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COAL INDUSTRY STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

ICS 83.140.99; 53.040.20; 13.220.40

G 42

MT/T 668-2019

Replacing MT 668-2008

Steel cord fire resistant conveyor belting for coalmine

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Issued on: November 28, 2019

Implemented on: June 01, 2020

Issued by: State Administration of Coal Mine Safety

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Steel cord fire resistant conveyor belting for coalmine

1 Scope

This standard specifies the product classification, model, specifications, technical requirements, test methods, inspection rules, marking, packaging, storage, transportation of steel cord fire resistant conveyor beltings for coal mines (hereinafter referred to as "fire resistant belts").

This standard applies to steel cord fire resistant conveyor beltings used in coal mines.

2 Normative references

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) is applicable to this standard.

GB/T 528-2009 Rubber, vulcanized or thermoplastic - Determination of tensile stress-strain properties

GB/T 3512 Rubber, vulcanized or thermoplastic - Accelerated ageing and heat resistance tests - Air-oven method

GB/T 5752 Conveyor belts - Marking

GB/T 5753 Steel cord conveyor belts - Methods for the determination of total thickness and cover thickness

GB/T 5754.2 Steel cord conveyor belts - Longitudinal traction test - Part 2: Measurement of tensile strength

GB/T 5755 Steel cord conveyor belts - Cord-to-coating bond test - Initial test and after thermal treatment

GB/T 7983 Conveyor belts - Transverse flexibility (troughability) - Test method

GB/T 9770-2013 Steel cord conveyor belts for general use

GB/T 9867 Rubber, vulcanized or thermoplastic - Determination of abrasion resistance using a rotating cylindrical drum device

GB/T 12753 Steel wire ropes for conveyer belts

between the supplier and the buyer. If there is no agreement through negotiation, it shall be governed by the provisions of Table 3 in GB/T 9770-2013.

4 Technical requirements

4.1 Appearance quality

4.1.1 The fire resistant belt shall not have edge waves.

4.1.2 When the depth of the exposed scar on the fire resistant belt is greater than 1 mm, it shall be repaired (if the depth is not greater than 1 mm, it will not be repaired).

4.1.3 The total area of blisters and delamination on the fire-retardant belt's covering layer shall not exceed 1600 cm² per 100 m²; they shall be repaired and in good condition.

4.1.4 The cumulative length of the edge rubber sponges or torn off edge tape on both sides of the fire resistant belt shall not exceed 8% of the belt length, which shall be repaired and in good condition.

4.1.5 For every 100 m of fire resistant belt, no more than 5 places with a depth greater than 1 mm shall be pressed with edge glue; they shall be repaired (those with a depth not greater than 1 mm will not be repaired).

4.1.6 There shall be no exposed steel wire rope on the fire resistant belt.

4.2 Dimensions

4.2.1 Width deviation

The width limit deviation of the fire resistant belt shall comply with the provisions of Table 1.

4.2.2 Covering layer thickness

The thickness of the covering layer of the fire resistant belt shall comply with the requirements in Table 2.

joint tensile strength of the fire resistant belt shall not be less than 80% of the longitudinal rated tensile strength of the belt.

4.11.4 For fire resistant belts of models above ST/S7500 (not included), the static joint tensile strength of the fire resistant belt shall not be less than 75% of the longitudinal rated tensile strength of the belt.

4.12 Dynamic joint durability

There is no damage to the fire resistant belt joint after 10000 cycles.

4.13 Surface resistance properties

The arithmetic average surface resistance of the two surfaces on the fire resistant belt and the lower surface shall not be greater than $3.0 \times 10^8 \Omega$.

4.14 Fire resistant properties

4.14.1 Roller friction performance

When the fire resistant belt is subjected to the roller friction test, flaming or flameless combustion shall not occur in any part of the fire resistant belt; the surface temperature of the roller shall not exceed 325 °C.

4.14.2 Blowtorch combustion performance

The fire resistant belt shall comply with the following requirements, after the alcohol blowtorch combustion test:

- a) For specimens with complete coverage, the arithmetic mean of the flaming burning time and the arithmetic mean of the flameless burning time of the specimen shall not be greater than 3.0 s, where the single value of flaming burning time and flameless burning time of each specimen shall not be greater than 10.0 s;
- b) For the test piece with the covering layer peeled off, the arithmetic mean value of the flaming burning time and the arithmetic mean value of the flameless burning time of the test piece shall not be greater than 5.0 s, where the single value of flaming burning time and the flameless burning time of each test piece shall not be greater than 15.0 s.

4.14.3 Propane tunnel combustion performance

If the fire resistant belt meets either of the following two requirements, the conveyor belt is deemed to be qualified. The requirements are as follows:

- a) The undamaged length of each specimen shall not be less than 600 mm;

- b) The undamaged length shall not be less than 50 mm; the maximum average temperature rise shall not be greater than 140 °C; the length of the belt loss shall not be greater than 1250 mm.

A conveyor belt's propane tunnel burning test is deemed to have failed, when the test is terminated prematurely, due to endangerment to people and equipment during the burning process.

5 Test methods

5.1 Sample collection

Take samples, 24 h after the product is manufactured.

5.2 Appearance quality

Use visual inspection and measuring tools for inspection.

5.3 Dimensional measurements

5.3.1 Width measurement

Use a steel belt measure or steel ruler, which has a minimum resolution of not less than 1 mm, for measurement. Make 3 measurements in total. The longitudinal interval of each measurement shall not be less than 0.5 m. Take the median value as the measurement result.

5.3.2 Measurement of covering layer thickness

Follow the provisions of GB/T 5753.

5.3.3 Measurement of tear-resistant layer configuration

Follow the provisions of HG/T 3646.

5.4 Longitudinal tensile strength test

Follow the provisions of GB/T 5754.2.

5.5 Adhesion strength test

5.5.1 The bonding strength of the steel wire rope shall be carried out in accordance with the provisions of GB/T 5755. The measurement of the total thickness of the belt and the thickness of the upper and lower covering layers shall be carried out, in accordance with the provisions of GB/T 5753. The difference between the total thickness of the belt and the thickness of the upper and lower covering layers is the diameter of steel wire rope d .

5.5.2 The measurement of the bonding strength of the covering layer shall be carried out, in accordance with the provisions of Appendix A.

5.6 Performance test of steel wire rope in fire resistant belt

5.6.1 The diameter of the wire rope shall be in accordance with the provisions of GB/T 12753.

5.6.2 The distance between steel wire ropes shall be measured in accordance with the provisions of GB/T 9770.

5.6.3 The number of wire ropes shall be determined by visual inspection.

5.6.4 The determination of the eccentricity value of the wire rope shall be carried out in accordance with the provisions of GB/T 9770.

5.7 Covering layer performance test

5.7.1 The tensile properties of the covering layer shall be in accordance with the provisions of GB/T 528-2008. The specimen shall be cut using a type 2 [narrow parallel section width (4.0 ± 0.1) mm] dumbbell-shaped cutter.

5.7.2 The aging resistance of the covering layer shall be in accordance with the provisions of GB/T 3512.

5.7.3 The wear resistance of the covering layer shall be in accordance with the provisions of GB/T 9867.

5.8 Bonding fatigue resistance test of dynamic wire rope

Follow the provisions of Appendix B.

5.9 Tear resistance test

Follow the provisions of HG/T 3646.

5.10 Troughing performance test

Follow the provisions of GB/T 7983.

5.11 Rubber permeability test

Follow the provisions of Appendix C.

5.12 Tensile strength test of static joint

The number of samples is 3 pieces. The sample size shall meet the requirements of Figure 4. The width b shall be (250 ± 30) mm. The tensile speed of the holder is (100 ± 10) mm/min. The static joint's tensile strength is calculated according to formula (1).

f) Inspection conclusion;

g) Inspector.

6.2 Exit-factory inspection

6.2.1 The product shall be inspected by the quality inspection department of the manufacturer. 1000 m is considered a batch (less than 1000 m is also considered a batch, in which the post-aging test of the covering layer is conducted once a quarter), which shall be inspected once. Only after it passes the inspection and the certificate of conformity is issued can it leave the factory.

6.2.2 See Table 9 for exit-factory inspection items.

6.3 Type inspection

6.3.1 Type inspection shall be carried out under any of the following circumstances:

- a) Type finalization of trial production of new products or old products after transplant production;
- b) After formal production, there are major changes in structure, materials, processes that may affect product performance;
- c) When the production is resumed after suspension for two years;
- d) When the exit-factory inspection results are inconsistent with the last type inspection results;
- e) When relevant national supervisory agencies, etc. propose type inspection requirements.

6.3.2 Samples for type inspection shall be selected from products that have passed exit-factory inspection, with a sampling base of 100 m and a total sample length of 10 m (excluding joint performance test specimens).

6.3.3 Type inspection items are as shown in Table 9.

Appendix A

(Normative)

Method for determination of bonding strength of covering layer

A.1 Determination of bonding strength between covering layer and adhesive layer

A.1.1 Test piece preparation

A.1.1.1 The test piece is a rectangular strip, which has a thickness of the full thickness of the strip and a width of at least 25 mm. It shall contain two steel wire ropes (the wire ropes are arranged symmetrically) and have a length of at least 500 mm (along the direction of the wire ropes).

A.1.1.2 The number of test pieces is 3. Cut and prepare the test pieces from the sample belt, according to the following method.

Cut the specimen parallel to the axis of the belt, at a distance of at least 50 mm from the edge of the belt. At one end of the test piece, peel off one side of the covering layer in full width close to the edge of the wire rope for a length of 50 mm (this shall ensure that the test piece is firmly clamped in the holder of the testing machine). Use the same method to peel off the other side of the covering from the other end of the test piece.

A.1.2 Instruments and equipment

A.1.2.1 Tensile testing machine: It has an accuracy of 1% and a device for automatically recording the peeling force.

A.1.2.2 Holder: It shall be able to ensure that the test piece is well fixed, does not slip during the test, the moving speed can be controlled at (100 ± 10) mm/min.

A.1.3 Measurement steps

A.1.3.1 The cut specimens shall be placed in such environment, which has a temperature of (23 ± 2) °C and a relative humidity of 45%RH ~ 75%RH for at least 2 hours. The test shall also be conducted in this environment.

A.1.3.2 Fix the specimen in the holder of the tensile testing machine. Use one chuck to clamp the peeled covering layer; use another chuck to clamp the wire rope and surrounding covering layer. The automatic graphing instrument records peeling off force, which is required to peel the covering layer for 100 mm, when the holder is separated at a constant speed of (100 ± 10) mm/min. The unpeeled part of the specimen may not be fixed.

A.1.3.3 The average peel force and bonding strength are determined according to A.1.4.1 and A.1.4.2, respectively.

A.1.3.4 If the test piece breaks, record the maximum stress value of the two test pieces, which is determined by the automatic graphing instrument.

A.1.4 Determination of average peeling force and bonding strength

A.1.4.1 Determination of the average peeling force: The initial force recorded automatically can be ignored. Take the automatically recorded curve with the effective peeling length of the covering layer not less than 75 mm, to determine the peeling force.

A.1.4.2 The bonding strength is the ratio of the peeling force to the width of the specimen, in Newtons per millimeter (N/mm).

A.1.5 Result expression

The average peeling force between the upper and lower covering layers and bonding layers of each specimen shall be recorded separately; the average bonding strength of the three specimens shall be calculated.

A.2 Bonding strength within covering layer containing fabric layer

A.2.1 Test piece preparation

A.2.1.1 The test piece is a rectangular strip, which has a thickness of the full thickness of the strip and a width of at least 25 mm. It shall contain two steel wire ropes (the wire ropes are arranged symmetrically) and have a length of at least 500 mm (along the direction of the wire ropes).

A.2.1.2 The number of test pieces is 3. Cut and prepare the test pieces from the sample belt according to the following method:

Cut the specimen parallel to the axis of the belt, at a distance of at least 50 mm from the edge of the belt. At one end of the test piece, cut one side of the covering layer close to the fabric layer at its full width to a length of 50 mm (this shall ensure that the test piece is firmly clamped in the holder of the testing machine); use the same method to peel off the other side of the covering from the other end of the test piece.

A.2.2 Determination steps

Proceed according to A.1.3.

A.2.3 Determination of average peel force and internal bonding strength

Proceed according to A.1.4.

A.2.4 Result expression

Where:

F_B - Rated tensile force of the specimen, in kilonewtons (kN);

n_s - Number of wire ropes at the specimen connector;

t - Wire rope pitch, in millimeters (mm);

σ - Rated tensile strength of steel core conveyor belt, in kilonewtons per meter (kN/m).

D.6 Measurement steps

D.6.1 Connect the fire resistant belt into an annular integral belt. Install it on the drum of the test bench according to Figure D.1.

D.6.2 According to the rated tensile force F_B of the specimen, determine the maximum cyclic tension of the test as 50% F_B and the minimum cyclic tension as 6.6% F_B . Set the maximum and minimum cyclic tensions into the control coefficient database.

D.6.3 Check the turnover period T_p of the endless belt. Confirm the tension cycle period T_F on the test bench, to make $T_F/T_p = 18 \pm 1$.

D.6.4 When starting the test bench, the starting acceleration shall not be greater than 0.2 m/s^2 . All display, monitoring, recording and other devices will start working simultaneously.

D.6.5 Under the cycle condition of maintaining the set tension, make the specimen turnover period and tension cycle period run continuously and uninterrupted according to the specified ratio, until the specimen joint is disconnected or the number of tension cycles reaches the specified value.

D.7 Result expression

D.7.1 The average dynamic test life of a joint is the arithmetic mean of the measured number of tension cycles when the two joints are disconnected.

D.7.2 If the joints of the specimen in the test are subject to 10^4 tension cycles without breaking, it will be judged that the dynamic joint durability test of the modified fire resistant belt meets the standard requirements, meanwhile the test conditions will be recorded and filed.

D.8 Test report

When referring to this standard in the test report, it shall be stated:

a) Conveyor belt manufacturer;

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