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Die casting dies - Technical specifications

压铸模 技术规范

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1 Scope

This document specifies the technical requirements, the inspection rules and the marking, packing, transport and storage of die casting dies, and describes the corresponding test methods.

It applies to the manufacture of die casting dies.

2 Normative references

The contents of the following documents constitute indispensable provisions of this document through normative reference in the text. For dated references, only the edition corresponding to that date applies. For undated references, the latest edition, including all amendments, applies.

GB/T 191 Packaging - Pictorial marking for handling of goods · GB/T 230.1 Metallic materials - Rockwell hardness test - Part 1: Test method · GB/T 231.1 Metallic materials - Brinell hardness test - Part 1: Test method · GB/T 825 Lifting eye bolts · GB/T 1184-1996 Geometrical tolerancing - Tolerances of form, orientation, location and run-out - Generally tolerances · GB/T 1804-2000 General tolerances - Tolerances for linear and angular dimensions without individual tolerance indications · GB/T 1958 Geometrical product

specifications (GPS) - Geometrical tolerancing - Inspection and verification · GB 2894 Safety signs and guideline for the use · GB/T 3177 Geometrical product specifications (GPS) - Inspection of plain workpiece sizes · GB/T 4340.1 Metallic materials - Vickers hardness test - Part 1: Test method · GB/T 4678 (all parts) Die casting die - Components · GB/T 8845 Die - Terminology · GB/T 9969 General principles for preparation of instructions for use of industrial products · GB/T 10610 Geometrical product specifications (GPS) - Surface texture: Profile method - Rules and procedures for the assessment of surface texture · GB/T 13306 Plates

3 Terms and definitions

The terms and definitions given in GB/T 8845 apply to this document.

4 Technical requirements

Structure: the typical structure of a die casting die is shown in Figure 1, in longitudinal and transverse section, with its forty-one numbered items - moving die clamping plate, ejector plate stop block, spacer block, moving die frame plate, bracket, slide guide plate, cylinder, slide, wedge block, fixed die frame plate, movable core, fixed die insert, insert, cavity, gate, runner, sprue, sprue bush, cooling ring, flow guide block, moving die insert, ejector retaining plate, ejector plate, ejector pin, point cooler, stop pin, ejector guide bush, ejector guide pillar, core, moving die venting plate, fixed die venting plate, conformal cooling insert, squeeze pin, squeeze pin bush, partition, guide pillar, latch, guide bush, return pin, support pillar and ejector connecting rod.

4.2 Parts

The components specified in GB/T 4678 (all parts) should be used in designing a die casting die.

The materials of the main parts shall meet the technical standards of the corresponding grade for chemical composition, mechanical properties, hardness and microstructure. The recommended materials and heat treatment hardness are given in Table 1: for the forming parts (moving and fixed die inserts, inserts, movable cores) and for the parts of the gating and overflow and venting systems (sprue bushes, flow guide blocks, venting plates), the representative die casting die steels are 4Cr5Mo2SiV, 4Cr5MoSiV1 and 4Cr5MoSiV. For die casting aluminium alloy the hardness is 42 HRC to 50 HRC for the forming parts and 44 HRC to 52 HRC for the gating parts; for magnesium alloy, 44 HRC to 52 HRC and 48 HRC to 52 HRC; for zinc alloy, 48 HRC to 52 HRC for both; and for copper alloy, 45 HRC to 50 HRC for both. Materials of higher performance than those recommended, or similar materials of comparable performance, are permitted.

After heat treatment, the forming surfaces of parts for die casting zinc, magnesium and

aluminium alloys should be nitrided, oxidised or given a physical vapour deposition (PVD) treatment. The nitrided case should be 0.05 mm to 0.25 mm deep with a hardness of 700 HV to 1 100 HV, and the white layer shall be avoided; the PVD coating should be 0.003 mm to 0.006 mm thick with a hardness of 2 700 HV to 3 300 HV.

The surfaces of the forming parts shall be free of cracks, scratches, mechanical damage, corrosion and any other defect affecting their use.

Limit deviations of the untoleranced dimensions of the forming parts (Table 2), in millimetres: plus or minus 0.03 up to 10; plus or minus 0.05 above 10 to 63; plus or minus 0.08 above 63 to 160; plus or minus 0.12 above 160 to 400; plus or minus 0.15 above 400 to 1 000; plus or minus 0.20 above 1 000 to 1 600; and plus or minus 0.30 above 1 600.

Limit deviations of the untoleranced transition radii of the forming parts (Table 3), in millimetres: for convex radii 0 to -0.10 and for concave radii +0.10 to 0 up to 6; 0 to -0.15 and +0.15 to 0 above 6 to 18; 0 to -0.20 and +0.20 to 0 above 18 to 30; 0 to -0.30 and +0.30 to 0 above 30 to 120; and 0 to -0.40 and +0.40 to 0 above 120.

Limit deviations of the untoleranced angles and tapers of the forming parts (Table 4), in minutes of arc, the taper tolerance being taken on the length of the generatrix and the angle tolerance on the length of the shorter side: plus or minus 30 up to 6 mm; plus or minus 20 above 6 to 18 mm; plus or minus 15 above 18 to 50 mm; plus or minus 10 above 50 to 120 mm; plus or minus 6 above 120 to 200 mm; and plus or minus 3 above 200 mm.

The draft angle of lettering and symbols should be 15 degrees to 20 degrees. Where the drawing does not show the direction of the draft, it shall be set in the direction that reduces the wall thickness of the casting; where it does not show the size, it shall be taken from Annex A.

Untoleranced dimensions of the non-forming parts shall meet grade m of Clause 5 of GB/T 1804-2000, and the untoleranced hole spacings of screw holes, ejector pin holes and return pin holes grade f of the same clause. Untoleranced geometrical tolerances of the forming parts shall meet grade H of Clause 5 of GB/T 1184-1996.

Surface roughness Ra of the working faces of the forming parts and of the gating and venting system (Table 5), in micrometres: cavity, polished in the direction of ejection, not more than 0.8; parting face, machined, not more than 3.2; runner and gate, machined, not more than 0.8; overflow and vent grooves, machined, not more than 3.2.

The edges of the non-working parts of the forming parts shall be chamfered or radiused, and the untoleranced fillet radius of the forming parts shall be 0.5 mm to 1.0 mm. The edges where the forming face meets the parting face, a core or an ejector pin shall not be chamfered or radiused.

4.3 Assembly

The parallelism of the parting face to the mounting plane of the fixed and moving die clamping plates shall meet Table 6, whose tolerance is set by the greatest straight length at the parting face of the moving and fixed die inserts.

The contact of the ejector system shall be continuous and shall cover not less than 80 % of the area; after the die is opened the stop shall be accurate and reliable.

When the die is closed, the parting faces shall be in close contact: checked by the marking-compound method the effective contact area shall be not less than 95 % and any local gap not more than 0.05 mm, except at the vent grooves.

The cooling water circuits shall be clear and shall not leak. The distance from the cooling circuit to the die face should be 1.5 to 2.5 times the diameter of the circuit, and the flow directions IN and OUT shall be marked clearly and permanently near every water connection.

4.4 Safety

Safety signs against burns and crushing shall be placed in a conspicuous position on the die.

Parts weighing more than 15 kg shall have lifting holes, and the lifting eye bolts shall comply with GB/T 825.

The die shall have a device for lifting it as a whole. The rated load of the lifting gear shall exceed the mass of the die and the lifting points shall be distributed to match its centre of gravity, so that lifting is safe.

The die shall have the necessary guards to prevent injury from leaking cooling water or lubricating oil, from splashing hot metal and from moving parts.

4.5 Stability

Under normal production conditions the die should run continuously and stably for not less than 8 h, or for a period agreed between supplier and purchaser; during that period its movements shall be smooth and free of anything abnormal.

5 Test methods

Appearance: the surface quality of the parts is examined visually and the structure of the die is checked against this document and the die drawing; the outer surfaces are examined visually for the anti-corrosion treatment.

Material and hardness: the material quality certificate and the heat treatment inspection report are examined and, where necessary, the chemical composition is analysed. Brinell hardness is measured to GB/T 231.1, Rockwell hardness to GB/T 230.1 and Vickers