

BUREAU OF INDIAN STANDARDS

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भारतीय मानक मसौदा

**तेल कुओं और तेल कुओं के वेधन में
प्रयुक्त तार रस्सियाँ — विशिष्टि**

(आई एस 4521 का तीसरा पुनरीक्षण)

Draft Indian Standard

**WIRE ROPES USED IN OIL WELLS AND OIL WELL
DRILLING — SPECIFICATION**

(Third Revision of IS 4521)

ICS 75.180.10; 77.140.65

Wire Ropes and Wire Products
Sectional Committee, MED 10

Last date for receipt of
comments is **21 June 2024**

FOREWORD

(Formal clauses to be added later)

This standard was first issued in 1968 and revised in 1977 and 2001. The standard is being revised again for incorporating the modifications found necessary as a result of experience gained with the use of this standard. Also the major changes in the standard in this revision are given below:

- a) The scope of the standard has been modified;
- b) Minimum breaking force of the wires have been modified;
- c) Size, Construction, Core, and Grades for wire ropes have been modified;
- d) New rope grade of 2160 has been added with the revision of the standards; and
- e) Table 9 has also been modified with the revision of the standard.

The requirements for galvanized wire strands and well measuring wire, though they do not come under the definitions of wire ropes are also covered.

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 shall be rounded-off in accordance with IS 2: 2022 'Rules for rounding off numerical values (*second revision*)'. The number of

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significant places retained in the rounded-off value should be the same as that of the specified value in this standard

Draft Indian Standard

**WIRE ROPES USED IN OIL WELLS AND OIL WELL
DRILLING — SPECIFICATION**

(*Second Revision*)

1 SCOPE

The wire ropes covered in this standard are suitable for the following oil field uses:

- a) Rod and tubing pull lines;
- b) Rod hanger lines;
- c) Sand lines;
- d) Cable-tool drilling, cleanout and cleaning lines;
- e) Rotary drilling lines;
- f) Winch lines;
- g) Horsehead pumping unit lines;
- h) Torpedo lines;
- j) Mooring and Anchor lines;
- k) Cable Tool Casing lines;
- m) Mast Raising lines;
- n) Guideline tensioner lines; and
- p) Riser Tensioner Lines.

2 REFERENCES

The standards listed below 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 edition of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
IS 280 : 2006	Mild steel wire for general engineering purpose (<i>fourth revision</i>)
IS 2363 : 2022	Glossary of terms relating to wire ropes (<i>second revision</i>)
IS 6594 : 2018	Technical supply conditions for steel wire ropes and strands (<i>third revision</i>)

3 TERMINOLOGY

For the purpose of this standard, in addition to the following the definitions given in IS 2363 shall apply.

3.1 Rod — A bar, the end of which is slotted, tapered or screwed for the attachment of drill bit.

3.2 Rotary Drilling — A method of drilling in which rotation and thrust are applied to the bit, producing a continuous cutting action.

3.3 Torpedo Line — A small diameter galvanized wire rope used to lower the explosive down the hole when digging a well.

3.4 Tubing Line — A wire rope used for running in or pulling oil well rod and tubing.

4 SIZE, CONSTRUCTION, CORE, AND GRADES

4.1 Most common rope constructions and rope types are given in table no. 1 to 13. Common rope grades, cores and size ranges are given in these tables, however other sizes, intermediate grades (up to including 2160 grade) and core may be supplied as agreed between manufacturer and purchaser. Specific size range against individual construction may be as decided by manufacturer.

4.2 Specially developed constructions and other special type of ropes including rotation resistant ropes, compacted ropes and cushion core rope may also be supplied to fulfil specific requirement of purchaser as agreed between manufacture and purchaser. Technical details of these ropes shall be as stated by manufacturer.

5 MINIMUM BREAKING FORCE

Minimum breaking force for most common sizes and grades are given in Tables 1 to 13, higher minimum breaking force may be supplied if agreed between manufacturer and supplier. Minimum Breaking Force for the sizes and grades not covered in these tables may be calculated by formula specified in **6.6** of IS 6594.

Minimum breaking force for specially developed constructions and other special type of ropes including rotation resistant ropes, compacted ropes, cushion core ropes etc. shall be as agreed between manufacturer and purchaser.

Table 1 Size, Breaking Force and Mass for 6 × 7 (6-1) Construction
(Clause 4, 5 and 6.4)

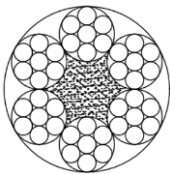
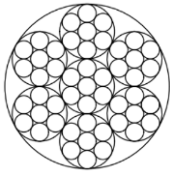
Typical Cross Section		Typical Construction	
		Rope Construction	Strand Construction
		WITH FIBRE CORE (CF)	WITH STEEL CORE (CWS)

Table 1A

Nominal Diameter	Approximate Mass		Minimum Braking Force Corresponding to Rope Grade of					
			1570		1770		1960	
	Fibre Core	Steel Core	Fibre Core	Steel Core	Fibre Core	Steel Core	Fibre Core	Steel Core
	(CF)	(CWR)	(CF)	(CWR)	(CF)	(CWR)	(CF)	(CWR)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
mm	kg/100 m	kg/100 m	kN	kN	kN	kN	kN	kN
6	12.9	14.2	18	20	21	23	23	25
8	22.9	25.2	32	36	37	41	40	45
9	28.9	31.8	41	46	46	51	51	57
10	35.7	39.3	51	56	57	64	63	70
11	43.2	47.6	61	68	69	77	76	85
12	51.5	56.6	73	81	82	92	91	101
13	60.4	66.4	86	95	96	107	107	119
14	70.1	77.0	99	110	112	125	124	138
16	92	101	130	144	146	163	162	180
18	116	127	164	183	185	206	205	228
19	129	142	183	203	206	229	228	254
20	143	157	202	225	228	254	253	281
22	173	190	245	273	276	307	306	340
24	206	226	291	325	329	366	364	405
26	242	266	342	381	386	429	427	475
28	280	308	397	442	447	498	495	551
30	322	354	455	507	513	572	568	633
32	366	403	518	577	584	650	647	720
34	413	454	585	651	659	734	730	813
35	438	482	620	690	699	778	774	862
36	463	510	656	730	739	823	818	911
38	516	568	731	813	824	917	912	1 016
40	572	629	809	901	913	1 016	1 010	1 125

NOTE — To calculate the aggregate breaking force multiply the figures given in 4, 6 and 8 by 1.111 and in 5, 7 and 9 by 1.193. Wire strand core (CWS) may be used for rope diameter 12 mm and below

Table 1B

Nominal Diameter		Approximate Mass		Minimum Braking Force Corresponding to Rope Grade of			
				IPS		EIP	
		Fibre Core	Steel Core	Fibre Core	Steel Core	Fibre Core	Steel Core
		(CF)	(CWR)	(CF)	(CWR)	(CF)	(CWR)
(1)		(2)	(3)	(4)	(5)	(6)	(7)
mm	In.	kg/100 m	kg/100 m	kN	kN	kN	kN
6.35	1/4"	14.4	15.9	23.5	25.3	25.8	27.8
7.94	5/16"	22.5	24.8	36.5	39.2	40.1	43.1
9.5	3/8"	32.3	35.5	52.1	56	57.4	61.6
11.1	7/16"	44.0	48.4	70.5	75.8	77.6	83.4
12.7	1/2"	57.6	63.4	91.6	98.7	101	109
14.3	9/16"	73.1	80.4	116	125	127	137
15.9	5/8"	90.4	99.4	141	152	154	167
19.1	3/4"	130	143	202	217	222	238
22.2	7/8"	176	194	273	294	301	323
25.4	1"	231	254	353	380	389	418
28.6	1.1/8"	292	322	443	476	488	524
31.8	1.1/4"	361	398	543	584	597	642

38.1	1.1/2"	519	571	767	825	843	907
NOTE — To calculate the aggregate breaking force multiply the figures given in 4, 6 and 8 by 1.111 and in 5, 7 and 9 by 1.193. Wire strand core (CWS) may be used for rope diameter 12 mm and below							

Table 2 Size, Breaking Force and Mass for 6 × 19 Class Seale constructions and Warrington Constructions
(Clause 4, 5 and 6.4)

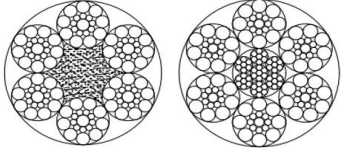
Typical Cross Section  WITH FIBRE CORE (CF) WITH STEEL CORE (CWR)	Typical Construction	
	Rope Construction	Strand Construction
	6 × 17S	8-8-1
	6 × 19S	9-9-1
	6 × 19W	6+6-6-1
	6 × 25S	9-9/6-1

Table 2A

Nominal Rope Diameter	Approximate Mass		Minimum Breaking Force corresponding to Rope Grade							
			1570		1770		1960		2160	
	Fibre Core (CF)	Steel Core (CWR)	Fibre Core (CF)	Steel Core (CWR)	Fibre Core (CF)	Steel Cover (CWR)	Fibre Core (CF)	Steel Core (CWR)	Fibre Core (CF)	Steel Core (CWR)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
mm	kg/100 m	kN	kN	kN	kN	kN	kN	kN	kN	kN
13	63.0	69.3	87.8	94.8	99.0	107	110	118	121	130
14	73.0	80.3	102	110	115	124	127	137	140	151
16	95.4	105	133	144	150	162	166	179	183	198
18	121	133	168	182	190	205	210	227	232	250
19	135	148	188	203	211	228	234	253	258	279
20	149	164	208	224	234	253	260	280	286	309
22	180	198	252	272	284	306	314	339	346	374
24	215	236	299	323	337	364	374	403	412	445
26	252	277	351	379	396	428	439	474	483	522
28	292	321	407	440	459	496	509	549	561	605
29	313	345	437	472	493	532	546	589	601	649
32	382	420	532	575	600	648	664	717	732	791
35	456	502	637	687	718	775	795	858	876	946
36	483	531	673	727	759	820	841	908	927	1 000
38	538	592	750	810	846	913	937	1 012	1 032	1 115
40	596	656	831	898	937	1 012	1 038	1 121	1 144	1 235
42	657	723	917	990	1 033	1 116	1 144	1 236	1 261	1 362
44	721	794	1 006	1 086	1 134	1 225	1 256	1 356	1 384	1 495
45	755	830	1 052	1 136	1 186	1 281	1 314	1 419	1 448	1 563
46	788	867	1 100	1 187	1 240	1 339	1 373	1 482	1 513	1 634
48	858	944	1 197	1 293	1 350	1 458	1 495	1 614	1 647	1 779
49	895	984	1 248	1 347	1 407	1 519	1 558	1 682	1 717	1 854
50	932	1 025	1 299	1 403	1 465	1 581	1 622	1 751	1 787	1 930
51	969	1 066	1 352	1 459	1 524	1 645	1 687	1 822	1 860	2 008
52	1 008	1 108	1 405	1 517	1 584	1 711	1 754	1 894	1 933	2 087

53	1 047	1 151	1 460	1 576	1 646	1 777	1 822	1 968	2 008	2 169
54	1 087	1 195	1 515	1 636	1 708	1 845	1 892	2 043	2 085	2 251
55	1 127	1 240	1 572	1 697	1 772	1 914	1 962	2 119	2 163	2 335
56	1 168	1 285	1 630	1 760	1 837	1 984	2 035	2 197	2 242	2 421
58	1 253	1 379	1 748	1 888	1 971	2 128	2 182	2 356	2 405	2 597
60	1 341	1 476	1 871	2 020	2 109	2 277	2 336	2 522	2 574	2 779

NOTE — To calculate the aggregate breaking force, multiply the figures shown in columns 4, 6, 8 and 10 by 1.163 and columns 5, 7, 9 and 11 by 1.25.

Table 2B

Nominal Diameter		Approximate Mass		Minimum Braking Force Corresponding to Rope Grade of					
				IPS		EIP		EEIP	
		Fibre Core (CF)	Steel Core (CWR)	Fibre Core (CF)	Steel Core (CWR)	Fibre Core (CF)	Steel Core (CWR)	Fibre Core (CF)	Steel Core (CWR)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
mm	In.	kg/100 m	kg/100 m	kN	kN	kN	kN	kN	kN
6.35	1/4"	15.0	16.5	24.4	26.2	26.8	30.2	-	-
7.94	5/16"	23.5	25.8	37.9	40.7	41.7	46.9	-	-
9.5	3/8"	33.6	37.0	54.3	58.4	59.7	67.2	65.7	73.8
11.1	7/16"	45.9	50.5	73.6	79.1	81	90.7	89	99.6
12.7	1/2"	60.1	66.1	95.2	102	105	118	115	130
14.3	9/16"	76.2	83.8	120	129	133	149	145	165
15.9	5/8"	94.2	104	149	157	164	183	180	202
19.1	3/4"	136	150	212	228	233	262	256	288
22.2	7/8"	184	202	286	308	315	354	347	390
25.4	1"	240	264	372	399	409	460	450	506
28.6	1.1/8"	305	335	468	503	515	578	566	636
31.8	1.1/4"	377	415	575	617	633	711	696	782
34.9	1.3/8"	454	499	691	743	761	854	836	943
38.1	1.1/2"	541	595	818	880	898	1 010	987	1 110
41.3	1.5/8"	636	699	952	1 020	1 050	1 170	1 150	1 300
44.5	1.3/4"	738	812	1 100	1 180	1 210	1 360	1 330	1 500
47.6	1.7/8"	844	929	1 250	1 350	1 380	1 550	1 520	1 710
50.8	2"	962	1 058	1 420	1 530	1 570	1 760	1 730	1 930
54	2.1/8"	1 087	1 195	1 590	1 710	1 750	1 970	1 930	2 160
57.2	2.1/4"	1 219	1 341	1 780	1 910	1 960	2 200	2 150	2 420
60.3	2.3/8"	1 355	1 490	1 980	2 120	2 180	2 440	2 390	2 690

NOTE — To calculate the aggregate breaking force, multiply the figures shown in columns 4, 6, and 8 by 1.163 and columns 5, 7, and 9 by 1.25.

Table 3 Size, Breaking Force and Mass for 6 × 19 Class Filler Constructions
(Clause 4, 5 and 6.4)

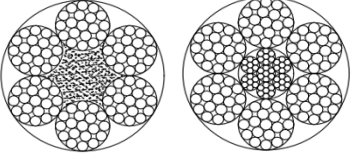
Typical Cross Section  WITH FIBRE CORE (CF) WITH STEEL CORE (CWR)	Typical Construction	
	Rope Construction	Strand Construction
	6 × 21F	10-5F-5-1
	6 × 25F	12-6F-6-1
	6 × 29F	14-7F-7-1

Table 3A

Nominal Diameter	Approximate Mass		Minimum Braking Force Corresponding to Rope Grade of							
			1570		1770		1960		2160	
	Fibre Core (CF)	Steel Core (CWR)	Fibre Core (CF)	Steel Core (CWR)	Fibre Core (CF)	Steel Core (CWR)	Fibre Core (CF)	Steel Core (CWR)	Fibre Core (CF)	Steel Core (CWR)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
mm	kg/100 m	kg/100 m	kN	kN	kN	kN	kN	kN	kN	kN
8	24.3	26.8	34	37	38	41	42	46	47	50
9	30.8	33.9	43	46	48	52	54	58	59	64
10	38	41.8	53	57	60	65	66	71	73	79
11	46	50.6	64	69	72	78	80	86	88	95
12	54.7	60.2	76	82	86	93	95	103	105	113
13	64.3	70.7	90	97	101	109	112	121	123	133
14	74.5	82	104	112	117	127	130	140	143	154
16	97.3	107	136	147	153	165	169	183	187	202
18	123	135	172	186	194	209	214	232	236	255
19	137	151	191	207	216	233	239	258	263	284
20	152	167	212	229	239	258	265	286	292	315
22	184	202	257	277	289	312	320	346	353	381
24	219	241	305	330	344	372	381	412	420	454
25	238	261	331	358	374	403	414	447	456	492
26	257	283	358	387	404	436	447	483	493	533
28	298	328	416	449	469	506	519	560	572	618
32	389	428	543	586	612	661	678	732	747	807
36	493	542	687	742	775	837	858	926	945	1 021
38	549	604	766	827	863	932	956	1 032	1 053	1 138
40	608	669	848	916	956	1 033	1 059	1 144	1 167	1 260
44	736	810	1 026	1 109	1 157	1 250	1 281	1 384	1 412	1 525
48	876	964	1 222	1 319	1 377	1 487	1 525	1 647	1 681	1 815
52	1 028	1 131	1 434	1 548	1 616	1 745	1 790	1 933	1 972	2 130
56	1 192	1 311	1 663	1 796	1 874	2 024	2 076	2 242	2 287	2 470
60	1 369	1 506	1 909	2 061	2 152	2 324	2 383	2 573	2 626	2 836

NOTE — To calculate the aggregate breaking force multiply the figures given in col. 4, 6, 8 and 10 by 1.163 and in col. 5, 7, 9 and 11 by 1.25. Wire strand core (CWS) may be used for rope diameter 12 mm and below.

Table 3B

Nominal Diameter		Approximate Mass		Minimum Braking Force Corresponding to Rope Grade of					
				IPS		EIP		EEIP	
		Fibre Core	Steel Core	Fibre Core	Steel Core	Fibre Core	Steel Core	Fibre Core	Steel Core
		(CF)	(CWR)	(CF)	(CWR)	(CF)	(CWR)	(CF)	(CWR)
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
mm	In.	kg/100 m	kg/100 m	kN	kN	kN	kN	kN	kN
6.35	1/4"	15.0	16.5	24.4	26.2	26.8	30.2	-	-
7.94	5/16"	23.5	25.8	37.9	40.7	41.7	46.9	-	-
9.5	3/8"	33.6	37.0	54.3	58.4	59.7	67.2	65.7	73.8
11.1	7/16"	45.9	50.5	73.6	79.1	81	90.7	89	99.6
12.7	1/2"	60.1	66.1	95.2	102	105	118	115	130
14.3	9/16"	76.2	83.8	120	129	133	149	145	165
15.9	5/8"	94.2	104	149	157	164	183	180	202
19.1	3/4"	136	150	212	228	233	262	256	288
22.2	7/8"	184	202	286	308	315	354	347	390
25.4	1"	240	264	372	399	409	460	450	506
28.6	1.1/8"	305	335	468	503	515	578	566	636
31.8	1.1/4"	377	415	575	617	633	711	696	782
34.9	1.3/8"	454	499	691	743	761	854	836	943
38.1	1.1/2"	541	595	818	880	898	1 010	987	1 110
41.3	1.5/8"	636	699	952	1 020	1 050	1 170	1 150	1 300
44.5	1.3/4"	738	812	1 100	1 180	1 210	1 360	1 330	1 500
47.6	1.7/8"	844	929	1 250	1 350	1 380	1 550	1 520	1 710
50.8	2"	962	1 058	1 420	1 530	1 570	1 760	1 730	1 930
54	2.1/8"	1 087	1 195	1 590	1 710	1 750	1 970	1 930	2 160
57.2	2.1/4"	1 219	1 341	1 780	1 910	1 960	2 200	2 150	2 420
60.3	2.3/8"	1 355	1 490	1 980	2 120	2 180	2 440	2 390	2 690

NOTE — To calculate the aggregate breaking force, multiply the figures shown in columns 4, 6, and 8 by 1.163 and columns 5, 7, and 9 by 1.25.

Table 4 Size, Breaking Force and Mass for 6 × 36 Class and 6 x 26 SW Construction
(Clauses 4, 5 and 6.4)

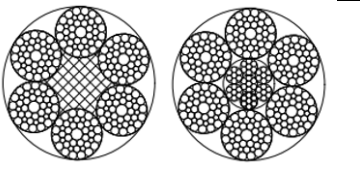
	Typical Construction	
	Rope Construction	Strand Construction
	6 x 26SW	10-5+5-5-1
	6 x 31 SW	12-6 + 6-6-1
	6 x 36 SW	14-7 + 7-7-1
	6 x 41 SW	16-8 + 8-8-1
	6 x 49 SWS	16-8 + 8-8-8-1
	6 x 46SW	18-9+9-9-1
	6 x 55 SWS	16-8 + 8-8-8/6-1
	6 x 52SW	18-9+9-9/6-1
	6 x 41SF	16-8F-8-8-1

Table 4A

Nominal Diameter	Approximate Mass		Minimum Braking Force Corresponding to Rope Grade of							
	Fibre Core (CF)	Steel Core (CWR)	1570		1770		1960		2160	
			Fibre Core (CF)	Steel Core (CWR)	Fibre Core (CF)	Steel Core (CWR)	Fibre Core (CF)	Steel Core (CWR)	Fibre Core (CF)	Steel Core (CWR)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
mm	kg/100 m	kg/100 m	kN	kN	kN	kN	kN	kN	kN	kN
8	24.3	26.8	33	36	37	40	41	45	46	49
9	30.8	33.9	42	45	47	51	52	57	58	62
10	38	41.8	52	56	58	63	65	70	71	77
11	46	50.6	63	68	71	76	78	85	86	93
12	54.7	60.2	75	81	84	91	93	101	103	111
13	64.3	70.7	88	95	99	107	109	118	120	130
14	74.5	82	102	110	114	124	127	137	140	151
16	97.3	107	133	143	149	161	166	179	182	197
18	123	135	168	181	189	204	209	226	231	249
19	137	151	187	202	211	228	233	252	257	278
20	152	167	207	224	234	252	259	279	285	308
22	184	202	251	271	283	305	313	338	345	372
24	219	241	298	322	336	363	372	402	410	443
25	238	261	324	350	365	394	404	436	445	481
26	257	283	350	378	395	426	437	472	482	520
28	298	328	406	439	458	494	507	548	559	603
32	389	428	530	573	598	646	662	715	730	788
36	493	542	671	725	757	817	838	905	924	997
38	549	604	748	808	843	911	934	1 008	1029	1 111
40	608	669	829	895	934	1 099	1 035	1 117	1 140	1 231
44	736	810	1 003	1 083	1 130	1 221	1 252	1 352	1 380	1 490
48	876	964	1 193	1 289	1 345	1 453	1 490	1 609	1 642	1 773
52	1 028	1 131	1 401	1 513	1 579	1 705	1 748	1 888	1 927	2 081
56	1 192	1 311	1 624	1 754	1 831	1 978	2 028	2 190	2 235	2 413
60	1 369	1 506	1 865	2 014	2 102	2 270	2 328	2 514	2 565	2 771

NOTE — To calculate the aggregate breaking force multiply the figures given in col. 4, 6, 8 and 10 by 1.19 and in col. 5, 7, 9 and 11 by 1.28. Wire strand core (CWS) may be used for rope diameter 12 mm and below.

Table 4B

Nominal Diameter		Approximate Mass		Minimum Braking Force Corresponding to Rope Grade of					
				IPS		EIP		EEIP	
		Fibre Core	Steel Core	Fibre Core	Steel Core	Fibre Core	Steel Core	Fibre Core	Steel Core
		(CF)	(CWR)	(CF)	(CWR)	(CF)	(CWR)	(CF)	(CWR)
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
mm	In.	kg/100 m	kg/100 m	kN	kN	kN	kN	kN	kN
6.35	1/4"	15.3	16.9	24.4	26.2	26.8	30.2	-	-
7.94	5/16"	24.0	26.4	37.9	40.7	41.7	46.9	-	-
9.5	3/8"	34.3	37.7	54.3	58.4	59.7	67.2	65.7	73.8
11.1	7/16"	46.8	51.5	73.6	79.1	81	90.7	89	99.6
12.7	1/2"	61.3	67.5	95.2	102	105	118	115	130
14.3	9/16"	77.7	85.5	120	129	133	149	145	165
15.9	5/8"	96.1	106	149	157	164	183	180	202
19.1	3/4"	139	153	212	228	233	262	256	288
22.2	7/8"	187	206	286	308	315	354	347	390
25.4	1"	245	270	372	399	409	460	450	506
28.6	1.1/8"	311	342	468	503	515	578	566	636
31.8	1.1/4"	384	423	575	617	633	711	696	782
34.9	1.3/8"	463	509	691	743	761	854	836	943
38.1	1.1/2"	552	607	818	880	898	1 010	987	1 110
41.3	1.5/8"	649	713	952	1 020	1 050	1 170	1 150	1 300
44.5	1.3/4"	753	828	1 100	1 180	1 210	1 360	1 330	1 500
47.6	1.7/8"	861	948	1 250	1 350	1 380	1 550	1 520	1 710
50.8	2"	981	1 079	1 420	1 530	1 570	1 760	1 730	1 930
54	2.1/8"	1 109	1 219	1 590	1 710	1 750	1 970	1 930	2 160
57.2	2.1/4"	1 244	1 368	1 780	1 910	1 960	2 200	2 150	2 420
60.3	2.3/8"	1 382	1 521	1 980	2 120	2 180	2 440	2 390	2 690

NOTE — To calculate the aggregate braking force, multiply the figures shown in columns 4, 6, and 8 by 1.163 and columns 5, 7, and 9 by 1.25.

Table 5 Size, Breaking Force and Mass for Filler constructions of 8 × 19 Class
(Clause 4, 5 and 6.4)

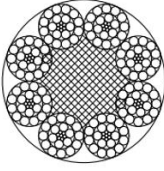
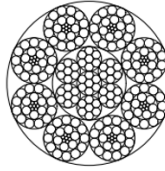
Typical Cross Section		Typical Construction	
 WITH FIBRE CORE (CF)	 WITH STEEL CORE (CWR)	Rope Construction	Strand Construction
		8 × 21F	10-5F-5-1
		8 × 25F	12-6F-6-1

Table 5A

Nominal Rope Diameter	Approximate Mass kg/100 m	Minimum Breaking Force Corresponding to Rope Grade of			
		1570	1770	1960	2160
		Steel Core (CWR)	Steel Core (CWR)	Steel Core (CWR)	Steel Core (CWR)
(1)	(2)	(3)	(4)	(5)	(6)
mm		kN	kN	kN	kN
8	27.8	35	39	43	48
9	35.2	44	50	55	61
10	43.5	54	61	68	75
11	52.6	66	74	82	91
12	62.6	78	88	98	108
13	73.5	92	104	115	126
14	85.2	107	120	133	147
16	111	139	157	174	192
18	141	176	199	220	242
19	157	196	221	245	270
20	174	218	245	272	299
22	210	263	297	329	362
24	251	313	353	391	431
25	272	340	383	424	468
26	294	368	414	459	506
28	341	426	481	532	587
32	445	557	628	695	766
36	564	705	795	880	970
38	628	785	885	980	1 080
40	696	870	981	1 086	1 197
44	842	1 053	1 187	1 314	1 449
48	1 002	1 253	1 413	1 564	1 724
52	1 176	1 471	1 658	1 836	2 023
53	1 222	1 528	1 722	1 907	2 102
54	1 268	1 586	1 788	1 980	2 182
56	1 364	1 706	1 923	2 129	2 346
58	1 463	1 830	2 063	2 284	2 517
60	1 566	1 958	2 207	2 444	2 694

NOTE — To calculate the aggregate breaking force, multiply the figures shown in columns 3, 4 and 5 by 1.33.

Table 5B

Nominal Rope Diameter		Approximate Mass kg/100 m	Minimum Breaking Force Corresponding to Rope Grade of		
			IPS	EIP	EEIP
		Steel Core (CWR)	Steel Core (CWR)	Steel Core (CWR)	Steel Core (CWR)
(1)		(2)	(3)	(4)	(5)
mm	In.		kN	kN	kN
6.35	1/4"	17.5	26.2	30.2	
7.94	5/16"	27.4	40.7	46.9	
9.5	3/8"	39.2	58.4	67.2	73.8
11.1	7/16"	53.6	79.1	90.7	99.6
12.7	1/2"	70.1	102	118	130
14.3	9/16"	88.9	129	149	165
15.9	5/8"	110	157	183	202
19.1	3/4"	159	228	262	288
22.2	7/8"	214	308	354	390
25.4	1"	281	399	460	506
28.6	1.1/8"	356	503	578	636
31.8	1.1/4"	440	617	711	782
34.9	1.3/8"	530	743	854	943
38.1	1.1/2"	631	880	1 010	1 110
41.3	1.5/8"	742	1 020	1 170	1 300
44.5	1.3/4"	861	1 180	1 360	1 500
47.6	1.7/8"	985	1 350	1 550	1 710
50.8	2"	1 122	1 530	1 760	1 930
54	2.1/8"	1 268	1 710	1 970	2 160
57.2	2.1/4"	1 423	1 910	2 200	2 420
60.3	2.3/8"	1 581	2 120	2 440	2 690

NOTE — To calculate the aggregate breaking force, multiply the figures shown in columns 3, 4 and 5 by 1.33.

Table 6 Size, Breaking Force and Mass for 8 x 36 Class and 8 x 26SW Construction
(Clauses 4, 5 and 6.4)

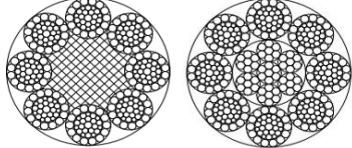
Typical Cross Section		Typical Construction	
 <p>WITH FIBRE CORE (CF) WITH STEEL CORE (CWR)</p>	Rope Construction	Strand Construction	
	8 x 26SW	10-5+5-5-1	
	8x 31 SW	12-6 + 6-6-1	
	8 x 36 SW	14-7 + 7-7-1	
	8 x 41 SW	16-8 + 8-8-1	
	8 x 49 SW	16-8 + 8-8-8-1	
	8x 55 SWS	16-8 + 8-8-8/6-1	
	8 x 46 SW	18-9+9-9-1	
	8 x 52 SW	18-9+9-9/6-1	

Table 6A

Nominal Diameter	Approximate Mass		Minimum Braking Force Corresponding to Rope Grade of							
	Fibre Core (CF)	Steel Core (CWR)	1570		1770		1960		2160	
			Fibre Core (CF)	Steel Core (CWR)	Fibre Core (CF)	Steel Core (CWR)	Fibre Core (CF)	Steel Core (CWR)	Fibre Core (CF)	Steel Core (CWR)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
mm	kg/100 m	kg/100 m	kN	kN	kN	kN	kN	kN	kN	kN
16		111		136		153		170		187
18		141		172		194		215		237
19		157		192		216		239		264
20		174		212		239		265		292
22		210		257		290		321		354
24		251		306		345		382		421
25		272		332		374		414		457
26		294		359		405		448		494
28		341		416		469		520		573
32		445		544		613		679		748
36		564		688		776		859		947
38		628		767		864		957		1 055
40		696		850		958		1 061		1 169
44		842		1 028		1 159		1 283		1 414
48		1 002		1 223		1 379		1 527		1 683
52		1 176		1 436		1 619		1 792		1 975
56		1 364		1 665		1 877		2 079		2 291
60		1 566		1 912		2 155		2 386		2 630

NOTE — To calculate the aggregate breaking force multiply the figures given in col. 4,6, 8 and 10 by 1.220 and in col. 5, 7, 9 and 11 by 1.364

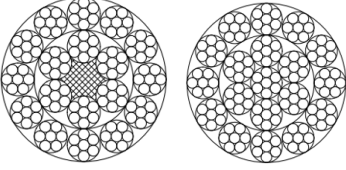
Table 6B

Nominal Rope Diameter		Approximate Mass kg/100 m	Minimum Breaking Force Corresponding to Rope Grade of		
			IPS	EIP	EEIP
		Steel Core (CWR)	Steel Core (CWR)	Steel Core (CWR)	Steel Core (CWR)
(1)		(2)	(3)	(4)	(5)
mm	In.		kN	kN	kN
6.35	1/4"	17.5	26.2	30.2	
7.94	5/16"	27.4	40.7	46.9	
9.5	3/8"	39.2	58.4	67.2	73.8
11.1	7/16"	53.6	79.1	90.7	99.6
12.7	1/2"	70.1	102	118	130
14.3	9/16"	88.9	129	149	165
15.9	5/8"	110	157	183	202
19.1	3/4"	159	228	262	288
22.2	7/8"	214	308	354	390
25.4	1"	281	399	460	506
28.6	1.1/8"	356	503	578	636
31.8	1.1/4"	440	617	711	782
34.9	1.3/8"	530	743	854	943
38.1	1.1/2"	631	880	1 010	1 110
41.3	1.5/8"	742	1 020	1 170	1 300
44.5	1.3/4"	861	1 180	1 360	1 500
47.6	1.7/8"	985	1 350	1 550	1 710
50.8	2"	1 122	1 530	1 760	1 930
54	2.1/8"	1 268	1 710	1 970	2 160
57.2	2.1/4"	1 423	1 910	2 200	2 420
60.3	2.3/8"	1 581	2 120	2 440	2 690

NOTE — To calculate the aggregate breaking force, multiply the figures shown in columns 3, 4 and 5 by 1.33.

Table 7 Size, Breaking Force and Mass for 18 × 7 Class
(Clauses 4, 5 and 6.4)

Table 7A

Typical Cross Section	Typical Construction	
	Rope Construction	Strand Construction
 <p>WITH FIBRE CORE (CF) WITH STEEL CORE (CWS)</p>	17 × 7 (11 × 7 : 6 × 7-FC)	6-1
	18 × 7 (12 × 7 : 6 × 7-FC)	6-1
	18 × 19S (12 x 19S : 6 x 19S - FC)	9-9-1
	18 × 19S (12 x 19S : 6 x 19S -1 x 19S)	9-9-1

Nominal Diameter	Approximate Mass		Minimum Braking Force Corresponding to Rope Grade of					
	Fibre Core	Steel Core	1770		1960		2160	
			Fibre Core	Steel Core	Fibre Core	Steel Core	Fibre Core	Steel Core
(1)	(CF)	(CWR)	(CF)	(CWR)	(CF)	(CWR)	(CF)	(CWR)
mm	kg/100 m	kg/100 m	kN	kN	kN	kN	kN	kN
6	13.8	14.5	20	21	22	23	25	26
7	18.8	19.7	28	28	31	32	34	35
8	24.5	25.7	36	37	40	41	44	45
9	31	32.6	46	47	51	52	56	57
10	38.3	40.2	56	58	62	64	69	71
11	46.3	48.6	68	70	76	78	83	86
12	55.1	57.9	81	84	90	93	99	102
13	64.7	67.9	95	98	106	109	116	120
14	75	78.8	111	114	122	126	135	139
16	98	103	144	149	160	165	176	181
18	124	130	183	188	202	208	223	230
19	138	145	204	210	225	232	248	256
20	153	161	226	232	250	257	275	283
22	185	195	273	281	302	311	333	343
24	220	232	325	335	360	370	396	408
25	239	251	352	363	390	402	430	443
26	259	272	381	393	422	435	465	479
28	300	315	442	455	490	504	540	556
32	392	412	577	595	639	659	705	726
36	496	521	731	753	809	833	892	918
38	553	580	814	839	902	929	994	1 023
40	612	643	902	929	999	1 029	1 101	1 134

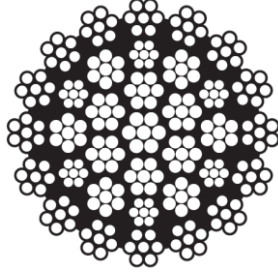
NOTE — To calculate the aggregate breaking force multiply the figures given in col. 4,6, and 8 by 1.282 and in col. 5, 7, and 9 by 1.319.

Table 7B

Nominal Diameter		Approximate Mass		Minimum Braking Force Corresponding to Rope Grade of			
				IPS		EIP	
		Fibre Core	Steel Core	Fibre Core	Steel Core	Fibre Core	Steel Core
		(CF)	(CWR)	(CF)	(CWR)	(CF)	(CWR)
(1)		(2)	(3)	(4)	(5)	(6)	(7)
mm	In.	kg/100 m	kg/100 m	kN	kN	kN	kN
6.35	1/4"	15.4	16.2	22.3	22.3	24.6	24.6
7.94	5/16"	24.1	25.3	34.7	34.7	38.3	38.3
9.5	3/8"	34.5	36.3	49.7	49.7	54.5	54.5
11.1	7/16"	47.2	49.5	67.4	67.4	73.9	73.9
12.7	1/2"	61.7	64.8	87.6	87.6	95.8	95.8
14.3	9/16"	78.3	82.2	110	110	121	121
15.9	5/8"	96.8	102	136	136	149	149
19.1	3/4"	140	147	194	194	214	214
22.2	7/8"	189	198	262	262	289	289
25.4	1"	247	259	341	341	375	375
28.6	1.1/8"	313	329	429	429	472	472
31.8	1.1/4"	387	407	527	527	579	579
34.9	1.3/8"	466	490	634	634	697	697
38.1	1.1/2"	556	584	751	751	826	826

NOTE — To calculate the aggregate breaking force multiply the figures given in col. 4,6, and 8 by 1.282 and in col. 5, 7, and 9 by 1.319.

Table 8 Size, Breaking Force and Mass for 35(W) × 7 Class
(Clauses 4, 5 and 6.4)

Typical Cross Section	Typical Construction	
	Rope Construction	Strand Construction
 <p>WITH STEEL CORE (CWS)</p>	28 × 7 (16 × 7 : 4 × 7 + 4 × 7 - 4 × 7)	6-1
	35 × 7 (16 × 7 : 6 × 7 + 6 × 7 - 6 × 7 - 1 × 7)	6-1
	40 × 7 [18 × 7 : 7 × 7 + 7 × 7 - 7 × 7 - 1 × 7]	6-1
	35 × 19S (16 × 19S : 6 × 19S + 6 × 19S - 6 × 19S - 1 × 19S)	9-9-1

Nominal Diameter	Approximate Mass		Minimum Braking Force Corresponding to Rope Grade of					
	Fibre Core	Steel Core	1770		1960		2160	
			Fibre Core	Steel Core	Fibre Core	Steel Core	Fibre Core	Steel Core
(1)	(CF)	(CWR)	(CF)	(CWR)	(CF)	(CWR)	(CF)	(CWR)
mm	kg/100 m	kg/100 m	kN	kN	kN	kN	kN	kN
8	-	29.1	-	40.8	-	45.2	-	49.8
10	-	45.4	-	63.7	-	70.6	-	77.8
11	-	54.9	-	77.1	-	85.4	-	94.1
12	-	65.4	-	91.8	-	102	-	112
13	-	76.7	-	108	-	119	-	131
14	-	89	-	125	-	138	-	152
16	-	116	-	163	-	181	-	199
18	-	147	-	206	-	229	-	252
19	-	164	-	230	-	255	-	281
20	-	182	-	255	-	282	-	311
22	-	220	-	308	-	342	-	376
24	-	262	-	367	-	406	-	448
25	-	284	-	398	-	441	-	486
26	-	307	-	431	-	477	-	526
28	-	356	-	500	-	553	-	610
29	-	382	-	536	-	593	-	654
30	-	409	-	573	-	635	-	700
32	-	465	-	652	-	723	-	796
34	-	525	-	737	-	816	-	899
35	-	556	-	781	-	864	-	953
36	-	588	-	826	-	914	-	1 008
38	-	656	-	920	-	1 019	-	1 123
40	-	726	-	1 020	-	1 129	-	1 244
42	-	801	-	1 124	-	1 245	-	1 372
44	-	879	-	1 234	-	1 366	-	1 505
45	-	919	-	1 290	-	1 429	-	1 575
46	-	961	-	1 348	-	1 493	-	1 645
48	-	1 046	-	1 468	-	1 626	-	1 792

50	-	1 135	-	1 593	-	1 764	-	1 944
51	-	1 181	-	1 657	-	1 835	-	2 023
52	-	1 228	-	1 723	-	1 908	-	2 103
54	-	1 324	-	1 858	-	2 058	-	2 267
55	-	1 373	-	1 928	-	2 134	-	2 352
56	-	1 424	-	1 998	-	2 213	-	2 439
58	-	1 527	-	2 144	-	2 374	-	2 616
60	-	1 634	-	2 294	-	2 540	-	2 799

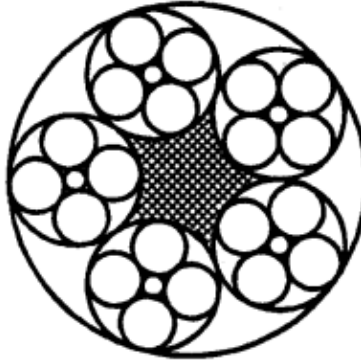
Table 9 Large Diameter 6 Stranded Ropes
(Clauses 4, 5 and 6.4)

Rope diameter larger than 60 mm (or 2.3/8") for 6 stranded ropes, shall be as per following table. Construction for large diameter rope shall be as decided by manufacturer or as agreed between manufacturer and purchaser.

Nominal Diameter		Approximate Mass	Minimum Braking Force Corresponding to Rope Grade of
		Steel Core (CWR)	Steel Core (CWR)
mm	In.	kg/100 m	kN
63.5	2.1/2"	1 730	2 950
66.7	2.5/8"	1 910	3 240
69.9	2.3/4"	2 080	3 530
73	2.7/8"	2 280	3 840
76.2	3"	2 470	4 160
79.4	3.1/8"	2 680	4 490
82.6	3.1/4"	2 900	4 830
85.7	3.3/8"	3 130	5 180
88.9	3.1/2"	3 380	5 520
95.3	3.3/4"	3 870	6 270
102	4"	4 400	6 340
108	4.1/4"	4 960	7 110
114	4.1/2"	5 570	7 900
121	4.3/4"	6 200	8 730
127	5"	6 870	9 590
133	5.1/4"	7 410	9 960
140	5.1/2"	8 110	1 0,800
146	5.3/4"	8 870	1 1,700
152	6"	9 680	1 2,700

NOTE — The breaking force values above apply to wire ropes with bright or zinc-coated quality B wires. The values of breaking force for wire ropes with a heavier mass of coating than quality B may be lower than those given above.

Table 10 Size, Breaking Force and Mass for 5 × 5 (4-1) Construction
(Clauses 4, 5 and 6.4)



5x5(4-1)-CF

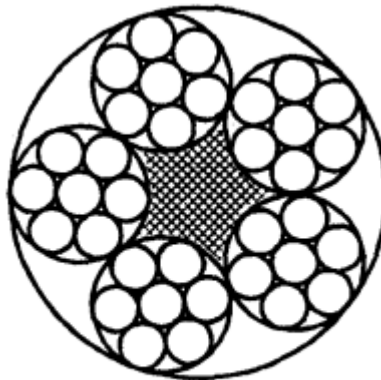
Nominal Rope Diameter	Approximate Mass	Minimum Breaking Force Corresponding to Rope Grade of	
		1570	1770
	Fibre Core (CF)	Fibre Core (CF)	
(1)	(3)	(4)	(5)
mm	kg/100 m	kN	kN
3	2.89	4.5	5.1
4	5.14	8.0	9.0
5	8.03	12.5	14.1
6	11.56	18.0	20.3
7	15.74	24.5	27.6
8	20.56	32.0	36.1

NOTES

1 Interpolation is allowed in steps of 0.2 mm since ropes in decimal of millimeter are required in actual practice.

2 To calculate aggregate braking force, multiply the figures shown in columns 4 and 5 by 1.127.

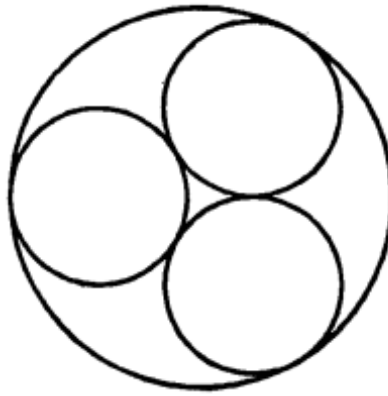
Table 11 Size, Breaking Force and Mass for 5 × 7 (6-1) Construction
(Clauses 4, 5 and 6.4)



5x7(6-1)-CF

Nominal Rope Diameter	Approximate Mass	Minimum Breaking Force Corresponding to Rope Grade of	
		1570	1770
	Fibre Core (CF)	Fibre Core (CF)	
(1)	(3)	(4)	(5)
mm	kg/100 m	kN	kN
3	3.11	4.9	5.5
4	5.52	8.7	9.8
5	8.63	13.6	15.4
6	12.43	19.6	22.1
7	16.92	26.7	30.1
8	22.10	34.9	39.3
<p>NOTES</p> <p>1 Interpolation is allowed in steps of 0.2 mm since ropes in decimal of millimeter are required in actual practice.</p> <p>2 To calculate aggregate breaking force, multiply the figures shown in columns 4 and 5 by 1.127.</p>			

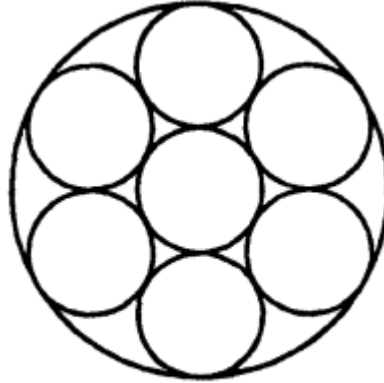
**Table 12A Size, Breaking Force and Mass for Galvanized
Wire Guy Strand of 3(3-0) Wire Construction**
(Clauses 4, 5 and 6.4)



1x3(3-0)

Nominal Rope Diameter	Approximate Mass	Minimum Breaking Force Corresponding to Rope Grade of
(1)	(3)	(4)
mm	kg/100 m	kN
6.2	15.41	23.3
8.3	27.62	41.7
9.3	34.68	52.3
NOTE — To calculate aggregate breaking force, multiply the figures shown in column 4 by 1.03.		

**Table 12B Size, Breaking Force and Mass for Galvanized Wire Guy
Strand of 7(6-1) Wire Construction
(Clauses 4, 5 and 6.4)**

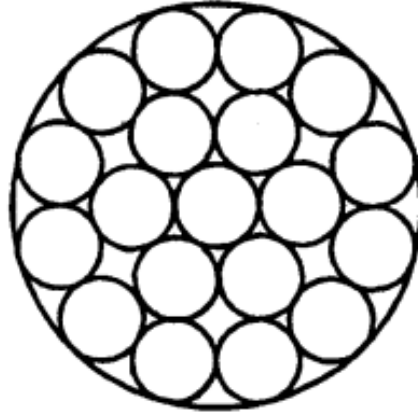


1x7(6-1)

Nominal Rope Diameter	Approximate Mass	Minimum Breaking Force Corresponding to Rope Grade of		
		450	1230	1570
(1)	(3)	(4)	(5)	(6)
mm	kg/100 m	kN	kN	kN
3	4.5	2.2	6.0	7.7
4	8.0	3.9	10.7	13.7
5	12.5	6.1	16.7	21.4
5.5	15.2	7.4	20.3	25.9
6	18.1	8.8	24.1	30.8
7	24.6	12.0	32.8	41.9
8	32.1	15.7	42.8	54.7
9	40.7	19.8	54.2	69.2
11	60.7	29.6	81.0	103
13	84.8	41.4	113	144
14	98.4	48.0	131	167
16	128	62.7	171	219

NOTE — To calculate aggregate breaking force, multiply the figures shown in columns 4, 5 and 6 by 1.111.

**Table 12C Size, Breaking Force and Mass for Galvanized Wire Guy
Strand of 19(12/6-1) or (12:6-1) Wire Construction
(Clauses 4, 5 and 6.4)**



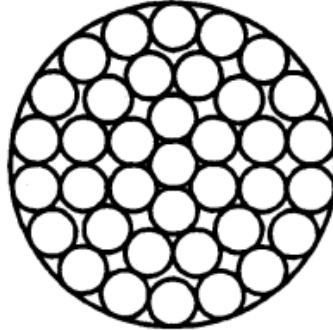
1×19 M (12/6-1)

1×19 J (12:6-1)

Nominal Rope Diameter	Approximate Mass	Minimum Breaking Force Corresponding to Rope Grade of		
		450	1230	1570
(1)	(3)	(4)	(5)	(6)
Mm	kg/100 m	kN	kN	kN
13	83.7	39.9	109	139
14	97.1	46.3	127	162
16	127	60.5	165	211
19	179	85.3	233	298
22	240	114	313	399
25	310	148	404	515

NOTE — To calculate aggregate breaking force, multiply the figures shown in columns 4, 5 and 6 by 1.136.

**Table 12D Size, Breaking Force and Mass for Galvanized Wire Guy Strand of
37 (18/12/6-6) or (18:12:6-1) Wire Construction
(Clauses 4, 5 and 6.4)**



1x37 M (18/12-6-1)

1x37 J (18:12:6-1)

Nominal Rope Diameter	Approximate Mass	Minimum Breaking Force Corresponding to Rope Grade of		
		450	1230	1570
(1)	(3)	(4)	(5)	(6)
Mm	kg/100 m	kN	kN	kN
25	306	146	399	509
29	411	196	536	684
32	501	239	653	833

NOTE — To calculate aggregate breaking force, multiply the figures shown in columns 4, 5 and 6 by 1.136.

**Table 13 Requirements for Well Measuring Wire
(Clauses 4, 5 and 6.4)**

Nominal Wire Diameter	Tolerance on Wire Diameter	Approx Wire Mass	Elongation on 250mm Gauge Length, Percent		Breaking Force of Wire	Minimum Number of Twist of 100 × Nominal Wire Diameter
			Min	Max		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
mm	mm	kg/100 m			kN	
1.70	± 0.03	1.78	1.5	3.00	3.7	32
1.80	± 0.03	2.00	1.5	3.00	4.1	30
2.00	± 0.03	2.47	1.5	3.00	5.0	25
2.36	± 0.03	3.43	1.5	3.00	7.0	25

6 GENERAL REQUIREMENTS

The wire ropes, wire strands and wires shall conform to IS 6594 and shall also meet the following requirements.

6.1 The wire for guy strands shall be of mild steel of condition 'soft' complying with IS 280 having a minimum tensile strength of 450 N/mm².

6.2 Core

Cores of stranded ropes shall normally be of steel or fiber, although other types, such as composites (e.g. steel plus fibers or plastics) or cores made of solid polymer, may also be supplied. The purchaser should specify the type of core.

Use of jute core is not permitted. Steel core may be of independent wire rope core or wire strand core as required.

6.3 Joints

If joints are necessary in wires over 0.4 mm, they shall have their ends joined by brazing or welding. Wires up to and including 0.4 mm, may be joined by twisting or by ends being simply inserted into the strand formation.

For stranded ropes, the minimum distance between joints within one strand shall be '18 × rope nominal diameter'

In well-measuring wires no joints shall be used.

6.4 Mass

The masses given in Tables 1 to 10 are for fully greased ropes. The ropes, which are not greased, may be lighter.

6.5 Lay of the Rope

The lay of the rope shall be either lang's lay or ordinary lay and shall be right hand or left hand as specified by the purchaser. If not otherwise specified, right hand ordinary lay rope shall be furnished. The torpedo line shall be right hand ordinary lay. Alternate lay may also be supplied as agreed between manufacturer and purchaser.

6.6 Length of Lay

For ropes 5 × 5, 5 × 7 and 6 × 7 constructions, the length of lay shall not exceed eight times the

nominal diameter of the rope. For ropes of all other constructions covered by this specification, the length of lay shall not exceed $7\frac{1}{4}$ times the nominal diameter of the finished rope. The length of lay for the guy strands shall not be more than 16 times the nominal diameter of the strand.

7 GALVANIZING

The wire ropes, strands and wires shall be supplied as bright or galvanized. The type of galvanizing shall be as agreed to between the purchaser and the supplier. Where zinc coated (galvanized) is specified, this may also include Zinc Alloy Zn95/Al5 for improved corrosion resistance.

8 LUBRICATION

All wire ropes shall be lubricated thoroughly by a suitable compound during manufacturing process unless otherwise specified. Lubrication for strands and wires shall be as agreed to between the purchaser and the manufacturer.

9 ROPE GRADES

The rope grades for the common class and construction of rope are given in the table 1 to 11. Common Grades are 450, 1230, 1570, 1770, 1960, 2160, IPS, EIP & EEIP (Grade 450 and 1230 are for strand only). Intermediate grades may be supplied by agreement between the purchaser and the manufacturer.

NOTE — Not all wire ropes (e.g. large diameter wire ropes i.e. above 60 mm diameter ropes) will have a nominated rope grade, however manufacturer may decide the rope grade to achieve the designated minimum breaking force of rope.

9 WIRE TENSILE STRENGTH GRADES

For those wire ropes where a wire rope grade is applicable, the tensile strength grade of wire shall be subject to limits given in following table;

Range of Wire Tensile Strength Grades

Rope Grade	Wire Tensile Strength Grades (N/mm²)
1570	1370 to 1770
1770	1570 to 1960
1960	1770 to 2160
2160	1960 to 2160
IPS	1570 to 1960
EIP	1770 to 2160
EEIP	1960 to 2160

For those wire ropes (e.g. larger diameter wire ropes) where a wire rope grade is not applicable, the tensile strength grades of the wires shall be one, or a combination of 1370, 1570, 1770, 1960 and

2160 or intermediate as decided by manufacturer. All wires of the same nominal wire diameter in the same wire layer shall be of the same tensile strength grade.

10 TOLERANCE IN ROPE DIAMETER

The measured (actual) diameter of stranded ropes shall be within the tolerances given in following table-

Nominal Diameter of rope 'd' mm	Tolerance as percentage of Nominal Diameter
$2 \leq d < 4$	-0, +8
$4 \leq d < 6$	-0, +7
$6 \leq d < 8$	-0, +6
$d \geq 8$	-0, +5

The measured diameter of guy strands shall be within 0% to 5%. Diameter of well measuring wire shall be as per table no. 11

11 MARKING

11.1 The size, construction, rope grade, lay, core, coating and length of wire rope, reel/coil no along with the order number of purchaser and any other marking which may be specified by the purchaser shall be legibly mentioned on a suitable tag securely attached, when wire ropes are supplied in coils. In case wire ropes are supplied in reels, the information maybe stenciled on both sides of the reels or stenciled on one side of the reel and a suitable tag giving the same information may be attached on the other side of the reel.

11.2 BIS Certification Marking

11.2.1 The product may also be marked with the Standard Mark.

11.2.2 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standard Act, 1986* and the Rules and Regulations made thereunder. The details of conditions under which a license for the use of the Standard Mark maybe granted to the manufacturers or the producers may be obtained from the Bureau of Indian Standards.