

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION R 346

SHIPBUILDING DETAILS
GALVANIZED STEEL WIRE ROPES

1st EDITION
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BRIEF HISTORY

The ISO Recommendation R 346, *Shipbuilding Details — Galvanized Steel Wire Ropes*, was drawn up by Technical Committee ISO/TC 8, *Shipbuilding Details*, the Secretariat of which is held by the Stichting Nederlands Normalisatie-instituut (NNI).

Work on this question by the Technical Committee began in 1952, taking into account the studies which had been made by the former International Federation of the National Standardizing Associations (ISA), and led in 1960 to the adoption of a Draft ISO Recommendation.

In October 1961, this Draft ISO Recommendation (N° 465) was circulated to all the ISO Member Bodies for enquiry. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies:

Australia	India	Spain
Belgium	Italy	Switzerland
Czechoslovakia	Japan	Turkey
Finland	Netherlands	United Kingdom
France	New Zealand	U.S.S.R.
Germany	Portugal	Yugoslavia
Greece	Romania	

One Member Body opposed the approval of the Draft: U.S.A.

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in October 1963, to accept it as an ISO RECOMMENDATION.

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SHIPBUILDING DETAILS

GALVANIZED STEEL WIRE ROPES

1. SCOPE

This ISO Recommendation covers ropes for standing and running rigging, hawsers, mooring and towing purposes and also cargo gear ropes. The provisions apply to round strand galvanized steel wire ropes of ordinary or regular lay, the lay being right-hand unless otherwise specified.

2. DEFINITIONS

- 2.1** *Actual breaking load of the wire rope.* Maximum load obtained in tension in an approved testing machine at the moment of complete or partial fracture of a random sample cut from the rope.*
- 2.2** *Theoretical aggregate breaking load of wires in a rope.* Sum of the breaking loads of all the wires in a rope, based on the value as obtained from the coefficient k_2 and using a tensile strength equal to the minimum of the tensile range specified plus 5 kgf/mm² (3.2 tonf/in²) (49 N/mm²).
- 2.3** *Coefficient k_1 .* Factor by which the nominal diameter of the rope should be divided to obtain the theoretical diameter of the wires for the external layer.
- 2.4** *Coefficient k_2 .* Factor which takes into account the loss of strength in the process of manufacture and by which the theoretical aggregate breaking load is multiplied in order to obtain the calculated minimum breaking load, given in the tables.

As a basis for this calculation, a mean tensile strength of wire has been assumed, equal to the minimum value for the grade of wire plus 5 kgf/mm² (3.2 tonf/in²) (49 N/mm²).

Note. — It is essential that a test of the actual breaking load, as described above, be carried out in order to confirm compliance with the calculated minimum breaking load. The actual breaking load obtained from this test should be shown on the test certificate.

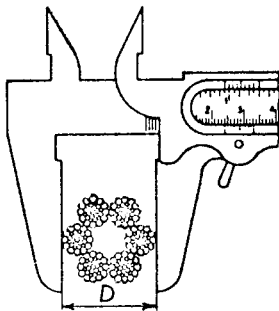
The values taken are as follows:

Grade 140 to 159 kgf/mm² (89 to 101 tonf/in²) (1375 to 1560 N/mm²):
145 kgf/mm² (92 tonf/in²) (1420 N/mm²).

Grade 160 to 179 kgf/mm² (101.5 to 114 tonf/in²) (1570 to 1755 N/mm²):
165 kgf/mm² (105 tonf/in²) (1620 N/mm²).

* See clause 187 of *International Labour Office (ILO) Code of Practice*, "Safety and health in dock work", Geneva, 1958.

3. MEASUREMENT OF WIRE ROPE SIZE



The diameter *D* of the wire rope is measured over each pair of opposite strands, using a suitable sliding caliper.

Measurements are made at each of three places at least 1.5 m (5 ft) apart, and the average of these measurements is taken as the diameter, from which the circumference is calculated.

4. CLASSIFICATION OF TYPES

In this method of classification,

- “ A ” denotes the textile core of the steel wire rope,
- “ a ” denotes the textile core of a strand (Types II and IV).

5. DIMENSIONS

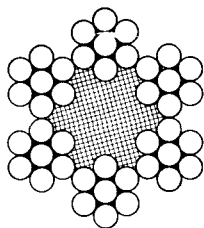
The dimensions of the types of steel wire ropes listed below are given on pages 7 to 13:

Type I:	6 strands of 7 wires	— $A + 6 (1 + 6)$		see clause 5.1,
Type II:	6 strands of 12 wires	— $A + 6 (a + 12)$		see clause 5.2,
Type III:	6 strands of 19 wires	— $A + 6 (1 + 6 + 12)$		see clause 5.3,
Type IV:	6 strands of 24 wires	— $A + 6 (a + 9 + 15)$		see clause 5.4,
Type V:	6 strands of 37 wires	— $A + 6 (1 + 6 + 12 + 18)$		see clause 5.5,
Type VI:	6 strands of 31 wires	— $A + 6 [1 + 6 + (6 + 6) + 12]$		see clause 5.6,
Type VII:	6 strands of 36 wires	— $A + 6 [1 + 7 + (7 + 7) + 14]$		see clause 5.7,
Type VIII:	7 strands of 7 wires	— $(1 + 6) + 6 (1 + 6)$		see clause 5.8,
Type IX:	7 strands of 19 wires	— $(1 + 6 + 12) + 6 (1 + 6 + 12)$		see clause 5.9.

5.1 Galvanized Steel Wire Ropes, Type I

6 strands of 7 wires :

$A + 6 (1 + 6)$



$k_1 = 9.4$

$k_2 = 0.9$

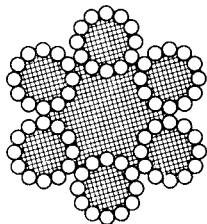
Tensile strength of wire:
140 to 159 kgf/mm²
(89 to 101 tonf/in²)
(1375 to 1560 N/mm²)

Nominal sizes of rope		Calculated minimum breaking load		Approximate mass	
Diameter mm	Circumference inches	kgf (1 kgf = 9.8 N)	tonf	kg/m	lb/100 ft
8	1	3150	3.1	0.22	14.8
9	1 ¹ / ₈	3950	3.8	0.28	18.8
10	1 ¹ / ₄	4800	4.7	0.34	22.9
11	1 ³ / ₈	5800	5.7	0.41	27.6
12	1 ¹ / ₂	7400	7.3	0.52	35.0
14	1 ³ / ₄	9800	9.6	0.69	46.4
16	2	12 600	12.4	0.89	59.9
18	2 ¹ / ₄	15 700	15.5	1.11	74.6
20	2 ¹ / ₂	20 200	19.9	1.42	95.5
22	2 ³ / ₄	24 100	23.7	1.69	127.0
24	3	28 400	28.0	1.99	134.0
26	3 ¹ / ₄	33 000	32.5	2.32	156.0
28	3 ¹ / ₂	39 300	38.6	2.76	186.0
32	4	50 400	49.5	3.54	238.0
36	4 ¹ / ₂	64 700	63.7	4.54	306.0
40	5	78 900	77.5	5.54	372.0

5.2 Galvanized Steel Wire Ropes, Type II

6 strands of 12 wires :

$A + 6 (a + 12)$



$k_1 = 15.5$

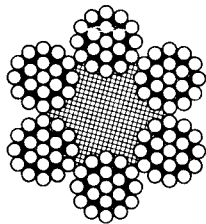
$k_2 = 0.9$

Tensile strength of wire:
140 to 159 kgf/mm²
(89 to 101 tonf/in²)
(1375 to 1560 N/mm²)

Nominal sizes of rope		Calculated minimum breaking load		Approximate mass	
Diameter mm	Circumference inches	kgf (1 kgf = 9.8 N)	tonf	kg/m	lb/100 ft
8	1	1850	1.8	0.15	10.1
9	1 ¹ / ₈	2650	2.5	0.21	14.1
10	1 ¹ / ₄	3100	3.1	0.25	16.8
11	1 ³ / ₈	3600	3.5	0.29	19.5
12	1 ¹ / ₂	4700	4.6	0.38	25.6
14	1 ³ / ₄	5950	5.9	0.48	32.3
16	2	8100	8.0	0.65	43.7
18	2 ¹ / ₄	9750	9.6	0.78	52.5
20	2 ¹ / ₂	12 450	12.3	1.00	67.2
22	2 ³ / ₄	14 450	14.2	1.16	78.0
24	3	17 700	17.4	1.42	95.5
26	3 ¹ / ₄	21 300	21.0	1.70	114.2
28	3 ¹ / ₂	23 900	23.7	1.91	128.3
32	4	31 000	30.6	2.48	166.8
36	4 ¹ / ₂	39 000	38.4	3.12	209.7
40	5	49 900	49.1	3.98	267.5

5.3 Galvanized Steel Wire Ropes, Type III

6 strands of 19 wires :
A + 6 (1 + 6 + 12)

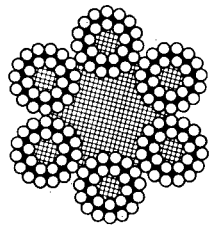


$k_1 = 15.5$
 $k_2 = 0.87$
Tensile strength of wire:
140 to 159 kgf/mm²
(89 to 101 tonf/in²)
(1375 to 1560 N/mm²)

Nominal sizes of rope		Calculated minimum breaking load		Approximate mass	
Diameter mm	Circumference inches	kgf (1 kgf = 9.8 N)	tonf	kg/m	lb/100 ft
8	1	2850	2.8	0.20	13.5
9	1 ¹ / ₈	4100	4.0	0.29	19.5
10	1 ¹ / ₄	4800	4.7	0.35	23.6
11	1 ³ / ₈	5500	5.5	0.40	26.9
12	1 ¹ / ₂	7250	7.1	0.52	35.0
14	1 ³ / ₄	9200	9.1	0.66	44.4
16	2	12 500	12.3	0.90	60.5
18	2 ¹ / ₄	15 000	14.8	1.08	72.6
20	2 ¹ / ₂	19 200	18.9	1.38	92.8
22	2 ³ / ₄	22 300	22.0	1.60	107.8
24	3	27 300	26.9	1.96	132.0
26	3 ¹ / ₄	32 800	32.2	2.36	158.8
28	3 ¹ / ₂	36 800	36.2	2.65	177.0
32	4	47 800	47.0	3.44	231.0
36	4 ¹ / ₂	60 000	59.1	4.32	291.0
40	5	76 800	75.5	5.52	372.0
44	5 ¹ / ₂	92 300	90.9	6.64	446.0
48	6	110 600	108.9	7.95	535.0
52	6 ¹ / ₂	127 600	125.6	9.18	618.0
56	7	147 500	145.0	10.61	713.0

5.4 Galvanized Steel Wire Ropes, Type IV

6 strands of 24 wires :
A + 6 (a + 9 + 15)



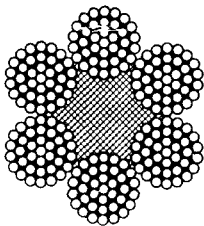
$k_1 = 18.4$
 $k_2 = 0.87$
Tensile strength of wire:
140 to 159 kgf/mm²
(89 to 101 tonf/in²)
(1375 to 1560 N/mm²)

Nominal sizes of rope		Calculated minimum breaking load		Approximate mass	
Diameter mm	Circumference inches	kgf (1 kgf = 9.8 N)	tonf	kg/m	lb/100 ft
8	1	2900	2.8	0.22	14.8
9	1 ¹ / ₈	3550	3.5	0.27	18.2
10	1 ¹ / ₄	4300	4.2	0.32	21.5
11	1 ³ / ₈	5100	5.0	0.38	25.5
12	1 ¹ / ₂	6000	5.9	0.45	30.2
14	1 ³ / ₄	8000	7.9	0.60	40.4
16	2	11 500	11.3	0.86	57.9
18	2 ¹ / ₄	14 300	14.1	1.06	71.3
20	2 ¹ / ₂	17 300	17.0	1.29	86.8
22	2 ³ / ₄	20 500	20.1	1.53	103.0
24	3	24 100	23.8	1.80	121.0
26	3 ¹ / ₄	30 000	29.6	2.24	150.5
28	3 ¹ / ₂	34 300	33.8	2.56	172.4
32	4	43 700	43.1	3.26	219.0
36	4 ¹ / ₂	57 000	56.0	4.26	287.0
40	5	69 000	68.0	5.15	346.0
44	5 ¹ / ₂	82 200	81.0	6.13	412.0
48	6	100 200	98.5	7.47	502.0
52	6 ¹ / ₂	115 900	114.5	8.64	581.0
56	7	132 700	130.6	9.90	666.0

5.5 Galvanized Steel Wire Ropes, Type V

6 strands of 37 wires :

A + 6 (1 + 6 + 12 + 18)



$k_1 = 21.7$

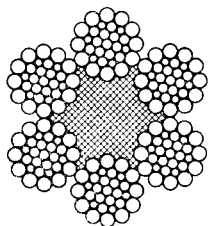
$k_2 = 0.825$

Tensile strength of wire:
160 to 179 kgf/mm²
(101.5 to 114 tonf/in²)
(1570 to 1755 N/mm²)

Nominal sizes of rope		Calculated minimum breaking load		Approximate mass	
Diameter mm	Circumference inches	kgf (1 kgf = 9.8 N)	tonf	kg/m	lb/100 ft
8	1	3250	3.2	0.23	15.5
9	1 ¹ / ₈	4200	4.1	0.30	20.2
10	1 ¹ / ₄	4800	4.7	0.34	22.9
11	1 ³ / ₈	5950	5.9	0.42	28.2
12	1 ¹ / ₂	7200	7.1	0.51	34.3
14	1 ³ / ₄	10 000	9.8	0.71	47.3
16	2	13 400	13.2	0.95	64.0
18	2 ¹ / ₄	17 200	16.9	1.22	82.0
20	2 ¹ / ₂	21 450	21.2	1.52	102.3
22	2 ³ / ₄	26 200	25.8	1.86	125.0
24	3	28 800	28.4	2.04	137.4
26	3 ¹ / ₄	34 300	33.8	2.43	163.5
28	3 ¹ / ₂	40 200	39.6	2.85	192.0
32	4	53 500	52.7	3.79	255.0
36	4 ¹ / ₂	68 800	67.7	4.87	328.0
40	5	81 400	80.0	5.77	388.0
44	5 ¹ / ₂	100 100	98.4	7.09	477.0
48	6	120 700	118.8	8.55	575.0
52	6 ¹ / ₂	137 100	134.5	9.71	655.0
56	7	160 900	158.2	11.39	765.0

5.6 Galvanized Steel Wire Ropes, Type VI

6 strands of 31 wires :
A + 6 [1 + 6 + (6 + 6) + 12]



$k_1 = 15.7$
 $k_2 = 0.825$
Tensile strength of wire:
160 to 179 kgf/mm²
(101.5 to 114 tonf/in²)
(1570 to 1755 N/mm²)

Nominal sizes of rope		Calculated minimum breaking load		Approximate mass	
Diameter mm	Circumference inches	kgf (1 kgf = 9.8 N)	tonf	kg/m	lb/100 ft
12	1 1/2	7400	7.3	0.52	35.0
14	1 3/4	11 200	11.0	0.80	53.8
16	2	13 500	13.3	0.96	64.5
18	2 1/4	17 800	17.5	1.26	84.7
20	2 1/2	21 400	21.0	1.52	102.3
22	2 3/4	26 700	26.3	1.89	127.0
24	3	30 100	29.6	2.14	144.0
26	3 1/4	36 900	36.4	2.62	176.0
28	3 1/2	43 800	43.1	3.11	209.0
32	4	56 600	55.7	4.02	271.0
36	4 1/2	71 700	70.5	5.09	342.0
40	5	88 500	87.0	6.28	422.0