

Attached Table 1 Breaking Load of Wire Rope for
Aeronautical Use

Unit : kg

Classification Construction mark	A 1		A 2		A 3		A 4		A 5	
	Carbon steel	Stainless steel	Carbon steel	Stainless steel	Carbon steel	Stainless steel	Carbon steel	Stainless steel	Carbon steel	Stainless steel
0.78 (1/16)	49.9									
1.5										
1.59 (1/16)			218							170
2.0 (1/8)										182
2.38 (1/8)			417							354
2.5										400
2.78 (1/8)										450
3.0										550
3.18 (1/8)					907	798				570
3.5										700
4.0 (1/2)					1270	1090				998
4.76 (1/2)					1910	1680				1248
5.58 (1/2)					2540	2270				
6.35 (1/2)					3180	2900				
7.14 (1/2)					3650	3540				
8.0 (1/2)					4150	4080				
8.75 (1/2)					5670					
9.53 (1/2)					6530	5440				
11.0 (1/2)							7980	7390		
12.7 (1/2)							10300	10300		
14.3 (1/2)							12900	12900		
15.9 (1/2)							15900	15900		
19.1 (1/2)							22500	22500		
22.2 (1/2)							30200	30200		
25.4 (1/2)							38700	38700		
28.6 (1/2)							48300	48300		
31.8 (1/2)							58700	58700		
34.9 (1/2)							69700	69700		
38.1 (1/2)							81900	81900		

Uncoated Stress-Relieved Steel Wire and Strand for Prestressed Concrete*

1. Scope

This standard specifies uncoated stress-relieved steel wire, hereinafter referred to as "wire" and strand, hereinafter referred to as "strand" for prestressed concrete.

2. Class, Symbol and Sizes

2.1 Class and symbol for wire and strand shall conform to Table 1.

Table 1. Class and Symbol

Class		Symbol	Cross section
Uncoated stress-relieved steel wire	Round wire	SWPR 1	○
	Deformed wire	SWPD 1	○
Uncoated stress-relieved steel strand	2 wire strand		8
	7-wire strand	A	⊗
		B	⊗

2.2 Sizes for wire and strand shall conform to Table 2.

Table 2. Sizes

Symbol	Sizes		
SWPR 1 and SWPD 1	(2.9 mm) (6 mm)	(3.5 mm) 7 mm	(4 mm) 8 mm
SWPR 2	2.9 mm 2-wire strand		
SWPR 7A	(7-wire strand 6.2 mm)		
	7-wire strand 9.3 mm		
	7-wire strand 12.4 mm		
SWPR 7B	7-wire strand 9.5 mm		
	7-wire strand 12.7 mm		

Remark: Wire and strand whose sizes are in parenthesis should not be used.

3. Manufacturing Process

3.1 The wire from which wire and strand are to be fabricated shall conform to JIS G 3502-Piano Wire Rods, and have a cold working finish after patenting applied thereon.

3.2 Wire and strand shall be subjected to the bluing for the stress-relieving at the final process.

3.3 The wire from which wire and strand are to be fabricated shall be free of joints, however, the wire from which seven-wire strand is fabricated may have joints butt-welded at the diameters measured after the patenting applied and before the application.

3.4 Individual wire of seven-wire strand may have a butt welded joint during the stranding process, providing that the number of the joints shall not be more than one within the scope of strand's length of 45 m.

3.5 Strand itself shall not be jointed.

4. Mechanical Properties

Mechanical properties of wire and strand shall conform to Table 3.

Table 3. Mechanical Properties

Symbol	Sizes	Tension test			Relaxation test
		Load giving permanent elongation of 0.2 % kg	Tension load kg	Elongation %	
SWPR 1 and SWPD 1	(2.9 mm)	1150 min.	1300 min.	3.5 min.	3.0 max.
	(3.5 mm)	1450 min.	1650 min.	3.5 min.	3.0 max.
	(4 mm)	1900 min.	2150 min.	3.5 min.	3.0 max.
	(4.5 mm)	2300 min.	2600 min.	4.0 min.	3.0 max.
	5 mm	2850 min.	3250 min.	4.0 min.	3.0 max.
	(6 mm)	3950 min.	4500 min.	4.0 min.	3.0 max.
	7 mm	5200 min.	5950 min.	4.5 min.	3.0 max.
SWPR 2	8 mm	6550 min.	7550 min.	4.5 min.	3.0 max.
	9 mm	7950 min.	9200 min.	4.5 min.	3.0 max.
	2.9 mm 2-wire strand	2300 min.	2600 min.	3.5 min.	3.0 max.

Symbol	Sizes	Tension test			Relaxation test
		Load giving permanent elongation of 0.2 % kg	Tension load kg	Elongation %	
SWPR 7A	(7-wire strand 6.2 mm)	3450 min.	4100 min.	3.5 min.	3.0 max.
	(7-wire strand 7.9 mm)	5600 min.	6600 min.	3.5 min.	3.0 max.
	7-wire strand 9.3 mm	7700 min.	9050 min.	3.5 min.	3.0 max.
	7-wire strand 10.8 mm	10400 min.	12200 min.	3.5 min.	3.0 max.
	7-wire strand 12.4 mm	13900 min.	16300 min.	3.5 min.	3.0 max.
SWPR 7B	7-wire strand 15.2 mm	19700 min.	23100 min.	3.5 min.	3.0 max.
	7-wire strand 9.5 mm	8850 min.	10400 min.	3.5 min.	3.0 max.
	7-wire strand 11.1 mm	12000 min.	14100 min.	3.5 min.	3.0 max.
	7-wire strand 12.7 mm	15900 min.	18700 min.	3.5 min.	3.0 max.

5. Appearance and Shape

5.1 Wire and strand shall be free from injurious scratches, oil or other defects on the surface, however they may have rust which will not create pitting.

5.2 When the strand is cut without seizings, the wire shall not fly out of position.

5.3 Stranding direction of strand shall be of S stranding. S stranding shall conform to JIS G 3525-Wire Rope.

5.4 Stranding pitch of strand shall be uniform on each wire, and of 24 to 32 times of basic diameter specified in Table 4 for 2-wire strand and 12 to 16 times of basic diameter specified in Table 4 for 7-wire strand.

5.5 Deformed wire shall have almost round sectional area and either uniform projections or dents in sequence or at certain interval.

6. Size and Tolerance

6.1 Basic diameters and tolerances of wire (except deformed wire), the wire for 2-wire strand and the wire for 7-wire strand shall conform to Table 4. Diameter of a centre wire of 7-wire strand shall be larger than of the outer wires and those differences shall conform to Table 4.

Furthermore nominal diameter of deformed wire shall conform to basic diameter of SWPR 1 specified in Table 4 and the tolerance shall not be specified.

Table 4. Size and Tolerance

Symbol	Sizes	Basic dia.	Tolerance	Difference of dia. of centre wire and outer wires
SWPR 1	(2.9 mm)	2.90	+0.03	-
	(3.5 mm)	3.50	+0.04	-
	(4 mm)	4.00	+0.04	-
	(4.5 mm)	4.50	+0.05	-
	5 mm	5.00	+0.05	-
	(6 mm)	6.00	+0.05	-
	7 mm	7.00	+0.05	-
	8 mm	8.00	+0.05	-
SWPR 2	9 mm	9.00	+0.05	-
	2.9 mm 2-wire strand	2.90	+0.03	-
	(7-wire strand 6.2 mm)	6.2	+0.4 -0.2	0.03 min.
	(7-wire strand 7.9 mm)	7.9	+0.4 -0.2	0.04 min.
SWPR 7A	7-wire strand 9.3 mm	9.3	+0.4 -0.2	0.05 min.
	7-wire strand 10.8 mm	10.8	+0.4 -0.2	0.07 min.
	7-wire strand 12.4 mm	12.4	+0.4 -0.2	0.08 min.
	7-wire strand 15.2 mm	15.2	+0.4 -0.2	0.08 min.
	7-wire strand 9.5 mm	9.5	+0.4 -0.2	0.05 min.
SWPR 7B	7-wire strand 11.1 mm	11.1	+0.4 -0.2	0.07 min.
	7-wire strand 12.7 mm	12.7	+0.4 -0.2	0.08 min.

Remark: Basic diameter of 7-wire strand shall be of the circumscribed circle of strand.

6.2 Nominal sectional area and unit weight of wire and strand shall conform to Table 5.

Table 5. Nominal Sectional Area and Unit Weight

Symbol	Sizes	Nominal sectional area mm ²	Unit weight kg/km
SWPR 1 and SWPD 1	(2.9 mm)	6.605	51.8
	(3.5 mm)	9.621	75.5
	(4 mm)	12.57	98.7
	(4.5 mm)	15.90	125
	5 mm	19.64	154
	(6 mm)	28.27	222
	7 mm	38.48	302
	8 mm	50.27	395
SWPR 2	9 mm	63.62	499
	2.9 mm 2-wire strand	13.21	104
SWPR 7A	(7-wire strand 6.2 mm)	23.23	182
	(7-wire strand 7.9 mm)	37.42	293
	7-wire strand 9.3 mm	51.61	405
	7-wire strand 10.8 mm	69.68	546
	7-wire strand 12.4 mm	92.90	729
	7-wire strand 15.2 mm	138.7	1101
SWPR 7B	7-wire strand 9.5 mm	54.84	432
	7-wire strand 11.1 mm	74.19	580
	7-wire strand 12.7 mm	98.71	774

7. Tests

7.1 Tension Test

7.1.1 Tension test shall be operated in accordance with JIS Z 2241—Methods of Tension Test of Metals, providing that distance between grips shall be of 100 mm and more for wire, 200 mm and more for 2-wire strand and 600 mm and more for 7-wire strand. When a test piece is broken off the gripping point and the results of test do not conform to standardized values, the tests shall be considered invalid and retest shall be required on the test piece retaken.

Galvanized Steel Wire Strands*

7.1.2 Tension load shall be of maximum during the test, and minimum load giving permanent elongation of 0.2 % shall be specified with an intersection on load-elongation curve made by the line parallel to straight part of the curve with distance of 0.2 %.

7.1.3 Wire elongation shall be the gauge length of fractured test piece for original gauge length of 100 mm when the ends of the fractured test piece are fitted together carefully. Regarding the strand, after setting distance of grips so as to conform to 7.1.1, the initial load which is equivalent to 10 % of the required minimum breaking strength as specified in Table 3 shall be applied on the test piece and the total elongation at the time shall be considered as 0.1 %, then the strand elongation when strand test piece fractured shall be calculated by measuring the movement of the test machine head. Upon measuring elongation at the fracture, if the elongation value reaches the value prescribed therein before the fracture, then the measuring elongation at the fracture may not be required.

7.2 Relaxation Test Gripping the test piece at the proper distance at room temperature, the load equivalent to 80 % of the required minimum load giving the test piece permanent elongation of 0.2 % which is prescribed in Table 3 shall be applied on the test piece for about one minute, then holding the distance of grips as it is for 10 hours and decrease of the load shall be measured. The relaxation value then shall be determined as a percentage of the decreased load for the original load.

1. Scope

This standard specifies galvanized steel wire strands for use of electric power transmission lines, earth wire messenger wires, guy wires of self supported cable and stay wires as well as for similar purpose hereto, hereinafter referred to as the "steel wire strands".

2. Classification and Grade

2.1 The steel wire strands shall be classified into three kinds of No. 1 to No. 3 in accordance with the construction as given in Table 1.

Table 1

Classification	No. 1	No. 2 (a)	No. 2 (b)	No. 3 (a)	No. 3 (b)
Section					
Construction	3-wires	7-wires		19-wires	
Constructional symbol	1 x 3	1 x 7 (a)	1 x 7 (b)	1 x 19 (a)	1 x 19 (b)

2.2 The steel wire strands shall be classified into 1 to 3 grade in accordance with standard tensile strength of the individual wire.

Grade	Grade 1	Grade 2	Grade 3
Standard tensile strength of individual wire kg/mm ²	125	90	70

2.3 The steel wire strands shall be divided into Class Special A, Classes A and B in accordance with weight of zinc coating of individual wire.

Class	Special A	A	B
Weight of zinc coating	Extra thick coating	Thick coating	Thin coating

3. Manufacturing Process

3.1 The steel wire strands shall be of wire rod to conform to SWRM 17 to SWRM 22 specified in JIS G 3505-Mild Steel Wire Rods and SWRH 32, SWRH 37, SWRH 42 (A, B), SWRH 47 (A, B), SWRH 52 (A, B), SWRH 57 (A, B), and SWRH 62 (A, B) specified in JIS G 3506-Hard Steel Wire Rods.