

Specification for

Pipe supports —

**Part 2: Pipe clamps, cages, cantilevers
and attachments to beams**

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:

Associated Offices Technical Committee	Department of Transport
Association of Consulting Engineers	Electricity Supply Industry in England and Wales*
Association of Hydraulic Equipment Manufacturers	Engineering Equipment Users Association*
Association of Mining Electrical and Mechanical Engineers	Federation of Manufacturers of Construction Equipment and Cranes
British Compressed Air Society	Health and Safety Executive
British Electrical and Allied Manufacturers Association (BEAMA)	Institution of Gas Engineers
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British Internal Combustion Engine Manufacturers Association	Institution of Production Engineers
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British Marine Equipment Council	High Pressure Pipework Consultative Committee
British Ship Research Association	Low Pressure Pipework Conference
British Steel Industry	
Council of British Manufacturers of Petroleum Equipment	

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Contents

	Page
Cooperating organizations	Inside front cover
Foreword	iii
1 Scope	1
2 References	1
3 Definitions	1
4 Materials	2
5 Beam clips	2
6 Beam welding attachments	6
7 Cages	7
8 Dee shackles	12
9 Riser pipe clamps	14
10 Support feet	20
11 Pipeline anchors and guides	24
12 Welding of support components	31
13 Supplementary supporting steelwork	32
14 Manufacture	32
15 Protection	32
16 Inspection	32
17 Marking	33
Appendix A Design guidance for pipe support feet	35
Appendix B Maximum spans for simply supported universal beams	36
Appendix C Method of calculating maximum loads on cantilevers	42
Appendix D Method of calculating universal beam clip design load “W”	43
Figure 1 — Universal beam clip	3
Figure 2 — Typical applications of beam clips	6
Figure 3 — Beam welding attachments	6
Figure 4 — Spring cage, type U: universal beam	8
Figure 5 — Spring cage, type R: rolled steel joist	9
Figure 6 — Typical spring cage assembly	10
Figure 7 — Sling rod cage, type U: universal beam	10
Figure 8 — Sling rod cage, type R: rolled steel joist	11
Figure 9 — Alternative methods of attaching cages	12
Figure 10 — Dee shackles	13
Figure 11 — Typical method of suspending dee shackles and weldless eyenuts	13
Figure 12 — Riser clamps for pipes up to and including 300 mm nominal size (ranges A and B)	15
Figure 13 — Riser clamps for pipes over 300 mm nominal size (ranges A and B)	16
Figure 14 — Riser clamps for pipes up to and including 600 mm nominal size (range C: over 400 °C to 470 °C)	18
Figure 15 — Typical support feet	22
Figure 16 — Forces and moments acting on three axes of an anchor	25
Figure 17 — Typical anchors and guides	26
Figure 18 — Fillet welds showing flat, convex or concave weld faces	31
Figure 19 — Typical cantilever supports showing moment arm “L”	33
Figure 20 — Universal beam, load acting at $B/4$ from toe of lower flange	36
Figure 21 — Universal beam, load acting at toe of lower flange	37
Table 1(a) — Dimensions of clips for universal beams	4

	Page
Table 1(b) — Maximum loads “ <i>W</i> ” for beam clips for universal beam application	5
Table 2 — Dimensions of U-shape and inverted U-shape beam welding attachments	7
Table 3 — Dimensions of spring cage, type U: universal beam	8
Table 4 — Dimensions of spring cage, type R: rolled steel joist	9
Table 5 — Dimensions of sling rod cage, type U: universal beam	11
Table 6 — Dimensions of sling rod cage, type R: rolled steel joist	12
Table 7 — Dimensions of dee shackles	14
Table 8(a) — Dimensions of riser clamps for pipes up to and including 300 mm nominal size (ranges A and B)	16
Table 8(b) — Maximum loads for riser clamps in accordance with Table 8(a)	17
Table 9(a) — Dimensions of riser clamps for pipes over 300 mm nominal size (ranges A and B)	17
Table 9(b) — Maximum loads for riser clamps in accordance with Table 9(a)	17
Table 10 — Dimensions of riser clamps for pipes up to and including 600 mm nominal size (range C: over 400 °C to 470 °C)	19
Table 11(a) — Maximum loads for tubular support feet	21
Table 11(b) — Maximum loads for sectional support feet	24
Table 12 — Maximum vertical loads on cantilevers of various sections	34
Table 13 — Maximum permissible single span, simply supported, universal beams when loaded at $B/4$ from toe of flange	38
Table 14 — Maximum permissible single span, simply supported, universal beams when loaded at toe of flange	40
Publications referred to	Inside back cover

Foreword

This Part of BS 3974 is an extension of the metric revision of BS 3974-1 which was published in 1974 under the direction of the Mechanical Engineering Standards Committee.

It gives requirements for the manufacture of further components used in connection with pipe supports. It also gives guidance on design data and formulae for pipe support calculations and methods of fixing.

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 44, 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.

1 Scope

This Part of BS 3974 specifies dimensions of pipe clamps, cages, cantilevers and beam attachments and is an extension of Part 1. Temperature conditions are specified for certain components.

NOTE Unless otherwise specified, all the dimensions given in this standard are in millimetres.

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 Part of BS 3974 the following definitions apply (see also BS 3974-1).

3.1

beam clips

components that attach a supplementary steelwork member to the base of structural steelwork beams thus avoiding drilling or welding

3.2

riser clamp

a component for supporting vertical pipework

3.3

spring cage

a U-shaped component that can be attached to horizontal steelwork from which a sling rod can be hung. The cage is of sufficient size to hold a variable load spring

3.4

sling rod cage

similar to a spring cage, the cage to be of sufficient size to hold a spherical washer

3.5

restraint

a device that partially or totally restricts movement in one or more directions

4 Materials

The following are the preferred materials from which components of pipe support assemblies are to be manufactured. Other materials may be used providing they have equal or higher physical properties:

Schedule of materials	
Component	Material reference
Beam clips	BS 4360: grade 43A
Spring cages	BS 4360: grade 43A
Sling rod cages	BS 4360: grade 43A
Dee shackles	BS 970-1. grades 080A27, 080A30 or 150M28
Riser clamps Range A: – 20 °C to 100 °C Range B: – 20 °C to 400 °C Range C: Over 400 °C to 470 °C	BS 4360: grade 43A BS 1501-151 ^a : grade 26B and BS 1501-161 ^a : grade 26B
Support feet	See text
Tubular components	BS 1387, medium or heavy, BS 1775 HFS13 or HFW13
Bolts and nuts For riser clamps over 400 °C For other uses	BS 3692: grade 8.8 BS 4190: grade 4.6
^a See BS 1501-1.	

5 Beam clips

5.1 Universal beam clip

5.1.1 Materials and dimensions. Beam clips for universal beam applications shall be constructed preferably from materials specified in clause 4.

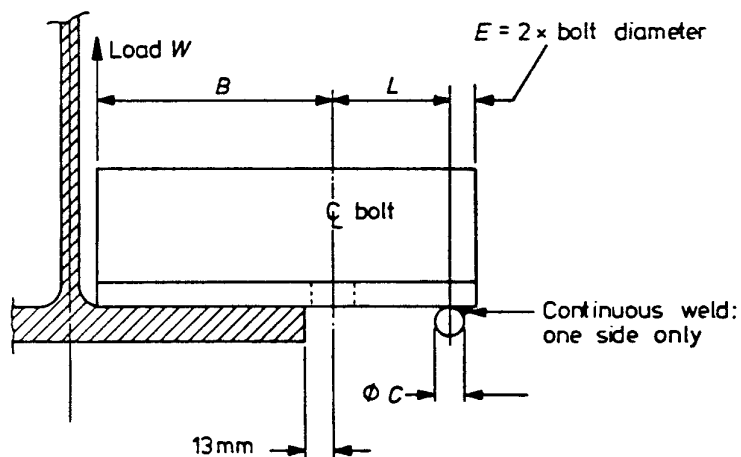
Dimensions shall be as given in Table 1(a) and Table 1(b) and as illustrated in Figure 1.

5.1.2 Design. The following notes refer to Table 1(a) and Table 1(b).

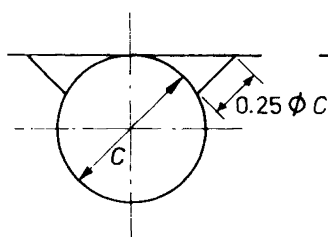
- All the clip loads (W) have been calculated with the bolt stress as the limiting factor.
- Allowable stresses and bolt hole to edge of clip dimensions from BS 449-2. Bolt stresses were derated by 25 % to allow for shock loading.
Maximum bolt loads for BS 4190: grade 4.6 steel bolts are:
M16:1 560 kg
M20:2 435 kg
M22:3 012 kg
- The dimensions C conform to bar diameters specified in BS 4229-2.
- Rolled steel angles (RSA) shall be as specified in BS 4848-4.
- The beam clip allowable loads W are determined by the strength of the clip and bolt only. Due account shall be taken of the strength of the universal beam.
- The method of calculating the load W is given in Appendix D.
- The beam clip dimensions and loads given in Table 1(a) and Table 1(b) are suitable for use with universal beams with taper flanges.

5.2 Rolled steel joist (RSJ) clips. The beam clips specified in 5.1 may be adapted for rolled steel joists provided dimension C in Table 1(a) is suitably modified.

5.3 Applications. Typical applications in the use of beam clips are shown in Figure 2.

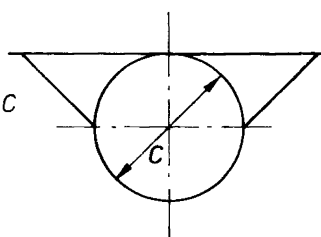


NOTE Square or hexagonal bar of same dimensions across flats as round bar C may be used. Length of bar to be same as width of angle used.

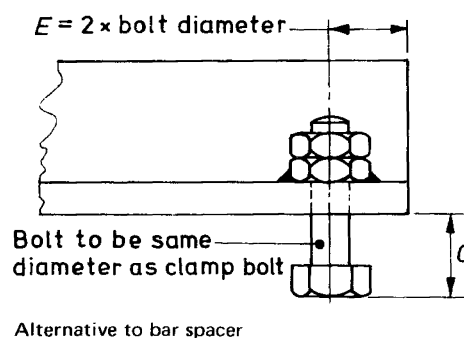


When C is greater than 12 mm weld face shall be 0.25 C minimum at an angle of 45°

Enlargement of detail X



When C is 12 mm or less the weld face shall extend from the centre line of the bar at an angle of 45°



Alternative to bar spacer

Figure 1 — Universal beam clip

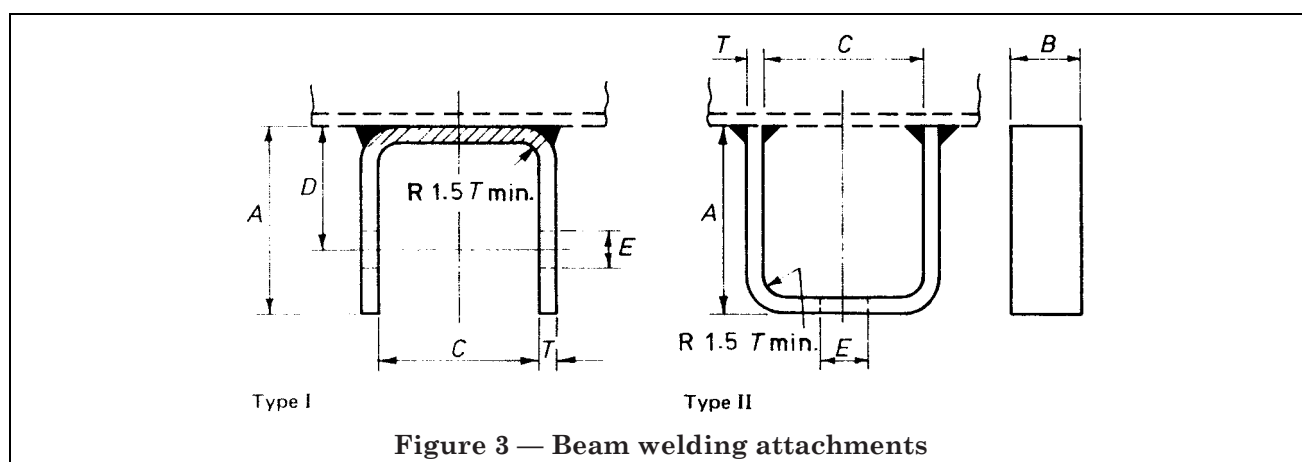
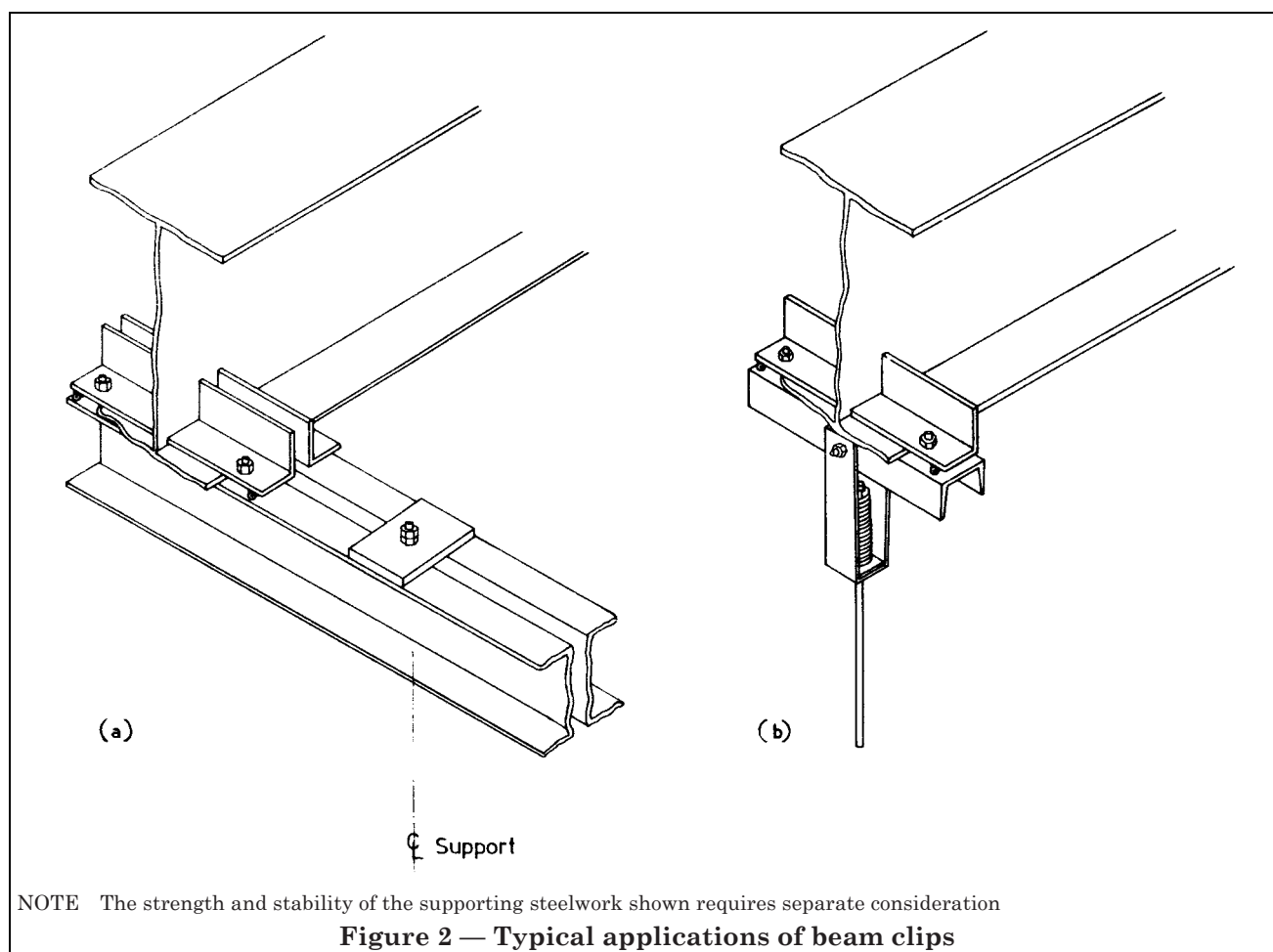
Table 1(a) — Dimensions of clips for universal beams (see Figure 1)

Beam		Beam clip dimensions		Beam		Beam clip dimensions		Beam		Beam clip dimensions	
Depth × width	Mass/length	B	C	Depth × width	Mass/length	B	C	Depth × width	Mass/length	B	C
	kg/m				kg/m				kg/m		
914 × 419	388 343	188	40 35	533 × 210	122 109 101	99	25 20 20	254 × 146	43 37 31	75	16 12 10
914 × 305	289 253 224 201	137	35 30 25 25		92 82		16 16	406 × 140	46 39	70	12 10
610 × 305	238 179 149	127	32 25 20	457 × 191	98 89 82 74 67	93	20 20 16 16 16	203 × 133	30 25	68	10 8
				406 × 178				356 × 127	39 33	62	12 10
838 × 292	226 194 176	133	30 25 20		74 67 60 54	87	16 16 16 12	305 × 127	48 42 37	62	16 16 12
				356 × 171				305 × 102	33 28 25	52	12 10 8
762 × 267	197 173 147	122	30 25 20		67 57 51 45	84	16 16 12 10	254 × 102	28 25 22	52	10 10 8
				305 × 165							
686 × 254	170 152 140 125	117	25 25 20 20		54 46 40	83	16 12 12				
				457 × 152							
610 × 229	140 125 113 101	108	25 20 20 16		82 74 67 60 52	75	20 20 16 16 12				

NOTE Dimension A as shown in Figure 1 and Table 1(a) is the thickness of the beam flange at the point of contact of the beam clip on beams rolled with a taper flange only; for dimension L, size of RSA size of bolt and corresponding maximum load W, see Table 1(b).

Table 1(b) — Maximum loads “W” for beam clips for universal beam application (see Figure 1)

Length <i>L</i>	Rolled steel angle size	Bolt size	Length <i>B</i>															
			52	62	68	70	75	83	84	87	93	99	108	117	122	133	137	188
			Maximum load <i>W</i> (in kg)															
35	70 × 70 × 10	M16	630	565	530	520	495	465	460	450	425	410	380	360	350	325	315	245
	80 × 80 × 10	M20	980	880	825	810	775	720	715	700	665	635	595	560	545	505	495	380
	90 × 90 × 12	M22	1 210	1 085	1 025	1 005	960	895	885	865	825	785	735	695	670	630	615	475
50	70 × 70 × 10	M16	765	695	660	650	620	585	580	565	545	520	490	465	450	425	415	325
	80 × 80 × 10	M20	1 190	1 085	1 030	1 010	970	915	905	885	850	815	770	725	705	665	650	510
	90 × 90 × 12	M22	1 475	1 340	1 275	1 255	1 200	1 130	1 120	1 095	1 050	1 010	950	900	875	820	805	630
75	70 × 70 × 10	M16	920	850	815	805	780	740	735	720	695	670	635	605	590	560	550	445
	80 × 80 × 10	M20	1 435	1 330	1 275	1 255	1 215	1 155	1 145	1 125	1 085	1 045	995	950	925	875	860	690
	90 × 90 × 12	M22	1 775	1 645	1 575	1 555	1 505	1 425	1 420	1 390	1 340	1 295	1 230	1 175	1 145	1 085	1 065	855
100	70 × 70 × 10	M16	1 025	960	925	915	890	850	845	830	805	780	750	715	700	665	655	540
	80 × 80 × 10	M20	1 600	1 500	1 445	1 430	1 390	1 330	1 320	1 300	1 260	1 220	1 170	1 120	1 095	1 045	1 025	845
	90 × 90 × 12	M22	1 980	1 855	1 790	1 770	1 720	1 645	1 635	1 610	1 560	1 510	1 445	1 385	1 355	1 290	1 270	1 045
125	70 × 70 × 10	M16	1 100	1 040	1 010	1 000	975	935	930	920	895	870	835	805	785	755	740	620
	80 × 80 × 10	M20	1 720	1 625	1 575	1 560	1 520	1 460	1 455	1 435	1 395	1 355	1 305	1 255	1 230	1 180	1 160	970
	90 × 90 × 12	M22	2 125	2 010	1 950	1 930	1 880	1 810	1 800	1 775	1 725	1 680	1 615	1 555	1 520	1 455	1 435	1 200
150	70 × 70 × 10	M16	1 155	1 100	1 070	1 060	1 040	1 000	1 000	985	960	940	905	875	860	825	815	690
	80 × 80 × 10	M20	1 805	1 720	1 675	1 660	1 620	1 565	1 560	1 540	1 500	1 465	1 415	1 365	1 340	1 290	1 270	1 080
	90 × 90 × 12	M22	2 235	2 130	2 070	2 050	2 005	1 935	1 930	1 905	1 855	1 810	1 750	1 690	1 660	1 595	1 570	1 335
175	70 × 70 × 10	M16	1 200	1 150	1 120	1 110	1 090	1 055	1 050	1 040	1 015	995	965	935	915	885	875	750
	80 × 80 × 10	M20	1 875	1 795	1 750	1 735	1 705	1 650	1 645	1 625	1 590	1 555	1 505	1 455	1 435	1 380	1 365	1 170
	90 × 90 × 12	M22	2 320	2 220	2 165	2 150	2 105	2 040	2 035	2 010	1 965	1 920	1 860	1 805	1 775	1 710	1 685	1 450
NOTE The load given above refers to the load taken by each individual beam clip.																		



6 Beam welding attachments

Two types of beam welding attachments are specified:

Type I: Inverted U-shape attachment

Type II: U-shape attachment.

6.1 Details and dimensions. The dimensions of attachments shall be as given in Figure 3 and Table 2. Account shall be taken of the strength of welds and, in this respect, reference shall be made to clause 12.

6.2 Interchangeability. These attachments are interchangeable if supplied with all three holes drilled, as given in Table 2.

Table 2 — Dimensions of U-shape and inverted U-shape beam welding attachments

Sling rod diameter	Material size $B \times T$	A	C	D	Hole diameter E	Bolt or rod diameter	Safe working load kg
8	50×6	75	40	50	14	12	230
10	50×6	75	40	50	14	12	360
12	50×6	75	40	50	18	16	550
16	75×10	85	60	55	22	20	1 010
20	75×12	85	70	55	27	24	1 580
24	100×12	115	75	80	33	30	2 280

7 Cages

7.1 General. Cages are designed to be attached to the underside of beams and joists for the purpose of suspending sling rods.

Cages are included for use with or without springs and for attachment to rolled steel joists and universal beams.

They are included for rolled steel joists to cater for existing structures.

Sling rod cages and spring cages type “U” are intended for use on universal beams having parallel or taper flanges and shall not be used on rolled steel joists.

Sling rod cages and spring cages type “R” are intended for use on rolled steel joists having 5° taper flanges and shall not be used on universal beams.

7.2 Spring cages. Spring cages are illustrated in Figure 4 for type “U” and in Figure 5 for type “R”. Dimensions shall be as given in Table 3 and Table 4 respectively.

Spring cages shall be constructed from materials specified in clause 4.

The depth of the cage shall allow for the “free” length of the spring plus an allowance for the thickness of spring washers, sling rod nuts, etc.

The inside dimension of the base (Y) shall be equal to the maximum diameter of the lower spring washer plus approximately 10 mm.

The inside dimension of the cage at the top attachment shall be not less than dimension Y .

When used on beams or joists having flanges greater than the selected dimension “ Y ”, the sides of the cage shall be inclined to suit but this inclination shall not exceed 25° from the vertical for standard cages. If necessary, spring cages may be increased in depth in order to comply with this limitation on inclination.

NOTE Where the limit on inclination would be exceeded and the cage cannot be increased in depth, standard cages should not be used unless a design check is carried out. Alternatively, the standard form of cage may be used but the method of attachment to beams, etc., has to receive special consideration.

An illustration of a typical spring cage assembly is shown in Figure 6.

7.2 Sling rod cages. Sling rod cages are illustrated in Figure 7 for type “U” and in Figure 8 for type “R”. Dimensions shall be as given in Table 5 and Table 6 respectively.

Sling rod cages shall be constructed from materials specified in clause 4.

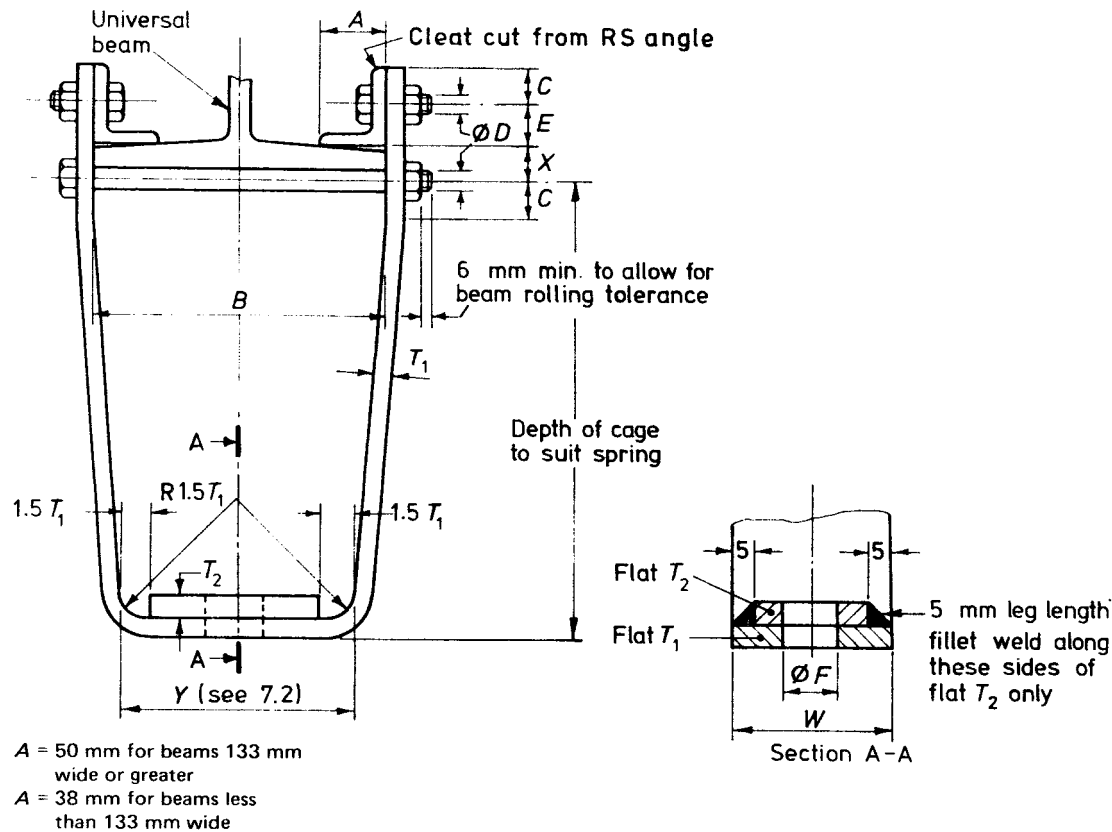
When used on wide beams the depth (H) of the standard cage may be increased if necessary so that the inclination of the sides does not exceed 25° from the vertical.

As a guide, the maximum beam widths for which the standard sling rod cage depths are suitable, are as follows:

Sling rod diameter	8	10	12	16	20	24	30	36	42
Maximum beam width	191	191	191	210	229	254	292	330	330

NOTE Where the limit on inclination would be exceeded and the cage cannot be increased in depth, standard cages should not be used unless a design check is carried out. Alternatively, the standard form of cage may be used but the method of attachment to beams, etc., has to receive special consideration, see Figure 9.

7.4 Attachment to universal beams. Where cages are attached in the lower flanges of universal beams, the loading on the lower flange shall be considered to act at the toe of the flange (see 13.2).



NOTE 1 B is the "width of section" given in BS 4-1.

NOTE 2 $X = T + \frac{D}{2}$, where T is the "flange thickness" given in BS 4-1.

Figure 4 — Spring cage, type U: universal beam

Table 3 — Dimensions of spring cage, type U: universal beam

Sling rod diameter <i>D</i>	Width <i>W</i> for flat <i>T</i> ₁ and cleats			Thickness of flats		Hole diameter <i>F</i>	Angle size	Bolt size <i>D</i>	Bolt hole	<i>C</i>	<i>E</i>	Safe working load
	Spring inside diameter			<i>T</i> ₁	<i>T</i> ₂							
	45 to 65	100	140									
8	80	—	—	6	8	12	<i>A</i> × 30 × 5	M8	9	10	20	kg 230
10	80	—	—	6	—	16	<i>A</i> × 40 × 6	M10	11	15	25	360
12	80	100	130	8	10	18	<i>A</i> × 50 × 8	M12	14	20	30	530
16	80	100	130	10	10	22	<i>A</i> × 65 × 8	M16	18	30	35	1 010
20	80	100	130	10	12	30	<i>A</i> × 75 × 8	M20	22	35	40	1 580
24	90	100	130	12	15	33	<i>A</i> × 100 × 12	M24	26	45	55	2 280
30	90	100	130	15	20	43	<i>A</i> × 100 × 12	M30	33	45	55	3 650
36	—	100	130	20	25	48	<i>A</i> × 125 × 12	M36	39	60	65	5 340
42	—	100	130	25	35	56	<i>A</i> × 150 × 15	M42	45	75	75	7 400

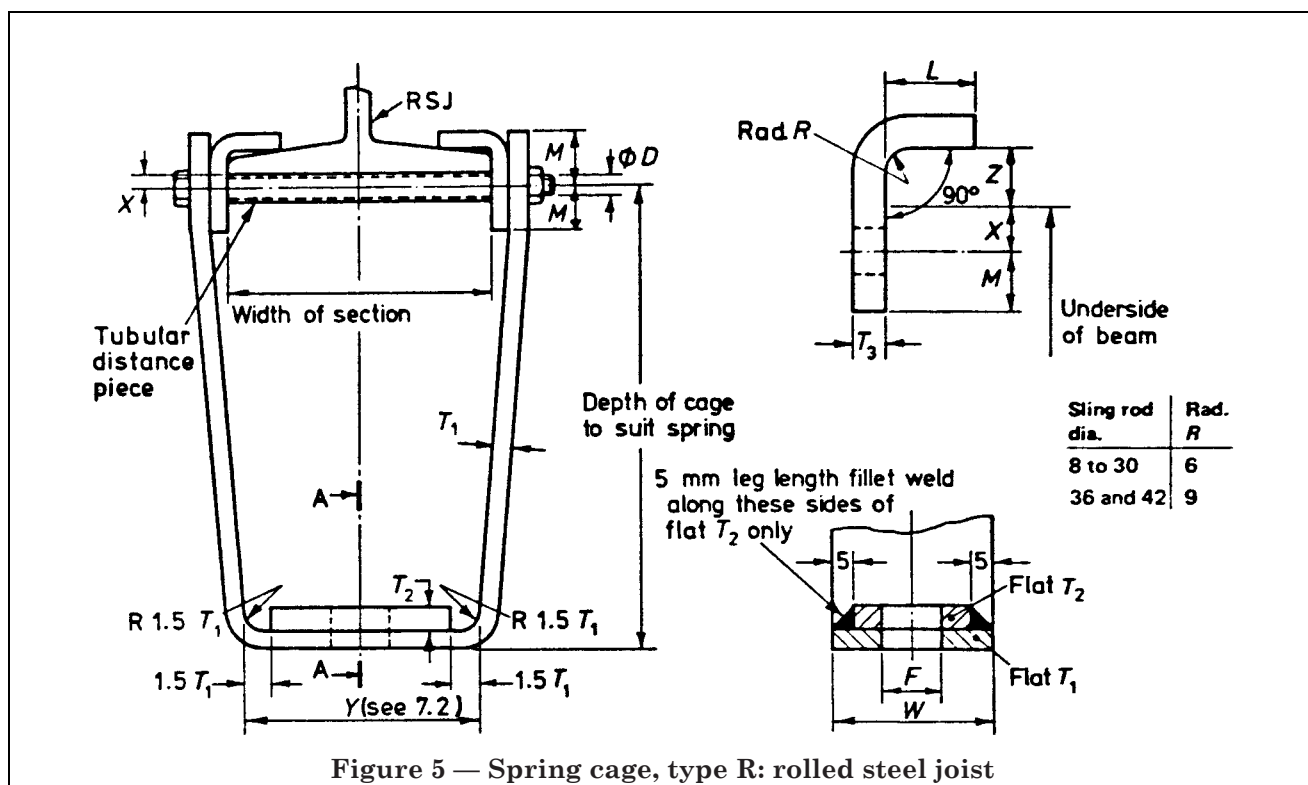


Table 4 — Dimensions of spring cage, type R: rolled steel joist

Sling rod diameter	Width W for flats T_1 and cleats T_3			Thickness of flats		T_3	Hole Diameter F	Bolt size D	Bolt hole diameter	Tubular distance piece. Nominal size	Cleat				Safe working load
				T_1	T_2						L	M	X	Z	
	Spring inside diameter			Spring inside diameter											
	45 to 65	100	140	45 to 65	100 to 140										
8	80	—	—	6 8	—	8	12	M8	9	8	15	20	8	10	kg 230
10	80	—	—	6 10	—	8	16	M10	11	10	20	20	9	10	360
12	80	100	130	8 10	10	10	18	M12	14	15	20	25	10	10	530
16	80	100	130	10 10	10	10	22	M16	18	20	20	30	12	10	1 010
20	80	100	130	10 12	12	15	30	M20	22	20	25	30	14	12	1 580
24	90	100	130	12 12	15	15	33	M24	26	25	25	40	18	12	2 280
30	90	100	130	15 15	20	20	43	M30	33	32	25	50	20	12	3 650
36	—	100	130	20 —	25	25	48	M36	39	40	30	65	24	12	5 340
42	—	100	130	25 —	35	25	56	M42	45	50	20	75	28	14	7 400

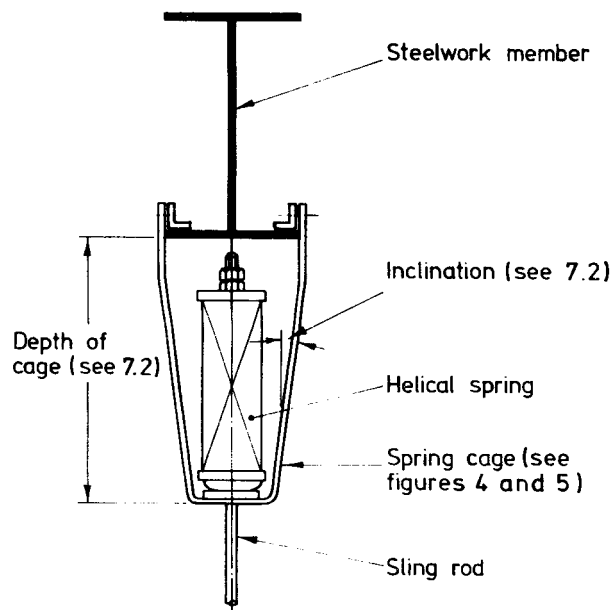


Figure 6 — Typical spring cage assembly

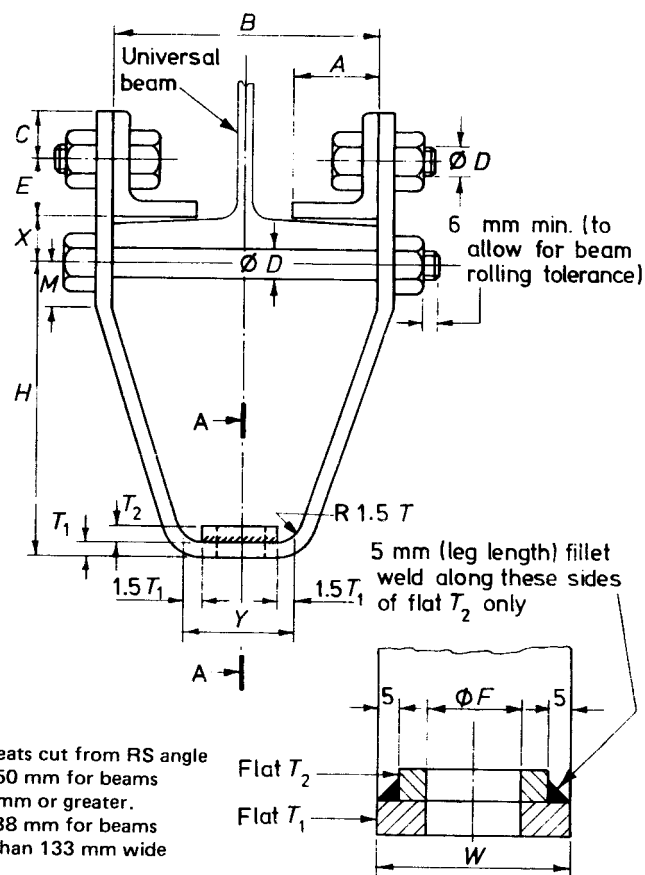
NOTE 1 B is the "width of section" given in BS 4-1.NOTE 2 $X = T + \frac{D}{2}$, where T is the "flange thickness" given in BS 4-1.

Figure 7 — Sling rod cage, type U: universal beam