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**Technical delivery requirements of steel wire ropes for coal
mine hoisting**

煤矿重要用途钢丝绳验收技术条件

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Technical delivery requirements of steel wire ropes for coal mine hoisting

1 Scope

This document specifies the requirements for acceptance, pre-hanging inspection, inspection and testing, inspection rules, packaging, marking, quality certificates and safety signs, etc. of steel wire ropes for coal mine hoisting.

Steel wire ropes for coal mine hoisting include: shaft hoisting wire ropes, inclined shaft hoisting wire ropes, hanging hoist wire ropes, inclined wire ropes for transporting personnel, traction belt conveyor wire ropes and tilted stepless rope winch wire ropes and wire ropes for overhead passenger installations.

This Standard applies to various round strand wire ropes, special-shaped strand wire ropes and compacted strand wire ropes for coal mine hoisting.

This Standard does not apply to balancing flat wire ropes and sealed wire ropes.

2 Normative references

The following referenced documents are indispensable for the application 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.

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: Simple torsion test*

GB/T 1839, *Test method for gravimetric determination of the mass per unit area of galvanized coatings on steel products*

GB/T 2104, *Steel wire ropes -- Packing, marking and certificate -- General requirements*

GB/T 8170, *Rules of rounding off for numerical values and expression and judgement of limiting values*

GB/T 8358, *Steel wire ropes -- Determination of breaking force*

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

GB/T 8918, *Steel wire ropes*

GB/T 8919, *Wire for steel wire ropes use*

GB/T 15030, *Sisal wire rope core*

GB/T 21965, *Steel wire ropes -- Vocabulary for acceptance and defect*

AQ 1043, *Mining Products Safety Label*

YB/T 5343, *Steel wire for ropes*

YB/T 5359, *Compacted strand ropes*

NB/SH/T 0387, *Wire rope greases*

Coal Mine Safety Regulations (Edition 2016)

3 Wire rope material

3.1 Steel wire for rope making

The steel wire used for rope making shall comply with the requirements for important purpose steel wire in GB/T 8919. Compacted strand wire rope wires shall comply with the requirements for important purpose steel wires in YB/T 5343.

3.2 Rope core

3.2.1 Fiber core

The fiber core shall comply with the requirements of GB/T 15030 or be made of jute, synthetic fiber or other fibers that meet the requirements. Unless otherwise required by the purchaser, the fiber core shall be soaked with lubricating grease with anti-corrosion and anti-rust properties.

3.2.2 Steel core

The steel core is divided into independent steel wire rope core [IWR, IWRC, IWRC(K)], compacted strand parallel twisted steel wire rope core [PWRC(K)] and steel wire strand core (IWS, WSC). For compacted strand steel wire ropes, if the purchaser has no special requirements, the supplier shall determine whether the steel core is a compacted strand core.

3.3 Grease

Unless otherwise required by the purchaser, the surface of the wire rope shall be evenly

and continuously coated with anti-rust lubricating grease. When the purchaser requires the steel wire rope to have friction-increasing performance, the steel wire rope shall be coated with friction-increasing grease and there shall be no leakage.

The grease and hemp core grease used for steel wire ropes shall comply with NB/SH/T 0387 or other relevant requirements.

4 Requirements

4.1 Basic requirements

4.1.1 Wire ropes shall have mining product safety signs.

4.1.2 Wire ropes shall have quality certificates. Among them, the requirements for steel wire ropes shall comply with the implementation standards and requirements for safety signs of mining products.

4.1.3 After the new wire rope arrives, it shall be inspected for performance according to this Standard and can only be used after passing the test.

4.1.4 Steel wire ropes stored for more than 1 year shall be tested again according to this Standard before being hung, and can only be used after passing the test.

4.1.5 The safety factor when hanging wire ropes for various purposes (the ratio of the measured sum of the breaking tension of qualified steel wires to the maximum static tension it bears) shall comply with the relevant provisions of the "Coal Mine Safety Regulations".

4.2 Requirements for wire ropes

4.2.1 Diameter

4.2.1.1 Nominal diameter

The nominal diameter shall comply with the requirements of GB/T 8918 and YB/T 5359, otherwise it shall be agreed upon by both parties. The nominal diameter shall be indicated on the wire rope quality certificate.

4.2.1.2 Diameter deviation and out-of-roundness

Diameter deviation and out-of-roundness are shown in Table 1.

breaking tension of the steel wire and the corresponding conversion factor between the sum of the minimum breaking tension of the steel wire and the minimum breaking tension of the steel wire in GB/T 8918 or the product of the conversion factor corresponding to the sum of the minimum breaking tensile forces in the table of mechanical property in YB/T 5359.

NOTE: When the typical structure of the wire rope is inconsistent with GB/T 8918 or YB/T 5359, the minimum total wire breaking tension confirmed by the mining product safety mark shall be followed.

4.2.7.2.2 Method 2 -- Wire rope breaking tension

The measured breaking force of the wire rope shall not be less than the minimum breaking force of the wire rope corresponding to the nominal tensile strength of the wire rope in the mechanical property table of GB/T 8918 or the mechanical property table of YB/T 5359.

NOTE: When the nominal diameter and nominal tensile strength of the wire rope are inconsistent with the mechanical properties table of GB/T 8918 or YB/T 5359, the minimum breaking tension of the wire rope shall be calculated according to the method of GB/T 8918 or YB/T 5359. When the typical structure of the steel wire rope is inconsistent with GB/T 8918 or YB/T 5359, and the minimum breaking tension of the steel wire rope confirmed by the mining product safety mark is greater than the calculated value, the minimum breaking tension of the steel wire rope confirmed by the mining product safety mark shall be followed.

4.3 Requirements for split steel wire

4.3.1 General

Remove the steel wire from the wire rope specimen. The tensile strength, breaking tension, repeated bending and torsion of the steel wire are assessed based on the nominal tensile strength and nominal diameter of the steel wire. Or take steel wires with the same nominal diameter as a group (the nominal diameter of the steel wire before twisting for compacted stranded steel wire ropes), and use the nominal tensile strength in Table 2 below the actual measured average tensile strength value as the nominal tensile strength of the steel wire. Assess various test results of steel wires.

When the nominal tensile strength of the steel wire is inconsistent with Table 2, use it as the nominal tensile strength to evaluate the tensile strength of the steel wire. Under repeated bending and torsion, the nominal tensile strength in Table 2 is used for assessment.

4.3.2 Diameter

4.3.2.1 Nominal diameter

It shall be noted on the wire rope quality certificate.

Wire rope length measurements are in meters. The accuracy of the measuring tool shall be no less than $\pm 2.5\%$.

5.1.3 Measurement of weight

Measure the total weight of the wire rope (including spool, hook and packaging material) in kg. Subtract the weight of the reel, chain hook and packaging material from the total weight and divide it by the actual measured length of the wire rope (in hundreds of meters). The resulting quotient is the actual unit weight of the wire rope, expressed in kg/100 m.

The total weight of the wire rope shall be measured with a scale.

5.1.4 Appearance inspection

The appearance of the wire rope and its strands shall be inspected by hand and visual inspection.

5.1.5 Inspection for no looseness

Unwind one end of the wire rope into two symmetrical strands, about two lay lengths. When the two strands return to their original positions, they shall not spread out on their own (except for wire ropes with multi-layer strands and four fan-shaped strands). The steel wire rope determined to be loose during inspection is the steel wire rope with substandard twisting quality.

5.1.6 Measurement of elongation

The measurement of wire rope elongation shall be agreed between the supplier and the purchaser.

5.1.7 Determination of the sum of the breaking tensile forces of wires in wire ropes

The sum of the breaking forces of steel wires is the sum of the measured breaking forces of all steel wires.

5.1.8 Breaking tensile test of wire rope

The breaking tension of the wire rope shall be determined according to the method specified in GB/T 8358.

5.2 Split wire test

5.2.1 Measurement of diameter

Two diameter values shall be measured on the same section of the steel wire in perpendicular directions. Then take the average value as the actual measured diameter of the steel wire.

5.2.6.1.2 Compacted strand wire rope shall meet the following conditions:

- a) The number of low-value steel wires shall not exceed the requirements in Table 9;
- b) The total number of low-value steel wires allowed for the three tests of steel wire breaking tension, repeated bending and torsion is calculated based on the ratio of the total cross-sectional area of the low-value steel wires to the total cross-sectional area of the test steel wires. Wire ropes used to lift people or to lift people and materials shall be less than 6%. Wire ropes designed for lifting materials shall be less than 10%;
- c) The number of steel wires whose galvanized layer weight is lower than the minimum zinc layer weight shall not exceed 5%.

When the same steel wire has multiple low values, only one wire will be counted. When the number of unqualified steel wires calculated based on the galvanized layer weight is less than one, one is allowed.

5.2.6.2 Method 2

5.2.6.2.1 Round strand wire ropes and special-shaped strand wire ropes shall meet the following conditions:

- a) The number of unqualified steel wires of any diameter shall not exceed 1;
- b) If the number of unqualified steel wires of any one diameter is 2 or more, other steel wires of that diameter shall be tested for unqualified items one by one. The number of unqualified steel wires shall not be greater than 4% of the number of steel wires of the same diameter (rounded to an integer according to GB/T 8170);
- c) The number of steel wires whose galvanized layer weight is lower than the minimum zinc layer weight shall not exceed 5%.

When the same steel wire has multiple failures, only one wire will be counted. When the number of unqualified steel wires calculated based on the galvanized layer weight is less than one, one is allowed.

5.2.6.2.2 Compacted strand wire rope shall meet the following conditions:

- a) The number of steel wires whose galvanized layer weight is lower than the minimum zinc layer weight shall not exceed 5%;
- b) If one or more test items do not meet the specified requirements, the unqualified items of the remaining strands of steel wires of the same nominal diameter shall be retested. The original test results shall be added to the 100% test evaluation specified in Table 9.

When the same steel wire has multiple low values, only one wire will be counted. When

the number of unqualified steel wires calculated based on the galvanized layer weight is less than one, one is allowed.

6 Inspection rules

6.1 General

6.1.1 Each wire rope shall undergo acceptance inspection and inspection before hanging.

6.1.2 Acceptance inspection and pre-hanging inspection shall be proposed and sampled by the user.

6.1.3 Acceptance inspection and pre-hanging inspection shall be carried out by qualified inspection organizations authorized by the department responsible for supervision and management of production safety.

6.2 Sampling method and sampling quantity

6.2.1 Method 1

Cut a specimen of sufficient length from the end that has passed the visual inspection. The number of tests shall be 100% of the total number of test specimens (excluding galvanized coating tests). Group steel wires of the same nominal diameter. Carry out various tests according to the provisions of 5.1.7 and 5.2.

The filling steel wires in the strands, the various strand core steel wires and the steel cores in the steel wire ropes only participate in the test and assessment of the total breaking tensile force of the steel wires.

The low carbon steel wires, filler wires and patch wires that make up the triangular strand core are not included in the sample range.

The length of the specimen shall not be less than 1.5 m.

6.2.2 Method 2

Take a specimen of sufficient length from one end of each wire rope. Carry out the breaking tensile test of the wire rope according to the provisions of 5.1.8.

Take a specimen of sufficient length from one end of each wire rope. Choose any 1 strand of single-layer wire rope. Multi-layer strand steel wire ropes are selected according to Table 12, and multi-layer strands of compacted strand steel wire ropes are selected according to Table 13 (except for welding points). Carry out various tests according to the provisions of 5.2. The steel wires tested do not include filler wires in strands, various strand core steel wires and steel cores in steel wire ropes.

The length of the specimen shall not be less than 4 m.

Annex A

(normative)

Wire rope twist quality and surface quality

A.1 Twist quality

A.1.1 The strands shall be twisted evenly and tightly.

A.1.2 The size of the strand core wire and strand fiber core shall ensure sufficient support so that the outer twisted steel wire can be twisted evenly. A relatively uniform gap is allowed between adjacent steel wires of strand ropes with fiber cores. For strands made of steel wires of the same diameter and the steel core in the rope, the center wire and center strand shall be appropriately enlarged.

A.1.3 The wire rope shall be twisted evenly, tightly and not loosely. The intrafemoral wire shall not be loose. It must not be wavy when unfolded and unloaded.

A.2 Surface quality

The following appearance defects are not allowed on steel wire ropes:

- a) Broken wire: the phenomenon of steel wire breakage in the steel wire rope strand;
- b) Jump wire: a steel wire in a strand with one or more protrusions forming an arch or loop;
- c) Missing wire: there is a lack of steel wire in the steel wire rope strand;
- d) Interlacing of steel wires: one or several steel wires cross on the surface of the steel wire rope, and the steel wires are not in the specified geometric position;
- e) Uneven tightness of strands or wires: protrusions or depressions in the strands or wires in the rope;
- f) Wrong wire connection: there are wire diameter mismatches, wire hooking, overlapping, and twisting in the strands;
- g) Kink in the wire rope: the wire rope cannot return to a straight shape due to excessive bending or twisting;
- h) Surface damage: damage occurs on the surface of the steel wire due to collision, squeezing, falling, etc.;
- i) Exposed hemp core: the rope core is extruded from between the rope strands, the local hemp core is thickened, the rope diameter becomes larger, or the hemp core

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