Quality Guidelines for Prototypes and Pre-Series Mounting and Functional Parts in the Interior and Exterior of Automobiles.

Any changes or deviations shall be agreed between the customer and the contractor in writing.

Verbal agreements are invalid. All previous "target specifications" hereby lose their validity.

Version 04
Quality Guidelines for Prototypes and Pre-Series Mounting and Functional Parts in the Interior and Exterior of Automobiles.

History of the document versions

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<th>Author</th>
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Quality Guidelines for Prototypes and Pre-Series Mounting and Functional Parts in the Interior and Exterior of Automobiles.

1 General information

This requirements specification applies to the "Quality Guidelines for Prototypes and Pre-Series Automotive Parts of Industry Interiors" and is to secure any undefined requirements between the client and the contractor.

If there is no specification whatsoever, for moulded parts or assembly components, injection moulding T1; DIN 16742:2013-10 TG5 table 2; class 3; laser scan colour comparison with CAD shall apply

Model construction DIN ISO 2768-1 depending on the production process; class 3; short test report

1.1 Scope of application

This requirements specification shall be applied if there are no prescribed procedures from the customer when the contract is assigned.

1.2 Accountabilities

Accountabilities regarding the provision of services shall be agreed and documented.

2 Management system of Robert Hofmann GmbH

Robert Hofmann GmbH is certified in accordance with 9001:2008; 9100:2012; VDA6.4.

Our objective is generally a 0-error strategy; however this is only feasible if a coordination of the qualitative requirements of prototypes takes place.

3 Tolerances

If no tolerances are provided, we implement our components and assemblies in accordance with Plastic: DIN 16742:2013-10 TG5 table 2.

3.1 Process-dependent tolerances

The general tolerances for linear dimensions according to DIN ISO 2768-1 in three process-dependent categories m (medium), c (coarse) as well as v (very coarse)

1. Category m (medium)
   - Stereolithography (SLA)
   - Vacuum casting
   - CNC milling / laser cutting

2. Category c (coarse)
   - Selective laser sintering (SLS)
   - Selective laser melting (SLM and ALM)

3. Category v (very coarse)
   - Fused Deposition Modelling (FDM)
3.2 History
We create a history for each component. Unless otherwise agreed with the customer, we shall use our template.

4 Quality

4.1 Quality levels
We generally produce according to T levels which are set out in the offer and in the order confirmation:

**Status T2:**
- Parts manufactured according to requirements
- Function and materials according to the requirements of 2.2 - Factory test certificate
- Dimensionally OK
- Visually OK (smooth surface, no pores, bubbles, lines or other defects)
- No burrs
- No nicks, delicate seams with perceptible brittleness in the sprue position
- No defects such as cracks, cavities etc. in the interior
- No peeling on laminated parts

**Status T1:**
- Visually OK
- No burrs, possibly reworked by hand
- No peeling on laminated parts
- No limited processing materials reduction (parts fully formed)

**Status T0:**
- First parts removed manually
- Not produced in the cycle
- No peeling on laminated parts
- No limited processing materials reduction (parts fully formed)

4.2 Quality classes
At the beginning of the project, we also define the quality classes for the injection moulding tools which could have a significant impact on the offer price.

<table>
<thead>
<tr>
<th>Quality classes to be defined at the beginning of the project</th>
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<tr>
<td><strong>Classification of parts quality</strong></td>
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<tr>
<td><strong>Class 1</strong> Series status:</td>
</tr>
<tr>
<td>No rework work on the moulded part, without sink marks, no burrs or distortion, without black spots, scratches, components true to dimensions and function with VDA test report, no colour / gloss level deviation</td>
</tr>
<tr>
<td>Steel tool</td>
</tr>
<tr>
<td><strong>Class 2</strong> Prototype status:</td>
</tr>
<tr>
<td>Rework work on the moulded part / parts finish (abrasive blasting, casting, burr formation), surface (VDA 16 zones A-D), minimal colour / gloss level deviation (not in VDA 16 zones A-D)</td>
</tr>
<tr>
<td>Aluminium tool</td>
</tr>
<tr>
<td><strong>Class 3</strong> Prototype status:</td>
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<tr>
<td>Parts with substantial manual rework work on the moulded part, drilling holes, abrasive blasting, casting,</td>
</tr>
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<td></td>
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</table>
4.3 Test criteria and test zones

Our test criteria are defined in accordance with VDA16. Unless otherwise agreed, they shall apply.

<table>
<thead>
<tr>
<th>ZONE</th>
<th>DEFINITION</th>
<th>ZUORDNUNG</th>
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<tr>
<td>B</td>
<td>Flächen die sich im Sichtschatten befinden, oder nicht in Normalposition wahrnehmbar sind Betrachtungssektor &lt; 45°</td>
<td>Außen: Fahrzeug unterhalb der Gürtellinie des Betrachters bis oberhalb Stoßstangenebene, bzw. Funktionselemente (geöffnete Klappen, Türen usw.) Innen: Alle Flächen ohne unmittelbare Wahrnehmung</td>
</tr>
<tr>
<td>Optional: C</td>
<td>Flächen, die nach der Montage verdeckt sind</td>
<td>keine Oberflächenrelevanz</td>
</tr>
<tr>
<td>Optional: D</td>
<td>Flächen, die hinsichtlich Oberflächenbeschichtung keine Bedeutung haben, wo aber hinsichtlich der Funktion bestimmte Merkmalsausprägungen der Oberfläche trotzdem nicht zugelassen sind</td>
<td></td>
</tr>
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</table>

4.3.1 Evaluation

Framework conditions
The visual conspicuousness of the fault is decisive for the evaluation.
The evaluation of the error takes place from a viewing distance of approximately 0.5 to 1 meter, with the part located in the installation position or with this position simulated. Assessment period: max. 30 seconds.
Type of illumination: “daylight” fluorescent tubes with white reflectors and 1800 lux.

4.3.2 Acceptance values:

General requirements
The acceptance values are divided into the following types of errors:
- Permissible errors
- Countable errors with circular appearance (e.g. inclusions, pores)
The indicated values are always per evaluation zone. A zone is restricted by the component limits, for example the contour of the bumper.
Errors which affect the function are not permissible. (For example, scratches through to the base material.)
The basis is VDA16.
5 Metrological testing

5.1 Alignment according to RPS (Reference Point System)
The dimensions of a component refer to a reference base, the so-called component coordinate system. It is clearly defined in space by geometric elements of the component. We generally use the points / areas contained in the CAD data. In accordance with the standard, the measurement and documentation takes place on the basis of a tactile measuring device or a laser scanner. Documentation takes place by means of colour comparison and up to 15 presented dimensions.

5.2 Testing and evaluation
In principle, the measuring parts are measured without tension in the clamp or clamping system. Wherever possible, the components are measured in the installation position. If necessary, the measurement takes place with the assistance of a gauge or measuring fixture.

Robert Hofmann has several levels for evaluation

1 = Jab at dimensions with slide gauge or the like (no measuring room)
2 = Laser scanning (colour comparison); see CAD
2a = Laser scanning (...) up to 15 dimensions measured; see CAD
2b = Laser scanning (...) from 16 dimensions measured; see CAD
3 = Part short (parts measurement of control dimensions)
4 = Part long (parts measurement complete)
5 = VDA

5.3 Test reports
Unless otherwise agreed, the test reports are provided with the following information:

- Assembly weight / individual weight
- Temperature of measuring room
- Idle period of component before measurement
- Measurement result of "Best Fit" colour comparison with up to 15 measured values
- Materials factory test certificates
- Result of visual inspection
- Indication of Q level
- History
6 Mounting parts
In the following, the standard of Robert Hofmann GmbH for prototypes and automotive interior preseries parts is described.

6.1 Preset parts
In principle, for components that are prescribed or made available by the customer, we do not undertake any evaluation, selection or testing whatsoever. These components are also excluded from our General Terms and Conditions of Business.

6.2 Panels, decor
For checking components, we create a specific gauge, a device that ensures tension-free support and does not damage the parts.

With chrome components with a gloss finish, the surface is always to be polished in the tooling in order to avoid any surface defects.

The gloss level shall be defined by the customer.

6.3 Dashboard / vent
Additional functional requirements, such as tightness, freedom from burrs and smooth operation of the control elements (slats and adjusters) are fulfilled.

Supplemental actuating forces to be tested or adjusted shall be specified prior to project start.

Electrical / electronic functionality, lighting and potentiometer settings can be performed, but shall be specified more precisely.

The gaps dimensions are determined by colour comparison through laser scanning.

6.4 Lights
In principle, we examine each light for function and tightness. However, the requirements for this shall come from the customer.

Ideally, the following items are provided by the customer:

- Testing device or adapter that has production condition
- Test instruction
- Reference parts

Tightness:
Testing by means of "Hella leak test device". Examined under positive pressure.

Unless otherwise requested by the customer, we use the following standard values:

- Testing duration: 30 s
- Testing pressure: 30 mbar
- Leak rate: 0.1 – 0.5 mbar*1 / s

Function:
Testing by means of "PWM Box".
Each function of each light is examined with respect to correct wiring and lighting function. After testing has taken place, the system prints a part label and stores a test report with photos of every function.

### 6.5 Fabric / leather

We test and monitor the quality in accordance with VDA16 but primarily for:

- Creasing
- Smooth seams (seam distance), stitch length and joints
- Alignment / parallelism of the seams, …
- Cleanliness of the materials
- Freedom from defects of the fabric / leather
- Welds

### 6.6 Carpeting

We document the cut and shape precision by means of templates, gauges, etc.

### 7 Packaging and labelling

If no specific requirements are given, the components are labelled as described and packaged to the best of one's knowledge.

#### 7.1 Content of the labelling

There are several options for labelling / identifying the components / items.

However, the following information shall be present:

- Com, item designation, item number, production status, index, date, customer, part number, material batches, expiration date (if applicable), serial number (if applicable)

#### 7.2 Type of labelling of components

Labelling may be chosen freely, to the extent that this is not governed by a different instruction or requirement of the customer.

If no customer requirements are present, the components are marked with the xxx label (allocate item number for label).

Example of a component label
7.3 Position of the label

The position may also be freely chosen here, to the extent that this is not governed by a different instruction or requirement of the customer.

However, this shall be easily visible and shall not be located on the areas to be measured.

Example of a component label

7.4 Labelling of packing units

If the components are packaged or it is not possible to label the individual parts (too small or not permitted), a label with the content shall also be attached to the packaging (cardboard box / box).

Example of individual packaging
Example of cardboard box labelling

8 Storage of moulds and tooling

The manufacturer's retention period shall end at the latest 3 years after the receipt of an order. However, any scrapping or other exploitation of the moulds and tooling requires the customer's prior written consent. This will be requested in writing prior to expiration. If, by the expiration of the three-year period, there is no contrary feedback on the part of the customer, we will assume approval for scrapping and will also carry this out.

9 Documentation and components

Components that are not needed for the production of the customer's orders and the original manufacturing instructions or work instructions will be destroyed after 6 months.

If a new order arises within the framework of the 3-year period, the documentation is retained in the archives, and the components shall be recreated because of obsolescence management.