

DEP SPECIFICATION

PIPE SUPPORTS

DEP 31.38.01.29-Gen.

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DESIGN AND ENGINEERING PRACTICE



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TABLE OF CONTENTS

1.	INTRODUCTION	4
1.1	SCOPE	4
1.2	DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS	4
1.3	DEFINITIONS	4
1.4	CROSS-REFERENCES	4
1.5	SUMMARY OF MAIN CHANGES.....	5
1.6	COMMENTS ON THIS DEP	5
1.7	DUAL UNITS.....	5
1.8	NON NORMATIVE TEXT (COMMENTARY).....	5
2.	GENERAL	6
3.	DESIGN	8
3.1	GENERAL	8
3.2	TYPES OF PIPE SUPPORTS	13
3.3	PIPE SUPPORTING OF PIPING SYSTEMS	16
4.	FABRICATION, MATERIALS AND WELDING	18
4.1	GENERAL	18
4.2	PIPE SUPPORT MATERIAL SELECTION.....	19
5.	MARKING AND PAINTING.....	19
6.	INSTALLATION.....	20
6.1	GENERAL	20
6.2	INSTALLATION OF SPRING SUPPORTS	20
6.3	INSTALLATION OF HD-PIR / HD-PUR COLD PIPE SUPPORTS	21
7.	REFERENCES	22

APPENDICES

APPENDIX 1	PIPE SHOES – SELECTION CHART	24
APPENDIX 2	GUIDES – SELECTION CHART.....	25
APPENDIX 3	ANCHORS AND DIRECTIONAL ANCHORS - SELECTION CHART	26
APPENDIX 4A	BASE SUPPORTS – SELECTION CHART STANDARD BASE SUPPORT	27
APPENDIX 4B	BASE SUPPORTS – SELECTION CHART STANDARD ADJUSTABLE BASE SUPPORT	28
APPENDIX 5	CLAMPED BASE SUPPORTS – SELECTION CHART	29
APPENDIX 6	BASE ANCHORS AND BASE PLATES – SELECTION CHART	30
APPENDIX 7	DUMMY LEGS – SELECTION CHART	31
APPENDIX 8	TYPICAL DETAILS.....	32
APPENDIX 9	CALCULATION PROCEDURE FOR SHOE-TYPE FULL ANCHOR SUPPORTS	33

1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for the design and application of pipe supports in piping systems.

A set of DEP Standard Drawings is available which includes the most commonly applied pipe supports, giving their allowable loads and identification. These DEP Standard Drawings are listed in (7).

For support selection charts, see (Appendices 1 to 7).

This DEP is a revision of the DEP of the same title and number dated February 2013; a summary of the main changes from that edition is given in (1.5).

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by Shell GSI, the distribution of this DEP is confined to Shell companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them. Any authorised access to DEPs does not for that reason constitute an authorisation to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in oil refineries, chemical plants, gas plants, exploration and production facilities and supply/marketing installations. This DEP may also be applied in other similar facilities.

When DEPs are applied, a Management of Change (MOC) process shall be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements could be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regards to the safety, environmental, economic and legal aspects. In all cases, the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned, the objective being to obtain agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project and ultimately pays for it. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

The word **may** indicates a permitted option.

1.3.2 Specific definitions

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section number is shown in brackets (). Other documents referenced by this DEP are listed in (7).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated February 2013. The following are the main, non-editorial changes:

Section/Clause	Change
All	Restructured and clarified requirements, enforced use of shall/should/may for normative statements.

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be submitted to the Administrator using one of the following options:

Shell DEPs Online (Users with access to Shell DEPs Online)	Enter the Shell DEPs Online system at https://www.shelldeps.com Select a DEP and then go to the details screen for that DEP. Click on the "Give feedback" link, fill in the online form and submit.
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DEP Standard Form (other users)	Use DEP Standard Form 00.00.05.80-Gen. to record feedback and email the form to the Administrator at standards@shell.com .

Feedback that has been registered in the DEP Feedback System by using one of the above options will be reviewed by the DEP Custodian for potential improvements to the DEP.

1.7 DUAL UNITS

This DEP contains both the International System (SI) units, as well as the corresponding US Customary (USC) units, which are given following the SI units in brackets. When agreed by the Principal, the indicated USC values/units may be used.

1.8 NON NORMATIVE TEXT (COMMENTARY)

Text shown in italic style in this DEP indicates text that is non-normative and is provided as explanation or background information only.

Non-normative text is normally indented slightly to the right of the relevant DEP clause.

2. GENERAL

1. Refer to DEP 31.38.01.11-Gen. for the required positioning of pipe supports.
Typical sketches and dimensions of pipe supports are given in BS 3974, MSS SP 58 and MSS SP 69.
2. If a 3D-CAD model is made, all supports shall be modelled. See DEP 30.10.05.11-Gen.
Supporting of pipes is an integral part of piping design.
Standard pipe support details are given in the Standard Drawings listed in Table 1. A set of Standard Drawings is available that includes the most commonly applied pipe supports, giving their allowable loads and identification.
3. Pipe supports shall be designed so that access is not prohibited for operation and maintenance.
4. The Contractor shall prepare a specification and a bill of material for pipe supports.
5. The specification for pipe supports shall contain the following:
 - a. An index of the identification of the standard pipe supports;
 - b. Dimensional sketches of the standard pipe supports and/or a reference to applied standards;
 - c. A description of the pipe support identification numbering system;
 - d. The maximum allowable loading of the standard pipe supports;
 - e. Materials of construction;
 - f. Surface protection.
6. The bill of material for pipe supports shall contain the following:
 - a. A list of the special pipe support identification numbers;
 - b. A summary of the standard pipe supports;
 - c. Dimensional sketches of the special supports including materials of construction and surface protection;
 - d. Material summary sheets.
7. Supports should be standardised as far as practical.
8. Each support shall bear an identification number.
9. Refer to DEP 01.00.09.10-Gen for special support identification numbers
10. For support selection charts, see (APPENDIX 1) through (APPENDIX 7).
11. The Contractor may use their own standards and commercially available pipe supports and methods provided they are equivalent to this DEP and subject to the approval of the Principal.
 - a. The Contractor shall submit supporting calculations for pipe support standard drawings.
12. For centre-to-centre distance of supports for straight steel pipes and for bent steel pipe, see DEP 31.38.01.11-Gen.
13. For supporting glass-lined steel piping, plastic piping and elastomeric piping, the installation instructions of the Manufacturer/Supplier shall apply.
14. Galvanised supports shall not be used on austenitic stainless steel, duplex stainless steel, nickel alloy, or 9 % nickel steel piping.

15. Pipe support identification numbers including special pipe supports and symbols shall be shown clearly on the 3D model, on Piping Plan drawings and on the Piping Isometric drawings.

Table 1 Standard Pipe Support Drawings

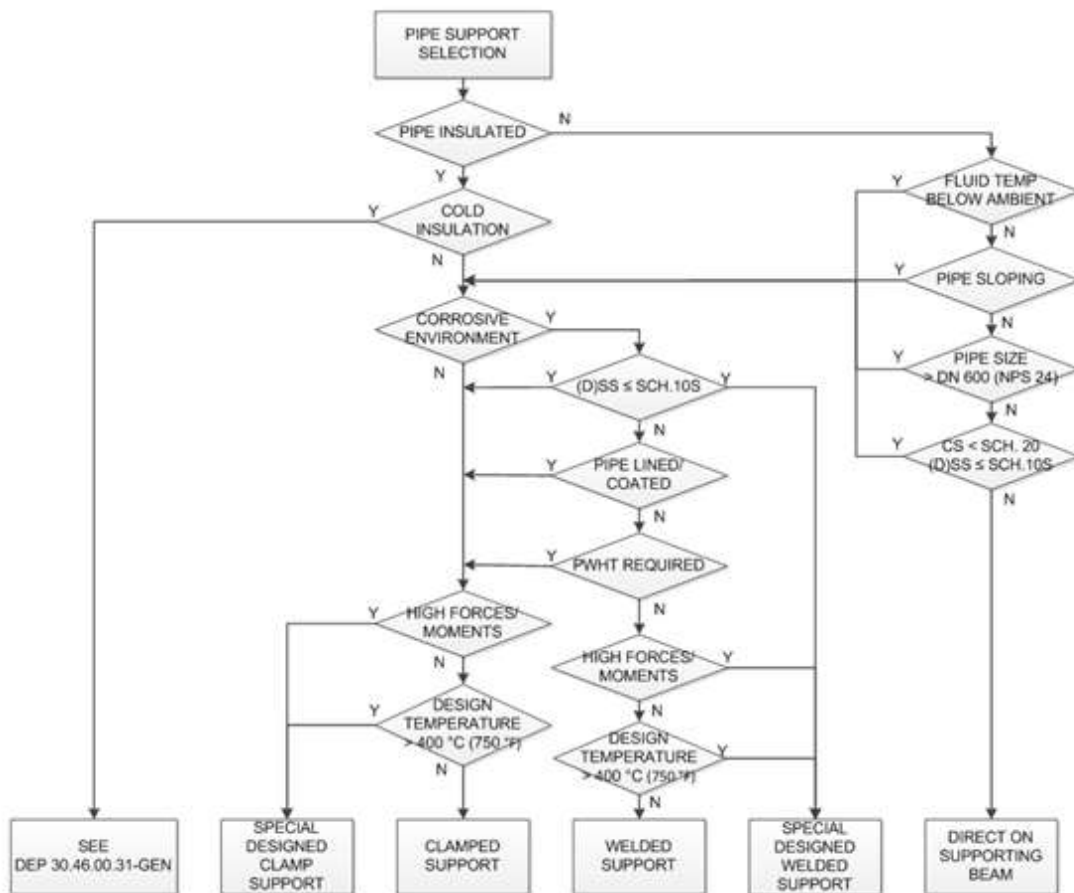
Typical bracings for small bore branches of piping (e.g., drain/vent point)	S 44.030
Typical bracings for small bore branches of piping (e.g., orifice instrument connection)	S 44.031
Typical bracings for small bore branches of piping (e.g., pressure instrument connection)	S 44.032
Standard lined pipe shoe type S7 thru S12	S 44.034
Standard welded pipe shoe type S29 thru S34	S 44.035
Standard guide type G1 thru G10	S 44.036
Standard guide type G11 and G12	S 44.037
Standard directional anchor type DA6 thru DA7	S 44.038
Standard base support type BS1 thru BS8	S 44.039
Standard adjustable base support type BS9 thru BS17	S 44.040
Clamped base support type CB1 thru CB9	S 44.041
Adjustable clamped base support type ACB1 thru ACB9	S 44.042
Standard clamp heavy type DN 40 (NPS 1-1/2) thru DN 600 (NPS 24)	S 44.043
Standard base plate BP1 thru BP7	S 44.044
Standard directional base anchor BA1 thru BA8	S 44.045
Standard base anchor BS1A thru BS5A	S 44.046
Standard dummy leg type DL1 thru DL8	S 44.047
Standard dummy leg type DL9 thru DL16	S 44.048

3. DESIGN

3.1 GENERAL

1. The pipe support selection flowchart (Figure 1), shall be used in conjunction with this section.

Figure 1 Pipe Support Selection Flowchart



Clamped type pipe supports are susceptible to corrosion because water can collect between the support and the pipe.

Clamped type pipe supports require more maintenance than welded type pipe supports.

2. The piping system shall be supported, anchored or guided to prevent deflection, vibrations or expansion/contraction which could result in stresses in excess of those permitted by ASME B31.3 and DEP 31.38.01.11-Gen. in the piping or in-line connected equipment.
3. Adjustable supports shall be used where differential settlement between equipment and piping may occur.
4. Pipes should be supported in groups at a common support elevation of the supporting structure as much as possible.
5. The guides of adjacent pipes should be staggered wherever possible.

6. Where structural columns/beams are of reinforced concrete type, inserts or curb angles shall be installed to allow the installation of pipe supports.
7. During the design stage of reinforced concrete columns/beams, anchor bolts shall not be used in lieu of insert plates or curb angles on reinforced concrete columns/beams.
8. Welded guides and other welded support elements in hot dip galvanised steel structures (e.g., pipe racks/bridges) should be attached to steel members before they are hot dip galvanised.
9. Pipe supports at locations with potentially high load concentrations (such as valves, strainers, in-line instruments, and equipment) shall be suitable for the required loads and facilitate maintenance of the heavy valves/equipment.
10. When very low variable load springs supports are essential, such as lines connected to strain sensitive equipment or for critical systems with large movements, "constant load spring supports" shall be used.

The most common type of spring assembly used is the "variable load type spring supports".

11. Counterweights, snubbers and sway braces shall be accessible (using temporary access if necessary) to facilitate programmed maintenance.
12. Each support assembly, including the spring supports, shall be designed to sustain the hydrostatic test load.
13. Insulated piping systems running in pipe trenches shall be supported high enough to assure the insulation will remain above the highest expected storm water levels.
14. Piping shall not be supported by hanging one piping system from another piping system.

3.1.1 Location of pipe support

1. Pipe supports shall be positioned on the piping system as follows:
 - a. On pipe rather than valves and flanges;
 - b. Where base type tubular supports, such as pipe dummies and trunnions are attached to elbows and tees, attach to the "back" of the fitting, not to the "side" which is the highly stressed region;
 - c. On piping sections which are fixed in place which do not require removal or disconnection e.g., heat exchangers tube bundle maintenance, decoking, regeneration, cleaning or isolation;
 - d. As close as possible to heavy components such as relief valves and isolation valves in particular for high pressure rating and actuated valves for all pressure ratings;
 - e. At the positions where the vertical movements are minimal;
 - f. At the position close to flanged components (e.g., valves), the disconnection of which will bend down or deform or topple the connected piping system;
 - g. To minimise vibration in accordance with Appendix E and Appendix K of DEP 31.38.01.11-Gen.
2. Supports shall be located as close as possible to changes in direction, while allowing adequate flexibility to the piping system concerned.
3. For guides around piping system elbow turns (e.g., corner of pipe way), lateral movements of the piping system due to thermal expansion shall be checked, and when necessary axial pipe stoppers with suitable clearances installed.

4. Where vertical movements are anticipated at pipe supports due to thermal expansion and settlement of piping, equipment or supporting structure, the following shall apply:
 - a. Use resting type supports with guides or stopper when piping will rise up from supports but it will not cause excessive stresses/moments on piping and the connected piping system;
 - b. Use spring supports when piping system will rise up from pipe supports and causing excessive stresses/bending moments on piping or the connected equipment nozzles;
 - c. For piping systems of size DN 200 (NPS 8) and above, pump suction and discharge piping systems, install the first pipe support on the common foundation with the pumps.

3.1.2 Pipe support arrangement for piping systems in pipe rack and pipe track

1. For straight sections of piping in a pipe rack or pipe track > 100m (330 ft), at least one anchor support shall be provided regardless of design temperature:
 - a. Pipe anchor supports shall be grouped to minimise the number of anchor bays;
 - b. The position of the anchor support shall be determined by taking account of piping flexibility, movements of piping and restriction of dynamic or reaction forces.
2. Axial movements of piping system shall be minimized at the following:
 - a. Process unit battery limit;
 - b. Piping around pumps, compressors and other strain sensitive equipment to be connected;
 - c. Piping near pipe rack or pipe track crossings.
3. Piping systems in pipe racks or pipe tracks shall be guided at intervals twice the bare vapour service pipe support span against the lateral movements due to thermal expansion including solar radiation.
4. Pipe shoe supports of varying heights used on sloping lines shall be designed to withstand buckling loads.

3.1.3 Pipe support arrangement for piping systems connected to equipment

3.1.3.1 Piping systems connected to columns and vertical vessels

1. All supports for equipment piping shall be designed and selected to cope with the maximum temperature difference between the piping and the equipment.
2. These piping systems shall have a resting support as close as possible to the column or vessel nozzle, and be guided at suitable intervals to safeguard the line against wind load and/or buckling.
3. Vertical pipe runs shall have a maximum guide distance as per the following:
 - a. For piping systems of size < DN 200 (NPS 8) - 6 m (20 ft);
 - b. For piping systems of size $\geq$ DN 200 (NPS 8) - 10 m (32 ft).

In view of the required flexibility of the piping, the location of the lowest guide and limit stop could require vertical offset.

4. Pipe supports on equipment shall be of bolted type, connecting to welded cleats on the equipment:
 - a. The cleats shall be supplied by the equipment Manufacturer/Supplier.
5. To support piping systems connected to equipment, maximum use should be made of platforms, table tops, fire decks.

3.1.3.2 Piping systems connected to heat exchangers

1. To allow adequate clearance for the removal of covers, heads, channels, bundles and shells, piping system shall not be supported on heat exchanger shells and heads.

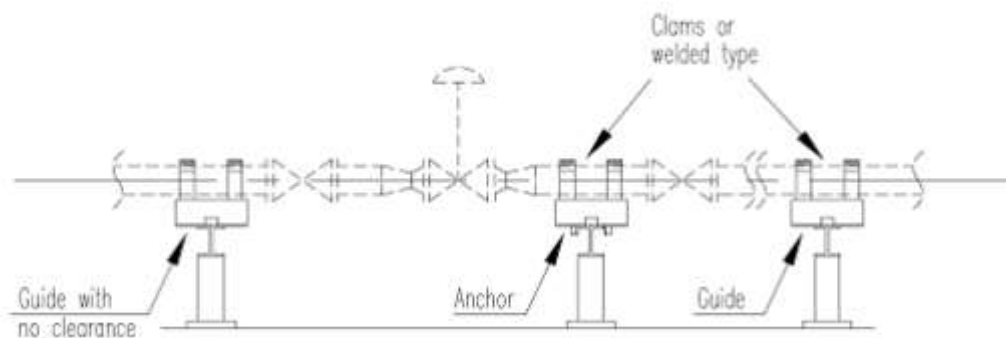
3.1.3.3 Piping systems connected to rotating equipment

1. Onshore compressor piping systems shall be supported independently from grade level in order to prevent transmission of vibrations to the compressor house.
2. Piping connected to rotating equipment shall have adjustable supports to facilitate alignment, spading and equipment exchange.
3. Integral (e.g., interstage) piping system of reciprocating compressors and pumps shall be supported from common foundation.
4. Vibration dampener type pipe supports shall be used at pipe supporting locations for piping systems connected to reciprocating compressor to prevent the vibration forces and allow the axial thermal movements of piping, as required:
 - a. Where lateral movements are essential, slotted holes shall be provided on the vibration dampener pipe supports.

3.1.3.4 Piping systems with control valves with high pressure drop ratio (choked flow) and relief valves

1. Safety relief valve discharge piping shall be supported to withstand the dead loads and the blow-off loads.
 - a. Blow-off design loads shall take into account the most severe case, such as two phase flow.
2. Inlet and outlet piping system having control valves with high pressure drop ratio (choked flow) in accordance with DEP 32.36.01.17-Gen., shall be supported rigidly as shown in Figure 2 to sustain hydraulic forces due to differential pressure across control valve and to prevent the flow-induced vibration of piping system.
 - a. These pipe supports shall have sufficient strength and mass against expected thrust forces.

Figure 2 Typical pipe support arrangement for control valves with high pressure drop ratio



3.1.4 Pipe support arrangement of piping systems with expansion joints

1. Supports in piping system with expansion joints shall be designed and positioned in accordance with the requirements of the Manufacturer and the standards of EJMA.