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Petroleum, petrochemical and natural gas industries — Bulk material for offshore projects — Pipe support

Industries pétrolière, pétrochimique et du gaz naturel — Matériels de base pour les projets en mer — Supports de tuyauterie

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 12 *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document aims to provide a set of unified specifications for pipe supports for offshore projects, responding to the current lack of recognized specifications for such pipe supports in terms of shape, dimensions, material and application area.

Company specific standards from owners, engineering companies and shipbuilders have therefore been prevailing for specifications related to pipe support types, shapes, sizes and dimensions. There are big variations in specifications from project to project, because of lack of internationally recognized specifications within this area.

Thus, individual pipe support items have often failed to be compatible across different projects. A suggested solution is to apply one unified approach for design, material selection, shape and application, etc. This will also significantly reduce engineering hours and lead times and improve the fabrication efficiency. Other expected benefits are improved practice for design and application of pipe support types related to design life, maintainability and integrity. The ultimate goal is to reduce the overall cost in general offshore projects and lead time while increase the efficiency, interoperability and safety.

In the lack of common industrial specifications for pipe supports, an assessment has been conducted to compare the pipe supports designs and application areas used in past offshore projects. Based on the supports design examples of those projects, a set of unified specifications have been established, which are described in this document.

The main factors considered to arrive at an optimal design of pipe supports are pipe load endurance, weight and material cost. Those three factors have been considered when reviewing pipe supports from past projects and ultimately defining the requirements described in this document.

The requirements including design and dimensions specified in this document are based on the use of H-beam or plate that are commonly used as sections. When an unlisted material or section is used, the designer is responsible for demonstrating the validity of the allowable stress and other limits used in design.

This document can be used as a baseline for suppliers and engineering companies that do not already have a more comprehensive and usable standard for both greenfield and brownfield projects.

Petroleum, petrochemical and natural gas industries — Bulk material for offshore projects — Pipe support

1 Scope

This document specifies the requirements for design including shape and dimensions, material as well as strength for pipe support. Applicable pipe size range varies depending on support types. This document covers topside systems for fixed or floating offshore oil and gas projects. This document is applicable to design temperature of support within the range between –46 °C up to 200 °C.

This document is limited to metallic pipes, covering the following pipe supports:

— clamped shoe;

— welded shoe;

— U-bolt;

— U-strap;

— bracing for branch connection;

— trunnion and stanchion;

— guide support (guide, hold-down, guide and hold-down, line stop).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ASTM A193, *Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications*

ASTM A194, *Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1.1
allowable load
maximum load that each support can withstand under static load conditions

Note 1 to entry: For dynamic loads induced by occasional or extreme conditions, the maximum allowable load can be increased by applying allowable increase factor in accordance with project specification or international code.

3.1.2
bracing for branch connection
reinforcement used to avoid fatigue failure due to the vibration from the parent pipe

3.1.3
bracket
main 'U'-shaped part of *U-strap* (3.1.20) that is in contact with the protection

3.1.4
grip type
type of *U-bolt* (3.1.19) without any allowances for the inside pipe to move

3.1.5
guide support
support used to restrict lateral movement of pipe

3.1.6
guide and hold-down
support used to restrict vertical and lateral movement of pipe

3.1.7
gusset
plates placed between pipe and base plate in lateral direction of pipe to resist any load transferred to piping

3.1.8
hold-down
support used to restrict vertical movement of pipe

3.1.9
line-stop
support used to restrict axial movement of pipe

3.1.10
machine bolt
threaded bolt with a square or hexagonal head

3.1.11
non-grip type
type of *U-bolt* (3.1.19) that gives some allowance for the inside pipe to move vertically and laterally with a maximum gap of 3 mm

3.1.12
pipe shoe
structure consisting of a saddle and integral base that is used to support the pipe by transmitting the load or forces to the adjacent structure

Note 1 to entry: The pipe shoe can be divided into clamped shoe and welded shoe.

3.1.13
protection pad
pad to prevent damages caused from direct contact between pipe and structural support

Note 1 to entry: If anti-vibration function is required, it can be replaced by anti-vibration material.

3.1.14
rib plate
plate placed between pipe and base plate in axial direction of pipe to resist any load transferred to piping

3.1.15
slotted hole
extension of hole for bolts allowing lateral movement

3.1.16
stanchion
extended pipe resting on floor or structure vertically

3.1.17
strip
thin pad, typically made of non-water retaining material for clamp and anti-mechanical vibration for *U-strap* (3.1.20), under the strap used to prevent fretting and other vibration between pipe and strap

3.1.18
trunnion
pipe extended hung on structure or spring

3.1.19
U-bolt
commonly used pipe support type in the shape of the letter "U" with screw threads on both ends

Note 1 to entry: The U-bolt can be divided into *grip type* (3.1.4) and *non-grip type* (3.1.11).

3.1.20
U-strap
commonly used pipe support designed to absorb mechanical vibration from piping by inserting anti-mechanical vibration material

Note 1 to entry: The U-strap can be divided into type A and type B (see 5.4).

3.1.21
wear pad
protection plate or pipe fixture or structural attachment attached to pipe to enhance strength of pipe wall and to prevent direct damages from welded attachment or high bearing load

3.1.22
weep hole
small opening, typically located at the bottom of the object, that allows water or gas to drain from within an assembly and checks pipe leakage within an assembly

3.2 Abbreviated terms

AIV	acoustic induced vibration
CRA	corrosion resistant alloy
CS	carbon steel
LTCS	low temperature carbon steel
NPS	nominal pipe size
PTFE	polytetrafluoroethylene
UV	ultra-violet

4 General

The pipe supports described in this document are applicable to the pipes designed according to the following:

— ASME B16.5 for pipe flanges and flanged fittings;

— ASME B16.9 for factory-made wrought butt welding fittings;

— ASME B16.10 for face-to-face and end-to-end dimensions of valves;

— ASME B16.19 for stainless steel pipe;

— ASME B16.47 for large diameter steel flanges;

— ASME B18.2.4 for metric bolt and nuts;

— ASME B31.3 for process piping;

— ASME B36.10M for welded and seamless wrought steel pipe.

Internationally recognized piping codes and standards are applicable for welding of pipe support attachments (including wear pads, trunnions and pipe shoes) with the pipe.

5 Support selection guideline

This clause provides a guideline to select the appropriate type of support depending on different criteria. The actual selection may be different from this guidance, depending on the client's requirements, project specification and pipe material.

Generally proper support should be selected depending on:

a) required movement restraint;

b) forces and loads at point of support;

c) pipe insulation;

d) structural limitations / restrictions.

Support can be generally selected from Table 1 depending on pipe size and insulation.

Table 1 — Possible support selection

Pipe size	Insulation	Priority level	Type
Pipe NPS 8 and below	Insulated	Priority	Welded shoe
		Alternative	Clamped shoe [a] / U-bolt [a,b] / U-strap [a,b]
	Uninsulated	Priority	U-bolt [a,b] / U-strap [a] / Direct resting on structure
		Alternative	Clamped shoe / Welded shoe
Pipe NPS 10 and above	Insulation	Priority	Welded shoe
		Alternative	Clamped shoe [c]
	Uninsulated	Priority	Welded shoe / Direct resting on structure
		Alternative	Clamped shoe [c]

All support type should be verified not to exceed maximum allowable load.

The type directly resting on structure should include proper isolation between the pipe and the structure.

NOTE 1 Supporting method will be more specified as resting/hold down/guide/line stop as per pipe stress analysis.

NOTE 2 Trunnion type of support are same priority with welded shoe.

[a] System operating temperature shall be within the temperature range of contacted coating material.

[b] U-bolt can be selected only if partial absence of insulation on U-bolt section is allowed such as personal protection .

[c] Welded shoe to be a priority when stopper is required.

6 Design and material requirements

6.1 Clamped shoe

6.1.1 Key parameters

The key parameters of the clamped shoe are:

— shape;

— dimension;

— material;

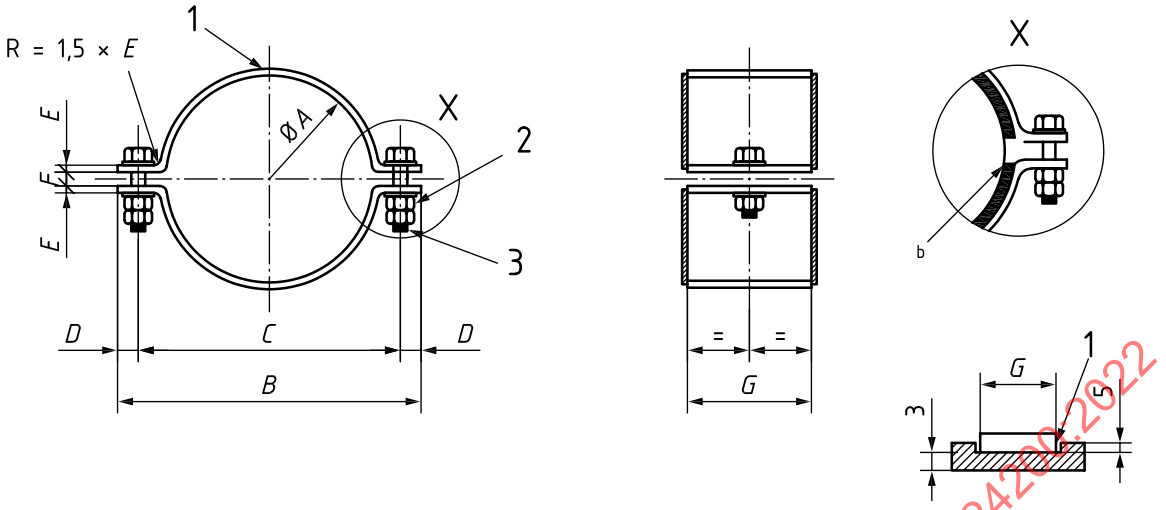
— application;

— allowable load.

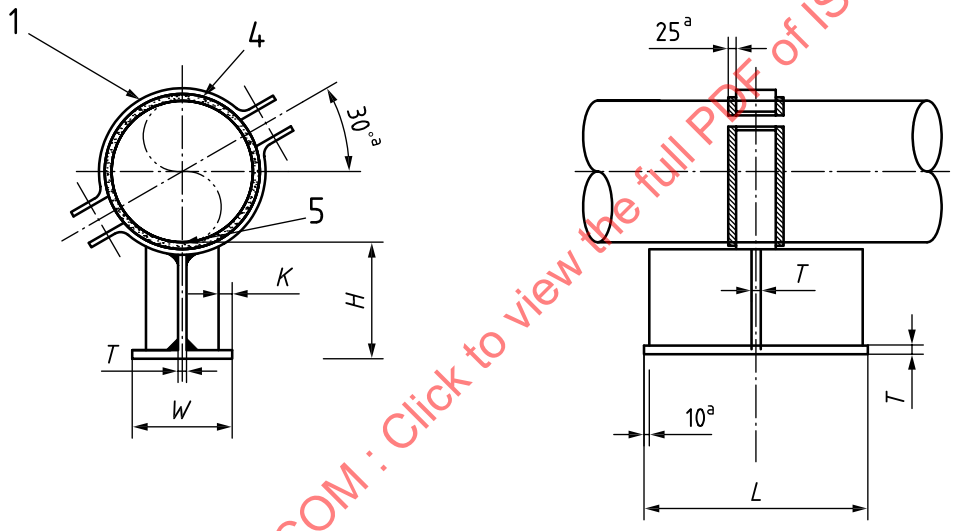
6.1.2 Size/Dimension

Figure 1 shows the design specification of clamped shoe used for steel/non-ferrous NPS 2 to NPS 36. Table 2 presents the dimensions, as also shown in Figure 1, including standard length and height of clamped shoe for different pipe sizes.

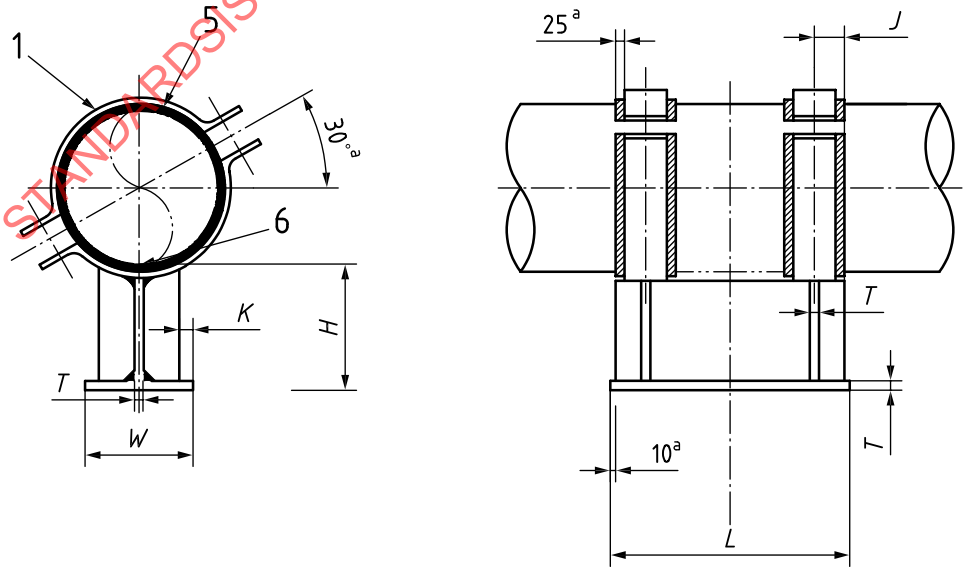
Dimensions in millimetres



a) Clamp detail (typical)



b) For pipe NPS 2



c) For pipe NPS 3 to NPS 36

Key

1 clamp
2 nut
3 machine bolt
4 3 mm thickness strip (non-water retaining and anti-mechanical vibration material)
5 bottom of pipe
[a] Typical.
[b] Strip to be fabricated as 2 pieces with cut ring at this corner.

Height, *H*, shall be indicated on isometric drawing, if greater than 100 mm with a maximum of 175 mm.

All welds shall be 6 mm of welding leg continuous fillet, unless specified otherwise.

Clamp material should be in accordance with ASTM A36 or equivalent material (e.g. JIS SS400 per JIS G3101).

For machine bolt, at least two threads of bolt shall be protruded at the end of nut.

Dimensions shown in Table 2 are based on 3 mm thickness of strip. It shall be recalculated upon on the material and thickness.

NOTE Length, *L*, can be increased or decreased, if required when indicated on isometric drawing.

Figure 1 — Design specification of clamped shoe used for steel/non-ferrous NPS 2 to NPS 36

Table 2 — Dimensions of clamped shoe for different pipe sizes

Pipe	Length *L* mm		ΦA	Dimension											Bolt		Allowable load kN
				B	C	D	E	F	G	H	J	K	T	W			
NPS	Standard	Long		mm												inch	Vertical
2	200	300	66	152	120	16	5	12	30	100	40	25	10	80	M12	1/2	5,5
3	200	300	95	192	160	16	8	16	30	100	40	25	10	100	M12	1/2	19
4	250	300	120	236	196	20	8	16	40	100	45	25	10	120	M16	5/8	24
6	250	350	174	310	264	23	10	20	40	100	45	25	10	140	M20	3/4	25
8	300	400	225	360	316	22	10	20	40	100	45	25	10	180	M20	3/4	25
10	300	400	279	448	390	29	12	24	50	100	50	25	10	220	M24	1	32
12	300	400	330	560	470	45	15	34	50	100	50	25	10	260	M24	1	41
14	300	400	362	618	510	54	15	40	65	100	58	35	15	300	M24	1	84
16	300	400	412	668	560	54	15	40	65	100	58	35	15	370	M24	1	90
18	350	400	463	718	610	54	15	40	65	100	58	35	15	370	M24	1	91
20	350	450	514	788	680	54	20	40	65	100	58	35	15	420	M36	1 1/2	106
24	400	450	616	898	790	54	20	40	80	100	65	35	15	470	M36	1 1/2	122
26	400	450	666	988	880	54	25	40	80	100	65	45	15	540	M36	1 1/2	147
28	450	550	717	1 038	930	54	25	40	80	100	65	45	15	560	M36	1 1/2	150
30	450	550	768	1 092	984	54	25	40	80	100	65	45	15	610	M36	1 1/2	158
32	450	550	819	1 140	1 030	55	25	40	110	100	80	55	15	620	M36	1 1/2	175
34	500	600	870	1 180	1 070	55	25	40	110	100	80	55	15	640	M36	1 1/2	188
36	500	600	920	1 220	1 110	55	25	40	110	100	80	55	15	660	M36	1 1/2	193

6.1.3 Material

Material for all the associated parts, including clamp, base plate, gusset and rib plate, shall be of carbon steel for all pipes. Other material may be used instead of carbon steel in case of specific requirements.

6.1.4 Application

Lines sizes listed in Figure 1 can be applicable with clamped shoe.

The clamped shoe may be used as guide, but torque should be calculated and defined depending on project. The clamped shoe shall not be used for anchor or axial stops without lugs on pipe.

6.2 Welded shoe

6.2.1 Key parameters

The key parameters of the welded shoe are:

— shape;

— dimension;

— material;

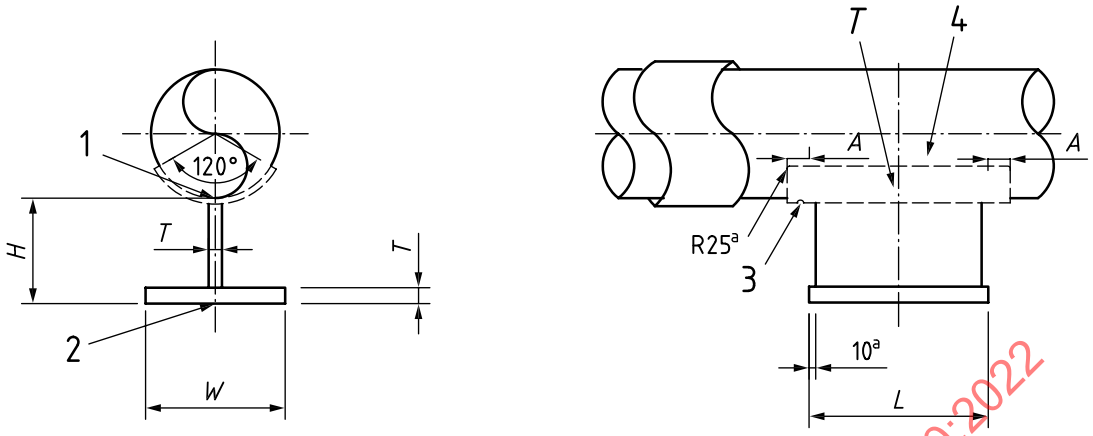
— application;

— allowable load.

6.2.2 Size/Dimension

Figure 2 shows the design specification of welded shoe used for pipes of up to NPS 2. Table 3 presents the dimensions, as also shown in Figure 2, including standard length and height of welded shoe for different pipe sizes.

Dimensions in millimetres



Key

1 bottom of pipe
2 top of steel
3 6 mm weep hole
4 wear pad
a Typical.

For NPS 2 and below, wear pad shall be applied for thin wall pipe (SCH. 10S and below for CRA material, and SCH. 30 and below for CS material).

For wear pad thickness for pipe thickness less than 10 mm, the same thickness as parent pipe shall be used; otherwise 10 mm or higher thickness should be used.

Height, *H*, shall be noted on isometric drawing, if greater than 100 mm.

All welds shall be 6 mm of welding leg continuous fillet, unless specified otherwise.

All weep holes shall be sealed with mastic (resin) after hydro test. The mastic shall be watertight, UV resistant and also able to endure pipe operating temperature as a minimum requirement.

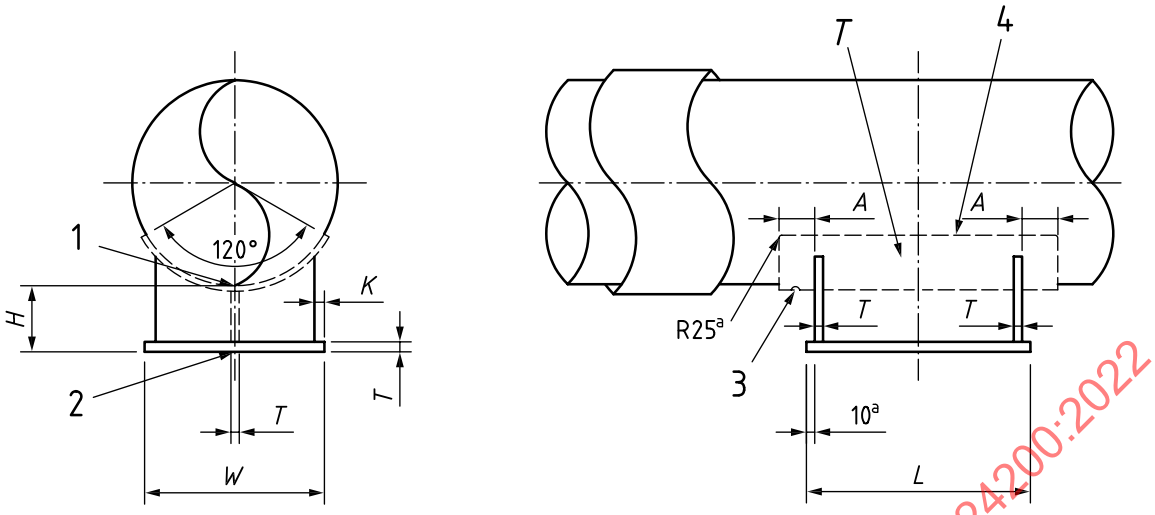
For pipes of NPS 2, gussets are not required. If the shoe length is more than 500 mm, an additional gusset shall be added.

NOTE Length, *L*, can be increased or decreased, if required when indicated on isometric drawing.

Figure 2 — Design specification of welded shoe used for pipes of NPS 2

Figure 3 shows the design specification of welded shoe used for pipes of from NPS 3 to NPS 30. Table 3 presents the dimensions, as also shown in Figure 3, including standard length and height of welded shoe for different pipe sizes.

Dimensions in millimetres



Key

1 bottom of pipe
2 top of steel
3 6 mm weep hole
4 wear pad
a Typical.

For NPS 30 and below, wear pad shall be applied for thin wall pipe (SCH. 10S and below for CRA material, and SCH. 30 and below for CS material).

For wear pad thickness for pipe thickness less than 10 mm, the same thickness as parent pipe shall be used; otherwise 10 mm or higher thickness should be used.

Height, *H*, shall be noted on isometric drawing, if greater than 100 mm.

All welds shall be 6 mm of welding leg continuous fillet, unless specified otherwise.

All weep holes shall be sealed with mastic(resin) after hydro test. The mastic shall be watertight, UV resistant and also able to endure pipe operating temperature as a minimum requirement.

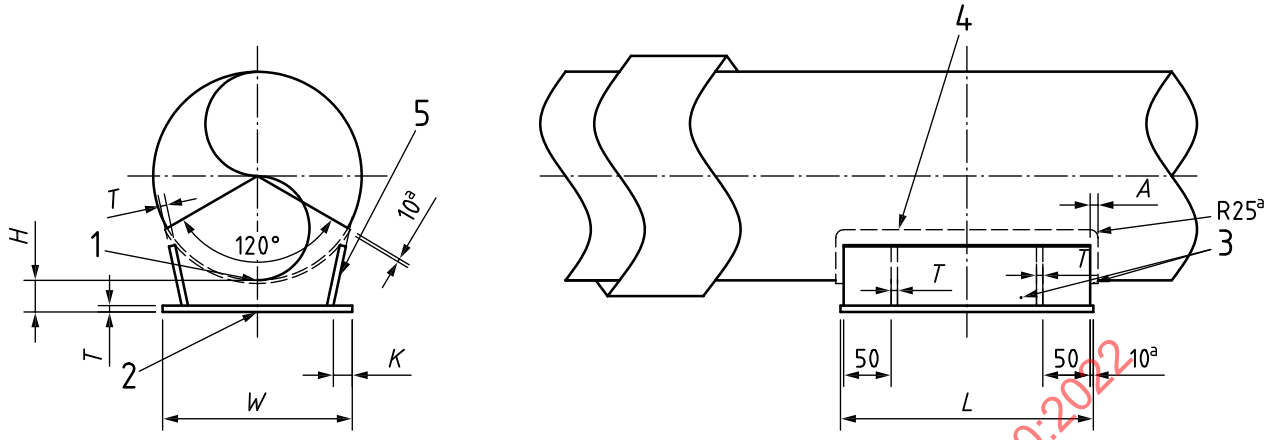
For pipes from NPS 3 to NPS 30, shoe shall have two gussets located in symmetrical distance in the centre of the shoe. If the shoe length is more than 500 mm, an additional gusset shall be added.

NOTE Length, *L*, can be increased or decreased, if required when indicated on isometric drawing.

Figure 3 — Design specification of welded shoe used for pipes of from NPS 3 to NPS 30

Figure 4 shows the design specification of welded shoe used for pipes of from NPS 32 to NPS 36. Table 3 presents the dimensions, as also shown in Figure 4, including standard length and height of welded shoe for different pipe sizes.

Dimensions in millimetres



Key

1 bottom of pipe
2 top of steel
3 6 mm weep hole
4 wear pad thickness
5 gusset
a Typical.

For wear pad thickness for pipe thickness less than 10 mm, the same thickness as parent pipe shall be used; otherwise 10 mm or higher thickness should be used.

Height, *H*, shall be noted on isometric drawing, if greater than 100 mm.

All welds shall be 6 mm of welding leg continuous fillet, unless specified otherwise.

All weep holes shall be sealed with mastic(resin) after hydro test. The mastic shall be watertight, UV resistant and also able to endure pipe operating temperature as a minimum requirement.

For pipes from NPS 32 to NPS 36, shoe shall have two gussets located in symmetrical distance in the centre of the shoe.

NOTE Length, *L*, can be increased or decreased, if required when indicated on isometric drawing.

Figure 4 — Design specification of welded shoe used for pipes of from NPS 32 to NPS 36

Table 3 — Dimensions of welded shoe for different pipe sizes

Pipe size	**Length *L*** mm		**Width *W*** mm	**Height *H*** mm	**Dimension**			**Allowable load** kN
NPS	Standard	Long		Standard	**A** mm	**K** mm	**T** mm	Vertical
2	200	300	60	100	25	25	10	7
3	200	300	100	100	25	25	10	10
4	250	300	120	100	25	25	10	17
6	250	350	140	100	25	25	10	25
8	300	400	180	100	25	25	10	27
10	300	400	220	100	25	25	10	30
12	300	400	260	100	25	25	10	32
14	300	400	300	100	25	35	15	54
16	300	400	370	100	25	35	15	58
18	350	400	370	100	25	35	15	65
20	350	450	420	100	25	35	15	98
24	400	450	470	100	25	35	15	100

Table 3 *(continued)*

Pipe size	Length *L* mm		Width *W* mm	Height *H* mm	Dimension			Allowable load kN
NPS	Standard	Long		Standard	A mm	K mm	T mm	Vertical
26	400	450	540	100	25	55	15	155
28	450	550	560	100	25	55	15	158
30	450	550	610	100	25	55	15	163
32	450	550	700	100	25	70	15	240
34	500	600	730	100	25	70	15	243
36	500	600	770	100	25	70	15	248

Table 4 presents the assumption that has been used to calculate the maximum allowable loads.

Table 4 — Calculation hypothesis for maximum allowable loads of welded shoes

Rating	Material	Size	Schedule	Temperature	Pressure
150	ASTM A106	2 NPS to 6 NPS	S/40	100 °C	1 800 000 Pa
		8 NPS to 36 NPS	S/20		

6.2.3 Material

Tables 5 and 6 show the material specification for each part of the welded shoe without and with wear pad, respectively. Any plate welded to the pressure boundary shall be of the same material of the pipe.

Table 5 — Material specification for welded shoe without wear pad

Pipe	Rib plate and stiffener	Base plate
CS and LTCS	Same or equivalent to parent pipe	ASTM A36 or equivalent
Galvanized CS		
Stainless steel, duplex stainless steel, super duplex stainless steel		

Table 6 — Material specification for welded shoe with wear pad

Pipe	Wear pad	Rib plate and stiffener	Base plate
CS and LTCS	Same or equivalent to parent pipe	CS	ASTM A36 or equivalent
Galvanized CS		Galvanized CS or CS	
Stainless steel, duplex stainless steel, super duplex stainless steel		Carbon steel or stainless steel	

6.2.4 Application

The welded shoe can be applied at:

— all insulated lines;

— all uninsulated slope lines of NPS 2 and above.

Application of welded pipe shoe shall be minimized for lines having risks of AIV. Either clamped shoe or full encirclement of wear pad may be used for this purpose, provided that asymmetric discontinuity between pipe and wear pad to damp-out the level of shell vibration is avoided.

6.3 U-bolt

6.3.1 Key parameters

The size of the U-bolt is described by the size of pipe it supports (e.g. an NPS 2 U-bolt means it supports an NPS 2 nominal diameter pipe). The non-grip type gives some allowance for the inside pipe to move vertically and lateral with a gap of 3 mm. Grip type U-bolts may be applied for NPS 4 and below size pipe. Non-grip type U-bolts may be applied for NPS 8 and below size pipe.

The key parameters of the U-bolt are:

— material type(bolt/nut/washer);

— thread dimensions (e.g. M12) (length and diameter);

— inside dimension (i.e. the distance between two legs);

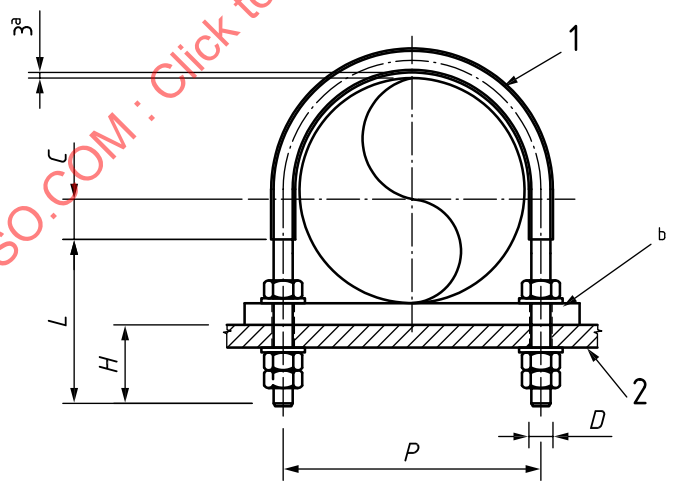
— inside height;

— allowable load.

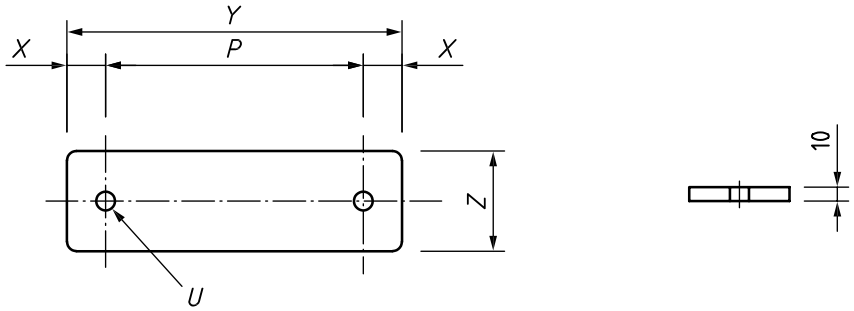
6.3.2 Size/Dimension

Figure 5 shows the design specification of U-bolt for non-grip type. Table 7 presents, as also shown in Figure 5, the dimensions of non-grip type U-bolt for different pipe sizes.

Dimensions in millimetres



a) Overall design



b) Design of isolation pad, 10 mm thickness, white colour

Key

1	polytetrafluoroethylene (PTFE) coating, thickness	2 mm[a]	Typical.
2	existing steel	[b]	See Figure 5 b) for details.

Isolation pad shall be provided with U-bolts as assembly.

One additional nut (3 in total) shall be used to prevent nut loose.

Size M8 and below of U-bolt shall be B8M per ASTM A193. Size M10 and above shall be B7 per ASTM A193.

Nut for size up to M8 shall be of 8M as per ASTM A194.

Nut for size M10 and above shall be of 2H as per ASTM A194.

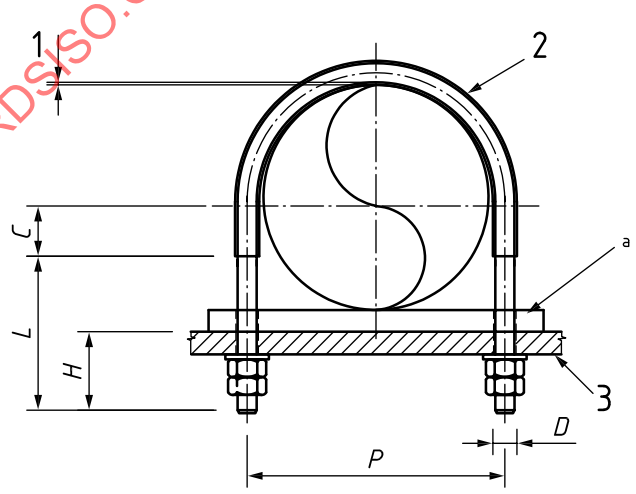
Figure 5 — Design specification of non-grip type U-bolt

Table 7 — Dimensions of non-grip type U-bolt for different pipe sizes

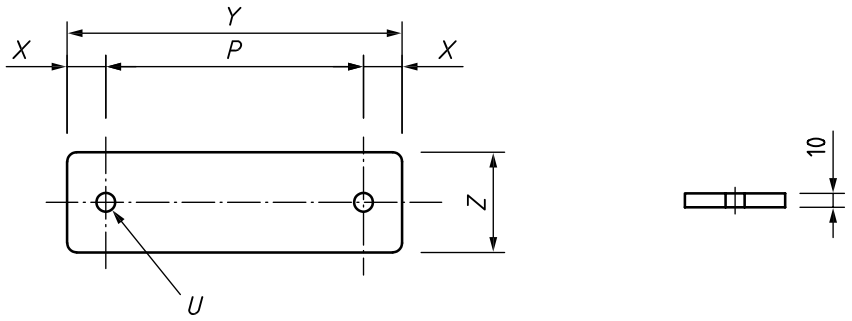
Line size NPS	Pipe out-side diameter mm	U-bolt / nut mm	Dimension									Lateral load kN	Vertical load kN	Weight kg
			P mm	D mm	C mm	L mm	H mm	U mm	X mm	Y mm	Z mm			
1/2	21,4	M8	39	8	2	51	32	10	20	79	40	1,37	1,47	0,1
3/4	26,7	M8	45	8	3	52	32	10	20	85	40	1,11	1,38	0,3
1	33,4	M8	51	8	5	55	33	10	20	91	40	0,89	1,25	0,6
1 1/2	48,3	M10	68	10	7	63	35	12	25	118	50	4,14	6,65	0,4
2	60,3	M10	80	10	10	66	35	12	25	130	50	3,21	5,55	0,5
3	88,9	M12	111	12	16	78	40	14	25	161	50	3,42	6,37	0,7
4	114,3	M16	140	16	20	97	49	18	30	200	60	6,48	12,08	1,0
6	168,3	M16	194	16	34	110	49	18	30	254	60	3,32	6,92	2,0
8	219,1	M20	249	20	45	130	55	22	35	319	70	5,03	10,58	2,3

Figure 6 shows the design specification of U-bolt for grip type. Table 8 presents, as also shown in Figure 6, the dimensions of grip type U-bolt for different pipe sizes.

Dimensions in millimetres



a) Overall design



b) Design of isolation pad, 10 mm thickness, white colour

Key

1	no gap	3	existing steel
2	polytetrafluoroethylene (PTFE) coating, thickness	2 mm[a]	See Figure 6 b) for details.

Isolation pad shall be provided with U-bolts as assembly.

One additional nut (2 in total) shall be used to prevent nut loose.

Size M8 and below of U-bolt shall be B8M per ASTM A193. Size M10 and above shall be B7 per ASTM A193.

Nut for size up to M8 shall be of 8M as per ASTM A194.

Nut for size M10 and above shall be of 2H as per ASTM A194.

Figure 6 — Design specification of grip type U-bolt

Table 8 — Dimensions of grip type U-bolt for different pipe sizes

Line size NPS	Pipe outside diameter mm	U-bolt / nut mm	Dimension									Later-al kN	Vertical load kN	Weight kg
			P mm	D mm	C mm	L mm	H mm	U mm	X mm	Y mm	Z mm			
1/2	21,4	M8	39	8	5	47	32	10	20	79	40	1,37	1,47	0,1
3/4	26,7	M8	45	8	6	49	32	10	20	85	40	1,11	1,38	0,3
1	33,4	M8	51	8	8	51	32	10	20	91	40	0,89	1,25	0,6
1 1/2	48,3	M10	68	10	10	60	35	12	25	118	50	4,14	6,65	0,4
2	60,3	M10	80	10	13	61	35	12	25	130	50	3,21	5,55	0,5
3	88,9	M12	111	12	19	72	40	14	25	161	50	3,42	6,37	0,7
4	114,3	M16	140	16	23	89	49	18	30	200	60	6,48	12,08	1,0

6.3.3 Application

Use of U-bolts should be avoided in services with extreme vibration.

6.4 U-strap

6.4.1 Key parameters

The type of U-strap can be classified into two types:

1) type A: fixed type, no slotted hole in bolt hole;

2) type B: this type allows for lateral movement due to a slotted hole in the bolt hole.

The key parameters of the U-strap are:

— strap dimension: length, radius, width and thickness;

— strip size;

— protection pad size;

— bolt/nut/washer size;

— isolation pad size;

— bracket size;

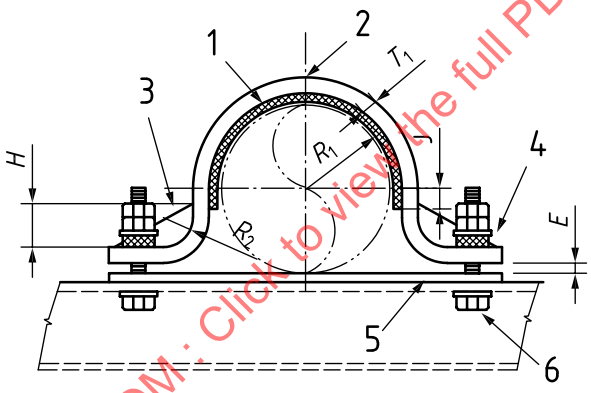
— material for strap, strip, protection pad, bolts/nuts/washers and isolation pad;

— allowable load.

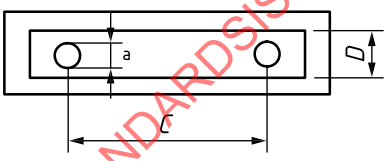
6.4.2 Size/Dimension

Figure 7 shows the design specification of U-strap for type A and type B. Table 9, as also shown in Figure 7, presents the dimensions of U-strap clamp type A and type B for different pipe sizes.

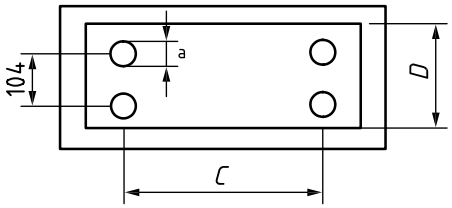
Dimensions in millimetres



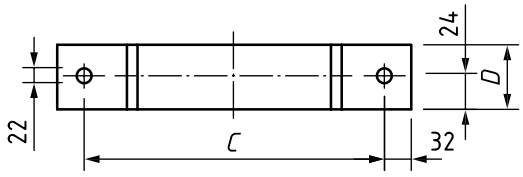
a) General design for U-strap



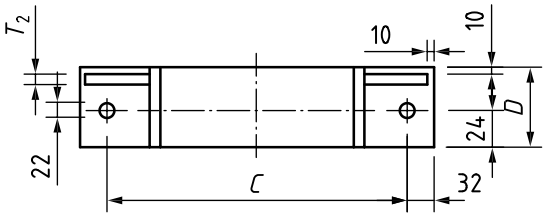
b) Design for isolation pad for pipe NPS ¾ to NPS 8



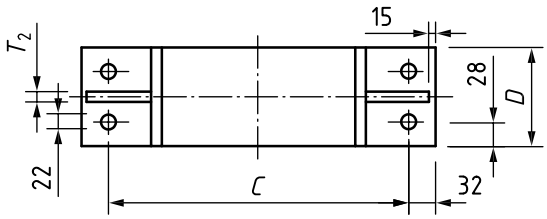
c) Design for isolation pad for pipe NPS 10



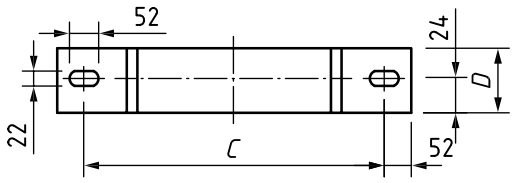
d) Design for clamp 'type A' for pipe NPS 3/4 to NPS 2



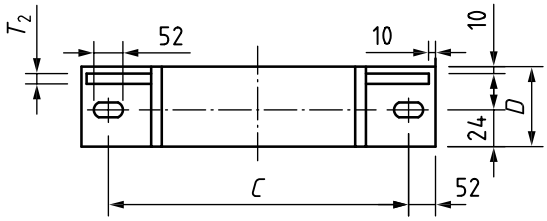
e) Design for clamp 'type A' for pipe NPS 3 to NPS 8



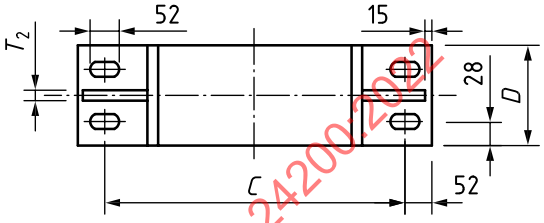
f) Design for clamp 'type A' for pipe NPS 10



g) Design for clamp 'type B' for pipe NPS 3/4 to NPS 2



h) Design for clamp 'type B' for pipe NPS 3 to NPS 8



i) Design for clamp 'type B' for pipe NPS 10

Key

1 strip, 3 mm thickness
2 clamp
3 bracket
4 protection pad, 12,7 mm thickness, bonded to washer
5 isolation pad, 6 mm thickness
6 machine bolt
[a] Bolt diameter + 2 mm.

Figure 7 — Design specification of U-strap clamp type A and type B

Table 9 — Dimensions of U-strap clamp type A and type B for different pipe sizes

Pipe size NPS	Dimension									Bolt size		Lateral load kN	Vertical load kN	Weight kg
	C mm	D mm	E mm	R_1 mm	R_2 mm	H mm	T_1 mm	T_2 mm	J mm	Diameter mm	Length mm			
$^3/_4$	118	48	10	13	6	-	6	-	-	M20	100	13,5	4,1	1,5
$1\ ^1/_2$	156	48	12	24	6	-	6	-	2		110	6,7	3,8	2,0
2	196	48	12	30	9	-	6	-	4		110	5,3	2,7	2,0
3	224	64	20	44	15	24	10	8	8		120	20,1	16,9	3,0
4	250	64	20	57	15	37	10	8	8		120	12,7	17,0	4,0
6	312	80	20	84	15	64	15	15	16		125	14,5	40,5	5,0
8	360	80	20	110	15	90	15	15	24		135	13,3	42,5	7,0
10	424	160	20	137	15	117	20	20	24	M22	140	22,3	88,9	10,0

Table 10 presents material specification for each part of U-strap.

Table 10 — Material specification for U-strap

Material	Specification
U-strap	ASTM A36 or equivalent material (e.g. JIS SS400 per JIS G3101)
Isolation pad 6 mm	PTFE
Strip	Anti-mechanical vibration material

Table 10 *(continued)*

Material	Specification
Bolt/Nut/Washer	B7 per ASTM A193/Grade 2H/F436 per ASTM A194
Protection pad	Anti-vibration material
Bracket	Same or equivalent to the U-strap

6.4.3 Application

U-straps shall be used in services subject or prone to vibration.

6.5 Bracing for branch connection

6.5.1 Key parameters

The key parameters of the bracing for branch connection are:

— brace types;

— wear pad size located between bracing and parent pipe;

— weep hole size on wear pad to allow escape of welding gas;

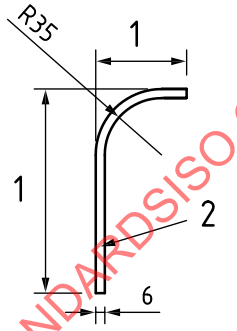
— material for bracing and wear pad;

— allowable load.

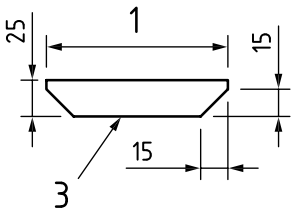
6.5.2 Size/Dimension

Figure 8 shows the design specification of bracing for branch connection type A to type C.

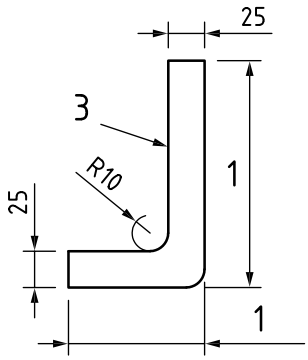
Dimensions in millimetres



a) Type 'A' – section view



b) Type 'B'



c) Type 'C'

Key

1 adjust to fit
2 steel width 40 mm
3 steel plate, 6 mm thickness

All material grades shall be compatible with pipe and fittings.

Bracing should be applied to small bore branch connections (NPS 2 and below) that ends with one or more valves.

Wear pad shall be applied for thin wall pipe (SCH. 10S and below for CRA material, and SCH. 30 and below for CS material). For wear pad thickness for pipe thickness less than 10 mm, the same thickness as parent pipe shall be used; otherwise 10 mm or higher thickness should be used.

All weep holes shall be sealed with mastic (resin) after hydro test. The mastic shall be watertight, UV resistant and also able to endure pipe operating temperature as a minimum requirement.

Unless otherwise specified on drawing, all welds shall be of continuous fillet welds with throat thickness of 0,7 × pipe wall thickness, but not exceeding 4 mm.

All material edges shall be rounded by R2 at the minimum.

NOTE Bracing is generally not required for the following cases:

— for hydro test vent and drain;

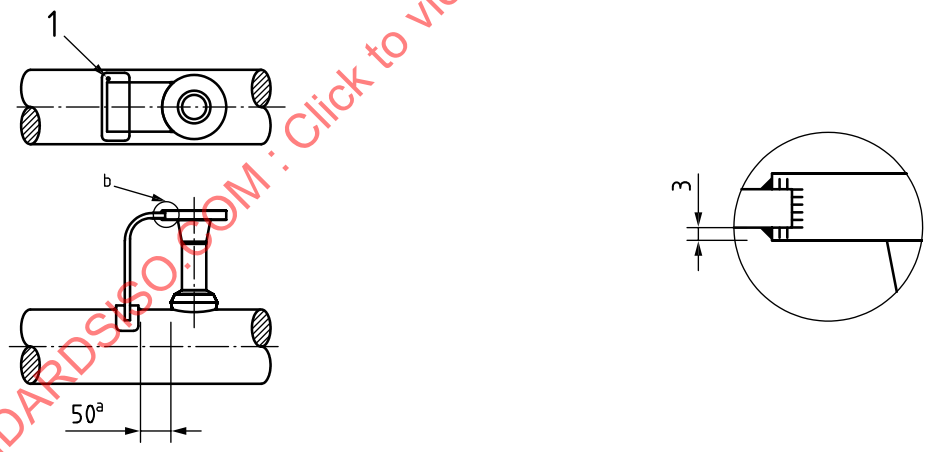
— for thermo-well (temperature transmitter and temperature gauge);

— for continuous pipe line (not open ended).

Figure 8 — Design specification of bracing for branch connection type A to type C

Figure 9 shows typical application of bracing for branch connection to header of NPS 4 and below.

Dimensions in millimetres



a) Overall design **b) Design for detail 2**

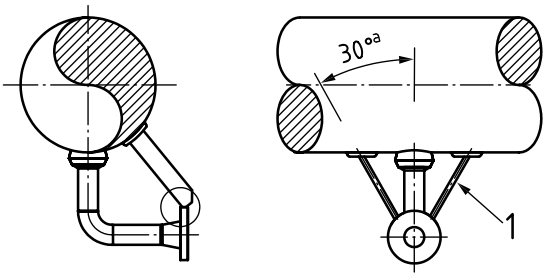
Key

1 weep hole, diameter 3 mm
a Minimum distance between pipe welds.
b See Figure 9 b) for details.

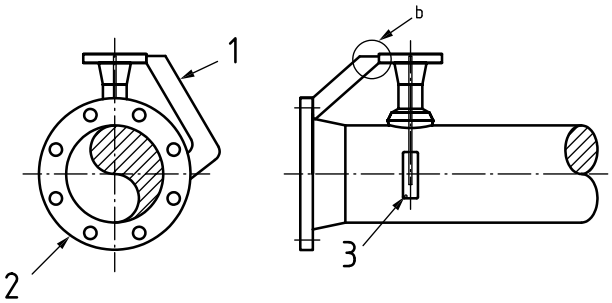
Figure 9 — Typical application of bracing for branch connection to header of NPS 4 and below

Figure 10 shows typical applications of bracing for branch connection to header of NPS 6 and above.

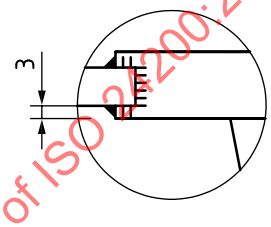
Dimensions in millimetres



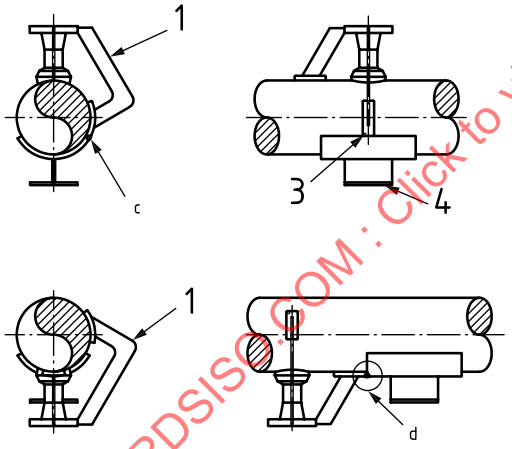
a) Application 1



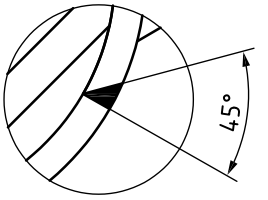
b) Application 2



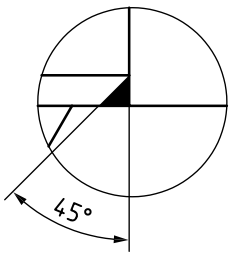
c) Design for detail 3



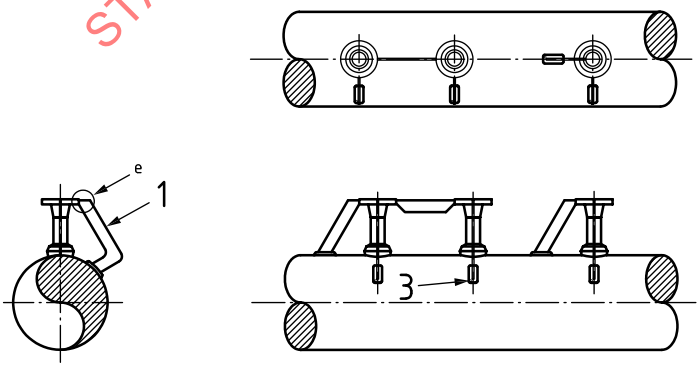
d) Application 3



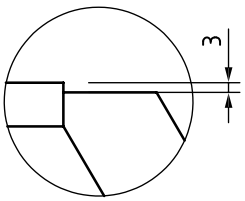
e) Design for detail 5



f) Design for detail 7



g) Application 4



h) Design for detail 8

Key

1	"type B" (or "type C")	a	Minimum.
2	flange	b	See Figure 10 c) for details.
3	weep hole, diameter 3 mm	c	See Figure 10 e) for details.
4	pipe shoe or trunnion	d	See Figure 10 f) for details.
		e	See Figure 10 h) for details.

The bracing shall be in two planes, connected between the small-bore pipe work and the main pipe. The bracing can be modified to Figure 9 if geometry does not allow two planes bracing.

"Type B" may be used instead of "Type C".

The applications 1 to 4 may be mixed in any combination.

NOTE Individual bracing can be installed to allow thermal expansion of main pipe associated branch pipes.

Figure 10 — Typical applications of bracing for branch connection to header of NPS 6 and above

6.5.3 Application

For other shape of bracing supports, the bracing support stiffness shall be at least as stiff as the branch connection.

6.6 Trunnion and stanchion

6.6.1 Trunnion

6.6.1.1 Key parameters

The key parameters of the trunnion support are:

— wear pad size and material;

— trunnion size and material;

— weep hole size;

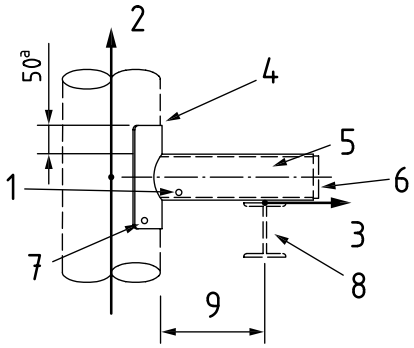
— base plate size and material;

— plate for cap size and material.

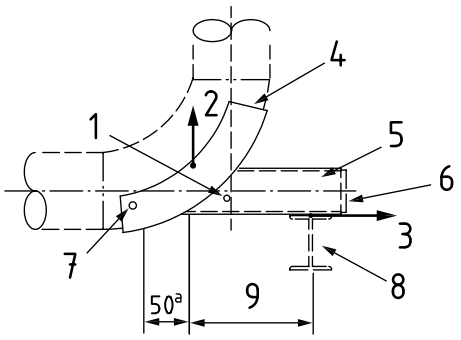
6.6.1.2 Design specification

Figure 11 shows the design specification of the trunnion support.

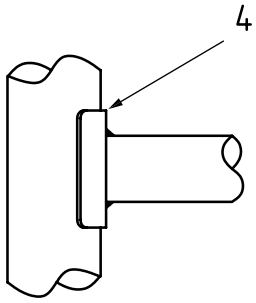
Dimensions in millimetres



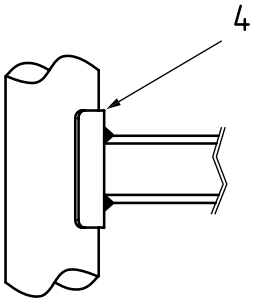
a) Pipe trunnion – pipe/beam section



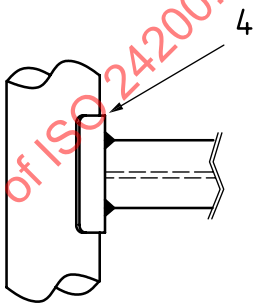
b) Elbow trunnion – pipe/beam section



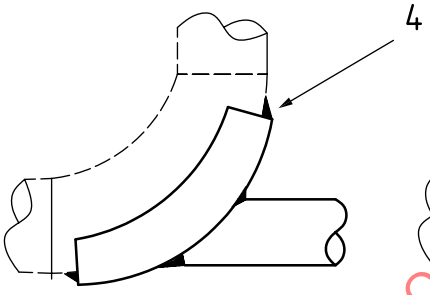
c) Pipe trunnion weld detail (pipe section)



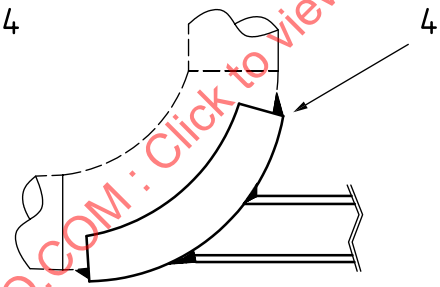
d) Pipe trunnion weld detail (H section Type A)



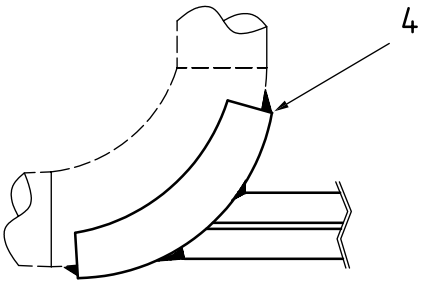
e) Pipe trunnion weld detail (H section Type B)



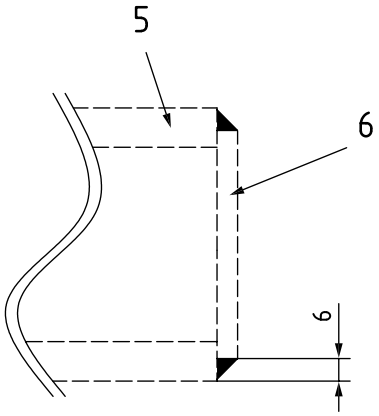
f) Elbow trunnion weld detail (pipe section)



g) Elbow trunnion weld detail (H section Type A)



h) Elbow trunnion weld detail (H section Type B)



i) Detail for end cap (pipe section)

Key

1 weep hole for pipe section

7 weep hole

2 load direction (axial)
3 load direction (horizontal)
4 wear pad
5 trunnion pipe/beam
6 end cap for pipe section
8 support/structure member
9 support length
[a] Minimum.
[b] Typical.

The weep hole should be located at bottom and away from contact point with structural steel work.

Support length shall be:

— no more than 600 mm for pipe size up to NPS 6;
— no more than 800 mm for pipe up to NPS 24;
— determined based upon the stress analysis.

Support length '9' may be increased or decreased, if required when indicated on isometric drawing.

All weep holes shall be sealed with mastic (resin) after hydro test. The mastic shall be watertight, UV resistant and also able to endure pipe operating temperature as a minimum requirement.

Wear pad shall be used only for pipe up to NPS 24 if required. For wear pad thickness for pipe thickness less than 10 mm, the same thickness as parent pipe shall be used; otherwise 10 mm or higher thickness should be used.

End caps shall be of 6 mm thickness at the minimum.

Weld leg length should be 6 mm, unless specified otherwise.

Figure 11 — Design specification of trunnion support

6.6.1.3 Material specification

Tables 11 and 12 show the material specification of the trunnion support with and without wear pad, respectively.

Table 11 — Material specification of trunnion support without wear pad

Pipe	Pipe section	H beam section	End plate
CS and LTCS	Same or equivalent to parent pipe	CS	ASTM A36 or equivalent
Stainless steel, duplex stainless steel, super duplex stainless steel		Same or equivalent to parent pipe or fabricated plates	

Table 12 — Material specification of trunnion support with wear pad

Pipe	Wear pad	Pipe section and H beam section	End plate
CS and LTCS	Same or equivalent to parent pipe	CS	ASTM A36 or equivalent
Stainless steel, duplex stainless steel, super duplex stainless steel		CS or equivalent to parent pipe or fabricated plates	

6.6.1.4 Dimensions

Tables 13 and 14 show the dimensions of the trunnion support for different pipe sizes.

Table 13 — Dimensions of trunnion support for straight pipe

Run pipe	Pipe section size		Beam section size	Pipe trunnion – Allowable load kN					
				Pipe section [a]			H section [b]		
NPS	NPS	SCH	(H×H×T_1×T_2) mm	Lateral	Horizontal	Axial	Lateral	Horizontal	Axial
2	$1\,^1/_2$	As per run pipe class (min. std)	H40×40×6×8	2	12,5	2	2	12,5	2
3	2		H50×50×6×8	3	20	4	5	20	6
4	3		H75×75×6×8	8	48	12	10	48	12
6	4		H100×100×6×8	12	73	19	19	73	19
8	6		H150×150×7×10	12	135	30	24	135	30
10				12	135	30	24	135	30
12	10		H200×200×8×12	35	190	100	48	230	60
14			H250×250×9×14	40	230	110	104	230	130
16	14		H300×300×10×15	56	280	160	144	280	180
18			H350×350×12×19	56	280	160	168	280	210
20	16		H400×400×13×21	69	300	200	240	300	300
24				69	300	200	240	300	300
28				90	400	200	240	400	300
30	20			120	500	300	304	500	380
32				120	500	300	304	500	380
34				120	500	300	304	500	380
36				120	500	300	304	500	380

[a] Allowable load for trunnion pipe is based on schedule STD CS pipe with 600 mm length up to NPS 6 run pipe and 800 mm length above NPS 6 run pipe. For pipes of other dimensions and design parameters, allowable load should be calculated separately.

[b] Allowable load for trunnion beam is based on strong axis of H section CS A36 grade with 600 mm length up to NPS 6 run pipe and 800 mm length above NPS 6 run pipe.

Table 14 — Dimensions of trunnion support for elbow

Run pipe	Pipe section size		Beam section size	Elbow trunnion - Allowable load kN					
				Pipe section [a]			H section [b]		
NPS	NPS	SCH	(H×H×T_1×T_2) mm	Lateral	Horizon-tal	Axial	Lateral	Horizon-tal	Axial
2	$1\,^1/_2$	As per run pipe class (min. std)	H40×40×6×8	2,5	12,5	3	2,5	12,5	3
3	2		H50×50×6×8	4,5	20	4,5	4,5	20	4,5
4	3		H75×75×6×8	9	48	10	9	48	10
6	4		H100×100×6×8	15	73	16	15	73	16
8	6		H150×150×7×10	23	125	29	38	125	48
10				23	135	29	38	135	48
12	10		H200×200×8×12	52,5	193	52	58	193	57
14			H250×250×9×14	65	235	70	137	235	148
16	14		H300×300×10×15	96	270	102	192	270	204
18			H350×350×12×19	98	278	105	317	278	339
20	16		H400×400×13×21	110	304	108	399	304	392
24				112	330	110	406	330	399
28				123	363	121	446	363	439
30	20			136	399	133	311	399	305
32				150	439	147	343	439	337
34				165	483	162	378	483	371
36				182	531	180	417	531	412

[a] Allowable load for trunnion pipe is based on schedule-STD CS pipe with 600 mm length up to NPS 6 run pipe and 800 mm length above NPS 6 run pipe.

[b] Allowable load for trunnion beam is based on strong axis of H section CS A36 grade with 600 mm length up to NPS 6 run pipe and 800 mm length above NPS 6 run pipe.

6.6.2 Stanchion

6.6.2.1 Key parameters

The use of stanchion support should be evaluated based upon factors, such as stress analysis and access for inspection as per recommendation from lead pipe engineer.

The key parameters of the stanchion support are:

— dimensions and material of stanchion support;

— dimensions and material of base plate;

— dimensions and material of wear pad;

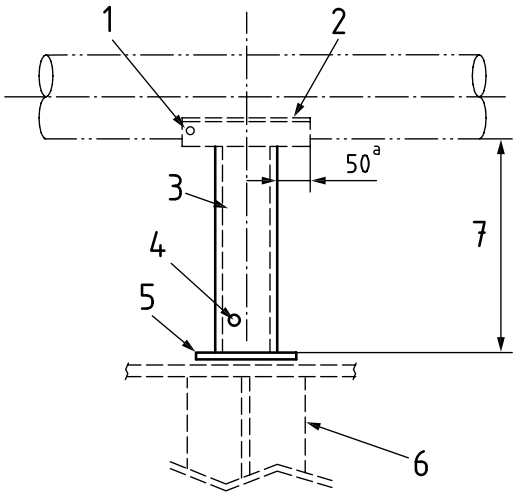
— size of weep hole;

— allowable load.

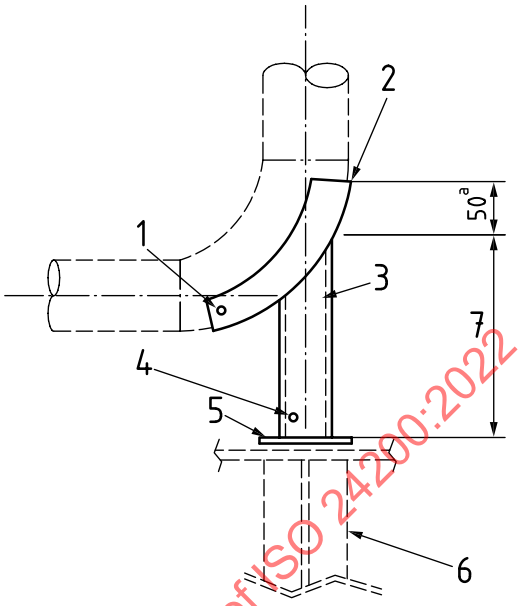
6.6.2.2 Design specification

Figure 12 shows the specification of stanchion support.

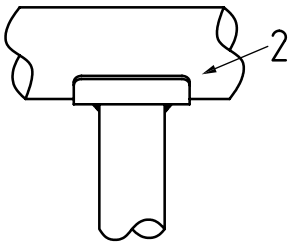
Dimensions in millimetres



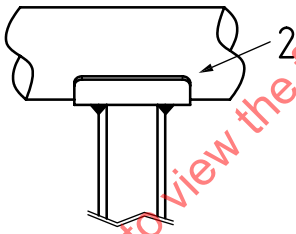
a) Pipe stanchion – pipe/beam section



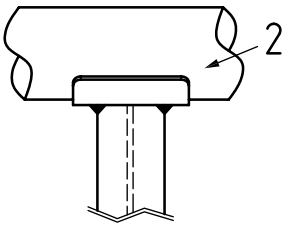
b) Elbow stanchion – pipe/beam section



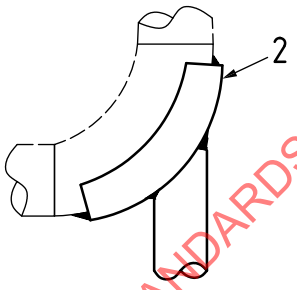
c) Pipe stanchion weld detail (pipe section)



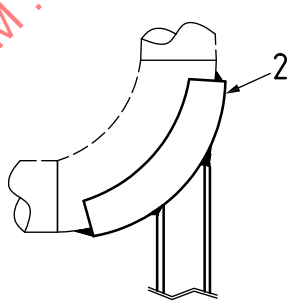
d) Pipe stanchion weld detail (H section type A)



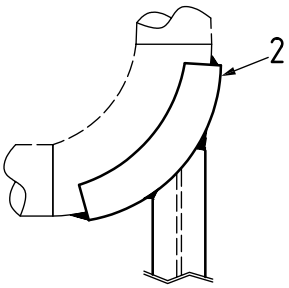
e) Pipe stanchion weld detail (H section type B)



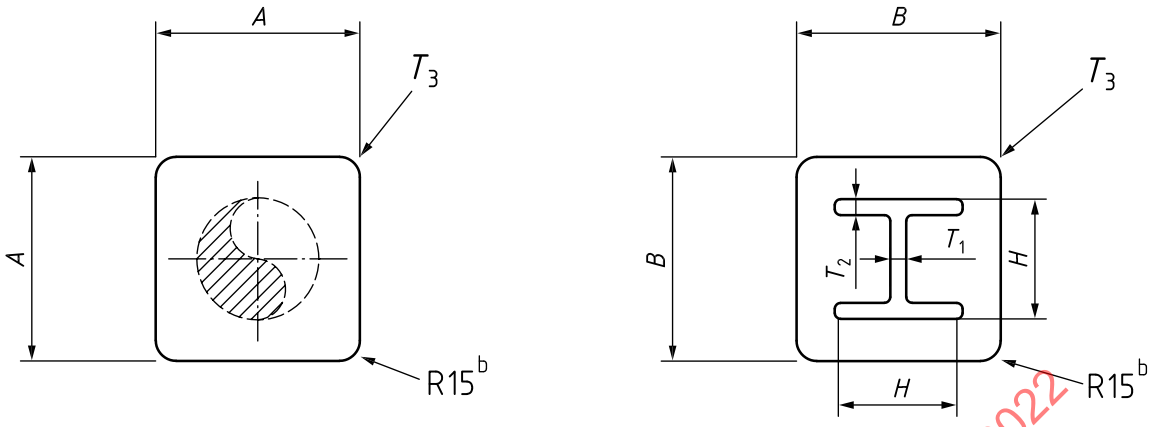
f) Elbow stanchion weld detail (pipe section)



g) Elbow stanchion weld detail (H section type A)



h) Elbow stanchion weld detail (H section type B)



i) Detail for base plate (pipe section)

j) Detail for base plate (H section type A or type B)

Key

1 weep hole
2 wear pad
3 stanchion pipe/beam
4 weep hole for pipe section
5 base plate
6 support/structure member
7 height
a Minimum.
b Typical.

The weep hole should be located at bottom and away from contact point with structural steel work.

Height of stanchion should be between 200 mm and 800 mm regardless of pipe sizes. The height should be determined based upon the stress analysis.

All weep holes shall be sealed with mastic (resin) after hydro test. The mastic shall be watertight, UV resistant and also able to endure pipe operating temperature as a minimum requirement.

Wear pad should be used only for pipe up to NPS 24 if required. For wear pad thickness for pipe thickness less than 10 mm, the same thickness as parent pipe shall be used; otherwise 10 mm or higher thickness should be used.

Weld leg length should be 6 mm, unless specified otherwise.

Figure 12 — Design specification of stanchion support

6.6.2.3 Material specification

Tables 15 and 16 show the material specification of the stanchion support with and without wear pad, respectively.

Table 15 — Material specification of stanchion support without wear pad

Pipe	Pipe section	H beam section	Base plate
CS and LTCS	Same or equivalent to parent pipe	CS	ASTM A36 or equivalent
Stainless steel, duplex stainless steel, super duplex stainless steel		Same or equivalent to parent pipe or fabricated plates	

Table 16 — Material specification of stanchion support with wear pad

Pipe	Wear pad	Pipe section and H beam section	Base plate
CS and LTCS	Same or equivalent to parent pipe	CS	ASTM A36 or equivalent
Stainless steel, duplex stainless steel, super duplex stainless steel		CS or equivalent to parent pipe or fabricated plates	

6.6.2.4 Dimensions

Tables 17 and 18 show the dimensions of the stanchion support for different pipe sizes.

Table 17 — Dimensions of stanchion support for straight pipe

Run pipe	Pipe section dimension				Beam section dimension			Pipe stanchion – Allowable load kN					
								Pipe section [a]			H section [b]		
NPS	NPS	SCH	A	T_3	Size ($H \times H \times T_1 \times T_2$)	B	T_3	Lateral	Vertical	Axial	Lateral	Vertical	Axial
2	$1\,^1/_2$	As per run pipe class (min. std)	150	10	H40×40×6×8	100	10	2	12,5	2	2	12,5	2
3	2				H50×50×6×8	110		3	20	6	5	20	6
4	3		180		H75×75×6×8	135		8	48	12	10	48	12
6	4		200		H100×100×6×8	180		12	73	19	19	73	19
8	6		250		H150×150×7×10	230		13	135	30	24	135	30
10								13	135	30	24	135	30
12	10		350		H200×200×8×12	350		35	190	100	48	230	60
14				15	H250×250×9×14			40	230	110	104	230	130
16	14		440		H300×300×10×15	440		56	280	160	144	280	180
18					H350×350×12×19			56	280	160	168	280	210
20	16		500		H400×400×13×21	500	15	69	300	200	240	300	300
24								69	300	200	240	300	300
28								90	400	200	240	400	300
30	20		600					120	500	300	304	500	380
32								120	500	300	304	500	380
34								120	500	300	304	500	380
36								120	500	300	304	500	380

[a] Allowable load for stanchion pipe is based on schedule-STD CS pipe with 600 mm height up to NPS 6 run pipe and 800 mm height above NPS 6 run pipe. For pipes of other dimensions and design parameters, allowable load should be calculated separately.

[b] Allowable load for stanchion beam is based on strong axis of H section CS A36 grade with 600 mm height up to NPS 6 run pipe and 800 mm height up to NPS 6 run pipe.

Table 18 — Dimensions of stanchion support for elbow

Run pipe	Pipe section dimension				Beam section dimension			Pipe stanchion – Allowable load kN					
								Pipe section [a]			H section [b]		
NPS	NPS	SCH	A	T_3	Size ($H \times H \times T_1 \times T_2$)	B	T_3	Lateral	Vertical	Axial	Lateral	Vertical	Axial
2	1 1/2	As per run pipe class (min. std)	150	10	H40 × 40 × 6 × 8	100	10	2,5	12,5	3	2,5	12,5	3
3	2				H50 × 50 × 6 × 8	110		4,5	20	4,5	4,5	20	4,5
4	3		180		H75 × 75 × 6 × 8	135		9	48	10	9	48	10
6	4		200		H100 × 100 × 6 × 8	180		15	73	16	15	73	16
8	6		250		H150 × 150 × 7 × 10	230		23	125	29	38	125	48
10								23	135	29	38	135	48
12	10		350		H200 × 200 × 8 × 12	350		52,5	193	52	58	193	57
14				15	H250 × 250 × 9 × 14		15	65	235	70	137	235	148
16	14		440		H300 × 300 × 10 × 15	440		96	270	102	192	270	204
18					H350 × 350 × 12 × 19			98	278	105	317	278	339
20	16		500		H400 × 400 × 13 × 21	500		110	304	108	399	304	392
24								112	330	110	406	330	399
28								123	363	121	446	363	439
30	20		600					136	399	133	311	399	305
32								150	439	147	343	439	337
34								165	483	162	378	483	371
36								182	531	180	417	531	412

[a] Allowable load for stanchion pipe is based on schedule-std CS pipe with 600 mm height up to NPS 6 run pipe and 800 mm height above NPS 6 run pipe.

[b] Allowable load for stanchion beam is based on strong axis of H section CS A36 grade with 600 mm height up to NPS 6 run pipe and 800 mm height up to NPS 6 run pipe.

6.7 Guide, hold-down, guide and hold-down and line-stop support

6.7.1 Guide

6.7.1.1 Key parameters

Guide support refers to support that is used to restrict lateral movement.

The key parameters of the guide support are:

— dimensions;

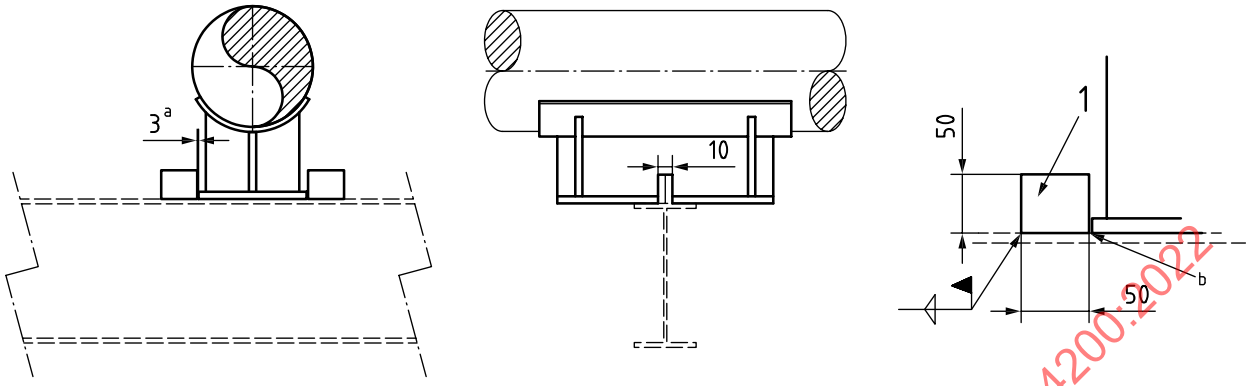
— material guide plate;

— allowable load.

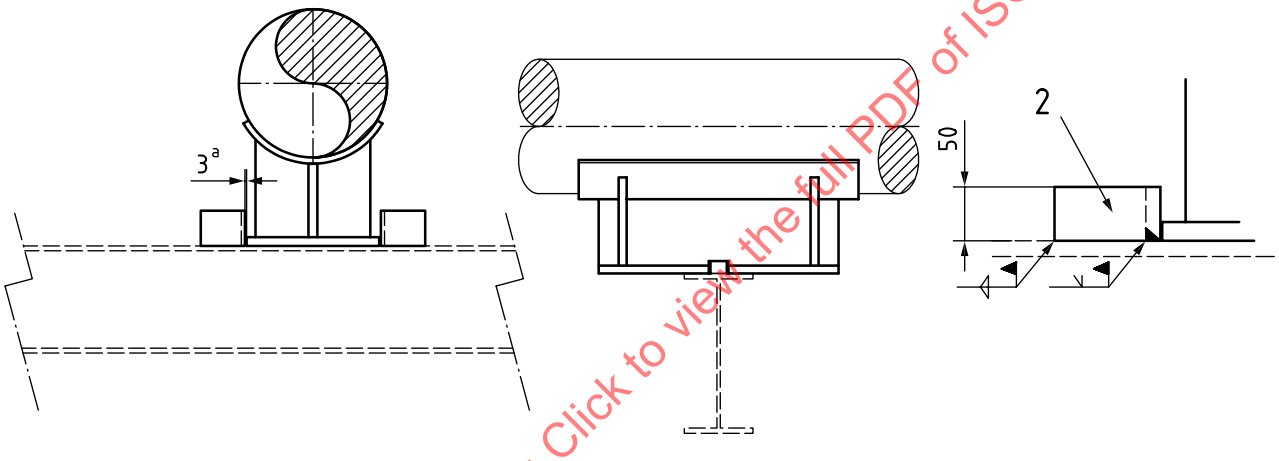
6.7.1.2 Design specification type A to type C

Figure 13 shows the design specification of guide support type A to type C.

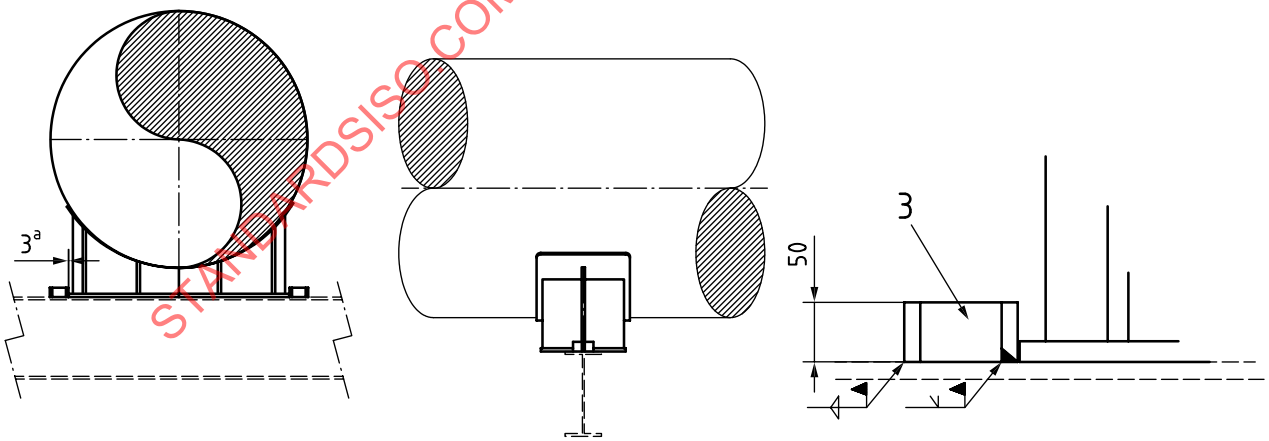
Dimensions in millimetres



a) Guide support type A



b) Guide support type B



c) Guide support type C

Key

1 flat bar
2 U shape
3 H shape
[a] Typical.
[b] Do not weld on this side.

Material should be ASTM A36 or equivalent material (e.g. JIS SS400 per JIS G3101).
Gap shall be 3 mm, unless specified on stress isometric.
All welds shall be 6 mm of welding leg continuous fillet, unless specified otherwise.

Figure 13 — Design specification of guide support type A to type C

6.7.1.3 Dimensions and loads for type A to type C

Table 19 shows the shapes and loads of guide support type A to type C.

Table 19 — Dimensions and loads of guide support type A to type C

Type	Shape	Horizontal allowable load kN
A	Flat bar	15
B	U8	38
	U16	76
C	H10	75
	H12	85
	H16	133
	H20	182
	H24	253
The width of guide support type A to type C should be within the size of structure member and the margin for weld leg length.		

6.7.2 Guide and hold-down

6.7.2.1 Key parameters

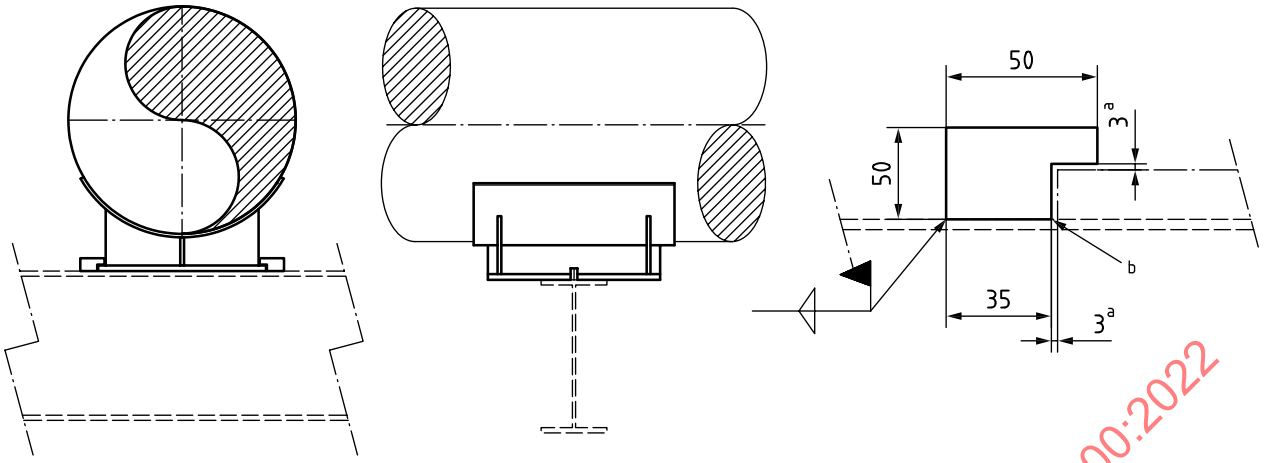
The key parameters of the guide and hold-down support are:

— dimensions;
— material guide plate;
— allowable load.

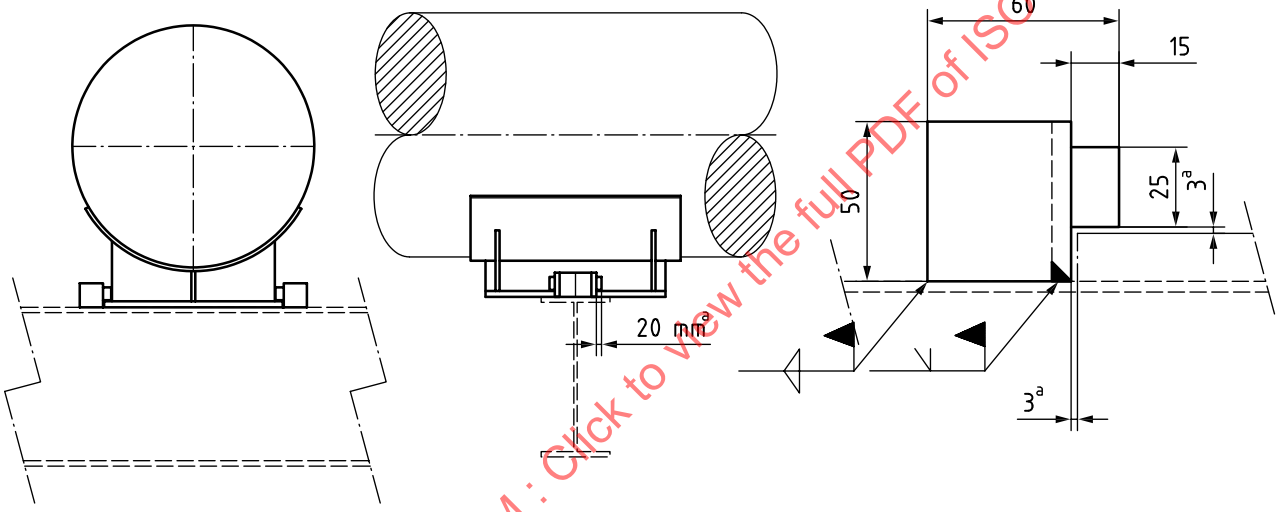
6.7.2.2 Design specification type A and type B

Figure 14 shows the design specification of guide and hold down support type A and type B.

Dimensions in millimetres



a) Guide and hold-down support type A



b) Guide/hold-down support type B

a Typical.

b Do not weld on this side.

Material should be ASTM A36 or equivalent material (e.g. JIS SS400 per JIS G3101).

Gap shall be 3 mm, unless specified on stress isometric.

All welds shall be 6 mm of welding leg continuous fillet, unless specified otherwise.

Figure 14 — Design specification of guide and hold down support type A and type B

6.7.2.3 Shape and loads for type A and type B

Table 20 shows the shape and loads of the guide and hold down support type A and type B.

Table 20 — Dimensions of guide and hold down support type A and type B

Type	Shape	Vertical load kN	Horizontal load kN
A	Flat bar	15	15
B	U8	50	30
	U16		69
	H10		75
	H12		85
	H14		100
	H16		133
	H20		182
	H24		253
The width of guide support type A and type B should be within the size of structure member and the margin for weld leg length.			

6.7.3 Line-stop

6.7.3.1 Key parameters

Line stop support refers to support that restricts axial movement.

The key parameters of the line-stop are:

— dimensions;

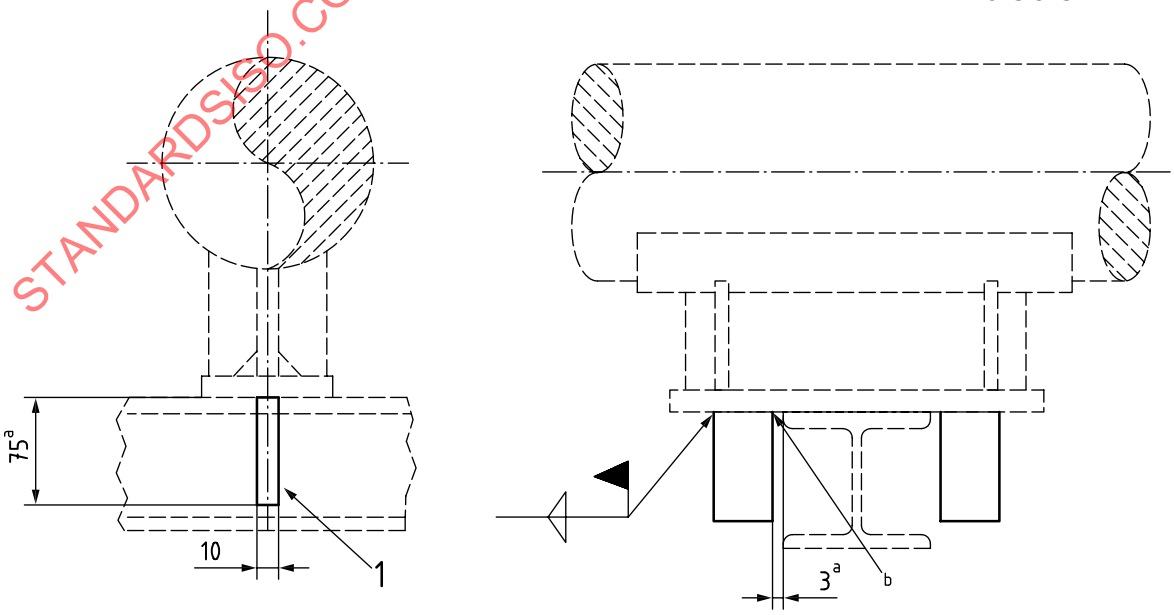
— material line-stop plate;

— allowable load.

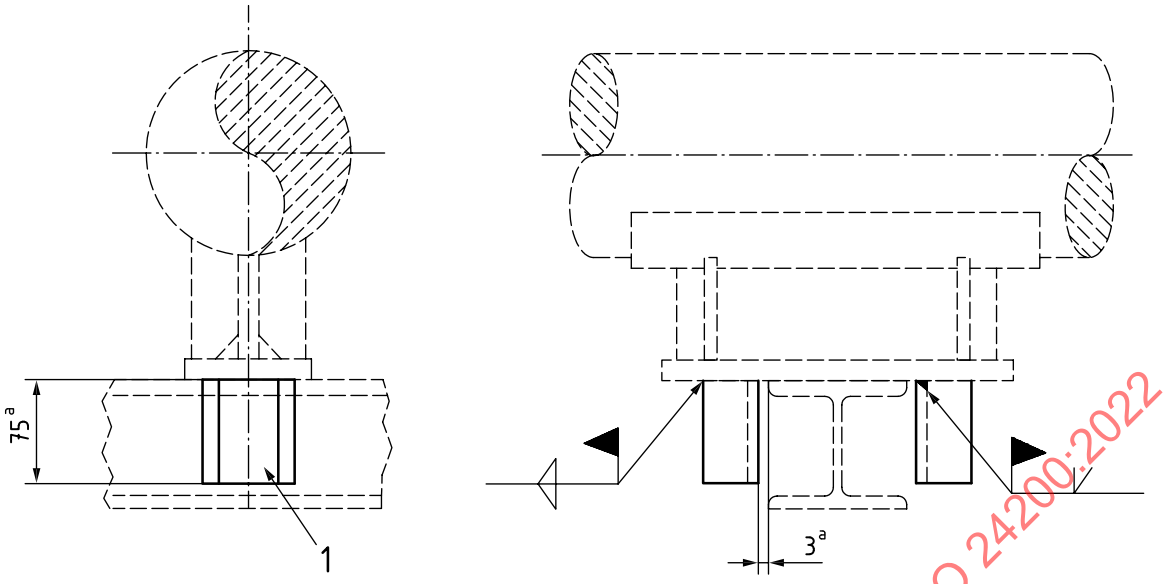
6.7.3.2 Design specification type A to type C

Figure 15 shows the design specification of the line-stop support type A to type C.

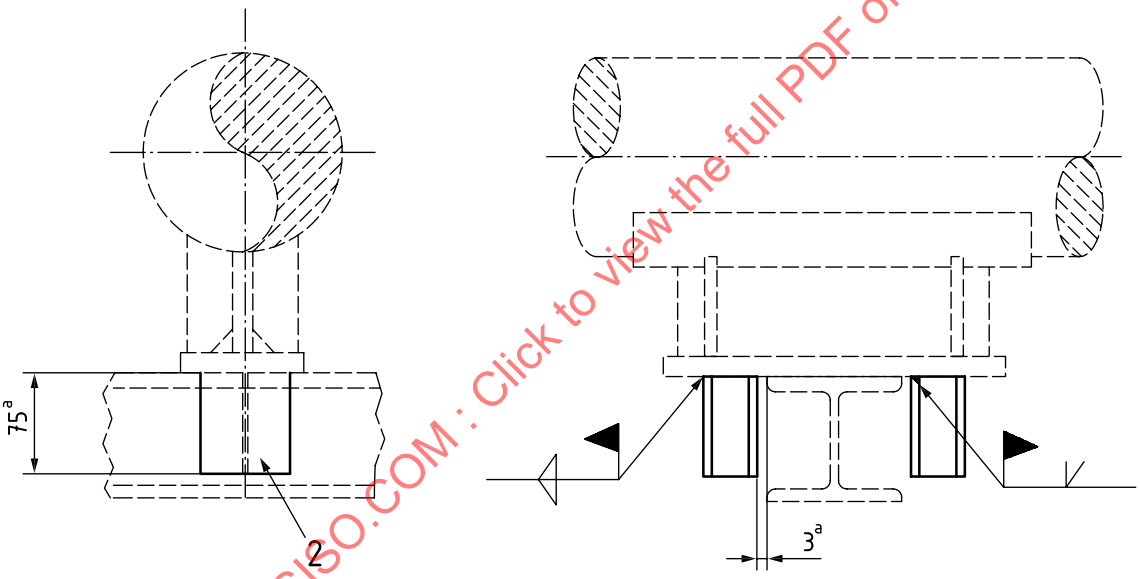
Dimensions in millimetres



a) Line-stop support type A



b) Line-stop support type B



c) Line-stop support type C

Key

1 U shape

2 H shape

a Typical.

b Do not weld on this side.

Material should be ASTM A36 or equivalent material (e.g. JIS SS400 per JIS G3101).

Gap shall be 3 mm, unless specified on stress isometric.

All welds shall be 6 mm of welding leg continuous fillet, unless specified otherwise.

Figure 15 — Design specification of line-stop support type A to type C

6.7.3.3 Dimensions and loads for type A to type C

Table 21 shows the dimensions of the line-stop support type A to type C.

Table 21 — Dimensions of line-stop support type A to type C

Type	Shape	Horizontal load kN
A	Flat bar	15
B	U8	38
	U16	76
C	H10	75
	H12	85
	H16	133
	H20	182
	H24	253
The width of guide support type A to type C should be within the size of structure member and the margin for weld leg length. If pipe is exposed to vibration, type B or type C is recommended to be used instead of type A.		

6.8 Guide, guide and hold-down and line-stop support – With hole

6.8.1 Guide

6.8.1.1 Key parameters

Guide support refers to support that is used to restrict lateral movement.

The key parameters of the guide support are:

— dimensions;

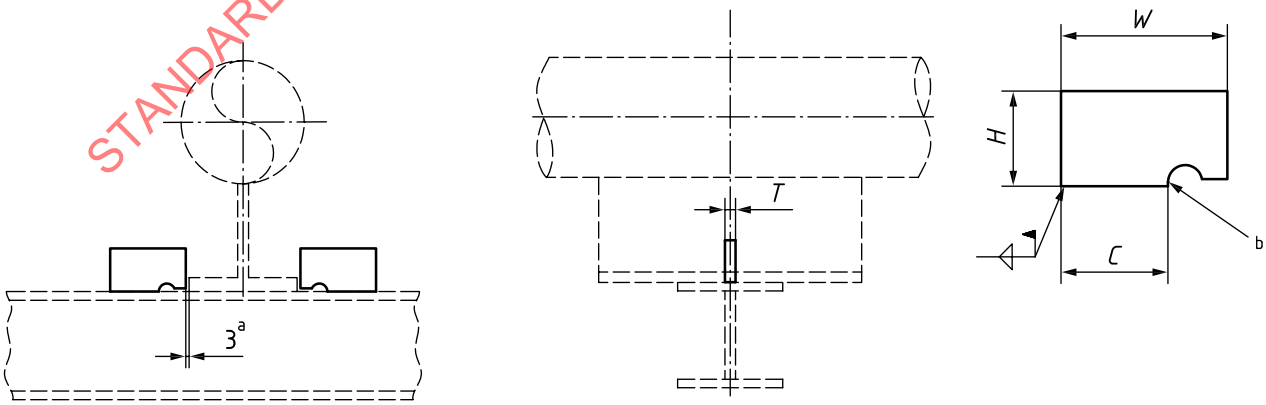
— material guide plate;

— allowable load.

6.8.1.2 Design specification type A to type C

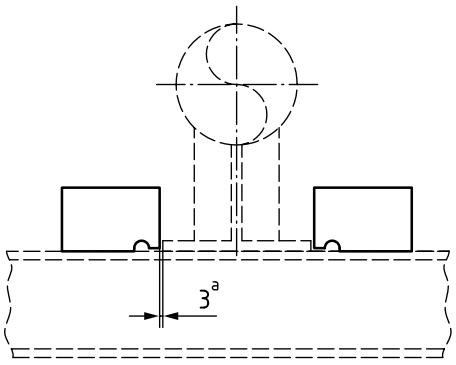
Figure 16 shows the design specification of guide support type A to type C.

Dimensions in millimetres

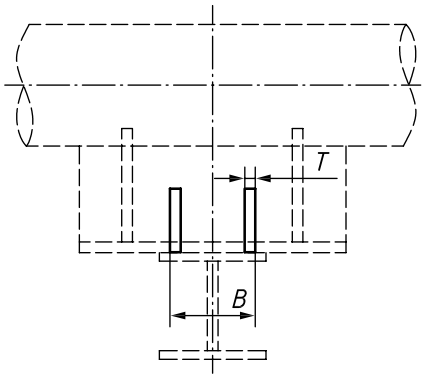


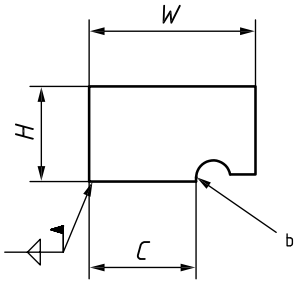
a) Guide support type A

b) Detail of plate for guide support type A

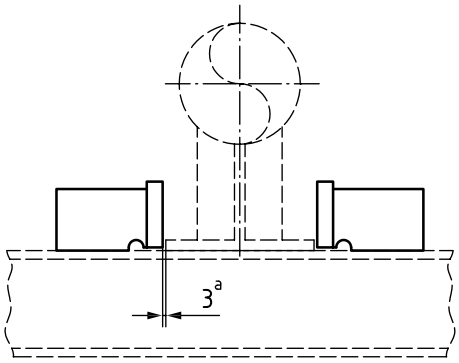


c) Guide support type B

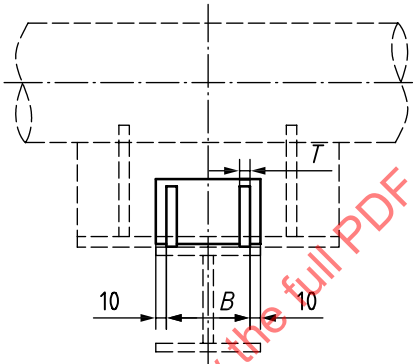


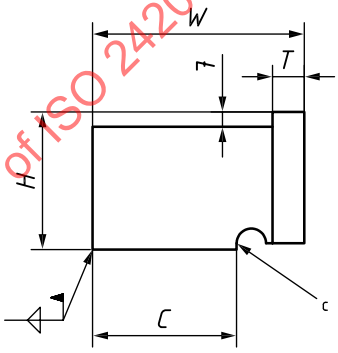


d) Detail of plate for guide support type B

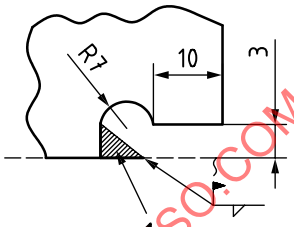


e) Guide support type C

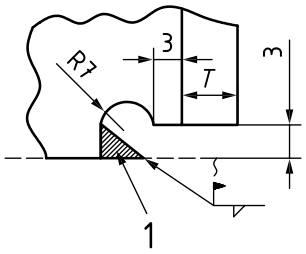




f) Detail of plate for guide support type C



g) Detail 1



h) Detail 2

Key

1 seal weld (typical)

[a] Typical.

[b] See details in Figure 16 g).

[c] See details in Figure 16 h).

Material should be ASTM A36 or equivalent material (e.g. JIS SS400 per JIS G3101).

Gap shall be 3 mm, unless specified on stress isometric.

All welds shall be 6 mm of welding leg continuous fillet, unless specified otherwise.

Figure 16 — Design specification of guide support type A to type C

6.8.1.3 Dimensions for type A to type C

Table 22 shows the dimensions of guide support type A to type C for different pipe sizes.

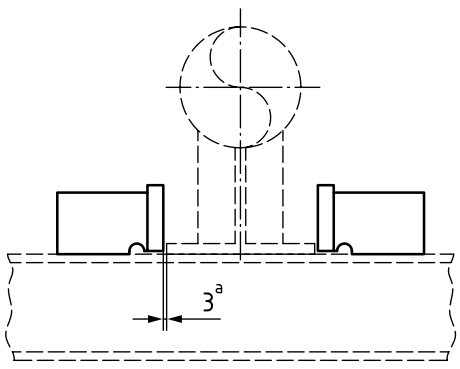
Table 22 — Dimensions of guide support type A to type C for different pipe sizes

Type	Dimension					Lateral allowable load
	H	W	B	C	T	
	mm	mm	mm	mm	mm	kN
A	40	60	-	36	10	12
B	60	90	80	66	10	25
C	65	100	80	68	15	55
The width of guide support type B and type C should be within the size of structure member and the margin for weld leg length.						

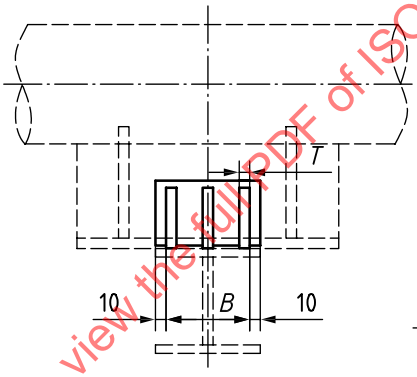
6.8.1.4 Design specification type D and type E

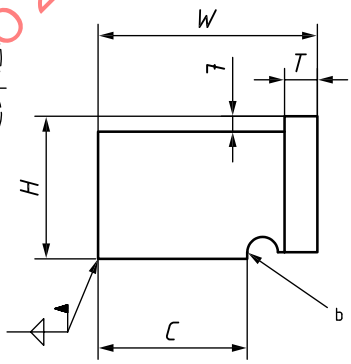
Figure 17 shows the design specification of guide support type D and type E.

Dimensions in millimetres

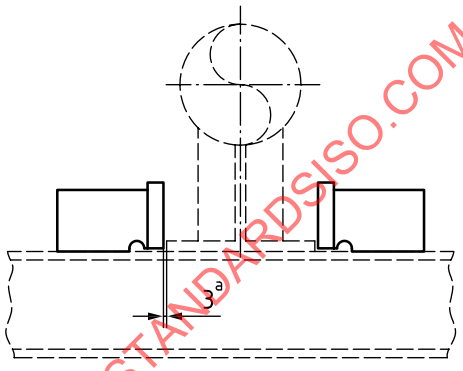


a) Guide support type D

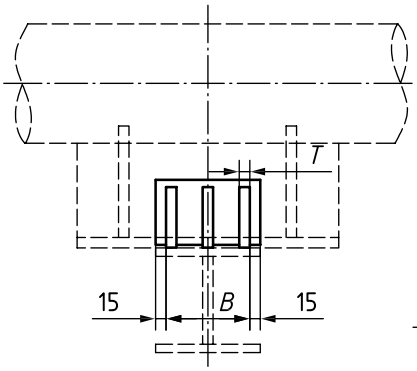


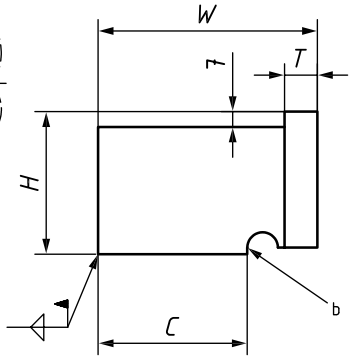


b) Detail of plate for guide support type D

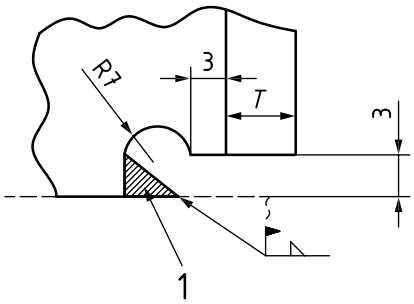


c) Guide support type E





d) Detail of plate for guide support type E



e) Detail 1

Key

1 seal weld (typical)

[a] Typical.

[b] See details in Figure 17 e).

Material should be ASTM A36 or equivalent material (e.g. JIS SS400 per JIS G3101).

Gap shall be 3 mm, unless specified on stress isometric.

All welds shall be 6 mm of welding leg continuous fillet, unless specified otherwise.

Figure 17 — Design specification of guide support type D and type E

6.8.1.5 Dimensions type D and type E

Table 23 shows the dimensions of guide support type D and type E for different pipe sizes.

Table 23 — Dimensions of Guide support type D and type E for different pipe sizes

Type	Dimension					Lateral allowable load
	H	W	B	C	T	
	mm	mm	mm	mm	mm	kN
D	65	130	135	68	15	83
E	65	155	150	88	20	112
The width of guide support type D and type E should be within the size of structure member and the margin for weld leg length.						

6.8.2 Hold-down

6.8.2.1 Key parameters

The key parameters of the hold-down support are:

— dimensions;

— material guide plate;

— allowable load.

6.8.2.2 Design specification type A to type C

Figure 18 shows the design specification of hold down support type A to type C.

Dimensions in millimetres