

Confidential, all rights reserved. Observe copyright notice ISO 16016.

Language code to ISO 639-1: en

ICS 01,110

Descriptors: Production process, Product release, Master sample release

**Table of Contents**

	<b>Page</b>
<b>1</b>	<b>Scope of validity and purpose .....2</b>
<b>2</b>	<b>Conditions for approval.....2</b>
<b>3</b>	<b>Order and drawing specifications .....2</b>
<b>4</b>	<b>General terms of delivery .....2</b>
<b>4.1</b>	<b>Classification by functional requirements.....2</b>
<b>5</b>	<b>Quality requirements on aluminum castings .....2</b>
<b>5.1</b>	<b>Material .....2</b>
<b>5.2</b>	<b>Chemical composition.....3</b>
<b>5.3</b>	<b>Internal and external properties.....3</b>
<b>5.3.1</b>	<b>Surface faults (unmachined surfaces) .....3</b>
<b>5.3.2</b>	<b>Surface faults (machined surfaces).....3</b>
<b>5.3.3</b>	<b>Internal faults .....4</b>
<b>5.4</b>	<b>Hydraulic and / or pneumatic pressure tests.....6</b>
<b>5.5</b>	<b>Strength properties.....6</b>
<b>5.6</b>	<b>Hardness.....6</b>
<b>5.7</b>	<b>Surface roughness.....6</b>
<b>5.8</b>	<b>Mass .....6</b>
<b>5.9</b>	<b>Dimensions and tolerances .....6</b>
<b>5.10</b>	<b>Marking .....6</b>
<b>6</b>	<b>Production specifications .....7</b>
<b>6.1</b>	<b>Removal of coupons, vents and casting channels .....7</b>
<b>6.2</b>	<b>Dressing.....7</b>
<b>6.3</b>	<b>Repairs.....7</b>
<b>7</b>	<b>Technical series release.....7</b>
<b>7.1</b>	<b>Supplements to master sample inspections .....7</b>
<b>7.2</b>	<b>Delivery and marking of the master samples .....7</b>
<b>8</b>	<b>Applicable documents.....8</b>

**Revisions:**

Compared to VN 3068: (2005-07), the following alterations were made:

- a) Scope of application for Voith Turbo Group Division added in header
- b) Scope supplemented with die-cast parts
- c) Addition of acceptance criteria for die-cast parts (as cross reference 5.3.3)

Earlier editions: : 2005-07

Revision: see "Revisions"

	Name	Date	Signature
Prepared by	Kämmerer-VPH-c1qg	<u>2012-12-12</u>	sgd. (Kämmerer)
Checked by	Schade-VTCR-ardtc	<u>2012-12-13</u>	sgd. (Schade)
Approved by	Wulz-VPH-c1qg	<u>2012-12-17</u>	sgd. (Wulz)

Observe Copyright ! - Observe Copyright ! - Observe Copyright !

## 1 Scope of validity and purpose

This Voith standard (VN) specifies the criteria for the classification of castings, the information to be included in drawings, the required tests, the applicable test methods and the permissible faults in unmachined and machined light alloy castings made of aluminum alloys.

It relates to unmachined and machined light metal castings in aluminium alloys, cast according to the gravity or die casting process.

This VN applies generally to castings used in the production of drive components for the market segment Road of Voith Turbo Antriebstechnik unless otherwise specified in the drawings, standards for individual components or in the data sheets or other agreements are made with the order.

This VN also applies to prototype castings from pre-series, series-related or series dies.

The technical terms of delivery according to EN 1559-1, EN 1559-4 and EN 1706 are also fully applicable.

## 2 Conditions for approval

The general terms of delivery as stated in the order and the requirements of the Voith quality assurance agreement are applicable. In specific cases, the conditions for approval of master samples according to VN 3205 are applicable.

## 3 Order and drawing specifications

The following binding rules are contained in the order or drawing:

- Number of the applicable order and delivery specification with reference to this delivery specification.
- Designation and condition of the material.
- Marking of the part (see item 5).
- Mass (see item 6).
- The order or drawing may contain the following supplementary specifications:
  - Surface protection.
  - Reference to quality features (as per VN 1631), test specifications and methods.
  - Designation of the point from which samples for tensile strength tests are to be taken.
  - Designation of critical points. If critical points exist, these are indicated in the drawing.
  - Testing of the hydraulic and/or pneumatic sealing according to the requirements specified in the drawing. The process parameters and test frequencies must be agreed with Voith in the course of advance quality planning and must be documented in the production control plan (see VN 3205, VN 3206).
- Classification of the part according to its function and/or advance quality planning (VN 3206).

## 4 General terms of delivery

Rough and finished parts must comply with the drawing approved by Voith Turbo.

Castings must be free of coupons, flash, burrs and similar material residues and free of fractures, cracks, signs of overheating and scorches, creases, cavities, depressions, cold shots and porosity which more than substantially restrict the usefulness (function and/or succeeding process steps) are inadmissible and must be eliminated by suitable measures taken by the supplier.

### 4.1 Classification by functional requirements

Classification is conducted by the responsible Voith development departments by selection of the appropriate ordering and delivery specification.

The castings are divided into the following function classes:

- Function class 1: Castings with safety requirements
- Function class 2: Castings, statically and dynamically loaded castings and/or surfaces with special functional requirements
- Function class 3: Castings not included in classes 1 or 2 without specific functional requirements

## 5 Quality requirements on aluminum castings

### 5.1 Material

Al casting alloys to EN 1706.

If heat treatment of the components is necessary, this heat treatment must be specified in the material designation box.

In the enhancement of eutectic and closely eutectic alloys, the quantities of the metal additives (e.g. Na/Sr) must be specified by the supplier in the master sample test report.







**5.4 Hydraulic and / or pneumatic pressure tests**

Pressure tests are conducted according to the information contained in the drawing or in the corresponding standards.

Hydraulic and/or pneumatic pressure test (only for castings in function classes 1 and 2). Unless otherwise specified in the drawing, this test is to be conducted with a finished casting.

The technical data for the test and the acceptance conditions must be contained in the drawing or in the corresponding standards (production control plan).

**5.5 Strength properties**

The mechanical strength properties of the component must be proven (master sample inspection). The sampling points must be made known in the master sample test report by the supplier if these are not specified in the component drawing. Voith Turbo reserves the right to verify the strength properties by a tensile strength sample from the component.

The tensile tests are to be specified according to DIN 50125 and conducted according to EN 10002. The minimum diameter of the tensile test sample is 4 mm.

If a tensile test sample cannot be taken from a component, the strength properties must be proven by a tensile strength test conducted with a separately cast test rod. The tensile tests must be specified according to DIN 50125 and conducted according to EN 10002. The diameter of the separately cast test rod must be at least 12 mm for sand and chill castings.

The measured values must comply with the limits of the material standard (EN 1706) specified in the drawing.

The choice of the test method for strength monitoring during series production is made by the supplier. The use of separately cast test rods is permissible as a part of the process qualifying reference. In cases of doubt, the strength characteristics (tensile strength/hardness) of the component are decisive. The strength properties of the presented master sample provide the general characteristic values.

The manufacturer determines the required number of random samples.

The strength properties of heat treated parts must be constantly monitored by hardness tests.

**5.6 Hardness**

The hardness must be tested at the surface according to ISO 6506-1 and at pore-free areas of the casting or on a fractured sample which has not been subjected to stress. The areas must be chosen such that the functionality of the casting is not impaired after the surface layer has been ground off. The measured values must comply with the limits contained in the material standards (EN 1706) specified in the drawing. The hardness test positions must be documented in the test report.

**5.7 Surface roughness**

As specified in the drawing or in the material standard.

**5.8 Mass**

The mass of the rough casting must be agreed between the supplier and the client by one of the following two methods:

Mathematical calculation on the basis of the dimensions and tolerances specified in the drawing and the density specified in the material standard, taking account of any machining allowances required for shaping.

Arithmetic mean of the values measured with 10 qualified castings.

A tolerance of  $\pm 5\%$  applies to the mass specified in the drawing.

**5.9 Dimensions and tolerances**

The dimensions must be verified on the basis of the drawing and/or the corresponding standards or CAD model.

The profiles, connections and internal dimensions which cannot be measured on a finished casting must be measured on an opened part.

**5.10 Marking**

Marking is to be conducted as specified in the drawing at a place which is not affected by subsequent machining. It must be clearly legible and must contain the following information:

- Voith Turbo part number.
- Material designation (abbreviation or material number according to EN 1706)
- Number of the mould and the model for parts in function classes
- Date of manufacture or smelt batch number.
- Manufacturer's code.



## 8

**Applicable documents**

DIN standards available from:  
 Beuth Verlag GmbH  
 Postbox 1145  
 10772 Berlin

Table 4

01	DIN EN 1706	Aluminum and aluminum alloys - Castings – Chemical composition and mechanical properties
02	DIN EN ISO 9000	Quality management systems – Principles and terms
03	DIN EN ISO 9001-2000	Quality management systems, requirements
04	DIN EN 10002-1	Metallic materials – Tensile test - Part 1: Test methods at room temperature
05	DIN EN ISO 6506-1	Metallic materials, hardness test according to Brinell, Part 1: Test methods
06	DIN EN 10204	Metallic products – Types of test certificates
07	DIN EN 12681	X-ray tests
08	DIN EN ISO14001	Environmental management systems
09	DIN 50125.	Testing of metallic materials – Tensile tests
10	DIN 55350-11	Terms of quality assurance and statistics
11	ASTM E 155	Radiographic exposure for testing aluminum and magnesium castings
12	ASTM E 505	Standard Reference Radiographs for Inspection of Aluminum and Magnesium Die Castings

Verband der Automobilindustrie e.V. (VDA)

Source:

Verband der Automobilindustrie e.V. (VDA)  
 Qualitätsmanagement Center (QMC)  
 Karl-Hermann-Flach-Str. 2  
 D 61440 Oberursel  
 e-mail: info@vda-qmc.de

Table 5

12	Volume 1	Certification
13	Volume 2	Quality assurance for supplies to the automotive industry
14	Volume 4	Quality assurance for series employment
15	ISO/TS 16949	Quality management systems, special requirements for the application of ISO 9001:2000 for series and single part production in the automotive industry

Voith standards

Table 6

16	VN 1631	Documentation requirements (test dimensions) in drawings; D and DS parts
17	VN 3205	Production process and product release (master sample release)
18	VN 3206	Advance quality planning (QVP)
19	QSV	Quality assurance agreement with Voith Turbo (latest valid version)