

Ball Studs and Sockets

1. Scope

This Standards specifies the design standards for the shapes, dimensions and manufacturing quality for the major ball studs and sockets to be used as components of automobiles.

2. Purpose of Standardization

It aims to unify and standardize ball studs and sockets for automobiles, and to contribute to cost reduction while assuring appropriate qualities.

3. Types and Series

3.1 Ball Studs

Ball studs shall be of the five types indicated in **Table 1** according to their shapes. The series in each type shall be classified into 10 steps for No. 1 through No. 4 type by the size of standard diameter of the shank and into 7 steps for No. 5 type by the size of the ball diameter.

Table 1

Type	Type of Shank	Nomenclature	Shapes & Dimensions	Step of Series
No. 1 Type	Tapered shank	Standard type ball stud	Attached Table 1	10 steps
No. 2 Type		Flanged ball stud	Attached Table 2	
No. 3 Type		Hemispherical ball stud	Attached Table 3	
No. 4 Type	Straight shank	Drive-in type ball stud	Attached Table 4	
No. 5 Type	Screw-in type	Screw-in type ball stud	Attached Table 5	7 steps

3.2 Sockets

Sockets shall be of the three types indicated in **Table 2** according to their shape and structure. The series in each type shall be classified into 10 steps for No. 1 type according to the outer diameter of the socket, and 7 steps and 4 steps respectively for No. 2 and No. 3 types according to the ball diameter of the corresponding ball stud.

4. Shapes and Dimensions

The shapes and dimensions of ball studs and sockets shall be pursuant to the attached **Tables 1 ~ 5** and the attached **Tables 6 ~ 8** respectively.

5. Materials and Mechanical Properties

The materials for ball studs shall be SCr 4 and SCr 21 of **JIS G 4104** and SCM 3 and SCM 21 of **JIS G 4105** for No. 1 ~ No. 4 type, and S 45 C of **JIS G 4051** for No. 5 type or shall have equivalent or better mechanical properties to those materials mentioned above.

Table 2

Type	Nomenclature	Shapes & Dimensions	Step of Series
No. 1 type	Eye type socket	Attached Table 6	10 steps
No. 2 type	Plug-end type socket	Attached Table 7	7 steps
No. 3 type	Ball type socket	Attached Table 8	4 steps

The materials used for sockets shall have equivalent or better mechanical properties to those of S 45 C of **JIS G 4051**.

Remarks- The materials used for socket seats shall have almost equivalent hardness with the corresponding ball studs. In some cases, synthetic resin, etc. having properties suitable for the application, may be also used. Synthetic resin may also be used for No. 3 type sockets intended for extremely light load.

6. Surface Treatment

Surface hardening shall be, in principle, applied to the ball surface of ball studs and the sheet surface of sockets. The surface hardness shall be HRC 55 or harder.

Remarks- In case where synthetic resin are used, the surface hardening of both sheets and ball studs is not particularly required regardless of this provision.

7. Processing Accuracy

The processing accuracies of ball studs and socket shall satisfy the specifications of the shapes, dimensions and surface finishing indicated in the attached **Tables 1 ~ 5** and the attached **Tables 6 ~ 8** respectively.

Remarks- The surface finishing symbols shall be pursuant to **JIS B 0601**. No provision shall be made for finishing methods.

8. Appearance

The surface roughness of ball studs and sockets shall conform with the provision of 7. No defects such as cracks, flaws, flashes, rust or peelings which are harmful in use shall be present.

9. Screws

9.1 Dimensions of Screws

The screw dimensions of ball studs and sockets shall be pursuant to **JIS B 0205** and **JIS B 0207**.

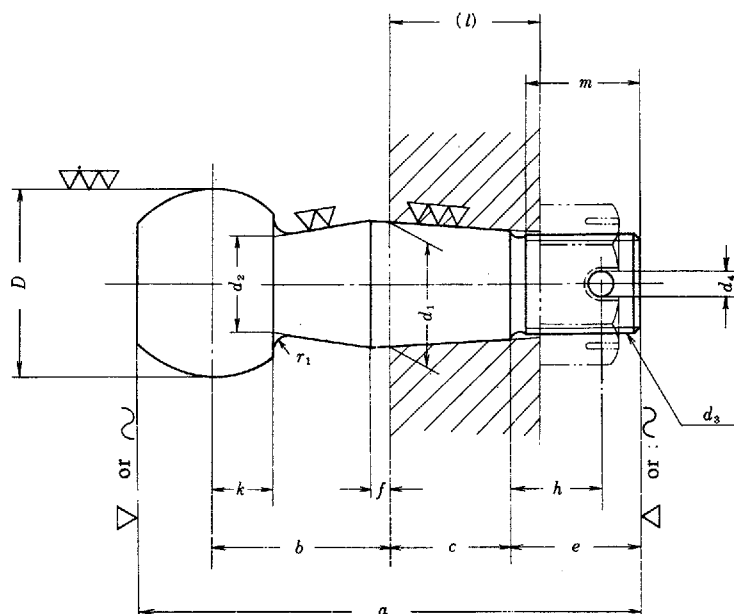
9.2 Accuracy of Screws

The accuracy of screws shall be the second class of **JIS B 0209** and **JIS B 0211**.

Reference Standards-

- JIS B 0205** (Metric Coarse Screw Threads)
- JIS B 0207** (Metric Fine Screw Threads)
- JIS B 0209** (Limits of Sizes and Tolerances for Metric Coarse Screw Threads)
- JIS B 0211** (Limits of Sizes and Tolerances for Metric Fine Screw Threads)
- JIS B 0401** (Limits and Fits for Engineering)
- JIS B 0601** (Surface Roughness)
- JIS B 1170** (Hexagon Slotted and Castle Nuts)
- JIS B 1351** (Split Pins)
- JIS G 4051** (Carbon Steel for Machine Structural Use)
- JIS G 4104** (Chromium Steels)
- JIS G 4105** (Chromium Molybdenum Steels)

Attached Table 1 No. 1 Type (Standard Ball Studs)

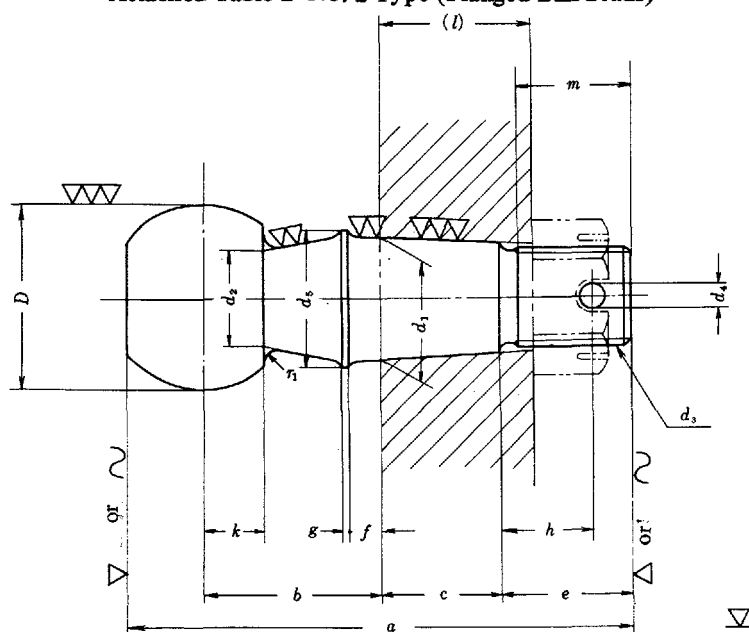


Unit: mm

D h 9	a		b	c	d_1 ± 0.05 (hole 0 -0.05)	d_2	d_3	d_4	e	f	h	k	l	m	r_1	Taper	(Reference)	
																	Slotted nut JIS B 1170	Spilt pin JIS B 1351
18	49	50*	15.5	11	12	10	M 10×1.25	2.5	14.5	2	10	6	14.5	12.5	1.5		M 10×1.25	2.5×25
20	51.5	52*	18															
22*	55.5	57*	18															
20	55.5	57*	18	12.5	14	11	M 12×1.25	3	16	2	11.5	7*	16	14	1.5		M 12×1.25	3×25
22	59	60*	21.5															
24*	61.5	20																
24	61.5	20		14	16	13	M 12×1.25	3	17	2	12	8.5	18	15	2		M 12×1.25	3×25
26	65.5	24																
26	68.5	22																
28	72.5	26		16.5	18	14	M 14×1.5	3	18.5	3	13.5	9	21	16.5	2.5		M 14×1.5	3×30
28	75.5	24																
30	79.5	28																
30	81.5	26		19	20	15.5	M 16×1.5	4	20.5	3	14.5	9.5	23	18	2.5		M 16×1.5	4×30
32	86.5	31																
32	86.5	28																
32	86.5	28		22.5	24	18.5	M 18×1.5	4	22	3	16	11	28	19.5	2.5		M 18×1.5	4×35
35	91.5	33																
35	93	30																
38	98	35		24.5	26	21	M 20×1.5	4	23	4	16	12	30	20.5	3		M 20×1.5	4×40
38	99.5	32																
40	104.5	37																
40	105	34		26	28	22.5	M 22×1.5	5	25	4	18	13	33	22.5	3		M 22×1.5	5×40
40	105	34																
45	110	39																
45	110	39		28	30	24	M 24×2	5	25.5	4	18	13.5	34	23	3		M 24×2	5×45
45	110	39																
45	110	39																

- Remarks-**
- Shapes and dimensions of parts not mentioned in the above may be determined as deemed appropriate.
 - Oil grooves may be added according to the purpose, and no provisions are made for the shapes and dimensions.
 - Provisions are made for the length of screws and the location of split pin hole according to the low type of JIS B 1170 as the standard. In cases where the high type nuts are employed, the corresponding length and location should be adopted.
 - The screw ends may be shaped appropriately according to necessity.
 - Taper must show 70% or more area of contact when blued in a master gauge.
 - The smaller end of taper hole against the taper standard diameter $d_1=12$ and 14 should be straight so as not to interfere with the outer diameter of the screw.
 - h9 in the Table is pursuant to JIS B 0401.
 - () in the Table indicates the dimensions of the corresponding boss.
 - * marks in the Table indicate corresponding dimensions.

Attached Table 2 No. 2 Type (Flanged Ball Studs)

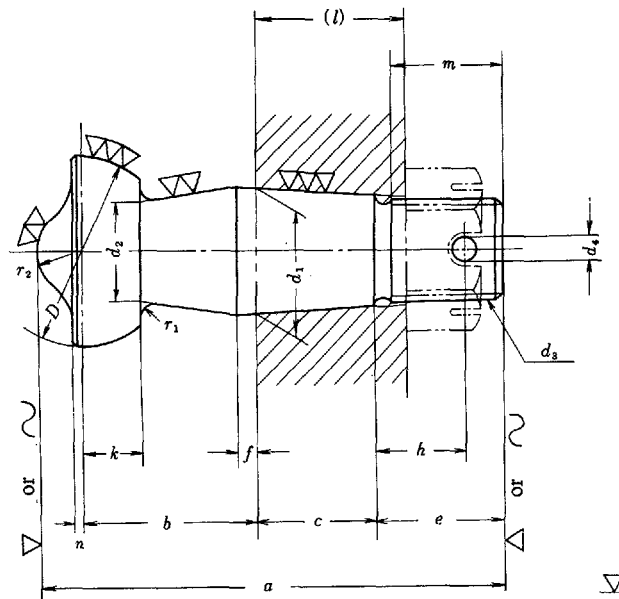


Unit: mm

D h 9	a		b	c	d_1 ± 0.05 (hole 0 -0.05)	d_2	d_3	d_4	d_5	e	f	g	h	k	l	m	r ₁	Taper	(Reference)	
																			Slotted nut JIS B 1170	Spilt pin JIS B 1351
18 20 22*	49 51.5 52.5*	50* 52.5 57*	15.5 18	11	12	10	M 10×1.25	2.5	14	14.5	5	1.0	10	6 7*	14.5	12.5	1.5	$\frac{1}{8}$ - or $\frac{1}{10}$	M 10×1.25	2.5×25
20 22 24*	55.5 59	57* 60.5*	18 21.5																12.5	14
24	61.5	20	14	16	13	M 12×1.25	3	18	17	5	1.0	12	8.5	18	15	2	M 12×1.25			
26	65.5	24															16.5		18	14
26	68.5	22	19	20	15.5	M 16×1.5	4	22	20.5	5	1.0	14.5	9.5	23	18	2.5				
28	72.5	26															20.5		22	17
28	75.5	24	22.5	24	18.5	M 18×1.5	4	26	22	5	1.5	16	11	28	19.5	2.5				
30	79.5	28															24.5		26	21
30	81.5	26	26	28	22.5	M 22×1.5	5	30	25	5	1.5	18	13	33	22.5	3				
32	86.5	31															28		30	24
32	86.5	28	28	30	24	M 24×2	5	32	25.5	5	1.5	18	13.5	34	23	3		M 24×2		
35	91.5	33															28	30	24	M 24×2
35	93	30	28	30	24	M 24×2	5	32	25.5	5	1.5	18	13.5	34	23	3				
38	98	35															28	30	24	M 24×2
38	99.5	32	28	30	24	M 24×2	5	32	25.5	5	1.5	18	13.5	34	23	3				
40	104.5	37															28	30	24	M 24×2
40	105	34	28	30	24	M 24×2	5	32	25.5	5	1.5	18	13.5	34	23	3				
45	110	39															28	30	24	M 24×2

- Remarks-**
1. Shapes and dimensions of parts not mentioned in the above may be determined as deemed appropriate.
 2. Oil grooves may be added according to the purpose, and no provisions are made for the shapes and dimensions.
 3. Provisions are made for the length of screws and the location of split pin hole according to the low type of JIS B 1170 as the standard. In cases where the high type nuts are employed, the corresponding length and location should be adopted.
 4. The screw ends may be shaped appropriately according to necessity.
 5. Taper must show 70% or more area of contact when blued in a master gauge.
 6. The smaller end of taper hole against the taper standard diameter $d_1 = 12$ and 14 should be straight so as not to interfere with the outer diameter of the screw.
 7. h9 in the Table is pursuant to JIS B 0401.
 8. () in the Table indicates the dimensions of the corresponding boss.
 9. * marks in the Table indicate corresponding dimensions.

Attached Table 3 No. 3 Type (Hemispherical Ball Studs)



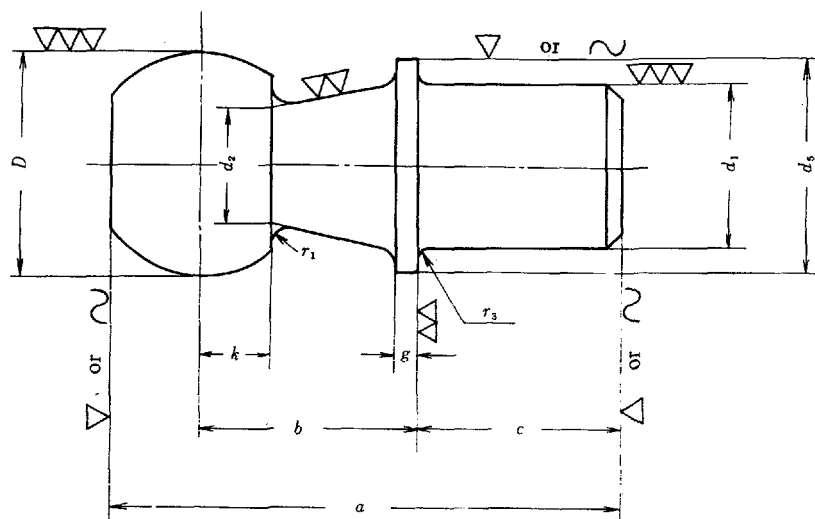
Unit: mm

D h 9	a		b	c	d_1 ± 0.05 (hole 0 -0.05)	d_2	d_3	d_4	e	f	h	k	l	m	n	r_1	r_2	Taper	(Reference)	
																			Slotted nut JIS B 1170	Spilt pin JIS B 1351
18 20 22*	49 51.5	50* 52.5*	15.5 18	11	12	10	M10×1.25	2.5	14.5	2	10	6 7*	14.5	12.5	1	1.5	6		M10×1.25	2.5×25
20 22 24*	55.5 59	57* 60.5*	18 21.5									12.5								
24	61.5	20	14	16	13	M12×1.25	3	17	2	12	8.5		18	15	1.5	2	6			M12×1.25
26	65.5	24										16.5								
26	68.5	22	19	20	15.5	M16×1.5	4	20.5	3	14.5	9.5		23	18	1.5	2.5	7			M16×1.5
28	72.5	26										20.5								
28	75.5	24	22.5	24	18.5	M18×1.5	4	22	3	16	11		28	19.5	2	2.5	8			M18×1.5
30	79.5	28										24.5								
30	81.5	26	26	28	22.5	M22×1.5	5	25	4	18	13		33	22.5	2	3	9			M22×1.5
32	86.5	31										28								
32	86.5	28	28	30	25.5	M24×2	5	25.5	4	18	13.5		34	23	2	3	9			M24×2
35	91.5	33										28								
35	93	30	28	30	25.5	M24×2	5	25.5	4	18	13.5		34	23	2	3	9			M24×2
38	98	35										28								
38	99.5	32	28	30	25.5	M24×2	5	25.5	4	18	13.5		34	23	2	3	9			M24×2
40	104.5	37										28								
40	105	34	28	30	25.5	M24×2	5	25.5	4	18	13.5		34	23	2	3	9			M24×2
45	110	39										28								

- Remarks-**

 1. Shapes and dimensions of parts not mentioned in the above may be determined as deemed appropriate.
 2. Oil grooves may be added according to the purpose, and no provisions are made for the shapes and dimensions.
 3. Provisions are made for the length of screws and the location of split pin hole according to the low type of JIS B 1170 as the standard. In cases where the high type nuts are employed, the corresponding length and location should be adopted.
 4. The screw ends may be shaped appropriately according to necessity.
 5. Taper must show 70% or more area of contact when blued in a master gauge.
 6. The smaller end of taper hole against the taper standard diameter $d_1=12$ and 14 should be straight so as not to interfere with the outer diameter of the screw.
 7. h9 in the Table is pursuant to JIS B 0401.
 8. () in the Table indicates the dimensions of the corresponding boss.
 9. * marks in the Table indicate corresponding dimensions.

Attached Table 4 No. 4 Type (Drive-in Type Ball Studs)

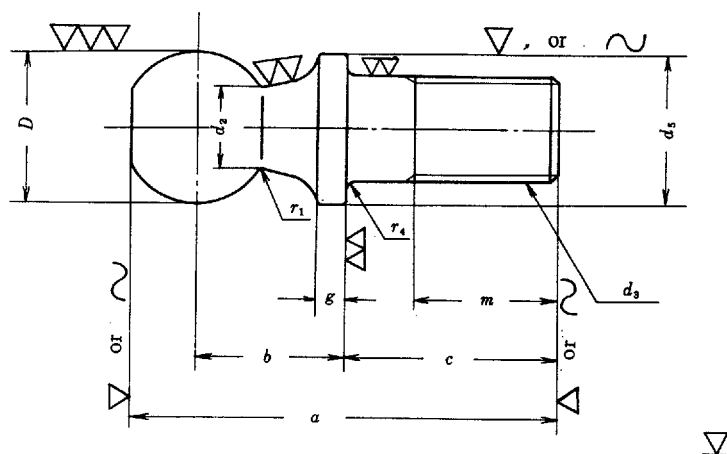


Unit: mm

$\begin{matrix} D \\ h9 \end{matrix}$	a	b	c	$\begin{matrix} d_1 \\ u6 \\ \text{(hole H7)} \end{matrix}$	d_2	d_3	g	k	r_1	r_3
18	46	20.5	17.5	14	10	19	3	6	1.5	1
20	47							7		
22	52	23	20	16	11	21	3	7	1.5	1
24	53.5							8.5		
24	58	25	22.5	18	13	23.5	3	8.5	2	1
26	63	27	24.5	20	14	26	3	9	2.5	1
28	68	29	27	22	15.5	28.5	3	9.5	2.5	1
30	73.5	31	29.5	24	17	31	3	10.5	2.5	1.5
32	78	32.5	31.5	26	18.5	33	3	11	2.5	1.5
35	83	34.5	33.5	28	21	35.5	3	12	3	1.5
38	89	36.5	36	30	22.5	38	3	13	3	1.5
40	94.5	38.5	38	32	24	40	3	13.5	3	1.5

- Remarks-
1. Shapes and dimensions of parts not mentioned in the above may be determined as deemed appropriate.
 2. Oil grooves may be added according to the purpose, and no provisions are made for the shapes and dimensions.
 3. Shank ends may be shaped appropriately according to necessity.
 4. h9, H7 and u6 in the Table are pursuant to JIS B 0401.

Attached Table 5 No. 5 Type (Screw-in Type Ball Studs)



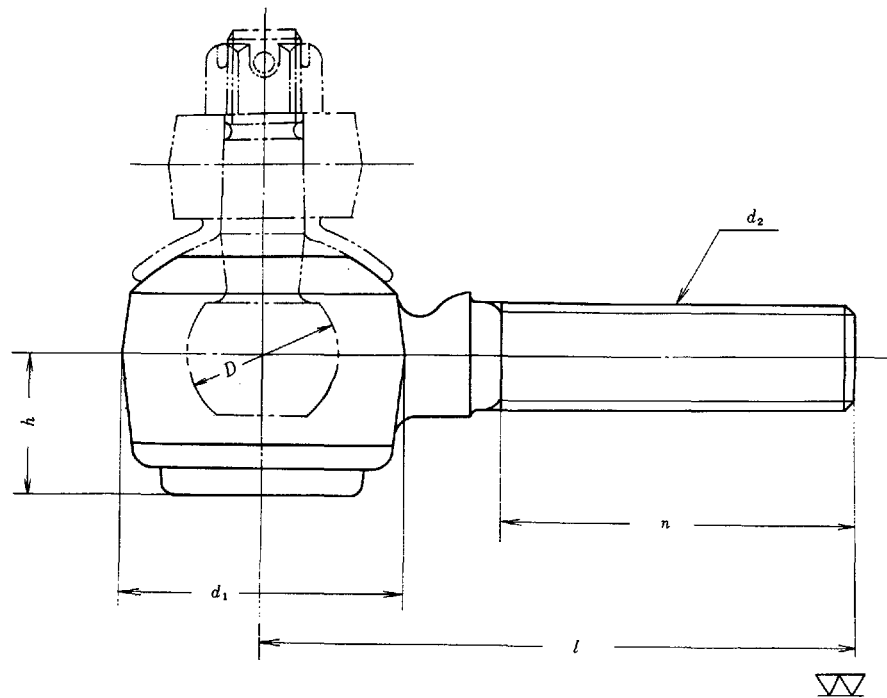
▽

Unit: mm

$\begin{smallmatrix} D \\ h9 \end{smallmatrix}$	a	b	c	m	d_2	d_3	d_5	g	r_1	r_4
8	26	11	12	9	4	M 5 × 0.8	8	3	1	0.5
10	29	12	13	10	5	M 6	10	3	1	0.5
12	34.5	14.5	15	11	6	M 8 × 1	13	3	1	0.5
14	39	15.5	17.5	13	7	M 8 × 1	13	3	1	0.5
16	43.5	16.5	20	15	8	M 10 × 1.25	16	3	1.5	1
18	50	18	24	17	10	M 12 × 1.25	18	4	1.5	1
20	57	20	28	19	11	M 14 × 1.5	20	4	1.5	1

- Remarks-**
1. Shapes and dimensions of parts not mentioned in the above may be determined as deemed appropriate.
 2. Oil grooves may be added according to the purpose, and no provisions are made for the shapes and dimensions.
 3. The shape of flanges may be of double widths so as to become convenient when screwing them in.
 4. h9 in the Table is pursuant to JIS B 0401.
 5. Refer to the attached Tables 7 and 8 for the combination of sockets.

Attached Table 6 No. 1 Type (Eye-type Sockets)

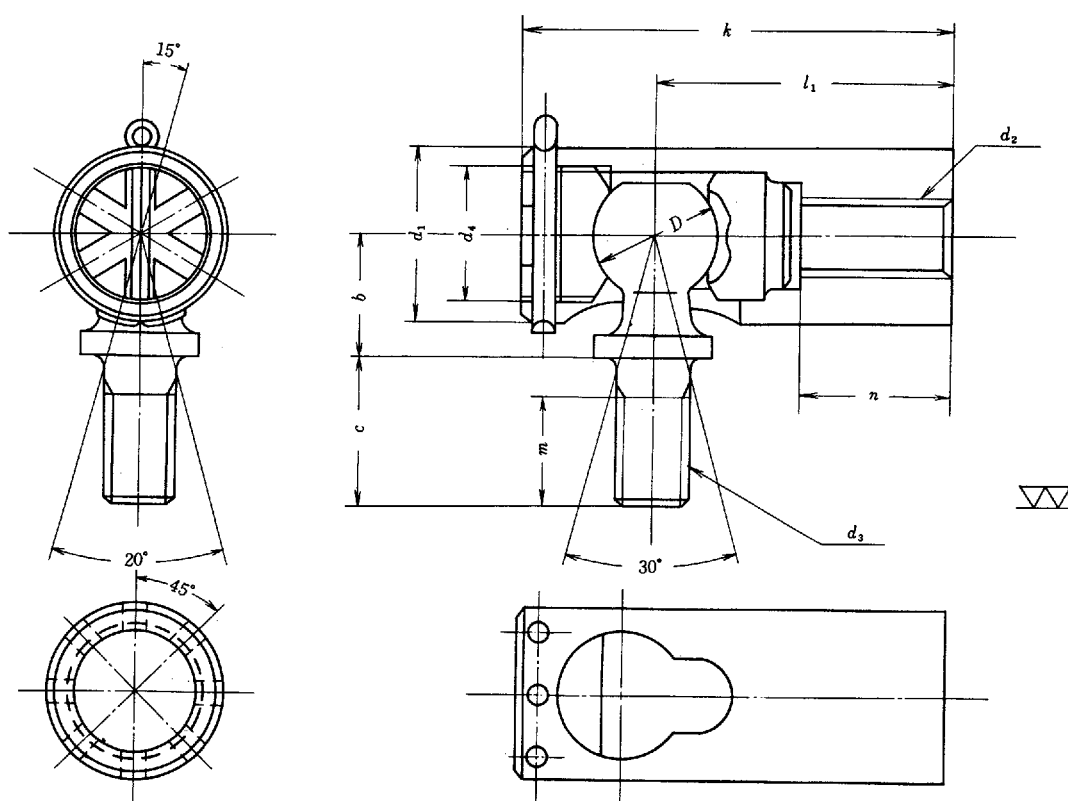


Unit: mm

D	d_1	d_2	h (Max)	l	n	D	d_1	d_2	h (Max)	l	n
18 20	38	M14×1.5	19	80	48	28 30	51	M22×1.5	29	105	59
20 22	40	M16×1.5	20.5	85	50	30 32	55	M24×2	31	110	62
22 24	42	M16×1.5	22	90	52	32 35	59	M27×2	33	120	65
24 26	44	M18×1.5	24	95	55	35 38	64	M30×2	36	130	65
26 28	47	M20×1.5	26	100	57	38 40 45	68	M30×2	38	140	65

- Remarks-
1. Shapes and dimensions of parts not mentioned in the above may be determined as deemed appropriate.
 2. In case of a left-hand screw, it shall be clearly indicated, at the easily recognizable place of the part.
 3. The ball center and the screw center may be offset according to necessity.

Attached Table 7 No. 2 Type (Plug-end Type Sockets and Ball Studs)

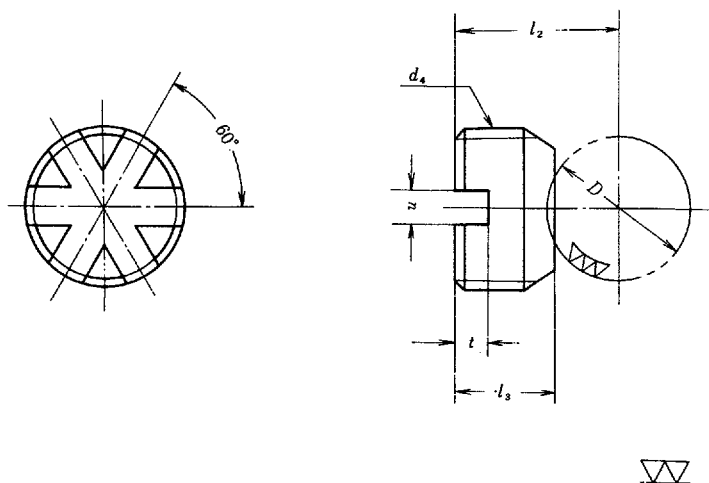


Unit: mm

D	d ₁	d ₂	d ₄	d ₅	n	l ₁	k	d ₃	b	c	m	(Reference)
												Split pin JIS B 1351
8	12	M 5 × 0.8	M10 × 1.25	2.5	10	21	31	M 5 × 0.8	11	12	8	2.5 × 18
					25	36	46					
10	15	M 6	M12 × 1.25	3	12	25	37	M 6	12	13	9	3 × 22
					27	40	52					
12	18	M 8 × 1	M14 × 1.5	3	14	29	43	M 8 × 1	14.5	15	10	3 × 25
					29	44	58					
14	21	M 8 × 1	M16 × 1.5	3	17	34	50	M 8 × 1	15.5	17.5	11.5	3 × 28
					32	49	65					
16	23	M10 × 1.25	M18 × 1.5	4	20	39	57	M10 × 1.25	16.5	20	13	4 × 30
18	25	M10 × 1.25	M20 × 1.5	4	24	46	66	M12 × 1.25	18	24	15	4 × 35
20	27	M14 × 1.5	M22 × 1.5	4	28	53	75	M14 × 1.5	20	28	17	4 × 35

- Remarks-**
1. Shapes and dimensions of parts not mentioned in the above may be determined as deemed appropriate.
 2. In case of a left-hand screw, it shall be clearly indicated, at the easily recognizable place of the part.
 3. The dimensions of plug ends are listed in the attached Table 7-1.
 4. 15° in the Figure indicates the minimum adjustment angle which corresponds to 0.052 ball water when the screw pitch is 1.25.

Attached Table 7-1 Plug Ends for No. 2 Type

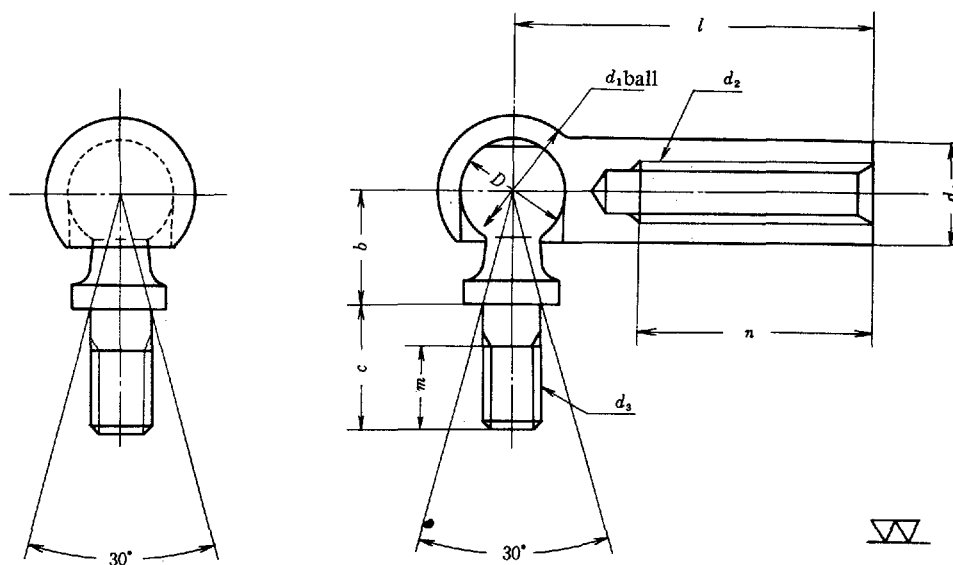


Unit: mm

D	d_4	l_2	l_3	u	t
8	M10×1.25	10	6.5	2.8	4
10	M12×1.25	12	8	3.5	4
12	M14×1.5	14	9	3.5	4
14	M16×1.5	16	10	3.5	4
16	M18×1.5	18	11.5	4.5	5
18	M20×1.5	20	12.5	4.5	5
20	M22×1.5	22	13.5	4.5	5

- Remarks-**
1. Shapes and dimensions of parts not mentioned in the above may be determined as deemed appropriate.
 2. The dimensions of grooves are pursuant to JIS B 1170.

Attached Table 8 No. 3 Type (Ball-type Sockets and Ball Studs)



Unit: mm

D	d_1	d_2	d_4	n	l	d_3	b	c	m
8	12	M 5 × 0.8	8	10	21	M 5 × 0.8	11	12	8
				25	36				
10	14.5	M 6	10	12	25	M 6	12	13	9
				27	40				
12	17.5	M 8 × 1	12	14	29	M 8 × 1	14.5	15	10
				29	44				
14	20.5	M 8 × 1	14	17	34	M 8 × 1	15.5	17.5	11.5
				32	49				

- Remarks-**
1. Shapes and dimensions of parts not mentioned in the above may be determined as deemed appropriate.
 2. In case of a left-hand screw, it shall be clearly indicated, at the easily recognizable place of the part.