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May 2022

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BUREAU OF INDIAN STANDARDS

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भारतीय मानक **मसौदा**

खदानों में वाईडिंग – चरखी – ढलाई — विशिष्टि

(आई एस 9239 का *दूसरा पुनरीक्षण*)

Draft *Indian Standard*

WINDING IN MINES – SHEAVES – CAST — SPECIFICATION

(*Second Revision* of IS 9239)

ICS 73.100.99

Mining Techniques And Equipment Sectional Committee, MED 08	**Last date for receipt of comments is 26 July 2022**

FOREWORD

(Formal clause to be added later)

This standard was first published in 1979 and consequently revised in 1999. This standard is being revised again to keep pace with the latest technological developments and international practices. In this revision, the following major changes have been made:

1. A reference clause has been added mentioning the latest version of all the referred standards.
2. An alternative method for fixation of spoke in tread has been included
3. Editorial corrections have been done.

The sheaves conforming to the requirements of this standard are suitable for use in new installations. The sheaves conforming to this standard may also be used for replacement of the

sheaves in the existing installations However, in case of any difficulty, sheaves with the existing dimensions may be continued to be used.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)' The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1 SCOPE

This standard covers the requirements for cast sheaves and bearing blocks for winding in mines using locked coil ropes of different sizes.

2 REFERENCES

The standards listed in Annex A contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed in Annex A.

3 TERMINOLOGIES

3.1 Static Rope Tension (Safe Working Load)

The maximum static rope tension to which the head gear sheaves and the bearing blocks can be loaded. It includes the weight of the rope also.

3.2 Factor of Safety

The ratio of the nominal breaking load of the rope to the static rope tension shall be higher than 10.

4 TYPES

Type A—Sheaves cast in one piece (Sheave diameter from 1350 to 2800 mm),

Type B—Sheaves cast in two halves and bolted together at hub and also at rim.

5 DIMENSIONS

5.1 Sheaves

Dimensions of sheaves shall be as specified in Table 1 for sheaves of Type A and Tables 2 to 8 for sheaves of Type B

5.1.1 ***Sheave Tread***

Dimensions of sheave tread shall be as specified in Table 5.

5.1.1.1 The radius *R* (*see* Table 5) at the bottom of groove of sheave tread shall be as specified in Table 5. The surface roughness of the tread shall be N8.

5.1.1.2 The spokes of the sheaves shall be fixed in tread as indicated in Table 5.

5.1.1.3 Length of spoke embedded in the hub shall be two times the diameter of the spoke The portion to be embedded shall be machined to form grooves and collars to provide better grip in a similar way as shown in tread portion.

6 MATERIAL

Material used in the manufacture of the components of the sheaves shall be as specified below

Components	*Material*
Rim	Grade 25 of IS 210 or equivalent
Hub	Grade 25 of IS 210 or equivalent
Axle (shaft)	Class 5 of IS 1875 or C55Mn75 of IS 1570 (Part 2/Sec 1)
Key	C40 or C55 of IS 2048
Spokes Sheet	conforming to IS 2062
Bearings box	Grade 25 of IS 210 or Grease
(Plummer block)	Lubricated plumber block housing for spherical roller bearing
Bearings	Bronze, gun-metal, cast iron lined with white metal or babbit metal

7 GENERAL REQUIREMENTS

7.1 All castings shall be tested ultrasonically/radio-graphically to ensure that it is free from blow holes, porosity, hard sport, cold sheets, intrusions and other harmful defects.

7.2 Axles shall be carefully forged and machined to specified tolerances in order to avoid any possible notch effect. When subjected to non-destructive testing like magnetic particle inspection method using current flow technique, etc, or equivalent, the axle shall not show any sign of internal/external/cracks/flaws/defects.

7.3 For journal bearings, bearings lined with babbit metal shall be channeled for distribution of lubricants.

7.4 Hoops (shrink rings) shall be provided ready for shrinking on hub.

7.5 Spokes shall have sound connection with rim and hub.

7.6 Arrangements shall be made on plumber blocks for drainage of lubricant and for fixing oil level indicator specially for journal bearing However, all necessary arrangements for lubrication of spherical roller bearings shall be provided if selected.

7.7 Two inspection holes of 6 mm dia. and plugged with copper rivets shall be provided for measuring the thickness of material in tread. These holes shall be situated between the spokes and shall be diametrically opposite to each other.

7.8 All bolts and nuts used for fastening shall conform to Grade A of IS 1364 (Part 1) having precision class 12.9. Studs shall conform to IS 1862.

8 DESIGNATIONS

A cast sheave used for winding in mines shall be designated by its diameter, static rope tension, diameter of the rope for which the sheave is to be used and the number of this standard.

Example

A sheave of 2 800 mm diameter, static rope tension of 1115 KN and employed for rope of 21 mm diameter shall be designated as Sheave 2 800 × 111 5 × 21 IS 9239.

9 MARKING

Headgear sheave shall be marked with the following:

a) Manufacturer's name or identification mark,
b) Diameter of sheave,
c) Static rope tension for which sheave is designed,
d) Diameter of rope, and
e) Year of manufacture.

9.1 BIS Certification Marking

The appliance may also be marked with the Standard Mark.

9.1.2 The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the standard mark.

10 TESTS AND CERTIFICATE OF TEST

The results of the test conducted in accordance with **10.1, 10.2** and **10.3** shall be endorsed on a certificate of test (*see* Annex B). A copy of this test certificate shall be provided with every consignment of the headgear sheaves.

10.1 The axles of the sheaves when subjected to non-destructive testing shall not show any sign of cracks or flaws.

10.2 Static Balancing Test

The static balancing test of the sheave shall be conducted at the manufacturer's works to the accuracy as agreed between the purchaser and the manufacturer.

10.3 Proof Load Test

The sheave assembly shall be subjected to a proof load test at the manufacturer's works. The test shall consist of applying a load of three times the static rope tension at three places 120° apart in a manner as specified in **10.3.1** to check the sheave for any deformation after the removal of proof load. The sheave shall not show any deformation or any abnormality after the removal of proof load.

10.3.1 The rope suitable for sheave to be tested is anchored at both ends with white metal cones. The white metal cone is housed within the grip and is connected with the threaded shaft and fixed nut For the purpose of rope length adjustment and application of initial tension for the same. Other white metal cone is housed within the grip which is connected with the loading plates and is subjected to tensile load by operating the double acting hydraulic jack The end of hydraulic jack is fixed with anchor block and the ram end is connected with loading plates The hydraulic jack is operated by the power pack fitted with the load indicator and connecting hose A typical mg for proof load testing of sheaves is shown in Fig 1**.**

11 INFORMATIONS TO BE SUPPLIED BY THE PURCHASER

While ordering, the purchaser shall supply the following information to the manufacturer:

a) Type, diameter and material of construction of sheave required, and
b) Wire rope data, that is, type, tensile designation, lay and diameter in accordance with IS 1855 of rope to be used at the mine.

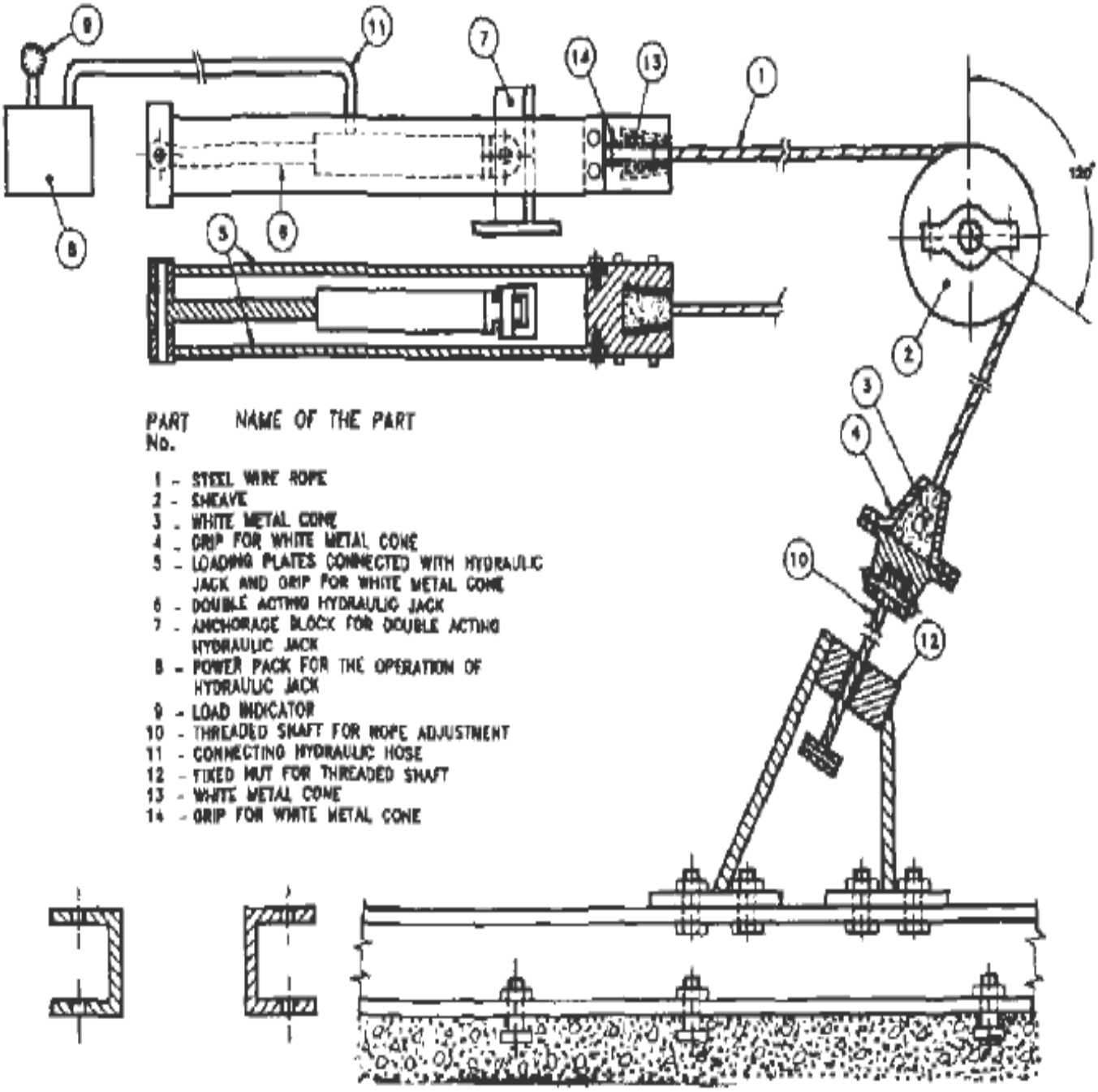
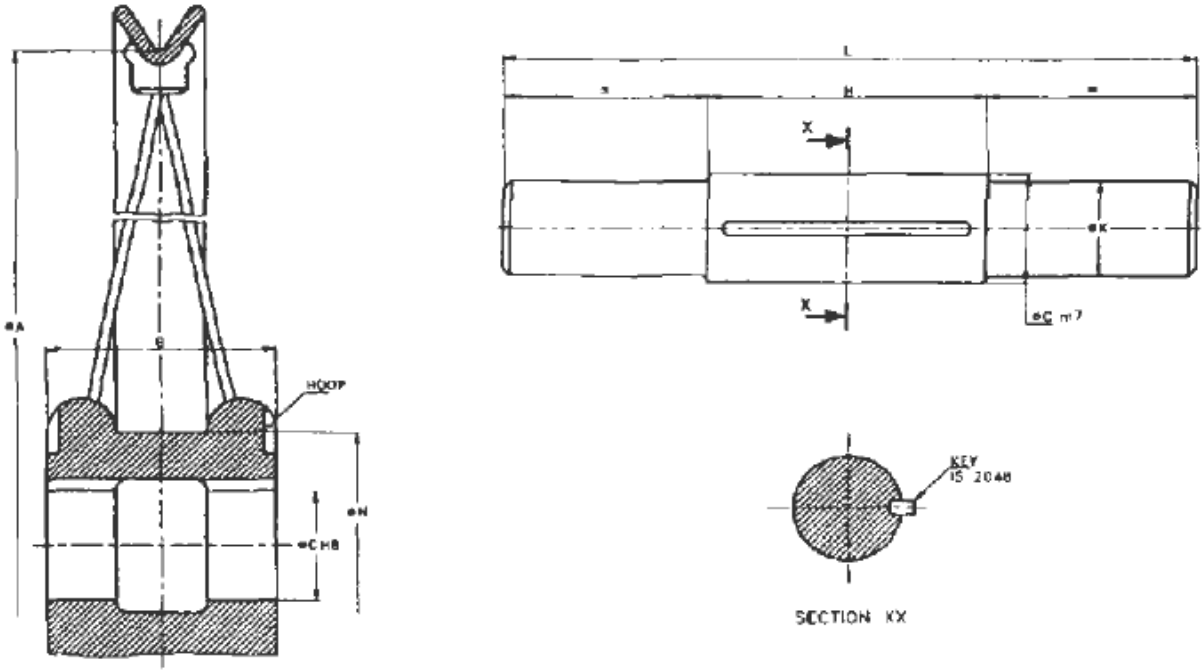


FIG 1 TYPICAL RIG FOR PROOF LOAD TESTING OF SHEAVES

Table 1 Dimensions for Head Gear Sheaves — Type A

(*Clause* 5.1)

All dimensions in millimeters.



Sl No.	Diameter of Sheave A	Static Rope Tension KN		B	C	H	L (S>	K-	N	Diameter of Spoke	Number of Sopkes	Suitable for Steel Wire Rope of Size Max	Key Size[2)]
1	1 350	130	1 325	265	100	320	740	85	320	16	12	14	A 25×14
2	1 800	275	28	265	130	320	800	115	280	20	16	18	A 28×16
3	2 100	375	382	280	150	330	830	320	310	22	20	21	A 28×16
4	2 600	645	657	320	180	370	890	150	350	25	24	27	A 32×18
5	2 800	11 115	1 136	320	190	370	900	160	360	28	24	28	A 32×18

NOTE— Although the table indicates the maximum size of rope which can be used with the corresponding sheave the ropes contorting to IS 1855 of same size or of size smaller than that specified in col-13 are also permitted to be used with the sheave provided that their safe working load does not exceed the static rope tension specified in col-3 for the concerned sheave.

1) According to IS 1855
2) According to IS 2048

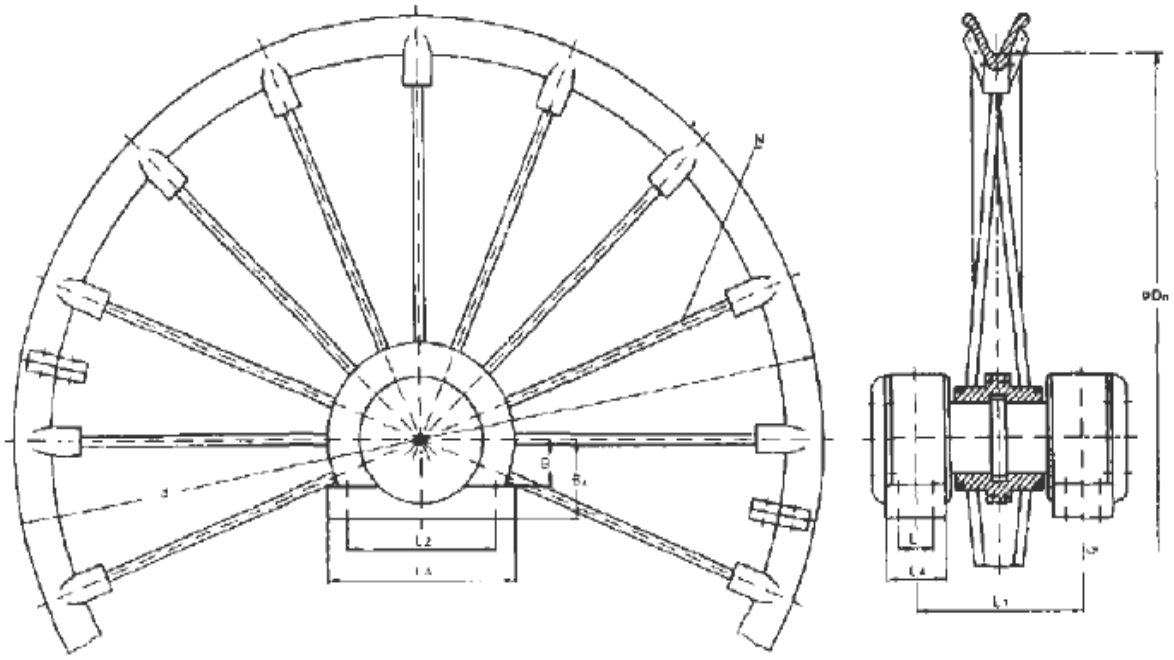
Table 2 In the present vision Dimensions for Head Gear Sheaves — Type B

(*Clause* 5.1)

No. of spokes has been changed as follows:

Further alternative method of fixation of spoke in Tread has been included.

All dimensions in millimeters.



Sl No.	Sheave Diameter	Suitable for Slevl Wire Row or Size [A]	Maximum Rope Tension (fcgf) x 1«[3]	*Dn*	D_n	L^{31}	L_1^{31}	L_2^{31}	L_3^{31}	L_4^{31}	B_1^{31}	B_2^{31}	N	Key Size
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1	3 000	≤ 30	78	3220	3000	140	670	655	770	250	125	310	28	50 × 28
2	3 200	≤ 32	88	3430	3200	140	680	730	860	260	125	110	28	50 × 28
3	3 400	≤ 33	94	3640	3400	145	690	750	880	270	130	320	32	56 × 32
4	3 600	≤ 35	106	3860	3600	148	700	750	880	280	130	320	32	56 × 32
5	3 800	≤ 38	125	4070	3800	165	745	800	940	295	140	350	36	56 × 32
6	4 000	≤ 40	139	4280	4000	165	790	800	940	310	140	350	36	56 × 32

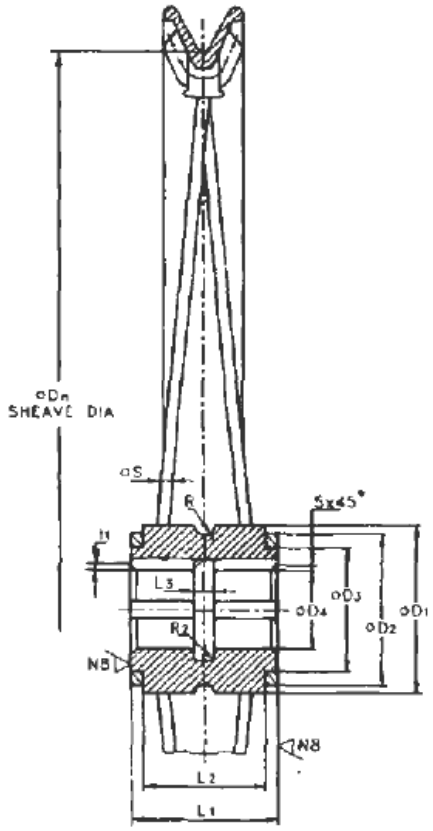
7	4 200	≤ 42	153	4500	4200	170	830	900	1 060	330	155	380	40	63 × 32
8	4 400	≤ 44	168	4710	4400	195	865	940	1 110	345	165	410	40	70 × 36
9	4 600	≤46	184	4920	4600	195	880	940	1 110	360	165	410	44	70 × 36
10	4 800	<48	200	5140	4800	195	930	940	1 110	380	165	380	44	70 × 36

[11] According to IS 3626
[2] According to IS 2048
[3] Values are for journal bearing If spherical roller bearing is used suitable values should be adopted.

Table 3 Dimensions of Head Gear Sheaves — Hub and Rim — Type B

(*Clause* 5.1)

All dimensions in millimeters.



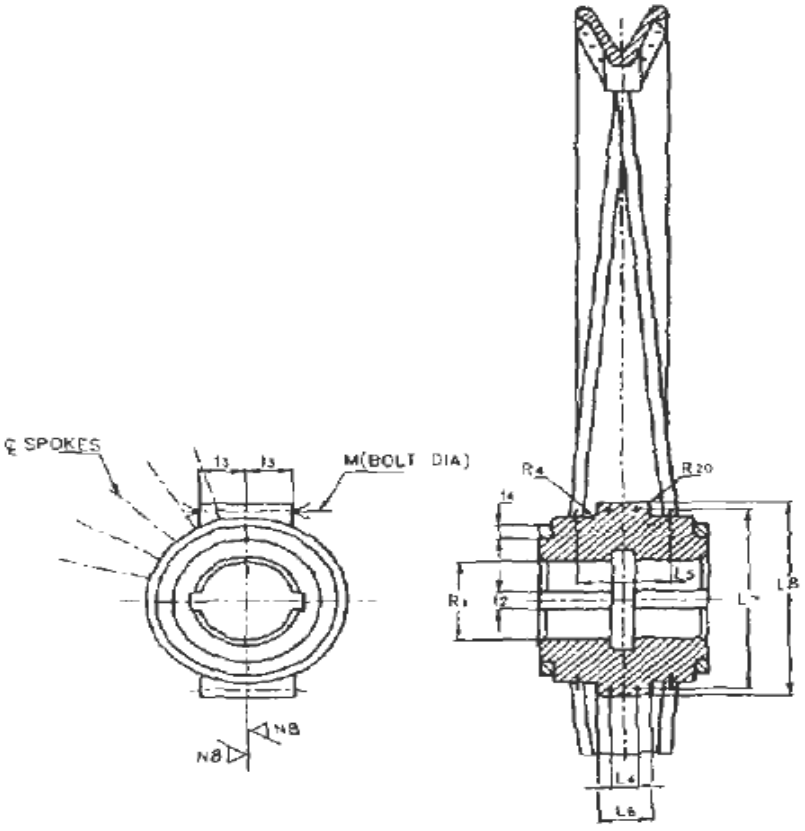
Sl. No.	D_n ±20	D_1	D_2	D_3 H7/B6	D_4 HB	S	L_1 0 -01	L_2	L_3	R	li
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	3 000	425	405	325	205	30	380	310	50	35	114

2	3 200	440	425	345	215	32	380	310	50	35	114
3	3 400	475	455	375	235	38	330	310	50	35	134
4	3 600	500	480	400	235	38	380	310	55	35	134
5	3 800	550	530	450	255	40	410	340	60	35	134
6	4 000	600	580	500	255	40	440	370	60	40	134
7	4 200	650	630	550	275	42	460	390	65	40	124
8	4 400	700	680	600	295	45	480	410	70	40	144
9	4 600	750	730	650	295	47	490	420	70	40	144
10	4 800	800	780	700	315	50	510	440	75	40	144
NOTE — Machining of the key-way should conform to IS 2048.											

Table 4 Dimensions of Head Gear Sheaves — Hub and Rim — Type B

(*Clause* 5.1)

All dimensions in millimeters.



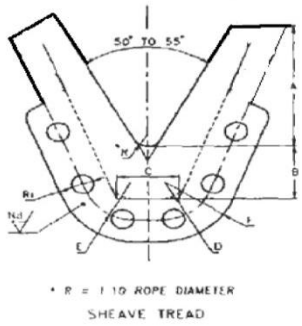
Sl No.	Sheave Diameter D_n	L_4	L_5	L_6	L_7	L_8	t_2	t_3	t_4	R	M
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	3 000	70	212	115	155	478	50	100	40	260	M 24
2	3 200	70	212	115	470	499	50	100	40	270	M 24

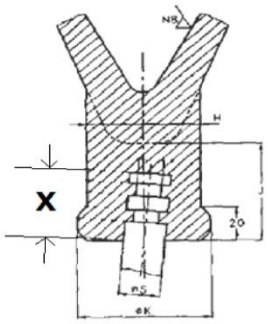
3	3 400	75	220	130	510	537	56	120	40	280	M 27
4	3 600	75	220	130	535	562	56	130	40	280	M 27
5	3 800	86	242	145	590	620	56	140	40	280	M 30
6	4 000	86	257	145	640	670	56	150	40	280	M 30
7	4 200	86	279	168	695	640	63	160	40	325	M 36
8	4 400	86	289	168	745	780	70	170	40	345	M 36
9	4 600	86	294	168	795	830	70	180	40	345	M 36
10	4 800	86	304	168	845	880	70	190	40	380	M36
NOTE — Machining of the key-way should confirm to IS 2048											

Table 5 Dimensions of Head Bar Sheaves — Rim and Spoke — Type B

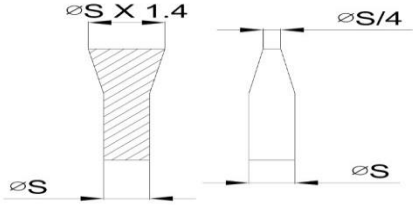
(*Clause* 5.1)

All dimensions in millimeters.





FIXATION OF FORGED SPOKE

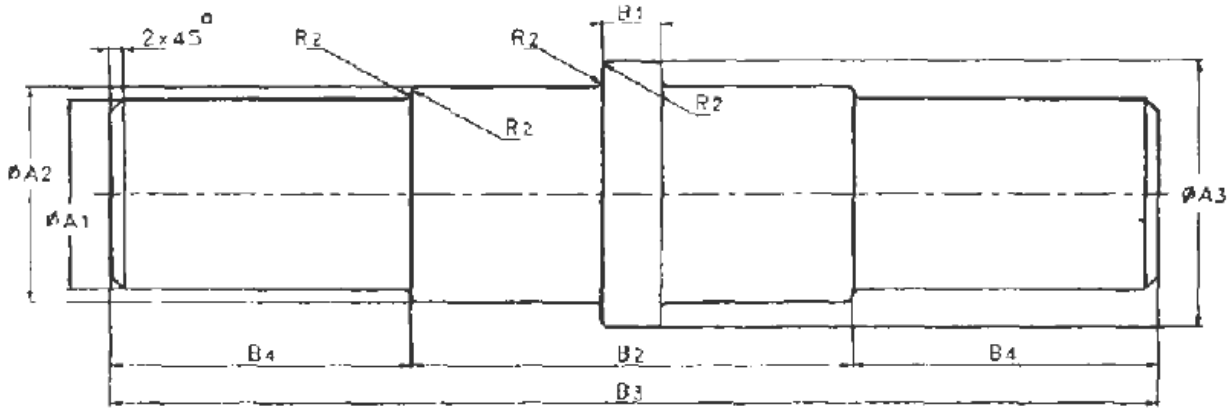


Sl No. (1)	Sheve Dia. mm (2)	*A* (3)	*B* (4)	*C* (5)	*E* (6)	*F* (7)	*G* (8)	*H* (9)	*J* (10)	Bolt Size for R_1 (11)	Web Thickness (12)	K (13)	D (14)	X
1	3 000	110	45	45	35	70	20	80	80	M 16	50	100	20	75
2	3 200	115	50	50	40	80	20	85	85	M 18	50	105	20	80
3	3 400	120	50	50	40	80	20	90	90	M 18	50	110	20	85
4	3 600	130	55	55	45	90	20	100	100	M 20	60	120	20	95
5	3 800	135	60	60	50	100	25	105	105	M 20	60	125	25	100
6	4 000	140	60	60	50	100	25	110	110	M 22	60	130	25	105
7	4 200	150	65	65	55	110	25	110	110	M 24	70	130	25	105
8	4 400	155	70	70	60	120	25	115	115	M 24	70	135	30	110
9	4 600	160	80	80	70	140	25	120	120	M 24	75	140	30	115
10	4 800	170	85	85	75	150	25	130	130	M 24	75	150	30	125

Table 6 Dimensions of Head Gear Sheaves — Axle (with Journal Bearing) —Type B

(*Clause* 5.1)

All dimensions in millimeters.

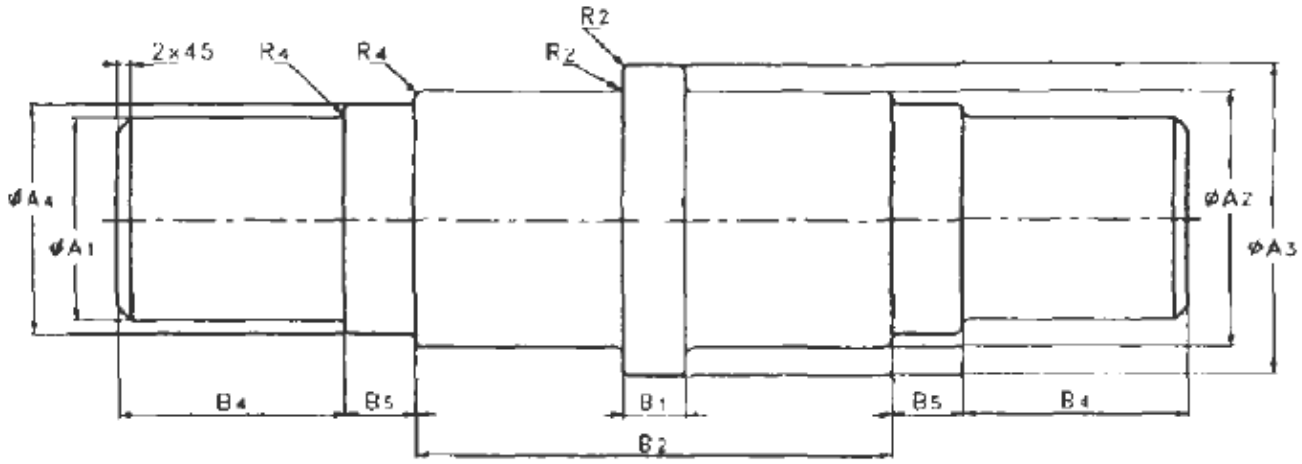


Sl No. (1)	Sheave Diameter (2)	A_1fg (3)	A_2 (4)	A_3 (5)	$\boldsymbol{B^{+01}_{1-05}}$ (6)	B_2 (7)	B_4 (8)	B_3 (9)
1	3000	180	205	255	50	400	270	940
2	3200	100	215	265	50	400	280	960
3	3400	200	235	275	50	400	290	980
4	3600	200	235	275	55	400	300	1000
5	3800	220	255	275	60	430	315	1060
6	4000	220	255	375	60	460	330	1120
7	4200	240	275	325	S5	480	350	1180
8	4400	260	295	340	70	500	365	1230
9	4600	260	295	340	70	510	380	1270
10	4800	280	315	375	75	510	400	1330
NOTE — Suitable key-way as shown in Tables 2 to 4 should be provided in the axle.								

Table 7 Dimensions of Head Bar Sheaves — Aide (with Spherical Roller Bearing) — Type B

(Clause 5.1)

All dimensions in millimeters



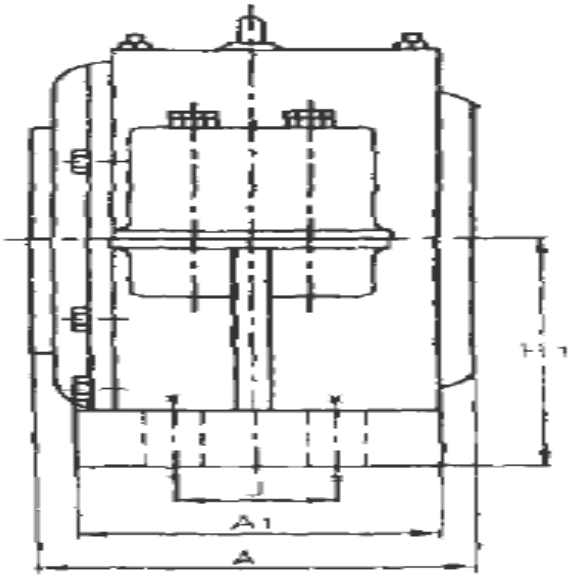
Sl No.	Sheave Diameter	*A1* h5	A_4	B_3	B_4	Housing No.	Housing No.	A_4	B_5	B_4	Bearing No.	Housing No.
		WITH WITHDRAWAL SLEEVE						WITH ADAPTER SLEEVE				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1	30 000	180	192	56	186	22 338	2 338	202	62	201	22 140	2 344
2	3 200	190	202	62	198	22 340	2 340					
3	3 400	200	222	62	208	22 344	2 344	222	62	210	22 344	2 344
4	3 600	200	222	62	208	22 344	2 344	222	62	210	22 344	2 344
5	3 800	220	242	68	220	22 348	2 348	212	68	227	22 348	2 348
6	4 000	220	242	68	220	22 348	2 348	242	68	227	22 348	2 348
7	4 200	240	262	72	238	22 352	2 352	262	72	240	22 352	2 352
8	4 400	260	282	80	245	22 356	2 356	282	80	254	22 356	2 356
9	4 600	260	282	80	245	22 356	2 356	282	80	254	22 356	2 356
10	4 800	280	302	84	254	22 360	2 360	302	84	263	22 380	2 360

NOTE — Suitable key-way as shown in Tables 2 to 4 should be provided in the axle values of *A2*,*A3*,*B1* and *B2* should be adopted From Table 6.

Table 8 Dimensions of Head Bar Sheaves — Journal Bearings — Type B

(*Clause* 5.1)

All dimensions in millimeters.



Sl No.	Sheave Dia	Axle Dia	For Journal Bearing			Housing Base Bolt Size	Bearing No.	Housing No.	For Spherical Roller Bearing				Housing Base Bolt Size
			A	A1	H1				A	A_1	H_1	J	
(1)	(2)	`(3)	`(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1	3 000	180	270	250	300	M 42	22 340 (22 338)	2340 (2 338)	328 (346)	250 (225)	310 (280)	140 (130)	M 42 (M 36)
2	3 200	199	280	260	300	M 42	(22 340)	(2 340)	(378) 330	(250) 250	(310) 320	(140) 145	(M 42) M 42
3	3 400	200	290	270	310	M 42	22 344	2 344	(380) 330	(250) 250	(320) 320	(145) 145	(M 42) M 42
4	3 600	200	300	280	310	M 42	22 344	2 344	(380) 360	(250) 280	(320) 350	(145) 165	(M 42) M 42
5	3 800	220	315	295	340	M 42	22 348	2 348	(425) 360	(280) 280	(350) 310	(165) 165	(M 42) M 42
6	4 000	220	330	310	340	M 42	22 348	2 348	(425) 384	(280) 305	(350) 380	(165) 170	(M 42) M 48
7	4 200	240	350	330	350	M 48	22 352	2 352	(454) 420	(305) 340	(380) 410	(170) 195	(M 48) M 48
8	4 400	260	365	345	380	M 48	22 356	2 356	(485) 420	(340) 340	(410) 410	(195) 195	(M 48) M 48
9	4 600	260	380	360	380	M 48	22 356	2 356	(485) 384	(340) 305	(410) 380	(195) 170	(M 48) M 48
10	4 800	280	400	380	400	M 48	23 260	3 260	(454)	(305)	(380)	(170)	(M 48)
NOTE — Figures shown in bracket indicate values with adapter sleeve.													

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	***Title***
210 : 2009	Grey iron castings (*fifth revision)*
1364 (Part 1) : 2002	Hexagon head bulls, screws and nuts of products Grades A and B Part 1 Hexagon head bolts (size range M 16 to M 64) *(fourth revision)*
1570 (Part 2/ Sec 1) : 1979	Schedules for wrought steels Part 2Carbon steels (unalloyed steels), Section 1 Wrought products other than wire with specific chemical composition and related properties *(first revision)*
1855 : 2003	Standard steel wire ropes for winding and man-riding haulages in mines *(second revision)*
1862 : 1975	Studs *(second revision)*
1875 : 1992	Carbon steel billets, blooms, slabs and bars for forgings *(fifth revision)*
2048 : 1983	Parallel keys and keyways *(second revision)*
3626 : 2001	Locked coal winding ropes *(second revision)*
IS 2062 : 2011	Hot rolled medium and high tensile structural steel - Specification (*seventh revision*)

ANNEX B

(*Clause* 10)

CERTIFICATE OF TKST AND EXAMINATION

We hereby certify that the head gear sheaves supplied here under conform in all respects to IS : 9239 - 1998 The following are their detailed particulars.

a) General Details
   i. SI No of sheaves
   ii. Sheave(s) designation
   iii. Manufacturer's identification mark
   iv. Sheave(s) diameter, mm
   v. Safe working load, kN
   vi. Remarks

b) Particulars of Material Employed
   i. Rim to IS
   ii. Spokes to IS
   iii. Hub to IS
   iv. Axle to IS
   v. Bearing to TS

c) Results of Tests
   i. Crack detection test
   ii. Static balancing test
   iii. Proof load lest

d) And other particulars/specification