shoe

Normally a tee section attached to the pipe to transmit the load or forces to the adjacent structure.

3.8 Structural Attachments

Structural attachments include elements which are welded, bolted, or clamped to the pipe, such as clips, lugs, rings, clamps, clevises, straps, and skirts.

3.9 Supporting Elements

The broad terms "Supporting Elements" or "Supports" shall encompass the entire range of the various methods of carrying the weight of pipelines, insulation, and the fluid carried. It therefore includes "Hangers" which are generally considered as those elements which carry the weight from above, with the supporting members being mainly in tension.

Likewise, it includes "Supports" which on occasion are delineated as those which carry the weight from below, with the supporting members being mainly in compression. In many cases a supporting element may be a combination of both of these.

3.10 Sway Strut

An adjustable device, usually applied for restraining movement of piping in one direction while providing for movement in another direction.

3.11 Trunnion

A tubular supporting device, branching-off horizontally from a vertical line, and resting on, or suspended from, the supporting structure.

3.12 U-Clip

A general description of the various types of U-shaped straps, bolted or welded to the supporting structure, clamping or guiding the line. A typical use of such a clip (welded as well as bolted) is on vibrating compressor lines. In some cases the U-clip may have one spring loaded bolt and, if necessary, a shim plate welded to the bottom of the pipe.

3.13 Definitions used in supplementing reference standards:

3.13.1 (Add.) - Addition

A new clause with a new number is added.

3.13.2 (Del.) - Deletion

The clause in reference standard is deleted without any replacement.

3.13.3 (Mod.) - Modification

Part of reference standard clause is modified and/or a new description and/or statement is added to that clause.

3.13.4 (Sub.) - Substitution

The clause in reference standard is deleted and replaced by a new clause.

4. UNITS

This Standard is based on International System of Units (SI), except where otherwise specified.

5. GENERAL

Pipe supports shall be designed, manufactured, fabricated, inspected and/or selected for installation in accordance with ANSI/ASME B31.3, B31.4, B31.8 and also MSS SP-58, MSS SP-89, BS 3974, ANSI/UL 203, IPS-D-PI-130 and this Standard.

5.1 The Executor shall prepare an index of pipe supports with identification number together with bill of materials.

6. DESIGN

6.1 Welding of support elements to galvanized steel structures is not permitted.

6.2 Mechanical devices like snubbers, sway braces and sway struts shall be:

- designed with 50% decreased allowable material stresses when subjected to vibration;
- designed to withstand the specified loads without buckling, provided with self-aligning spherical ball bushings at both ends of the assembly, permitting a minimum of 10 degrees rotation in any plane;
- furnished in such a way that an adjustable specified length of plus/minus 40 mm is possible and fitted with a secure locking device.

6.3 Snubbers shall have a clearly readable travel scale.

6.4 Snubbers shall be able to operate in the frequency range from 3 Hz to 33 Hz.

7. STRUCTURAL ATTACHMENTS

7.1 Non-Integral Attachments

7.2 Integral Attachments

7.2.1 Integral lugs, plates, angle clips, pipe stanchions, pipe dummies, turnnions, etc., used as part of an assembly for the support or guiding of pipe may be welded directly to the pipe provided the materials are compatible for welding and the design is adequate for the temperature and load.

7.2.2 Field welded supports shall be set correctly in place and adjusted to the final position before welding to the pipe.

7.2.3 Reinforcing pads (with a vent hole) for turnnions and pipe stanchions shall be a full plate rather than a ring.

7.3 Structural Connections

The load from piping and pipe supporting elements (including restraints and braces) shall be suitably transmitted to a pressure vessel, building, platform, support structure, foundation, or to other piping capable of bearing the load without deleterious effects, (see IPS-D-PI-130).

8. SUPPORTS FOR INSULATED PIPES AND ATTACHMENTS

Insulated lines running in pipe trenches shall be supported high enough to assure the insulation will remain above the highest expected storm water levels.

Clamped cradles or pipe shoes may be used on the following insulated lines:

- piping lined with glass, rubber, plastics, etc.;
- piping requiring post weld heat treatment;

- expensive materials such as titanium, hastelloy, monel, etc.;
- piping with corrosion resistant coating (e.g. galvanized piping).

For all other insulated lines welded cradles or pipe shoes should be used.

8.1 Insulated Lines for Hot Service

Pipe shoes for insulated hot piping shall include slots, as directed by the Engineer, to secure the insulation weather-proofing jacket near the shoe.

8.2 Insulated Lines in Cold and Dual Temperature Services

Supporting system for the above mentioned lines shall be in accordance with standard drawing No. IPS-D-PI-130.

9. UNINSULATED LINES

Cradles or pipe shoes, if specified, may be of the clamped or the welded type. For detail refer to standard drawing IPS-D-PI-130.

10. MULTIPLE PIPE SUPPORTS AND PICK-UP SUPPORTS

Reference shall be made to standard drawing IPS-D-PI-130.

11. CONCRETE PIPE SUPPORTS

Concrete pipe supports and sleepers, detailed on IPS Standard Drawings shall accord with the relevant requirements of IPS-E-CE-200 "Concrete Structure".

Different type of concrete pipe supports are shown in standard drawing IPS-D-PI-130.

12. ELEVATED PIPE SUPPORTS (H SUPPORTS)

12.1 Elevated pipe supports for different size of pipelines and different height shall be in accordance with standard drawing IPS-D-PI-130.

12.2 Pile driven supports shall have a minimum bearing capacity of 15 tonnes.

13. FABRICATION AND INSTALLATION OF PIPE SUPPORTS

This section is supplement to reference

standard MSS-SP-89, 1991. For ease of reference the clause or section numbering of reference standard has been used for supplement. Abbreviations noted in the following paragraphs are defined in sub-section 3.13 of this standard.

2.3 (Del.)

2.4 (Del.)

5.4 Forming

5.4.1 Cold forming of plate and flat bars may be performed on materials 0.5 inch (12.7 mm) thick or less to a minimum inside radius of one times the stock thickness. Cold forming may be performed on material over 0.5 inch (12.7 mm)

thick to a minimum inside radius of 2.5 times the stock thickness. Material over 0.5 inch (12.7 mm) thick may be cold formed to an inside radius less than 2.5 times but not less than one times the stock thickness provided heat treatment is performed as prescribed in Subsection 5.4.6. (Sub.)

5.4.2 Round bars 0.75 inch (19 mm) diameter and smaller may be cold formed to 2 minimum inside radius of ½ times the bar diameter. Forming is not permitted on threaded areas. (Add.)

5.4.3 Heating material to 1300°F (704°C) or less to facilitate the operation shall be considered cold forming. (Add.)

5.4.4 Hot forming of plate and flat bars may be performed on materials of any thickness to an inside radius not less than one times the stock thickness within the following surface temperature ranges (no holding time required):

Carbon steel	1400°F Min. (760°C)	2000°F Max. (1093°C)
Chrome-Moly Alloy steel	1550°F Min. (843°C)	2000°F Max. (1093°C)
Austenitic Stainless Steel	1400°F Min. (760°C)	2100°F Max. (1148°C)

Material shall not be heated in bundles or closed stacks in other than induction type furnaces but shall be separated to allow good circulation within the furnaces. Materials should not be heated above the maximum temperature shown. No hot forming operation shall be performed below the minimum temperature shown. Carbon steel and chrome-moly alloy steel shall be cooled in still air. Water quenching is not permitted. Cooling of stainless steel other than still air cooling, may be accomplished as per ASTM A403-82a, Paragraph 6. (Add.)

5.4.5 Round bars of any diameter may be hot formed to a minimum inside radius of ½ times the bar diameter within the temperature ranges given in Subsection 5.4.4. Forming is not permitted on threaded areas. (Add.)

5.4.6 Heat treatment, when required of carbon steel and chrome-moly alloy steel shall be done within the temperature ranges shown below. The material is to be held at temperature for one hour per inch of thickness, but not less than one hour, followed by slow cooling in furnace or still air.

Carbon steel	1100°F Min. (593°C)	1250°F Max. (676°C)	
Chrome-Moly Alloy steel	1300°F Min. (704°C)	1400°F Max. (760°C)	(Add.)

5.4.7 A carbide solution heat treatment of austenitic stainless steel, when required by design specification, shall be performed as prescribed by ASTM A403-82a, Paragraph 6. (Add.)

5.4.8 Formed components may be furnished in "as formed" condition without any further mechanical work. (Add.)

5.7 Welding

5.7.1 Unless otherwise specified by the job specification, welders and welding procedures shall be qualified in accordance with the ASME Boiler and Pressure Vessel Code, Section IX.

Welder's performance test results and Welding Procedure Qualification Records shall be available, upon request, to authorized inspection personnel. (Sub.)

5.7.2 When tack welds are to become a part of the finished weld, they shall be visually examined and ground or feathered, if necessary. Defective tack welds and tack welds made by unqualified welders shall be removed. (Add.)

5.7.3 Attachments welded directly to the pipe shall be of appropriate (compatible) chemical composition and be able to withstand the anticipated loads at the piping temperature. The method of attachment to the pipe shall meet all the pre-heating, welding and post weld heat treating requirements of the pipe. (Add.)

5.7.4 Preheating and post weld heat treating (PWHT) requirements for pipe hangers shall be as outlined in ASME/ANSI B.31.3. (Add.)

5.7.5 Unacceptable welds shall be removed by flame or arc gouging, grinding, chipping or machining. Welds requiring repair shall be welded in accordance with the requirements of the original weld. Base metal irregularities requiring repair by welding shall be repaired in accordance with the material specification or ASTM A6-82a, as applicable. Welders and welding procedures used in making repair welds shall be qualified in accordance with Subsection 5.7.1. (Add.)

5.8 Surface Discontinuities (Add.)

5.8.1 Only those surface discontinuities that are detrimental to the strength or function of a product shall be cause for rejection. (Add.)

5.8.2 Surface discontinuities of welds shall be evaluated in accordance with the applicable code or job specification requirements. (Add.)

6.2 Metallic Coatings

6.2.1 Metallic coatings for corrosion resistance may be applied by electroplating, hot dipping, or mechanical plating. (Sub.)

6.2.1.1 Electroplating shall be in accordance with ASTM B633-78 or A 165-80 for the specific coating used. To avoid difficulty in assembling threaded parts that are plated, it is recommended that female machine threads be tapped oversize by an amount equal to four times the maximum plating thickness. It is no permissible to rethread male parts after plating. It is standard practice for female threads to be uncoated. (Add.)

6.2.1.2 Hot dip galvanizing shall be done in accordance with ASTM A153-80 or A386-78. To avoid difficulty in assembling threaded parts, it is recommended that male parts be shaken, spun or hand brushed to remove spelter lumps from the threads. Female machine threads may be tapped oversize to accommodate the male thread. (Add.)

6.2.1.3 Mechanical plating shall be done in accordance with ASTM B454-76. (Add.)

6.2.1.4 Repair of galvanized surfaces may be performed by any suitable cold galvanizing compound or by hot spray metallizing. (Add.)

6.2.1.5 Protective shields may be manufactured from pre-galvanized sheet meeting the requirements of ASTM A526-80. (Add.)

6.2.2 Chromic acid dropping test

This test shall be performed according to ANSI/UL 203 1984 Section 7. (Add.)

6.3 Non-Metallic Coating

6.3.1 Non-metallic coatings shall be the types selected for specific purposes. application of coatings shall be in accordance with the coating manufacturer's recommendations. In general, only such coatings with good adhesive quality, namely, that do not lift, peel or chip when scratched and that will withstand reasonably rough handling should be used. Non-metallic coatings that are intended for threaded products may be applied before assembly.

Non-metallic coatings, jackets and liners to prevent abrasion of glass or plastic pipe, etc., shall be applied in accordance with manufacturer's recommendations.

Non-metallic coatings, jackets and liners for electrolytic resistance shall have dielectric strength suitable for the intended use. (Sub.)

7. TESTING OF PIPE HANGER AND SUPPORT COMPONENT

A hanger shall be fabricated to fit the appropriate rod sizes and rod attachments specified in standard drawing IPS-D-PI-130 for the size of pipe shown and shall have sufficient strength to support the test loading (pull test Clause 7.6), resistance to vibration (vibration test Clause 7.7) and corrosion resistance (Protective coating Section 6). (Mod.)

7.2 Test Classification

Testing of hanger and support components falls into five categories, given below:

- a) Design proof test,
- b) qualification test,
- c) calibration test,
- d) pull test,
- e) vibration test. (Mod.)

7.6 Pull Test

Pull test shall be performed according to ANSI/UL 203 1985, Section 8. (Sub.)

7.7 Vibration Test

This test shall be performed in accordance with ANSI/UL 203 1985, Section 9. (Add.)

7.8 Text of this Clause is same as Clause 7.6 of the supplemented standard. (Add.)

9.3.1.1 Add to the end of this Paragraph.

Except for small items which have restricted space for die-stamping (e.g. hanger rods, eye nuts, etc.) each standard support component shall, in addition to paint marking, be die-stamped with its size and identification mark. (Mod.)

9.3.4 Add to the end of clause

Hot dip galvanized supports shall be die-stamped with their respective identification mark and serial number before galvanizing. After hot dip galvanizing, these marks and numbers shall be marked by paint. (Mod.)

9.3.5 (f) Weight and size of package. (Mod.)

10.4.3 Substitute with third line

Support spacing specified in IPS-E-PI-240. (Mod.)

10.5.1 Rod hangers

Rod hangers, either rigid or spring type, are adjustable vertical assemblies consisting of structural attachment, hanger rod (with or without intermediate components) and pipe attachment. In installation of hangers following clauses shall be considered. (Mod.)

10.5.1.1 Spring assemblies shall be shipped to the job site with the springs compressed in the installed position as indicated on the pipe support detail drawing and/or requisition. They shall have caution tags attached which warn that

the spring locks must be removed before the line is put in service. Additionally, the spring supports shall have the marks "C" or "H" on the casing load indication scale:

- Mark "C" indicates the cold position of the spring when the line is at ambient temperature but filled with its actual service fluid. For tank lines filled with the actual service fluid, it indicates the position when the tank is empty and has zero settlement.
- Mark "H" indicates the operation positions of the spring. For tank lines, it indicates the position when the tank is filled and has settled. (Sub.)

10.5.1.5 Spring supports shall be installed with the spring locks in place. These spring locking plates or pins shall not be removed before hydrostatic testing and insulation of the piping system is completed. (Add.)

10.5.1.6 Normally, all construction aids such as spring locks, temporary supports, welding tracks, etc. shall be removed prior to commissioning. However, when the spring force on the empty line will cause possible damage to connected vulnerable equipment, the spring locks shall remain in position until the line is filled with the actual service fluid. The relevant support and support drawing shall bear the warning "lock Against Empty Conditions" and the locks shall be attached with the spring support during operation. (Add.)

10.5.1.7 Hanger rods for lines subject to expansion/contraction of more than 75 mm shall be set out of plumb, equal to half of the calculated travel of the pipe at the point of support, in the opposite direction to the travel as indicated on the support detail drawing, the piping arrangement drawing and/or the isometric drawing. (Add.)

10.5.4.1 Guides may be sliding, rolling or others. (Mod.)

10.5.4.4 Line 6 and 7

Saddles or pipe shoes should be attached to piping to prevent damage to insulation. (Mod.)