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Steel wire ropes for the petroleum and natural gas industries — Minimum requirements and terms of acceptance

Câbles en acier pour les industries du pétrole et du gaz naturel — Exigences minimales et conditions de réception

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 105, *Steel wire ropes*.

This second edition cancels and replaces the first edition (ISO 10425:2003), which has been technically revised.

The main changes are as follows:

— tolerance, difference of diameter measurements of compacted strands and compacted (swaged) ropes have been added (see 4.3);

— the breaking forces of the more common classes, sizes and grades of compacted strands and compacted (swaged) ropes have been added to the breaking force tables (see Annex C);

— some sizes of well-measuring wire have been added to the diameter tables (see Annex E).

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

In recognition of equipment already in use and originally designed to accommodate rope sizes (nominal rope diameters) based on “Imperial” units, some of the more common “converted SI unit” sizes have also been included.

In addition, and in recognition of equipment already in use and designed to operate with ropes having specific rope grades (e.g. IPS), based on “US” wire levels, these grades have also been included in order to give prominence to the required minimum values of breaking force associated with these grades and help to ensure that existing design safety levels are maintained.

Having due regard to size and breaking force for a particular rope class or construction, in some cases it is possible to safely substitute a US customary size and grade with one based solely on SI units and grade, and vice-versa. To assist in this process, this document gives a size range for each nominal rope diameter and equivalent minimum breaking forces (converted from US customary units) for comparison, although it is recommended that the equipment designer or rope manufacturer (or other competent person) is consulted prior to ordering a substitute rope.

Steel wire ropes for the petroleum and natural gas industries — Minimum requirements and terms of acceptance

1 Scope

This document specifies the minimum requirements and terms of acceptance for the manufacture and testing of steel wire ropes not exceeding rope grade 2160 for the petroleum and natural gas industries.

Typical applications include tubing lines, rod hanger lines, sand lines, cable-tool drilling and clean out lines, cable tool casing lines, rotary drilling lines, winch lines, horse head pumping unit lines, torpedo lines, mast-raising lines, guideline tensioner lines, riser tensioner lines, mooring and anchor lines. Wire ropes for lifting slings and cranes, and wire for well-measuring and strand for well-servicing are also included.

The minimum breaking forces for the more common sizes, grades and constructions of stranded rope are given in tables. However, this document does not restrict itself to the classes covered by those tables. Other types can also conform with its requirements. The minimum breaking force values for these wire ropes are provided by the manufacturer.

For information only, other tables present the minimum breaking forces for large diameter stranded and spiral ropes (i.e. spiral strand and locked coil), while approximate nominal length masses for the more common stranded rope constructions and large diameter stranded and spiral ropes are also given.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2232, *Round non-alloy steel wires for general purpose wire ropes, large diameter wire ropes and mine hoisting wire ropes — Specifications*

ISO 4345, *Steel wire ropes — Fibre main cores — Specification*

ISO 4346, *Steel wire ropes for general purposes — Lubricants — Basic requirements*

ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

ISO 7500-1, *Metallic materials — Calibration and verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Calibration and verification of the force-measuring system*

ISO 7800, *Metallic materials — Wire — Simple torsion test*

ISO 7989-2, *Steel wire and wire products — Non-ferrous metallic coatings on steel wire — Part 2: Zinc or zinc-alloy coating*

ISO 17558, *Steel wire ropes — Socketing procedures — Molten metal and resin socketing*

ISO 17893, *Steel wire ropes — Vocabulary, designation and classification*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 17893 and ISO 7989-2 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Requirements

4.1 Material

4.1.1 Wire

The wires for stranded ropes and well-servicing strand of carbon steel shall, before fabrication, conform to the diameter, tensile, torsion, and when applicable, coating requirements specified in Annex A.

The methods of test for wires of tensile strength grades 1 370 N/mm^2, 1 570 N/mm^2, 1 770 N/mm^2, 1 960 N/mm^2 and 2 160 N/mm^2 shall be in accordance with those given in ISO 2232.

The methods of test for wires of tensile strength grades Levels 2, 3, 4 and 5 shall be in accordance with Annex B.

For those wire ropes where a wire rope grade is applicable, the tensile strength grade of the wires shall be subject to the limits given in Table 1.

NOTE The minimum breaking force values of those wire ropes of grades 1770, 1960 and 2160 as covered by Tables C.1 through C.24 are calculated on the basis of wire rope grade and not individual wire tensile strength grades or levels.

Table 1 — Range of wire tensile strength grades

Rope grade	Wire tensile strength grades N/mm^2
1770 or IPS	1 570 or Level 2 to 1 960 or Level 4
1960 or EIP	1 770 or Level 3 to 2 160 or Level 5
2160 or EEIP	1 960 or Level 4 to 2 160 or Level 5

For those wire ropes (e.g. larger diameter ropes) where a wire rope grade is not applicable, the tensile strength grades of the wires shall be one, or a combination, of those given in Annex A.

All wires of the same nominal diameter in the same wire layer shall be of the same tensile strength grade.

Well-measuring wire and wires used in the manufacture of well-servicing strand shall normally be of carbon steel but other materials (e.g. stainless steel) may be used.

The purchaser should specify any particular material requirements.

4.1.2 Core

Cores of stranded ropes shall normally be of steel or fibre, although other types, such as composites (e.g. steel plus fibres or plastics) or cores made of solid polymer, may also be supplied.

The purchaser should specify the type of core.

Fibre cores shall conform to ISO 4345.

The fibre cores for single-layer stranded ropes larger than 8 mm diameter shall be doubly closed (i.e. from yarn into strand and from strand into rope).

To inhibit rotting and decay, at least one of the following methods shall be adopted for natural fibre cores:

a) before twisting, the yarn shall be treated with an impregnating compound;

b) after twisting, the fibre cores shall be treated with an impregnating compound.

Steel cores shall be either an independent wire rope (IWRC) or wire strand (WSC).

Steel cores of single-layer stranded ropes larger than 12 mm diameter shall be an independent wire rope (IWRC), unless specified otherwise.

4.1.3 Lubricant

Lubricants shall conform to ISO 4346.

4.2 Wire rope manufacture

4.2.1 General

In stranded ropes, all the wire layers in a strand shall have the same direction of lay. The lay lengths of corresponding wire layers in strands of the same size, construction and strand layer shall be uniform.

In compacted strand rope, the strands of the same group and layer shall be manufactured by the same compaction processing method.

The core of a stranded rope, except for compacted (swaged) ropes, shall be designed (steel) or selected (fibre) so that in a new wire rope under no load there is clearance between outer strands.

4.2.2 Wire joints

Diameters shall be continuous, but, for wires other than well-measuring wires, if joints are necessary in wires over 0,4 mm they shall have their ends joined by welding.

For stranded ropes, the minimum distance between joints within one strand shall be 18 × wire rope diameter (d).

For spiral ropes, the minimum distance between joints in any wire layer shall be 36 × diameter of the wire layer.

Wires up to and including 0,4 mm may be joined by twisting or by ends being simply inserted into the strands' formation.

4.2.3 Preformation and postformation

Stranded ropes shall be preformed or postformed, or both, unless specified otherwise by the purchaser.

Some parallel-closed ropes and rotation-resistant ropes may be non-preformed.

4.2.4 Construction

The wire rope construction shall be either one of those listed in Annex C or as stated by the manufacturer.

The constructions of large diameter (i.e. over 60 mm) stranded ropes and spiral ropes (i.e. spiral strand and full-locked coil) shall be stated by the manufacturer.

Where only the wire rope class is specified by the purchaser, the construction supplied shall be stated by the manufacturer.

For well-servicing strand, the construction shall be either 1 × 16M or 1 × 19M or as stated by the manufacturer.

4.2.5 Rope grade

The wire rope grades for the more common classes and sizes of stranded ropes shall be as given in Annex C.

Intermediate grades may be supplied by agreement between the purchaser and the manufacturer or supplier.

NOTE Not all wire ropes (e.g. large diameter stranded ropes and spiral ropes) will necessarily have a nominated rope grade.

4.2.6 Wire finish

The finish of the wires shall be uncoated (bright) and coated.

For wire ropes of bright wire finish, substitution of bright wires by coated wires shall be limited to inner wires, centre wires, filler wires and core wires.

For wire ropes of coated wire finish, all of the wires shall be coated, including those of any steel core.

Where coating is specified, this may include zinc, zinc alloy and zinc-aluminium alloy.

4.2.7 Direction and type of wire rope lay

The direction and type of wire rope lay for stranded ropes shall be one of the following:

a) right ordinary lay (sZ);

b) left ordinary lay (zS);

c) right lang lay (zZ);

d) left lang lay (sS);

e) right alternate lay (aZ);

f) left alternate lay (aS).

Well-servicing strand shall be left lay (S).

Spiral ropes (i.e. spiral strand and full locked coil) shall be either right (Z) or left lay (S).

NOTE Direction, right(Z) or left(S), is corresponding to the direction of lay of the outer wires in relation to the longitudinal axis of well-servicing strand or a spiral rope.

The direction and type of wire rope lay should be specified by the purchaser.

4.2.8 Designation and classification

For the purposes of this document, the designation and classification systems according to ISO 17893 shall apply.

4.3 Diameter

4.3.1 General

The nominal diameter shall be that by which the wire, strand or wire rope is designated.

4.3.2 Tolerance

When measured in accordance with 5.1.3, the measured (actual) diameter of stranded ropes shall be within the tolerances given in Table 2.

Table 2 — Tolerances on rope diameter (stranded rope)

Type of wire rope	Nominal wire rope diameter d mm	Tolerance as percentage of nominal diameter	
		Wire ropes with strands that are exclusively of wire or incorporate solid polymer centres	Wire ropes with strands that incorporate fibre centres
Conventional strand rope	$2 \leq d < 4$	$^{+8}_{0}$	$^{+9}_{0}$
	$4 \leq d < 6$	$^{+7}_{0}$	$^{+9}_{0}$
	$6 \leq d < 8$	$^{+6}_{0}$	$^{+8}_{0}$
	$d \geq 8$	$^{+5}_{0}$	$^{+7}_{0}$
Compacted strand rope	$d \geq 8$	$^{+5}_{0}$	$^{+6}_{0}$
Compacted (swaged) rope	$d \geq 8$	$^{+5}_{0}$	$^{+5}_{0}$

When measured in accordance with 5.1.3, the measured (actual) diameter of spiral ropes shall be within $^{+5}_{0}$ % of the nominal diameter.

When measured in accordance with 5.1.3, the measured (actual) diameter of well-servicing strand shall be within the tolerances given in Annex D.

4.3.3 Difference between diameter measurements

For stranded and spiral ropes, the difference between any two of the four measurements taken in accordance with 5.1.3 and expressed as a percentage of the nominal diameter shall not exceed the values given in Table 3.

Table 3 — Permissible differences between any two diameter measurements

Type of rope	Nominal wire rope diameter d mm	Wire ropes with strands that are exclusively of wire or incorporate solid polymer centres and spiral ropes %	Wire ropes with strands that incorporate fibre centres %
Conventional strand rope	$2 \leq d < 4$	7	—
	$4 \leq d < 6$	6	8
	$6 \leq d < 8$	5	7
	$d \geq 8$	4	6
Compacted strand rope	$d \geq 8$	4	6
Compacted (swaged) rope	$d \geq 8$	4	6

4.4 Lay length

For single-layer ropes of 6 × 7 class, the length of lay of the finished wire rope shall not exceed 8 × wire rope diameter (d).

For other single-layer ropes with round strands (except those with three or four strands), parallel-lay closed ropes and rotation-resistant ropes with round strands or shaped strands, the length of lay of the finished rope shall not exceed 7,25 × wire rope diameter (d). For single-layer ropes used in static applications, the length of lay of the finished rope shall not exceed 7,5× wire rope diameter (d).

For single-layer ropes with shaped strands, e.g. triangular strand, the length of lay of the finished rope shall not exceed 10 × wire rope diameter (d).

For well-servicing strand, the length of lay of the finished strand shall not exceed 10 × strand diameter (d).

4.5 Breaking force

4.5.1 Well-measuring wire

The minimum breaking force for a given diameter of well-measuring wire shall be as given in Clause E.1.

When tested in accordance with the method specified in Clause E.2, the measured breaking force shall be greater than or equal to the minimum breaking force.

4.5.2 Well-servicing strand

The minimum breaking force for a given diameter and construction shall be either:

a) as given in Annex D, or

b) as stated by the manufacturer (the value at least in excess of the minimum value given in Annex D).

When tested in accordance with method 1 (see 5.1.4.1), the measured breaking force shall be greater than or equal to the minimum breaking force.

4.5.3 Stranded ropes and spiral ropes

4.5.3.1 General

The minimum breaking force, F_{min}, for a given wire rope diameter and construction shall be either:

a) as given in Annex C for stranded ropes, or

b) as stated by the manufacturer (the value at least in excess of the minimum value given in Annex C).

NOTE 1 Values of minimum breaking force for large diameter stranded and spiral ropes are given for information in Annex F.

For those wire ropes covered in Annex C, the minimum breaking force of intermediate wire rope diameters shall be calculated with the respective minimum breaking force factors in accordance with Annex G.

When tested in accordance with method 1 of 5.1.4.1, the measured breaking force, F_m, shall be greater than or equal to the minimum breaking force, F_{min}.

Breaking force testing requirements shall be in accordance with Table 4.

NOTE 2 The requirements for breaking force take into account: (i) the wire rope size; (ii) whether or not wire ropes are produced in series, i.e. repeatedly produced; (iii) whether or not the minimum breaking force factor is consistent throughout a range of diameters; (iv) whether or not the manufacturer is operating a quality system in accordance with ISO 9001, certified by an accredited third party certification body.

4.5.3.2 Wire ropes produced in series — Manufacturer operating a quality system in accordance with ISO 9001, certified by an accredited third party certification body

The manufacturer shall be able to provide the results from type testing in accordance with the sampling and acceptance criteria given in Annex H.

Type testing shall be repeated on any wire rope that has its design changed in any way which results in a modified (e.g. increased) breaking force. Apart from wire tensile strength grades, if the same design is used for wire ropes of a lower grade or lower breaking force, or both, than the one which has successfully passed the type testing requirements, it shall not be necessary to repeat the tests on those wire ropes provided the breaking force is calculated with the same spinning loss.

Subsequent production lengths of wire ropes produced in series shall be deemed to conform to the breaking force requirements when the manufacturer has satisfactorily completed on a sample from every twentieth production length:

a) the appropriate type tests (see Annex H), and

b) a breaking force test in accordance with method 1 or one of the alternative methods, known as methods 2 and 3 (see 5.1.4.2 and 5.1.4.3).

Table 4 — Breaking force testing requirements

Wire rope diameter d mm	Min. breaking force factor	Manufacturer operating a quality system in accordance with ISO 9001, certified by an accredited third party certification body	Manufacturer NOT operating a quality system in accordance with ISO 9001, certified by an accredited third party certification body
$d \leq 60$	Same factor throughout a sub-group of wire rope diameters	Breaking force test in accordance with 5.1.4.1 (method 1) on a sample from each production length; or, if produced in series, type testing in accordance with H.1.1 plus periodic test in accordance with 5.1.4.1 (method 1), 5.1.4.2 (method 2) or 5.1.4.3 (method 3) on a sample from every twentieth production length relating to the sub-group of diameters.	Breaking force test in accordance with 5.1.4.1 (Method 1) on a sample from each production length.
	Different factor throughout a sub-group of wire rope diameters	Breaking force test in accordance with 5.1.4.1 (Method 1) on a sample from each production length; or, if produced in series, type testing in accordance with H.1.2 plus periodic test in accordance with 5.1.4.1 (method 1), 5.1.4.2 (method 2) or 5.1.4.3 (method 3) on a sample from every twentieth production length of a given wire rope diameter and construction.	Breaking force test in accordance with 5.1.4.1 (Method 1) on a sample from each production length.
$d > 60$		Breaking force test in accordance with 5.1.4.1 (method 1), 5.1.4.2 (method 2) or 5.1.4.3 (method 3) on a sample from each production length, or either of the following: a) if produced in series, type testing in accordance with H.2 plus periodic test in accordance with 5.1.4.1 (method 1), 5.1.4.2 (method 2) or 5.1.4.3 (method 3) on a sample from every twentieth production length; or b) if produced for supply as a set of wire ropes of the same design for a specific installation, the alternative breaking force testing and sampling as also given in H.2.	Breaking force test in accordance with 5.1.4.1 (method 1), 5.1.4.2 (method 2) or 5.1.4.3 (method 3) on a sample from each production length.
NOTE The result from method 1 is known as measured breaking force. The result from method 2 is known as calculated measured (post-spin) breaking force. The result from method 3 is known as calculated measured (pre-spin) breaking force.			

4.6 Length

For those wire ropes not forming part of an assembly, the actual length of wire rope supplied shall be the specified nominal length subject to the following tolerances:

a) up to and including 400 m: $^{+5}_{0}$ % of the specified length;

b) over 400 m, up to and including 1 000 m: $^{+20}_{0}$ m ;

c) over 1 000 m: $^{+2}_{0}$ % of the specified length.

The wire rope shall be measured under no load.

Wire ropes required with smaller length tolerance should be the subject of agreement between the purchaser and the manufacturer.

5 Verification of requirements and test methods

5.1 Stranded ropes and spiral ropes

5.1.1 Materials

Compliance with the wire, core, and lubricant requirements shall be through a visual verification of the inspection documents supplied with the wire, core and lubricant.

5.1.2 Wire rope manufacture

Compliance with the requirements for wire joints and preformation shall be through visual verification.

5.1.3 Test on wire rope for diameter

Diameter measurements shall be taken on a straight portion of wire rope, either under no tension or a tension not exceeding 5 % of the minimum breaking force, at two positions spaced at least 1 m apart. At each position, two measurements, at right angles, of the circumscribed circle diameter shall be taken. The measuring equipment shall extend over at least two adjacent strands (see Figure 1). The average of these four measurements shall be the measured diameter.

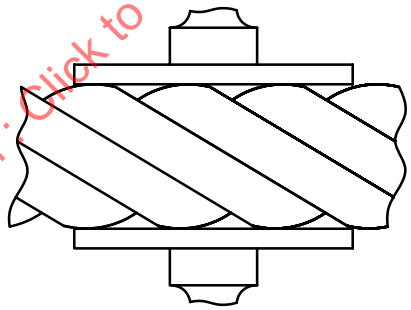


Figure 1 — Method of measuring wire rope diameter

5.1.4 Test on wire rope for breaking force

5.1.4.1 Method 1 — Measured breaking force

The method shall be in accordance with Annex I.

The wire rope shall be deemed to have satisfied the breaking force requirement when the measured breaking force reaches or exceeds the minimum value.

When the minimum breaking force is not reached, three additional tests may be carried out, one of which shall achieve or exceed the minimum breaking force value for the manufacture to be accepted. Otherwise, the whole manufacture shall be rejected.

5.1.4.2 Method 2 —Calculated measured (post-spin) breaking force

Add together the measured breaking forces of all individual wires after they have been removed from the rope and multiply this value by either:

a) the spinning loss factor derived from Annex G, or

b) the partial spinning loss factor obtained from the results of type testing.

The partial spinning loss factor used in the calculation shall be the lowest of the three values obtained from type testing.

In the case of triangular strand ropes, the triangular centre of the strand may be considered as an individual wire.

Test the wires in accordance with the wire tensile test specified in Clause B.2 or in ISO 6892-1.

NOTE The result from this test is known as the "calculated measured (post-spin) breaking force".

When this method (i.e. method 2) is used for the periodic test (see Table 4) and the calculated measured (post-spin) breaking force value is less than the intended minimum breaking force value, carry out another test using method 1.

If the measured (actual) breaking force in this second test fails to meet the intended minimum breaking force value, de-rate the minimum breaking force to a value not exceeding the measured (actual) breaking force value and repeat the type testing using method 1.

In such cases, either de-rate the wire rope grade in line with the de-rated minimum breaking force value or delete it from the wire rope designation.

5.1.4.3 Method 3 —Calculated measured (pre-spin) breaking force

Add together the measured breaking forces of all the individual wires before they are laid into the wire rope and multiply this value by the total spinning loss factor obtained from the results of type testing. The total spinning loss factor used in the calculation shall be the lowest of the three values obtained from type testing.

The wires shall be tested in accordance with the wire tensile test specified in ISO 6892-1.

NOTE The result from this test is known as the "calculated measured (pre-spin) breaking force".

When this method (i.e. method 3) is used for the periodic test (see Table 4) and the calculated measured (pre-spin) breaking force value is less than the intended minimum breaking force value, carry out another test using method 1.

If the measured (actual) breaking force in this second test fails to meet the intended minimum breaking force value, de-rate the minimum breaking force to a value not exceeding the measured (actual) breaking force value and repeat the type testing using method 1.

In such cases, either de-rate the wire rope grade in line with the de-rated minimum breaking force value or delete it from the wire rope designation.

5.1.5 Tests on wires from the wire rope

When tests, if any, are required to be performed on wires taken from the wire rope after fabrication, and unless specified otherwise by the purchaser, sampling, test methods, and acceptance criteria should be in accordance with Annex J.

If tests on the wires are required to be carried out, this should be stated in the purchaser's order.

5.2 Tests on well-measuring wire

The tests shall consist of a simultaneous elongation and tensile test and a separate torsion test. Testing methods and acceptance criteria shall be in accordance with Annex E.

5.3 Tests on well-servicing strands

The tests shall consist of a measured diameter in accordance with 5.1.3 and a breaking force test in accordance with 5.1.4.1.

5.4 Facilities for witnessing tests

The manufacturer shall offer the purchaser or purchaser's representative all necessary facilities for the witnessing of tests (when these are performed) or for the examination of records of type tests in order to be assured of compliance with this document, or both.

Test lengths required by the purchaser should be ordered as additional lengths.

6 Information for use

6.1 Certificate

6.1.1 General

A certificate shall confirm conformance with this document and, unless specified otherwise by the purchaser, shall give at least the following information:

a) certificate number;

b) name and address of the manufacturer;

c) wire rope designation or wire rope description;

d) minimum breaking force;

e) date of issue of the certificate and authentication.

NOTE Refer to the information provided to the purchaser in Annex K.

Quantity and nominal length of wire rope may also be included.

The certificate shall enable traceability of the wire rope.

6.1.2 Test results

When actual test results are required to be certified (see above), the certificate shall additionally give either a) or b) or both, as follows:

a) breaking force test on wire rope — state which value, i.e.

   1) measured breaking force, or

   2) calculated measured (post-spin) breaking force, or

   3) calculated measured (pre-spin) breaking force;

b) tests on wires —

   1) number of wires tested,

2) nominal dimension of wire,

3) measured dimension of wire (diameter or height of profile),

4) breaking force of wire,

5) tensile strength of wire (based on nominal dimension),

6) number of torsions completed (and test length),

7) mass of coating.

6.2 Packaging and marking

6.2.1 Packaging

Wire ropes shall be supplied in coils or on reels at the discretion of the manufacturer.

The wire rope ends shall be secured such that they are prevented from unlaying.

The purchaser should specify any particular packaging requirements.

Rotation-resistant ropes should be supplied on reels.

6.2.2 Marking

The wire rope manufacturer's or supplier's name and address, certificate number if appropriate (see 6.1), length, and wire rope designation shall be legibly and durably marked on a tag attached to each coil or a plate attached to each reel of wire rope.

Annex A
(normative)

Dimensional and mechanical properties of round wires (before wire rope fabrication)

A.1 Tensile strength grades 1 370 N/mm², 1 570 N/mm², 1 770 N/mm², 1 960 N/mm² and 2 160 N/mm²

The permitted variations in tensile strengths of non-alloyed steel wires shall not exceed the nominal values by an amount greater than those given in Table A.1. The values of tensile strength grade are the lower (minima) limits for each tensile strength grade.

Table A.1 — Permitted variations in tensile strength

Nominal diameter mm	Permitted variation in tensile strength above nominal N/mm²
$0{,}2 \leq \delta < 0{,}5$	390
$0{,}5 \leq \delta < 1{,}0$	350
$1{,}0 \leq \delta < 1{,}5$	320
$1{,}5 \leq \delta < 2{,}0$	290
$2{,}0 \leq \delta < 3{,}5$	260
$3{,}5 \leq \delta < 7{,}0$	250

In the case of alloy steel wires, the maximum values shall be no greater than the minimum value plus 15 %.

The diameter tolerances, minimum number of torsions, and minimum masses of coating shall be in accordance with the values given in Table A.2.

Table A.2 — Diameter tolerances, minimum number of torsions, and minimum masses of coating for tensile strength grades 1 370 N/mm², 1 570 N/mm², 1 770 N/mm², 1 960 N/mm² and 2 160 N/mm²

Nominal diameter of wire	Tolerance		Min. number of torsions based on 100δ									Min. coating mass	
	Bright and coated	Coated	Bright and coated					Coated				Coated	
	Quality B	Quality A	Quality B					Quality A					
mm	mm		Tensile strength grade (N/mm²)									g/m²	
			1 370	1 570	1 770	1 960	2 160	1 370	1 570	1 770	1 960	B	A
$0{,}20 \leq \delta < 0{,}25$	±0,008	—										20	
$0{,}25 \leq \delta < 0{,}30$	±0,008	—										30	
$0{,}30 \leq \delta < 0{,}40$	±0,01	±0,025										30	
$0{,}40 \leq \delta < 0{,}50$	±0,01	±0,025										40	75
$0{,}50 \leq \delta < 0{,}55$	±0,015	±0,03	34	30	28	25	23					50	90
$0{,}55 \leq \delta < 0{,}60$	±0,015	±0,03	34	30	28	25	23					50	90

Table A.2 *(continued)*

Nominal diameter of wire	Tolerance		Min. number of torsions based on 100δ									Min. coating mass	
	Bright and coated	Coated	Bright and coated					Coated				Coated	
	Quality B	Quality A	Quality B					Quality A					
mm	mm		Tensile strength grade (N/mm^2)									g/m^2	
			1 370	1 570	1 770	1 960	2 160	1 370	1 570	1 770	1 960	B	A
$0,60 \leq \delta < 0,65$	±0,015	±0,03	34	30	28	25	23					60	120
$0,65 \leq \delta < 0,70$	±0,015	±0,03	34	30	28	25	23					60	120
$0,70 \leq \delta < 0,75$	±0,015	±0,03	34	30	28	25	23		21	19	17	60	120
$0,75 \leq \delta < 0,80$	±0,015	±0,03	34	30	28	25	23		21	19	17	60	120
$0,80 \leq \delta < 0,85$	±0,015	±0,03	34	30	28	25	22		21	19	17	60	140
$0,85 \leq \delta < 0,90$	±0,015	±0,03	34	30	28	25	22		21	19	17	60	140
$0,90 \leq \delta < 0,95$	±0,015	±0,03	34	30	28	25	22		21	19	17	70	150
$0,95 \leq \delta < 1,00$	±0,015	±0,03	34	30	28	25	22		21	19	17	70	150
$1,00 \leq \delta < 1,10$	±0,02	±0,04	33	29	26	23	21		20	18	13	80	160
$1,10 \leq \delta < 1,20$	±0,02	±0,04	33	29	26	23	21		20	18	13	80	160
$1,20 \leq \delta < 1,30$	±0,02	±0,04	33	28	25	22	20		18	15	10	90	170
$1,30 \leq \delta < 1,40$	±0,02	±0,04	33	28	25	22	19		18	15	10	90	170
$1,40 \leq \delta < 1,50$	±0,02	±0,04	33	28	25	22	19		18	15	10	100	180
$1,50 \leq \delta < 1,60$	±0,02	±0,04	33	28	25	22	19		18	15	10	100	180
$1,60 \leq \delta < 1,70$	±0,02	±0,04	33	28	25	22	19		18	15	10	100	200
$1,70 \leq \delta < 1,80$	±0,02	±0,05	33	28	25	22	19		18	15	10	100	200
$1,80 \leq \delta < 1,90$	±0,025	±0,05	32	27	24	21	18		17	14	9	100	200
$1,90 \leq \delta < 2,00$	±0,025	±0,05	32	27	24	21	18		17	14	9	110	215
$2,00 \leq \delta < 2,10$	±0,025	±0,05	32	27	24	21	18		17	14	9	110	215
$2,10 \leq \delta < 2,20$	±0,025	±0,06	32	27	24	21	18		17	14	9	110	215
$2,20 \leq \delta < 2,30$	±0,025	±0,06	31	27	24	21	18	20	17	14	9	125	230
$2,30 \leq \delta < 2,40$	±0,025	±0,06	30	27	24	21	18	20	17	14	9	125	230
$2,40 \leq \delta < 2,50$	±0,025	±0,06	29	26	23	20	18	19	15	12	7	125	230
$2,50 \leq \delta < 2,60$	±0,025	±0,06	29	26	23	20	18	19	15	12	7	125	230
$2,60 \leq \delta < 2,70$	±0,025	±0,06	29	26	23	20	18	19	15	12	7	125	230
$2,70 \leq \delta < 2,80$	±0,025	±0,06	29	26	23	20	18	19	15	12	7	135	240
$2,80 \leq \delta < 2,90$	±0,03	±0,07	28	26	23	20	18	19	15	12	7	135	240
$2,90 \leq \delta < 3,00$	±0,03	±0,07	28	26	23	20	18	18	15	12	7	135	240
$3,00 \leq \delta < 3,10$	±0,03	±0,07	27	25	21	18	16	18	12	8	5	135	240
$3,10 \leq \delta < 3,20$	±0,03	±0,07	27	25	21	18	16	13	12	8	5	135	240
$3,20 \leq \delta < 3,30$	±0,03	±0,07	27	25	21	18	16	13	12	8	5	135	250
$3,30 \leq \delta < 3,40$	±0,03	±0,07	27	25	21	18	16	13	12	8	5	135	250
$3,40 \leq \delta < 3,50$	±0,03	±0,07	27	25	21	18	16	13	12	8	5	135	250
$3,50 \leq \delta < 3,60$	±0,03	±0,07	26	24	20	16	14	11	10	6	5	135	250
$3,60 \leq \delta < 3,70$	±0,03	±0,07	26	24	20	16	14	11	10	6	5	135	260
$3,70 \leq \delta < 3,80$	±0,03	±0,07	25	23	19	15	13	11	8	6	5	135	260
$3,80 \leq \delta < 3,90$	±0,03	±0,07	24	22	18	14	12	11	7	6	4	135	260

Table A.2 *(continued)*

Nominal diameter of wire	Tolerance		Min. number of torsions based on 100δ									Min. coating mass	
	Bright and coated	Coated	Bright and coated					Coated				Coated	
	Quality B	Quality A	Quality B					Quality A					
mm	mm		Tensile strength grade (N/mm^2)									g/m^2	
			1 370	1 570	1 770	1 960	2 160	1 370	1 570	1 770	1 960	B	A
3,90 ≤ δ < 4,00	±0,03	±0,07	24	22	18	14	12	10	7	6	4	135	260
4,00 ≤ δ < 4,20	±0,03	±0,08	23	21	17	13	11	9	6	6	4	150	275
4,20 ≤ δ < 4,40	±0,03	±0,08	21	19	15	11		8	6	5	4	150	275
4,40 ≤ δ < 4,60	±0,03	±0,08	20	18	14	10		7	6	5		150	275
4,60 ≤ δ < 4,80	±0,03	±0,08	18	16	12	8		6	5	4		150	275
4,80 ≤ δ < 5,00	±0,03	±0,08	17	14	11	7		5	4	3		150	275
5,00 ≤ δ < 5,20	±0,03	±0,08	17	14	11	7		5	4	3		150	300
5,20 ≤ δ < 5,40	±0,03	±0,08	14	12	10			5	4	3		160	300
5,40 ≤ δ < 5,60	±0,04	±0,09	12	10	8			4	3	2		160	300
5,60 ≤ δ < 5,80	±0,04	±0,09	10	8	6			3	2	2		160	300
5,80 ≤ δ < 6,00	±0,04	±0,09	8	6	6			3	2	2		160	300
6,00 ≤ δ < 6,25	±0,04	±0,09	8	6	6			3	2	2		160	300
6,25 ≤ δ < 6,50	±0,04	±0,09	7	6	5			2	2			160	300
6,50 ≤ δ < 6,75	±0,04	±0,09	6	5	4			2	2			160	300
6,75 ≤ δ < 7,00	±0,04	±0,10	6	5	4			2	2			160	300

A.2 Tensile strength grades Levels 2, 3, 4 and 5

The diameter tolerances of bright and drawn coated wires shall be in accordance with Table A.3.

The diameter tolerances of final coated wires shall be in accordance with Table A.4.

The individual minimum breaking loads of bright and drawn coated wires and minimum number of torsions shall be in accordance with Table A.5.

The individual minimum breaking loads and torsions of final coated wires shall be in accordance with those given in Table A.5 — subject to a reduction of 10 %.

The maximum values of tensile strength shall be no more than 207 N/mm^2 (30 000 lb/in^2) greater than the minimum values.

The minimum masses of coating for drawn coated and final coated wires shall be in accordance with Tables A.6 and A.7 respectively.

Table A.3 — Diameter tolerances for bright and drawn coated wires

Nominal diameter of wire		Total variation			
		Minus		Plus	
mm	(in)	mm	(in)	mm	(in)
$0,25 \leq \delta \leq 0,64$	$0,010 \leq \delta \leq 0,025$	0,01	0,000 3	0,02	0,000 7
$0,64 < \delta \leq 1,50$	$0,025 < \delta \leq 0,060$	0,01	0,000 5	0,03	0,001
$1,50 < \delta \leq 2,36$	$0,060 < \delta \leq 0,093$	0,03	0,001	0,03	0,001
$2,36 < \delta \leq 3,61$	$0,093 < \delta \leq 0,142$	0,03	0,001	0,04	0,001 5
$3,61 < \delta \leq 5,08$	$0,142 < \delta \leq 0,200$	0,04	0,001 5	0,05	0,002
$5,08 < \delta \leq 6,35$	$0,200 < \delta \leq 0,250$	0,05	0,002	0,05	0,002

Table A.4 — Diameter tolerances for final coated wires

Nominal diameter of wire		Total variation			
		Minus		Plus	
mm	(in)	mm	(in)	mm	(in)
$0,64 \leq \delta \leq 1,55$	$0,025 \leq \delta \leq 0,061$	0,03	0,001	0,03	0,001
$1,55 < \delta \leq 2,01$	$0,061 < \delta \leq 0,079$	0,05	0,002	0,05	0,002
$2,01 < \delta \leq 3,61$	$0,079 < \delta \leq 0,142$	0,08	0,003	0,08	0,003
$\delta > 3,61$	$\delta > 0,142$	0,10	0,004	0,10	0,004

Table A.5 — Minimum breaking force and minimum number of torsions for Levels 2, 3, 4 and 5

Nominal diameter of wire		Level 2			Level 3			Level 4			Level 5		
		Minimum breaking force		Torsion	Minimum breaking force		Torsion	Minimum breaking force		Torsion	Minimum breaking force		Torsion
mm	(in)	N	(lb)		N	(lb)		N	(lb)		N	(lb)	
0,25	0,010	76	17	254	89	20	234	98	22	218	107	24	190
0,28	0,011	93	21	231	107	24	213	120	27	198	129	29	173
0,30	0,012	111	25	212	129	29	195	142	32	182	151	34	158
0,33	0,013	129	29	195	151	34	180	165	37	168	178	40	146
0,36	0,014	151	34	181	173	39	167	191	43	156	205	46	136
0,38	0,015	173	39	169	200	45	156	218	49	145	236	53	126
0,41	0,016	196	44	158	227	51	146	249	56	136	267	60	118
0,43	0,017	222	50	149	254	57	137	280	63	128	302	68	111
0,46	0,018	249	56	141	285	64	130	316	71	121	338	76	105
0,48	0,019	276	62	133	320	72	123	351	79	114	378	85	100
0,51	0,020	307	69	126	351	79	116	387	87	108	418	94	94
0,53	0,021	338	76	120	387	87	111	427	96	103	458	103	90
0,56	0,022	369	83	115	427	96	106	467	105	98	503	113	86
0,58	0,023	405	91	110	467	105	101	512	115	94	552	124	82
0,61	0,024	440	99	105	507	114	97	556	125	90	600	135	78
0,64	0,025	476	107	101	547	123	93	605	136	86	649	146	75
0,66	0,026	516	116	97	592	133	89	654	147	83	703	158	72

Table A.5 *(continued)*

Nominal diameter of wire		Level 2			Level 3			Level 4			Level 5		
		Minimum breaking force		Torsion	Minimum breaking force		Torsion	Minimum breaking force		Torsion	Minimum breaking force		Torsion
mm	(in)	N	(lb)		N	(lb)		N	(lb)		N	(lb)	
0,69	0,027	556	125	93	641	144	86	703	158	80	756	170	70
0,71	0,028	596	134	90	689	155	83	756	170	77	814	183	67
0,74	0,029	641	144	87	738	166	80	810	182	74	872	196	65
0,76	0,030	685	154	84	787	177	77	867	195	72	934	210	62
0,79	0,031	729	164	81	841	189	75	925	208	69	996	224	60
0,81	0,032	778	175	78	894	210	72	983	221	67	1 059	238	58
0,84	0,033	827	186	76	952	214	70	1 045	235	65	1 125	253	57
0,86	0,034	876	197	74	1 010	227	68	1 112	250	63	1 192	268	55
0,89	0,035	930	209	72	1 068	240	66	1 174	264	61	1 263	284	53
0,91	0,036	983	221	70	1 130	254	64	1 245	280	60	1 339	301	52
0,94	0,037	1 036	233	68	1 192	268	62	1 312	295	58	1 410	317	50
0,97	0,038	1 094	246	66	1 259	283	61	1 383	311	56	1 486	334	49
0,99	0,039	1 152	259	64	1 326	298	59	1 454	327	55	1 566	352	48
1,02	0,040	1 210	272	62	1 392	313	57	1 530	344	53	1 646	370	46
1,04	0,041	1 272	286	61	1 463	329	56	1 606	361	52	1 726	388	45
1,07	0,042	1 334	300	59	1 535	345	55	1 686	379	51	1 810	407	44
1,09	0,043	1 397	314	58	1 606	361	53	1 766	397	50	1 899	427	43
1,12	0,044	1 459	328	57	1 681	378	52	1 846	415	48	1 988	447	42
1,14	0,045	1 526	343	55	1 757	395	51	1 930	434	47	2 077	467	41
1,17	0,046	1 592	358	54	1 833	412	50	2 015	453	46	2 166	487	40
1,19	0,047	1 664	374	53	1 913	430	49	2 104	473	45	2 260	508	39
1,22	0,048	1 735	390	52	1 993	448	48	2 193	493	44	2 357	530	38
1,24	0,049	1 806	406	51	2 077	467	47	2 282	513	43	2 455	552	38
1,27	0,050	1 877	422	50	2 162	486	46	2 375	534	42	2 553	574	37
1,30	0,051	1 953	439	49	2 246	505	45	2 469	555	42	2 655	597	36
1,32	0,052	2 028	456	48	2 335	525	44	2 566	577	41	2 758	620	35
1,35	0,053	2 108	474	47	2 424	545	43	2 664	599	40	2 865	644	35
1,37	0,054	2 184	491	46	2 513	565	42	2 762	621	39	2 971	668	34
1,40	0,055	2 264	509	45	2 607	586	41	2 865	644	38	3 082	693	33
1,42	0,056	2 349	528	44	2 700	607	41	2 967	667	38	3 194	718	33
1,45	0,057	2 429	546	43	2 793	628	40	3 074	691	37	3 305	743	32
1,47	0,058	2 513	565	43	2 891	650	39	3 180	715	36	3 421	769	32
1,50	0,059	2 598	584	42	2 989	672	38	3 287	739	36	3 536	795	31

Table A.5 *(continued)*

Nominal diameter of wire		Level 2			Level 3			Level 4			Level 5		
		Minimum breaking force		Torsion	Minimum breaking force		Torsion	Minimum breaking force		Torsion	Minimum breaking force		Torsion
mm	(in)	N	(lb)		N	(lb)		N	(lb)		N	(lb)	
1,52	0,060	2 687	604	41	3 091	695	38	3 398	764	35	3 652	821	30
1,55	0,061	2 776	624	40	3 194	718	37	3 509	789	35	3 772	848	30
1,57	0,062	2 865	644	40	3 296	741	37	3 625	815	34	3 896	876	29
1,60	0,063	2 958	665	39	3 398	764	36	3 741	841	33	4 021	904	29
1,63	0,064	3 047	685	38	3 505	788	35	3 856	867	33	4 146	932	28
1,65	0,065	3 145	707	38	3 616	813	35	3 977	894	32	4 275	961	28
1,68	0,066	3 238	728	37	3 723	837	34	4 097	921	32	4 404	990	28
1,70	0,067	3 336	750	37	3 834	862	34	4 217	948	31	4 533	1 019	27
1,73	0,068	3 434	772	36	3 945	887	33	4 341	976	31	4 666	1 049	27
1,75	0,069	3 532	794	36	4 061	913	33	4 466	1 004	30	4 804	1 080	26
1,78	0,070	3 634	817	35	4 177	939	32	4 595	1 033	30	4 942	1 111	26
1,80	0,071	3 736	840	35	4 297	966	32	4 724	1 062	29	5 080	1 142	26
1,83	0,072	3 839	863	34	4 412	992	31	4 853	1 091	29	5 218	1 173	25
1,85	0,073	3 941	886	34	4 533	1 019	31	4 986	1 121	29	5 360	1 205	25
1,88	0,074	4 048	910	33	4 657	1 047	30	5 120	1 151	28	5 507	1 238	24
1,91	0,075	4 154	934	33	4 777	1 074	30	5 258	1 182	28	5 653	1 271	24
1,93	0,076	4 266	959	32	4 906	1 103	30	5 395	1 213	27	5 800	1 304	24
1,96	0,077	4 372	983	32	5 031	1 131	29	5 533	1 244	27	5 947	1 337	23
1,98	0,078	4 484	1 008	31	5 160	1 160	29	5 676	1 276	27	6 098	1 371	23
2,01	0,079	4 599	1 034	31	5 289	1 189	28	5 818	1 308	26	6 254	1 406	23
2,03	0,080	4 710	1 059	30	5 418	1 218	28	5 960	1 340	26	6 410	1 441	22
2,06	0,081	4 826	1 085	30	5 551	1 248	28	6 107	1 373	26	6 565	1 476	22
2,08	0,082	4 942	1 111	30	5 685	1 278	27	6 254	1 406	25	6 721	1 511	22
2,11	0,083	5 062	1 138	29	5 822	1 309	27	6 405	1 440	25	6 886	1 548	22
2,13	0,084	5 182	1 165	29	5 956	1 339	27	6 552	1 473	25	7 046	1 584	21
2,16	0,085	5 302	1 192	29	6 098	1 371	26	6 708	1 508	24	7 210	1 621	21
2,18	0,086	5 422	1 219	28	6 236	1 402	26	6 859	1 542	24	7 375	1 658	21
2,21	0,087	5 547	1 247	28	6 378	1 434	26	7 014	1 577	24	7 544	1 696	21
2,24	0,088	5 671	1 275	28	6 521	1 466	25	7 175	1 613	23	7 713	1 734	20
2,26	0,089	5 796	1 303	27	6 668	1 499	25	7 330	1 648	23	7 882	1 772	20
2,29	0,090	5 925	1 332	27	6 810	1 531	25	7 490	1 684	23	8 055	1 811	20
2,31	0,091	6 049	1 360	27	6 957	1 564	24	7 655	1 721	23	8 229	1 850	20
2,34	0,092	6 183	1 390	26	7 108	1 598	24	7 820	1 758	22	8 407	1 890	19
2,36	0,093	6 312	1 419	26	7 259	1 632	24	7 984	1 795	22	8 585	1 930	19

Table A.5 *(continued)*

Nominal diameter of wire		Level 2			Level 3			Level 4			Level 5		
		Minimum breaking force		Torsion	Minimum breaking force		Torsion	Minimum breaking force		Torsion	Minimum breaking force		Torsion
mm	(in)	N	(lb)		N	(lb)		N	(lb)		N	(lb)	
2,39	0,094	6 445	1 449	26	7 410	1 666	24	8 149	1 832	22	8 763	1 970	19
2,41	0,095	6 579	1 479	25	7 562	1 700	23	8 318	1 870	22	8 945	2 011	19
2,44	0,096	6 712	1 509	25	7 717	1 735	23	8 491	1 909	21	9 127	2 052	18
2,46	0,097	6 845	1 539	25	7 873	1 770	23	8 660	1 947	21	9 310	2 093	18
2,49	0,098	6 983	1 570	25	8 033	1 806	23	8 834	1 986	21	9 496	2 135	18
2,51	0,099	7 121	1 601	24	8 189	1 841	22	9 012	2 026	21	9 683	2 177	18
2,54	0,100	7 264	1 633	24	8 349	1 877	22	9 185	2 065	20	9 875	2 220	18
2,57	0,101	7 401	1 664	24	8 513	1 914	22	9 363	2 105	20	10 066	2 263	18
2,59	0,102	7 544	1 696	24	8 678	1 951	22	9 545	2 146	20	10 262	2 307	17
2,62	0,103	7 686	1 728	23	8 843	1 988	21	9 723	2 186	20	10 453	2 350	17
2,64	0,104	7 833	1 761	23	9 007	2 025	21	9 910	2 228	20	10 653	2 395	17
2,67	0,105	7 980	1 794	23	9 176	2 063	21	10 093	2 269	19	10 849	2 439	17
2,69	0,106	8 126	1 827	23	9 345	2 101	21	10 279	2 311	19	11 049	2 484	17
2,72	0,107	8 273	1 860	22	9 514	2 139	21	10 466	2 353	19	11 249	2 529	16
2,74	0,108	8 425	1 894	22	9 688	2 178	20	10 657	2 396	19	11 454	2 575	16
2,77	0,109	8 576	1 928	22	9 861	2 217	20	10 844	2 438	19	11 658	2 621	16
2,79	0,110	8 727	1 962	22	10 035	2 256	20	11 040	2 482	18	11 867	2 668	16
2,82	0,111	8 878	1 996	22	10 213	2 296	20	11 231	2 525	18	12 076	2 715	16
2,84	0,112	9 034	2 031	21	10 391	2 336	20	11 427	2 569	18	12 285	2 762	16
2,87	0,113	9 190	2 066	21	10 568	2 376	19	11 623	2 613	18	12 494	2 809	15
2,90	0,114	9 345	2 101	21	10 746	2 416	19	11 823	2 658	18	12 708	2 857	15
2,92	0,115	9 505	2 137	21	10 929	2 457	19	12 023	2 703	18	12 926	2 906	15
2,95	0,116	9 661	2 172	21	11 111	2 498	19	12 223	2 748	17	13 139	2 954	15
2,97	0,117	9 826	2 209	20	11 298	2 540	19	12 428	2 794	17	13 357	3 003	15
3,00	0,118	9 986	2 245	20	11 485	2 582	18	12 632	2 840	17	13 580	3 053	15
3,02	0,119	10 146	2 281	20	11 672	2 624	18	12 837	2 886	17	13 798	3 102	15
3,05	0,120	10 310	2 318	20	11 858	2 666	18	13 046	2 933	17	14 025	3 153	14
3,07	0,121	10 475	2 355	20	12 050	2 709	18	13 255	2 980	17	14 247	3 203	14
3,10	0,122	10 644	2 393	19	12 241	2 752	18	13 464	3 027	17	14 474	3 254	14
3,12	0,123	10 813	2 431	19	12 432	2 795	18	13 678	3 075	16	14 701	3 305	14
3,15	0,124	10 978	2 468	19	12 628	2 839	18	13 891	3 123	16	14 932	3 357	14
3,18	0,125	11 151	2 507	19	12 824	2 883	17	14 105	3 171	16	15 163	3 409	14
3,20	0,126	11 320	2 545	19	13 019	2 927	17	14 323	3 220	16	15 395	3 461	14

Table A.5 *(continued)*

Nominal diameter of wire		Level 2			Level 3			Level 4			Level 5		
		Minimum breaking force		Torsion	Minimum breaking force		Torsion	Minimum breaking force		Torsion	Minimum breaking force		Torsion
mm	(in)	N	(lb)		N	(lb)		N	(lb)		N	(lb)	
3,23	0,127	11 494	2 584	19	13 215	2 971	17	14 541	3 269	16	15 630	3 514	14
3,25	0,128	11 667	2 623	18	13 415	3 016	17	14 758	3 318	16	15 866	3 567	13
3,28	0,129	11 841	2 662	18	13 615	3 061	17	14 981	3 368	16	16 102	3 620	13
3,30	0,130	12 018	2 702	18	13 820	3 107	17	15 203	3 418	15	16 342	3 674	13
3,33	0,131	12 192	2 741	18	14 025	3 153	17	15 426	3 468	15	16 582	3 728	13
3,35	0,132	12 370	2 781	18	14 229	3 199	16	15 653	3 519	15	16 822	3 782	13
3,38	0,133	12 552	2 822	18	14 434	3 245	16	15 879	3 570	15	17 067	3 837	13
3,40	0,134	12 730	2 862	18	14 643	3 292	16	16 106	3 621	15	17 312	3 892	13
3,43	0,135	12 913	2 903	17	14 852	3 339	16	16 333	3 672	15	17 561	3 948	13
3,45	0,136	13 095	2 944	17	15 061	3 386	16	16 564	3 724	15	17 810	4 004	13
3,48	0,137	13 282	2 986	17	15 270	3 433	16	16 800	3 777	15	18 059	4 060	13
3,51	0,138	13 464	3 027	17	15 483	3 481	16	17 031	3 829	14	18 312	4 117	12
3,53	0,139	13 651	3 069	17	15 697	3 529	15	17 267	3 882	14	18 562	4 173	12
3,56	0,140	13 838	3 111	17	15 915	3 578	15	17 503	3 935	14	18 819	4 231	12
3,58	0,141	14 025	3 153	17	16 128	3 626	15	17 743	3 989	14	19 073	4 288	12
3,61	0,142	14 216	3 196	17	16 346	3 675	15	17 983	4 043	14	19 331	4 346	12
3,63	0,143	14 407	3 239	16	16 569	3 725	15	18 223	4 097	14	19 589	4 404	12
3,66	0,144	14 598	3 282	16	16 787	3 774	15	18 468	4 152	14	19 851	4 463	12
3,68	0,145	14 790	3 325	16	17 009	3 824	15	18 713	4 207	14	20 114	4 522	12
3,71	0,146	14 985	3 369	16	17 232	3 874	15	18 957	4 262	14	20 376	4 581	12
3,73	0,147	15 181	3 413	16	17 458	3 925	15	19 202	4 317	13	20 643	4 641	12
3,76	0,148	15 377	3 457	16	17 681	3 975	14	19 451	4 373	13	20 910	4 701	11
3,78	0,149	15 572	3 501	16	17 908	4 026	14	19 700	4 429	13	21 177	4 761	11
3,81	0,150	15 773	3 546	16	18 139	4 078	14	19 954	4 486	13	21 448	4 822	11
3,84	0,151	15 973	3 591	15	18 366	4 129	14	20 203	4 542	13	21 720	4 883	11
3,86	0,152	16 173	3 636	15	18 597	4 181	14	20 456	4 599	13	21 991	4 944	11
3,89	0,153	16 373	3 681	15	18 828	4 233	14	20 714	4 657	13	22 267	5 006	11
3,91	0,154	16 578	3 727	15	19 064	4 286	14	20 968	4 714	13	22 542	5 068	11
3,94	0,155	16 782	3 773	15	19 295	4 338	14	21 226	4 772	13	22 818	5 130	11
3,96	0,156	16 987	3 819	15	19 531	4 391	14	21 488	4 831	13	23 098	5 193	11
3,99	0,157	17 192	3 865	15	19 771	4 445	14	21 746	4 889	13	23 379	5 256	11
4,01	0,158	17 401	3 912	15	20 007	4 498	13	22 009	4 948	12	23 659	5 319	11
4,04	0,159	17 605	3 958	15	20 247	4 552	13	22 271	5 007	12	23 944	5 383	11

Table A.5 *(continued)*

Nominal diameter of wire		Level 2			Level 3			Level 4			Level 5		
		Minimum breaking force		Torsion	Minimum breaking force		Torsion	Minimum breaking force		Torsion	Minimum breaking force		Torsion
mm	(in)	N	(lb)		N	(lb)		N	(lb)		N	(lb)	
4,06	0,160	17 814	4 005	14	20 487	4 606	13	22 538	5 067	12	24 228	5 447	10
4,09	0,161	18 028	4 053	14	20 732	4 661	13	22 805	5 127	12	24 513	5 511	10
4,11	0,162	18 237	4 100	14	20 972	4 715	13	23 072	5 187	12	24 802	5 576	10
4,14	0,163	18 450	4 148	14	21 217	4 770	13	23 339	5 247	12	25 091	5 641	10
4,17	0,164	18 664	4 196	14	21 462	4 825	13	23 610	5 308	12	25 380	5 706	10
4,19	0,165	18 877	4 244	14	21 711	4 881	13	23 881	5 369	12	25 674	5 772	10
4,22	0,166	19 095	4 293	14	21 960	4 937	13	24 153	5 430	12	25 967	5 838	10
4,24	0,167	19 309	4 341	14	22 209	4 993	13	24 428	5 492	12	26 261	5 904	10
4,27	0,168	19 527	4 390	14	22 458	5 049	13	24 704	5 554	12	26 555	5 970	10
4,29	0,169	19 749	4 440	14	22 707	5 105	12	24 980	5 616	12	26 853	6 037	10
4,32	0,170	19 967	4 489	14	22 961	5 162	12	25 260	5 679	11	27 151	6 104	10
4,34	0,171	20 189	4 539	13	23 214	5 219	12	25 536	5 741	11	27 453	6 172	10
4,37	0,172	20 412	4 589	13	23 472	5 277	12	25 816	5 804	11	27 756	6 240	10
4,39	0,173	20 634	4 639	13	23 726	5 334	12	26 101	5 868	11	28 058	6 308	10
4,42	0,174	20 857	4 689	13	23 984	5 392	12	26 386	5 932	11	28 360	6 376	10
4,45	0,175	21 084	4 740	13	24 242	5 450	12	26 670	5 996	11	28 667	6 445	9
4,47	0,176	21 306	4 790	13	24 504	5 509	12	26 955	6 060	11	28 974	6 514	9
4,50	0,177	21 533	4 841	13	24 766	5 568	12	27 240	6 124	11	29 286	6 584	9
4,52	0,178	21 764	4 893	13	25 029	5 627	12	27 529	6 189	11	29 593	6 653	9
4,55	0,179	21 991	4 944	13	25 291	5 686	12	27 818	6 254	11	29 904	6 723	9
4,57	0,180	22 222	4 996	13	25 554	5 745	12	28 111	6 320	11	30 220	6 794	9
4,60	0,181	22 454	5 048	13	25 821	5 805	12	28 405	6 386	11	30 531	6 864	9
4,62	0,182	22 685	5 100	13	26 088	5 865	11	28 698	6 452	11	30 847	6 935	9
4,65	0,183	22 916	5 152	12	26 354	5 925	11	28 992	6 518	11	31 167	7 007	9
4,67	0,184	23 152	5 205	12	26 626	5 986	11	29 286	6 584	10	31 483	7 078	9
4,70	0,185	23 388	5 258	12	26 897	6 047	11	29 584	6 651	10	31 803	7 150	9
4,72	0,186	23 623	5 311	12	27 168	6 108	11	29 882	6 718	10	32 123	7 212	9
4,75	0,187	23 859	5 364	12	27 440	6 169	11	30 184	6 786	10	32 448	7 295	9
4,78	0,188	24 099	5 418	12	27 711	6 230	11	30 487	6 854	10	32 773	7 368	9
4,80	0,189	24 339	5 472	12	27 987	6 292	11	30 785	6 921	10	33 098	7 441	9
4,83	0,190	24 575	5 525	12	28 263	6 354	11	31 092	6 990	10	33 422	7 514	9
4,85	0,191	24 820	5 580	12	28 543	6 417	11	31 394	7 058	10	33 751	7 588	9
4,88	0,192	25 060	5 634	12	28 819	6 479	11	31 701	7 127	10	34 081	7 662	8
4,90	0,193	25 305	5 689	12	29 099	6 542	11	32 008	7 196	10	34 410	7 736	8

Table A.5 *(continued)*

Nominal diameter of wire		Level 2			Level 3			Level 4			Level 5		
		Minimum breaking force		Torsion	Minimum breaking force		Torsion	Minimum breaking force		Torsion	Minimum breaking force		Torsion
mm	(in)	N	(lb)		N	(lb)		N	(lb)		N	(lb)	
4,93	0,194	25 549	5 744	12	29 379	6 605	11	32 319	7 266	10	34 739	7 810	8
4,95	0,195	25 794	5 799	12	29 659	6 668	11	32 626	7 335	10	35 072	7 885	8
4,98	0,196	26 039	5 854	12	29 944	6 732	11	32 937	7 405	10	35 411	7 961	8
5,00	0,197	26 283	5 909	11	30 229	6 796	10	33 249	7 475	10	35 744	8 036	8
5,03	0,198	26 532	5 965	11	30 513	6 860	10	33 565	7 546	10	36 082	8 112	8
5,05	0,199	26 781	6 021	11	30 798	6 924	10	33 880	7 617	10	36 420	8 188	8
5,08	0,200	27 030	6 077	11	31 087	6 989	10	34 196	7 688	9	36 758	8 264	8
5,11	0,201	27 280	6 133	11	31 372	7 053	10	34 512	7 759	9	37 101	8 341	8
5,13	0,202	27 533	6 190	11	31 661	7 118	10	34 828	7 830	9	37 443	8 418	8
5,16	0,203	27 787	6 247	11	31 954	7 184	10	35 148	7 902	9	37 786	8 495	8
5,18	0,204	28 040	6 304	11	32 244	7 249	10	35 468	7 974	9	38 128	8 572	8
5,21	0,205	28 294	6 361	11	32 537	7 315	10	35 793	8 047	9	38 475	8 650	8
5,23	0,206	28 547	6 418	11	32 831	7 381	10	36 113	8 119	9	38 822	8 728	8
5,26	0,207	28 805	6 476	11	33 124	7 447	10	36 438	8 192	9	39 169	8 806	8
5,28	0,208	29 063	6 534	11	33 422	7 514	10	36 763	8 265	9	39 520	8 885	8
5,31	0,209	29 321	6 592	11	33 720	7 581	10	37 092	8 339	9	39 872	8 964	8
5,33	0,210	29 579	6 650	11	34 018	7 648	10	37 417	8 412	9	40 223	9 043	8
5,36	0,211	29 837	6 708	11	34 316	7 715	10	37 746	8 486	9	40 579	9 123	8
5,38	0,212	30 100	6 767	11	34 614	7 782	10	38 075	8 560	9	40 930	9 202	8
5,41	0,213	30 362	6 826	11	34 917	7 850	10	38 408	8 635	9	41 286	9 282	8
5,44	0,214	30 624	6 885	11	35 219	7 918	10	38 742	8 710	9	41 647	9 363	7
5,46	0,215	30 887	6 944	10	35 522	7 986	9	39 071	8 784	9	42 002	9 443	7
5,49	0,216	31 154	7 004	10	35 824	8 054	9	39 409	8 860	9	42 363	9 524	7
5,51	0,217	31 416	7 063	10	36 131	8 123	9	39 743	8 935	9	42 723	9 605	7
5,54	0,218	31 683	7 123	10	36 438	8 192	9	40 081	9 011	9	43 088	9 687	7
5,56	0,219	31 950	7 183	10	36 745	8 261	9	40 419	9 087	9	43 448	9 768	7
5,59	0,220	32 221	7 244	10	37 052	8 330	9	40 757	9 163	8	43 813	9 850	7
5,61	0,221	32 488	7 304	10	37 363	8 400	9	41 100	9 240	8	44 182	9 933	7
5,64	0,222	32 760	7 365	10	37 670	8 469	9	41 438	9 316	8	44 547	10 015	7
5,66	0,223	33 031	7 426	10	37 981	8 539	9	41 780	9 393	8	44 916	10 098	7
5,69	0,224	33 302	7 487	10	38 297	8 610	9	42 127	9 471	8	45 285	10 181	7
5,72	0,225	33 574	7 548	10	38 609	8 680	9	42 470	9 548	8	45 654	10 264	7
5,74	0,226	33 845	7 609	10	38 924	8 751	9	42 816	9 626	8	46 028	10 348	7

Table A.5 *(continued)*

Nominal diameter of wire		Level 2			Level 3			Level 4			Level 5		
		Minimum breaking force		Torsion	Minimum breaking force		Torsion	Minimum breaking force		Torsion	Minimum breaking force		Torsion
mm	(in)	N	(lb)		N	(lb)		N	(lb)		N	(lb)	
5,77	0,227	34 121	7 671	10	39 240	8 822	9	43 163	9 704	8	46 402	10 432	7
5,79	0,228	34 396	7 733	10	39 556	8 893	9	43 510	9 782	8	46 775	10 516	7
5,82	0,229	34 672	7 795	10	39 872	8 964	9	43 862	9 861	8	47 149	10 600	7
5,84	0,230	34 948	7 857	10	40 192	9 036	9	44 209	9 939	8	47 527	10 685	7
5,87	0,231	35 228	7 920	10	40 508	9 107	9	44 560	10 018	8	47 905	10 770	7
5,89	0,232	35 504	7 982	10	40 828	9 179	9	44 911	10 097	8	48 283	10 855	7
5,92	0,233	35 784	8 045	9	41 153	9 252	9	45 267	10 177	8	48 661	10 940	7
5,94	0,234	36 064	8 108	9	41 473	9 324	9	45 623	10 257	8	49 044	11 026	7
5,97	0,235	36 345	8 171	9	41 798	9 397	9	45 975	10 336	8	49 426	11 112	7
5,99	0,236	36 629	8 235	9	42 123	9 470	8	46 335	10 417	8	49 809	11 198	7
6,02	0,237	36 910	8 298	9	42 447	9 543	8	46 691	10 497	8	50 191	11 284	7
6,05	0,238	37 194	8 362	9	42 772	9 616	8	47 051	10 578	8	50 578	11 371	7
6,07	0,239	37 479	8 426	9	43 101	9 690	8	47 411	10 659	8	50 965	11 458	7
6,10	0,240	37 764	8 490	9	43 426	9 763	8	47 772	10 740	8	51 352	11 545	6
6,12	0,241	38 048	8 554	9	43 755	9 837	8	48 132	10 821	8	51 744	11 633	6
6,15	0,242	38 337	8 619	9	44 089	9 912	8	48 497	10 903	8	52 131	11 720	6
6,17	0,243	38 622	8 683	9	44 418	9 986	8	48 857	10 984	8	52 522	11 808	6
6,20	0,244	38 911	8 748	9	44 751	10 061	8	49 226	11 067	8	52 918	11 897	6
6,22	0,245	39 200	8 813	9	45 080	10 135	8	49 591	11 149	7	53 309	11 985	6
6,25	0,246	39 494	8 879	9	45 414	10 210	8	49 955	11 231	7	53 705	12 074	6
6,27	0,247	39 783	8 944	9	45 752	10 286	8	50 325	11 314	7	54 101	12 163	6
6,30	0,248	40 076	9 010	9	46 086	10 361	8	50 694	11 397	7	54 497	12 252	6
6,32	0,249	40 366	9 075	9	46 424	10 437	8	51 063	11 480	7	54 893	12 341	6
6,35	0,250	40 659	9 141	9	46 757	10 512	8	51 437	11 564	7	55 293	12 431	6

Table A.6 — Minimum coating masses for drawn coated wire Levels 2, 3, 4 and 5

Nominal diameter of wire		Minimum mass of coating	
mm	(in)	g/m^2	(oz/ft^2)
0,46 to 0,72	0,018 to 0,028	30	0,10
0,73 to 1,53	0,029 to 0,060	60	0,20
1,54 to 2,29	0,061 to 0,090	90	0,30
2,30 to 3,56	0,091 to 0,140	120	0,40

Table A.7 — Minimum coating masses for final coated wire Levels 2, 3, 4 and 5

Nominal diameter of wire		Minimum mass of coating	
mm	(in)	g/m^2	(oz/ft^2)
0,72 to 1,20	0,028 to 0,047	60	0,20
1,21 to 1,38	0,048 to 0,054	120	0,40
1,39 to 1,61	0,055 to 0,063	150	0,50
1,62 to 2,01	0,064 to 0,079	180	0,60
2,02 to 2,34	0,080 to 0,092	210	0,70
2,35 and larger	0,093 and larger	240	0,80

Annex B
(normative)

Methods of wire testing for Levels 2, 3, 4 and 5

B.1 Diameter test

The diameter shall be determined from two measurements in two perpendicular directions on the same section and the same diametrical plane using a measuring instrument, for example, a micrometer, accurate to 0,01 mm.

B.2 Tensile test

Specimens shall not be less than 450 mm (= 18 in) long, and the distance between the grips of the testing machine shall not be less than 305 mm (= 12 in). The speed of the movable head of the testing machine, under no load, shall not exceed 0,5 mm/s (= 1 in/min). Any specimen breaking within 6 mm (= 1/4 in) of the jaws may be disregarded and a retest performed.

B.3 Torsion test

The distance between the jaws of the testing machine shall be 203 mm ± 1 mm (= 8 in ± 1/16 in). In order to save time during tests, the distance may be shortened to as small as 100 wire diameters.

One end of the wire shall be rotated with respect to the other end at uniform speed not to exceed sixty 360° revolutions per minute, until breakage occurs.

The machine shall be equipped with an automatic counter to record the number of revolutions causing breakage. One jaw shall be fixed axially and the other jaw movable axially and arranged for applying tension weights to wire under test. Tests in which breakage occurs within 3 mm (= 1/8 in) of the jaw may be discounted.

During the torsion test, tension weights as shown in Table B.1 shall be applied to the wire being tested. Tension weights shall not exceed twice the minimum values given in Table B.1.

When the distance between the jaws of the testing machine is other than 203 mm, the minimum torsion values given in Table A.5 shall be adjusted in direct proportion to the change in jaw spacing.

B.4 Coating tests

The determination of mass of coating shall be carried out in accordance with ISO 7989-2. An adhesion test shall be carried out in accordance with ISO 7989-2.

Table B.1 — Applied tension for torsion tests

Nominal diameter of wire		Minimum applied tension	
mm	(in)	N	(lbf)
0,28 to 0,42	0,011 to 0,016	4	1
0,43 to 0,52	0,017 to 0,020	9	2
0,53 to 0,77	0,021 to 0,030	18	4
0,78 to 1,02	0,031 to 0,040	27	6
1,03 to 1, 28	0,041 to 0,050	36	8

Table B.1 *(continued)*

Nominal diameter of wire		Minimum applied tension	
mm	(in)	N	(lbf)
1,29 to 1, 53	0,051 to 0,060	40	9
1,54 to 1,79	0,061 to 0,070	49	11
1,80 to 2,04	0,071 to 0,080	58	13
2,05 to 2,30	0,081 to 0,090	71	16
2,31 to 2,55	0,091 to 0,100	85	19
2,56 to 2,80	0,101 to 0,110	93	21
2,81 to 3,06	0,111 to 0,120	102	23
3,07 to 3,31	0,121 to 0,130	111	25
3,32 to 3,57	0,131 to 0,140	116	26
3,58 to 3,82	0,141 to 0,150	125	28
3,83 to 4,07	0,151 to 0,160	133	30
4,08 to 4,33	0,161 to 0,170	142	32
4,34 to 4,58	0,171 to 0,180	151	34
4,59 to 4,84	0,181 to 0,190	160	36
4,85 to 5,09	0,191 to 0,200	169	38
5,10 to 5,34	0,201 to 0,210	178	40
5,35 to 5,60	0,211 to 0,220	187	42
5,61 to 5,85	0,221 to 0,230	196	44
5,86 to 6,10	0,231 to 0,240	205	46
6,11 to 6,35	0,241 to 0,250	214	48

Annex C
(normative)

Tables of breaking forces for the more common classes, sizes and grades of stranded ropes up to and including 60 mm diameter

Tables C.1 to C.24 give the breaking forces of the more common classes, sizes and grades of stranded ropes up to and including 60 mm diameter.

Higher values of minimum breaking force than those given in the Tables may be guaranteed by the manufacturer.

NOTE 1 The equivalent minimum breaking force values in kilonewtons for wire rope grades IPS, EIP and EEIP are given for comparison with the minimum breaking force values for grades 1770, 1960 and 2160.

NOTE 2 The conversion factor from short tons to kilonewtons is 8,896.

NOTE 3 The values of nominal length mass are approximate and are given for information.

Table C.1 — Class 6 × 7 fibre core

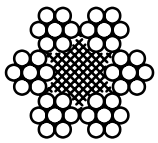
Typical cross-section				Typical construction					
				Rope construction	Strand construction		Outer wires		
							Total	Per strand	
				6 × 7-FC	1-6		36	6	
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})					
				Grade 1770	Grade 1960	Grade IPS		Grade EIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	(short tons)	kN	(short tons)
6		12,4		21,2	23,4				
(6,35)	(1/4)		(0,09)			23,5	(2,64)	25,8	(2,90)
7		16,9		28,8	31,9				
(7,94)	(5/16)		(0,15)			36,5	(4,10)	40,1	(4,51)
8		22,1		37,6	41,6				
9		27,9		47,6	52,7				
(9,5)	(3/8)		(0,21)			52,1	(5,86)	57,4	(6,45)
10		34,5		58,8	65,1				
11		41,7		71,1	78,7				
(11,1)	(7/16)		(0,29)			70,5	(7,92)	77,6	(8,72)
12		49,7		84,6	93,7				
(12,7)	(1/2)		(0,37)			91,6	(10,3)	101	(11,4)
13		58,3		99,3	110				
14		67,6		115	128				
(14,3)	(9/16)		(0,47)			116	(13,0)	127	(14,3)
(15,9)	(5/8)		(0,58)			141	(15,8)	156	(17,5)
16		88,3		150	167				
18		112		190	211				

Table C.1 *(continued)*

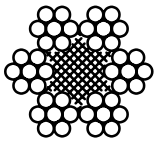
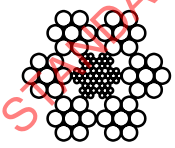
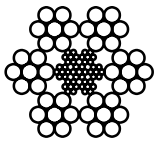
Typical cross-section				Typical construction					
				Rope construction	Strand construction			Outer wires	
								Total	Per strand
				6 × 7-FC	1-6			36	6
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})					
				Grade 1770	Grade 1960	Grade IPS		Grade EIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	(short tons)	kN	(short tons)
19		125		212	235				
(19,1)	(3/4)		(0,84)			202	(22,7)	222	(25,0)
20		138		235	260				
22		167		284	315				
(22,2)	(7/8)		(1,15)			273	(30,7)	301	(33,8)
24		199		338	375				
(25,4)	(1)		(1,50)			353	(39,7)	389	(43,7)
26		233		397	440				
28		270		461	510				
(28,6)	(1-1/8)		(1,89)			443	(49,8)	488	(54,9)
(31,8)	(1-1/4)		(2,34)			543	(61,0)	597	(67,1)
32		353		602	666				
(34,9)	(1-3/8)		(2,83)			650	(73,1)	715	(80,4)
35		423		720	797				
36		447		762	843				
38		498		849	940				
(38,1)	(1-1/2)		(3,37)			767	(86,2)	843	(94,8)
40		552		940	1 040				

Table C.2 — Class 6 × 7 steel core

Typical cross-section				Typical construction					
				Rope construction	Strand construction			Outer wires	
								Total	Per strand
				6 × 7-WSC 6 × 7-IWRC	1-6 1-6			36 36	6 6
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})					
				Grade 1770	Grade 1960	Grade IPS		Grade EIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	(short tons)	kN	(short tons)
6		13,8		22,9	25,3				
(6,35)	(1/4)		(0,10)			25,3	(2,84)	27,8	(3,12)

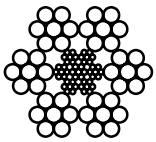
NOTE For smaller diameters with wire strand core (WSC), breaking force factor K_3 can be used in the calculation of minimum breaking force. The values of breaking force given in the table are for ropes with independent wire rope core (IWRC) using K_2.

Table C.2 *(continued)*

Typical cross-section				Typical construction					
				Rope construction	Strand construction	Outer wires			
						Total	Per strand		
				6 × 7-WSC 6 × 7-IWRC	1-6 1-6	36 36	6 6		
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})					
				Grade 1770	Grade 1960	Grade IPS		Grade EIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	(short tons)	kN	(short tons)
7		18,8		31,1	34,5				
(7,94)	5/16)		(0,16)			39,2	(4,41)	43,1	(4,85)
8		24,6		40,7	45,0				
9		31,1		51,5	57,0				
(9,5)	(3/8)		(0,23)			56,0	(6,30)	61,6	(6,93)
10		38,4		63,5	70,4				
11		46,5		76,9	85,1				
(11,1)	(7/16)		(0,32)			75,8	(8,52)	83,4	(9,37)
12		55,3		91,5	101				
(12,7)	(1/2)		(0,42)			98,7	(11,1)	109	(12,2)
13		64,9		107	119				
14		75,3		125	138				
(14,3)	(9/16)		(0,53)			125	(14,0)	137	(15,4)
(15,9)	(5/8)		(0,65)			152	(17,1)	167	(18,8)
16		98,3		163	180				
18		124		206	228				
19		139		229	254				
(19,1)	(3/4)		(0,94)			217	(24,4)	238	(26,8)
20		154		254	281				
22		186		308	341				
(22,2)	(7/8)		(1,27)			294	(33,0)	323	(36,3)
24		221		366	405				
(25,4)	(1)		(1,66)			380	(42,7)	418	(47,0)
26		260		430	476				
28		301		498	552				
(28,6)	(1-1/8)		(2,11)			476	(53,5)	524	(58,9)
(31,8)	(1-1/4)		(2,60)			584	(65,6)	642	(72,2)
32		393		651	721				
(34,9)	(1-3/8)		(3,15)			699	(78,6)	770	(86,5)
35		470		778	862				
36		498		824	912				
38		554		918	1 020				

NOTE For smaller diameters with wire strand core (WSC), breaking force factor K_3 can be used in the calculation of minimum breaking force. The values of breaking force given in the table are for ropes with independent wire rope core (IWRC) using K_2.

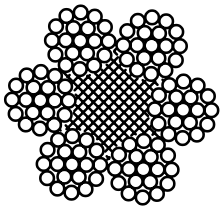
Table C.2 *(continued)*

Typical cross-section		Typical construction			
		Rope construction	Strand construction	Outer wires	
				Total	Per strand
		6 × 7-WSC 6 × 7-IWRC	1-6 1-6	36 36	6 6

Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})					
				Grade 1770	Grade 1960	Grade IPS		Grade EIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	(short tons)	kN	(short tons)
(38,1) 40	(1-1/2)	614	(3,75)	1 020	1 130	825	(92,7)	907	(102)

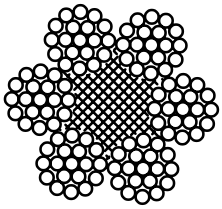
NOTE For smaller diameters with wire strand core (WSC), breaking force factor K_3 can be used in the calculation of minimum breaking force. The values of breaking force given in the table are for ropes with independent wire rope core (IWRC) using K_2.

Table C.3 — Class 6 × 19M fibre core

Typical cross-section		Typical construction			
		Rope construction	Strand construction	Outer wires	
				Total	Per strand
		6 × 19M-FC	1-6/12	72	12

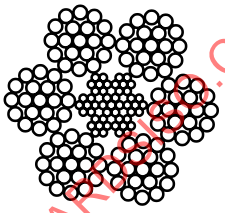
Nominal wire rope diameter		Approximate nominal length mass	Minimum breaking force (F_{min})	
			Grade 1770	Grade 1960
mm	(in)	kg/100 m	kN	kN
3		3,11	4,89	5,42
4		5,54	8,69	9,63
5		8,65	13,6	15,0
6		12,5	19,6	21,7
7		17,0	26,6	29,5
8		22,1	34,8	38,5
9		28,0	44,0	48,7
(9,5)	(3/8)			
10		34,6	54,3	60,2
11		41,9	65,8	72,8
(11,1)	(7/16)			
12		49,8	78,2	86,6
(12,7)	(1/2)			
13		58,5	91,8	102
14		67,8	107	118
(14,3)	(9/16)			
(15,9)	(5/8)			
16		88,6	139	154

Table C.3 *(continued)*

Typical cross-section	Typical construction			
	Rope construction	Strand construction	Outer wires	
			Total	Per strand
	6 × 19M-FC	1-6/12	72	12

Nominal wire rope diameter		Approximate nominal length mass	Minimum breaking force (F_{min})	
			Grade 1770	Grade 1960
mm	(in)	kg/100 m	kN	kN
18		112	176	195
19		125	196	217
(19,1)	(3/4)			
20		138	217	241
22		167	263	291
(22,2)	(7/8)			
24		199	313	347
(25,4)	(1)			
26		234	367	407
28		271	426	472
(28,6)	(1-1/8)			
(31,8)	(1-1/4)			
32		354	556	616

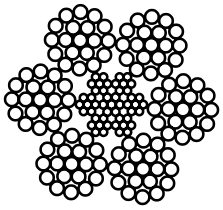
Table C.4 — Class 6 × 19M steel core

Typical cross-section	Typical construction			
	Rope construction	Strand construction	Outer wires	
			Total	Per strand
	6 × 19M-WSC	1-6/12	72	12
	6 × 19M-IWRC	1-6/12	72	12

Nominal wire rope diameter		Approximate nominal length mass	Minimum breaking force (F_{min})	
			Grade 1770	Grade 1960
mm	(in)	kg/100 m	kN	kN
8		24,4	37,6	41,6
9		30,9	47,6	52,7
(9,5)	(3/8)			
10		38,1	58,8	65,1
11		46,1	71,1	78,7
(11,1)	(7/16)			
12		54,9	84,6	93,7
(12,7)	(1/2)			

NOTE For smaller diameters with wire strand core (WSC), breaking force factor K_3 can be used in the calculation of minimum breaking force. The values of breaking force given in the table are for ropes with independent wire rope core (IWRC) using K_2.

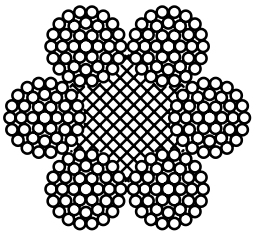
Table C.4 *(continued)*

Typical cross-section	Typical construction			
	Rope construction	Strand construction	Outer wires	
			Total	Per strand
	6 × 19M-WSC	1-6/12	72	12
	6 × 19M-IWRC	1-6/12	72	12

Nominal wire rope diameter		Approximate nominal length mass	Minimum breaking force (F_{min})	
			Grade 1770	Grade 1960
mm	(in)	kg/100 m	kN	kN
13		64,4	99,3	110
14		74,7	115	128
(14,3)	(9/16)			
(15,9)	(5/8)			
16		97,5	150	167
18		123	190	211
19		138	212	235
(19,1)	(3/4)			
20		152	235	260
22		184	284	315
(22,2)	(7/8)			
24		219	338	375
(25,4)	(1)			
26		258	397	440
28		299	461	510
(28,6)	(1-1/8)			
(31,8)	(1-1/4)			
32		390	602	666

NOTE For smaller diameters with wire strand core (WSC), breaking force factor K_3 can be used in the calculation of minimum breaking force. The values of breaking force given in the table are for ropes with independent wire rope core (IWRC) using K_2.

Table C.5 — Class 6 × 37M fibre core

Typical cross-section	Typical construction			
	Rope construction	Strand construction	Outer wires	
			Total	Per strand
	6 ×37M-FC	1-6/12/18	108	18

Nominal rope diameter		Approximate nominal length mass	Minimum breaking force (F_{min})	
			Grade 1770	Grade 1960
mm	(in)	kg/100 m	kN	kN
5		8,65	13,1	14,5
6		12,5	18,8	20,8
7		17,0	25,6	28,3
8		22,1	33,4	37,0
9		28,0	42,3	46,8
(9,5)	(3/8)			
10		34,6	52,2	57,8
11		41,9	63,2	70,0
(11,1)	(7/16)			
12		49,8	75,2	83,3
(12,7)	(1/2)			
13		58,5	88,2	97,7
14		67,8	102	113
(14,3)	(9/16)			
(15,9)	(5/8)			
16		88,6	134	148
18		112	169	187
19		125	188	209
(19,1)	(3/4)			
20		138	209	231
22		167	253	280
(22,2)	(7/8)			
24		199	301	333
(25,4)	(1)			
26		234	353	391
28		271	409	453
(28,6)	(1-1/8)			
(31,8)	(1-1/4)			
32		354	535	592
(34,9)	(1-3/8)			
35		424	640	708
36		448	677	749
38		500	754	835
(38,1)	(1-1/2)			

Table C.5 *(continued)*

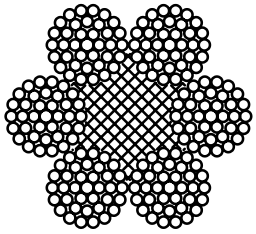
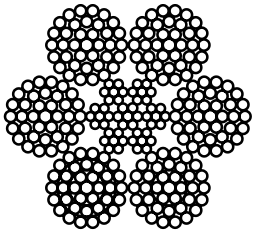
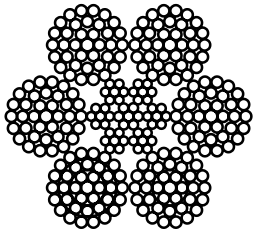
Typical cross-section			Typical construction			
			Rope construction	Strand construction	Outer wires	
					Total	Per strand
			6 ×37M-FC	1-6/12/18	108	18
Nominal rope diameter		Approximate nominal length mass	Minimum breaking force (F_{min})			
			Grade 1770		Grade 1960	
mm	(in)	kg/100 m	kN		kN	
40		554	835		925	

Table C.6 — Class 6 × 37M steel core

Typical cross-section			Typical construction			
			Rope construction	Strand construction	Outer wires	
					Total	Per strand
			6 ×37M-WSC	1-6/12/18	108	18
			6 ×37M-IWRC	1-6/12/18	108	18
Nominal wire rope diameter		Approximate nominal length mass	Minimum breaking force (F_{min})			
			Grade 1770		Grade 1960	
mm	(in)	kg/100 m	kN		kN	
8		24,4	39,2		43,4	
9		30,9	49,6		54,9	
(9,5)	(3/8)					
10		38,1	61,2		67,8	
11		46,1	74,1		82,1	
(11,1)	(7/16)					
12		54,9	88,2		97,7	
(12,7)	(1/2)					
13		64,4	95,4		106	
14		74,7	111		123	
(14,3)	(9/16)					
(15,9)	(5/8)					
16		97,5	145		160	
18		123	183		203	
19		138	204		226	
(19,1)	(3/4)					
20		152	226		250	
22		184	273		303	
(22,2)	(7/8)					

NOTE For smaller diameters with wire strand core (WSC), breaking force factor K_3 can be used in the calculation of minimum breaking force. The values of breaking force given in the table are for ropes with independent wire rope core (IWRC) using K_2.

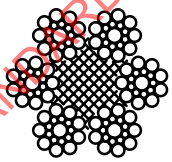
Table C.6 *(continued)*

Typical cross-section	Typical construction			
	Rope construction	Strand construction	Outer wires	
			Total	Per strand
	6 ×37M-WSC	1-6/12/18	108	18
	6 ×37M-IWRC	1-6/12/18	108	18

Nominal wire rope diameter		Approximate nominal length mass	Minimum breaking force (F_{min})	
			Grade 1770	Grade 1960
mm	(in)	kg/100 m	kN	kN
24		219	325	360
(25,4)	(1)			
26		258	382	423
28		299	443	490
(28,6)	(1-1/8)			
(31,8)	(1-1/4)			
32		390	578	640
(34,9)	(1-3/8)			
35		467	692	766
36		494	732	810
38		550	815	903
(38,1)	(1-1/2)			
40		610	903	1 000

NOTE For smaller diameters with wire strand core (WSC), breaking force factor K_3 can be used in the calculation of minimum breaking force. The values of breaking force given in the table are for ropes with independent wire rope core (IWRC) using K_2.

Table C.7 — Class 6 × 19 fibre core

Typical cross-section	Typical construction			
	Rope construction	Strand construction	Outer wires	
			Total	Per strand
	6 ×19S-FC	1-9-9	54	9
	6 ×21F-FC	1-5-5F -10	60	10
	6 ×26WS-FC	1-5-5+5-10	60	10
	6 ×19W-FC	1-6-6+6	72	12
	6 ×25F-FC	1-6-6F-12	72	12

Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})								
				Grade 1770	Grade 1960	Grade 2160	Grade IPS		Grade EIP		Grade EEIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	kN	(short tons)	kN	(short tons)	kN	(short tons)
6		12,9		21,0	23,3	25,7						
(6,35)	(1/4)		(0,10)				24,4	(2,74)	26,8	(3,01)		
7		17,6		28,6	31,7	34,9						
(7,94)	(5/16)		(0,15)				37,9	(4,26)	41,7	(4,69)		
8		23,0		37,4	41,4	45,6						

Table C.7 *(continued)*

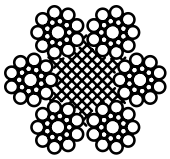
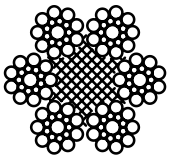
Typical cross-section				Typical construction								
				Rope construction			Strand construction				Outer wires	
											Total	Per strand
				6 ×19S-FC			1-9-9				54	9
				6 ×21F-FC			1-5-5F -10				60	10
				6 ×26WS-FC			1-5-5+5-10				60	10
				6 ×19W-FC			1-6-6+6				72	12
				6 ×25F-FC			1-6-6F-12				72	12
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})								
				Grade 1770	Grade 1960	Grade 2160	Grade IPS		Grade EIP		Grade EEIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	kN	(short tons)	kN	(short tons)	kN	(short tons)
9		29,1		47,3	52,4	57,7						
(9,5)	(3/8)		(0,22)				54,3	(6,10)	59,7	(6,71)	65,7	(7,38)
10		35,9		58,4	64,7	71,3						
11		43,3		70,7	78,3	86,2						
(11,1)	(7/16)		(0,30)				73,6	(8,27)	81,0	(9,10)	89,0	(10,0)
12		51,7		84,1	93,1	103						
(12,7)	(1/2)		(0,39)				95,2	(10,7)	105	(11,8)	115	(12,9)
13		60,7		98,7	109	120						
14		70,4		114	127	140						
(14,3)	(9/16)		(0,49)				120	(13,5)	133	(14,9)	145	(16,3)
(15,9)	(5/8)		(0,61)				149	(16,7)	164	(18,4)	180	(20,2)
16		91,9		150	166	182						
18		116		189	210	231						
19		130		211	233	257						
(19,1)	(3/4)		(0,88)				212	(23,8)	233	(26,2)	256	(28,8)
20		144		234	259	285						
22		174		283	313	345						
(22,2)	(7/8)		(1,19)				286	(32,2)	315	(35,4)	347	(39,0)
24		207		336	373	411						
(25,4)	(1)		(1,56)				372	(41,8)	409	(46,0)	450	(50,6)
26		243		395	437	482						
28		281		458	507	559						
(28,6)	(1-1/8)		(1,97)				468	(52,6)	515	(57,9)	566	(63,6)
(31,8)	(1-1/4)		(2,43)				575	(64,6)	633	(71,1)	696	(78,2)
32		368		598	662	730						
(34,9)	(1-3/8)		(2,94)				691	(77,7)	761	(85,5)	836	(94,0)
35		440		716	792	873						
36		465		757	838	924						
38		518		843	934	1 030						
(38,1)	(1-1/2)		(3,50)				818	(92,0)	898	(101)	987	(111)
40		574		935	1 030	1 140						
(41,3)	(1-5/8)		(4,11)				952	(107)	1 050	(118)	1 150	(129)
44		695		1 130	1 250	1 380						

Table C.7 *(continued)*

Typical cross-section	Typical construction			
	Rope construction	Strand construction	Outer wires	
			Total	Per strand
	6 ×19S-FC	1-9-9	54	9
	6 ×21F-FC	1-5-5F -10	60	10
	6 ×26WS-FC	1-5-5+5-10	60	10
	6 ×19W-FC	1-6-6+6	72	12
	6 ×25F-FC	1-6-6F-12	72	12

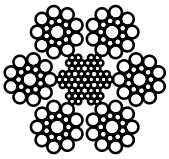
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})								
				Grade 1770	Grade 1960	Grade 2160	Grade IPS		Grade EIP		Grade EEIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	kN	(short tons)	kN	(short tons)	kN	(short tons)
(44,5)	(1-3/4)		(4,77)				1 100	(124)	1 210	(136)	1 330	(150)
45		727		1 180	1 310	1 440						
(47,6)	(1-7/8)		(5,47)				1 250	(141)	1 380	(155)	1 520	(171)
48		827		1 350	1 490	1 640						
(50,8)	(2)		(6,23)				1 420	(160)	1 570	(176)	1 730	(194)
51		934		1 520	1 680	1 850						
52		971		1 580	1 750	1 930						
(54,0)	(2-1/8)		(7,03)				1 590	(179)	1 750	(197)	1 930	(217)
56		1 130		1 830	2 030	2 240						
(57,2)	(2-1/4)		(7,88)				1 780	(200)	1 960	(220)	2 150	(242)
60		1 290		2 100	2 330	2 570						

Table C.8 — Class 6 × 19 steel core

Typical cross-section	Typical construction			
	Rope construction	Strand construction	Outer wires	
			Total	Per strand
	6 ×19S-IWRC	1-9-9	54	9
	6 ×21F-IWRC	1-5-5F-10	60	10
	6 ×26WS-IWRC	1-5-5+5-10	60	10
	6 ×19W-IWRC	1-6-6+6	72	12
	6 ×25F-IWRC	1-6-6F-12	72	12

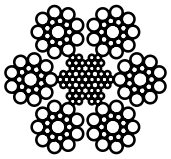
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})								
				Grade 1770	Grade 1960	Grade 2160	Grade IPS		Grade EIP		Grade EEIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	kN	(short tons)	kN	(short tons)	kN	(short tons)
6		14,4		22,7	25,1	27,7						
(6,35)	(1/4)		(0,11)				26,2	(2,94)	30,2	(3,40)		
7		19,6		30,9	34,2	37,7						
(7,94)	(5/16)		(0,17)				40,7	(4,58)	46,9	(5,27)		
8		25,6		40,3	44,7	49,2						
9		32,4		51,0	56,5	62,3						

Table C.8 *(continued)*

Typical cross-section	Typical construction			
	Rope construction	Strand construction	Outer wires	
			Total	Per strand
	6 ×19S-IWRC	1-9-9	54	9
	6 ×21F-IWRC	1-5-5F-10	60	10
	6 ×26WS-IWRC	1-5-5+5-10	60	10
	6 ×19W-IWRC	1-6-6+6	72	12
	6 ×25F-IWRC	1-6-6F-12	72	12

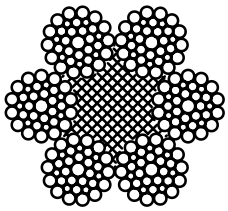
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})								
				Grade 1770	Grade 1960	Grade 2160	Grade IPS		Grade EIP		Grade EEIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	kN	(short tons)	kN	(short tons)	kN	(short tons)
(9,5)	(3/8)		(0,24)				58,4	(6,56)	67,2	(7,55)	73,8	(8,30)
10		40,0		63,0	69,8	76,9						
11		48,4		76,2	84,4	93,0						
(11,1)	(7/16)		(0,33)				79,1	(8,89)	90,7	(10,2)	99,6	(11,2)
12		57,6		90,7	100	111						
(12,7)	(1/2)		(0,43)				102	(11,5)	118	(13,3)	130	(14,6)
13		67,6		106	118	130						
14		78,4		124	137	151						
(14,3)	(9/16)		(0,55)				129	(14,5)	149	(16,7)	165	(18,5)
(15,9)	(5/8)		(0,68)				157	(17,6)	183	(20,6)	202	(22,7)
16		102		161	179	197						
18		130		204	226	249						
19		144		227	252	278						
(19,1)	(3/4)		(0,98)				228	(25,6)	262	(29,5)	288	(32,4)
20		160		252	279	308						
22		194		305	338	372						
(22,2)	(7/8)		(1,33)				308	(34,6)	354	(39,8)	390	(43,8)
24		230		363	402	443						
(25,4)	(1)		(1,73)				399	(44,9)	460	(51,7)	506	(56,9)
26		270		426	472	520						
28		314		494	547	603						
(28,6)	(1-1/8)		(2,19)				503	(56,5)	578	(65,0)	636	(71,5)
(31,8)	(1-1/4)		(2,71)				617	(69,4)	711	(79,9)	782	(87,9)
32		410		645	715	787						
(34,9)	(1-3/8)		(3,28)				743	(83,5)	854	(96,0)	943	(106)
35		490		772	855	942						
36		518		817	904	997						
38		578		910	1 010	1 110						
(38,1)	(1-1/2)		(3,90)				880	(98,9)	1 010	(114)	1 110	(125)
40		640		1 010	1 120	1 230						
(41,3)	(1-5/8)		(4,58)				1 020	(115)	1 170	(132)	1 300	(146)
44		774		1 220	1 350	1 490						

Table C.8 *(continued)*

Typical cross-section	Typical construction			
	Rope construction	Strand construction	Outer wires	
			Total	Per strand
	6 ×19S-IWRC	1-9-9	54	9
	6 ×21F-IWRC	1-5-5F-10	60	10
	6 ×26WS-IWRC	1-5-5+5-10	60	10
	6 ×19W-IWRC	1-6-6+6	72	12
	6 ×25F-IWRC	1-6-6F-12	72	12

Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})								
				Grade 1770	Grade 1960	Grade 2160	Grade IPS		Grade EIP		Grade EEIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	kN	(short tons)	kN	(short tons)	kN	(short tons)
(44,5)	(1-3/4)		(5,31)				1 180	(133)	1 360	(153)	1 500	(169)
45		810		1 280	1 410	1 560						
(47,6)	(1-7/8)		(6,10)				1 350	(152)	1 550	(174)	1 710	(192)
48		922		1 450	1 610	1 770						
(50,8)	(2)		(6,94)				1 530	(172)	1 760	(198)	1 930	(217)
51		1 040		1 640	1 810	2 000						
52		1 080		1 700	1 890	2 080						
(54,0)	(2-1/8)		(7,83)				1 710	(192)	1 970	(221)	2 160	(243)
56		1 250		1 980	2 190	2 410						
(57,2)	(2-1/4)		(8,78)				1 910	(215)	2 200	(247)	2 420	(272)
60		1 440		2 270	2 510	2 770						

Table C.9 — Class 6 × 36 fibre core

Typical cross-section	Typical construction			
	Rope construction	Strand construction	Outer wires	
			Total	Per strand
	6 ×31WS-FC	1-6-6+6-12	72	12
	6 ×36WS-FC	1-7-7+7-14	84	14
	6 ×41WS-FC	1-8-8+8-16	96	16
	6 ×41SF-FC	1-8-8-8F-16	96	16
	6 ×49SWS-FC	1-8-8-8+8-16	96	16
	6 ×46WS-FC	1-9-9+9-18	108	18

Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})								
				Grade 1770	Grade 1960	Grade 2160	Grade IPS		Grade EIP		Grade EEIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	kN	(short tons)	kN	(short tons)	kN	(short tons)
(6,35)	(1/4)		(0,10)				24,4	(2,74)	26,8	(3,01)		
7		18,0		28,6	31,7	34,9						
(7,94)	(5/16)		(0,16)				37,9	(4,26)	41,7	(4,69)		
8		23,5		37,4	41,4	45,6						
9		29,7		47,3	52,4	57,7						
(9,5)	(3/8)		(0,22)				54,3	(6,10)	59,7	(6,71)	65,7	(7,38)
10		36,7		58,4	64,7	71,3						
11		44,4		70,7	78,3	86,2						
(11,1)	(7/16)		(0,30)				73,6	(8,27)	81,0	(9,10)	89,0	(10,0)
12		52,8		84,1	93,1	103						
(12,7)	(1/2)		(0,40)				95,2	(10,7)	105	(11,8)	115	(12,9)
13		62,0		98,7	109	120						
14		71,9		114	127	140						
(14,3)	(9/16)		(0,50)				120	(13,5)	133	(14,9)	145	(16,3)
(15,9)	(5/8)		(0,62)				149	(16,7)	164	(18,4)	180	(20,2)
16		94,0		150	166	182						
18		119		189	210	231						
19		132		211	233	257						
(19,1)	(3/4)		(0,89)				212	(23,8)	233	(26,2)	256	(28,8)
20		147		234	259	285						
22		178		283	313	345						
(22,2)	(7/8)		(1,22)				286	(32,2)	315	(35,4)	347	(39,0)
24		211		336	373	411						
(25,4)	(1)		(1,59)				372	(41,8)	409	(46,0)	450	(50,6)
26		248		395	437	482						
28		288		458	507	559						
(28,6)	(1-1/8)		(2,01)				468	(52,6)	515	(57,9)	566	(63,6)
(31,8)	(1-1/4)		(2,49)				575	(64,6)	633	(71,1)	696	(78,2)
32		376		598	662	730						
(34,9)	(1-3/8)		(3,01)				691	(77,7)	761	(85,5)	836	(94,0)
35		450		716	792	873						

Table C.9 *(continued)*

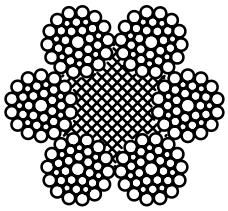
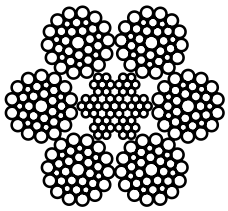
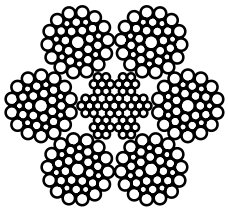
Typical cross-section		Typical construction										
		Rope construction		Strand construction			Outer wires					
							Total		Per strand			
		6 ×31WS-FC		1-6-6+6-12			72		12			
		6 ×36WS-FC		1-7-7+7-14			84		14			
		6 ×41WS-FC		1-8-8+8-16			96		16			
		6 ×41SF-FC		1-8-8-8F-16			96		16			
		6 ×49SWS-FC		1-8-8-8+8-16			96		16			
		6 ×46WS-FC		1-9-9+9-18			108		18			
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})								
				Grade 1770	Grade 1960	Grade 2160	Grade IPS		Grade EIP		Grade EEIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	kN	(short tons)	kN	(short tons)	kN	(short tons)
36		476		757	838	924						
38		530		843	934	1 030						
(38,1)	(1-1/2)		(3,58)				818	(92,0)	898	(101)	987	(111)
40		587		935	1 030	1 140						
(41,3)	(1-5/8)		(4,20)				952	(107)	1 050	(118)	1 150	(129)
44		711		1 130	1 250	1 380						
(44,5)	(1-3/4)		(4,87)				1 100	(124)	1 210	(136)	1 330	(150)
45		743		1 180	1 310	1 440						
(47,6)	(1-7/8)		(5,59)				1 250	(141)	1 380	(155)	1 520	(171)
48		846		1 350	1 490	1 640						
(50,8)	(2)		(6,36)				1 420	(160)	1 570	(176)	1 730	(194)
51		955		1 520	1 680	1 850						
52		992		1 580	1 750	1 930						
(54,0)	(2-1/8)		(7,18)				1 590	(179)	1 750	(197)	1 930	(217)
56		1 150		1 830	2 030	2 240						
(57,2)	(2-1/4)		(8,05)				1 780	(200)	1 960	(220)	2 150	(242)
60		1 320		2 100	2 330	2 570						

Table C.10 — Class 6 × 36 steel core

Typical cross-section	Typical construction			
	Rope construction	Strand construction	Outer wires	
			Total	Per strand
	6 ×31WS-IWRC	1-6-6+6-12	72	12
	6 ×36WS-IWRC	1-7-7+7-14	84	14
	6 ×41WS-IWRC	1-8-8+8-16	96	16
	6 ×41SF-IWRC	1-8-8-8F-16	96	16
	6 ×49SWS-IWRC	1-8-8-8+8-16	96	16
	6 ×46WS-IWRC	1-9-9+9-18	108	18

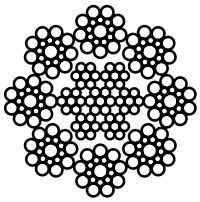
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})								
				Grade 1770	Grade 1960	Grade 2160	Grade IPS		Grade EIP		Grade EEIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	kN	(short tons)	kN	(short tons)	kN	(short tons)
(6,35)	(1/4)		(0,11)				26,2	(2,94)	30,2	(3,40)		
7		20,0		30,9	34,2	37,7						
(7,94)	(5/16)		(0,17)				40,7	(4,58)	46,9	(5,27)		
8		26,2		40,3	44,7	49,2						
9		33,1		51,0	56,5	62,3						
(9,5)	(3/8)		(0,25)				58,4	(6,56)	67,2	(7,55)	73,8	(8,30)
10		40,9		63,0	69,8	76,9						
11		49,5		76,2	84,4	93,0						
(11,1)	(7/16)		(0,34)				79,1	(8,89)	90,7	(10,2)	99,6	(11,2)
12		58,9		90,7	100	111						
(12,7)	(1/2)		(0,44)				102	(11,5)	118	(13,3)	130	(14,6)
13		69,1		106	118	130						
14		80,2		124	137	151						
(14,3)	(9/16)		(0,56)				129	(14,5)	149	(16,8)	165	(18,5)
(15,9)	(5/8)		(0,69)				157	(17,7)	183	(20,6)	202	(22,7)
16		105		161	179	197						
18		133		204	226	249						
19		148		227	252	278						
(19,1)	(3/4)		(1,00)				228	(25,6)	262	(29,4)	288	(32,4)
20		164		252	279	308						
22		198		305	338	372						
(22,2)	(7/8)		(1,36)				308	(34,6)	354	(39,8)	390	(43,8)
24		236		363	402	443						
(25,4)	(1)		(1,77)				399	(44,9)	460	(51,7)	506	(56,9)
26		276		426	472	520						
28		321		494	547	603						
(28,6)	(1-1/8)		(2,24)				503	(56,5)	578	(65,0)	636	(71,5)
(31,8)	(1-1/4)		(2,77)				617	(69,4)	711	(79,9)	782	(87,9)
32		419		645	715	787						
(34,9)	(1-3/8)		(3,35)				743	(83,5)	854	(96,0)	943	(106)
35		501		772	855	942						

Table C.10 *(continued)*

Typical cross-section	Typical construction			
	Rope construction	Strand construction	Outer wires	
			Total	Per strand
	6 ×31WS-IWRC	1-6-6+6-12	72	12
	6 ×36WS-IWRC	1-7-7+7-14	84	14
	6 ×41WS-IWRC	1-8-8+8-16	96	16
	6 ×41SF-IWRC	1-8-8-8F-16	96	16
	6 ×49SWS-IWRC	1-8-8-8+8-16	96	16
	6 ×46WS-IWRC	1-9-9+9-18	108	18

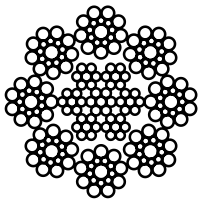
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})								
				Grade 1770	Grade 1960	Grade 2160	Grade IPS		Grade EIP		Grade EEIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	kN	(short tons)	kN	(short tons)	kN	(short tons)
36		530		817	904	997						
38		591		910	1 010	1 110						
(38,1)	(1-1/2)		(3,99)				880	(98,9)	1 010	(114)	1 110	(125)
40		654		1 010	1 120	1 230						
(41,3)	(1-5/8)		(4,68)				1 020	(115)	1 170	(132)	1 300	(146)
44		792		1 220	1 350	1 490						
(44,5)	(1-3/4)		(5,43)				1 180	(133)	1 360	(153)	1 500	(169)
45		828		1 280	1 410	1 560						
(47,6)	(1-7/8)		(6,23)				1 350	(152)	1 550	(174)	1 710	(192)
48		942		1 450	1 610	1 770						
(50,8)	(2)		(7,09)				1 530	(172)	1 760	(198)	1 930	(217)
51		1 060		1 640	1 810	2 000						
52		1 110		1 700	1 890	2 080						
(54,0)	(2-1/8)		(8,01)				1 710	(192)	1 970	(221)	2 160	(243)
56		1 280		1 980	2 190	2 410						
(57,2)	(2-1/4)		(8,98)				1 910	(215)	2 200	(247)	2 420	(272)
60		1 470		2 270	2 510	2 770						

Table C.11 — Class 8 × 19 steel core

Typical cross-section	Typical construction			
	Rope construction	Strand construction	Outer wires	
			Total	Per strand
	8 ×19S-IWRC	1-9-9	72	9
	8 ×21F-IWRC	1-5-5F -10	80	10
	8 ×26WS-IWRC	1-5-5+5-10	80	10
	8 ×19W-IWRC	1-6-6+6	96	12
	8 ×25F-IWRC	1-6-6F-12	96	12

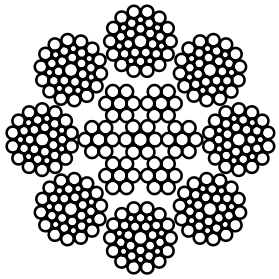
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})								
				Grade 1770	Grade 1960	Grade 2160	Grade IPS		Grade EIP		Grade EEIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	kN	(short tons)	kN	(short tons)	kN	(short tons)
(6,35)	(1/4)		(0,11)				26,2	(2,94)	30,2	(3,40)		
7		19,9		30,9	34,2	37,7						
(7,94)	(5/16)		(0,17)				40,7	(4,58)	46,9	(5,27)		
8		26,0		40,3	44,7	49,2						
9		33,0		51,0	56,5	62,3						
(9,5)	(3/8)		(0,25)				58,4	(6,56)	67,2	(7,55)	73,8	(8,30)
10		40,7		63,0	69,8	76,9						
11		49,2		76,2	84,4	93,0						
(11,1)	(7/16)		(0,34)				79,1	(8,89)	90,7	(10,2)	99,6	(11,2)
12		58,6		90,7	100	111						
(12,7)	(1/2)		(0,44)				102	(11,5)	118	(13,3)	130	(14,6)
13		68,8		106	118	130						
14		79,8		124	137	151						
(14,3)	(9/16)		(0,56)				129	(14,5)	149	(16,8)	165	(18,5)
(15,9)	(5/8)		(0,69)				157	(17,7)	183	(20,6)	202	(22,7)
16		104		161	179	197						
18		132		204	226	249						
19		147		227	252	278						
(19,1)	(3/4)		(0,99)				228	(25,6)	262	(29,4)	288	(32,4)
20		163		252	279	308						
22		197		305	338	372						
(22,2)	(7/8)		(1,35)				308	(34,6)	354	(39,8)	390	(43,8)
24		234		363	402	443						
(25,4)	(1)		(1,76)				399	(44,9)	460	(51,7)	506	(56,9)
26		275		426	472	520						
28		319		494	547	603						
(28,6)	(1-1/8)		(2,23)				503	(56,5)	578	(65,0)	636	(71,5)
(31,8)	(1-1/4)		(2,76)				617	(69,4)	711	(79,9)	782	(87,9)
32		417		645	715	787						
(34,9)	(1-3/8)		(3,34)				743	(83,5)	854	(96,0)	943	(106)
35		499		772	855	942						
36		527		817	904	997						

Table C.11 *(continued)*

Typical cross-section	Typical construction			
	**Rope construction**	**Strand construction**	**Outer wires**	
			Total	**Per strand**
	8 ×19S-IWRC	**1-9-9**	**72**	**9**
	8 ×21F-IWRC	**1-5-5F -10**	**80**	**10**
	8 ×26WS-IWRC	**1-5-5+5-10**	**80**	**10**
	8 ×19W-IWRC	**1-6-6+6**	**96**	**12**
	8 ×25F-IWRC	**1-6-6F-12**	**96**	**12**

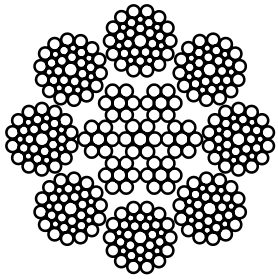
Nominal wire rope diameter		**Approximate nominal length mass**		**Minimum breaking force (F_{min})**								
				Grade 1770	**Grade 1960**	**Grade 2160**	**Grade IPS**		**Grade EIP**		**Grade EEIP**	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	kN	(short tons)	kN	(short tons)	kN	(short tons)
38		588		910	1 010	1 110						
(38,1)	(1-1/2)		(3,97)				880	(98,9)	1 010	(114)	1 110	(125)
40		651		1 010	1 120	1 230						
(41,3)			(4,66)				1 020	(115)	1 170	(132)	1 300	(146)
44	(1-5/8)	788		1 220	1 350	1 490						
(44,5)			(5,40)				1 180	(133)	1 360	(153)	1 500	(169)
45	(1-3/4)	824		1 280	1 410	1 560						
(47,6)	(1-7/8)		(6,20)				1 350	(152)	1 550	(174)	1 710	(192)
48		938		1 450	1 610	1 770						
(50,8)	(2)		(7,06)				1 530	(172)	1 760	(198)	1 930	(217)
51		1 060		1 640	1 810	2 000						
52		1 100		1 700	1 890	2 080						
(54,0)	(2-1/8)		(7,97)				1 710	(192)	1 970	(221)	2 160	(243)
56		1 280		1 980	2 190	2 410						
(57,2)	(2-1/4)		(8,93)				1 910	(215)	2 200	(247)	2 420	(272)
60		1 470		2 270	2 510	2 770						

Table C.12 — Class 8 × 36 steel core

Typical cross-section	Typical construction			
	Rope construction	Strand construction	Outer wires	
			Total	Per strand
	8 ×31WS-IWRC	1-6-6+6-12	96	12
	8 ×36WS-IWRC	1-7-7+7-14	112	14
	8 ×41WS-IWRC	1-8-8+8-16	128	16

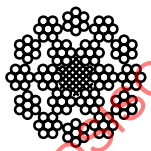
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})								
				Grade 1770	Grade 1960	Grade 2160	Grade IPS		Grade EIP		Grade EEIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	kN	(short tons)	kN	(short tons)	kN	(short tons)
8		26,7		40,3	44,7	49,2						
9		33,8		51,0	56,5	62,3						
(9,5)	(3/8)		(0,25)				58,4	(6,56)	67,2	(7,55)	73,8	(8,30)
10		41,7		63,0	69,8	76,9						
11		50,5		76,2	84,4	93,0						
(11,1)	(7/16)		(0,35)				79,1	(8,89)	90,7	(10,2)	99,6	(11,2)
12		60,0		90,7	100	111						
(12,7)	(1/2)		(0,45)				102	(11,5)	118	(13,3)	130	(14,6)
13		70,5		106	118	130						
14		81,7		124	137	151						
(14,3)	(9/16)		(0,57)				129	(14,5)	149	(16,8)	165	(18,5)
(15,9)	(5/8)		(0,71)				157	(17,7)	183	(20,6)	202	(22,7)
16		107		161	179	197						
18		135		204	226	249						
19		151		227	252	278						
(19,1)	(3/4)		(1,02)				228	(25,6)	262	(29,4)	288	(32,4)
20		167		252	279	308						
22		202		305	338	372						
(22,2)	(7/8)		(1,38)				308	(34,6)	354	(39,8)	390	(43,8)
24		240		363	402	443						
(25,4)	(1)		(1,81)				399	(44,9)	460	(51,7)	506	(56,9)
26		282		426	472	520						
28		327		494	547	603						
(28,6)	(1-1/8)		(2,29)				503	(56,5)	578	(65,0)	636	(71,5)
(31,8)	(1-1/4)		(2,82)				617	(69,4)	711	(79,9)	782	(87,9)
32		427		645	715	787						
(34,9)	(1-3/8)		(3,42)				743	(83,5)	854	(96,0)	943	(106)
35		511		772	855	942						
36		540		817	904	997						
38		602		910	1 010	1 110						
(38,1)	(1-1/2)		(4,07)				880	(98,9)	1 010	(114)	1 110	(125)
40		667		1 010	1 120	1 230						
(41,3)	(1-5/8)		(4,77)				1 020	(115)	1 170	(132)	1 300	(146)
44		807		1 220	1 350	1 490						
(44,5)	(1-3/4)		(5,54)				1 180	(133)	1 360	(153)	1 500	(169)

Table C.12 *(continued)*

Typical cross-section	Typical construction			
	Rope construction	Strand construction	Outer wires	
			Total	Per strand
	8 ×31WS-IWRC	1-6-6+6-12	96	12
	8 ×36WS-IWRC	1-7-7+7-14	112	14
	8 ×41WS-IWRC	1-8-8+8-16	128	16

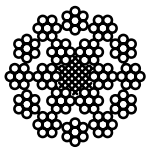
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})								
				Grade 1770	Grade 1960	Grade 2160	Grade IPS		Grade EIP		Grade EEIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	kN	(short tons)	kN	(short tons)	kN	(short tons)
45		844		1 280	1 410	1 560						
(47,6)	(1-7/8)		(6,36)				1 350	(152)	1 550	(174)	1 710	(192)
48		961		1 450	1 610	1 770						
(50,8)	(2)		(7,23)				1 530	(172)	1 760	(198)	1 930	(217)
51		1 080		1 640	1 810	2 000						
52		1 130		1 700	1 890	2 080						
(54,0)	(2-1/8)		(8,16)				1 710	(192)	1 970	(221)	2 160	(243)
56		1 310		1 980	2 190	2 410						
(57,2)	(2-1/4)		(9,15)				1 910	(215)	2 200	(247)	2 420	(272)
60		1 500		2 270	2 510	2 770						

Table C.13 — Class 18 × 7

Typical cross-section	Typical construction			
	Rope construction	Strand construction	Outer wires	
			Total	Per strand
	17 ×7-FC	1-6	66	6
	17 ×7-WSC	1-6	66	6
	18 ×7-FC	1-6	72	6
	18 ×7-WSC	1-6	72	6

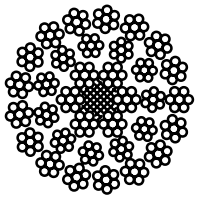
Nominal wire rope diameter		Approximate nominal lenCth mass				Minimum breaking force (F_{min})					
		Core — FC		Core — WSC		Grade 1770	Grade 1960	Grade IPS		Grade EIP	
mm	(in)	kg/100 m	(lb/ft)	kg/100 m	(lb/ft)	kN	kN	kN	(short tons)	kN	(short tons)
6		13,8		14,4		20,9	23,1				
(6,35)	(1/4)		(0,10)		(0,11)			22,3	(2,51)	24,6	(2,77)
7		18,7		19,6		28,4	31,5				
(7,94)	(5/16)		(0,16)		(0,17)			34,7	(3,90)	38,3	(4,30)
8		24,4		25,7		37,2	41,1				
9		30,9		32,5		47,0	52,1				
(9,5)	(3/8)		(0,23)		(0,24)			49,7	(5,59)	54,5	(6,15)
10		38,2		40,1		58,1	64,3				
11		46,2		48,5		70,2	77,8				
(11,1)	(7/16)		(0,32)		(0,33)			67,4	(7,58)	73,9	(8,33)
12		55,0		57,7		83,6	92,6				

Table C.13 *(continued)*

Typical cross-section	Typical construction			
	Rope construction	Strand construction	Outer wires	
			Total	Per strand
	17 ×7-FC	1-6	66	6
	17 ×7-WSC	1-6	66	6
	18 ×7-FC	1-6	72	6
	18 ×7-WSC	1-6	72	6

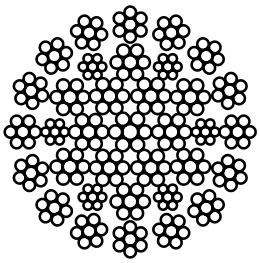
Nominal wire rope diameter		Approximate nominal lenCth mass				Minimum breaking force (F_{min})					
		Core — FC		Core — WSC		Grade 1770	Grade 1960	Grade IPS		Grade EIP	
mm	(in)	kg/100 m	(lb/ft)	kg/100 m	(lb/ft)	kN	kN	kN	(short tons)	kN	(short tons)
(12,7)	(1/2)		(0,41)		(0,43)			87,6	(9,85)	95,8	(10,8)
13		64,6		67,8		98,1	109				
14		74,9		78,6		114	126				
(14,3)	(9/16)		(0,52)		(0,55)			110	(12,4)	121	(13,6)
(15,9)	(5/8)		(0,65)		(0,68)			136	(15,3)	149	(16,8)
16		97,8		103		149	165				
18		124		130		188	208				
19		138		145		210	232				
(19,1)	(3/4)		(0,93)		(0,98)			194	(21,8)	214	(24,0)
20		153		160		232	257				
22		185		194		281	311				
(22,2)	(7/8)		(1,27)		(1,33)			262	(29,5)	289	(32,5)
24		220		231		334	370				
(25,4)	(1)		(1,66)		(1,74)			341	(38,3)	375	(42,2)
26		258		271		392	435				
28		299		314		455	504				
(28,6)	(1-1/8)		(2,10)		(2,20)			429	(48,2)	472	(53,1)
(31,8)	(1-1/4)		(2,59)		(2,72)			527	(59,2)	579	(65,1)
32		391		411		594	658				
(34,9)	(1-3/8)		(3,13)		(3,29)			634	(71,3)	697	(78,4)
35		468		491		711	788				
36		495		520		752	833				
38		552		579		838	928				
(38,1)	(1-1/2)		(3,73)		(3,91)			751	(84,4)	826	(92,8)

Table C.14 — Class 34(M) × 7

Typical cross-section	Typical construction			
	Rope construction	Strand construction	Outer wires	
			Total	Per strand
	34(M) ×7-FC	1-6	102	6
	34(M) ×7-WSC	1-6	102	6
	36(M) ×7-FC	1-6	108	6
	36(M) ×7-WSC	1-6	108	6

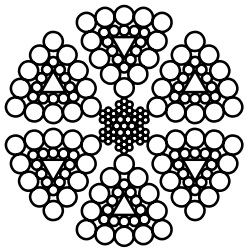
Nominal wire rope diameter		Approximate nominal length mass				Minimum breaking force (F_{min})					
		Core — FC		Core — WSC		Grade 1770	Grade 1960	Grade IPS		Grade EIP	
mm	(in)	kg/100 m	(lb/ft)	kg/100 m	(lb/ft)	kN	kN	kN	(short tons)	kN	(short tons)
10		39,0		40,1		56,3	62,3				
11		47,2		48,5		68,1	75,4				
(11,1)	(7/16)		(0,32)		(0,33)			69,5	(7,81)	77,0	(8,65)
12		56,2		57,7		81,1	89,8				
(12,7)	(1/2)		(0,42)		(0,43)			90,7	(10,2)	101	(11,3)
13		65,9		67,8		95,1	105				
14		76,4		78,6		110	122				
(14,3)	(9/16)		(0,54)		(0,55)			115	(12,9)	127	(14,3)
(15,9)	(5/8)		(0,66)		(0,68)			141	(15,9)	157	(17,7)
16		99,8		103		144	160				
18		126		130		182	202				
19		141		145		203	225				
(19,1)	(3/4)		(0,95)		(0,98)			205	(23,0)	226	(25,4)
20		156		160		225	249				
22		189		194		272	302				
(22,2)	(7/8)		(1,29)		(1,33)			278	(31,2)	308	(34,6)
24		225		231		324	359				
(25,4)	(1)		(1,69)		(1,74)			363	(40,8)	402	(45,2)
26		264		271		380	421				
28		306		314		441	489				
(28,6)	(1-1/8)		(2,14)		(2,20)			460	(51,7)	509	(57,2)
(31,8)	(1-1/4)		(2,64)		(2,72)			568	(63,8)	628	(70,6)
32		399		411		576	638				
(34,9)	(1-3/8)		(3,20)		(3,29)			687	(77,2)	761	(85,5)
35		478		491		690	764				
36		505		520		729	808				
38		563		579		813	900				
(38,1)	(1-1/2)		(3,80)		(3,91)			817	(91,8)	907	(102)
40		624		642		901	997				
(41,3)	(1-5/8)		(4,46)		(4,59)			961	(108)	1 060	(119)
44		755		776		1 090	1 210				

Table C.15 — Class 35(W) × 7

Typical cross-section	Typical construction			
	Rope construction	Strand construction	Outer wires	
			Total	Per strand
	35(W) ×7	1-6	96	6
	40(W) ×7	1-6	108	6

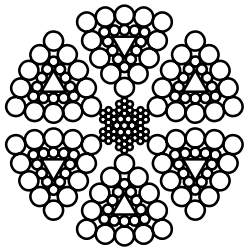
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})					
				Grade 1770		Grade 1960		Grade 2160	
mm	(lb/ft)	kg/100 m	(lb/ft)	kN	(short tons)	kN	(short tons)	kN	(short tons)
8		29,1		40,8	(4,58)	45,2	(5,08)	48,4	(5,44)
9		36,8		51,6	(5,80)	57,2	(6,42)	61,2	(6,88)
(9,5)	(3/8)		(0,28)						
10		45,4		63,7	(7,16)	70,6	(7,93)	75,6	(8,50)
11		54,9		77,1	(8,67)	85,4	(9,60)	91,5	(10,3)
(11,1)	(7/16)		(0,38)						
12		65,4		91,8	(10,3)	102	(11,4)	109	(12,2)
(12,7)	(1/2)		(0,49)						
13		76,7		108	(12,1)	119	(13,4)	128	(14,4)
14		89,0		125	(14,0)	138	(15,5)	148	(16,7)
(14,3)	(9/16)		(0,62)						
(15,9)	(5/8)		(0,77)						
16		116		163	(18,3)	181	(20,3)	194	(21,8)
18		147		206	(23,2)	229	(25,7)	245	(27,5)
19		164		230	(25,9)	255	(28,6)	273	(30,7)
(19,1)	(3/4)		(1,11)						
20		182		255	(28,7)	282	(31,7)	302	(34,0)
22		220		308	(34,7)	342	(38,4)	366	(41,1)
(22,2)	(7/8)		(1,51)						
24		262		367	(41,3)	406	(45,7)	435	(48,9)
(25,4)	(1)		(1,97)						
26		307		431	(48,4)	477	(53,6)	511	(57,4)
28		356		500	(56,2)	553	(62,2)	593	(66,6)
(28,6)	(1-1/8)		(2,49)						
(31,8)	(1-1/4)		(3,08)						
32		465		652	(73,3)	723	(81,2)	774	(87,0)
(34,9)	(1-3/8)		(3,72)						
35		556		781	(87,7)	864	(97,2)	926	(104)
36		588		826	(92,8)	914	(103)	980	(110)
38		656		920	(103)	1 020	(115)	1 090	(123)
(38,1)	(1-1/2)		(4,43)						
40		726		1 020	(115)	1 130	(127)	1 210	(136)
(41,3)	(1-5/8)		(5,20)						

Table C.16 — Class 6 × V25TS steel core

Typical cross-section	Typical construction			
	Rope construction	Strand construction	Outer wires	
			Total	Per strand
	6 × V25	V-12/12	72	12
	6 × V25B	3 × 2/12/12	72	12
	6 × V25B	3 × 2-3F/12/12	72	12
	6 × V25B	1-6K/12/12	72	12
	6 × V28B	3 × 2-3F/12/15	90	15

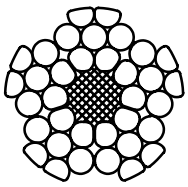
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})			
				Grade IPS		Grade EIP	
mm	(in)	kg/100 m	(lb/ft)	kN	(short tons)	kN	(short tons)
12							
(12,7)	(1/2)	69,9	(0,47)	112	(12,6)	125	(14,1)
13							
14							
(14,3)	(9/16)	89,3	(0,60)	142	(16,0)	157	(17,6)
(15,9)	(5/8)	110	(0,74)	174	(19,6)	193	(21,7)
16							
18							
19							
(19,1)	(3/4)	158	(1,06)	250	(28,1)	276	(31,0)
20							
22							
(22,2)	(7/8)	216	(1,45)	338	(38,0)	373	(41,9)
24							
(25,4)	(1)	281	(1,89)	439	(49,3)	484	(54,4)
26							
28							
(28,6)	(1-1/8)	356	(2,39)	553	(62,2)	609	(68,5)
(31,8)	(1-1/4)	439	(2,95)	679	(76,3)	747	(84,0)
32							
(34,9)	(1-3/8)	531	(3,57)	818	(92,0)	898	(101)
35							
36							
38							
(38,1)	(1-1/2)	632	(4,25)	961	(108)	1 060	(119)
40							
(41,3)	(1-5/8)	743	(4,99)	1 130	(127)	1 250	(141)
44							
(44,5)	(1-3/4)	862	(5,79)	1 300	(146)	1 430	(161)
45							
(47,6)	(1-7/8)	990	(6,65)	1 490	(167)	1 640	(184)
48							

Table C.16 *(continued)*

Typical cross-section	Typical construction			
	Rope construction	Strand construction	Outer wires	
			Total	Per strand
	6 × V25	V-12/12	72	12
	6 × V25B	3 × 2/12/12	72	12
	6 × V25B	3 × 2-3F/12/12	72	12
	6 × V25B	1-6K/12/12	72	12
	6 × V28B	3 × 2-3F/12/15	90	15

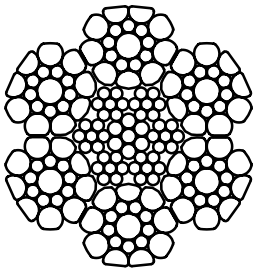
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})			
				Grade IPS		Grade EIP	
mm	(in)	kg/100 m	(lb/ft)	kN	(short tons)	kN	(short tons)
(50,8)	(2)	1 120	(7,53)	1 680	(189)	1 840	(207)
51							
52							
(54,0)	(2-1/8)	1 270	(8,53)	1 880	(211)	2 060	(232)
56							
(57,2)	(2-1/4)	1 420	(9,54)	2 110	(237)	2 310	(260)
60							
(60,3)	(2-3/8)	1 590	(10,7)	2 320	(261)	2 550	(287)

Table C.17 — Class K5 ×7 fibre core

Typical cross-section	Typical construction			
	Rope construction	Rope construction	Rope construction	
			Total	Per strand
	K5×7-FC	1-6	30	6

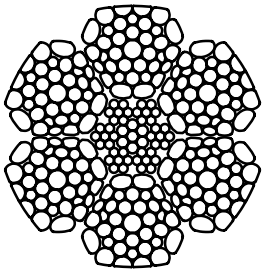
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})					
				Grade 1570	Grade 1770	Grade IPS		Grade EIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	(short tons)	kN	(short tons)
10		44,3		66,1	74,5				
11		53,6		80,0	90,2				
(12,7)	(1/2)		(0,48)			112	(12,6)	123	(13,8)
13		74,9		112	126				
(14,3)	(9/16)		(0,61)			145	(16,3)	159	(17,9)
14,5		93,1		139	157				
(15,9)	(5/8)		(0,75)			177	(19,9)	195	(21,9)
16		113		169	191				

Table C.18 — Class K6 ×19 steel core

Typical cross-section	Typical construction			
	Rope construction	Rope construction	Rope construction	
			Total	Per strand
	K6×19S-IWRC	1-9-9	54	9
	K6×26WS-IWRC	1-5-5+5-10	60	10

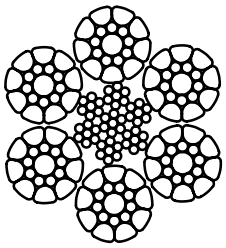
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})					
				Grade 1570	Grade 1770	Grade IPS		Grade EIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	(short tons)	kN	(short tons)
10		51,2		69,9	78,8				
12		73,7		101	113				
(12,7)	(1/2)		(0,55)			120	(13,5)	138	(15,5)
13		86,5		118	133				
(14,3)	(9/16)		(0,70)			151	(17,0)	174	(19,6)
14,5		108		147	166				
(15,9)	(5/8)		(0,87)			187	(21,0)	215	(24,2)
16		131		179	202				
18		166		226	255				
19		185		252	284				
(19,1)	(3/4)		(1,25)			270	(30,3)	310	(34,9)
20		205		279	315				
22		248		338	381				
(22,2)	(7/8)		(1,70)			367	(41,2)	442	(47,4)
24		295		402	454				
25		320		437	492				
(25,4)	(1)		(2,22)			479	(53,9)	552	(62,0)
26		346		472	532				
28		401		548	618				
(28,6)	(1-1/8)		(2,81)			568	(63,9)	654	(73,5)
30		461		629	709				
(31,8)	(1-1/4)		(3,47)			697	(78,3)	801	(90,1)
32		524		715	807				

Table C.19 — Class K6 ×36 steel core

Typical cross-section	Typical construction			
	Rope construction	Rope construction	Rope construction	
			Total	Per strand
	K6×31WS-IWRC	1-6-6+6-12	72	12
	K6×36WS-IWRC	1-7-7+7-14	84	14

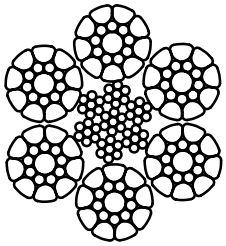
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})					
				Grade 1570	Grade 1770	Grade IPS		Grade EIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	(short tons)	kN	(short tons)
10		51,2		69,9	78,8				
12		73,7		101	113				
(12,7)	(1/2)		(0,55)			120	(13,5)	138	(15,5)
13		86,5		118	133				
(14,3)	(9/16)		(0,70)			151	(17,0)	174	(19,6)
14,5		108		147	166				
(15,9)	(5/8)		(0,87)			187	(21,0)	215	(24,2)
16		131		179	202				
18		166		226	255				
19		185		252	284				
(19,1)	(3/4)		(1,25)			270	(30,3)	310	(34,9)
20		205		279	315				
22		248		338	381				
(22,2)	(7/8)		(1,70)			367	(41,2)	422	(47,2)
24		295		402	454				
25		320		437	492				
(25,4)	(1)		(2,22)			479	(53,9)	552	(62,0)
26		346		472	532				
28		401		548	618				
(28,6)	(1-1/8)		(2,81)			568	(63,9)	654	(73,5)
30		461		629	709				
(31,8)	(1-1/4)		(3,47)			697	(78,3)	801	(90,0)
32		524		715		807			

Table C.20 — Class 6 ×K19 steel core

Typical cross-section	Typical construction			
	Rope construction	Rope construction	Rope construction	
			Total	Per strand
	6×K19S-IWRC	1-9-9	54	9
	6×K26WS-IWRC	1-5-5+5-10	60	10

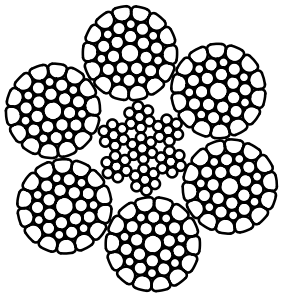
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})								
				Grade 1570	Grade 1770	Grade 1960	Grade IPS		Grade EIP		Grade EEIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	kN	(short tons)	kN	(short tons)	kN	(short tons)
10		46,2		64,4	72,6	80,4						
12		66,5		92,7	105	116						
(12,7)	(1/2)		(0,50)				113	(12,7)	130	(14,6)	143	(16,1)
14		90,6		126	142	158						
(14,3)	(9/16)		(0,63)				143	(16,1)	165	(18,5)	182	(20,4)
(15,9)	(5/8)		(0,78)									
16		118		165	186	206						
18		150		209	235	260						
(19,1)	(3/4)		(1,13)				251	(28,2)	288	(32,4)	317	(35,6)
20		185		257	290	321						
22		224		312	351	389						
(22,2)	(7/8)		(1,53)				339	(38,1)	390	(43,8)	429	(48,2)
24		266		371	418	463						
(25,4)	(1)		(2,00)				440	(49,5)	506	(56,9)	557	(62,6)
26		312		435	491	543						
28		362		505	569	630						
(28,6)	(1-1/8)		(2,53)				553	(62,2)	636	(71,5)	700	(78,7)
29		389		541	610	676						
30		416		579	653	723						
(31,8)	(1-1/4)		(3,13)				680	(76,4)	782	(87,9)	860	(96,7)
32		473		659	743	823						
34		534		744	839	929						
(34,9)	(1-3/8)		(3,79)				820	(92,2)	943	(106)	1 040	(117)
35		566		789	889	984						
36		599		834	941	1 040						
38		667		930	1 050	1 160						
(38,1)	(1-1/2)		(4,51)				970	(109)	1 110	(125)	1 230	(138)
40		739		1 030	1 160	1 290						
(41,3)	(1-5/8)		(5,29)				1 130	(127)	1 300	(146)	1 430	(161)
42		815		1 140	1 280	1 420						
44		894		1 250	1 400	1 560						
(44,5)	(1-3/4)		(6,13)				1 310	(147)	1 500	(169)	1 650	(186)
46		978		1 360	1 540	1 700						
(47,6)	(1-7/8)		(7,04)				1 490	(167)	1 710	(192)	1 880	(211)
48		1 060		1 480	1 670	1 850						

Table C.20 *(continued)*

Typical cross-section	Typical construction			
	Rope construction	Rope construction	Rope construction	
			Total	Per strand
	6×K19S-IWRC	1-9-9	54	9
	6×K26WS-IWRC	1-5-5+5-10	60	10

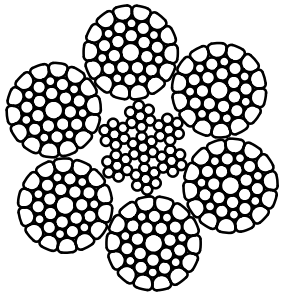
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})								
				Grade 1570	Grade 1770	Grade 1960	Grade IPS		Grade EIP		Grade EEIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	kN	(short tons)	kN	(short tons)	kN	(short tons)
50		1 160		1 610	1 810	2 010						
(50,8)	(2)		(8,01)				1 680	(189)	1 930	(217)	2 130	(239)
52		1 250		1 740	1 960	2 170						

Table C.21 — Class 6 ×K36 steel core

Typical cross-section	Typical construction			
	Rope construction	Rope construction	Rope construction	
			Total	Per strand
	6×K31WS-IWRC	1-6-6+6-12	72	12
	6×K36WS-IWRC	1-7-7+7-14	84	14

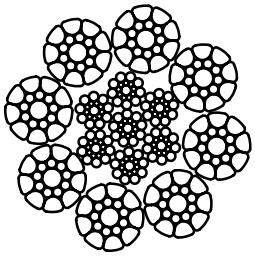
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})								
				Grade 1570	Grade 1770	Grade 1960	Grade IPS		Grade EIP		Grade EEIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	kN	(short tons)	kN	(short tons)	kN	(short tons)
10		46,2		64,4	72,6	80,4						
12		66,5		92,7	105	116						
(12,7)	(1/2)		(0,50)				113	(12,7)	130	(14,6)	143	(16,1)
14		90,6		126	142	158						
(14,3)	(9/16)		(0,63)				143	(16,1)	165	(18,5)	182	(20,4)
(15,9)	(5/8)		(0,78)									
16		118		165	186	206						
18		150		209	235	260						
(19,1)	(3/4)		(1,13)				251	(28,2)	288	(32,4)	317	(35,6)
20		185		257	290	321						
22		224		312	351	389						
(22,2)	(7/8)		(1,53)				339	(38,1)	390	(43,8)	429	(48,2)
24		266		371	418	463						
(25,4)	(1)		(2,00)				440	(49,5)	506	(56,9)	557	(62,6)
26		312		435	491	543						
28		362		505	569	630						

Table C.21 *(continued)*

Typical cross-section	Typical construction			
	Rope construction	Rope construction	Rope construction	
			Total	Per strand
	6×K31WS-IWRC	1-6-6+6-12	72	12
	6×K36WS-IWRC	1-7-7+7-14	84	14

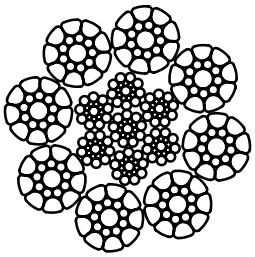
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})								
				Grade 1570	Grade 1770	Grade 1960	Grade IPS		Grade EIP		Grade EEIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	kN	(short tons)	kN	(short tons)	kN	(short tons)
(28,6)	(1-1/8)		(2,53)				553	(62,2)	636	(71,5)	700	(78,7)
29		389		541	610	676						
30		416		579	653	723						
(31,8)	(1-1/4)		(3,13)				680	(76,4)	782	(87,9)	860	(96,7)
32		473		659	743	823						
34		534		744	839	929						
(34,9)	(1-3/8)		(3,79)				820	(92,2)	943	(106)	1 040	(117)
35		566		789	889	984						
36		599		834	941	1 040						
38		667		930	1 050	1 160						
(38,1)	(1-1/2)		(4,51)				970	(109)	1 110	(125)	1 230	(138)
40		739		1 030	1 160	1 290						
(41,3)	(1-5/8)		(5,29)				1 130	(127)	1 300	(146)	1 430	(161)
42		815		1 140	1 280	1 420						
44		894		1 250	1 400	1 560						
(44,5)	(1-3/4)		(6,13)				1 310	(147)	1 500	(169)	1 650	(186)
46		978		1 360	1 540	1 700						
(47,6)	(1-7/8)		(7,04)				1 490	(167)	1 710	(192)	1 880	(211)
48		1 060		1 480	1 670	1 850						
50		1 160		1 610	1 810	2 010						
(50,8)	(2)		(8,01)				1 680	(189)	1 930	(217)	2 130	(239)
52		1 250		1 740	1 960	2 170						

Table C.22 — Class 8 ×K19 steel core

Typical cross-section	Typical construction			
	Rope construction	Rope construction	Rope construction	
			Total	Per strand
	8×K19S-IWRC	1-9-9	72	9
	8×K26WS-IWRC	1-5-5+5-10	80	10

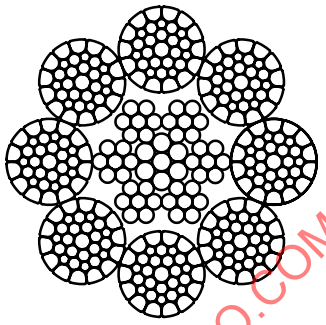
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})								
				Grade 1570	Grade 1770	Grade 1960	Grade IPS		Grade EIP		Grade EEIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	kN	(short tons)	kN	(short tons)	kN	(short tons)
10		48,5		64,4	72,6	80,4						
12		69,8		92,7	105	116						
(12,7)	(1/2)		(0,53)				113	(12,7)	130	(14,6)	143	(16,1)
14		95,1		126	142	158						
(14,3)	(9/16)		(0,67)				143	(16,1)	165	(18,5)	182	(20,4)
(15,9)	(5/8)		(0,82)									
16		124		165	186	206						
18		157		209	235	260						
(19,1)	(3/4)		(1,18)				251	(28,2)	288	(32,4)	317	(35,6)
20		194		257	290	321						
22		235		312	351	389						
(22,2)	(7/8)		(1,61)				340	(38,1)	390	(43,8)	429	(48,2)
24		279		371	418	463						
(25,4)	(1)		(2,10)				439	(49,5)	506	(56,9)	557	(62,6)
26		328		435	491	543						
28		380		505	569	630						
(28,6)	(1-1/8)		(2,66)				553	(62,2)	636	(71,5)	700	(78,7)
29		408		541	610	676						
30		436		579	653	723						
(31,8)	(1-1/4)		(3,29)				680	(76,4)	782	(87,9)	860	(96,7)
32		497		659	743	823						
34		561		744	839	929						
(34,9)	(1-3/8)		(3,98)				820	(92,2)	943	(106)	1 040	(117)
35		594		789	889	984						
36		629		834	941	1 040						
38		700		930	1 050	1 160						
(38,1)	(1-1/2)		(4,73)				970	(109)	1 110	(125)	1 230	(138)
40		776		1 030	1 160	1 290						
(41,3)	(1-5/8)		(5,55)				1 130	(127)	1 300	(146)	1 430	(161)
42		856		1 140	1 280	1 420						
44		939		1 250	1 410	1 560						
(44,5)	(1-3/4)		(6,44)				1 310	(147)	1 500	(169)	1 650	(186)
46		1 030		1 360	1 540	1 700						
(47,6)	(1-7/8)		(7,398)				1 490	(167)	1 710	(192)	1 880	(211)
48		1 120		1 480	1 670	1 850						
50		1 210		1 610	1 810	2 010						
(50,8)	(2)		(8,41)				1 680	(189)	1 930	(217)	2 130	(239)

Table C.22 *(continued)*

Typical cross-section	Typical construction			
	Rope construction	Rope construction	Rope construction	
			Total	Per strand
	8×K19S-IWRC	1-9-9	72	9
	8×K26WS-IWRC	1-5-5+5-10	80	10

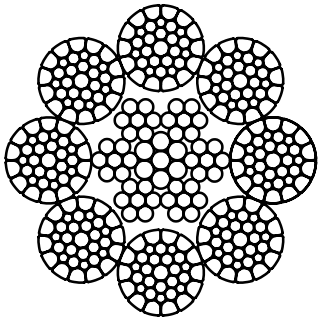
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})								
				Grade 1570	Grade 1770	Grade 1960	Grade IPS		Grade EIP		Grade EEIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	kN	(short tons)	kN	(short tons)	kN	(short tons)
52		1 310		1 740	1 960	2 170						
54		1 410		1 880	2 120	2 340						
56		1 520		2 020	2 280	2 520						
(57,2)	(2-1/4)		(10,6)				2 100	(237)	2 420	(272)	2 660	(299)
58		1 630		2 170	2 440	2 700						
60		1 750		2 320	2 610	2 890						

Table C.23 — Class 8 ×K36 steel core

Typical cross-section	Typical construction			
	Rope construction	Rope construction	Rope construction	
			Total	Per strand
	8×K31WS-IWRC	1-6-6+6-12	96	12
	8×K36WS-IWRC	1-7-7+7-14	112	14

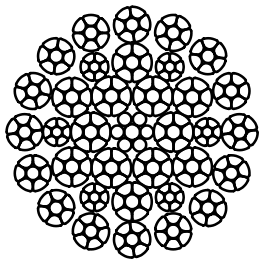
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})								
				Grade 1570	Grade 1770	Grade 1960	Grade IPS		Grade EIP		Grade EEIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	kN	(short tons)	kN	(short tons)	kN	(short tons)
10		48,5		64,4	72,6	80,4						
12		69,8		92,7	105	116						
(12,7)	(1/2)		(0,53)				113	(12,7)	130	(14,6)	143	(16,1)
14		95,1		126	142	158						
(14,3)	(9/16)		(0,67)				143	(16,1)	165	(18,5)	182	(20,4)
(15,9)	(5/8)		(0,82)									
16		124		165	186	206						
18		157		209	235	260						
(19,1)	(3/4)		(1,18)				251	(28,2)	288	(32,4)	317	(35,6)
20		194		257	290	321						
22		235		312	351	389						
(22,2)	(7/8)		(1,61)				340	(38,1)	390	(43,8)	429	(48,2)

Table C.23 *(continued)*

Typical cross-section	Typical construction			
	Rope construction	Rope construction	Rope construction	
			Total	Per strand
	8×K31WS-IWRC	1-6-6+6-12	96	12
	8×K36WS-IWRC	1-7-7+7-14	112	14

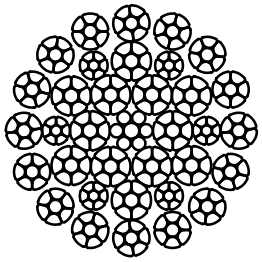
Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})								
				Grade 1570	Grade 1770	Grade 1960	Grade IPS		Grade EIP		Grade EEIP	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	kN	(short tons)	kN	(short tons)	kN	(short tons)
24		279		371	418	463						
(25,4)	(1)		(2,10)				439	(49,5)	506	(56,9)	557	(62,6)
26		328		435	491	543						
28		380		505	569	630						
(28,6)	(1-1/8)		(2,66)				553	(62,2)	636	(71,5)	700	(78,7)
29		408		541	610	676						
30		436		579	653	723						
(31,8)	(1-1/4)		(3,29)				680	(76,4)	782	(87,9)	860	(96,7)
32		497		659	743	823						
34		561		744	839	929						
(34,9)	(1-3/8)		(3,98)				820	(92,2)	943	(106)	1 040	(117)
35		594		789	889	984						
36		629		834	941	1 040						
38		700		930	1 050	1 160						
(38,1)	(1-1/2)		(4,73)				970	(109)	1 110	(125)	1 230	(138)
40		776		1 030	1 160	1 290						
(41,3)	(1-5/8)		(5,55)				1 130	(127)	1 300	(146)	1 430	(161)
42		856		1 140	1 280	1 420						
44		939		1 250	1 410	1 560						
(44,5)	(1-3/4)		(6,44)				1 310	(147)	1 500	(169)	1 650	(186)
46		1 030		1 360	1 540	1 700						
(47,6)	(1-7/8)		(7,398)				1 490	(167)	1 710	(192)	1 880	(211)
48		1 120		1 480	1 670	1 850						
50		1 210		1 610	1 810	2 010						
(50,8)	(2)		(8,41)				1 680	(189)	1 930	(217)	2 130	(239)
52		1 310		1 740	1 960	2 170						
54		1 410		1 880	2 120	2 340						
56		1 520		2 020	2 280	2 520						
(57,2)	(2-1/4)		(10,6)				2 100	(237)	2 420	(272)	2 660	(299)
58		1 630		2 170	2 440	2 700						
60		1 750		2 320	2 610	2 890						

Table C.24 — Class 35(W) × K7

Typical cross-section	Typical construction			
	Rope construction	Rope construction	Rope construction	
			Total	Per strand
	35(W)×K7	1-6	96	6

Nominal wire rope diameter		Approximate nominal length mass		Minimum breaking force (F_{min})		
				Grade 1770	Grade 1960	Grade 2160
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN
10		49,7		72,6	80,4	86,4
12		71,6		105	116	124
(12,7)	(1/2)		(0,54)			
14		97,4		142	158	169
(14,3)	(9/16)		(0,68)			
(15,9)	(5/8)		(0,84)			
16		127		186	206	221
18		161		235	260	280
(19,1)	(3/4)		(1,21)			
20		199		290	321	346
22		241		351	389	418
(22,2)	(7/8)		(1,65)			
24		286		418	463	498
(25,4)	(1)		(2,15)			
26		336		491	543	584
28		390		569	630	677
(28,6)	(1-1/8)		(2,73)			
30		447		653	723	778
(31,8)	(1-1/4)		(3,37)			
32		509		743	823	885
34		575		839	929	999
(34,9)	(1-3/8)		(4,07)			
36		644		941	1 040	1 120
38		718		1 050	1 160	1 250
(38,1)	(1-1/2)		(4,85)			
40		795		1 160	1 290	1 380
(41,3)	(1-5/8)		(5,69)			
42		877		1 280	1 420	1 520
44		962		1 400	1 560	1 670
(44,5)	(1-3/4)		(6,60)			
46		1 050		1 540	1 700	1 830
(47,6)	(1-7/8)		(7,57)			
48		1 150		1 670	1 850	1 990
50		1 240		1 810	2 010	2 160

Table C.24 *(continued)*

Typical cross-section				Typical construction			
				Rope construction	Rope construction	Rope construction	
						Total	Per strand
				35(W)×K7	1-6	96	6
Nominal wire rope diameter		**Approximate nominal length mass**		**Minimum breaking force (F_{min})**			
				Grade 1770	**Grade 1960**	**Grade 2160**	
mm	(in)	kg/100 m	(lb/ft)	kN	kN	kN	
(50,8)	(2)		(8,62)				
52		1 340		1 960	2 170	2 340	
54		1 450		2 120	2 340	2 520	
56		1 560		2 280	2 520	2 710	
(57,2)	(2-1/4)		(10,9)				
58		1 670		2 440	2 700	2 910	
60		1 790		2 610	2 890	3 110	