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Air hoists

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Air hoists

1 Scope

This standard specifies the terms and definitions, types and basic parameters, technical requirements, test method, inspection rules, marking, packaging, transportation and storage of air hoists.

This standard applies to air hoists used in general environments, explosive gas environments, explosive dust environments. Air hoists used in other special environments can make reference to this document.

2 Normative references

The following documents are essential for the application of this document. For all referenced documents with dates, only the versions with dates apply to this document. For all undated referenced documents, the latest versions (including all amendments) apply to this document.

GB/T 783 Lifting appliances - Range of maximum capacities for basic models

GB/T 3811 Design rules for cranes

GB 3836.1-2010 Explosive atmospheres - Part 1: Equipment - General requirements

GB/T 4205 Basic and safety principles for man-machine interface (MMI), marking and identification - Actuating principles

GB/T 5972 Cranes - Wire ropes - Care, maintenance, installation, examination and discard

GB 6067.1 Safety rules for lifting appliances - Part 1: General

GB/T 7932 Pneumatic fluid power - General rules relating to systems

GB 8918 Steel wire ropes for important purpose

GB/T 9286 Paints and varnishes - Cross cut test for films

GB/T 10051.1 Lifting hooks - Part 1: Mechanical properties, lifting capacities, stresses and materials

GB/T 13306 Plates

5.3.2 When the air hoist is subjected to a static load test, it shall be able to withstand a test load of 1.25 times the rated lifting capacity. After the test, a visual inspection is carried out. The metal structural parts that bear the force shall be free of cracks, permanent deformation, paint peeling, or damage that affects the performance and safety of the air hoist. The joints shall also be free of looseness or damage; there shall be no oil leakage.

5.3.3 When the air hoist is subjected to the dynamic load test, it shall be able to withstand a test load of 1.1 times the rated lifting capacity. During the test, each component shall be able to complete its functional test; the brake and other safety devices shall operate sensitively and reliably. After the test, a visual inspection shall be carried out, to ensure that each mechanism or structural component is free of damage, each connection is free of looseness or damage, meanwhile there shall be no oil leakage.

5.3.4 When the hook is lowered and there is no other external force acting on the wire rope, the wire rope can still be discharged freely from the rope outlet of the rope guide; when the rated load is lifted and lowered, the angle of the wire rope centerline deviating from the centerline of the spiral tip by no more than 3.5° on both sides shall be able to work normally.

5.3.5 Air hoists with running mechanisms shall be able to meet the following performance requirements under rated air pressure and rated load:

a) There shall be no abnormal phenomenon during the operation process;

b) There shall be no abnormal phenomenon in the 1/200 climbing test;

c) The allowable deviation of the operating speed shall be ±15% of the nominal value (slow speed is not tested).

5.3.6 Under rated load, when the lifting speed is less than or equal to 0.5 m/min, the lifting mechanism's braking slippage shall not be greater than 5 mm; when the lifting speed is greater than 0.5 m/min, the lifting mechanism's braking slippage shall not be greater than v/100 (v is the stable lifting distance within 1 min under rated air pressure and rated load); meanwhile it shall not be greater than 200 mm.

5.3.7 Under the condition that the rated load and the air pressure deviation of the air motor inlet are ±10%, the air hoist shall work normally.

5.3.8 The lifting height shall not be less than the nominal value.

5.3.9 The minimum hook spacing shall not be greater than the nominal value.

5.3.10 Under rated air pressure and rated lifting weight, the allowable deviation of the lifting speed shall be ±10% of the nominal value; the allowable deviation of the lowering speed shall be -10% ~ 25% of the nominal value (slow speed is not tested).

5.4 Safety and hygiene

5.4.1 For air hoists with a rated lifting capacity of 1 t ~ 10 t, the lifting mechanism shall be equipped with a safety clutch; for air hoists with a rated lifting capacity greater than 10 t, the lifting mechanism shall be equipped with a safety clutch or the air hoist body shall be limited in air pressure to prevent overloading. The load limit value shall be within the range of 1.1 ~ 1.3 times the rated lifting capacity.

5.4.2 Air chain hoists shall be equipped with chain guides, to ensure that the lifting chain is smoothly engaged with the lifting sprocket and loose pulley, that the lifting chain does not get stuck, climb, or have other abnormal conditions. A limiting device shall be set at the end of the lifting chain, that is not under stress, to prevent the lifting chain from overwinding and detaching from the lifting sprocket.

5.4.3 For air hoists with single-layer winding wire ropes, rope guides shall be set or other measures shall be taken to prevent rope tangling.

5.4.4 When the hook is lowered to the lower limit position, the number of safety turns of the wire rope on the drum shall be no less than two turns (excluding the number of turns for fixing the rope tail). Under this safety winding, the rope end fixing device shall not deform to cause looseness, when it is subjected to 2.5 times the maximum working static tension of the wire rope.

5.4.5 The air hoist shall have a stroke limiting function. When the hook rises or falls to the limit position or the set position, the movement of the hook in the original direction shall be automatically stopped; however, the movement of the hook in the opposite direction shall not be affected.

5.4.6 Where there are more than two air hoists on the same track, anti-collision buffer devices shall be installed between the air hoists.

5.4.7 The operating mechanism shall run smoothly without abnormal noise.

5.4.8 Air hoists shall be equipped with normally closed working brakes; the brake safety factor shall meet the following requirements:

a) When the working level is M5 and below, it shall not be less than 1.5:

b) When the working level is M6 and above, it shall not be less than 1.75.

5.4.9 When the safety brake is set, its function shall meet the following requirements: When the transmission component fails or the working brake fails and causes the load to fall, it shall be able to reliably support the rated load.

5.4.10 The hoses, hard pipes, connecting parts used for air hoists shall be able to withstand 1.5 times the rated working pressure of the pneumatic circuit; there shall be

5.5.6.1 The operating device shall have clear markings, which shall be consistent with the actual action of the air hoist and comply with the relevant provisions of GB/T 4205.

5.5.6.2 The operating device shall take appropriate measures, to prevent the pneumatic hose and connectors from being directly stressed.

5.5.6.3 The operating device shall be stable and reliable; the overall structure shall be free of defects.

Note: The operating device includes a rope controller, an operating button, an operating handle, a lever controller, and a remote wireless console (station).

5.5.7 Pneumatic system

5.5.7.1 The pneumatic system of the air hoist shall meet the requirements of GB/T 7932.

5.5.7.2 Before assembling the pneumatic system, the joints, pipes and channels shall be cleaned and there shall be no dirt (such as iron filings, burrs, fibrous substances, etc.).

5.5.7.3 The pneumatic system shall be leak-free and the seals shall be easy to replace.

5.6 Surface coating and appearance

5.6.1 The air hoist shall not have visible cracks, scratches, burrs, or other defects.

5.6.2 The exposed metal surface of the air hoist shall be rust-proofed.

5.6.3 When the air hoist needs to be painted, the coating shall be uniform and firm; the coating thickness shall not be less than 50 μm. The adhesion of the paint film shall meet the quality requirements of grade 1 specified in GB/T 9286.

5.7 Life of lifting mechanism

5.7.1 The lifting mechanisms of different working levels shall be tested for life according to the test force method specified in 6.2.10; the total service time specified in Table 6 shall be achieved. After the test, the lifting mechanism shall still be in a usable state and shall not have obvious identifiable damage.

5.8.3 Mechanical explosion-proof requirements

5.8.3.1 In order to prevent sparks and dangerous temperatures caused by mechanical friction or collision, the exposed parts of the explosion-proof air hoist with relative friction movement shall adopt speed limit measures or other explosion-proof measures, such as the winding line speed of the wire rope and drum or the chain and sprocket and the running speed of the explosion-proof air hoist trolley on the track shall not exceed 25 m/min.

5.8.3.2 The starting and braking of the air hoist shall be smooth and visible sparks shall be avoided.

5.8.3.3 The wire rope or chain shall be reliably lubricated. There shall be no obvious broken wires on the surface of the wire rope; the wire rope with exposed wires that may produce friction sparks shall be replaced in time.

5.8.3.4 There shall be a "no collision" warning sign on the outer surface of the hook. When the explosion-proof level is Class IIC specified in GB 3836.1-2010, the hook shall take measures to prevent dangerous sparks from impact or friction.

5.8.3.5 Explosion-proof brakes shall be used for working brakes used in explosive gas environments; brakes used in explosive dust environments shall be installed in dust-tight enclosures. If a safety brake is installed, appropriate explosion-proof measures shall be taken.

5.8.3.6 When a safety clutch is installed, explosion-proof measures shall be taken for the safety clutch.

6 Test methods

6.1 Test conditions

6.1.1 Test environment requirements

The test environment shall comply with the provisions of 5.1.

6.1.2 Requirements for main test instruments and measuring tools

The testing instruments and measuring tools shall be qualified and within the calibration cycle. The requirements for accuracy and range are as follows:

a) The accuracy of the barometer shall not be lower than level 1;

b) The accuracy of the gas flow meter shall not be lower than level 1;

c) The accuracy of the dynamometer shall not be lower than level 1.0;

d) The error of the thermometer shall be within ±1 °C;

e) The accuracy of the sound level meter shall not be lower than level 2;

f) The allowable deviation of the test load shall be ±1%;

g) When selecting the instrument, the measured value should be within the range of 20% ~ 95% of the instrument range.

6.2 Test method

6.2.1 General inspection

General inspection shall include the following:

a) Check whether the structural type, air source, product specifications meet the requirements;

b) Check the oil or grease filling of each reducer to see if there is any leakage;

c) Check whether there is a mark of rated lifting weight and hook locking device;

d) Check the assembly quality of the hook: whether the hook can be turned flexibly by hand and whether it can be turned 360° in the horizontal plane;

e) Check whether the quality of the exterior coating is good and there shall be no holiday;

f) Measure the overall dimensions: Measure the length, width, height according to the product drawings;

g) Check various marks;

h) For air chain hoists, check whether the installation of the lifting chain end meets the requirements; for air wire rope hoists, check whether the wire rope end fixing and winding meet the requirements. Use special tools to check the firmness of the rope end; check whether the wire rope winding method and rope end fixing method are correct according to the relevant drawings.

6.2.2 No-load test

6.2.2.1 Under rated air pressure, perform no-load operation on the test bench; lift and lower for no less than two cycles; perform the test in accordance with the provisions of 6.2.2.2 ~ 6.2.2.7.

6.2.2.2 Record and check the air pressure value.

Where:

H - Same as formula (1);

D_0 - Bottom diameter of drum rope groove, in millimeters (mm);

d - Wire rope diameter, in millimeters (mm);

a - Pulley ratio;

n - Number of wire rope turns excluding safety turns.

6.2.5 Rated load test

6.2.5.1 Pressure reduction and pressure increase test

Before the pressure reduction test, adjust the air pressure at the air inlet end of the air hoist to 90% of the rated air pressure; start the rated load three times in the air, with a total stroke of about 2 m; slowly lift the double-speed air hoist once again, to check whether the air hoist starts and works normally.

Before the pressure increase test, adjust the air pressure at the air inlet end of the air hoist to 110% of the rated air pressure; start the rated load three times in the air, with a total stroke of about 2 m; slowly lift the double-speed air hoist once again, to check whether the air hoist starts and works normally.

6.2.5.2 Determination of brake sliding amount

As shown in Figure 8, before the test, connect an auxiliary solenoid valve (normally closed) in series to the air inlet of the air hoist; connect the micro switch in series to the electrical circuit of the solenoid valve. Fix one end of a steel wire rope with a diameter of about 1 mm to the air hoist or the test bench; connect the other end to the micro switch (contact normally closed). The micro switch shall be embedded in a heavy block; the heavy block shall be sufficient to straighten the 1 mm steel wire rope. During the measurement, place the micro switch embedded in the heavy block on the load (weight); power on the solenoid valve to open the solenoid valve. When the load stably runs and descends to a certain height, the micro switch is separated from the load. At this time, cut off the power supply circuit of the solenoid valve, resulting in the cutting off of the air source of the air hoist. The load immediately starts to slide down. Measure the vertical distance between the micro switch and the load, which is the braked sliding amount. Repeat the measurement three times; take the average value.

6.2.5.3 Determination of lifting and lowering speed

When the lifting (or lowering) speed is stable, use a stopwatch to measure the lifting (or lowering) distance within 10 seconds, or take a fixed distance and measure the time required; calculate the lifting (or lowering) speed. Measure four times in a row and take

a) Under rated air pressure conditions, the air hoist's lower hook lifts a weight greater than 1.3 times the rated lifting capacity; press the up button; after the chain (or wire rope) is tightened, check whether the safety clutch slips. After the safety clutch slips for 10 seconds, read the dynamometer display value. For single-speed air hoists and dual-speed air hoists at fast or slow speeds, check whether the display value is within the range of 1.1 ~ 1.3 times the rated lifting capacity.

b) Under rated air pressure conditions, when the air hoist is lifted at a test load of 1.3 times the rated lifting capacity at fast or slow speeds of single or dual speeds, the safety clutch shall slip; when lifting a test load of 1.1 times the rated lifting capacity, it shall be able to lift the load normally and the safety clutch shall not slip.

6.2.6.2 For air hoists that use air pressure to limit load, the following method shall be used:

Under rated air pressure conditions, when the air hoist is lifting a test load of 1.3 times the rated lifting weight at single or double speeds, the air pressure valve shall release pressure and the load shall not be lifted; when lifting a test load of 1.1 times the rated lifting capacity, the load shall be lifted normally.

6.2.7 Safety brake test

Under rated air pressure conditions, the air hoist lifts the rated load and suspends it in the air 1500 mm above the ground. Turn on the working brake, to check whether the safety brake can reliably support the rated load.

6.2.8 Static load test

Under rated air pressure, install the air hoist on the test bench and load it gradually, slowly, steadily, until it reaches 1.25 times the rated load. The lifting load is 100 mm ~ 200 mm above the ground; the suspension time shall not be less than 10 minutes.

After unloading, visually inspect all parts for cracks, permanent deformation, paint peeling, damage, loose connections, or other abnormal phenomena.

6.2.9 Dynamic load test

Under the conditions of rated air pressure and test load of 1.1 times rated load, continuous operation shall be carried out in accordance with the cycle period in Appendix A, which shall not be less than 30 minutes. For air hoists with running trolleys, the trolleys shall run back and forth for 10 cycles continuously; the single-way running distance of each cycle shall not be less than 2 m.

After unloading, visually inspect all parts for cracks, permanent deformation, paint peeling, damage, loose connections, or other abnormal phenomena.

recorded respectively;

b) The oil shall be changed after running for 50 hours; the oil may be changed appropriately during other life tests;

c) When the test running time reaches 25%, 50%, 75%, 100% of the total use time specified in Appendix A, the machine shall be shutdown and disassembled to inspect the wear, fatigue, related performance indicators of all relative motion contact parts, which shall be recorded (such as recording the temperature change of the pneumatic motor, the noise, slippage and lubrication condition of the air hoist before shutdown; measuring or checking the wear of the brake friction plate, the wear, fatigue and lubrication of the reducer gear, the wear of the drum and pulley after shutdown);

d) The scrapping of the wire rope due to wear and fatigue damage shall be handled in accordance with the requirements of GB/T 5972; the scrapping of the chain due to wear and fatigue damage shall be handled in accordance with the requirements of GB/T 20305;

e) During the inspection, the brake friction pad shall be replaced if any of the following conditions occur:

- Cracks;
- The wear of the brake friction pad reaches 50% of the original thickness;
- The unevenness of the brake surface reaches 1.5 mm.

6.2.10.5 During the entire test process, no parts shall be replaced except the wire rope or chain and the brake friction pad.

6.2.11 Appearance coating quality

6.2.11.1 Paint film thickness

Measure the paint film thickness at 10 points on the painted surface of the air hoist with a paint film thickness gauge; take the average value.

6.2.11.2 Paint film adhesion

The test method of paint film adhesion shall comply with the provisions of GB/T 9286.

6.2.12 Explosion-proof performance test

The air hoist shall be started and braked three times under no-load and rated load conditions without light, to observe whether there is sparking.

7 Inspection rules

7.1 Inspection classification

The inspection of air hoists is divided into exit-factory inspection, type inspection, life test.

7.2 Exit-factory inspection

7.2.1 Each air hoist shall be inspected and qualified by the manufacturer; only after the certificate of conformity is issued can it be allowed to leave the factory.

7.2.2 The exit-factory inspection items are shown in Table 8.

7.3 Type inspection

7.3.1 Type inspection shall be carried out for any of the following conditions:

a) Trial production and type finalization of new products or old products after transplant production;

b) After formal production, if there are major changes in structure, materials, processes, which may affect product performance;

c) When the production is resumed after suspension for more than one year;

d) When the exit-factory inspection results are significantly different from the last type inspection;

e) When the national quality supervision agency proposes a type inspection requirement.

7.3.2 The inspection items of type inspection are shown in Table 8.

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