
British Standard
**Insulator and conductor fittings
for overhead power lines**
Part 2. Specification for a range of fittings

Accessoires pour les isolateurs et les conducteurs pour lignes aériennes
Partie 2. Norme standard — Spécifications

Freileitungsarmaturen
Teil 2. Normbereich

Foreword

This Part of BS 3288 has been prepared under the direction of the Power Electrical Engineering Standards Policy Committee and it supersedes BS 3288 : Part 2 : 1977, which is withdrawn.

In this revision an effort has been made to allow as much freedom as possible in the design while maintaining interchangeability with existing designs and compatibility with other fittings. This has led to the omission of many non-critical dimensions and, in some cases, one drawing with a table of dimensions now covers a series of fittings.

A range of fittings with a mechanical rating of 300 kN has been introduced. The socket fittings in this range use the split pin security clip rather than the W security clip.

In all fittings with a pin, washer and split pin, a bolt, nut and split pin has been given as an alternative. Such fittings are to be given a suffix A as part of their designation, e.g. shackle 15/29 is complete with pin, washer and split pin and shackle 15/29A is complete with bolt, nut and split pin.

Other modifications include the addition of the 400 kN sag adjuster assembly; the increase of the range of parallel and single links; the provision of details of a suitable interconnecting shackle in the drawings of eye-links; the inclusion of square section tower-shackles; and the rationalization of the range of insulator pins to reflect current practice.

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

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Specification

1 Scope

This Part of BS 3288 specifies requirements for a range of insulator and conductor fittings for overhead power lines.

The dimensions are given in figures 1 to 89 and tables 1 to 35.

NOTE 1. Typical arrangements of sag adjuster assemblies are shown in figures 77 to 82.

NOTE 2. The titles of the publications referred to in this standard are listed on the inside back cover.

2 Performance and general requirements

The fittings shall comply with the appropriate requirements of BS 3288 : Part 1.

3 Dimensions and tolerances

The following tolerances shall apply to the dimensions given in figures 1 to 89 and tables 1 to 35, except for dimensions given in parentheses or indicated by the suffix 'max.' or 'min.' or for dimensions for gauged parts, gauges or screw threads (see clauses 4 to 6):

dimensions up to and including 35 mm: ± 0.7 mm;

dimensions greater than 35 mm: ± 2 %.

NOTE. Dimensions shown in parentheses are given for guidance only.

All dimensions except diameters of bolts and pins, thicknesses of rolled plates and widths and thicknesses of rolled rectangular material shall apply after galvanizing. For the exceptions stated, the dimensions shall apply before galvanizing. All holes shall be parallel sided.

4 Insulator pins

4.1 Reference numbers

The reference number for each type of insulator pin and each type of head shall be as given in table 1.

4.2 Dimensions

The dimensions of every insulator pin shall be in accordance with the appropriate figure, as given in table 1.

4.3 Gauges

The accuracy of the dimensions of the head shall be checked after galvanizing by means of the gauge referred to in table 1 and shown in figure 6.

4.4 Shanks

The thread on the shank, before galvanizing, shall be ISO* metric coarse pitch series 'free' class (8 g) complying with BS 3643 : Part 2. The effective thread on the shank shall be not less than 45 mm long for the 50 mm shank and not less than 75 mm long for the 130 mm shank.

NOTE. For the purposes of this subclause, 'effective thread' means that the thread, after galvanizing, takes a nut for the distance stated.

4.5 Nuts

The external dimensions of the nut, before galvanizing, shall comply with BS 4190 and it shall have a thread, cut after galvanizing, complying with BS 3643 : Part 2, but sufficiently oversize to accommodate the threaded part of the galvanized shank, as specified in 4.4. The increase in diameter to comply with this requirement shall not however exceed 0.4 mm. The threads of nuts shall be oiled.

4.6 Failing loads

The minimum failing load of the pin shall be 0.7 kN (pilot pins only), 5 kN or 10 kN, as given in table 1.

5 Line post insulator studs

5.1 Studs

The shank length shall be measured below the seating surface of the metal base. The thread on the stud, before galvanizing, shall be ISO metric coarse pitch series 'free' class (8 g) complying with BS 3643 : Part 2. The effective thread on the stud shall be not less than 45 mm long for the 50 mm shank and not less than 75 mm long for the 130 mm shank.

NOTE 1. The preferred diameter of line post insulator studs is 22 mm, with alternative shank lengths of 50 mm and 130 mm.

NOTE 2. For the purposes of this subclause, 'effective thread' means that the thread, after galvanizing, takes a nut for the distance stated.

NOTE 3. When line post insulator studs are ordered separately, care should be taken to ensure that the upper part of the stud is suitable for the insulator.

5.2 Nuts

The external dimensions of nuts before galvanizing shall comply with BS 4190 and they shall have threads, cut after galvanizing, complying with BS 3643 : Part 2 but sufficiently oversize to accommodate the threaded part of the galvanized pin shank as specified in 4.4. The increase in diameter to meet this requirement shall not however exceed 0.4 mm. The threads of nuts shall be oiled.

*ISO = International Organization for Standardization.

Table 1. Insulator pins										
Head				Type of pin	Stalk length	Shank		Minimum failing load with standard mounting arrangement (see BS 3288 : Part 1)	Pin reference number	Pin figure number
Description	Reference number and figure number	Gauges				Diameter	Length			
		Reference number	Figure number							
Small steel	15 figure 1	15R	6	Line	mm 165	mm 18	mm 50 or 130	kN 10	23	3
				Pilot	500	20	50 or 150	0.7	49	5
Large steel	16 figure 2	16R	6	Line	165	18	50 or 130	5 10	26 27	4 4
					<u>230</u>	<u>22</u>	<u>50</u> or 130	5 <u>10</u>	28 <u>29</u>	4 <u>4</u>
					<u>305</u>	<u>22</u>	<u>50</u> or 130	5 <u>10</u>	30 <u>31</u>	4 <u>4</u>
				Pilot	<u>400</u>	<u>20</u>	<u>50</u> or 150	<u>0.7</u>	<u>45</u>	<u>5</u>
					<u>500</u>	<u>20</u>	<u>50</u> or 150	<u>0.7</u>	<u>50</u>	<u>5</u>
NOTE 1. Underlined characters represent preferred British practice.										
NOTE 2. The stalk and shank lengths of pilot pins are measured above and below the bottom face of the top nut (see figure 5).										
NOTE 3. A washer is required if an insulator pin with a 50 mm shank is to be used with a crossarm 7 mm or less in thickness.										

6 Insulator set fittings

NOTE. The reference number assigned to each type of insulator set fitting is given in appendix A and, for convenience, a list of fittings in order of reference numbers is given in appendix B.

6.1 Marking

6.1.1 General. All insulator set fittings shall be marked before galvanizing in accordance with 6.1.2 to 6.1.4.

6.1.2 Castings. Castings shall be marked with the following information:

- (a) the appropriate reference number in raised characters at least 6 mm in height;
- (b) the manufacturer's name, identification or trade mark;
- (c) the cast code, including year.

6.1.3 Forgings. Forgings shall be marked with the following information:

- (a) the appropriate reference number in raised characters between 4 mm and 6 mm in height;
- (b) the manufacturer's name, identification or trade mark.

6.1.4 Links and plates. Links and plates shall be marked with the following information:

- (a) the appropriate reference number in characters at least 6 mm in height;
- (b) the manufacturer's name, identification or trade mark.

6.2 Dimensions

The dimensions of every insulator set fitting shall be as given in the appropriate table and figure.

6.3 Ball and socket couplings

Where fittings are provided with ball and socket couplings, the dimensions of the ball and socket shall be as given in BS 3288 : Part 3 for the appropriate size of coupling. The dimensions of ball or socket shall be checked by means of the gauges described in BS 3288 : Part 3.

6.4 Failing loads

The minimum failing load of the fitting shall be as given in figures 7 to 76 and/or the appropriate tables.

6.5 Bolts and nuts

Where bolts and nuts are supplied as parts of clevis-ended fittings instead of pins (as provided for in the relevant figures), the bolts shall be ISO metric hexagon bolts complying with BS 4190 before galvanizing. In addition, bolts shall have screwed length and cross drilling dimensions as given in figure 89 and table 35, except arcing horn bolts which are not covered by figure 89. The thread lengths of arcing horn bolts shall comply with 7.1.2 of BS 4190 : 1967 and shall be fitted with a plain washer and two full nuts.

The external dimensions of the nuts, before galvanizing, shall comply with BS 4190 and they shall have threads, cut after galvanizing, complying with BS 3643 : Part 2 but sufficiently oversize to accommodate the galvanized bolts. The increase in diameter to meet this requirement shall not however exceed 0.4 mm. The threads of nuts shall be oiled.

6.6 Washers

When washers are supplied they shall have dimensions before galvanizing as given in table 3 of BS 4320 : 1968.

6.7 Split pins

Split pins shall comply with BS 1574 and shall be of austenitic stainless steel capable of complying with the requirements relating to the intercrystalline corrosion test of BS 970 : Part 4. In addition, split pin sizes shall be as given in figures 88 (and table 34) and 89 (and table 35).

6.8 Security clips

Socket type fittings shall be supplied complete with security clips complying with BS 3288 : Part 4.

7 Termination fittings and suspension clamps for conductors

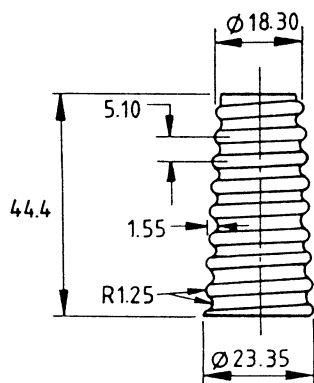
Termination fittings and suspension clamps are not completely standardized dimensionally but if a clamp includes a clevis or tongue, this part shall be in accordance with figure 39 or figure 40. If a clamp is provided with a ball or socket coupling, the ball or socket shall have dimensions complying with BS 3288 : Part 3 for the appropriate size of coupling. The dimensions of the ball or socket shall be checked by means of the gauges described in BS 3288 : Part 3.

NOTE 1. The clevis, tongue, ball or socket may be integral with the clamp or may be on a fitting supplied as part of the clamp. Typical suspension clamps are shown in figures 74 to 76.

NOTE 2. Minimum failing loads are not standardized for termination fittings.

General notes on figures and tables

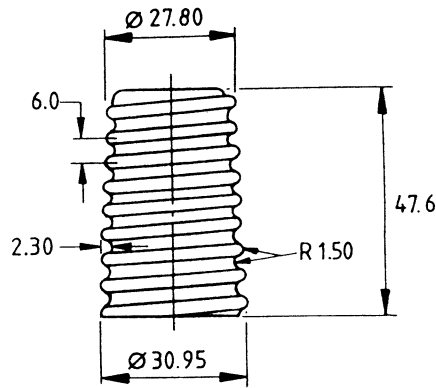
- NOTE 1. All dimensions are given in millimetres except where stated otherwise.
- NOTE 2. Dimensions given in parentheses are for guidance only. All other dimensions are subject to the tolerances given in clause 3.
- NOTE 3. Where the geometric form of the contour of a component is not fully specified by, or capable of being deduced from, the dimensions given, it will suffice for the form to approximate to that shown in the figure.
- NOTE 4. First angle projection is used throughout.
- NOTE 5. Spacing dimensions of socket-ended fittings should be checked with a ball in the socket. The GO gauge ball detailed in figure B10 of BS 3288 : Part 3 should be used for this purpose.
- NOTE 6. For clarity, the cotter pin has been omitted from one view of each clevis-ended fitting.
- NOTE 7. Where fittings are available with either a bolt or a cotter pin, the cotter pin has been shown. Suffix 'A' should be added to the reference number if bolts are required. In the past, some fittings with minor differences were allocated a suffix A, B or C. When one of these fittings is to be supplied with a bolt, the suffix becomes 'AA', 'BA' or 'CA'.
- NOTE 8. In figures 11, 13, 15, 17 to 19 and 21 to 27, both holes and registration ledges are shown for use with arcing horns. It is intended that the ledges should be, as far as is practicable, at right angles to the fixing face.
- NOTE 9. Details of pins, bolts and split pins are given in figures 88 and 89.
- NOTE 10. Ball and socket couplings are designated in BS 3288 : Part 3, which gives the detailed dimensions.
- NOTE 11. The dimensions of security clips are given in BS 3288 : Part 4, which also includes test requirements.



All dimensions are in millimetres.

NOTE. Insulator pin heads are subject to gauging (see 4.3).

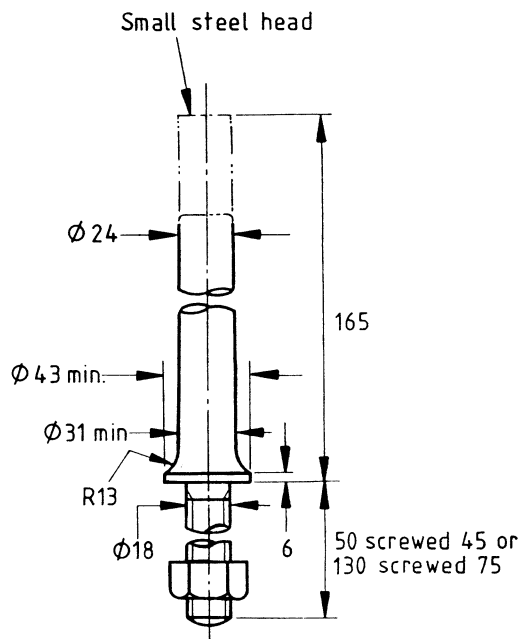
Figure 1. Dimensions of small steel insulator pin head
(see table 1, reference number 15)



All dimensions are in millimetres.

NOTE. Insulator pin heads are subject to gauging (see 4.3).

Figure 2. Dimensions of large steel insulator pin head
(see table 1, reference number 16)



All dimensions are in millimetres.

NOTE. A washer is required if an insulator pin with a 50 mm shank is to be used with a crossarm 7 mm or less in thickness.

Figure 3. Insulator pin with small steel head : reference number 23
(minimum failing load 10 kN)

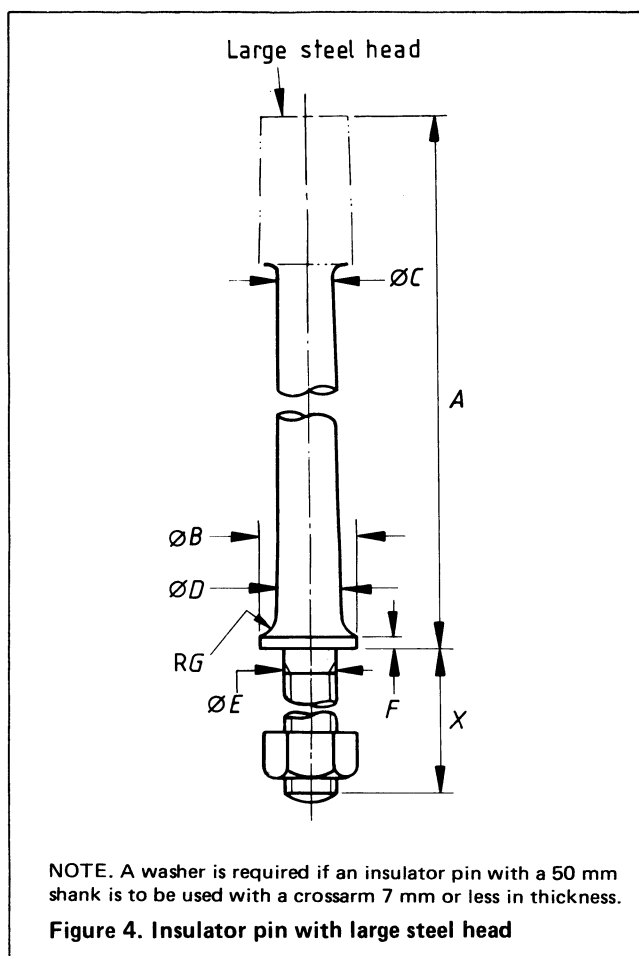


Table 2. Dimensions of insulator pin with large steel head						
Dimension	Minimum failing load					
	5 kN			10 kN		
	Reference number of pin					
	26	28	30	27	29	31
A	mm 165	mm 230	mm 305	mm 165	mm 230	mm 305
ϕB min.	37	40	43	43	50	63
ϕC	24	24	24	24	25	27
ϕD min.	24	28	31	31	37	40
ϕE	18	22	22	18	22	22
F	5	6	6	6	6	6
(RG)	13	13	13	13	13	16
X*	50 or 130	50 or 130	50 or 130	50 or 130	50 or 130	50 or 130
*Dimension X to be 50 mm screwed 45 mm, or 130 mm screwed 75 mm.						

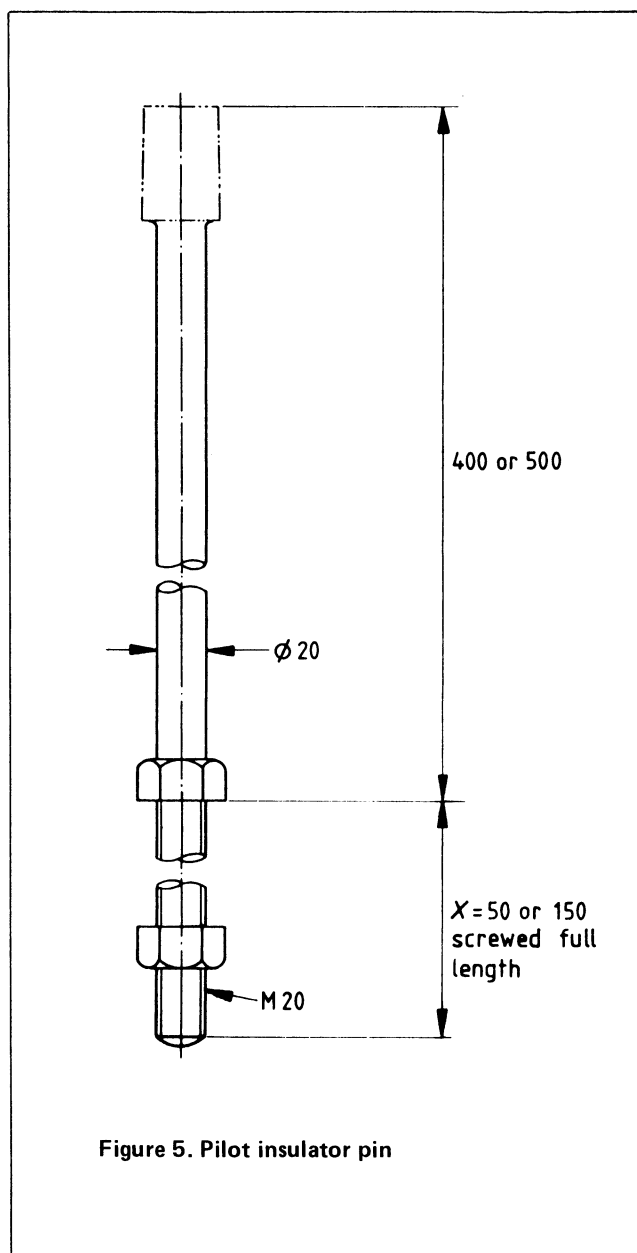


Table 3. Details of pilot insulator pin			
Reference number of pin		Type of head	Reference number of head (see figures 1 and 2)
Length			
400 mm	500 mm		
—	49	Small steel	15
45	50	Large steel	16

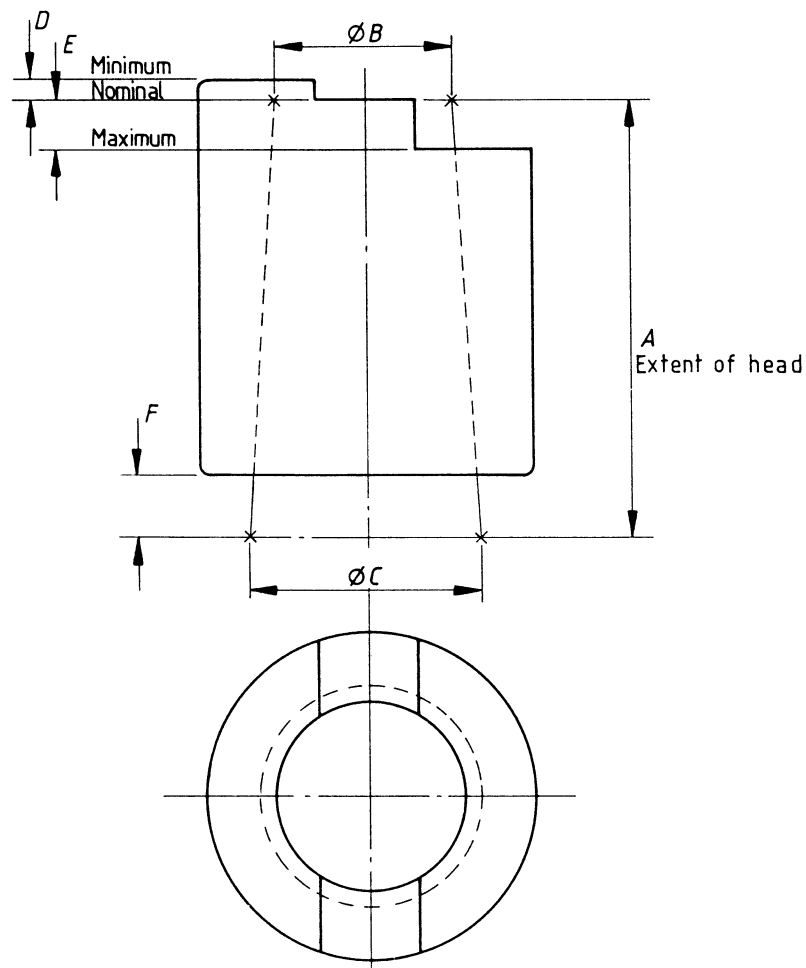


Figure 6. Ring gauge for head of insulator pin

Table 4. Dimensions of ring gauge for head of insulator pin

Reference number of gauge	Size of head	Reference number of head	A	ϕB	ϕC	D	E	F
15R	Small	15	mm 44.4	mm 18.30	mm 23.35	mm 1.60	mm 4.75	mm 6.35
16R	Large	16	47.6	27.80	30.95	1.60	4.75	6.35

NOTE 1. Tolerance on specified dimensions ± 0.02 mm.
NOTE 2. The dimension C is the base of the conic frustum which determines the taper of the gauge.

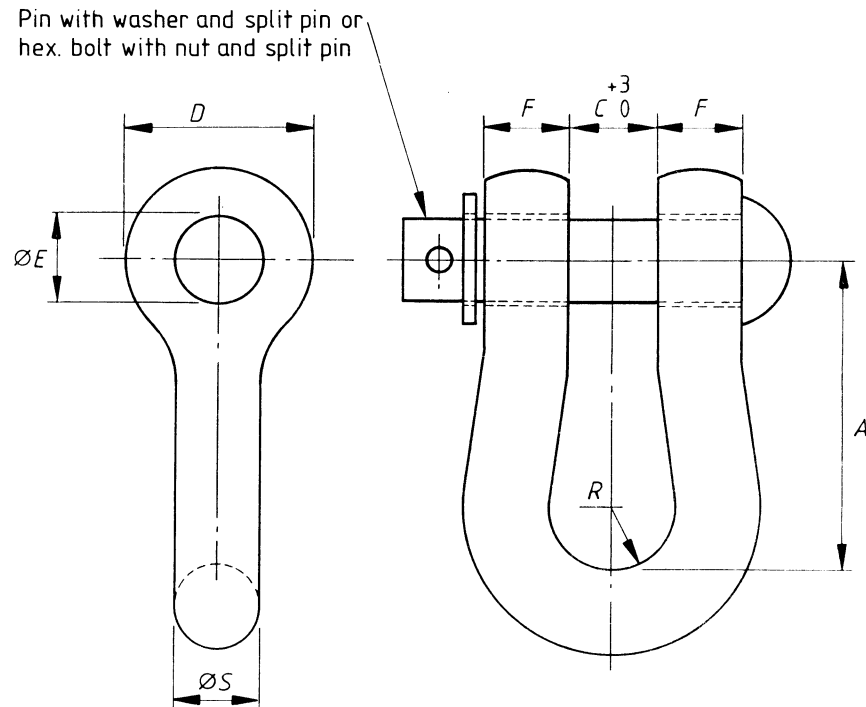


Figure 7. Shackle: reference numbers 15/29, 28/29, 42/29, 42/103, 67/103, 15/129, 42/129 and 28/108

Table 5. Dimensions of bow shackle: reference numbers 15/29, 28/29, 42/29, 42/103, 67/103, 15/129 and 42/129

Reference number	Minimum failing load	A	C	D	ϕE	F	R	ϕS	Pin		Bolt	
									Diameter	Length	Diameter	Length
15/29	kN	mm	mm	mm	mm	mm	mm	mm	mm	mm		mm
28/29	70	70	19	35	18	9.5	16	16	16	60	M16	70
42/29	125	76	21	54	22	13	19	19	20	65	M20	85
	190	83	27	51	24	22	17	22	22	95	M22	115
42/103 (see note 2)	190	83	28	51	27	22	17	22	(see note 3)			
67/103	300	90	27	60	29	25	20	25	27	105	M27	120
15/129	70	90	22	44	18	19	19	19	16	90	M16	90
42/129	190	102	28	57	32	22	17	22	30	100	M30	120

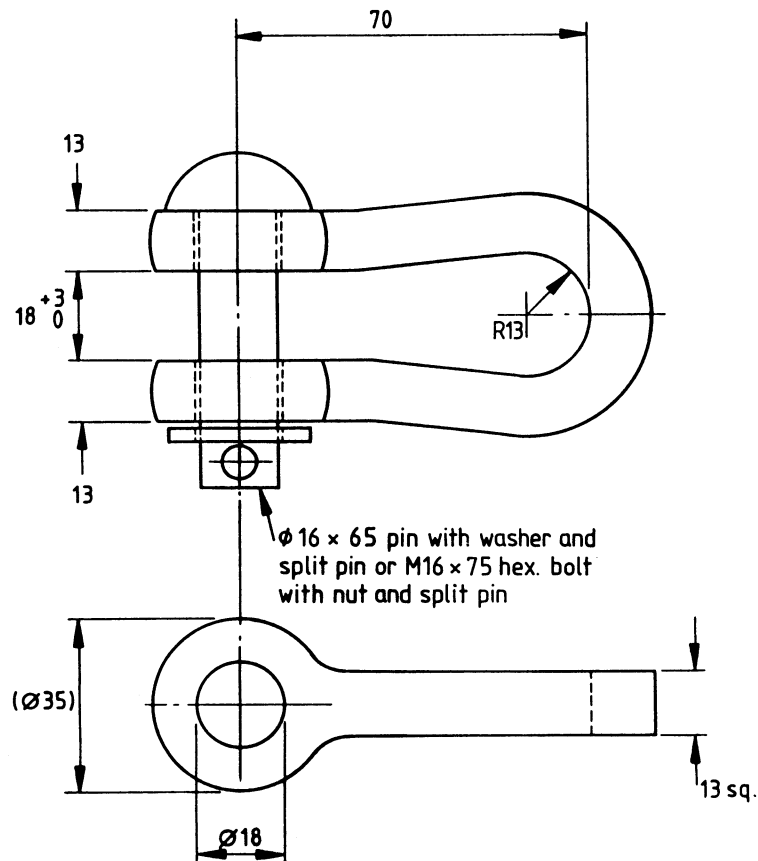
NOTE 1. Pins, washers and split pins (or bolts, nuts and split pins) are included, except for reference number 42/103.

NOTE 2. Reference number 42/103 was shackle Z in the previous edition of this Part of BS 3288.

NOTE 3. Reference number 42/103 is used in sag adjuster assemblies (see figures 77 and 78).

Table 6. Dimensions of dee shackle: reference number 28/108

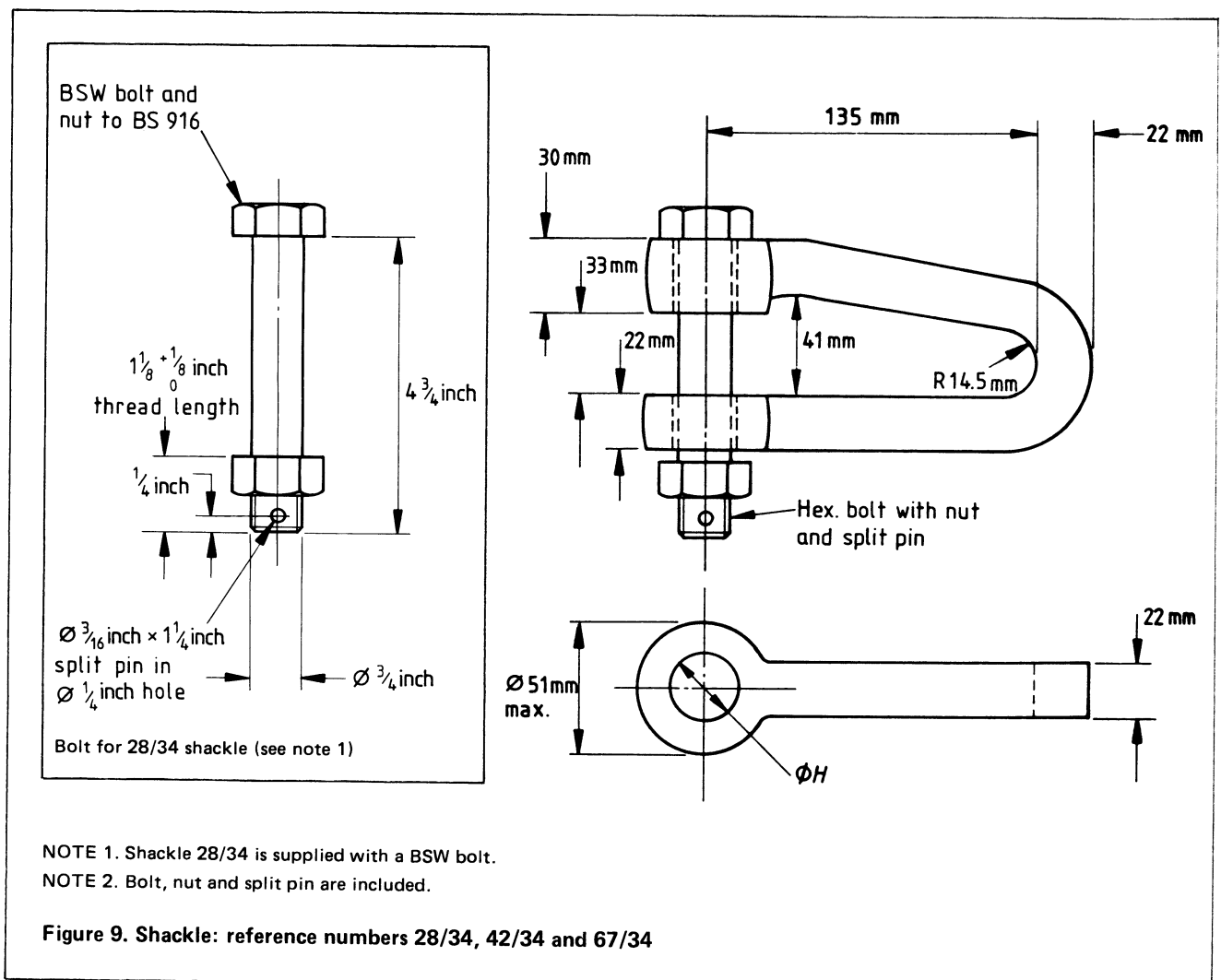
Reference number	Minimum failing load	A	C	D	ϕE	F	R	ϕS	Pin		Bolt	
									Diameter	Length	Diameter	Length
28/108	kN	mm	mm	mm	mm	mm	mm	mm	mm	mm		mm
	125	84	38	45	24	20	19	20	22	105	M22	125



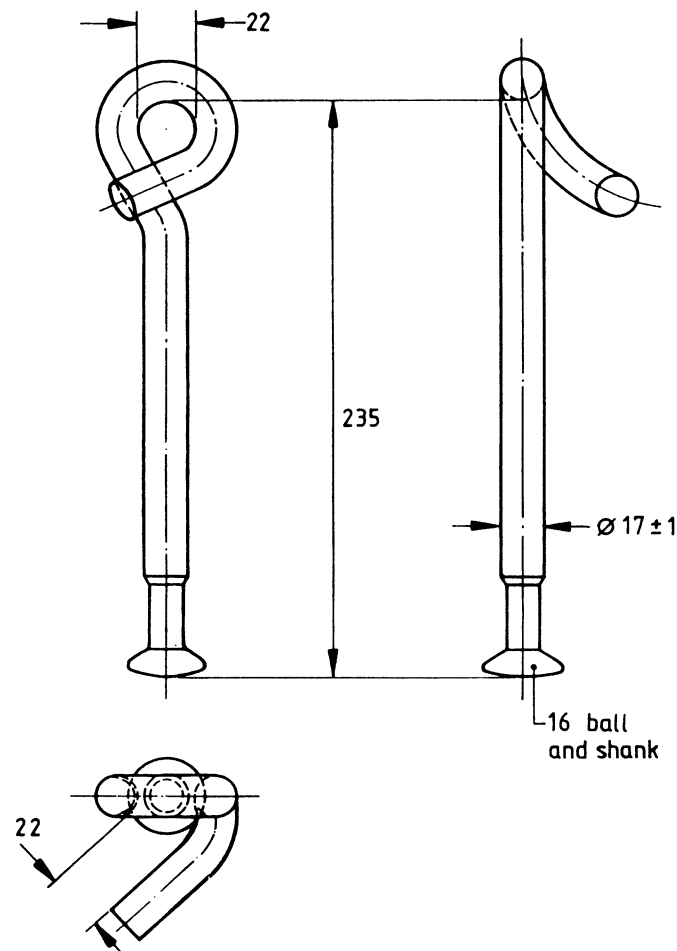
All dimensions are in millimetres.

NOTE. Pin, split pin and washer (or bolt, nut and split pin) are included.

Figure 8. Shackle: reference number 15/33 (minimum failing load 70 kN)

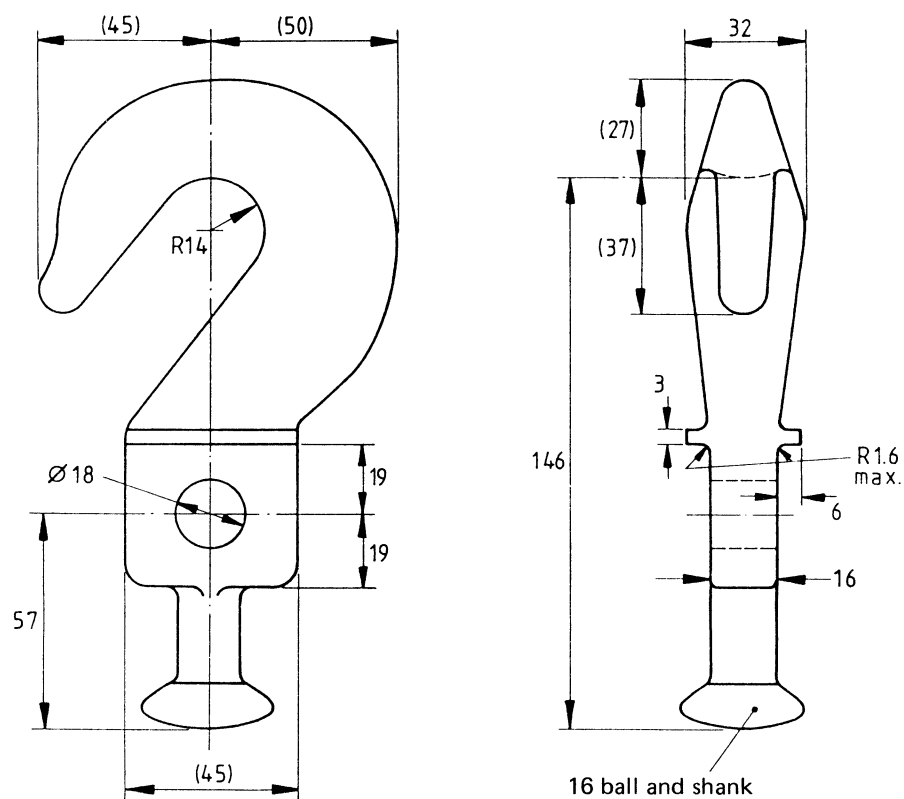


Reference number	Minimum failing load	ϕH	Bolt diameter	Bolt length
	kN	mm		mm
28/34	125	21	See inset drawing	See inset drawing
42/34	190	27	M24	125
67/34	300	29	M27	130



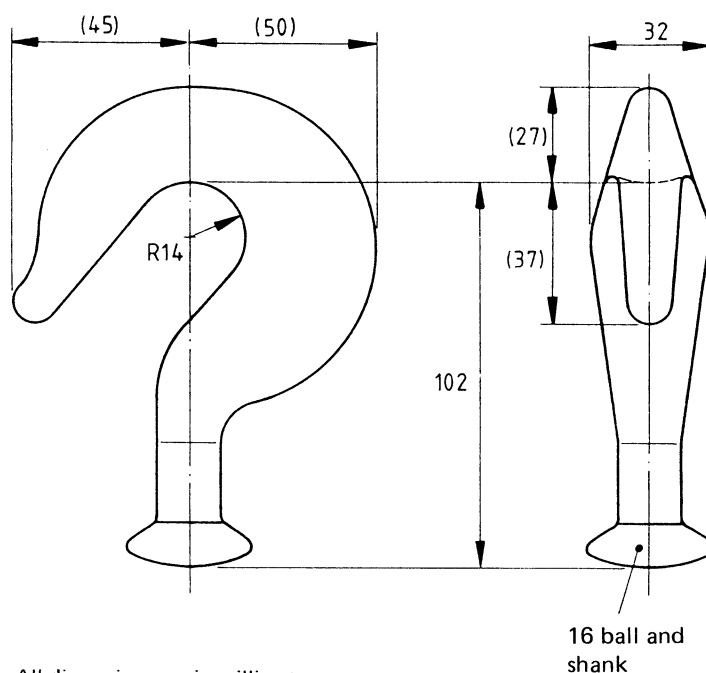
All dimensions are in millimetres.

Figure 10. Ball-ended hook: reference number 4/88
(minimum failing load 20 kN)



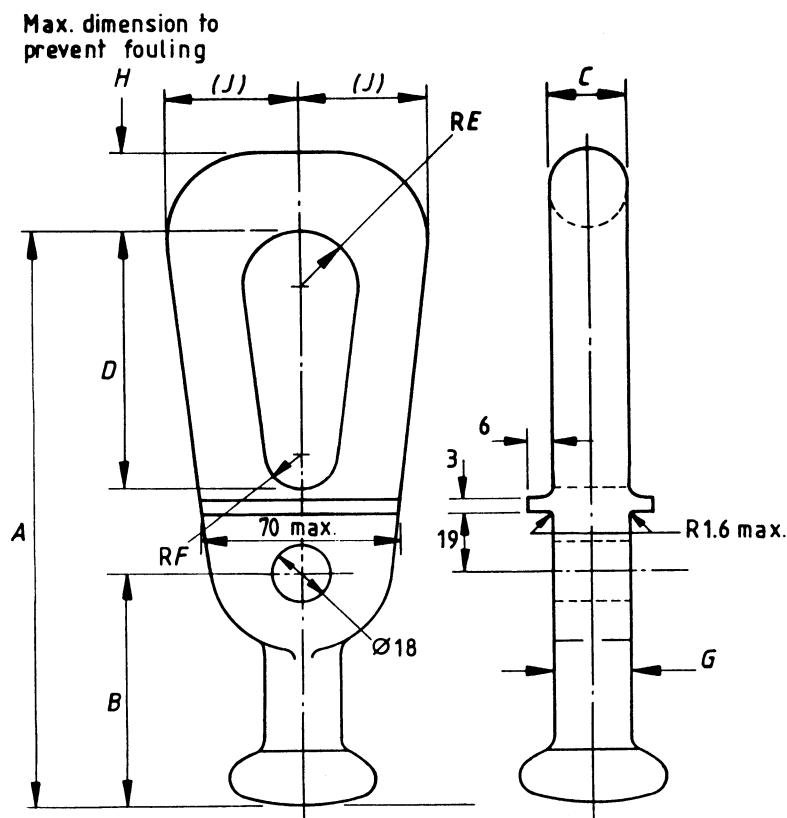
All dimensions are in millimetres.

Figure 11. Ball-ended hook : reference number 15/32
(minimum failing load 70 kN)



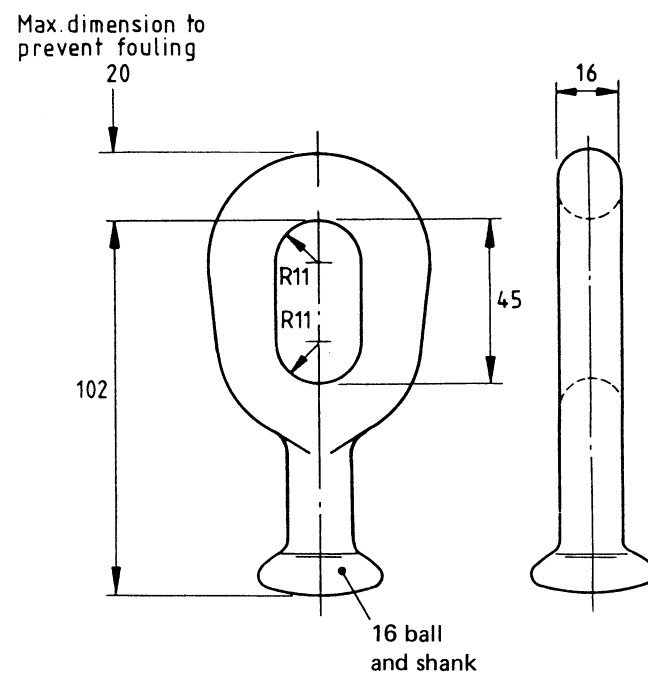
All dimensions are in millimetres.

Figure 12. Ball-ended hook: reference number 15/81
(minimum failing load 70 kN)



All dimensions are in millimetres.
Figure 13. Ball-ended eye link: reference numbers 15/30, 28/30 and 42/30

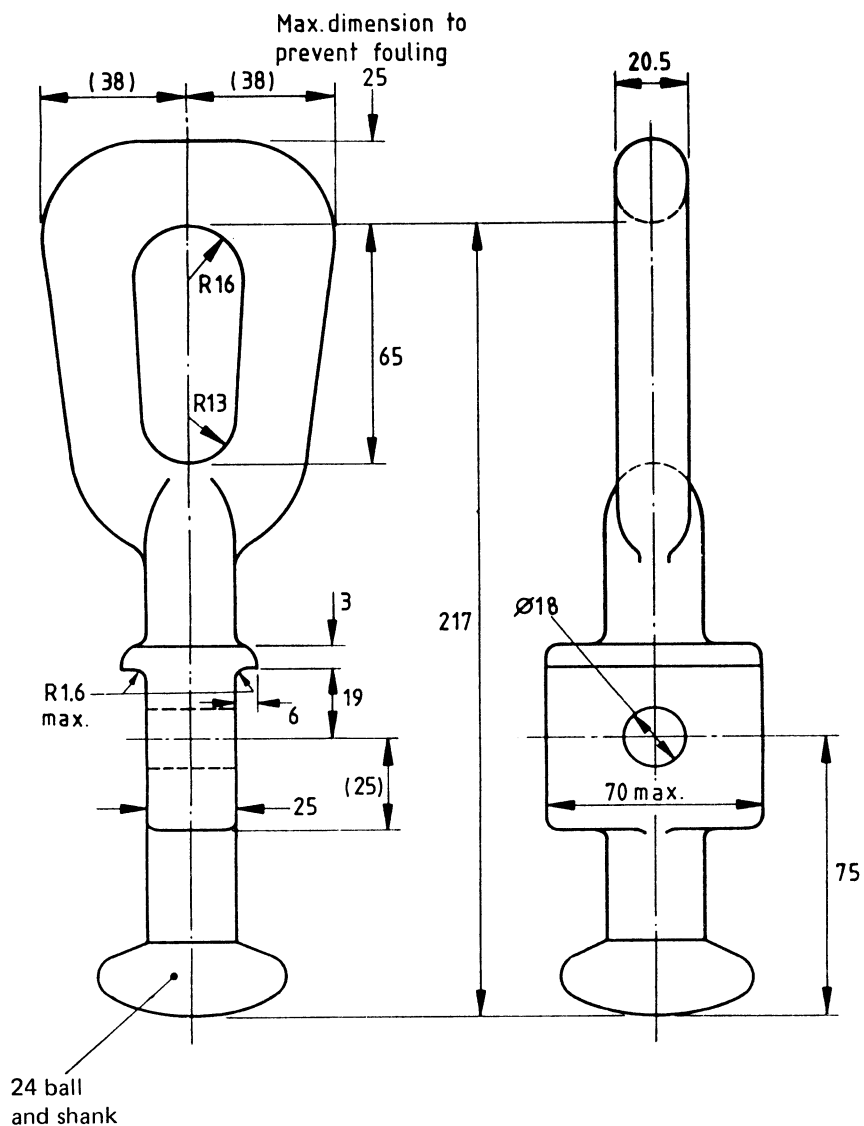
Table 8. Dimensions of ball-ended eye link: reference numbers 15/30, 28/30 and 42/30												
Reference number	Minimum failing load	Ball size	A	B	C	D	E	F	G	H max.	J	Reference number of shackle used with eye links
15/30	70	16	146	57	16	45	11	11	16	20	34	15/29
28/30	125	20	165	67	19	74	16	9.5	20	23	37	28/29
42/30	190	24	168	75	20.5	65	16	13	25	25	38	42/29



All dimensions are in millimetres.

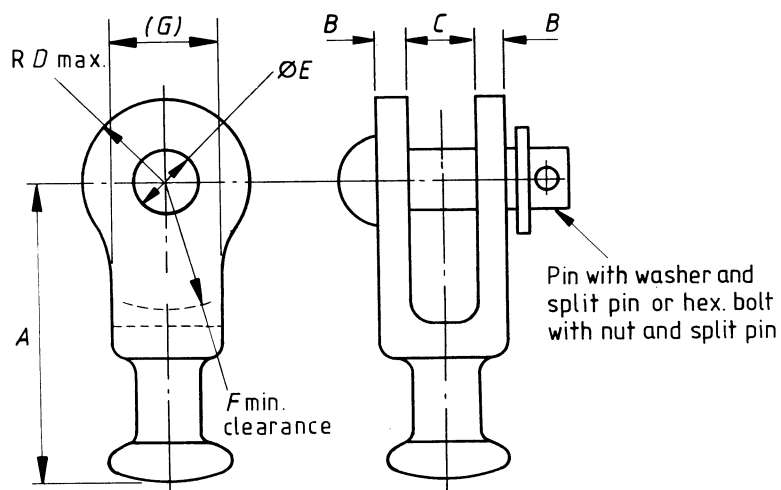
NOTE. For use with shackle reference number 15/29.

Figure 14. Ball-ended eye link: reference number 15/82
(minimum failing load 70 kN)



All dimensions are in millimetres.
NOTE. For use with shackle reference number 42/29.

Figure 15. Ball-ended eye link (twisted): reference number 42/44
(minimum failing load 190 kN)

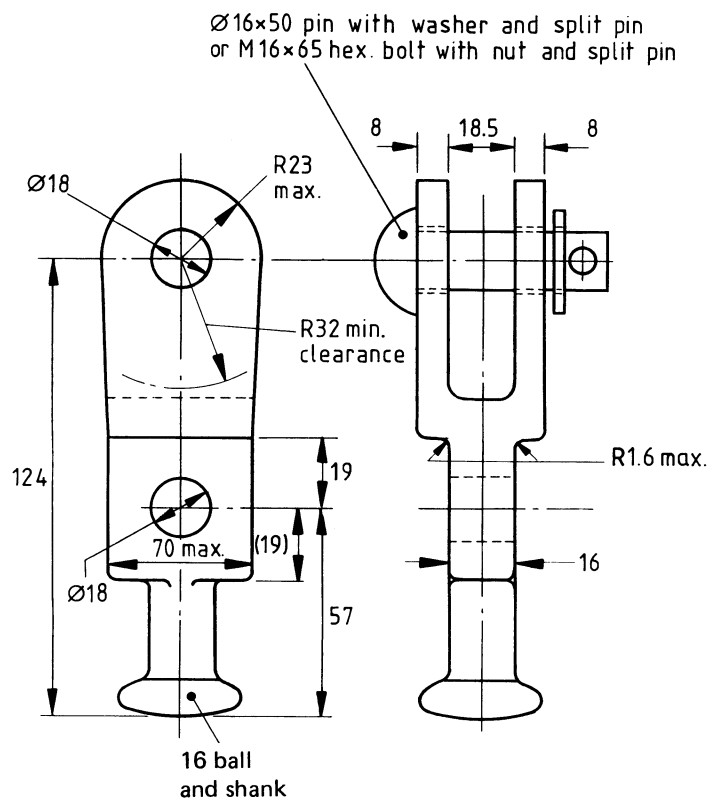


NOTE. Pin, split pin and washer (or bolt, nut and split pin) are included.

Figure 16. Ball clevis: reference numbers 15/83, 28/83 and 84/83

Table 9. Dimensions of ball clevis: reference numbers 15/83, 28/83 and 84/83

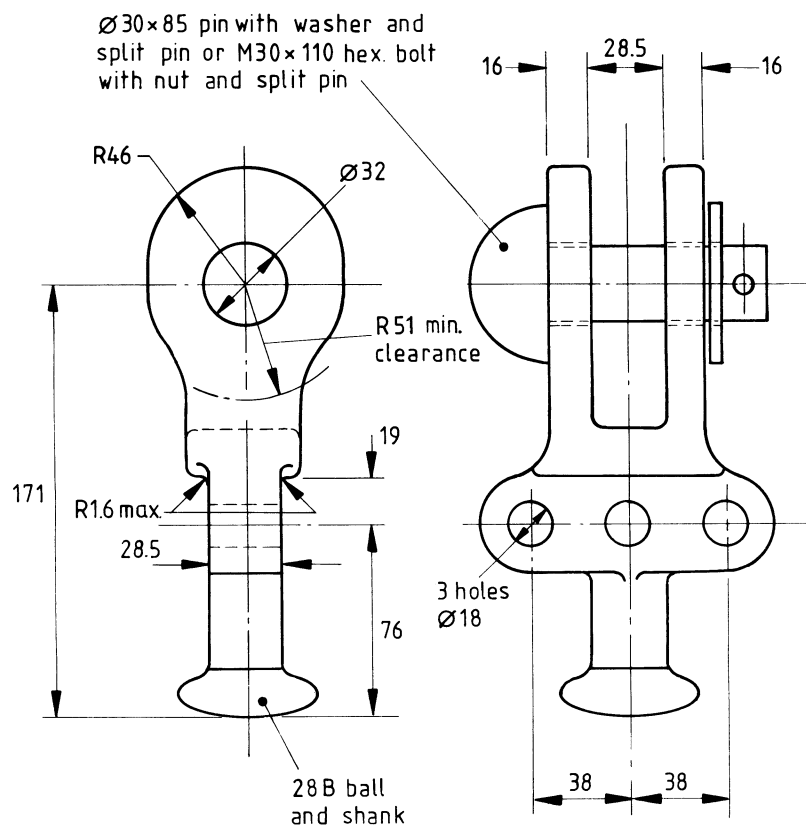
Reference number	Minimum failing load	Ball size	A	B	C	D max.	ϕE	F min.	Pin		Bolt	
									Diameter	Length	Diameter	Length
15/83	70	16	89	8	18.5	23	18	32	16	50	M16	65
28/83	125	20	95	11	21.5	32	22	32	20	60	M20	80
84/83	400	28B	127	16	28.5	46	32	51	30	85	M30	110



All dimensions are in millimetres.

NOTE. Pin, split pin and washer (or bolt, nut and split pin) are included.

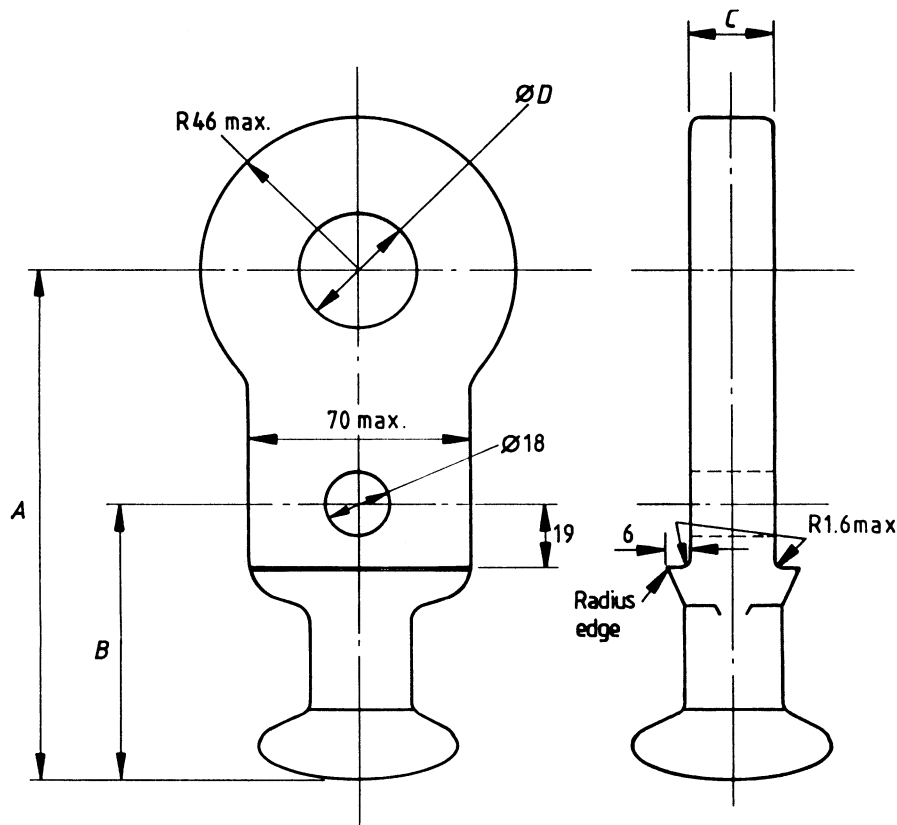
Figure 17. Ball clevis: reference number 15/25
(minimum failing load 70 kN)



All dimensions are in millimetres.

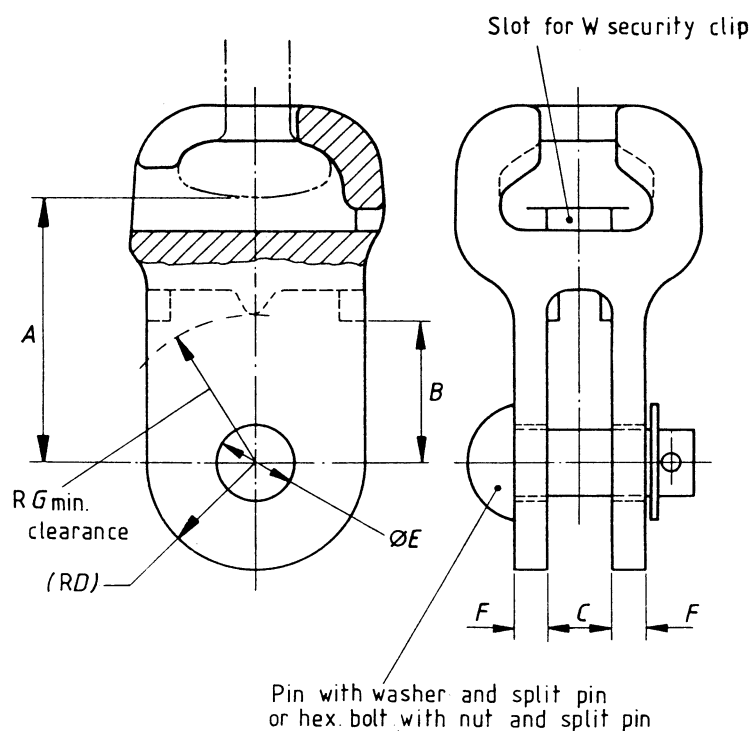
NOTE. Pin, split pin and washer (or bolt, nut and split pin) are included.

Figure 18. Ball clevis : reference number 84/25
(minimum failing load 400 kN)



All dimensions are in millimetres.
Figure 19. Ball tongue: reference numbers 67/48 and 84/48

Table 10. Dimensions of ball tongue: reference numbers 67/48 and 84/48						
Reference number	Minimum failing load	Ball size	A	B	C	ϕD
67/48	kN		mm	mm	mm	mm
84/48	300	24	165	83	25	29
	400	28B	159	83	25	32

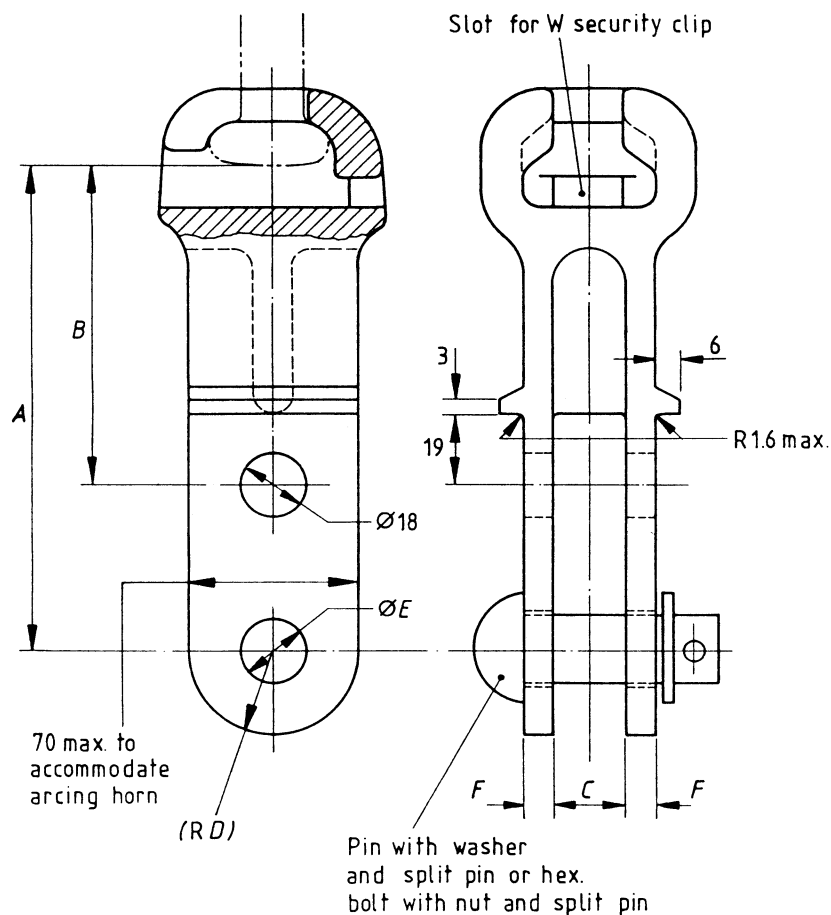


NOTE. Security clip, pin, split pin and washer (or bolt, nut and split pin) are included.

Figure 20. Socket clevis: reference numbers 15/84, 28/37, 42/37, 42/46, 42/104 and 84/37

Table 11. Dimensions of socket clevis: reference numbers 15/84, 28/37, 42/37, 42/46, 42/104 and 84/37

Reference number	Minimum failing load	Socket size	A	B	C	D max.	ϕE	F	G min.	Pin		Bolt	
										Diameter	Length	Diameter	Length
	kN		mm	mm	mm	mm	mm	mm	mm	mm	mm		mm
15/84	70	16B	59	—	18.5	23	18	8	38	16	50	M16	65
28/37	125	20	76	41	18.5	32	22	9.5	—	20	55	M20	70
42/37	190	24	76	41	21.5	35	24	13	—	22	70	M22	90
42/46	190	24	121	—	28.5	35	24	13	45	22	75	M22	95
42/104	190	24	105	—	28.5	46	32	22	64	30	100	M30	120
84/37	400	28B	105	—	28.5	46	32	22	64	30	100	M30	120



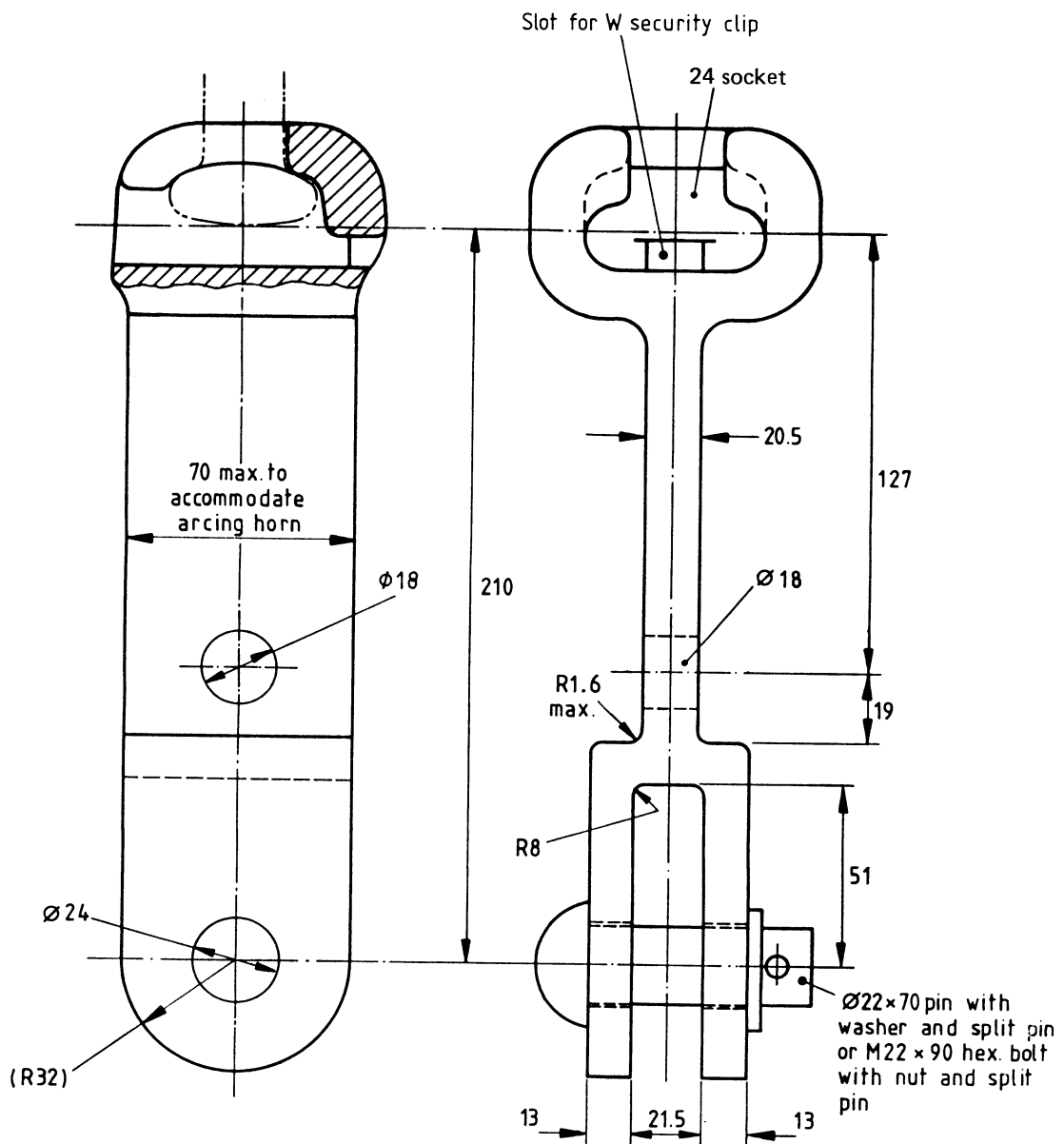
All dimensions are in millimetres.

NOTE. Security clip, pin, split pin and washer (or bolt, nut and split pin) are included.

Figure 21. Socket clevis (with arcing horn attachment): reference numbers 15/31, 28/31 and 42/31

Table 12. Dimensions of socket clevis (with arcing horn attachment) : reference numbers 15/31, 28/31 and 42/31

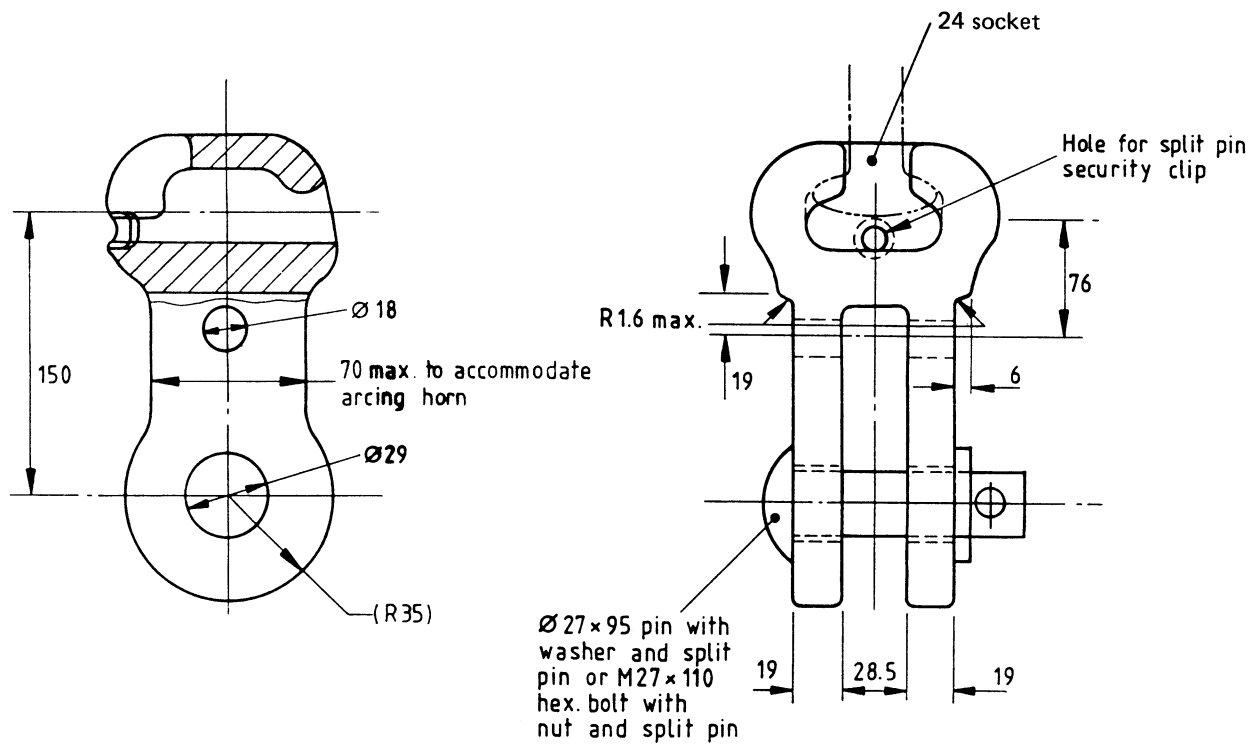
Reference number	Minimum failing load	Socket size	A	B	C	D max.	ϕE	F	Pin		Bolt	
									Diameter	Length	Diameter	Length
15/31	kN		mm	mm	mm	mm	mm	mm	mm	mm		mm
28/31	70	16B	130	86	18.5	23	18	8	16	50	M16	65
42/31	125	20	122	71	21.5	32	22	9.5	20	55	M20	75
	190	24	159	76	25	35	24	13	22	75	M22	95



All dimensions are in millimetres.

NOTE. Security clip, pin, split pin and washer (or bolt, nut and split pin) are included.

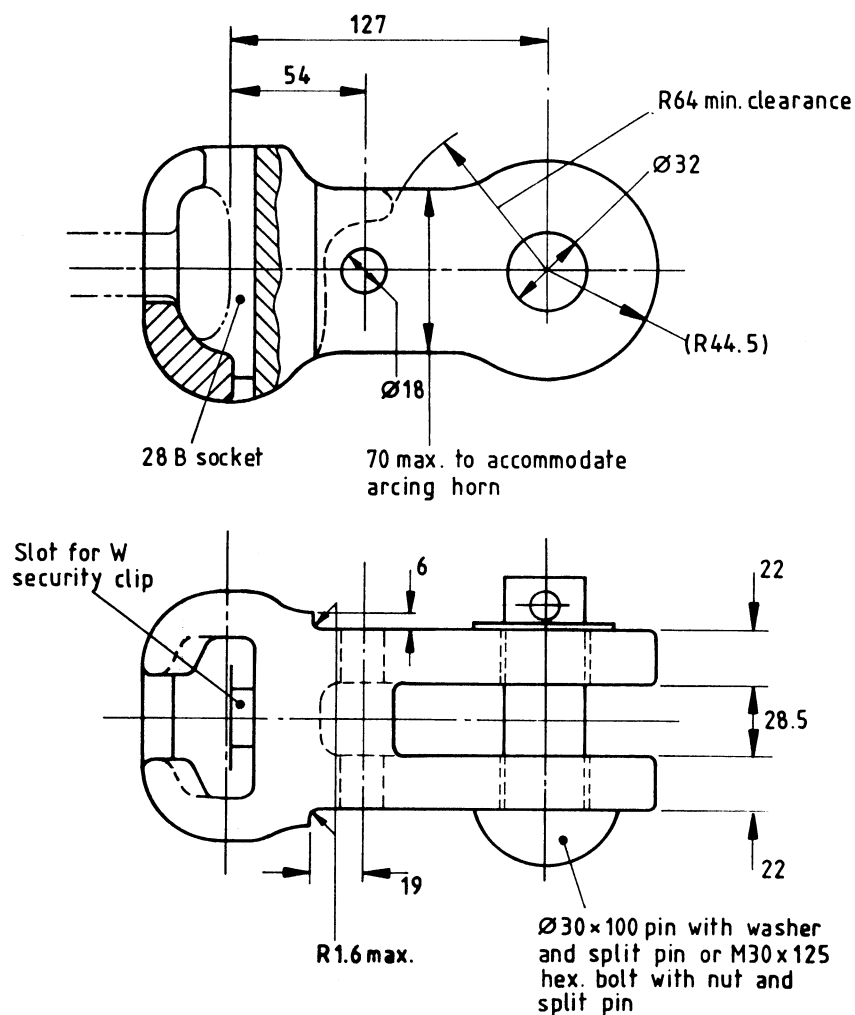
Figure 22. Socket clevis (with arcing horn attachment): reference number 42/45 (minimum failing load 190 kN)



All dimensions are in millimetres.

NOTE. Security clip, pin, split pin and washer (or bolt, nut and split pin) are included.

Figure 23. Socket clevis (with arcing horn attachment): reference number 67/31 (minimum failing load 300 kN)



All dimensions are in millimetres.

NOTE. Security clip, pin, split pin and washer (or bolt, nut and split pin) are included.

Figure 24. Socket clevis (with arcing horn attachment): reference number 84/31 (minimum failing load 400 kN)