# MT

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## MT/T 478-2011

**Replacing MT 478-1996**

# YBS series flameproof three phases asynchronous motor for conveyer

## YBS 系列

## 输送机用隔爆型三相异步电动机



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# Table of Contents

# Foreword

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

This Standard replaces MT 478-1996, YBS series flameproof three phases asynchronous motor for conveyer; and compared with MT 478-1996, the main technical changes of this Standard are as follows:

-- it changes the compulsory standard into a voluntary standard;

-- it extends the application scope of the standard, i.e. from flameproof three phases asynchronous motor for scraper conveyor to special flameproof three phases asynchronous motor for scraper and belt conveyers (see the standard name and Chapter 1; the standard name of Edition 1996 and Chapter 1);

-- it improves the enclosure protection class from IP54 to IP55 (see 3.1.2; 3.3 of Edition 1996);

-- it increases the application scope of maximum power from 500 kW to 1 000 kW (see 3.2.4; 3.9 of Edition 1996);

-- it improves the voltage to 3 300 V (see 3.2.3; 3.10 of Edition 1996);

-- it cancels the no-load hour breaking frequency test (see 4.8 of Edition 1996);

-- it cancels the continuous inching test (see 4.15 of Edition 1996); and

-- it adds the 1.5 times accidental over current test (see 4.12).

This Standard was proposed by China National Coal Association.

This Standard shall be under the jurisdiction of the Standardization Technical Committee on Special Equipment for Coal Mines and Coal Industry.

The responsible drafting organizations of this Standard: China Coal Research Institute Shanghai Branch and Shanxi Explosion-proof Motor (Group) Co., Ltd.

The participating drafting organizations of this Standard: Fushun Coal Mine Motor Manufacturing Co., Ltd., Henan Anyang Hua'an Coal Mine Motor Co., Ltd., Ningxia Northwest Junma Electric Manfacturing Co., Ltd. and Fenyi Coal Mine Motor Co., Ltd.

The main drafters of this Standard: Zhang Jian, Qing Bin, Xi Dawei, Chen Shengzhang, Wang Xuefang and Liu Gang.

The previous editions replaced by this Standard:

-- MT 478-1996.

# YBS series flameproof three phases asynchronous motor for conveyer

## 1 Scope

This Standard specifies the type, basic parameters, dimensions and tolerances, technical requirements, test methods, inspection rules and marking, packaging, transportation and storage of YBS series flameproof three phases asynchronous motor for conveyer.

This Standard applies to flameproof three phases asynchronous motor for scraper conveyer, scraper loader and belt conveyer for coal mines (hereinafter referred to as motor); this Standard can also be referred to for other derived all types of motors.

## 2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition dated applies to this document. For undated references, the latest edition of the referenced document (including all amendments) applies to this Standard.

GB/T 191-2008, *Packaging – Pictorial marking for handling of goods*

GB 755-2008, *Rotating electrical machines – Rating and performance*

GB/T 997-2008, *Rotating electrical machines – Classification of types of construction, mounting arrangements and terminal box position (IM code)*

GB/T 1032-2005, *Test procedures for three-phase induction motors*

GB/T 1993-1993, *Cooling methods for rotating electrical machines*

GB/T 2423.4-2008, *Environmental testing for electric and electronic products – Part 2: Test method – Test Db: Damp heat，cyclic (12h+12h cycle)*

GB 3836.1-2000, *Electrical apparatus for explosive gas atmospheres – Part 1: General requirements*

GB 3836.2-2000, *Electrical apparatus for explosive gas atmospheres – Part 2: Flameproof enclosure d*

GB 3836.3-2000, *Electrical apparatus for explosive gas atmospheres – Part 3: Increased safety*

GB/T 4942.1-2006, *Degrees of protection provided by the integral design of rotating electrical machined (IP code) – Classification*

GB 10068-2008, *Mechanical vibration of certain machines with shaft heights 56 mm and higher-measurement evaluation and limits of vibration severity*

GB/T 10069.1-2006, *Measurement of airborne noise emitted by rotating electrical machines and the noise limits – Part 1: Method for the measurement of airborne noise emitted by rotating electrical machines*

GB/T 10111-2008, *Generation of random numbers and procedures applied to sampling inspection for product quality*

AQ 1043-2007, *Mining products safety label*

JB/T 9615.1-2000, *Test methods of the interturn insulation on random wound winding for AC low-voltage machines*

JB/T 9615.2-2000, *Test limits of the interturn insulation on random wound winding for AC low-voltage machines*

JB/T 10098-2000, *Impulse voltage withstand levels of rotating AC machines with form-wound stator coils*

# 3 Type, basic parameters, dimensions and tolerances

**3.1** Type

**3.1.1** The motors are of flameproof type for mining; their explosion-proof sign is “Exd I”.

**3.1.2** The enclosure protection class of the motors shall be in accordance with IP55 specified in GB/T 4942.1-2006.

**3.1.3** The cooling method of the motors shall be one of the enclosure water cooling type (IC3W7) and air cooling type (ICO141) as specified in GB/T 1993-1993; and water cooling type for power 110 kW and above.

**3.1.4** The structural and installing types of the motors shall be of IMB3, IMB5 and IMB10 as specified in GB/T 997-2008, or other installing types.

**3.2** Basic parameters

**3.2.1** Product type:

The designation method for the motors is as follows:

d) in the coal mines with the possibility of explosion of methane and coal dust;

e) the cooling water temperature for the motors of water cooling does not exceed 25°C, the working pressure of cooling water is not greater than 3 MPa, and the flow rate of cooling water is not smaller than the values specified in Table 9.

**Table 9**

| Rated power kW | 110 to 132 | 160 to 200 | 250 to 355 | 375 | 400 to 500 | 630 to 710 | 800 to 1 000 |
|---|---|---|---|---|---|---|---|
| Cooling water flow rate $m^3/h$ | 1.2 | 1.5 | 1.8 | 2.1 | 2.3 | 2.5 | 2.7 |

**4.3** The motors of water cooling shall be started and operated on the condition that the flow rate of cooling water can be ensured.

**4.4** It is allowed for the motors to be started directly under the rated voltage.

**4.5** When the deviations of the supply voltage and frequency from the rated values during the operation period of the motors meet the specifications of GB 755-2008, the output power shall maintain at a rated value.

**4.6** When the power, voltage and frequency of the motors are at a rated value and the guarantee values of their efficiency and power factor are at a rated voltage, the ratio of the locked-rotor torque, locked-rotor current, maximum torque and minimum torque during starting process to their rated values shall be as specified in Table 10.

**4.15** The motors shall be capable of working normally on a coal bed working face of inclination angle not exceeding 35° to the horizontal plane.

**4.16** The working pressure of the cooling water channel of the motors shall not exceed 3 Mpa; the water channel shall be subjected to the 4.5 MPa elevated water pressure test for 5 min, without water leakage or harmful deformation.

**4.17** The insulation resistance of the stator windings of the motors shall not be lower than those specified in Table 13 after the thermal state or temperature rise test.

**Table 13**

| Rated voltage V | 380 | 660 | 1 140 | 3 300 |
|---|---|---|---|---|
| Insulation resistance MΩ | 0.38 | 0.66 | 1.14 | 3.30 |

**4.18** The stator windings of the motors, between the enclosure and windings, shall be capable of withstanding the withstand voltage test for 1 min, without breakdown. The test voltage is of a frequency 50 Hz, which is preferably of actual sinusoidal waveform. The effective of the test voltage is 1 000 V + 2 times of rated voltage.

**4.19** The low-voltage motors of random wound winding, in accordance with JB/T 9615.2-2000, shall be capable of withstanding the withstand interturn impact voltage test as required by the following (the front time of the impact test voltage is 0.2 μs, tolerance $^{+0.3}_{-0.1}$ μs; the tolerance of the impact voltage peak value is ± 3%);

$$U_T = 1.4 \times 1.2 \times U_G$$

where

$U_T$ – the voltage peak value for the winding interturn insulation impact withstand test, in V;

$U_G$ – the effective value of power frequency withstand voltage of windings to ground, in V.

**4.20** The motors of form-wound stator coils, in accordance with JB/T 10098-2000, shall be capable of withstanding the steep wave front time impact voltage test for 0.2 μs of front time; the impact voltage peak value of the 3.3 kV motors is 12 kV.

**4.21** When the three-phase power voltage is balanced, the deviation of any phase of the three-phase no-load current of the motors from the mean value of the three phases shall not be greater than 10% of the mean value of the three phases.

**4.27** The cable entry of the motors shall be capable of withstanding the clamping and sealing tests as specified respectively in GB 3836.1-2000 and GB 3836.2-2000. All parts shall not be damaged after the tests.

**4.28** The O rings of the motors shall be capable of withstanding the aging test as specified in D.3.3, Annex D of GB 3836.1-2000.

**4.29** The explosion-proof enclosure shall be capable of withstanding the enclosure static pressure test as specified in GB 3836.2-2000; the pressure shall be maintained for $10^{+z}_{0}$ s after the specified pressure is reached in the test; there shall be no leakage nor permanent deformation.

**4.30** The enclosure of the motors shall be capable of withstanding the withstand voltage test and the test of the non-explosion-propagation performance after internal ignition.

**4.31** The electric clearance and creepage distance of the terminal box of the motors shall be as specified in 4.3 and 4.4 of GB 3836.3-2000.

**4.32** Earthing bolts shall be provided in the terminal box and on the motor base of the motors; earthing signs shall be provided near the earthing bolts; the signs shall not be worn away during the entire service life of the motors.

**4.33** When the motors are operating, the bearings shall be run smoothly and steadily without stagnation or harmful noise.

**4.34** When the alphabetical order of terminal sign is consistent with the voltage phase sequence of three-phase power, the rotation direction of the motors shall be clockwise when it is seen from the principal axis end.

**4.35** When the water cooling motors are leaving factory and during storage, the measures for rust prevention and frost crack prevention shall be taken in the water jacket; water shall be discharged completely and plugs shall be provided at the inlet and outlet.

**4.36** The surface of the motors shall be coated with corrosion resistant paint which shall give a uniform film and be free from the defects such as staining, cracking, flow trace and bubble.

# 5 Test method

**5.1** The determination for the efficiency and power factors of the motors shall be as specified in Chapter 8, Chapter 9 and Chapter 10 of GB/T 1032-2005; the method E1 is preferred.

**5.15** The inclining test of the motors is to incline the motor shaft to 35° to the horizontal plane for inclined installation and operate it under no load until the bearing temperature become stabilized, and then reverse the direction of the shaft of the motors for re-try.

**5.16** The torsion test of the electrical connectors shall be conducted as specified in 23.4.5 OF GB 3836.1-2000.

**5.17** The clamping test of the cable entry of the motors shall be conducted as specified in D.3.1 of GB 3836.1-2000; the sealing performance test shall be conducted as specified in D.2.1 of GB 3836.2-2000.

**5.18** The aging test of the O ring material shall be conducted as specified in D.3.3 of GB 3836.1-2000.

**5.19** The static pressure test of the enclosure of the motors shall be conducted as specified in 15.1.2.1 and 16.3.16.4 of GB3836.2-2000.

**5.20** The withstand voltage test and the test of non-explosion-propagation performance after internal ignition of the motors shall be conducted as specified in 15.1.2.2 and 15.2 of GB 3836.2.

**5.21** The electrical clearance and creepage distance shall be examined with corresponding measuring tools as specified in 4.3 and 4.4 of GB 3836.3-2000.

**5.22** The installation dimensions and explosion-proof structures of the motors shall be examined with corresponding measuring tools.

**5.23** The enclosure protection test of the motors shall be conducted during the design of a new product, and shall be conducted as specified in GB/T 4942.1-2006.

# 6 Inspection rules

**6.1** Inspection classification

**6.1.1** The motors shall be provided with the “Explosion-proof Certificate” issued by a competent national explosion-proof testing institution.

**6.1.2** The inspection of the motors is divided into exit-factory inspection and type inspection.

**6.2** Exit-factory inspection rules and test items

Each motor shall be inspected item-by-item according to exit-factory inspection items; it can only be shipped out of the factory after qualified. The inspection items are shown in Table 17.

**6.3** Type test

| | | | | | |
|---|---|---|---|---|---|
| 15 | Winding power frequency withstand voltage test | √ | √ | 4.18 | 5.9 |
| 16 | Interturn impact voltage withstand test | √[b] | - | 4.19, 4.20 | 5.10 |
| 17 | Testing of no-load current three phases unbalance | √[c] | √ | 4.21 | 5.11 |
| 18 | Determination of vibration | - | √ | 5.22 | 5.12 |
| 19 | Determination of noise | - | √ | 4.23 | 5.13 |
| 20 | Cyclic damp heat test | - | √ | 4.24 | 5.14 |
| 21 | Torsion test | - | √ | 4.26 | 5.16 |
| 22 | Clamping and sealing test of cable entry | - | √ | 4.27 | 5.17 |
| 23 | Aging test of O ring | - | √ | 4.28 | 5.18 |
| 24 | Enclosure static pressure test | √[b] | √ | 4.29 | 5.19 |
| 25 | Test for withstand voltage and non-explosion-propagation performance after internal ignition | - | √ | 4.30 | 5.20 |
| 26 | Electrical clearance and creepage distance examination | √ | √ | 4.31 | 5.21 |
| 27 | Earthing bolt and earthing sign examination | √ | √ | 4.32 | Visual inspection |
| 28 | Enclosure protection test | - | √[d] | 3.1.2 | 5.23 |

[a] Only determine short-circuit current and short-circuit consumption during the exit-factory test.

[b] Inspection between working procedures.

[c] Add the determination of no-load current and no-load consumption during the exit-factory test.

[d] Conduct only when the product design is finalized or there is a major change in process.

**6.3.3** The rules of sampling and judgement : the samples used for type tests shall be taken from the products qualified by exit-factory test, in accordance with the simple random sampling method as specified in GB/T 10111-2008, 2 sets each time : if there are the same test items not conforming to standard of the tests of the two samples, then the product is judged to be non-conformity; if the unqualified test items of the two samples are different, the samples can be doubled for a re-test, and if there are still items not qualified, then the product is judged to be non-conformity.

# 7 Marking, packaging, transportation and storage

**7.1** The enclosure of the motors shall be marked with a conspicuous “Exd I” embossed mark, coated with red paint and provided with the safety sign “MA” as specified in AQ 1043-2007.

**7.2** The earthing screw of the motors shall be provided with the earthing sign made of brass or stainless steel and the sign shall not be worn away during the entire service life of the motors.

**Table 18**

| Stator winding name | Signs of leading-out terminal and wiring terminal | |
|---|---|---|
| | Starting terminal | Ending terminal |
| First phase | $U_1$ | $U_2$ |
| Second phase | $V_1$ | $V_2$ |
| Third phase | $W_1$ | $W_2$ |

**7.6** The shaft extension flat key of the motors shall be bound to the shaft; rust-proof and protective measures shall be taken for the shaft extension flat key, seam allowance and flange.

**7.7** The packaging of the motors shall ensure that they will not be affected with damp or damaged because of bad packaging, under normal storage conditions, within 1 year from the date of delivery.

**7.8** The technical documents accompanying with the product shall include:

a) the packing list;

b) the product quality certificate; and

c) the instructions to use and maintenance, including the type and operating temperature of the thermo-sensitive elements inbuilt in the motors.

**7.9** The words and signs on the outer surface of the packing box of the motors shall be clear and neat, including the following information:

a) the names of delivery station and manufacturer;

b) the names of receiving station and receiver;

c) the type and manufacturing number of the motors;

d) the net weight of the motors and the gross weight of them together with their box;

e) the dimensions of packing box;

f) the words and signs including “Handle with care”, “Keep dry” and “Do not roll” at an appropriate location on the packing box, with the pictorial symbols in accordance with GB/T 191-2008.

**7.10** The motors shall be stored in a ventilated and dry place and prevented from damp, corrosion and other damages.

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