BRITISH STANDARD

BS 3974-3: 1980

Incorporating Amendment No. 1

Specification for

Pipe supports —

Part 3: Large bore, high temperature, marine and other applications

UDC 621.881:621.643.2

Cooperating organizations

The Mechanical Engineering Standards Committee, under whose direction this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

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Association of Consulting Engineers
Association of Hydraulic Equipment Manufacturers
Association of Mining, Electrical and Mechanical Engineers
British Compressed Air Society
British Electrical and Allied Manufacturers' Association (BEAMA)
British Gas Corporation
British Gear Manufacturers' Association
British Internal Combustion Engine Manufacturers' Association
British Pump Manufacturers' Association
British Steel Corporation*
British Steel Industry*
British Valve Manufacturers' Association Ltd.
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British Chemical Engineering Contractors' Association
British Marine Equipment Council
British Ship Research Association
Ductile Iron Pipe Association
Heating and Ventilating Contractors' Association

This British Standard, having been prepared under the direction of the Mechanical Engineering Standards Committee, was published under the authority of the Executive Board and comes into effect on 31 October 1980

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Amendments issued since publication

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Contents

Foreword

This Part 3 of BS 3974 has been prepared under the direction of the Mechanical Engineering Standards Committee in cooperation with the Shipbuilding and Marine Standards Committee.

Part 3 specifies requirements for pipe support components for pipe sizes, materials and applications not covered in Parts 1 and 2. Due to particular requirements for certain industries or special material requirements for piping systems, it has been found convenient for presentation purposes to depart from the format previously established in Parts 1 and 2 of this standard and to divide Part 3 into sections, as follows.

— *Section 1: General design and manufacture*;

— *Section 2: General applications*;

— *Section 3: Marine applications*.

Section 3 provides data to meet the specific requirements of shipbuilding pipework installations and is based on a proposal of the British Ship Research Association.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 36, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

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Section 1. General design and manufacture

1 Scope

Part 3 of this standard specifies design requirements and dimensions for the manufacture of pipe support components that are generally outside the scope of Parts 1 and 2. These are

a) carbon steel pipe clips, overstraps and U-bolts for large diameter pipes;

b) alloy steel pipe clips, U-straps and riser clamps;

c) copper alloy overstraps and hookstraps.

The overall pipe nominal size range is from 10 to 1 200 for pipeline fluid temperatures in the range – 196 °C to 570 °C according to type and material.

The pipe support components specified provide for the supporting of pipes manufactured from carbon and alloy steels, cast iron, ductile iron and grey iron spun pipes, copper and copper alloys.

Section 1 provides design data, material specifications and manufacturing requirements for pipe support components.

Section 2 provides dimensional details and safe working loads (where applicable) for pipe support components on a general application basis.

Section 3 contains additional requirements or restrictions relating to the application to ships' installations of pipe supports detailed in section 2. This includes guidance notes, component details, marine range of working temperatures, safe working loads and material specifications not included in Part 1 and elsewhere in this Part. Typical illustrations of shipboard installations are shown in Figure 12 to Figure 17.

2 References

The titles of the publications referred to in this standard are listed on the inside back cover.

3 Definitions

For the purposes of this British Standard the terminology given in Parts 1 and 2 of this standard, and the following terms and definitions, apply.

3.1
liner

a sheath of protective material inserted between the outside of the pipe and the support clip to protect the pipe from abrasion, electrolytic action, or to limit heat transfer to the clip (see **4.2**). Also used to refer to the material inserted between the outside of the pipe and the support clip to distribute the load

3.2
bank

an arrangement of pipelines in close proximity and routed parallel to each other

3.3
seat

a fabricated bracket integral with but auxiliary to the main structure of a ship and provided for the purpose of attachment of a pipe support foot

4 Pipe support design

4.1 The design temperature for pipe clips, U-straps, and riser pipe clamps in direct contact with the pipe shall be that of the fluid in the pipe. Pipe clips, U-straps and riser clamps shall be designed on the basis that they are in direct contact with, but not tightened on to, the pipe.

4.2 Where a pipe clip is in contact with load-bearing insulation, the design temperature shall be that of the outer surface of this insulation. When load bearing insulation is employed between pipe and clip, deformation of the clip is not permitted and therefore the tabulated safe working loads shall be down-rated by 20 %, or alternatively, the width of the clip (dimension *B*) shall be increased by 25 %. Typical insulated pipe clip applications are shown in Figure 12.

4.3 Any dynamic loading to which the pipe clips, U-straps and riser clamps are subjected shall be added to the static load to obtain the total design safe working load. Care shall be taken in calculating both the static and any dynamic loadings.

4.4 High pressure/high temperature pipelines may be constructed using steel tube having a controlled bore and a wide rolling tolerance on the wall thickness, resulting in non-standard outside diameters.

The inside diameters of pipe clips, riser clamps and U-straps specified in this standard have been tabulated to give clearance over standard outside diameter steel tube where the tolerance on the outside diameter is ± 1 %. Where non-standard outside diameter tube is employed the inside diameter of these components shall be varied to suit.

This inside diameter shall be decided by measurement of the outside diameters of a number of tubes from each rolling batch, plus the addition of the clearance between the clip and the pipe as obtained from the tables for similar size tube.

Where the inside diameter thus obtained is different from the pipe outside diameters tabulated in this standard then the dimensions, clearances and sections of the next larger size shall be used except that dimension *P* on pipe clips and dimension *B* on riser clamps shall be reduced pro rata.

4.5 In the case of U-bolts, overstraps and hookstraps, these are primarily intended as retaining type, non-load bearing supports, consequently no safe working loads are specified. If these components are used as load bearing supports it is the responsibility of the user to ascertain that the loads are compatible within the yield strength of the materials of components and fasteners.

4.6 When overstraps are bolted on to a vertical surface so that the weight of the pipe is acting on one half of the overstrap, it is recommended that support ribs are fitted between the palm and the side of the overstrap. In certain instances, lateral strengthening ribs may also be necessary for overstraps fitted in the normal manner to restrain transverse forces on the pipeline.

5 Temperature ranges for pipe supports

5.1 The pipe clips, U-straps and riser clamps specified in this Part 3 are designated by letter reference according to working temperature range as follows.

Temperature ranges

Designation	Working temperature range	Remarks
	°C	
Range A	– 20 to 100	—
Range B	– 20 to 300	For copper and copper alloy tubes only
Range C	above 400 up to and including 470	See note 1
Range D	– 20 to 570	See note 2

NOTE 1 The application of range C pipe clips is not defined in this Part 3 and reference should be made to Part 1 for design, application and dimensional details.
NOTE 2 Because of different material sections, specifications and temperature applications for range D pipe clips these have been sub-divided into ranges D1, D1(M), D2, D3 and D3(M) within the overall temperature range given above. Specific temperature applications are specified in the appropriate sections 2 and 3. The suffix (M) denotes marine application in section 3.

5.2 Except where otherwise specified in section 3, the application of U-bolts, overstraps and hookstraps specified in this standard shall be within the temperature range – 20 °C to 250 °C.

6 Materials

6.1 The preferred materials from which components of pipe support assemblies shall be manufactured are given in the following schedule of material specifications. Other materials may be used provided that they have equal or higher physical properties.

6.2 Lining materials for support components used on copper/copper alloy tubes shall be suitable for the limiting temperature of the pipeline. Also, care shall be taken in the choice of materials to be used in direct contact with the copper/copper alloy tubes since in certain environmental conditions, galvanic action may take place.

7 Manufacture and heat treatment

7.1 Where material for the manufacture of pipe clips, U-straps, riser clamps, overstraps and hookstraps is cut from plate, the cut edges shall be ground smooth prior to forming.

7.2 Carbon steel pipe clips, overstraps and hookstraps may be formed either hot or cold but consideration should be given to the need for heat treatment on cold formed clips of thickness of 10 mm and over.

Schedule of materials

Component		Material	Material reference	
			BS no.	Designation
(a) Pipe clips				
Clips	Range A Range B	Carbon steel	BS 4360 BS 1501-1	Grade 43A 151 or 161: grade 26B
	Range D1, D1(M), D2 Range D3, D3(M)	Alloy steel	BS 1501-2 BS 1501-2	620 grade 27B 622 grade 31B
All bolts and studbolts	Range A, B	Carbon steel	BS 4190	Grade 4.6
	Range D1, D1(M), D2 Range D3, D3(M)	Alloy steel	BS 4882 BS 4882	661 grade B16 1 % Cr Mo V boron grade B16A
All nuts	Range A, B	Carbon steel	BS 4190	Grade 4
	Range D1, D1(M), D2 Range D3, D3(M)	Alloy steel	BS 4882 BS 4882	240 grade 4 621 grade 7
Distance-pieces	All ranges	Carbon steel	BS 1387	Medium or heavy
(b) U-straps				
Strap	Range D1, D2 Range D3	Alloy steel	BS 1501-2 BS 1501-2	620 grade 27B 622 grade 31B
Steady plate	Range D1, D2, D3	Alloy steel	BS 1501-2	620 grade 27A or 27B
Yoke, end and hanger plates	Ranges D1, D2, D3	Carbon steel	BS 4360	Grade 43A
All bolts All nuts	Ranges D1, D2, D3	Carbon steel	BS 3692 BS 3692	Grade 8.8 Grade 8
(c) Riser clamps				
Clamp and gusset	Range D1, D2 Range D3	Alloy steel	BS 1501-2 BS 1501-2	620 grade 27B 622 grade 31B
All bolts	Range D1, D2 Range D3	Alloy steel	BS 4882 BS 4882	661 grade B16 1 % Cr Mo V boron grade B16A
All nuts	Range D1, D2 Range D3	Alloy steel	BS 4882 BS 4882	240 grade 4 621 grade 7
Distance-pieces	Range D1 Range D2, D3	Carbon steel Alloy steel	BS 1387 BS 3604	Medium or heavy 620
(d) Sling rods	**All components**			
Rods Nuts	All ranges All ranges	Carbon steel	BS 4360 BS 4190	Grade 43A Grade 4 or 6
(e) Pipe overstraps and U-bolts		Carbon steel	BS 4360	Grade 43A
		Low temperature steel	See Table 12 in section 3	
(f) Pipe overstraps and hookstraps		Copper alloy	BS 2870	CZ 110
		Stainless steel	BS 1449-2	17 % min. Cr content

Schedule of materials

Component		Material	Material reference	
			BS no.	Designation
(g) Lining materials for steel pipe clips when used on copper/copper alloy tubes (See **6.2**)		Lead sheet	BS 1178	—
		Copper/copper alloy sheet	BS 2870	CZ 110
		Compressed fibre sheet	—	—

7.3 Alloy steel pipe clips, U-straps and riser clamps shall be hot formed within the temperature range 950 °C to 1 100 °C. After forming, heat treatment shall be applied as specified in the following schedule.

Minor rectification work to correct distortion caused by heat treatment may be carried out at a temperature not exceeding 650 °C for 1 % Cr, ½ Mo or 690 °C for 2¼ % Cr, 1 % Mo steel without the need for further heat treatment.

7.4 The welding and the examination of welds for the hanger plates of the U-straps shown in Figure 4 and the gusset plates for the riser clamps shown in Figure 5 shall comply with the requirements specified in BS 2633.

7.5 Distance pieces for use in pipe clips and riser clamps shall be manufactured from carbon steel or alloy steel pipe (see clause **6**) with the ends cut square and shall be of suitable bore to be a free fit over the bolt. For range A the length of the optional distance piece shall be equal to the width of the sling rod eye, and for ranges B and D pipe clips, shall be equal to the width of the sling rod eye plus 3 mm. For riser clamps, the minimum length shall be as specified in Table 5(a), Table 5(b) or Table 5(c), or the width of the sling rod eye plus 3 mm, whichever is the greater.

7.6 Locking nuts shall be fitted to all load bolts for ranges B, C and D applications. In addition, it is recommended that locking nuts or locking washers be fitted to all other bolts wherever movement due to expansion contraction, vibration or shock loading is expected.

Where studbolts are used for range D pipe clips and riser clamps, a nut and locking nut shall be fitted on each end.

Schedule of heat treatment

<table>
<tr><td colspan="2" rowspan="2">Heat treatment operation</td><td colspan="2">Material</td></tr>
<tr><td>BS 1501-2
620 grade 27B
(1 % Cr, ½ % Mo)</td><td>BS 1501-2
622 grade 31B
(2¼ % Cr, 1 % Mo)</td></tr>
<tr><td colspan="2" rowspan="3">Heat rate above 400 °C</td><td colspan="2">Temperature rate</td></tr>
<tr><td>220 °C/h for thicknesses not exceeding 25 mm</td><td>200 °C/h for thicknesses not exceeding 12 mm</td></tr>
<tr><td>$\left(220 \times \frac{25}{T}\right)$ °C/h for thicknesses (T) over 25 mm</td><td>100 °C/h for thicknesses over 12 mm</td></tr>
<tr><td rowspan="2">Normalizing</td><td>Soaking temperature</td><td colspan="2">900 °C to 960 °C</td></tr>
<tr><td>Time period</td><td colspan="2">0.5 min per mm of thickness (minimum 30 min)</td></tr>
<tr><td colspan="4">On completion of normalizing, components shall be removed from the furnace and allowed to cool in still air to a temperature below 150 °C before tempering.
Riser clamp gusset plates shall be welded on at this stage; the welding shall comply with the requirements of BS 2633.
After the welding of any component, tempering/stress relieving shall be carried out as follows.</td></tr>
<tr><td rowspan="2">Tempering/stress relieving</td><td>Soaking temperature</td><td>630 °C to 670 °C</td><td>680 °C to 720 °C</td></tr>
<tr><td>Time period</td><td>5 min per mm of thickness (minimum of 2 h)</td><td>3 h irrespective of thickness</td></tr>
<tr><td colspan="2" rowspan="4">Cooling rate after tempering</td><td colspan="2">Temperature rate</td></tr>
<tr><td>275 °C/h for thicknesses not exceeding 25 mm</td><td>250 °C/h for thicknesses not exceeding 12 mm</td></tr>
<tr><td>$\left(275 \times \frac{25}{T}\right)$ °C/h for thicknesses (T) over 25 mm</td><td>50 °C/h for thicknesses over 12 mm</td></tr>
<tr><td colspan="2">Below 400 °C components may be cooled in still air</td></tr>
</table>

7.7 The dimensions and manufacture of spherical washers, sling rods and sling rod eyes shall be as specified in **4.5** and **4.6** of Part 1:1974 of this standard.

7.8 The necessity for manufacturing tolerances on components, particularly range D supports, shall be taken into consideration. Manufacturing tolerances are not specified in this standard and where specific tolerances are required, they shall be agreed between the purchaser and the manufacturer.

8 Protection

Where steel pipe clips, overstraps and U-bolts are exposed to salt water or other corrosive environment they shall be adequately surface protected as agreed between the purchaser and the manufacturer to suit the particular conditions (see **6.2**).

9 Marking

Pipe clips, U-straps and riser clamps shall be identified by marking in accordance with the requirements specified in BS 5383 as follows.

Range A:	not colour marked
Ranges B and C:	dark grey
Ranges D1, D1(M) and D2:	pink
Ranges D3 and D3(M):	light blue

Section 2. General applications

10 Pipe clip design data

10.1 General. The pipe support components included in this section are, in general, extensions to those contained in Part 1 of this standard, but are augmented by the adaption of Part 1 pipe clips for use on copper alloy pipework and by the inclusion of alloy steel components for high temperature pipework up to 570 °C.

For temperature applications below – 20 °C the information given in clause **16** may be used for guidance purposes.

10.2 Safe working loads. The safe working loads for pipe clips, ranges A, B and D, specified in this section, have been designed on the following.

a) Range A: on the yield stress of the material at room temperature.

b) Range B: on 0.2 % proof stress of the material at 300 °C.

c) Range D: on the mean stress to rupture of the material in 1 00 000 h at the appropriate maximum working temperature, divided by a design factor of 1.4.

10.3 Calculated design stress levels. The calculated design stress levels for pipe clips shall be as given at the foot of the page.

NOTE 1 The design criteria for ranges B, D1, D2 and D3 are derived from BS 5500.
NOTE 2 Information on design considerations for pipework calculations is given in Appendix A of Part 1:1974 of this standard.

11 Summary of pipe support components

The pipe support components specified in section 2 are summarized below. They shall comply with the requirements given in the relevant figures and tables as indicated.

a) Range A pipe clips for nominal sizes of steel pipes from 650 to 1 000 inclusive: Figure 1 and Table 1(a).

b) Range A pipe clips for nominal sizes of cast iron pipes from 700 to 1 200 inclusive: Figure 1 and Table 1(b).

c) Range A pipe clips adapted for outside diameters of copper/copper alloy tubes from 20 mm to 1 016 mm inclusive: Figure 1 and Table 1(c).

d) Range A pipe clips adapted for outside diameters of copper/copper alloy tubes from 20 mm to 610 mm: Figure 2 and Table 2.

e) Range D pipe clips (incorporating subranges D1, D2 and D3 for nominal sizes of steel or alloy steel pipes from 15 to 600 inclusive: Figure 3 and Table 3.

f) Range D1 to D3 U-straps for nominal sizes of alloy steel pipes 200 to 600 inclusive: Figure 4 and Table 4.

g) Range D riser clamps (incorporating sub-ranges D1, D2 and D3) for nominal sizes of steel or alloy steel pipes from 200 to 600 inclusive: Figure 5 and Table 5(a), Table 5(b) and Table 5(c).

h) U-bolts, to grip pipe, for nominal sizes of steel pipes from 650 to 1 000 inclusive, and for nominal sizes of cast iron pipes from 700 to 1 200 inclusive: Figure 6 and Table 6(a) and Table 6(b).

i) Overstraps for nominal sizes of steel pipes from 225 to 1 000 inclusive, and for nominal sizes of cast iron pipes from 80 to 1 200 inclusive: Figure 7 and Figure 8 and Table 7 and Table 8.

j) Overstraps and hookstraps for copper/copper alloy tubes and precision steel tubes of outside diameter range 10 mm to 57 mm inclusive: Figure 9 and Table 9.

k) Overstraps for copper/copper alloy tubes of outside diameter range 76.1 mm to 1 016 mm inclusive: Figure 10 and Table 10.

Calculated design stress levels

Range	Material specification		Working temperature range	Design criteria	Design factor	Design stress level
	BS no.	Designation	°C			N/mm²
A	BS 4360	grade 43A	– 20 to 100	Yield stress	1	245
B	BS 1501-1	151 grade 26B 161 grade 26B	– 20 to 300	0.2 % proof stress	1	145
D1	BS 1501-2	620 grade 27B	– 20 to 510	Mean stress to rupture in 100 000 h	1.4	86
D2			above 510 up to and including 540			47
D3		622 grade 31A	above 540 up to and including 570			36

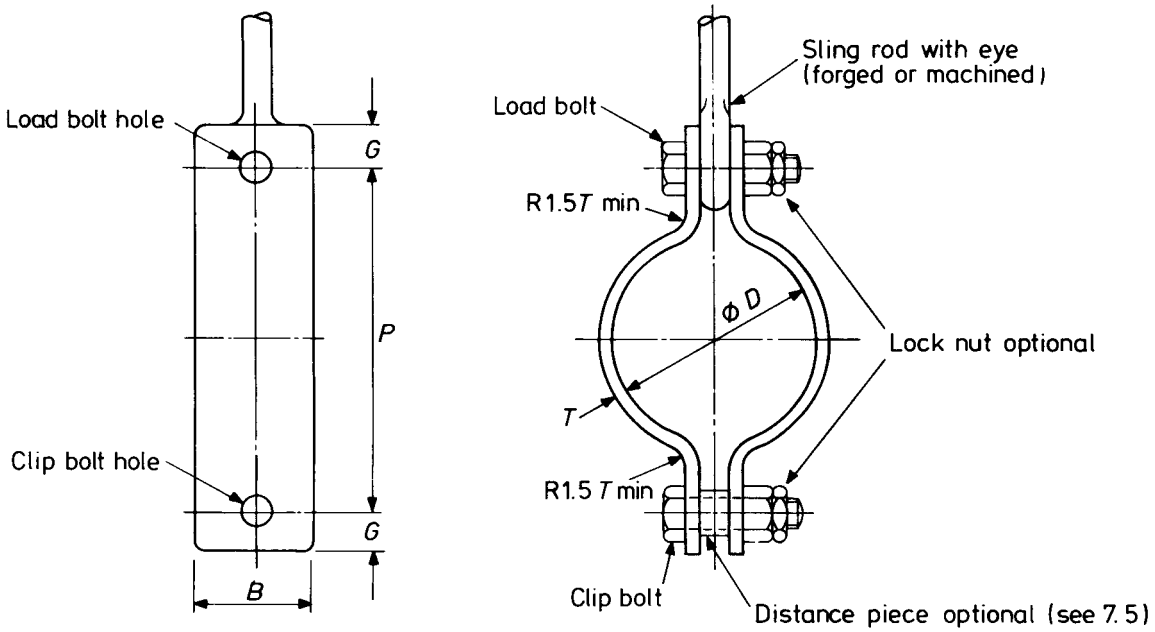


Figure 1 — Pipe clip for steel, cast iron and copper/copper alloy pipes (range A: – 20 °C to 100 °C) *[See Table 1(a), Table 1(b) and Table 1(c)]*

Table 1(a) — Dimensions of pipe clips for steel pipes (range A: – 20 °C to 100 °C)

All dimensions are in millimetres.

Pipe		Sling rod diameter	Clip dimensions			Clip and load bolts		*G* min.	Safe working load
Nominal size	Outside diameter		*D* diameter	*B* × *T*	*P*	Bolt size	Hole diameter		
									kg
650	660	30	665	80 × 20	830	M30	35	45	1 400
700	711	30	716	80 × 20	880	M30	35	45	1 300
750	762	30	765	80 × 20	930	M30	35	45	1 200
800	813	30	816	90 × 25	1 020	M30	35	45	2 000
850	864	30	868	90 × 25	1 070	M30	35	45	1 900
900	914	30	918	90 × 25	1 120	M30	35	45	1 800
1 000	1 016	36	1 020	100 × 30	1 250	M36	42	54	2 600

Table 1(b) — Dimensions of pipe clips for cast iron pipes (range A: – 20 °C to 100 °C)

All dimensions are in millimetres.

Pipe		Sling rod diameter	Clip dimensions			Clip and load bolts		*G* min.	Safe working load
Nominal size	Outside diameter		*D* diameter	*B* × *T*	*P*	Bolt size	Hole diameter		
									kg
700	738	30	740	80 × 20	900	M30	35	45	1 250
800	842	30	845	90 × 25	1 040	M30	35	45	1 950
900	945	30	950	90 × 25	1 150	M30	35	45	1 750
1 000	1 048	36	1 050	100 × 30	1 280	M36	42	54	2 500
1 100	1 152	36	1 155	100 × 30	1 380	M36	42	54	2 200
1 200	1 255	36	1 260	100 × 30	1 490	M36	42	54	2 000

Table 1(c) — Dimensions of pipe clips for copper/copper alloy tubes (range A: – 20 °C to 100 °C)

Tube outside diameter	Sling rod diameter	Clip dimensions			Clip and load bolts		*G* min.	Linear thickness	Safe working load
		D diameter	*B* × *T*	*P*	Bolt size	Bolt hole diameter			
									kg
20	10	23	35 × 5	65	M10	12	15	1.5	280
22	10	28	35 × 5	70	M10	12	15	3	280
25								1.5	
28	10	36	35 × 5	75	M10	12	15	4	280
30								3	
35	12	44	35 × 5	90	M12	15	18	4.5	280
38								3	
42	12	50	35 × 5	95	M12	15	18	4	280
44.5								2.5	
54	12	62	35 × 5	105	M12	15	18	4	280
57								2.5	
67	12	72	35 × 5	115	M12	15	18	2	165
76.1	12	80	35 × 5	125	M12	15	18	2	165
88.9	12	92	35 × 5	135	M12	15	18	1.5	165
108	12	118	35 × 5	170	M12	15	18	5	165
133	16	144	35 × 5	195	M16	19	24	5	280
159	16	172	35 × 5	225	M16	19	24	6	280
193.7	16	198	35 × 8	270	M16	19	24	2	450
219.1	16	224	35 × 8	295	M16	19	24	2	450
267	16	278	35 × 8	350	M16	19	24	5	450
323.9	20	330	45 × 10	420	M20	24	30	3	900
368	24	380	55 × 10	480	M24	28	36	6	900
419	24	435	60 × 15	555	M24	28	36	8	1 350
457.2	30	464	65 × 20	625	M30	35	45	3	2 250
508	30	516	65 × 20	675	M30	35	45	4	2 250
610	30	618	80 × 20	780	M30	35	45	4	2 700
711	30	716	80 × 20	880	M30	35	45	2	1 300
813	30	816	90 × 25	1 020	M30	35	45	1.5	2 000
914	30	918	90 × 25	1 120	M30	35	45	2	1 800
1 016	36	1 020	100 × 30	1 250	M36	42	54	2	2 600

NOTE 1 The following clips are identical with range A clips for steel pipes specified in Part 1 of this standard.

Tube sizes	**Table no. in Part 1:1974**
20 to 57 inclusive	7
76.1 to 323.9 inclusive	7
368 and 419	7A
457.2 to 610 inclusive	7

Clips for tube sizes 711 to 1 016 inclusive are identical with those given in Table 1(a) of this Part 3.

NOTE 2 Where required, other liner thicknesses may be accommodated by altering the lengths of the distance pieces on the clips.

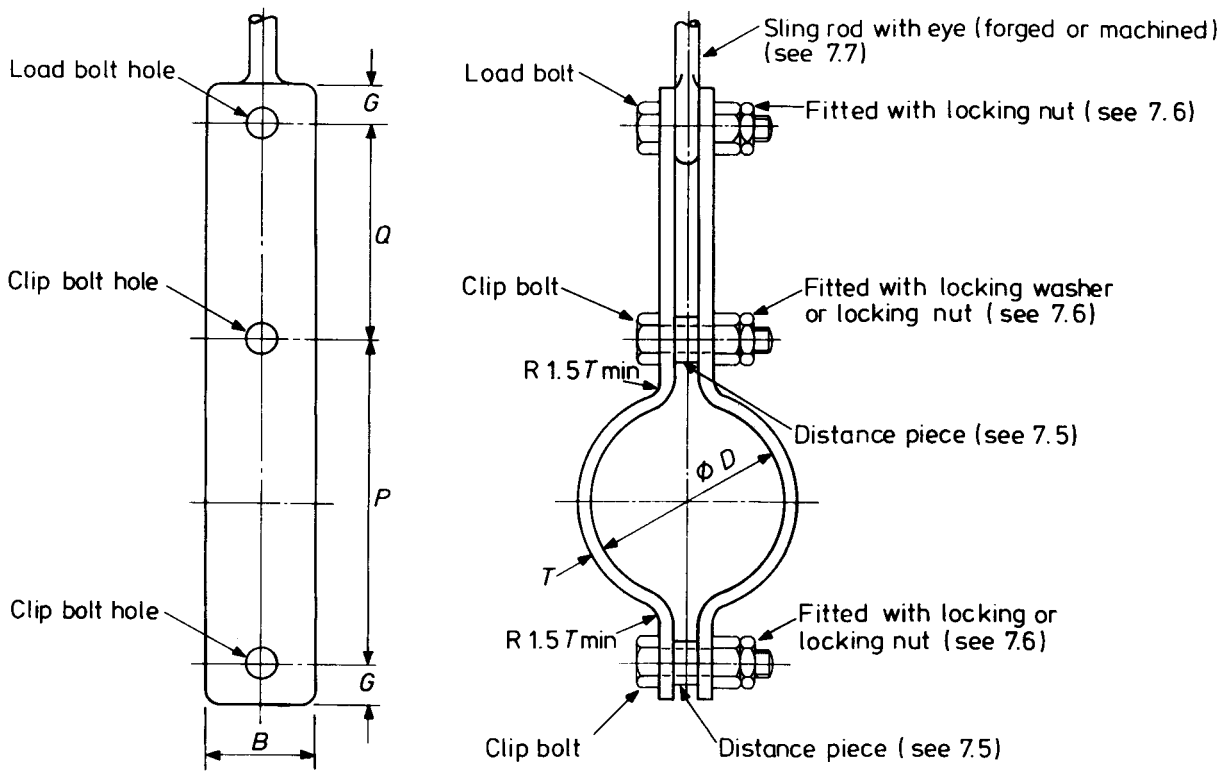


Figure 2 — Pipe clip for copper/copper alloy tubes (range B: – 20 °C to 300 °C) *(See Table 2.)*

Table 2 — Dimensions of pipe clips for copper/copper alloy tubes (range B: – 20 °C to 300 °C)

All dimensions are in millimetres.

Tube outside diameter	Sling rod diameter	Clip dimensions				Clip and load bolts		*G* min.	Linear thickness	Safe working load
		D diameter	*B* × *T*	*P*	*Q*	Bolt size	Bolt hole diameter			kg
20	10	23	35 × 5	65	70	M10	12	15	1.5	280
22	10	28	35 × 5	70	70	M10	12	15	3	280
25									1.5	
28	10	36	35 × 5	75	70	M10	12	15	4	280
30									3	
35	12	44	35 × 5	90	70	M12	15	18	5	280
38									3	
42	12	50	35 × 5	95	85	M12	15	18	4	280
44.5									3	
54	12	62	35 × 5	105	80	M12	15	18	4	280
57									2	
76.1	12	80	35 × 5	125	105	M12	15	18	2	165
88.9	12	92	35 × 5	135	105	M12	15	18	1.5	165
108	12	118	35 × 5	170	105	M12	15	18	5	165
133	16	144	35 × 8	215	95	M16	19	24	5	280
159	16	172	35 × 8	245	95	M16	19	24	6	280
193.7	16	198	35 × 8	270	95	M16	19	24	2	280
219.1	16	224	35 × 8	295	100	M16	19	24	2	280
267	16	278	45 × 10	360	105	M16	19	24	5	450
323.9	20	330	55 × 15	445	95	M20	24	30	3	900
368	24	374	55 × 15	495	100	M24	28	36	3	900
419	24	426	65 × 20	575	100	M24	28	36	3	1 350
457.2	30	464	65 × 20	625	80	M30	35	45	3	1 800
508	30	516	90 × 25	700	85	M30	35	45	4	2 700
610	30	618	90 × 25	805	80	M30	35	45	4	2 700

NOTE 1 Clips for tube outside diameters 20 to 323.9 and 457.2 to 610 are identical with range B clips for steel pipes as detailed in Table 8 of Part 1:1974 of this standard.

There are no identical clips for tube outside diameters 368 and 419 but these are similar to range B clips for steel pipes given in Table 8 of Part 1:1974 of this standard, with dimensions *D*, *P* and *Q* modified to suit outside diameters of copper alloy tubes.

NOTE 2 Where required, other liner thicknesses may be accommodated by altering the lengths of the distance pieces on the clips.

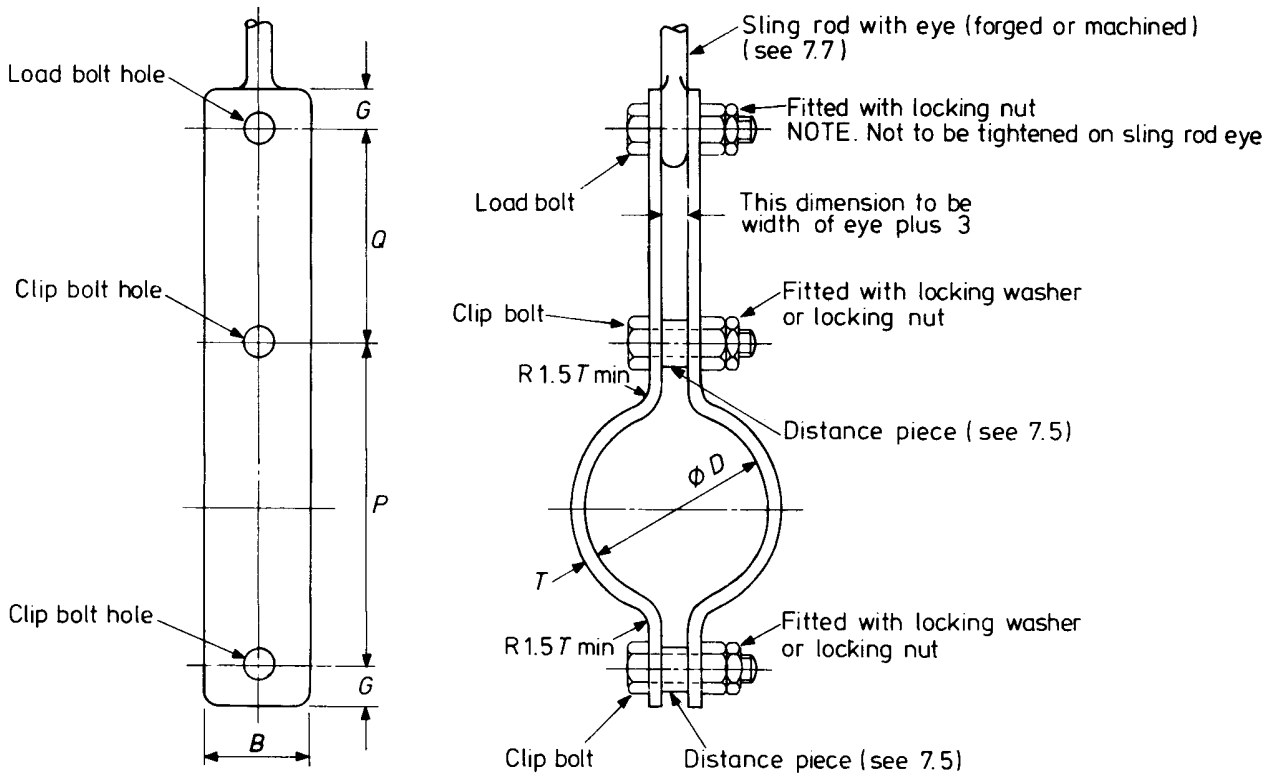


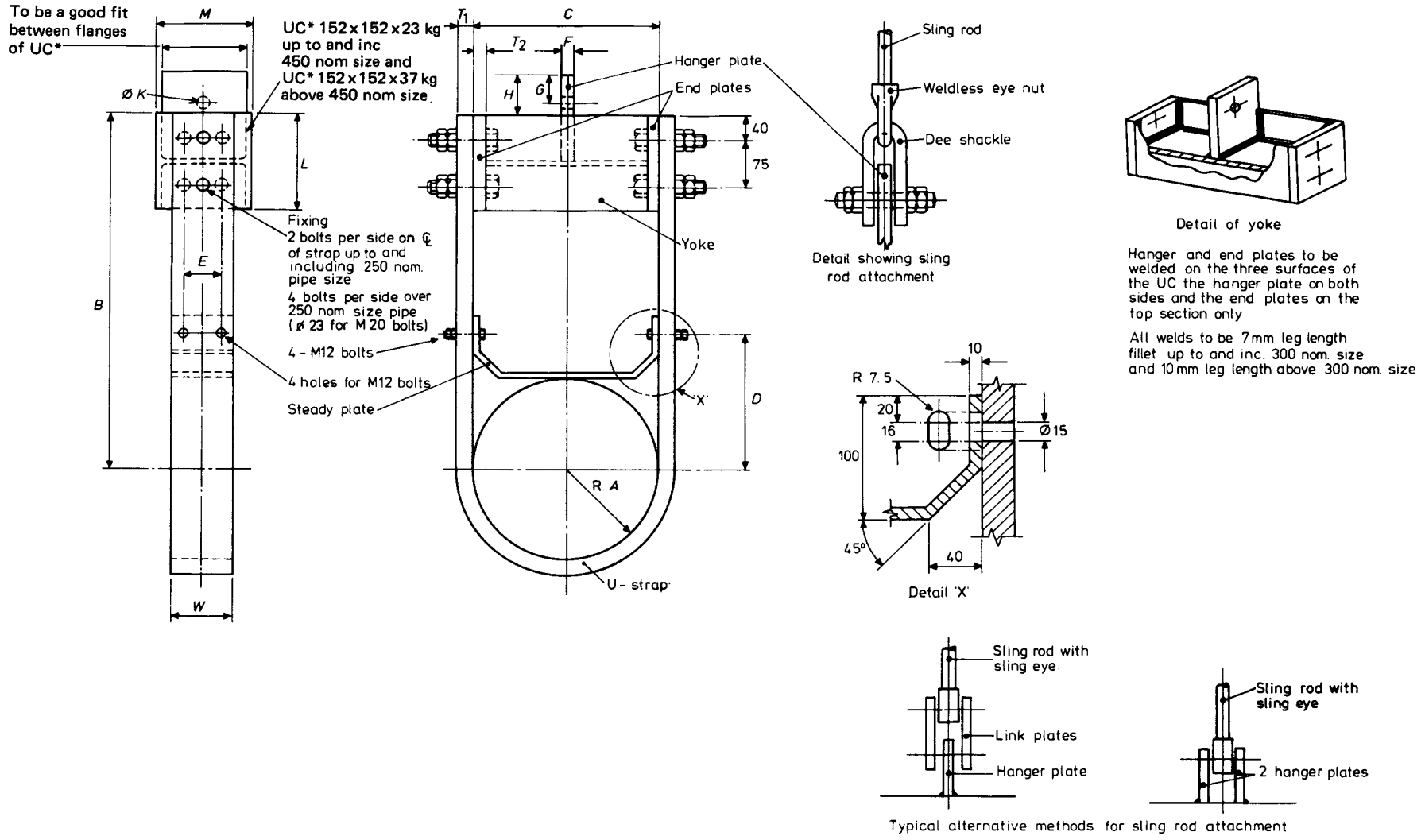
Figure 3 — Alloy steel pipe clip for steel pipes (range D: – 20 °C to 570 °C) *(See Table 3.)*

Table 3 — Dimensions of alloy steel pipe clips for steel pipes (range D: – 20 °C to 570 °C)

All dimensions are in millimetres.

Pipe			Clip dimensions[a]					Clip and load bolts		G min.	Safe working load	
Nominal size	Outside diameter	Sling rod diameter	D diameter	$B \times T$ sub-ranges		P	Q	Bolt size	Bolt hole diameter		D1 and D2	D3
				D1	D2 and D3						kg	kg
15	21.3	12	23	40 × 6	55 × 6	85	65	M12	15	18	450	375
20	26.9	12	28	40 × 6	55 × 6	90	65	M12	15	18	450	375
25	33.7	12	36	40 × 6	55 × 6	105	65	M12	15	18	450	375
32	42.4	12	44	40 × 6	55 × 6	105	65	M12	15	18	450	375
40	48.3	16	50	50 × 10	60 × 10	115	75	M16	19	24	900	750
50	60.3	16	62	50 × 10	60 × 10	130	75	M16	19	24	900	750
65	76.1	16	80	50 × 10	60 × 10	155	75	M16	19	24	900	750
80	88.9	16	92	50 × 10	60 × 10	165	100	M16	19	24	900	750
100	114.3	16	118	60 × 10	70 × 12	195	100	M16	19	24	900	750
125	139.7	20	144	70 × 12	80 × 12	235	100	M20	24	30	1 350	1 130
150	168.3	24	172	70 × 12	80 × 15	275	100	M24	28	36	1 800	1 500
175	193.7	24	198	80 × 12	100 × 20	325	100	M24	28	36	1 800	1 500
200	219.1	24	224	80 × 12	100 × 20	360	100	M24	28	36	1 800	1 500
225	244.5	24	248	110 × 12	100 × 20	385	100	M24	28	36	1 800	1 500
250	273	24	276	110 × 12	100 × 25	435	100	M24	28	36	1 800	1 500
300	323.9	30	330	100 × 20	120 × 25	500	115	M30	35	45	2 700	2 260
350	355.6	30	362	100 × 20	120 × 25	585	115	M30	35	45	2 700	2 260
		42	362	140 × 25	100 × 40	585	115	M42	48	63	5 900	4 950
400	406.4	30	412	110 × 20	140 × 25	625	115	M30	35	45	2 700	2 260
		42	412	140 × 25	130 × 40	625	115	M42	48	63	5 900	4 950
450	457	30	464	100 × 25	140 × 30	690	115	M30	35	45	3 600	3 020
		42	464	120 × 30	140 × 40	690	115	M42	48	63	5 900	4 950
500	508	30	516	120 × 25	160 × 30	745	115	M30	35	45	3 600	3 020
		42	516	130 × 30	160 × 40	745	115	M42	48	63	5 900	4 950
550	559	30	566	130 × 25	180 × 30	800	115	M30	35	45	3 600	3 020
		42	566	150 × 30	160 × 40	800	115	M42	48	63	5 900	4 950
600	610	30	618	140 × 25	200 × 30	845	115	M30	35	45	3 600	3 020
		42	618	160 × 30	200 × 40	845	115	M42	48	63	5 900	4 950

[a] Range D1 gives dimensions for pipe clips using BS 1501:620 grade 27B (1 % Cr, ½ % Mo) material for use for maximum temperature of 510 °C.
Ranges D2 and D3 give respectively, dimensions for pipe clips using BS 1501:620 grade 27B (1 % Cr, ½ % Mo) material for use for maximum temperature of 540 °C and BS 1501:622 grade 31B (2¼ % Cr, 1 % Mo) material for use up to 570 °C.



All dimensions are in millimetres.

*UC is universal column.

Figure 4 — U-strap

Table 4 — Dimensions of alloy steel U-straps for steel pipes (range D: – 20 °C to 570 °C)

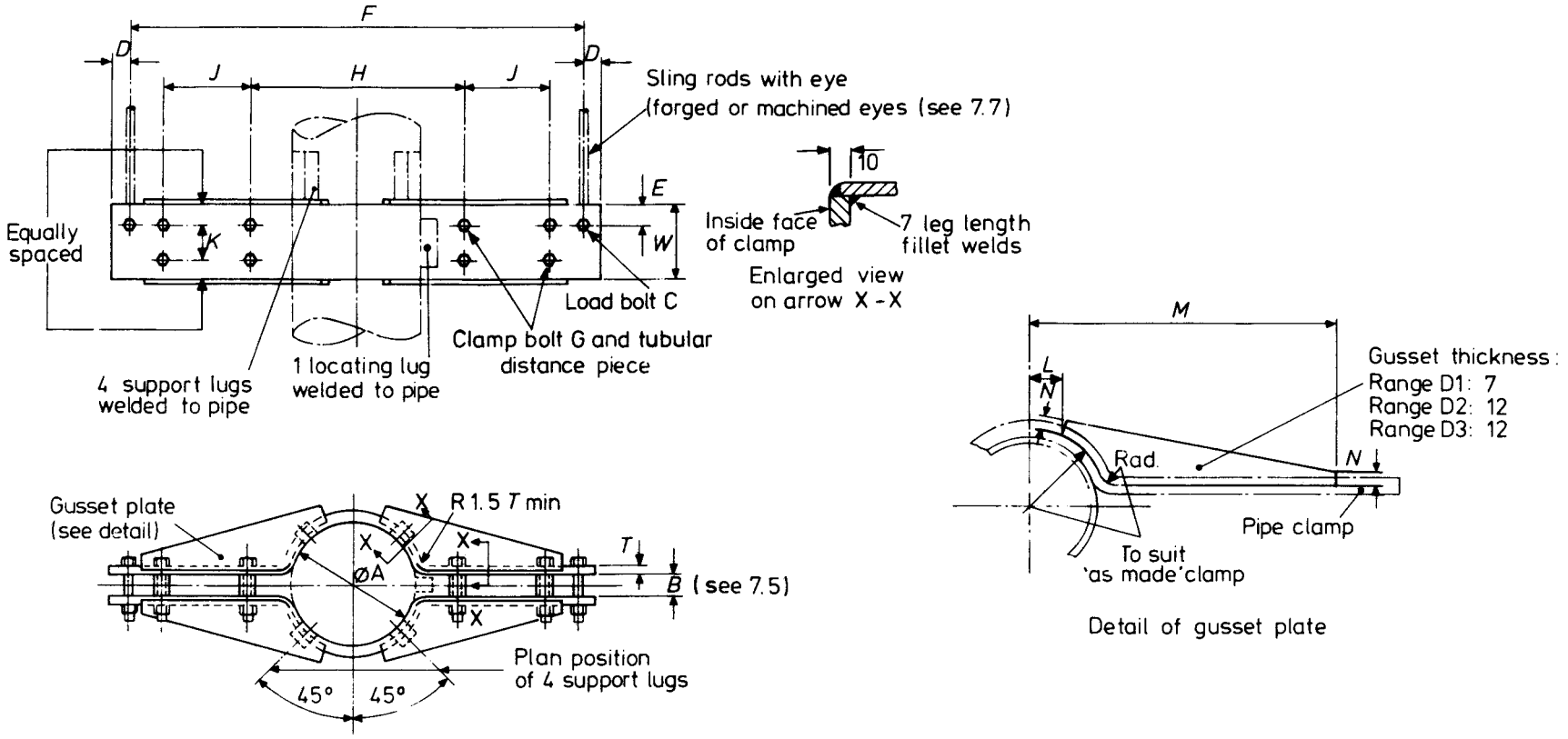
All dimensions are in millimetres.

Pipe		Sling rod diameter	U-plate							Yoke					Safe working load	
			Sub-ranges							Hanger plate				End plate		
Nominal size	Outside diameter		D1	D2 and D3	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*K*	$L \times M \times T_2$	D1 and D2	D3
			$W \times T_1$	$W \times T_1$											kg	kg
200	219.1	24	80 × 12	100 × 20	112	470	224	184	40	30	36	50	26	152 × 152 × 15	1 800	1 500
225	244.5	24	110 × 12	100 × 20	124	480	248	196	40	30	36	50	26	152 × 152 × 15	1 800	1 500
250	273	24	110 × 12	100 × 25	138	490	276	210	40	30	36	50	26	152 × 152 × 15	1 800	1 500
300	323.9	30	100 × 20	120 × 25	165	515	330	237	40	35	45	65	33	152 × 152 × 15	2 700	2 260
350	355.6	30	100 × 20	120 × 25	181	530	362	253	40	35	45	65	33	152 × 152 × 15	2 700	2 260
		42	140 × 25	100 × 40	181	530	362	253	40	50	63	90	45	152 × 152 × 20	5 900	4 950
400	406.4	30	110 × 20	140 × 25	206	560	412	278	50	35	45	65	33	152 × 152 × 15	2 700	2 260
		42	140 × 25	130 × 40	206	560	412	278	50	50	63	90	45	152 × 152 × 20	5 900	4 950
450	457	30	100 × 25	140 × 30	232	635	464	304	40	35	45	65	33	152 × 152 × 20	3 600	3 020
		42	120 × 30	140 × 40	232	635	464	304	40	50	63	90	45	152 × 152 × 20	5 900	4 950
500	508	30	120 × 25	160 × 30	258	660	516	330	60	35	45	65	33	154 × 161 × 20	3 600	3 020
		42	130 × 30	160 × 40	258	660	516	330	60	50	63	90	45	154 × 161 × 20	5 900	4 950
550	559	30	130 × 25	180 × 30	283	685	566	355	70	35	45	65	33	154 × 161 × 20	3 600	3 020
		42	150 × 30	160 × 40	283	685	566	355	70	50	63	90	45	154 × 161 × 20	5 900	4 950
600	610	30	140 × 25	200 × 30	309	710	618	381	75	35	45	65	33	154 × 161 × 20	3 600	3 020
		42	160 × 30	200 × 40	309	710	618	381	75	50	63	90	45	154 × 161 × 20	5 900	4 950

NOTE 1 This support is suitable only for nominally horizontal sections of pipe lines. When using this type of support consideration shall be given to problems related to possible in-service damage to the pipe thermal insulation in the vicinity of the support.

NOTE 2 Range D1 gives dimensions for pipe clips using BS 1501:620 grade 27B (1 % Cr, ½ % Mo) material for use for maximum temperature of 510 °C.
Ranges D2 and D3 give respectively, dimensions for pipe clips using BS 1501:620 grade 27B (1 % Cr, ½ % Mo) material for use for maximum temperature of 540 °C and BS 1501:622 grade 31B (2¼, % Cr, 1 % Mo) material for use up to 570 °C.

NOTE 3 Asbestos-free tape or millboard may be placed between the pipe and the U-strap. In such cases, the dimensions of the U-strap shall be adjusted to ensure that it does not tighten on to the pipe.



All dimensions are in millimetres.

NOTE 1 Design methods for support lugs are available, such as in BS 5500, that will enable a check to be made on the suitability of the pipe to withstand the stresses imposed upon it by the support lugs.

NOTE 2 The support lugs shall be designed so that the clearance between the pipe and the clamp, including any plus tolerance, occurs at any one single support lug.

Figure 5 — Alloy steel riser clamps for pipes up to and including 600 nominal size (range D: – 20 °C to 570 °C)

[See Table 5(a), Table 5(b) and Table 5(c).]

Table 5(a) — Dimensions of riser clamps for steel pipes (range D1: – 20 °C to 510 °C)

All dimensions are in millimetres.

Pipe		Sling rod diameter	Clamp			Load bolt					Clamp bolt					Gusset plate			Safe working load
Nominal size	Outside diameter		$W \times T$	A	B [a] min	Bolt size C	Bolt hole diameter	D	E	F	Bolt size G	Bolt hole diameter	H	J	K	L	M	N	
																			kg
200	219.1	24	130 × 20	225	65	M24	26	36	36	1 065	M16	18	458	205	65	50	485	40	2 270
225	244.5	24	130 × 20	250	65	M24	26	36	36	1 065	M16	18	508	180	65	60	485	40	2 270
250	273	24	155 × 20	279	65	M24	26	36	36	1 220	M16	18	508	255	80	60	560	40	2 270
300	323.9	30	155 × 25	330	65	M30	33	45	45	1 220	M20	22	560	230	80	75	560	40	3 630
350	355.6	30	155 × 25	362	65	M30	33	45	45	1 220	M20	22	610	205	80	85	560	40	3 630
		42	205 × 35	362	65	M42	45	63	63	1 370	M24	26	610	280	105	85	635	50	7 260
400	406.4	30	155 × 25	413	65	M30	33	45	45	1 370	M20	22	660	255	80	100	635	40	3 630
		42	205 × 35	413	65	M42	45	63	63	1 370	M24	26	660	255	105	100	635	50	7 260
450	457	36	155 × 35	470	65	M36.	39	54	54	1 370	M24	26	710	230	80	110	635	50	4 540
		42	205 × 35	470	65	M42	45	63	63	1 370	M24	26	710	230	105	110	635	50	7 260
500	508	36	180 × 35	521	65	M36	39	54	54	1 525	M24	26	762	280	90	125	710	50	4 540
		42	230 × 35	521	65	M42	45	63	63	1 525	M24	26	762	280	115	125	710	50	7 260
550	559	36	180 × 35	572	65	M36	39	54	54	1 525	M24	26	812	255	90	140	710	50	4 540
		42	230 × 35	572	65	M42	45	63	63	1 525	M24	26	812	255	115	140	710	50	7 260
600	610	36	180 × 35	622	65	M36	39	54	54	1 525	M24	26	864	230	90	150	710	50	4 540
		42	255 × 35	622	65	M42	45	63	63	1 525	M24	26	864	230	130	150	710	50	7 260

[a] Where the size of the sling rod eye is less than the dimension B, suitable packer pieces shall be fitted to bolt C to ensure that the eye is located centrally between the riser clamp ears. For those sizes of clamp requiring a 42 mm sling rod and where the screwed machined eye is being used, dimension B shall be increased to 73 mm.

Table 5(b) — Dimensions of riser clamps for steel pipes (range D2: 510 °C to 540 °C)

All dimensions are in millimetres.

Pipe		Sling rod diameter	Clamp			Load bolt					Clamp bolt					Gusset plate			Safe working load
Nominal size	Outside diameter		$W \times T$	A	B [a] min	Bolt size C	Bolt hole diameter	D	E	F	Bolt size G	Bolt hole diameter	H	J	K	L	M	N	
																			kg
200	219.1	24	155 × 25	225	65	M24	26	36	36	1 065	M20	22	458	205	80	50	485	40	2 270
225	244.5	24	155 × 25	250	65	M24	26	36	36	1 065	M20	22	508	180	80	60	485	40	2 270
250	273	24	155 × 25	279	65	M24	26	36	36	1 220	M20	22	508	255	80	60	560	40	2 270
300	323.9	30	180 × 35	330	65	M30	33	45	45	1 220	M24	26	560	230	90	75	560	40	3 630
350	355.6	30	180 × 35	362	65	M30	33	45	45	1 220	M24	26	610	205	90	85	560	40	3 630
		42	205 × 45	362	65	M42	45	63	63	1 370	M33	36	610	280	105	85	635	50	7 260
400	406.4	30	205 × 35	413	65	M30	33	45	45	1 370	M24	26	660	255	105	100	635	40	3 630
		42	230 × 45	413	65	M42	45	63	63	1 370	M33	36	660	255	115	100	635	50	7 260
450	457	36	180 × 45	470	65	M36	39	54	54	1 370	M33	36	710	230	90	110	635	50	4 540
		42	230 × 45	470	65	M42	45	63	63	1 370	M33	36	710	230	115	110	635	50	7 260
500	508	36	180 × 45	521	65	M36	39	54	54	1 525	M33	36	762	280	90	125	710	50	4 540
		42	255 × 45	521	65	M42	45	63	63	1 525	M33	36	762	280	130	125	710	50	7 260
550	559	36	180 × 45	572	65	M36	39	54	54	1 525	M33	36	812	255	90	140	710	50	4 540
		42	255 × 45	572	65	M42	45	63	63	1 525	M33	36	812	255	130	140	710	50	7 260
600	610	36	180 × 45	622	65	M36	39	54	54	1 525	M33	36	864	230	90	150	710	50	4 540
		42	255 × 45	622	65	M42	45	63	63	1 525	M33	36	864	230	130	150	710	50	7 260

[a] Where the size of the sling rod eye is less than the dimension B, suitable packer pieces shall be fitted to bolt C to ensure that the eye is located centrally between the riser clamp ears. For those sizes of clamp requiring a 42 mm sling rod and where the screwed machined eye is being used, dimension B shall be increased to 73 mm.

Table 5(c) — Dimensions of riser clamps for steel pipes (range D3: 540 °C to 570 °C)

All dimensions are in millimetres.

Pipe		Sling rod diameter	Clamp			Load bolt					Clamp bolt					Gusset plate			Safe working load
Nominal size	Outside diameter		$W \times T$	A	B [a] min	Bolt size C	Bolt hole diameter	D	E	F	Bolt size G	Bolt hole diameter	H	J	K	L	M	N	
																			kg
200	219.1	24	155 × 25	225	65	M24	26	36	36	1 065	M20	22	458	205	80	50	485	40	1 900
225	244.5	24	155 × 25	250	65	M24	26	36	36	1 065	M20	22	508	180	80	60	485	40	1 900
250	273	24	155 × 25	279	65	M24	26	36	36	1 220	M20	22	508	255	80	60	555	40	1 900
300	323.9	30	180 × 35	330	65	M30	33	45	45	1 220	M20	22	560	230	90	75	555	40	3 050
350	355.6	30	180 × 35	362	65	M30	33	45	45	1 220	M20	22	610	205	90	85	555	40	3 050
		42	230 × 40	362	65	M42	45	63	63	1 370	M24	26	610	280	115	85	635	50	6 100
400	406.4	30	180 × 40	413	65	M30	33	45	45	1 370	M20	22	660	255	100	100	635	40	3 050
		42	255 × 40	413	65	M42	45	63	63	1 370	M24	26	660	255	130	100	635	50	6 100
450	457	36	205 × 40	470	65	M36	39	54	54	1 370	M24	26	710	230	105	110	635	50	3 810
		42	280 × 40	470	65	M42	45	63	63	1 370	M24	26	710	230	155	110	635	50	6 100
500	508	36	205 × 40	521	65	M36	39	54	54	1 525	M24	26	762	280	105	125	710	50	3 810
		42	280 × 40	521	65	M42	45	63	63	1 525	M24	26	762	280	155	125	710	50	6 100
550	559	36	205 × 40	572	65	M36	39	54	54	1 525	M24	26	812	255	105	140	710	50	3 810
		42	305 × 40	572	65	M42	45	63	63	1 525	M24	26	812	255	180	140	710	50	6 100
600	610	36	230 × 40	622	65	M36	39	54	54	1 525	M24	26	864	230	115	150	710	50	3 810
		42	305 × 40	622	65	M42	45	63	63	1 525	M24	26	864	230	180	150	710	50	6 100

[a] Where the size of the sling rod eye is less than the dimension B, suitable packer pieces shall be fitted to bolt C to ensure that the eye is located centrally between the riser clamp ears.
For those sizes of clamp requiring a 42 mm sling rod and where the screwed machined eye is being used, dimension B shall be increased to 73 mm.

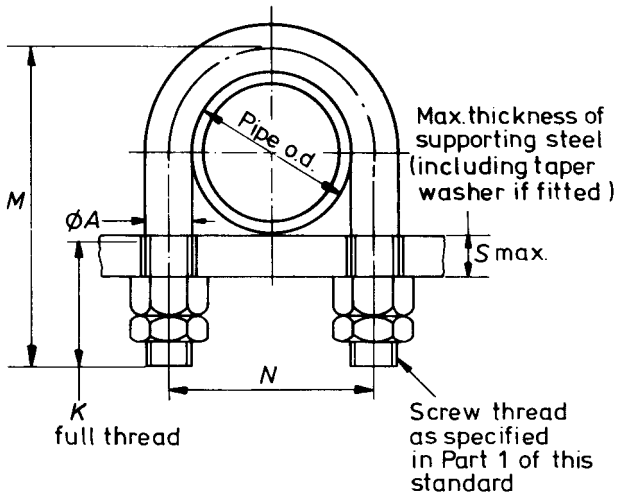


Figure 6 — U-bolt (to grip pipe)

Table 6 — Dimensions of U-bolts *(See Figure 6)*

All dimensions are in millimetres.

(a) Steel pipes						
Pipe		*A* **diameter**	*N*	*M*	*K*	*S* **maximum**
Nominal size	**Outside diameter**					
650	660	24	690	740	70	22
700	711	30	750	810	80	24
750	762	30	800	860	80	24
800	813	30	850	910	80	24
850	864	30	900	960	80	24
900	914	30	950	1 010	80	24
1 000	1 016	36	1 060	1 130	90	24
(b) Cast iron pipes						
700	738	30	775	835	80	24
800	842	30	880	940	80	24
900	945	30	980	1 045	80	24
1 000	1 048	36	1 090	1 160	90	24
1 100	1 152	36	1 195	1 260	90	24
1 200	1 255	36	1 300	1 360	90	24

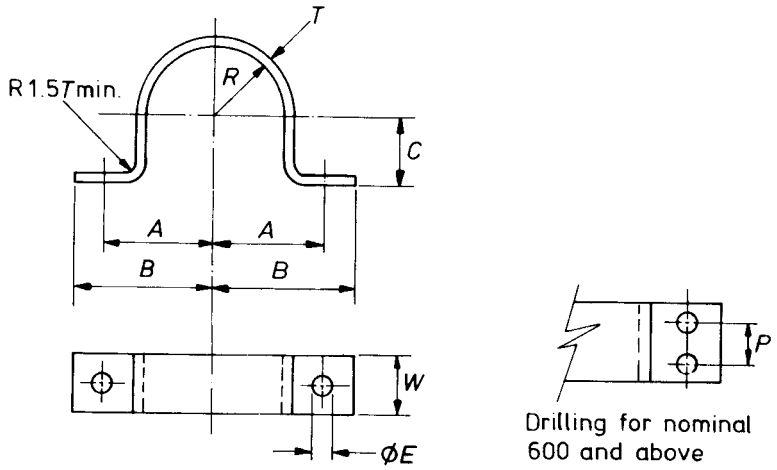


Figure 7 — Overstrap for steel pipes

Table 7 — Dimensions of steel overstraps for steel pipes

All dimensions are in millimetres.

Pipe		*A*	*B*	Strap size *W* × *T*	*C*	*R*	Hole *E*	Bolts		
Nominal size	Outside diameter							Size	No.	Pitch *P*
225	244.5	180	205	55 × 15	122	124	24	M20	2	—
250	273	195	220	55 × 15	135	138	24	M20	2	—
300	323.9	220	245	55 × 15	162	164	24	M20	2	—
350	355.6	235	260	55 × 15	172	180	24	M20	2	—
400	406.4	265	295	60 × 15	202	205	28	M24	2	—
450	457	290	320	60 × 15	228	231	28	M24	2	—
500	508	315	345	60 × 15	258	256	28	M24	2	—
550	559	340	370	60 × 15	278	282	28	M24	2	—
600	610	365	390	100 × 15	305	308	24	M20	4	60
650	660	390	415	100 × 15	328	333	24	M20	4	60
700	711	415	440	100 × 15	355	358	24	M20	4	60
750	762	440	465	100 × 15	380	385	24	M20	4	60
800	813	480	510	110 × 20	405	410	28	M24	4	65
850	864	505	535	110 × 20	430	435	28	M24	4	65
900	914	530	560	110 × 20	455	460	28	M24	4	65
1 000	1 016	585	615	110 × 20	507	511	28	M24	4	65

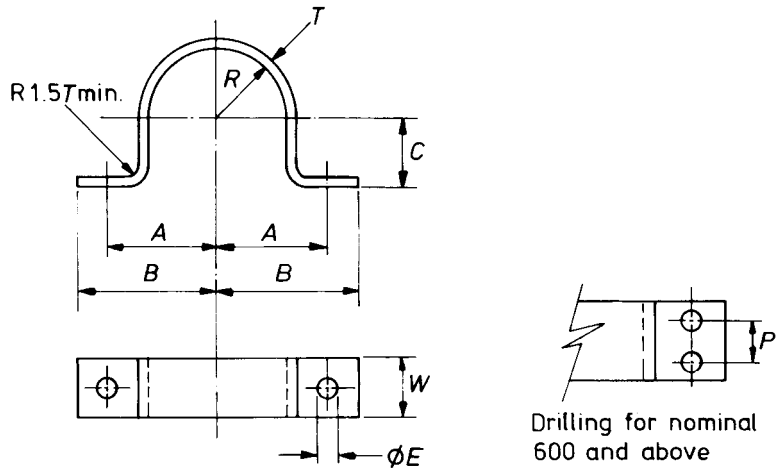


Figure 8 — Overstrap for cast iron pipes

Table 8 — Dimensions of steel overstraps for cast iron pipes

All dimensions are in millimetres.

Pipe		*A*	*B*	Strap size *W* × *T*	*C*	*R*	Hole *E*	Bolts		
Nominal size	Outside diameter							Size	No.	Pitch *P*
80	98	99	137	45 × 10	48	50	19	M16	2	—
100	118	108	146	45 × 10	55	59	19	M16	2	—
150	170	136	174	60 × 10	82	86	24	M20	2	—
200	222	170	200	55 × 15	110	112	24	M20	2	—
250	274	195	220	55 × 15	135	138	24	M20	2	—
300	326	220	245	55 × 15	162	164	24	M20	2	—
350	378	245	270	55 × 15	188	190	24	M20	2	—
400	429	275	305	60 × 15	214	215	28	M24	2	—
450	480	300	330	60 × 15	240	242	28	M24	2	—
500	532	330	360	60 × 15	265	268	28	M24	2	—
600	635	375	400	100 × 15	317	320	24	M20	4	60
700	738	430	455	100 × 15	368	372	24	M20	4	60
800	842	495	525	110 × 20	420	423	28	M24	4	65
900	945	545	575	110 × 20	472	475	28	M24	4	65
1 000	1 048	600	630	110 × 20	524	526	28	M24	4	65
1 100	1 152	655	690	140 × 20	575	578	35	M30	4	80
1 200	1 255	710	745	140 × 20	627	630	35	M30	4	80

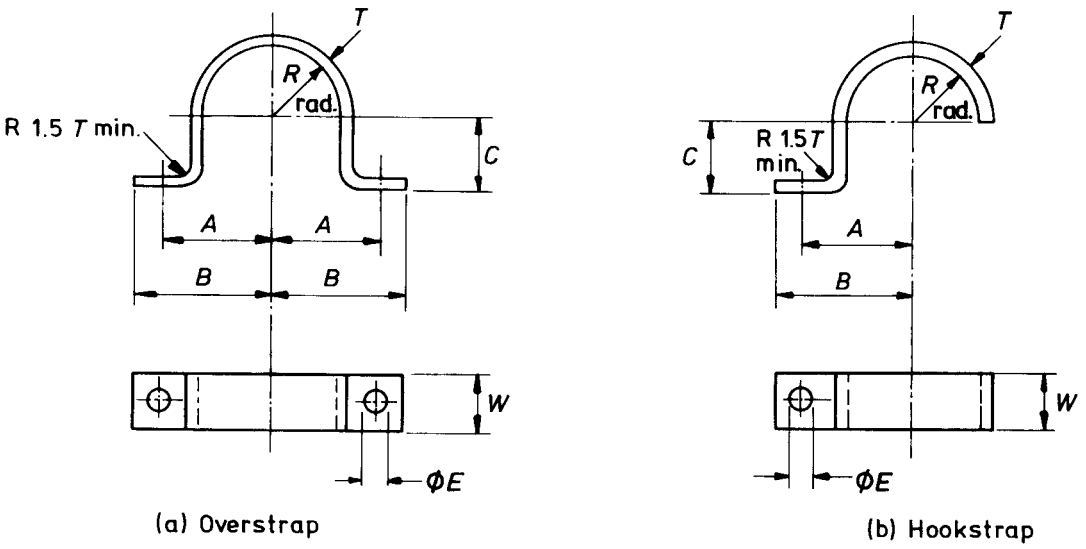


Figure 9 — Overstrap and hookstrap for copper/copper alloy tubes and precision steel tubes

Table 9 — Dimensions of overstraps and hookstraps for copper/copper alloy tubes and precision[b] steel tubes

All dimensions are in millimetres.

Tube outside diameter size		*A*	*B*	Strap size *W* × *T*	*C*	*R*	Hole diameter *E*	Bolt size
Copper/copper alloy	Steel							
10	10	13	20	12 × 1.6	4.5	5.5	3.6	M3
12	12	19	30	12 × 2.5	5.5	6.5	5.8	M5
15	15	19	30	12 × 2.5	7	8	5.8	M5
16	16	21	30	15 × 2.5	7.5	8.5	7	M6
18	18	23	35	15 × 2.5	8.5	9.5	7	M6
20	20	23	35	15 × 2.5	9.5	10.5	7	M6
22	22	26	40	20 × 2.5	10.5	11.5	10	M8
25	25	28	40	20 × 2.5	12	13	10	M8
28	28	30	45	20 × 3	13.5	14.5	10	M8
30	30	30	45	20 × 3	14.5	15.5	10	M8
35	35	40	55	25 × 4	17	18	12	M10
38	38	40	55	25 × 4	18.5	19.5	12	M10
42	42	43	60	25 × 4	20.5	21.5	12	M10
44.5	—	43	60	25 × 4	22	23	12	M10
—	50	46	60	25 × 4	24	26	12	M10
54	—	50	70	30 × 4	26.5	28	15	M12
57	—	52	70	30 × 4	28	30	15	M12
67	—	55	70	30 × 4	33	34	15	M12

NOTE Straps for copper/copper alloy tubes shall be made from copper and those for steel tubes from steel.

[b] The term "precision" applies to tubes complying with the requirements of Table 4 of BS 3600:1976.

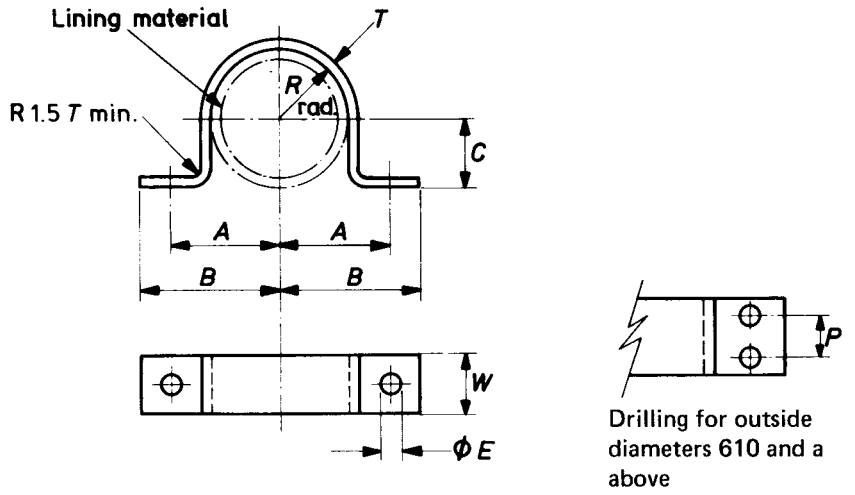


Figure 10 — Overstrap for copper/copper alloy tubes

Table 10 — Dimensions of steel overstraps for copper/copper alloy tubes

All dimensions are in millimetres.

Tube outside diameter	*A*	*B*	Strap size *W* × *T*	*C*	*R*	Hole *E*	Bolts			Linear thickness
							Size	No.	Pitch *P*	
76.1	89	127	45 × 10	36	40	19	M16	2	—	2
88.9	99	137	45 × 10	43	46	19	M16	2	—	1.5
108	108	146	45 × 10	55	59	19	M16	2	—	5
133	119	160	60 × 10	68	72	24	M20	2	—	5
159	136	174	60 × 10	82	86	24	M20	2	—	3
193.7	155	188	55 × 15	95	99	24	M20	2	—	3
219.1	170	200	55 × 15	107	112	24	M20	2	—	2
267	195	220	55 × 15	135	138	24	M20	2	—	4
323.9	220	245	55 × 15	162	164	24	M20	2	—	2
368	245	270	55 × 15	188	190	24	M20	2	—	5
419	275	305	60 × 15	214	215	28	M24	2	—	5
457	290	320	60 × 15	228	231	28	M24	2	—	3
508	315	345	60 × 15	258	256	28	M24	2	—	2
610	365	390	100 × 15	305	308	24	M20	4	60	3
711	415	440	100 × 15	355	358	24	M20	4	60	3
813	480	510	110 × 20	405	410	28	M24	4	65	3
914	530	560	110 × 20	455	460	28	M24	4	65	3
1 016	585	615	110 × 20	507	511	28	M24	4	65	3

Section 3. Marine applications

NOTE Users of this marine section should note that while observing the requirements of the section and the standard they should at the same time ensure compliance with such statutory requirements, rules and regulations as may be applicable to the individual ship concerned. Attention is drawn to the general design recommendations given in Appendix A.

12 Pipe support components

12.1 Wherever appropriate, marine pipe supports shall conform to the design requirements, materials, manufacturing details, types and dimensions specified in Parts 1, 2 and in this Part 3 of this standard. Part 2 is principally aligned to land-based installations but certain sections may have equal validity to shipbuilding pipework. It is therefore left to the discretion of the user to select from Part 2 any appropriate details and information.

12.2 In order to acquaint the user with the particular pipe components contained in Part 1 and in this Part 3 which are acceptable for marine installations, a list referring to the appropriate Parts of BS 3974 is given in the following summary. Where there are more specific requirements or restrictions relating to the application of these components in ships' installations, these are specified in this section 3.

Summary of pipe support components for marine use

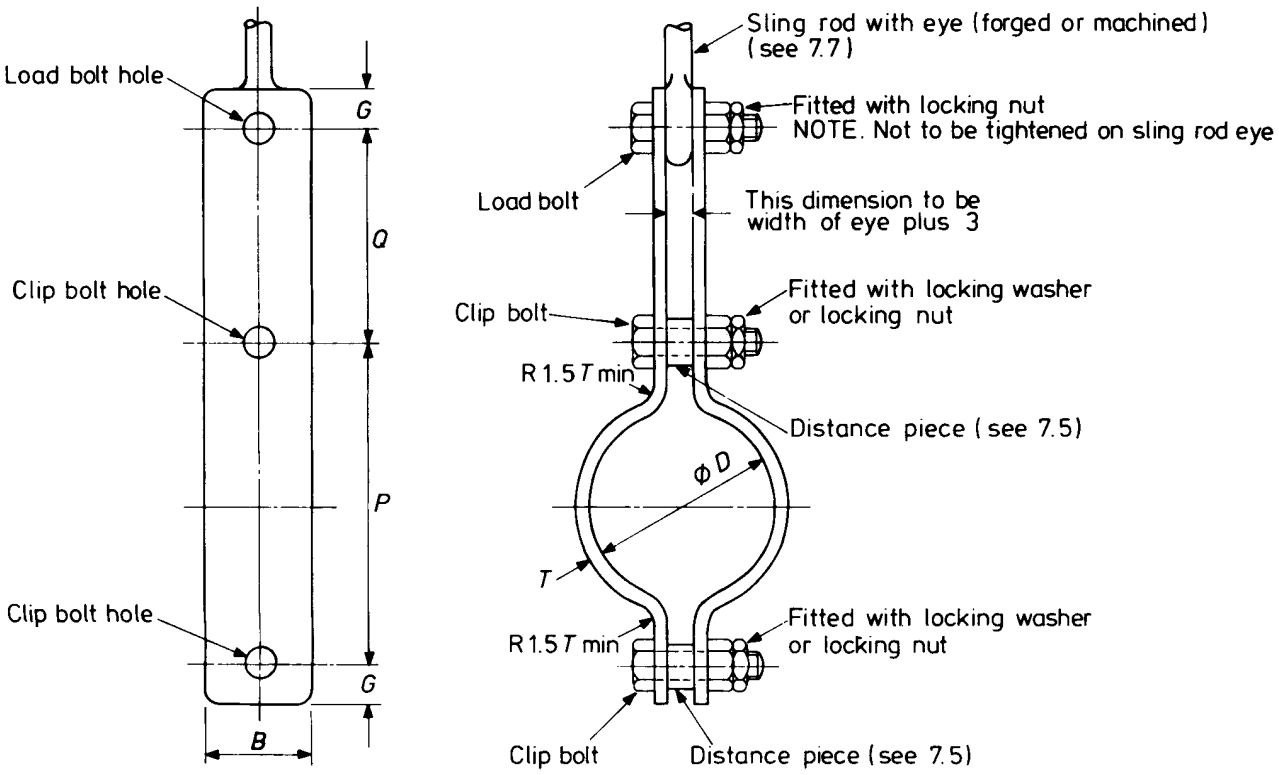
Component	BS 3974 Dimensional details		
	Part 1	Part 3	
	For steel and cast iron pipes	For steel, cast iron and alloy steel pipes	For copper alloy pipes
Sling rods	Figure 1, Figure 2 and Figure 3, Table 1, Table 2 and Table 3	See **7.7**	See **7.7**
Spherical washers	Figure 5, Table 5	See **7.7**	See **7.7**
Pipe clips	Range A: Figure 7, Table 7 and Table 7(a)	Figure 1, Table 1(a) and Table 1(b)	Figure 1, Table 1(c)
	Range B: Figure 8, Table 8	—	Figure 2, Table 2
	Range C: Figure 9, Table 9	—	—
	Range D(M): —	Figure 11, Table 11	—
U-bolts	Figure 11(a), Table 11	Figure 6, Table 6(a) and Table 6(b)	—
Overstraps and hookstraps	Figure 12, Table 12	Figure 7, Table 7 Figure 8, Table 8 Figure 9, Table 9	Figure 9, Table 9 Figure 10, Table 10

13 Pipe clip design

13.1 Pipe clips in this section include ranges A, B and C of Part 1 and this Part 3 of this standard except that the one-piece type of strap under range A (Figure 6 of Part 1) shall not be used in marine applications. Range D alloy Steel pipe clips for high temperature pipework are included in this Part 3 but are subject to particular marine working temperatures and safe working loads. The marine design data for pipe clips ranges A, B, C and D are as follows.

Marine pipe clip design data

Range	Material specification		Marine working temperature range	Design criteria	Design factor	Design stress level
	BS no.	Designation				
			°C			N/mm²
A	BS 4360	43A (see note 1)	– 20 to 100	Yield stress	1	245
B	BS 1501-1	151 grade 26A	– 20 to 300	0.2 % proof stress	1	132
		161 grade 26A				
C		151 grade 26A	Above 400 to 470	Mean stress to rupture in 100 000 h	1.4	50
		161 grade 26A				
D1(M)	BS 1501-2	620 grade 27A	above 470 to 525			63
D3(M)		622 grade 31A	above 525 to 565		1.4	47
NOTE Shipbuilding quality steel may be used provided it has equal or higher physical properties.						



Dimension is in millimetres.

Figure 11 — Alloy steel pipe clip for steel pipes (range D (marine): above 470 °C to 565 °C)
(See Table 11.)

13.2 For marine use the safe working loads of pipe clips ranges A, B and C shall be as specified in Part 1 and in this Part 3, but for range D clips the marine safe working loads have been calculated-on the design data given in **13.1**. A rationalized list of range D clip sizes based on preferred pipe sizes for marine use is given in Figure 11 and Table 11, together with marine safe working loads.

Table 11 — Dimensions of marine pipe clips for alloy steel pipes (range D(M): above 470 °C to 565 °C

All dimensions are in millimetres.

Pipe		Sling rod diameter	Clip dimensions					Bolt size	Bolt hole diameter	*G* min.	Safe working load	
Nominal size	Outside diameter		*D* diameter	*B* × *T*		*P*	*Q*				D1(M)	D3(M)
				D1(M) (see note 1)	D3(M) (see note 2)						kg	
15	21.3	12	23	40 × 6	55 × 6	85	65	M12	15	18	375	
20	26.9	12	28	40 × 6	55 × 6	90	65	M12	15	18	375	
25	33.7	12	36	40 × 6	55 × 6	105	65	M12	15	18	375	
32	42.4	12	44	40 × 6	55 × 6	105	65	M12	15	18	375	
40	48.3	16	50	50 × 10	60 × 10	115	75	M16	19	24	610	550
50	60.3	16	62	50 × 10	60 × 10	130	75	M16	19	24	610	550
65	76.1	16	80	50 × 10	60 × 10	155	75	M16	19	24	610	550
80	88.9	16	92	50 × 10	60 × 10	165	100	M16	19	24	610	550
100	114.3	16	118	60 × 10	70 × 12	195	100	M16	19	24	515	635
125	139.7	20	144	70 × 12	80 × 12	235	100	M20	24	30	705	600
150	168.3	24	172	70 × 12	80 × 15	275	100	M24	28	36	590	770
200	219.1	24	224	80 × 12	100 × 20	360	100	M24	28	36	505	1 260
250	273	24	276	110 × 12	100 × 25	435	100	M24	28	36	550	1 500
300	323.9	30	330	100 × 20	120 × 25	500	110	M30	35	45	1 100	1 500
350	355.6	30	362	100 × 20	120 × 25	585	110	M30	35	45	1 050	1 450
		42		140 × 25	100 × 40			M42	48	63	2 370	3 120
400	406.4	30	412	110 × 20	140 × 25	625	110	M30	35	45	960	1 410
		42		140 × 256	130 × 40			M42	48	63	1 960	3 350
450	457	30	464	100 × 25	140 × 30	690	110	M30	35	45	1 240	1 750
		42		120 × 30	140 × 40			M42	48	63	2 070	3 140
500	508	30	516	120 × 25	160 × 30	745	110	M30	35	45	1 235	1 750
		42		130 × 30	160 × 40			M42	48	63	1 965	3 140

NOTE 1 D1(M) material to BS 1501-2, 620 grade 27B (1 % Cr, ½ % Mo) is suitable for temperatures not exceeding 525 °C in ships' installations.

NOTE 2 D3(M) material to BS 1501-2, 622 grade 31B (2 ¼ % Cr, 1 % Mo) is suitable for temperatures not exceeding 565 °C in ships' installations.

13.3 The manufacture and heat treatment of range D alloy steel pipe clips for marine use shall be as specified in clause **7**.

13.4 Distance pieces shall be fitted to all clip bolts for range A, B, C and D clips as specified in Part 1 and in this Part 3, but the length of the lower distance piece may be reduced by not more than 50 % when fitting the clip to ensure a closer fit between pipe and clip.

NOTE Pipe clips for marine service are required to be a close fit on the pipe without restraining axial movements induced by temperature differentials. It is recommended that on ranges A, B and C clips, distance pieces should be tack-welded in position to one half of the clip to prevent loss during adjustment or maintenance.

13.5 The material of the studbolts for use as clip bolts and load bolts on range D clips intended for marine service shall be as specified in clause **6**. Clip studbolts shall be threaded full length.

14 U-bolts and overstraps

U-bolts, hook bolts, overstraps and hookstraps for steel, cast iron, or copper alloy pipes and tubes shall comply with the dimensional details specified in Part 1 and in this Part 3 as appropriate, except that U-bolts which do not grip the pipe (Figure 10, Table 10 of Part 1:1974) shall not be used for marine purposes.

15 Low temperature pipework

15.1 On pipework operating at sub-zero temperatures, the supports shall be arranged so as to minimize thermal conduction which could adversely affect the fluid in the pipe or the ship's surrounding structure.

15.2 When insulating rings are inserted between the pipe and clip they shall normally comprise high density epoxy bonded impregnated hardwood veneer laminated blocks machined to size. By agreement between the purchaser and the manufacturer, other suitable materials may be used. Natural timber shall not be used due to the detrimental effect of water permeation.

15.3 Where it is necessary to attach pipe clips, U-bolts, and overstraps directly on to the low temperature surface of the pipe they shall be manufactured from low temperature steel materials as detailed in Table 12. Other materials may be used provided they have equal or higher physical properties. For dimensional details reference should be made to the appropriate figures for similar carbon steel components in Part 1 or Part 3 of this standard.

Table 12 — Materials for low temperature marine pipe supports

Component	Specification			Limiting temperature of pipeline
	Material	BS no.	Designation	
				°C
Pipe clips and overstraps	Low temperature steel	BS 1501	503 LT 100	– 21 to – 100
		BS (1501-6)	801 LT 196	– 101 to – 196
U-bolts		BS 1506 BS (1501-6)	621A	– 100
			801B	– 196
Nuts			240	– 100
			801B	– 196
Insulating rings	See **15.2**	—	—	All low temperatures

Appendix A General design recommendations and typical illustrations for marine applications

A.1 The arrangement and positioning of supports for large diameter pipework and important piping systems should take priority over other systems and the location of all pipe hangers, support feet, or anchor points should be indicated on arrangement drawings. The supports should be suitably coded and numbered on the arrangement drawing for reference purposes.

A.2 The proportions and number of piping supports should be adequate not only to comply with normal design requirements of loading and thermal effects, but also to withstand the effects imposed on the pipework by external dynamic forces associated with the marine environment. The positioning and rigidity of the supports should be such as to minimize pipeline vibrations. Where pipes are connected by means of slip-on type couplings the coupling manufacturers recommendations for supporting and anchoring of pipes for marine applications should be followed.

A.3 Pipework connected to resiliently mounted machinery by means of flexible couplings or pipes should have supports fitted as close as possible to the flexible connections.

A.4 Where pipe clips are attached directly to the pipe surface of high temperature pipework, care should be taken to safeguard against danger or injury to personnel due to the thermal effects of heat transfer on to the uninsulated parts of the pipe hanger. In accessible areas where there is a possibility of this occurring, provision should be made to insulate or screen the support component parts.

A.5 Where support clips are lined for use on copper or copper alloy pipework, the lining should be of a suitable material to prevent chafing or electrolytic corrosion of the pipe material under environmental or service conditions. The lining should entirely cover the inner surface of the pipe clip in contact with the pipe and should permit free expansion and contraction of the pipe. Care should be taken to ensure replacement of the lining after removal for maintenance work. It is essential that linings fitted to pipework located under floorplates, in double bottoms, cofferdams and bilges are capable of resisting the effects of sea water and oil.

A.6 All pipework should be inspected during the ship's basin trials and sea trials to ascertain if there is a need for additional supports due to unforeseen vibrations or movements of the pipeline.

A.7 Figure 12 to Figure 17 illustrate various types of typical supports and anchors used on ships' piping systems. The selection of the type most suited to a particular installation is left to the designer, and pipes should preferably be routed to enable the provision of convenient points of support from the ship's structure.

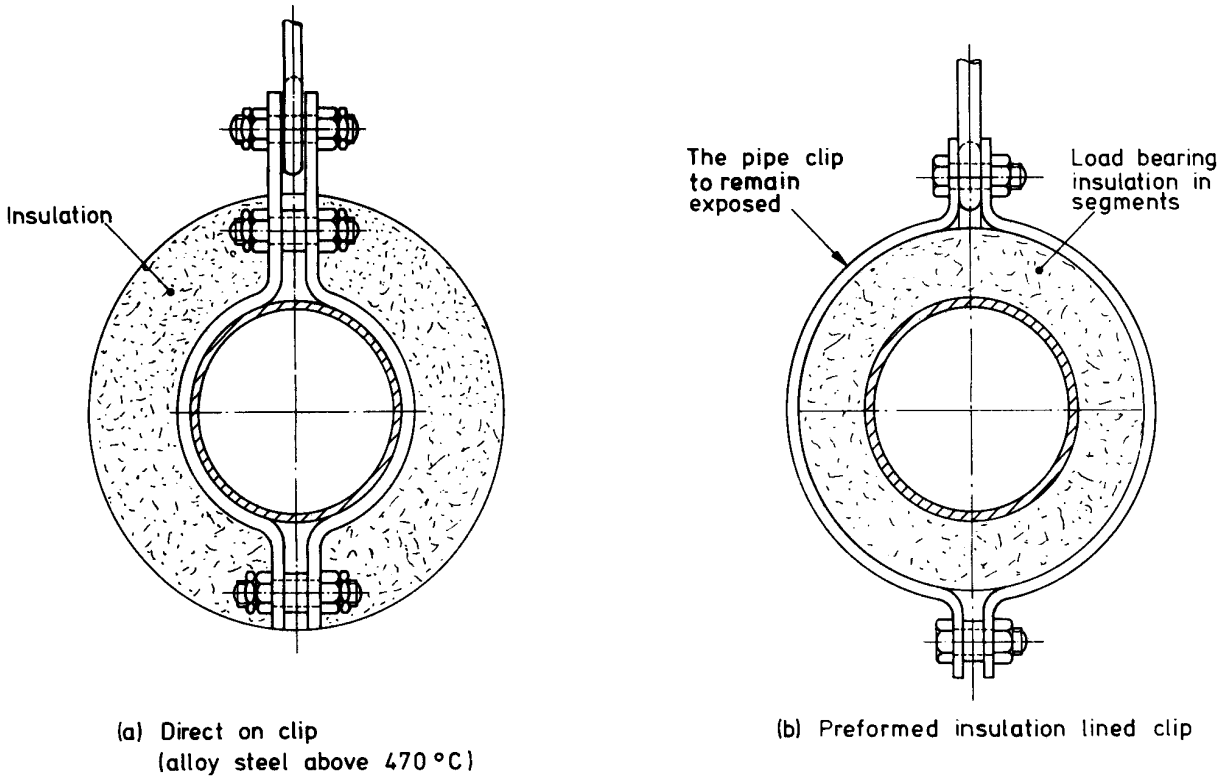
A.8 When a doubling plate is required (see Figure 13 and Figure 15) it should be not less than the thickness of the pipe and should be continuously fillet welded to the pipe. The length of the doubling plate should be equal to 1.5 to 2.0 times the pipe outside diameter and should encompass 140° to 160° of the pipe circumference. The doubling plate should be positioned symmetrically about the seat centre line and care should be taken to ensure a close mate at the interface between the pipe and doubling plate. The dimensions of the weld should be sufficient to withstand the axial and/or thrust force of the pipeline and a vent hole should be provided in the doubling plate.

A.9 Where a pipe foot is to be thermally insulated from its seating, this may be achieved by the use of insulating pads fitted between the foot and the seat in way of the holding down bolts (see Figure 13 and Figure 14). A typical construction of these pads comprises alternate 1.5 mm thick layers of carbon steel strip, heat resisting material, or laminated brass gauze complying with the requirements of BS 481-1. Where provision of pipe expansion is required, a carbon steel plate should be fitted under the insulation pad against the seat face to prevent abrasion of the insulation.

A.10 The maximum spans between support centres for pipes of various materials should be limited in accordance with the following material maximum bending stress values, due to self-weight only.

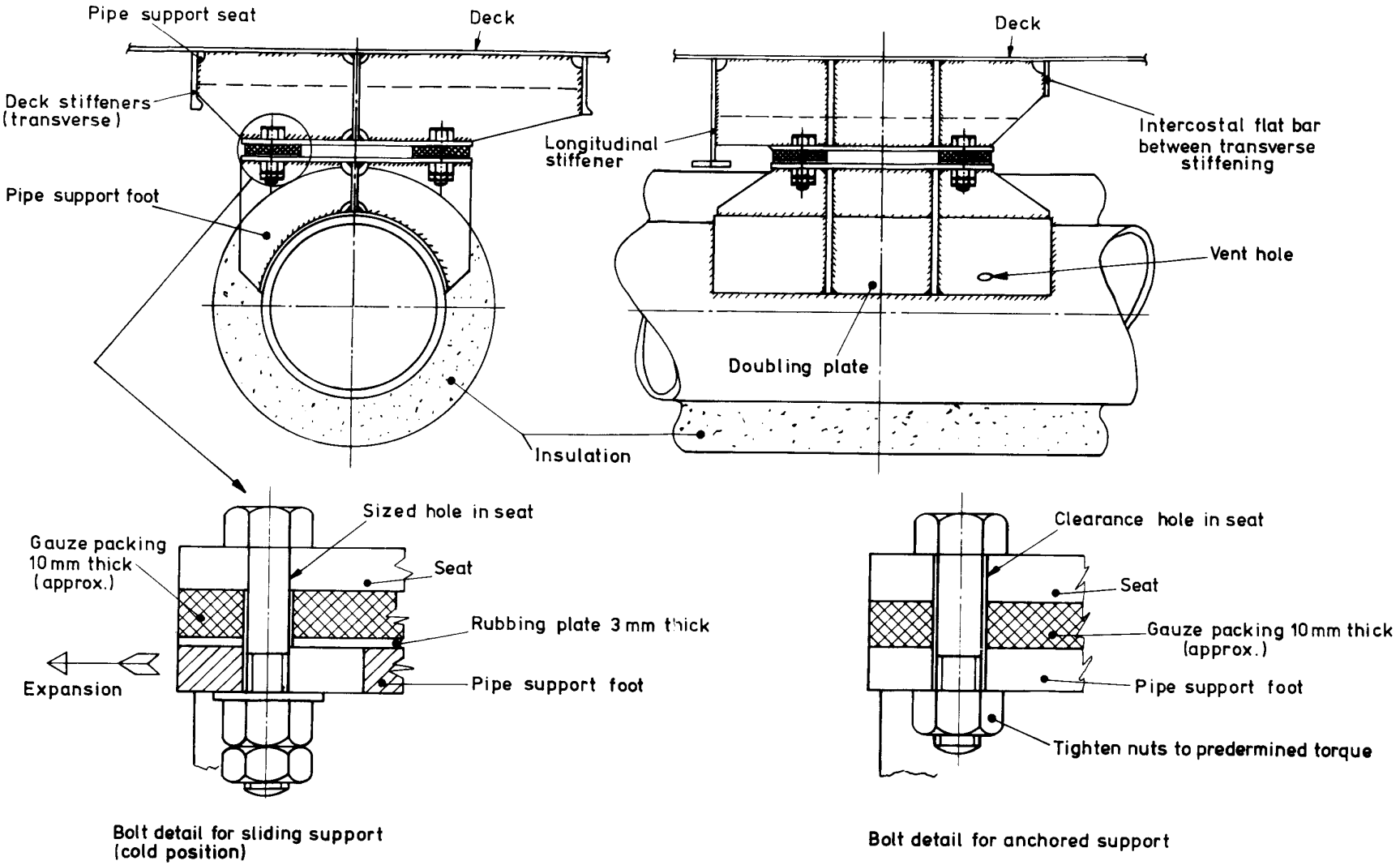
Material	**Maximum stress**
	N/mm^2
Steel, ductile iron and copper alloy	25
Grey cast iron and copper	15

A.11 The appropriate formulae given in Appendix B of Part 1:1974 of this standard may be used for evaluating maximum pipe support spans and deflections based on the limiting maximum bending stresses given in **A.10**.



NOTE Type (a) is preferred

Figure 12 — Typical insulated pipe clip applications



Fitting instructions
Tighten bolts to predetermined torque, then slacken back 2 flats and tighten lock nut. Alternatively, disc springs may be used. Rubbing plate to be coated with melting point grease.

NOTE Misalignment of the seat and pipe support may be compensated for by adding or removing layers of brass gauze.

Figure 13 — Typical high temperature marine pipe support applications

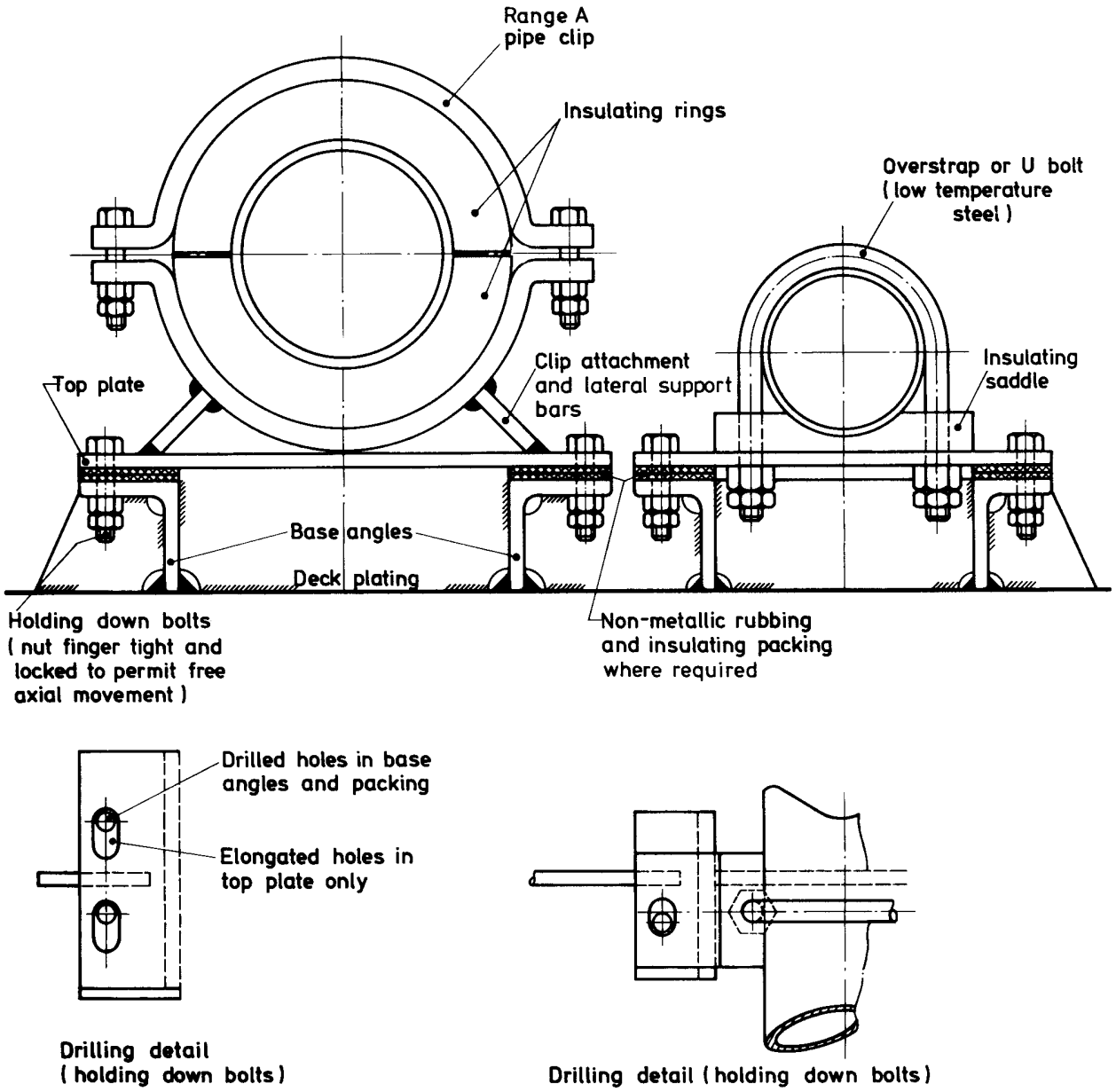


Figure 14 — Typical marine pipe support applications for low temperature on liquefied natural gas (LNG) and liquefied petroleum gas (LPG) ships

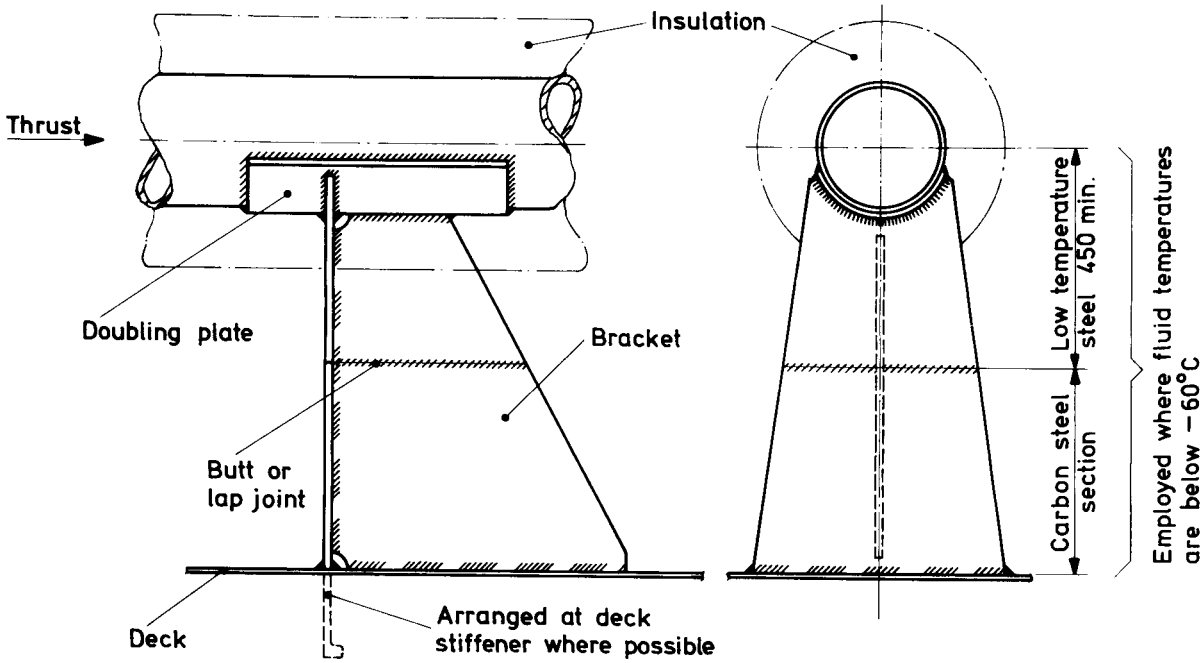


Figure 15 — Typical marine pipe anchor application for low temperature

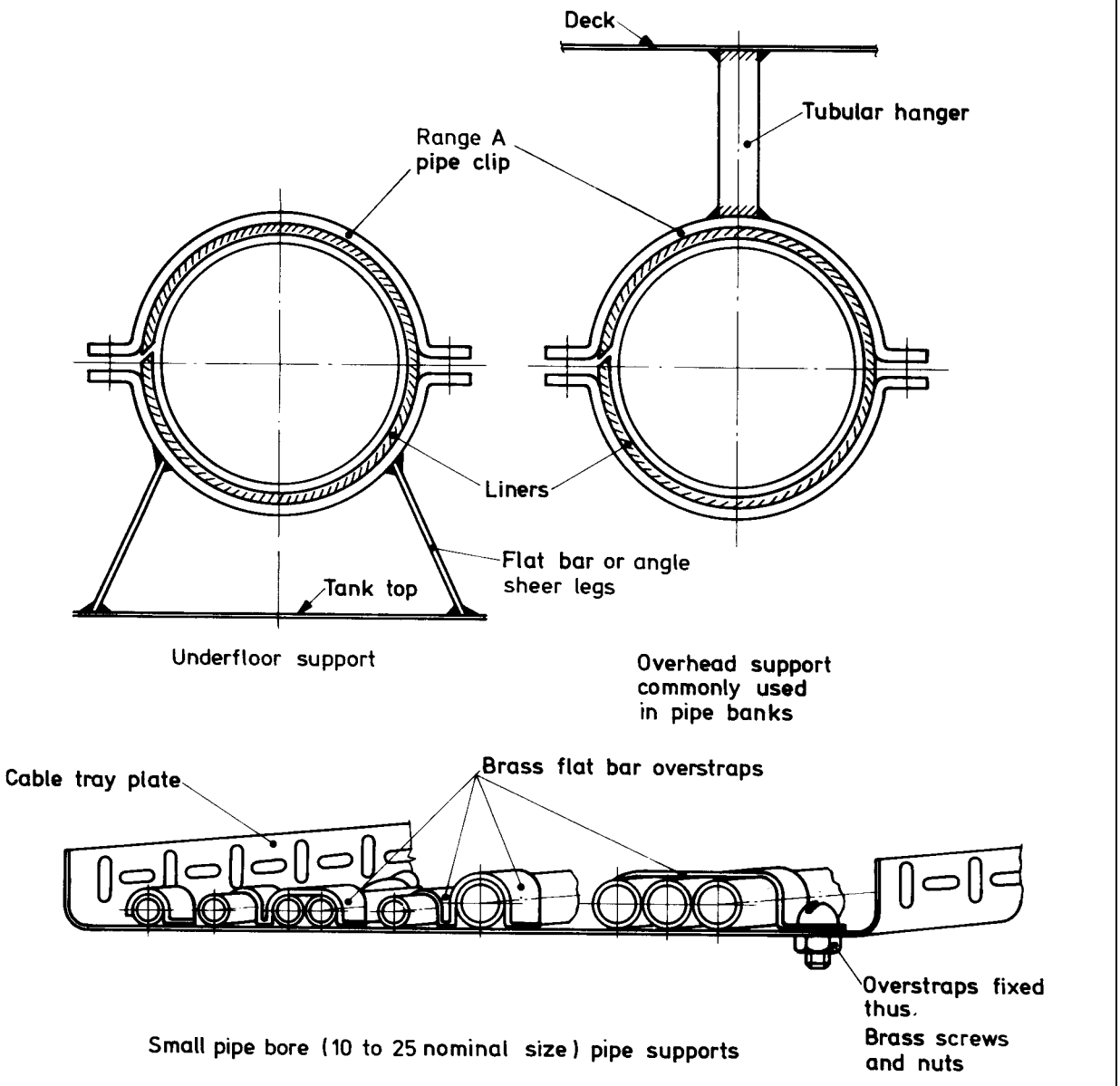


Figure 16 — Typical marine pipe support applications for non-ferrous pipework

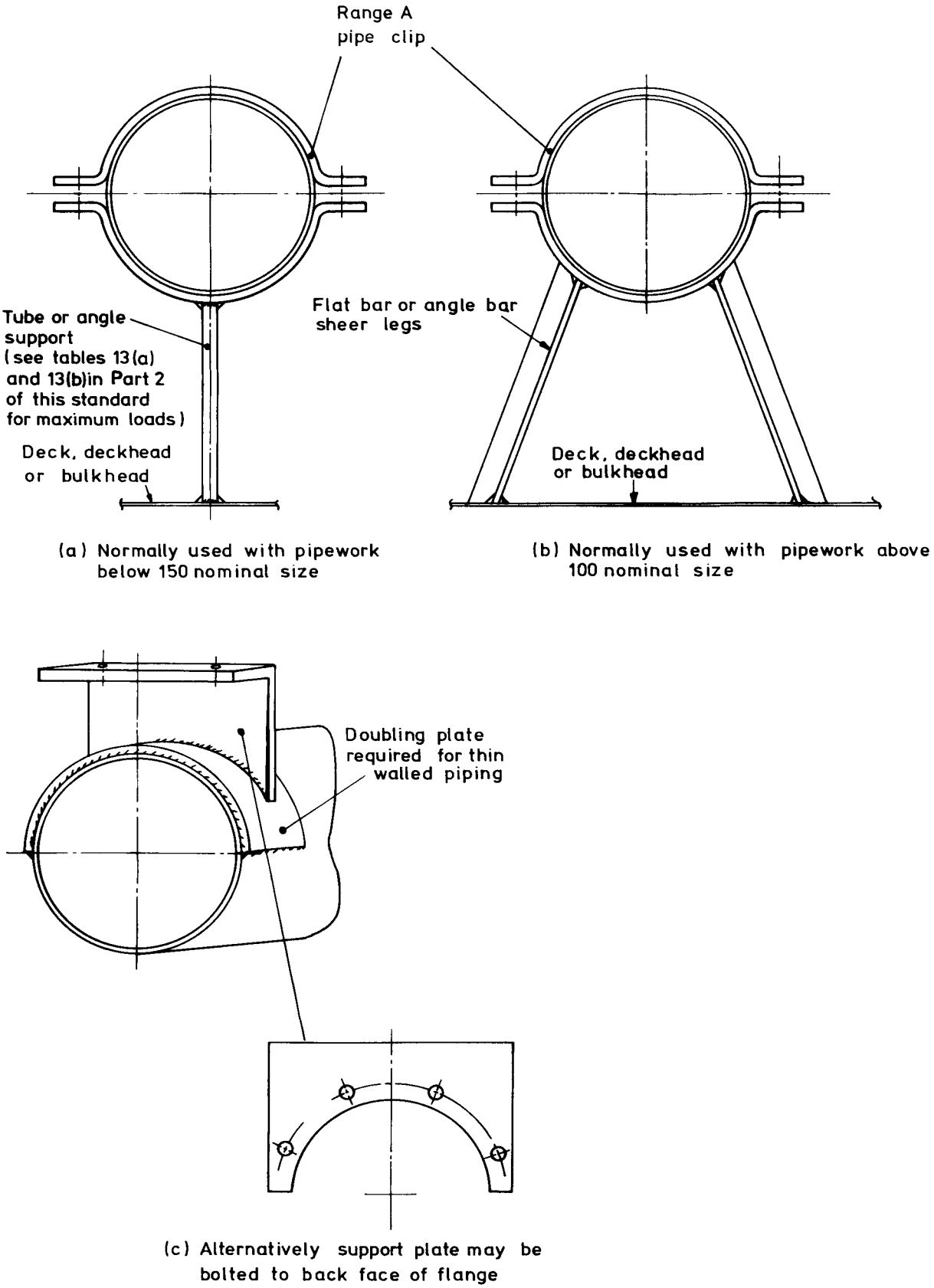
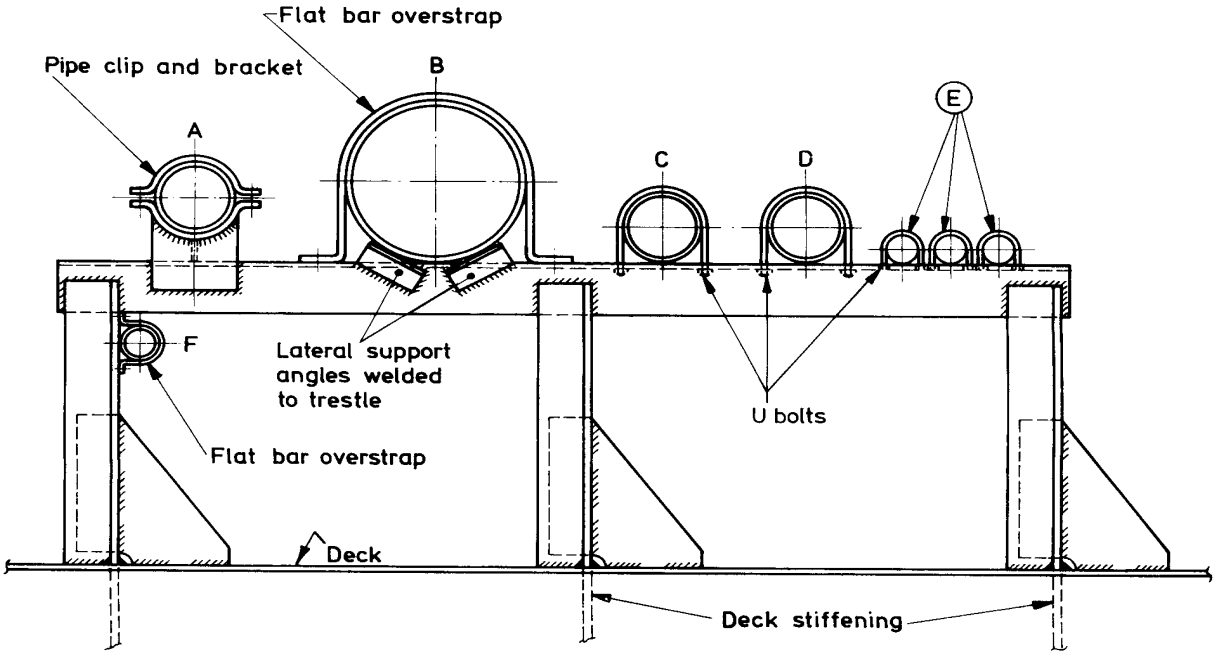
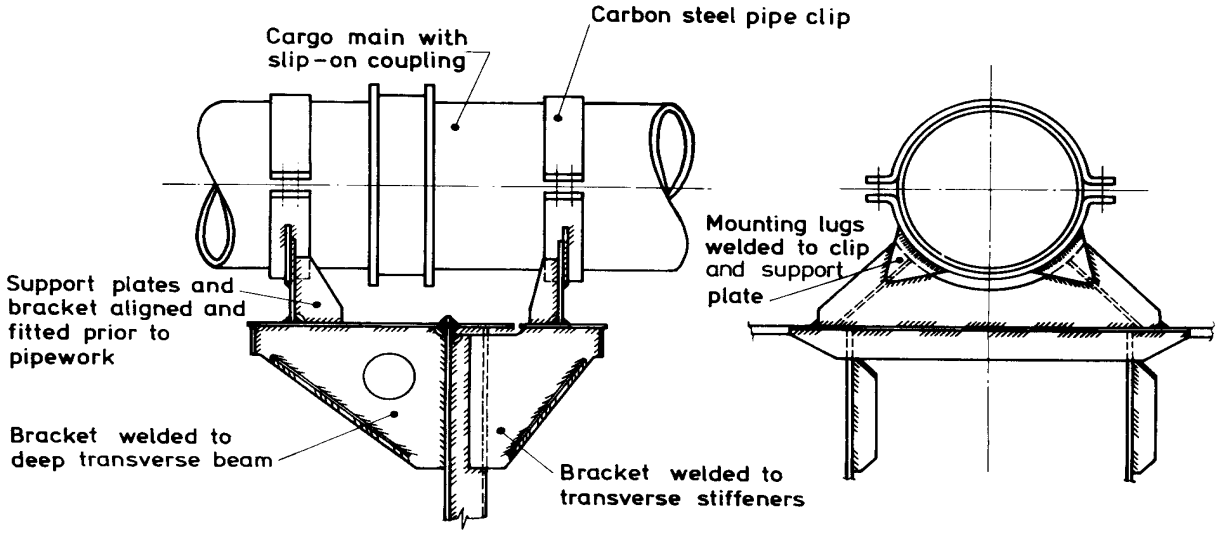


Figure 17 — Typical marine pipe support applications for ferrous pipework at ambient conditions *(continued)*



A: Stripping line
B: Cargo tanks inert gas main
C: Fire and washdeck main
D: Foam line
E: Cable pipes. Steam exhaust
F: Compressed air

(d) Weather deck banking



(e) Cargo main supports in tanks (cast iron pipework)

Figure 17 — Typical marine pipe support applications for ferrous pipework at ambient conditions *(concluded)*

Publications referred to

BS 481, *Industrial wire mesh.*

BS 481-1, *Woven annealed wire cloth with square apertures, plain or twilled weave.*

BS 1178, *Milled lead sheet and strip for building purposes.*

BS 1387, *Steel tubes and tubulars suitable for screwing to BS 21 pipe threads.*

BS 1449, *Steel plate, sheet and strip.*

BS 1449-2, *Stainless and heat resisting steel plate, sheet and strip.*

BS 1501, *Steels for fired and unfired pressure vessels. Plates.*

BS 1501-1, *Carbon and carbon manganese steels. Imperial units.*

BS 1501-2, *Alloy steels. Imperial units.*

BS 1501-6, *Steel for use in the chemical, petroleum and allied industries.*

BS 2633, *Class 1 arc welding of ferritic steel pipe work for carrying fluids.*

BS 2870, *Rolled copper and copper alloys. Sheet, strip and foil.*

BS 3600, *Specification for dimensions and masses per unit length of welded and seamless steel pipes and tubes for pressure purposes.*

BS 3604, *Specification for steel pipes and tubes for pressure purposes: ferritic alloy steel with specified elevated temperature properties.*

BS 3692, *ISO metric precision hexagon bolts, screws and nuts.*

BS 3974, *Pipe supports.*

BS 3974-1, *Pipe hangers, slider and roller type supports.*

BS 3974-2, *Pipe clamps, cages, cantilevers and attachment to beams.*

BS 4190, *ISO metric black hexagon bolts, screws and nuts.*

BS 4360, *Specification for weldable structural steels.*

BS 4882, *Bolting for flanges and pressure containing purposes.*

BS 5383, *Specification for material marking and colour coding of metal pipes and piping system components in steel, nickel alloys and titanium alloys.*

BS 5500, *Unfired fusion welded pressure vessels.*

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