VOLKSWAGEN AG

Group Standard

VW 50097

Issue 2007-07

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Descriptors: casting, light alloy casting, metal casting, pore, porosity

Porosity of Metal Castings

Requirements

Previous issues

2002-12

Changes

The following changes have been made as compared to Volkswagen standard VW 50097, 2002-12:

- Section 1: Scope changed
- Section 2.1: Section heading added and changes implemented
- Section 2.2: Newly added
- Section 4.2: Changed
- Section 5: Test Specification PV 6097 added

Contents

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1 Scope

The present standard defines the requirements on the porosity of metal castings regardless of the casting process used.

2 Designation

The underlying designation system and the definition of the reference surfaces correspond to the VDG (Association of German Casting Experts) Specification P 201.

2.1 Explanation of the designation system

Details on the designation system are given in the VDG Specification P 201. The designation system for porosity consists of the following parameters:

Pore classes

- S for components under static stress mainly
- D for components under dynamic stress mainly
- F for components with special requirements on functional surfaces
- G for components with not further specified requirements

Porosity

- maximum permissible porosity in percent for the pore classes S, D and G
- maximum permissible number of defined pores per reference surface for the pore class F

Diameter (optional)

- maximum permissible comparative diameter of single pores

Additional remark (additional remark 1 to n is optional, Pn shall be given for specifications on pore class F)

- An Minimum edge distance between two adjacent pores.
  The minimum edge distance is the diameter of the smaller of two adjacent pores multiplied by the integer factor n in mm (A = distance; from German "Abstand").
- M Center of component wall (only in connection with the parameter "diameter");
  Localized porosity is only permissible in the center (M; from German "Mitte") of the component wall.
- C Excess material (only in connection with the parameter "diameter").
  Localized porosity is only permissible in excess material and joint areas.
- R Center area of the component wall (only permissible for pore classes D10 to D30).
  Only applies to the center area (R) of the component wall (inner third of the relevant wall thickness). In the two outer thirds the porosity class D4 shall be adhered to.
- Pn Pore size (only in connection with the parameter "diameter").
  Maximum permissible pore size (defined by the parameter "diameter"); only applies to the component wall center area (inner third of the relevant wall thickness). In the two outer thirds the maximum permissible pore size (P) of single pores is limited to a diameter of n mm. In pore class F, n specifies the diameter up to which pores are not considered.

Representation: (pore class)(porosity)/[diameter]/[additional remark 1]/[...]/[additional remark n]

NOTE: The parameters in round brackets at least are required to adequately describe the permissible porosity. The parameters in square brackets are optional, the parameter P shall be given if the pore class F is specified. In the case of exclusive porosity specifications for an X-ray test, it shall be observed that fully automated systems for evaluating the pore size generally only use the equivalent diameter. In the case of a manual, comparative X-ray test, however, the evaluation is always performed using the comparative diameter. Drawing specification references to the equivalent diameter shall thus explicitly be integrated in the drawing.

Designation examples for max. permissible casting porosity:

- General casting: VW 50097-D5
- On sealing surfaces: VW 50097-F4/2/A3/P0,5

Explanations on the aforementioned designation examples:

D5

- (Porosity)
  Permissible porosity ≤ 5 %
- (Pore class)
  For components under dynamic stress mainly

F4/2/A3/P0,5

- [Additional remark 2]
  Pores with ∅ 0,5 mm are always ignored
- [Additional remark 1]
  The minimum edge distance is 3 x ∅ in mm
- [Diameter]
  Permissible single pore size 2 mm
- (Porosity)
  Number of pores: 4 per reference surface
- (Pore class)
  Component with special requirements for functional surfaces

2.2 Grading of porosity specifications in drawings

The following grading rules shall apply to the definition of drawing notes:

Pore class D	From D1 to D4 included in integer steps, from D5 on in integer steps of five. There is no pore class D0.
Pore class S	From S5 on in integer steps of five. There are no pore classes lower than S5.
Pore class F	From F0 on in integer steps. As for the necessary remark Pn, n is specified in steps of 0,1 mm Specifications of n < 0,2 mm are not permissible.
Pore class G	From G0 on in integer steps. The porosity specification G0 signifies that no pores are permissible within the resolution capacity of the X-ray system used.
Diameter	The parameter 'diameter' shall be specified in steps of 0,5 mm. The specification of diameters < 0,5 mm is not permissible.

3 Definitions

Definitions according to Volkswagen standard VW 50099.

4 Requirements

4.1 Delivery of components

The supplier shall automatically enclose test reports for components presented for testing, first sampling or technical engineering approval (BMG). These reports shall clearly identify all component properties required according to this standard.

NOTE: Castings presented for technical engineering approval shall be regarded as maximum deviation samples for future deliveries by the respective supplier, i.e. by presenting a casting for technical engineering approval, the supplier undertakes to only deliver parts of the same or better quality in the future. This applies to casting porosity in particular.

4.2 Definition of porosity

If this standard is referenced in a drawing, in other standards or in performance specifications documents or if porosity specifications referencing VW 50097 are given in a drawing, in other standards or in performance specifications documents, the following general standard specifications shall apply to the entire casting:

- Castings made of steel and iron casting material VW 50097-D1
- Castings made of zinc base alloys VW 50097-D10
- All other castings VW 50097-D5

Deviating requirements shall be specified more precisely adhering to all the specifications of this standard. The **exclusive** limitation of porosity specifications to specific test planes or a general exclusion of the standard specifications described here shall be done explicitly and **in writing** in the drawing.

Mechanical damage on machined surfaces shall be treated as pores unless otherwise specified.

In the case of delivery of production sample parts by a sole supplier or a first supplier, the max. porosity specified in the drawing shall be aimed at as limit porosity. If the supplier cannot fulfill this porosity requirement, the supplier shall document and verify this fact in a suitable form. The documentation must clearly identify all affected areas. The same applies to the first delivery of castings which are not subject to technical engineering approval.

The porosity of the tested casting shall be entered in the finished part drawing in the event of a positive test, provided the porosity exceeds the drawing specifications and represents the general state of the art. The existing drawing entry retains its validity in all other cases.

NOTE: From a different respect (strength-critical or process-critical areas of castings are known), it can prove convenient, in addition to a general porosity specification, to identify these areas in the drawing as preferred testing areas. A regular examination of porosity should always include these areas. The exclusive application of the porosity specification to these testing areas is only permissible if clearly specified in the wording.