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Rotary cylinder dryers with steam tube

蒸汽加热管式回转圆筒干燥机

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Rotary cylinder dryers with steam tube

1 Scope

This standard specifies the technical requirements, for the design, manufacture, inspection, marking, packaging, transportation and storage of rotary cylinder dryers with steam tube (hereinafter referred to as dryers), which has an inner diameter of 2000 mm ~ 4000 mm. When the inner diameter of the dryer exceeds the above range, it is for reference only.

The dryers, which is described in this standard, are mainly suitable for drying high-density polyethylene, polypropylene, polyvinyl chloride, terephthalic acid, corn alcohol trough and other moisture-containing materials, in petrochemical and related industries. It is also applicable to the drying of similar non-viscous moisture-containing materials, in the form of powder, granular, flake, paste.

2 Normative references

The provisions in following documents become the provisions of this Standard through reference in this Standard. For the dated references, the subsequent amendments (excluding corrections) or revisions do not apply to this Standard; however, parties who reach an agreement based on this Standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest edition of the referenced document applies.

GB 150-1998 Steel pressure vessels

GB 151-1999 Tubular heat exchangers

GB/T 1184-1996 Geometrical tolerancing - Geometrical tolerance for features without individual tolerance indications

GB/T 1804-2000 General tolerances - Tolerances for linear and angular dimensions without individual tolerance indications

GB/T 3077-1999 Alloy structure steels

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

GB/T 6404.1 Acceptance code for gear units - Part 1: Test code for airborne sound

GB/T 7233 Methods for ultrasonic testing and for specifying quality levels of steel

castings

GB/T 8163-1999 Seamless steel tubes for liquid service

GB/T 9443 Methods of liquid penetrant testing and classification of indication for steel castings

GB/T 10095.1-2001 Cylindrical gears - System of accuracy - Part 1: Definitions and allowable values of deviations relevant to corresponding flanks of gear teeth

GB/T 10095.2-2001 Cylindrical gears-system of accuracy - Part 2: Definitions and allowable values of deviations relevant to radial composite deviations and runout information

GB 13296 Seamless stainless steel tubes for boiler and heat exchanger

GB/T 13306 Plates

JB 4708-2000 Welding procedure qualification for steel pressure vessels

JB/T 4709-2000 Welding specification for steel pressure vessels

JB/T 4711-2003 Coating and packing for pressure vessels transport

JB/T 4730.2-2005 Nondestructive testing of pressure equipments - Part 2: Radiographic testing

JB/T 4730.3-2005 Nondestructive testing of pressure equipment - Part 3: Ultrasonic testing

JB/T 4730.4-2005 Nondestructive testing of pressure equipments - Part 4: Magnetic particle testing

JB/T 4730.5-2005 Nondestructive testing of pressure equipments - Part 5: Penetrant testing

JB 4732-1995 Steel pressure vessel - Stress analysis design standard

JB/T 4735-1997 Steel welded atmospheric pressure vessels

JB/T 6397 Specification for the heavy carbon structural steel forgings

3 Classification and model

3.1 Classification

The dryer can be divided into 3 types, according to the discharge method: radial discharge (J), gravity center discharge (Z), forced center discharge (Q).

running time of the whole machine reaches 20000 h.

4.2.5 Spherical roller bearings should be used for supporting roller and retaining roller bearings; the design life shall not be less than 50000 h.

4.2.6 For the noise control of the unit (except the hammer), the noise at 1000 mm from the transmission device and the screw feeder shall be lower than 85 dB(A), meanwhile it shall comply with the provisions of GB/T 6404.

4.2.7 For the dryer, whose materials are inflammable and explosive, AND which is used in the explosion-proof area, it shall consider the explosion-proof and flame-proof measures and requirements of the motor, electrical appliances, accompanying instruments, which comply with the provisions of GB 3836.1-2000.

4.3 Materials

4.3.1 In addition to complying with the provisions of the cited standards, the materials used shall also comply with the requirements of the drawings.

4.3.2 The materials of pressure parts and transmission parts shall have quality certificate.

4.3.3 The inspection and re-inspection of materials shall not only meet the requirements of the drawings, but also meet the requirements of the order contract.

4.3.4 When the heating tube is made of stainless steel tube, the heating tube shall comply with the provisions of GB/T 13296. When the heating tube is made of carbon steel tube, it shall comply with the provisions of GB/T 8163-1999.

4.3.5 Castings of medium carbon steel or low alloy steel should be used for the large ring gear; the castings shall be normalized and tempered.

4.3.6 The large carbon structural steel forgings should be used for the rolling rings AND comply with the provisions of JB/T 6397.

4.3.7 Forgings or castings of medium carbon steel and low alloy steel should be used for supporting rollers and retaining rollers.

4.3.8 Alloy steel forgings should be used for pinion gear, supporting roller shaft, retaining roller shaft, pinion shaft; their chemical composition and mechanical properties shall comply with the provisions of GB/T 3077-1999.

4.3.9 The acceptance of purchased mechanical and electrical products shall not only meet the requirements of national and industry standards, but also meet the requirements of drawings.

4.4 Manufacturing

4.4.1 Requirements for component manufacturing

4.4.6.5 When the annular tube is used to discharge the non-condensable gas, the butt weld of the annular tube shall be subjected to 100% radiographic inspection, which shall be qualified, according to the level II requirement of JB/T 4730.2-2005.

4.4.7 Large gear ring

4.4.7.1 Before milling teeth, ultrasonic testing shall be carried out; it shall be qualified according to the level 3 requirements of GB/T 7233.

4.4.7.2 The joint surface of the two halves of the gear ring shall be more than 4/5 of the contact area.

4.4.7.3 The tooth profile processing shall meet the level 9 precision requirements of GB/T 10095.1-2001 and GB/T 10095.2-2001. There shall be no pores, cracks, slag inclusions and other defects, on the tooth profile surface; repair welding is not allowed.

4.4.7.4 The heat treatment hardness of the tooth surface shall meet the requirements of the drawing.

4.4.7.5 Penetration testing shall be carried out on the tooth profile surface; it shall be qualified, according to the level I requirements of GB/T 9443.

4.4.7.6 After the large gear ring is made, a circular indexing line shall be engraved on its side, which has a width of 2 mm and a depth of 1 mm.

4.4.8 Pinion

4.4.8.1 Before milling teeth, ultrasonic testing shall be carried out; it shall be qualified, according to the level II requirements of JB/T 4730.3-2005.

4.4.8.2 The tooth profile processing shall meet the level 9 precision requirements of GB/T 10095.1-2001 and GB/T 10095.2-2001.

4.4.8.3 For the heat treatment of the tooth surface, the hardness shall meet the requirements of the drawing AND be higher than the hardness of the tooth surface of the large gear ring. The difference in hardness shall not be less than HB30.

4.4.8.4 Penetration test shall be carried out on the tooth profile surface; it shall be qualified according to the level 1 requirements of JB/T 4730.5-2005.

4.4.8.5 After the pinion is made, a circular indexing line shall be engraved on its side, which has a width of 2 mm and a depth of 1 mm.

4.4.9 Roller ring

4.4.9.1 There shall be no defects, such as cracks, interlayers, slag inclusions on the machined surface. The ultrasonic testing shall be carried out. Within the 1/3 thickness range below he machined surface, it is qualified, according to the level II requirements

of JB/T 4730.3-2005.

4.4.9.2 The machined surface shall be subjected to penetration testing, which shall be qualified according to the level II requirements of JB/T 4730.5-2005.

4.4.9.3 The hardness of the machined surface shall meet the requirements of the drawing.

4.4.10 Supporting rollers and retaining rollers

4.4.10.1 When the material of the supporting roller and the retaining wheel are forgings, the machined surface is subjected to ultrasonic inspection, which it is qualified according to the level II requirements of JB/T 4730.3-2005. When the material of the supporting roller and the retaining roller is casting steel parts, ultrasonic testing is carried out on the machined surface; within 1/3 of the thickness below the machined surface, it is qualified according to the level 3 requirements of GB/T 7233.

4.4.10.2 Penetration testing shall be carried out on the machined surface. Forgings shall be qualified, according to level II requirements of JB/T 4730.5-2005. Steel castings shall be qualified, according to level I requirements of GB/T 9443.

4.4.10.3 The hardness of the machined surface shall meet the requirements of the drawing. It is higher than the hardness of the machined surface of the roller ring. Its hardness difference is HB15 ~ 30.

4.4.11 Supporting roller shaft, retaining roller shaft, pinion shaft

4.4.11.1 The 100% ultrasonic testing shall be carried out, before the finishing of the supporting roller shaft, the retaining roller shaft, the pinion shaft. It shall be qualified, according to the level I requirements of JB/T 4730.3-2005.

4.4.11.2 After quenching and tempering, the machined surface hardness is HB240 ~ 280.

4.4.11.3 The machined surface shall be subjected to magnetic particle inspection, which shall be qualified, according to the level I requirements of JB/T 4730.4-2005.

4.4.12 Steam chamber

4.4.12.1 Procedure qualification shall be carried out, before the welding of the steam chamber. The welding procedure qualification shall comply with the provisions of JB 4708-2000.

4.4.12.2 The tube sheet and flat plate, on the steam chamber, can be splice-welded, but the number of splicing pieces shall not be more than 3. The position of the splicing weld shall not pass through the tube hole, but can pass through the support rod hole. After splicing, the flatness tolerance of the entire workpiece is 3 mm; the splicing weld shall

be subjected to 100% radiographic inspection; it shall be qualified according to the level II requirements of JB/T 4730.2-2005; then it shall be subject to 100% ultrasonic re-inspection AND pass 100% level I ultrasonic inspection.

4.4.12.3 The welding of longitudinal and circumferential welds of the steam chamber shall comply with the provisions of JB/T 4709-2000. After welding, 100% radiographic inspection shall be carried out. It shall be qualified according to the level II requirements of JB/T 4730.2-2005; then it shall be subject to 100% ultrasonic re-inspection AND pass 100% level I ultrasonic inspection.

4.4.12.4 The fillet weld, on the steam chamber, should be backed by argon arc welding; the magnetic particle or penetrant testing shall be carried out after welding; it shall be qualified, according to the level I requirements of JB/T 4730.4 or JB/T 4730.5-2005.

4.4.12.5 After the welding of the steam chamber, the flatness tolerance of the tube sheet and the flat plate shall be 4 mm.

4.4.12.6 After passing the non-destructive testing, the steam chamber shall be subjected to stress relief heat treatment, then shall be subjected to a hydraulic test. The test pressure shall be in accordance with the provisions of GB 150-1998, AND the pressure shall be maintained for 30 minutes. If it has no leakage, it is qualified. Then overall machining is carried out.

4.4.12.7 When processing the tube hole of the tube sheet, the diameter of the tube hole shall be 0.5 mm larger than the average value of the actual diameter of the heating tube; the machining deviation of the hole diameter shall be ±0.05 mm.

4.4.12.8 The heating tube and the tube plate hole of the steam chamber shall adopt strength welding plus expansion or strength expansion plus sealing welding. The sealing welding shall adopt a reliable welding procedure, to ensure the welding quality.

4.4.13 Assembly

4.4.13.1 Before the no-load trial operation of the dryer, the parts related to the rotation of the dryer are assembled, according to the requirements of the drawing. The parts, which are unrelated to the rotation of the dryer, may not be installed (such as roller ring cover, large gear ring cover, etc.).

4.4.13.2 The steam chamber, heating tube, rotary joint shall be subjected to the overall hydrostatic test. The test pressure shall be in accordance with the provisions of GB 150-1998; the pressure shall be maintained for 30 minutes. If there is no leakage, it is qualified.

4.4.13.3 For the coupling alignment, the coaxiality tolerance is Φ0.05 mm; the parallelism tolerance is 0.05 mm.

4.4.13.4 For manual turning inspection, all rotating parts shall be flexible, rotate

by one, according to the requirements of the drawing; the pressure drop value shall be as required by the drawing; the test time shall not be less than 10 min.

4.4.14.10 During the no-load test run, it should use artificial greasing to lubricate, to ensure that there is continuous greasing, between the large gear ring and the pinion, between the roller ring and the supporting roller, between the retaining rollers.

5 Inspection and inspection rules

5.1 Inspection method

5.1.1 The material used shall be provided with product quality certificate by the supplier. The equipment manufacturer shall also re-inspect the materials of the pressurized parts and transmission parts.

5.1.2 Use conventional measuring tools, to check the requirements in 4.4.5.1 ~ 4.4.5.4.

5.1.3 Method for inspecting the straightness of dryer in 4.4.5.5: Along the circumference of the tube segment, at both ends of the dryer, in at least four directions of 0°, 90°, 180°, 270°, horizontally draw the steel wire (steel wire diameter: Φ0.35 mm ~ Φ0.50 mm) for measurement; the distance from the measurement position to the circumferential and longitudinal welds of the dryer shall not be less than 50 mm; the distance from the steel wire to the outer surface of the dryer is δ mm; it takes $\delta_{max} \sim \delta_{min}$ as the straightness tolerance of the dryer; when the wall thickness of the tube segment of the dryer is unequal, it shall consider the thickness difference.

5.1.4 Use the inspection method of 5.1.3, to check the straightness requirements of 4.4.6.2.

5.1.5 The method of checking the coaxiality of the dryer in 4.4.5.5: It should set multi-point light-transmitting targets, at the front and rear ends of the dryer, the two roller rings, the large gear ring, the closing opening of the two large middle segments. The laser theodolite is used to make measurement. Take the maximum value of 2 times the radius of the coordinate of the light spot, on each section of the light target, by the laser, as the coaxiality tolerance of the dryer.

5.1.6 The method of checking the flatness in 4.4.12.2, 4.4.12.5: it should use a rectangular square ruler, which has a length of not less than 3000 mm; check the maximum value of gap, between the rectangular square ruler and the surface of workpiece, at the azimuth of 8 equal parts of the circumference, through the center of the workpiece. The maximum value of the gap is the flatness tolerance of workpiece.

5.1.7 Use the coloring method, to check the requirements in 4.4.14.5 and 4.4.14.6.

5.1.8 Install the magnetic dial indicator on the shaft heads, at both ends of the coupling, to check the requirements in 4.4.13.3.

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