MANUAL

PIPE SUPPORTS

DEP 31.38.01.29-Gen.

December 1997

DESIGN AND ENGINEERING PRACTICE

PREFACE

DEP (Design and Engineering Practice) publications reflect the views, at the time of publication, of:

Shell International Oil Products B.V. (SIOP)
and
Shell International Exploration and Production B.V. (SIEP)
and
Shell International Chemicals B.V. (SIC)

The Hague, The Netherlands,

and other Service Companies.

They are based on the experience acquired during their involvement with the design, construction, operation and maintenance of processing units and facilities, and they are supplemented with the experience of Group Operating companies. Where appropriate they are based on, or reference is made to, national and international standards and codes of practice.

The objective is to set the recommended standard for good design and engineering practice applied by Group companies operating an oil refinery, gas handling installation, chemical plant, oil and gas production facility, or any other such facility, and thereby to achieve maximum technical and economic benefit from standardization.

The information set forth in these publications is provided to users for their consideration and decision to implement. This is of particular importance where DEPs may not cover every requirement or diversity of condition at each locality. The system of DEPs is expected to be sufficiently flexible to allow individual operating companies to adapt the information set forth in DEPs to their own environment and requirements.

When Contractors or Manufacturers/Suppliers use DEPs they shall be solely responsible for the quality of work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, the Principal will expect them to follow those design and engineering practices which will achieve the same level of integrity as reflected in the DEPs. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the Principal or its technical advisor.

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2) Other parties who are authorized to use DEPs subject to appropriate contractual arrangements.

3) Contractors/subcontractors and Manufacturers/Suppliers under a contract with users referred to under 1) or 2) which requires that tenders for projects, materials supplied or - generally - work performed on behalf of the said users comply with the relevant standards.

Subject to any particular terms and conditions as may be set forth in specific agreements with users, SIOP, SIEP and SIC disclaim any liability of whatsoever nature for any damage (including injury or death) suffered by any company or person whomsoever as a result of or in connection with the use, application or implementation of any DEP, combination of DEPs or any part thereof. The benefit of this disclaimer shall inure in all respects to SIOP, SIEP, SIC and/or any company affiliated to these companies that may issue DEPs or require the use of DEPs.

Without prejudice to any specific terms in respect of confidentiality under relevant contractual arrangements, DEPs shall not, without the prior written consent of SIOP and SIEP, be disclosed by users to any company or person whomsoever and the DEPs shall be used exclusively for the purpose for which they have been provided to the user. They shall be returned after use, including any copies which shall only be made by users with the express prior written consent of SIOP and SIEP. The copyright of DEPs vests in SIOP and SIEP. Users shall arrange for DEPs to be held in safe custody and SIOP or SIEP may at any time require information satisfactory to them in order to ascertain how users implement this requirement.

All administrative queries should be directed to the DEP Administrator in SIOP.

NOTE: In addition to DEP publications there are Standard Specifications and Draft DEPs for Development (DDDs). DDDs generally introduce new procedures or techniques that will probably need updating as further experience develops during their use. The above requirements for distribution and use of DEPs are also applicable to Standard Specifications and DDDs. Standard Specifications and DDDs will gradually be replaced by DEPs.

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APPENDICES

1. INTRODUCTION

1.1 SCOPE

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

This DEP is a revision of the DEP of the same number dated November 1991. In conjunction with this revision, a set of Standard Drawings has been made which includes the most commonly applied pipe supports, giving their allowable loads and identification. For support selection charts, see Appendices 2 to 8.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by SIOP or SIEP, the distribution of this document is confined to companies forming part of or managed by the Royal Dutch/Shell Group, and to Contractors nominated by them (i.e. the distribution code is "C", as defined in DEP 00.00.05.05-Gen.).

This DEP is intended for use in oil refineries, chemical plants, gas plants, supply/marketing installations and, where applicable, in exploration and production facilities.

If national and/or local regulations exist in which some of the requirements may 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 as regards safety, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this document 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 with the object of obtaining agreement to follow this document as closely as possible.

1.3 DEFINITIONS

1.3.1 General Definitions

The **Contractor** is the party which 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 sometimes undertake all or part of the duties of the Contractor.

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

The **Principal** is the party which initiates the project and ultimately pays for its design and construction. The Principal will generally specify the technical requirements. 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.

1.3.2 Specific definitions

Where applicable, reference is made to the sections or appendices of this DEP, and/or to the relevant standard, where further details can be found.

Anchor	a device which restrains the pipe from movement and rotation in all directions. The member to which an anchor is fixed, however, may be subjected to displacements and/or rotations, e.g. connections to equipment	Appendix 4
Base support or pipe stanchion	a dummy pipe with base plate welded to the pipe. The pipe dummy will rests on the supporting structure and so support the pipe. When considerable site adjusting is required, the pipe stanchion may be of the 2-piece type, welded together after adjustment	Appendix 5
Clamp or clip	a device bolted around a pipe or, for cold insulation, around the insulation. Clamps form an integral part of hangers and clamped cradles or pipe shoes	BS 3974 and Appendix 6
Constant load support	a spring loaded support assembly or device designed such that the supporting effort is constant over the total travel of the support. Constant load supports are meanly used in pipes connected to strain sensitive equipment or for critical systems with large movements.	
Dummy leg	a dummy pipe welded to the pipe. The pipe dummy will rest on the supporting structure and so support the pipe	Appendix 8
Goal post support	frame type support for situations where heavy loads may be expected	BS 3974-2
Guide	a device controlling the direction of movement of piping/supports	Appendix 3
Guided support	a support allowed to move along a predetermined axis, controlled by guides	Appendix 3
Hanger	a support suspended from concrete floors, beams etc	BS 3974-1
Inserts	poured-in fixtures, in concrete floors or columns, allowing supports and/or hangers to be bolted	Appendix 9
Pipe shoe or cradle	a pipe support welded or clamped to a pipe	Appendix 2
Pipe stop	a device preventing the pipe from displacement in one direction may be applied in combination with a guide in an other direction	Appendix 3 and Appendix 9

Pivot	an element similar to a base support, but which allows the pipe to rotate around and to move along the longitudinal axis of that pivot. These supports are usually used as a sort of base support but they allow vertical movement and rotation while preventing lateral movement. Downward movement can be restricted with this type of support	Appendix 9
Rest support	Location where a pipe is resting with or without the application of a pipe shoe on the supporting structure	
Reinforcing pad or saddle	a plate welded to the pipe in order to reinforce thin-walled pipe to prevent the pipe from being damaged	Section 3.8
Rotating support	an anchor which allows the line to rotate around the longitudinal axis of that support but prevents vertical and lateral movement	Appendix 9
Shear lug	a welded attachment to the pipe at one or both sides of a clamped cradle or pipe shoe, preventing the pipe from slipping through the pipe support	Appendix 4
Snubber	a shock absorbing device, allowing the pipe to freely and slowly move whilst absorbing sudden shocks (e.g. seismic). It may be of the hydraulic, spring loaded or verge and verge wheel type.	
Sway brace	an adjustable spring or friction loaded device, usually applied for controlling vibration, absorbing shock loading, guiding or restraining the movement of the pipe and bracing against sway	BS 3974-1
Sway strut	an adjustable device, usually applied for restraining movement of piping in one direction while providing for movement in another direction.	
Spring hanger	a suspended spring loaded support	BS 3974-1
Spring support	a spring loaded assembly or device, supporting the pipe from underneath	Section 6 and BS 3974-1
Trunnion	a tubular supporting device, branching-off horizontally from a vertical line, and resting on, or suspended from, the supporting structure	BS 3974-1
U-bolt	a light-duty fixture, U-shaped, with both ends threaded and provided with nuts. These supports can be used for both semi-fixed or guiding points	BS 3974-1

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 (12).

2. GENERAL

DEP 31.38.01.11-Gen. is applicable for the piping and specifies 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.

Standard pipe support details are given in the Standard Drawings listed in (7).

The Contractor shall prepare a specification and a bill of material for pipe supports.

The **specification** for pipe supports shall contain:

- an index of the identification of the standard pipe supports;
- dimensional sketches of the standard pipe supports and/or a reference to applied standards;
- a description of the pipe support identification numbering system;
- the maximum allowable loading of the standard pipe supports;
- materials of construction;
- surface protection.

The **bill of material** for pipe supports shall contain:

- a list of the special pipe support identification numbers;
- a summary of the standard pipe supports;
- dimensional sketches of the special supports including materials of construction and surface protection;
- material summary sheets.

Supports shall be standardised as far as practical and shall bear an identification number. Special support identification numbers shall include the unit and/or area number.

A set of Standard Drawings has been made which includes the most commonly applied pipe supports, giving their allowable loads and identification. For support selection charts, see Appendices 2 to 8.

The Contractor may use his own standards and/or commercially available pipe supports and methods provided they comply with this DEP.

For centre-to-centre distance of supports for straight steel pipes and correction factors for bent steel pipe, see DEP 31.38.01.11-Gen.

For supporting glass-lined steel piping and plastic piping, the installation instructions of the supplier shall apply.

3. DESIGN

3.1 CLAMPED SUPPORTS

The position of clamped supports may be adjusted during construction to correct mismatches between the location of the support and the location of the supporting structure. These field modifications shall only be minor corrections and shall not lead to an increase of stresses and/or moments in the piping system and/or in the connecting nozzles. Clamped supports are susceptible to corrosion because water may collect between the support and the pipe. If clamped supports are used in situations where corrosion may be expected, precautions shall be taken to protect the supports against corrosion, e.g. by avoiding the ingress of water. Clamped supports require more maintenance than welded supports. To prevent galvanic corrosion, carbon steel clamps on pipes of other metallic materials shall be separated from the pipe by using a layer of synthetic rubber, glass fibre paper tape or other insulating material between the clamp and the pipe. Clamped supports on hot pipes or on pipes with variable temperature may loosen because of the difference in temperature between the pipe and the clamp. The application of goal post supports may avoid the clamp rotating over pipe when these supports are used as guides or as anchor points.

3.2 WELDED SUPPORTS

Welded supports are less susceptible to corrosion than clamped supports. In order to install welded supports at the correct positions these positions shall be determined during the detailed design phase. The field welds in the piping shall be used to correct differences in position during construction, caused by tolerances of the piping and the tolerances of the supporting structures.

Welded supports in galvanised steel structures shall be attached to steel members before they are galvanised. Stainless steel piping shall be protected against zinc embrittlement which may result from molten zinc dripping from galvanised steel during a fire. See DEP 31.38.01.11-Gen.

Welded pipe supports shall not be used on the following piping:

- 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. galvanised piping).

3.3 HANGER SUPPORTS

Individual pipes may be suspended by hanger supports. Hanger supports should not be used in systems with two-phase flow or where excessive vibration may be expected (e.g. near reciprocating compressors). Suspending a pipe from another pipe should be avoided.

3.4 SLIDING SUPPORTS

To reduce the friction forces of sliding supports, low friction elements such as PTFE/graphite sliding plates or roller-type supports may be considered.

The friction will be easily increased by minor corrosion between the element and the support, therefore the landing area shall be stainless steel. Even then, the friction will be easily increased by slight fouling (e.g. sand or dirt). For these reasons, the use of sliding supports shall be minimised. In many cases, the use of hangers is a better solution.

3.5 SUPPORTING OF INSULATED PIPES

Insulated pipes shall not rest directly on their insulation but pipe shoes shall be applied.

The clearance between the insulation and the supporting structure shall be at least 50 mm.

Cradles and pipe shoes of pipes operating at temperatures above 400 °C shall be insulated from the supporting structure by incombustible insulating blocks of sufficient load-bearing

and insulation capabilities. Alternatively, clamped cradles or pipe shoes can be installed around the insulation. At the location of these supports the insulation shall have sufficient load-bearing capacity.

For further details regarding supporting insulated pipes in hot services, see DEP 30.46.00.31-Gen.

3.6 SUPPORTING COLD-INSULATED PIPES

Pipe supports for cold-insulated pipes shall be clamped to the outer surface of the insulation system in order to avoid the ingress of moisture in the insulation. At locations where field insulation is applied (e.g. around field welds) the insulation will be installed after pressure testing the pipe. Therefore, since the pipe supports are required during erection and testing of the piping, field applied insulation shall not be located in positions where supports are located.

The clearance between the insulation and the supporting structure shall be at least 50 mm.

At sliding points the loads due to friction shall be checked against the load bearing capacity of the insulation. If required, sliding plates (3.4) shall be fitted between the pipe shoe and supporting member.

The forces and moments on anchors, pipe stops and rotating supports shall be checked. If these forces and moments are greater than the load-bearing capacity of clamped supports, specially designed supports shall be used. Welded attachments to the pipe may then be required and shall be of the same type of material as the pipe. The pipe supports shall be insulated from these attachments using laminated hard wood or solid resin blocks of sufficient load-bearing capacity and insulation properties.

For further details regarding supporting cold-insulated pipes, see DEP 30.46.00.32-Gen.

3.7 NON-INSULATED PIPES

Non-insulated pipes should rest directly on the supporting steel. However, pipe shoes (clamped or welded) shall be considered if:

- surface condensation is likely (i.e. the operating temperature of the pipe is below ambient temperature) and therefore access will be needed for painting and repair.
- the line requires a slope.
  NOTE: This is only for small slope corrections. The height of pipe shoes measured from the underside of the pipe shall be maximum 400 mm.
- the line may operate (even temporarily) at such a low temperature that this may cause embrittlement of the supporting member.
- needed to avoid unacceptable pipe corrosion in corrosive atmospheres (e.g. due to coating damage caused by pipe movement and water collection on top of the supporting structure).
  NOTE: Pipe shoes in these situations do not alleviate corrosion problems of the supporting members themselves.

3.8 PIPE SADDLES AND REINFORCING PADS

Pipe saddles and reinforcing pads shall be made from the same type of material as the pipe and shall have a vent hole.

Pipe saddles and reinforcing pads shall not be used unless proven to be more economical than welded or clamped supports over the total lifetime of the plant.

Pipe saddles and reinforcing pads shall not be applied on pipes operating at temperature levels which would create high stresses in the welds due to the temperature difference between the pipe wall and the saddle or reinforcing pad.

Pipe saddles and reinforcing pads shall not be applied on pipes operating with fluctuating temperatures which would create high stresses in the welds.

In corrosive atmospheres, corrosion may occur between the pipe and the saddle or

reinforcing pad due to water ingress in the vent hole. Since it is not possible to inspect or maintain the pipe under the reinforcing plate, saddles or reinforcing pads shall not be used in areas where this corrosion may occur.

4. FABRICATION, MATERIALS AND WELDING

Support materials welded directly to the pipe shall be of the same type of material as the pipe.

If pipe stanchions or dummy legs are welded to elbows or tees, a distance of at least 50 mm shall be kept between the welds of the support and the welds of the fitting.

Field welding to pipes for pipe supporting purposes shall be limited as far as practical. Field welding for pipe support purposes shall not be performed on the following pipe materials:

- materials requiring post weld heat treatment;
- lined carbon steel (glass, PTFE, rubber, cement, etc.);
- galvanised materials;
- non-ferrous materials.

For pipes requiring post weld heat treatment, attachments required for supporting purposes shall be indicated on the piping isometric drawings, and welding shall be performed in the workshop before post weld heat treatment.

All welds of support elements and of supports to piping shall be continuous. The fabricated and supplied supports shall conform to the "Bill of Material for Supports" drawings and standards and shall be able to withstand the specified loads.

Welding of supports shall be completed prior to flushing, chemical cleaning or blowing.

Mechanical devices such as 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, and 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.

Snubbers and sway braces shall have a clearly readable travel scale.

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

5. MARKING AND PAINTING

Painting shall be in accordance with DEP 30.48.00.31-Gen.

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.

The items which are not die-stamped shall have their size and identification legibly marked on a securely attached durable tag.

Hot dip galvanised supports shall be die-stamped with their identification mark and serial number before galvanising. After hot dip galvanising, these marks and numbers shall be painted on.

6. INSTALLATION

Piping shall be properly anchored and guided before pressure testing.

Tie rods shall be locked in their proper position before testing, and re-adjusted as necessary after testing in accordance with the installation instructions.

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 pipes 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 pipes, it indicates the position when the tank is filled and has settled.

Spring supports shall be installed with the spring locks in place. These spring locking plates or pins shall not be removed until hydrostatic testing and insulation of the piping system has been completed.

Normally, all construction aids such as spring locks, temporary supports, welding tacks, etc. shall be removed prior to commissioning. However, if the spring force on the empty line will cause possible damage to connected strain sensitive 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 "Block Against Empty Conditions" and the locks shall be attached with the spring support during operation.

When using a blocking device, care shall be taken not to move the load indicator and/or the spring pressure plate. Springs shall not be de-blocked while the pipe is still empty.

The length of pipe shoes shall be sufficient to prevent pipes moving off their supports when subjected to thermal expansion or contraction.

Adjustable supports shall be used where differential settlement between equipment and piping may occur.

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

Pipe stanchions, pipe dummies and trunnions shall have welded end plates. Before the end plates are welded, the inside of the pipe stanchions, pipe dummies and trunnions shall be painted.

Hanger rods for pipes subject to expansion or contraction of more than 75 mm shall be set 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.

For sliding supports, bearing surfaces shall be sufficiently clean to ensure unrestricted movement.

Safe loads on expansion bolts to be used for connecting supports to concrete shall be based on the loading capacity of the concrete.

7. REFERENCES

In this DEP, reference is made to the following publications:

NOTE: Unless specifically designated by date, the latest edition of each publication shall be used, together with any amendments/supplements/revisions thereto.

SHELL STANDARDS

Index to DEP Publications and Standard Specifications	DEP 00.00.05.05-Gen.
Index to Standard Drawings	DEP 00.00.06.06-Gen.
Thermal insulation for hot services	DEP 30.46.00.31-Gen.
Thermal insulation for cold and dual-temperature services	DEP 30.46.00.32-Gen.
Painting and coating for new construction projects	DEP 30.48.00.31-Gen.
Piping general requirements	DEP 31.38.01.11-Gen.

STANDARD DRAWINGS

NOTE: The latest revisions of Standard drawings can be found in DEP 00.00.06.06-Gen.

Standard pipe shoe type S1 through S6	S 44.033
Standard pipe shoe type S7 through S12	S 44.034
Standard pipe shoe type S29 through S34	S 44.035
Standard guide type G1 through G10	S 44.036
Standard guide type G11 through G12	S 44.037
Standard directional anchor type DA5 through DA7	S 44.038
Standard base support type BS1 through BS8	S 44.039
Standard adjustable base support type BS9 through BS17	S 44.040
Clamped base support type CB1 through CB9	S 44.041
Adjustable clamped base support type ACB1 through ACB9	S 44.042
Standard clamp heavy type DN40 through DN600	S 44.043
Standard base plate type BP1 through BP7	S 44.044
Standard directional base anchor type BA1 through BA8	S 44.045
Standard base anchor type BS1A through BS5A	S 44.046
Standard dummy leg type DL1 through DL8	S 44.047
Standard dummy leg type DL9 through DL16	S 44.048

AMERICAN STANDARDS

Pipe hangers and supports - materials, design and manufacture	MSS SP 58
Pipe hangers and supports - selection and application	MSS SP 69

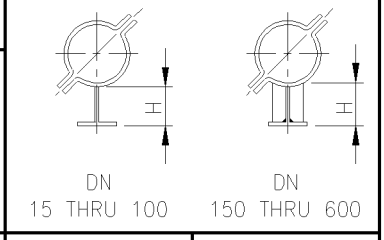
Issued by:
Manufacturers Standardisation Society
of the Valve and Fittings Industry
5203 Leesburg Pike, Suite 502
Falls Church, Virginia 22041
USA

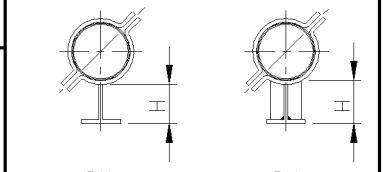
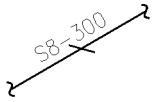
BRITISH STANDARDS

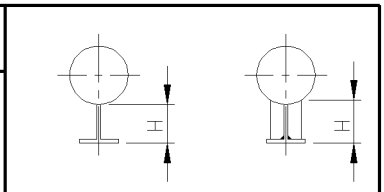
Specification for Pipe Supports	BS 3974

Issued by:
British Standards Institution
389 Chiswick High Road
London W4 4AL
UK

APPENDIX 1 PIPE SHOES - SELECTION CHART

SEE ST. DWG. S 44.033						
IDENTIFICATION EXAMPLE 	DN 15 THRU 100			DN 150 THRU 600		
MAXIMUM MOVEMENT	75 mm			200 mm		
LENGTH	250 mm			500 mm		
HEIGHT	100	150	200	100	150	200
15 THRU 25	S1					
40 THRU 100		S2		S4	S5	
150 THRU 400			S3			S6
450 THRU 600						

SEE ST. DWG. S 44.034						
IDENTIFICATION EXAMPLE 	DN 15 THRU 100			DN 150 THRU 600		
MAXIMUM MOVEMENT	75 mm			200 mm		
LENGTH	250 mm			500 mm		
HEIGHT	100	150	200	100	150	200
15 THRU 25	S7					
40 THRU 100		S8		S10	S11	
150 THRU 400			S9			S12
450 THRU 600						

SEE ST. DWG. S 44.035						
IDENTIFICATION EXAMPLE 	DN 15 THRU 100			DN 150 THRU 600		
MAXIMUM MOVEMENT	75 mm			200 mm		
LENGTH	250 mm			500 mm		
HEIGHT	100	150	200	100	150	200
15 THRU 25	S29					
40 THRU 100		S30		S32	S33	
150 THRU 400			S31			S34
450 THRU 600						

NOTES:

1. THERE ARE FABRICATION AND INSTALLATION DRAWINGS FOR EACH SUPPORT ON THIS SELECTION CHART.

APPENDIX 2 GUIDES - SELECTION CHART

SEE ST. DWG. S 44.036

IDENTIFICATION EXAMPLE

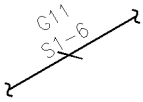
G1 THRU G7 G8 THRU G10

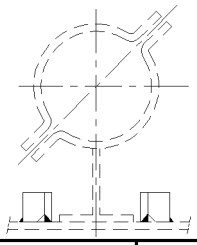
TYPE	DN	MAX. TRANSVERSE FORCE kN
G1	40 THRU 80	2
G2		5
G3	100 AND 150	2
G4		5
G5	200 AND 250	5
G6		10
G7	300 THRU 400	12
G8		26
G9	500 AND 600	9
G10		21

G1 THRU G10

SEE ST. DWG. S 44.037

IDENTIFICATION EXAMPLE





TYPE	DN	TO BE USED WITH	MAX. TRANSVERSE FORCE kN
G11	15	S1, S4, S7, S9, S29, S32	
	20		
	25		
	40	S1, S2, S4, S5, S7, S8, S10, S11, S29, S30, S32, S33	1.0
	50		1.9
	80		2.6
	100		5.2
	150	S1 THRU S12, S29 THRU S34	5.6
	200		6.6
	250		8.0
G12	300		9.75
	350		10.25
	400		12.50
	450	S4 THRU S8 S10 THRU S12	12.50
	500		12.50
	600		15.0

G11 AND G12

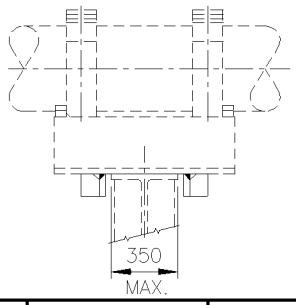
NOTES:

1. THERE ARE FABRICATION AND INSTALLATION DRAWINGS FOR EACH SUPPORT ON THIS SELECTION CHART.
2. THE GUIDES OF ADJACENT PIPES SHALL BE STAGGERED WHEREEVER POSSIBLE.

APPENDIX 3 ANCHORS AND DIRECTIONAL ANCHORS - SELECTION CHART

SEE ST. DWG.
S 44.038

IDENTIFICATION
EXAMPLE

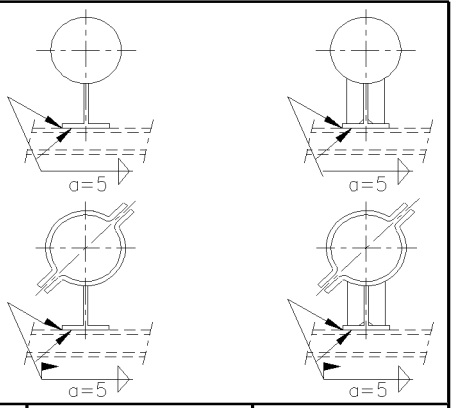


TYPE	DN	TO BE USED WITH	MAX. AXIAL FORCE kN
DA6	40	S4, S5, S10, S11	1.0
	50		1.9
	80		2.6
	100		5.2
	150	S4 THRU S8 S10 THRU S12	7.5
	200		7.5
DA7	250		12.5
	300		12.5
	350		12.5
	400		17.5
	450		17.5
	500		19.0
	600		30.0

DA6 AND DA7

SEE ST. DWG.
S 44.033
S 44.035

IDENTIFICATION
EXAMPLE



DN	TYPE			MAX. ANCHOR FORCE kN (3 DIRECTIONS)
	H=100	H=150	H=200	
15	S1A			
20				
25				
40	S4A/ S32A	S5A/ S33A	S6A/ S34A	1.0
50				1.9
80				2.6
100				5.2
150				5.6
200				6.6
250				8.0

S1A / S4A THRU S6A / S32A THRU S34A

NOTES:

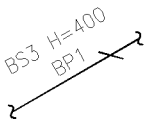
1. THERE ARE FABRICATION AND INSTALLATION DRAWINGS FOR EACH SUPPORT ON THIS SELECTION CHART.

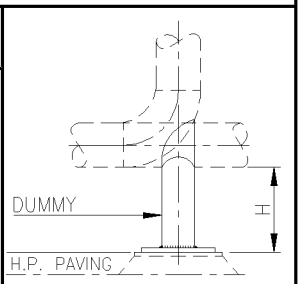
APPENDIX 4 BASE SUPPORTS - SELECTION CHART

BASE SUPPORTS

SEE ST. DWG. S 44.039

IDENTIFICATION EXAMPLE





H MIN. 300, MAX. 600 FOR BS1
H MIN. 300, MAX. 1300 FOR BS2 THRU BS8

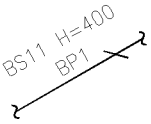
DN	DN DUMMY	TYPE	ALLOWABLE VERT. LOAD kN H 300–600 CS	300–600 SS	601–1300 CS	601–1300 SS
50	50	BS1	1.0	0.6		
80	50		3.0	1.2		
100	80	BS2	6.8	2.4	3.1	1.2
150	100	BS3	11.0	3.6	5.1	1.8
200	100					
	150	BS4	25.0	7.75	11.5	3.8
250	150					
	200	BS5	27.5	8.5	13.0	3.9
300	200					
	250	BS6	40.0	12.0	18.5	6.7
350	200	BS5	27.5	9.8	13.0	4.5
	250	BS6	40.0	14.5	18.5	6.6
	300	BS7	60.0	22.0	27.0	9.9
400	200	BS5	27.5	9.8	13.0	4.7
	250	BS6	40.0	14.25	18.5	6.7
	300	BS7	57.5	20.5	26.0	9.3
450	250	BS6	40.0	14.2	18.5	6.6
	300	BS7	57.5	20.5	26.0	9.4
	400	BS8	70.5	25.0	32.5	11.6
500	250	BS6	40.0	18.0	18.5	8.2
	300	BS7	57.5	25.0	26.0	11.6
	400	BS8	70.5	31.0	32.5	14.4
600	300	BS7	57.5	31.0	26.0	14.0
	400	BS8	70.5	38.5	32.5	17.7

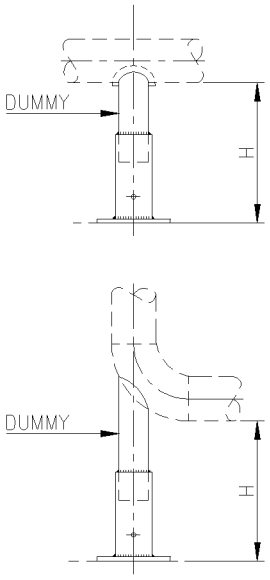
BS1 THRU BS8

ADJUSTABLE BASE SUPPORTS

SEE ST. DWG. S 44.040

IDENTIFICATION EXAMPLE





DN	DN DUMMY	TYPE	ALLOWABLE VERT. LOAD kN H 240–600 CS	240–600 SS	601–1300 CS	601–1300 SS
		BS9				
80	65					
100	80	BS10				
150	100	BS11				
200	100					
	150	BS12				
250	150					
	200	BS13	SEE BS1 THRU BS8			
300	200					
	250	BS14				
350	200	BS13				
	250	BS14				
	300	BS15				
400	200	BS13				
	250	BS14				
	300	BS15				
450	300	BS15				
	350	BS16				
	400	BS17				
500	300	BS15				
	350	BS16				
	400	BS17				
600	350	BS16				
	400	BS17				

BS9 THRU BS17

NOTES:

1. THERE ARE FABRICATION AND INSTALLATION DRAWINGS FOR EACH SUPPORT ON THIS SELECTION CHART.

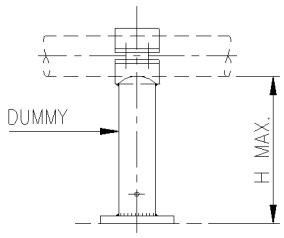
APPENDIX 5 CLAMPED BASE SUPPORTS - SELECTION CHART

CLAMPED BASE SUPPORT

SEE ST. DWG. S 44.041

IDENTIFICATION EXAMPLE

CB3 H=400 BP1



FOOTING TYPE

TYPE	DN DUMMY	ALLOWABLE VERT. LOAD kN H	
		300–600	601–1300
CB1	40	1.0	–
CB2	50	3.0	–
CB3	80	6.8	3.1
CB4	100	11.0	5.1
CB5	150	25.0	11.5
CB6	200	27.5	13.0
CB7	250	40.0	18.5
CB8	300	57.5	26.0
CB9	400	70.5	32.6

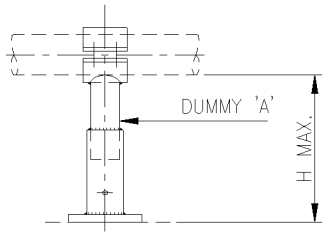
CB1 THRU CB9

ADJUSTABLE CLAMPED BASE SUPPORT

SEE ST. DWG. S 44.042

IDENTIFICATION EXAMPLE

ACB3 H=400 BP1



FOOTING TYPE

TYPE	DN DUMMY A	ALLOWABLE VERT. LOAD kN H	
		300–600	601–1300
ACB1	65	3.0	
ACB2	80	6.8	3.1
ACB3	100	11.0	5.1
ACB4	150	25.0	11.5
ACB5	200	27.5	13.0
ACB6	250	40.0	18.5
ACB7	300	57.5	26.0
ACB8	350	66.0	30.5
ACB9	400	70.5	32.6

ACB1 THRU ACB9

NOTES:

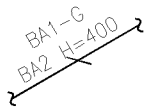
1. THERE ARE FABRICATION AND INSTALLATION DRAWINGS FOR EACH SUPPORT ON THIS SELECTION CHART.

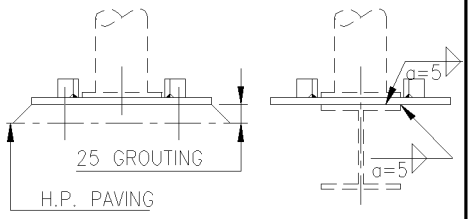
APPENDIX 6 BASE ANCHORS AND BASE PLATES - SELECTION CHART

DIR. BASE ANCHORS ON PAVING & STEEL

SEE ST. DWG. S 44.045

IDENTIFICATION EXAMPLE





ON PAVING ON STEEL

G – FOR TRANSVERSE GUIDE
D – FOR AXIAL GUIDE

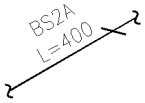
TYPE	TO BE USED WITH	MAX. AXIAL OR TRANSVERSE FORCE kN
BA1	BS1 THRU BS17 ACB1 THRU ACB9 CB1 THRU CB9	7.5
BA2		7.5
BA3		7.5
BA4		7.5
BA5		12.5
BA6		12.5
BA7		12.5
BA8		12.5

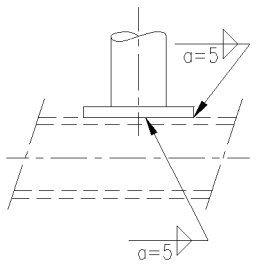
BA1 THRU BA8

BASE ANCHORS ON STEEL

SEE ST. DWG. S 44.046

IDENTIFICATION EXAMPLE





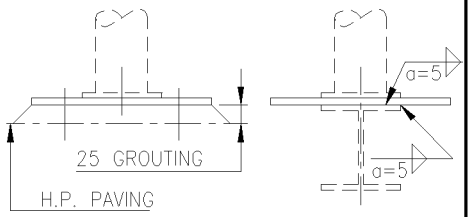
TYPE	MAX. ANCHOR FORCE kN (3 DIRECTIONS)
BS1A	3.0
BS2A	6.8
BS3A	11.0
BS4A	25.0
BS5A	27.5

BS1A THRU BS5A

BASE PLATES ON PAVING & STEEL

SEE ST. DWG. S 44.044

IDENTIFICATION EXAMPLE



ON PAVING ON STEEL

TYPE	TO BE USED WITH
BP1	BS1 THRU BS17 ACB1 THRU ACB9 CB1 THRU CB9
BP2	
BP3	
BP4	
BP5	
BP6	
BP7	

BP1 THRU BP7

NOTES:

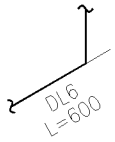
1. THERE ARE FABRICATION AND INSTALLATION DRAWINGS FOR EACH SUPPORT ON THIS SELECTION CHART.

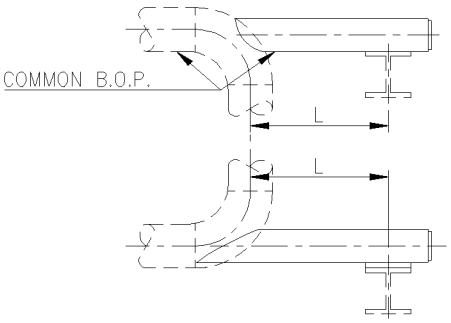
APPENDIX 7 DUMMY LEGS - SELECTION CHART

DUMMY LEGS

SEE ST. DWG. S 44.047

IDENTIFICATION EXAMPLE

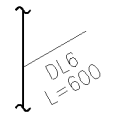


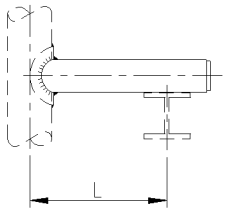


DL1 THRU DL8

SEE ST. DWG. S 44.048

IDENTIFICATION EXAMPLE





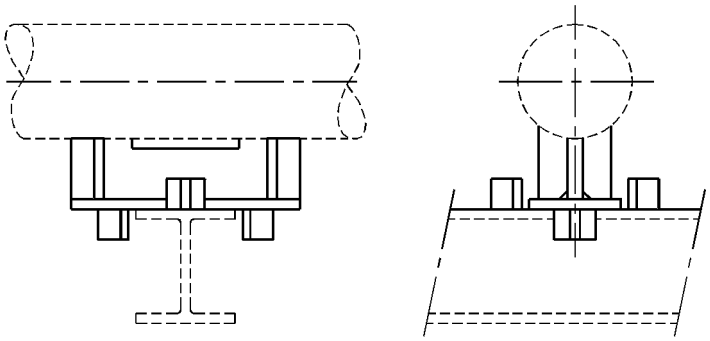
DL9 THRU DL16

DN	DN DUMMY	TYPE	ALLOWABLE VERT. LOAD kN					
			H					
			L=500		L=1000		L=1500	
			CS	SS	CS	SS	CS	SS
50	50	DL1/DL9	0.8	0.4				
80	50		1.1					
100	80	DL2/DL10	2.4	0.7	1.2	0.4	0.8	0.3
150	100	DL3/DL11	4.0	1.2	2.1	0.8	1.4	0.4
200	100		4.3		2.2		1.5	
	150	DL4/DL12	9.1	2.7	4.8	1.4	3.2	0.9
250	150		9.7		5.1		3.5	
	200	DL5/DL13	16.1	4.5	8.6	2.5	5.9	1.7
300	200		15.1		8.2		5.6	
	250	DL6/DL14	23.0	7.0	12.6	3.8	8.7	2.6
350	200		14.0	4.5	7.7	2.5	5.3	1.7
	250		21.2	6.9	11.8	3.8	8.2	2.6
	300	DL7/DL15	29.2	9.5	16.5	5.3	11.5	3.7
400	200		12.8	4.2	7.1	2.3	5.0	1.6
	250		19.5	6.4	11.0	3.5	7.6	2.5
	300		27.0	8.8	15.2	5.0	10.6	3.5
450	250		18.1	5.9	10.2	3.3	7.1	2.3
	300		25.0	8.2	14.2	4.6	10.0	3.2
	350	DL8/DL16	28.0	12.5	22.1	7.2	15.5	5.0
500	250		17.0	6.9	9.5	3.9	6.7	2.7
	300		23.4	9.5	13.5	5.5	9.4	3.8
	400		28.0	14.6	20.8	8.5	14.6	6.0
600	300		21.0	10.4	12.0	6.0	8.5	4.2
	400		28.0	16.0	18.7	9.3	13.2	6.6

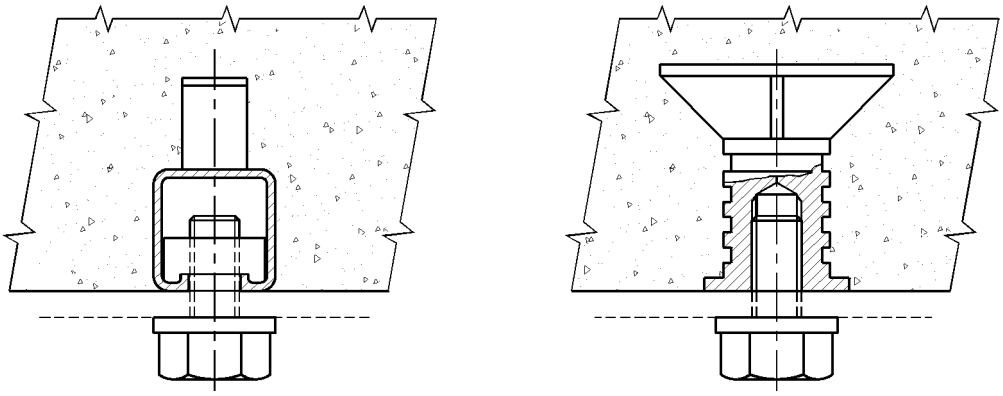
NOTES:

1. THERE ARE FABRICATION AND INSTALLATION DRAWINGS FOR EACH SUPPORT ON THIS SELECTION CHART.

APPENDIX 8 TYPICAL DETAILS



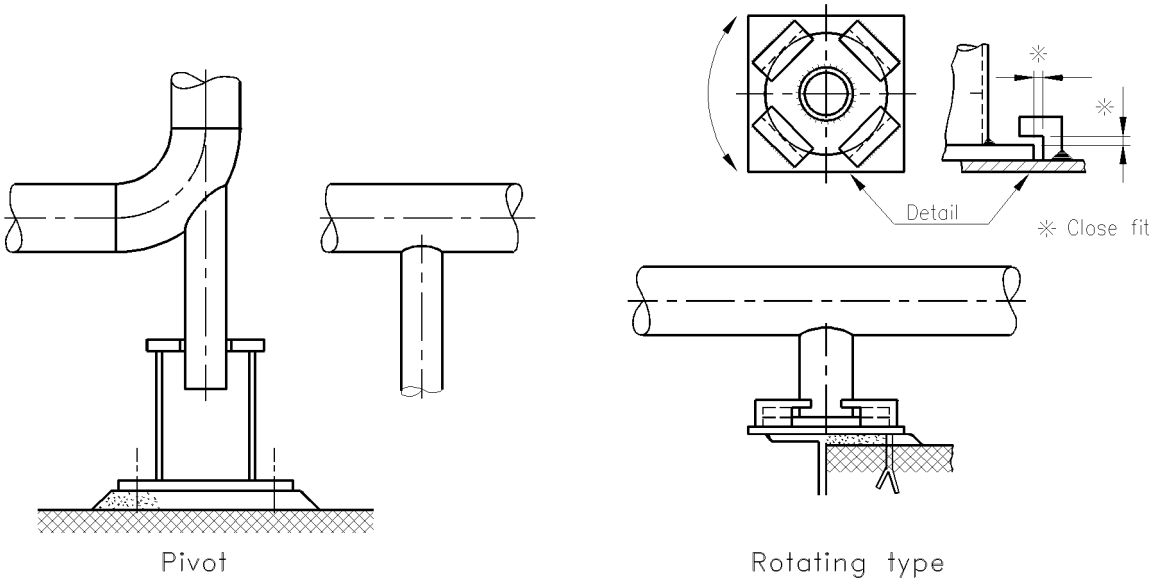
Pipe stop
(see also appendix 2 and 3)



Channel type

Threaded type

Inserts



Pivot

Detail

* Close fit

Rotating type