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GB/T 38818-2020

Steel wire ropes for hanger of suspension bridge

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Foreword

GB/T 38818-2020 was issued on 2 June 2020 by the State Administration for Market Regulation and the Standardization Administration of the People's Republic of China, and has been in force since 1 December 2020. The /T in the designation marks it as a recommended national standard.

This standard was drafted in accordance with the rules given in GB/T 1.1-2009.

This standard was proposed by the China Iron and Steel Association and is under the jurisdiction of the National Technical Committee on Steel of Standardization Administration of China (SAC/TC 183).

The drafting units are Guizhou Wire Rope Co. Ltd., Xianyang Baoshi Steel Tube and Wire Rope Co. Ltd., Jiangsu Langshan Wire Rope Co. Ltd., China Railway Major Bridge Engineering Group Materials Co. Ltd., Juli Sling Co. Ltd. and the Metallurgical Industry Information Standards Research Institute.

1 Scope

China's national standard for the steel wire rope used in the hangers of a suspension bridge - the vertical ropes that hang the deck off the main cable. They are among the shortest-lived structural members of a long-span bridge and among the hardest to replace: each one carries a share of the deck permanently, works in constant fatigue as traffic and wind move the deck, sits in the open for its whole life and is anchored at both ends where water collects. When a hanger fails the load transfers to its neighbours and the failure tends to propagate, so the whole class of product is treated as safety-critical and hanger replacement campaigns are a routine and expensive part of keeping a suspension bridge in service. This standard specifies the terms and definitions, the classification and designation, the ordering information, the technical requirements, the test methods, the inspection rules, the acceptance method, the packaging, marking and quality certificate, and the safe use and maintenance of steel wire ropes for suspension bridge hangers, and it applies to such ropes in the diameter range 40 mm to 120 mm and of grade not higher than 2160. Its content is largely about the things that decide how long a hanger lasts: the tensile grade of the wire before closing, the class and weight of the zinc coating, the tolerance and out-of-roundness of the finished rope, the evenness and tightness of the lay, and the rule that no joint may appear in an outer wire over any independently used length. Annex A carries the minimum breaking force tables that a designer actually sizes from, by rope class, diameter and grade, and Annex B the test on wires drawn from the strands.

This standard specifies the terms and definitions, the classification and designation, the ordering information, the technical requirements, the test methods, the inspection rules, the acceptance method, the packaging, marking and quality certificate, and the safe use and maintenance of steel wire ropes for the hangers of suspension bridges.

This standard applies to steel wire ropes for the hangers of suspension bridges in the diameter range 40 mm to 120 mm and of a rope grade not exceeding grade 2160.

2 Normative references

The following documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition

(including all amendments) applies.

GB/T 228.1 Metallic materials - Tensile testing - Part 1: Method of test at room temperature

GB/T 238 Metallic materials - Wire - Reverse bend test

GB/T 239.1 Metallic materials - Wire - Part 1: Single direction twist test

GB/T 1839 Steel products - Test method for the quality of zinc coating

GB/T 2104 General specification for the packaging, marking and quality certificate of steel wire ropes

GB/T 8358 Steel wire ropes - Determination of the actual breaking force

GB/T 8706 Steel wire ropes - Terminology, designation and classification

GB/T 21965 Steel wire ropes - Acceptance and defect terminology

GB/T 24191 Steel wire ropes - Determination of the actual modulus of elasticity

GB/T 29086 Steel wire ropes - Safety - Use and maintenance

JT/T 449 Hangers for highway suspension bridges

YB/T 081 Rounding of numerical values and judgement of test data in metallurgical technical standards

YB/T 4643-2018 Shaped steel wire for rope making

YB/T 5343-2015 Round steel wire for rope making

3 Terms and definitions

The terms and definitions given in GB/T 8706 and in JT/T 449 apply to this document.

4.1 Classification

4.1.1 Classification follows the principles laid down in GB/T 8706. Steel wire ropes are divided into single-layer round strand ropes, single strand ropes and locked coil (sealed) ropes; the detail is given in Table 1 to Table 3.

Table 1 covers single-layer round strand ropes. Classes 6 x 19, 6 x 36 and 6 x 61 all have 6 strands, 6 outer strands and 1 strand layer; classes 8 x 19, 8 x 36 and 8 x 61 all have 8 strands, 8 outer strands and 1 strand layer. For the 19 classes the outer strand has 15 to 26 wires, 7 to 12 outer wires and 2 to 3 wire layers; for the 36 classes, 29 to 57 wires, 12 to 18 outer wires and 3 to 4 wire layers; for the 61 classes, 61 to 85 wires, 18 to 24 outer wires and 3 to 4 wire layers. In every case the strand is of parallel lay.

Table 2 covers single strand ropes. Class 1 x 91 has 90 to 125 wires, 29 to 34 outer wires and 5 to 6 wire layers; class 1 x 127 has 126 to 167 wires, 35 to 40 outer wires and 6 to 7

wire layers; class 1 x 169 has 168 to 215 wires, 41 to 46 outer wires and 7 to 8 wire layers; class 1 x 217 has 216 to 269 wires, 47 to 52 outer wires and 8 to 9 wire layers; class 1 x 271 has not fewer than 270 wires, not fewer than 53 outer wires and not fewer than 9 wire layers.

Table 3 covers locked coil ropes: the double-layer fully locked coil rope has 2 layers of Z-shaped wire, the triple-layer fully locked coil rope has 3 layers and the four-layer fully locked coil rope has 4 layers.

4.1.2 Classified by the direction and the type of lay, single-layer round strand ropes are divided into right ordinary lay (sZ) and left ordinary lay (zS), and single strand ropes and locked coil ropes are divided into right lay (Z) and left lay (S).

4.2 Designation

The designation of the steel wire rope follows GB/T 8706; the structural arrangement of the strands is marked from the centre outwards. Examples of rope designations are given in Figure 1.

Example a), for a locked coil rope, reads 60 n1Z-n2Z-n3Z - WSC 1470 A Z, where the fields are in order the nominal diameter, the rope structure, the core structure, the rope grade, the surface condition of the wire and the direction of lay of the rope.

Example b), for other ropes, reads 46 6 x 36WS-IWRC 1770 AB sZ and 42 1 x 91 1570 A Z, where the fields are in order the nominal diameter, the rope structure, the core structure, the rope grade, the surface condition of the wire and the type and direction of lay of the rope.

5 Ordering information

A contract placed under this standard shall include the following: a) the number of this standard; b) the product name; c) the structure (designation code); d) the nominal diameter of the rope; e) the rope grade; f) the type and direction of lay; g) the surface condition (coating class and type); h) the quantity (length, number of coils, weight); i) the intended use; j) any other particular requirements.

6.1 Wire for rope making

6.1.1 Round steel wire for rope making, including the centre wires, the filler wires and the core wires, shall comply with the provisions for wire for important applications in YB/T 5343-2015.

6.1.2 The coating weight of shaped steel wire for rope making shall comply with Table 4, and the remaining indexes shall comply with the provisions for wire for static applications in YB/T 4643-2018.