

## Quality and surface requirements metallic surfaces

### 1 Goals

The target of this Vitra norm is to define the quality and surface requirements in relation to metallic surfaces. This norm was updated, and integrates & replaces the existing norm ,VN-02002 Quality requirements and properties of powder-coated and painted surfaces ‘.

The fulfilling of the norm is given through the initial sample report, if needed Vitra will ask for the test report(s) in order to confirm the specific requirements.

This Vitra norm describes the Vitra requirements for the following surfaces:

- chrome-plated surfaces
- powder-coated surfaces
- polished surfaces

### 2 General requirements

Professional grinding, polishing and cleaning of the parts is crucial for a good final result.

#### 2.1 Labelling of samples

- The supplier shall label the samples as follows, e.g. with an adhesive or attached label:

- project
- material number
- surface finish sample
- powder coating or lacquer sample incl. powder coating or lacquer designation
- chrome
- polished
- colour code (for powder coating or lacquer)
- date
- supplier

- **Number of test samples**

- The supplier shall submit test samples. These can be finished products and/or sample plates

### **3 Requirements chrome-plated surfaces**

#### **3.1 Cr regular (Crr) according to EN ISO 1456:2009**

Stress level 2,5 according to EN ISO 1456:2009.

If chrom III is used it has to be proven that dip solution is free from chromium.

The measurement of the layer thickness should be done at exposed positions (2-3 positions – average).  
Measuring according to ISO 1463 or 2177 or 2361 or 3497.

#### **3.2 Test requirements**

Corrosion test, salt spray test according to **DIN EN ISO 9227\_2017**

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It is mandatory to achieve corrosion resistance for parts without weld of 72 hours and for parts with weld seam of 8 hours.

- Adhesion test according to Vitra test 4.054

The parts should be tempered at 200° C for 15 minutes. Afterwards, the tempered parts should be quenched in 15° C cold water. Surface damage such as bubbles, cracks are not permitted.

**4 Requirements powder-coated and lacquered surfaces**

**4.1 Test requirements**

Test types	Vitra standard	Requirements	Test samples
Cross-cut test according to DIN EN ISO 2409	7.017	Cross-cut value 1	1 unit Test performed directly on product
Lightfastness / UV stability	3.042	Indoor = 600h Outdoor = 2000h Blue scale $\geq 7$	5 sample plates 60mm x 20mm x 5mm
Salt spray test DIN EN ISO 9227_2017 (According to this standard, the surface is provided with scratch lines before the test)	4.055	Indoor = 72h Outdoor = 600h* Without corrosion (*pre-treatment may be necessary, e.g. galvanising etc.)	1 unit Test performed directly on product

**4.2 UV stability and colour deviation**

**4.2.1 UV stability**

**Lightfastness of coated/lacquered surfaces:**

- Test requirement for indoor applications 600 h
- Test requirement for outdoor applications 2000 h

**Test requirements:** in accordance with Vitra test procedures (as per EN ISO 105-B02)

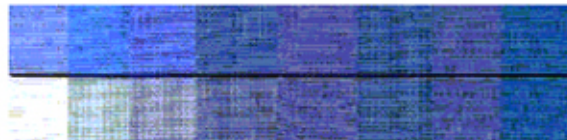
**Testing device:** Suntest CPS, xenon lamp 1500 B + UV filter + quartz glass

**Blue scale**

1 2 3 4 5 6 7\*\* 8\*\*

Original colour

after 600/2000 hours



\*\* = fulfills Vitra requirement (at least grade 7)

**4.2.2 Colour deviation**

Colorimetry is performed using the CIELAB system with the following types of light:

- D 65, daylight
- F 11 or TL84, artificial daylight

The visual assessment is performed in a light booth (ASTM D 1729) with the above-mentioned types of light.

**Permissible measurement tolerances:**

- $\Delta L$  < 1
- $\Delta a$  < 1
- $\Delta b$  < 1
- $\Delta E$  < 1

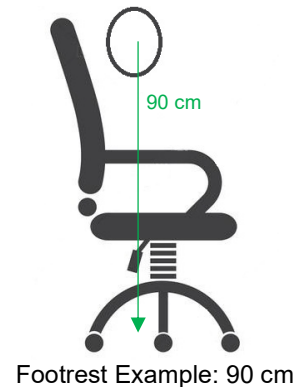
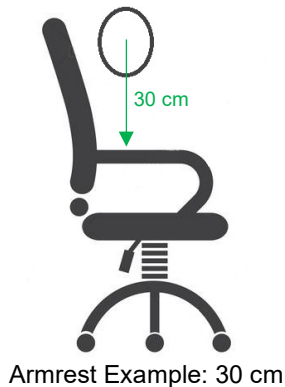
**Metamerism index: < 0.5**

The visual assessment takes precedence over the measured value. Minor optical deviations from the original sample are permitted, see stage 4 of EN 14323:2004 (D)

## 5 Surface Specification

### 5.1 Test conditions

- **Testers**
  - Normal viewing ability
- **Illumination**
  - Daylight (D65) and artificial light (F11), low reflection of 1,000 lux
- **Viewing distance**
  - If possible, the viewing distance should reflect the real usage/installation condition
  - The surfaces should generally be assessed at a distance of 0.3-0.9 metres. The surface to be assessed must be evaluated from different viewing angles.

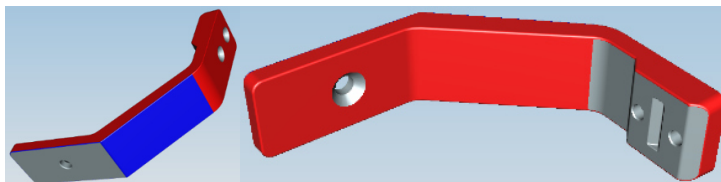


- **Test condition**
  - The surfaces must be assessed in a clean condition
- **Error Detection/Identification**
  - The defectiveness of the area to be assessed on the component must be detected within a maximum of 10 seconds
- **ABC Surfaces Definition**
  - Component specific information on A/B/C surfaces is included in the product-related Q specification

**Legend:**

- Red = A surface // directly visible surfaces
- Blue = B surface // indirectly visible surfaces
- Grey = C surface // invisible surfaces

For example:



## 5.2 Not / poorly countable Errors

Errors that cannot be counted are to be evaluated as described below. Detailed error description with examples, see 5.5.

No	Characteristic / Error	Validity:	polished	chrome	lacquered / coated
1	Roughness		x	x	x
2	Cracks		x	x	x
3	Grinding marks		x	x	x
4	Uncoated areas			x	x
5	Stains		x	x	x
5a	Acid Stains			x	
6	Geometry deviation at corners/edges/surfaces		x	x	x
7	Strips, streaks, weld line		x		x
8	Discolouration		x	x	x
9	Bubbles			x	x
10	Polishing direction		x		
11	Polishing lines		x		
12	(water-) stains, marbling		x	x	
13	Dent, bump		x	x	x
14	Dull / gloss spot		x	x	x
15	Polishing stripe mark		x		
16	Chromium accumulation			x	
17	Heat crack		x	x	
18	Contact/mounting point, clamping point			x	x
19	Nickel spots			x	
20	Deburring error		x	x	x
21	Flash, burr at mould parting and edges		x	x	x
22	Tool Offset, visible mould separation		x	x	x
23	Ripple, surface unevenness		x	x	x
24	Orange peel effect				x
25	Paint runs, paint accumulation, edge build-up				x
26	Mechanical damage prior to coating e.g. scuff marks				x
27	Blisters				x
28	Mechanical damage prior to coating				x
29	Unevenness (dents, draw marks, welding beads, inclusions, etc.)				x

- **On A surfaces**, the defects shall not be recognisable under the test conditions specified in 5.1.
- **On B surfaces** the defects must not be recognisable from a distance of 100 cm
- Burr (error no. 21/22) must not be visible and palpable on **A and B surfaces**

- **Exceptions regarding B surfaces:**

<b>Polished aluminium</b>	<b>Chrome plating</b>	<b>Coated / lacquered</b>
Error no. 10: the polishing direction can be visible from max. 2 directions (stroke + cross stroke) and errors no. 3 and no. 6: grinding marks and geometric deviations can be visible but not palpable	Errors No. 3 and No. 6: Grinding marks and geometry deviations can be visible but not palpable	Errors No. 3 and 6: Grinding marks and geometry deviations can be visible but not palpable

- **The technical requirements apply to C surfaces**

**5.3 Needs of limit samples**

In the case of unavoidable, visible/ palpable error, the above-mentioned errors must be defined with boundary and/or reference samples.

Proposals for these samples shall be submitted by the supplier in duplicate version in signed form with signature and date before EMPB completion to Vitra for counter-signature. If necessary, Vitra can assist in the selection of samples.

To assist/clarify the written specification and documentation of the samples, Vitra and the supplier can create a product-specific error catalogue, which is compiled and supplemented during sampling and production.

**5.4 Countable Errors**

Countable errors are defined and evaluated in number and size for each area category (A/B/C). To determine the allowable error size, an evaluation card (“Fehlergrößenbestimmungstabelle”) can be used. This evaluation tool is provided by Vitro on request.



No	Characteristic / Error	Validity:	polished	chrome	Coated / lacquered
30	Pore, pinhole		x	x	x
31	Scratch		x	x	x
32	Inclusion, pick, crater, dust inclusion		x	x	x
33	Color point				x

**Allowed errors on A/B/C surfaces**

The information is valid for the entire area of the respective category (A/B/C).

▪ Polished aluminium

A-faces: directly visible surfaces	
Group	Allowed error frequency
≤ 0.2mm <sup>2</sup>	2 pcs
Distance > 200mm between each error	
B surfaces: indirectly visible surfaces	
Group	Allowed error frequency
≤ 0.4mm <sup>2</sup>	4 pcs
Distance > 100mm between each error	
1x agglomeration (diameter max. 20 mm) of pores of	
5x ≤ 0.05 mm <sup>2</sup> + 2x ≤ 0.1 mm <sup>2</sup> is allowed	

▪ Chrome




A-faces: directly visible surfaces	
Group	Allowed error frequency
≤ 0.1mm <sup>2</sup>	2 pcs
Distance > 200mm between each error	
B surfaces: indirectly visible surfaces	
Group	Allowed error frequency
≤ 0.2mm <sup>2</sup>	4 pcs
Distance > 100mm between each error	
1x agglomeration (diameter max. 20 mm) of pores of	
3x ≤ 0.05 mm <sup>2</sup> + 1x ≤ 0.1 mm <sup>2</sup> is allowed	




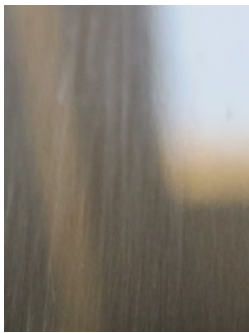




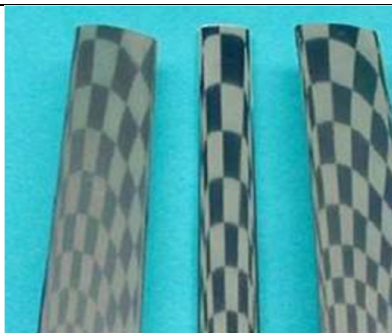

▪ Coated / lacquered



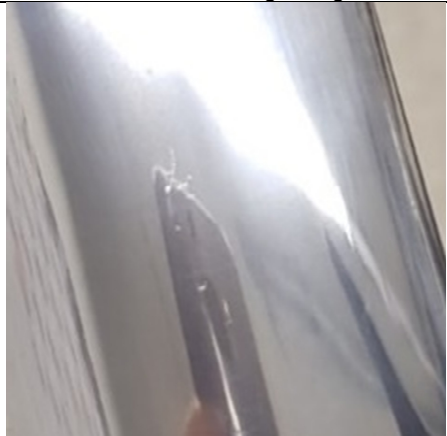
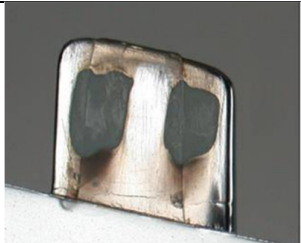
<b>A surfaces: directly visible surfaces</b>	
Group	Allowed error frequency
≤0.2mm <sup>2</sup>	2 pcs
Distance > 200mm	
<p><b>High contrast / f.e. black-white, clearly delimited</b></p> <ul style="list-style-type: none"> <li>- Error frequency of group ≤ 0.1mm<sup>2</sup> is allowed on this area 4x</li> <li>- Error frequency of group ≤ 0.2mm<sup>2</sup> is allowed on this area 2x</li> </ul> <p><b>Low contrast / f.e. blue-green, not clearly delimited</b></p> <ul style="list-style-type: none"> <li>- Error frequency of group ≤ 0.2mm<sup>2</sup> is allowed on this area 4x</li> <li>- Error frequency of group ≤ 0.4mm<sup>2</sup> is allowed on this area 2x</li> <li>- Error frequency of group ≤ 0.8mm<sup>2</sup> is allowed on this area 1x</li> </ul>	
<b>B surfaces: indirectly visible surfaces</b>	
Group	Allowed error frequency
≤0.4mm <sup>2</sup>	4 pcs
Distance > 100mm	
1x agglomeration (diameter max. 20mm) of pores of 3x ≤0.05mm <sup>2</sup> + 1x ≤0.1mm <sup>2</sup> is allowed	
<b>C Surfaces: not visible surfaces</b>	
Technical requirements	

**5.5 Description of the characteristics /errors**

No	characteristic /Error	
1	Roughness	Differences in the roughness of the surface are noticeable, optical and/or haptic.
2	Cracks	Cracks in the surface of the part due to damage, or cooling process.
3	Grinding marks	 <p>Grinding marks are linear, deep, long scratching marks of a grinding process that have not been removed, for example, by a finer grinding or sufficient polishing.</p>
4	Uncoated areas	Uncoated areas due to e.g. surface impurities prior to coating, field shielding,...
5	Stains	 <p>Stains are limited, superficial, noticeable changes in the surface, e.g. gloss or colour due to impurities of the workpiece before or after a coating</p>
6	Geometry deviation at corners/edges/surfaces	

			<p>Geometry deviations are form defects due to e.g. inadequately accurate manual or machine rework such as grinding</p>
7	Strips, streaks, weld lines		<p>weld lines are scratch-like visible flow marks, due to e.g. two mass currents flow together</p>
8	Discolouration		<p>Discolouration of the surface due to e.g. material/structure or heat exposure, bath composition, etc.</p>
9	Bubbles		<p>Bubbles due to e.g. outgassing</p>
10	Polishing direction		<p>Polishing direction not OK, e.g. due to incorrect orientation (transverse instead of longitudinal) or multiple visible directions</p>
11	Polishing lines		<p>Finest, local accumulation of visible grooves caused by polishing treatment, due to e.g. unfavourable choice of polishing paste and/or polishing disc).</p>



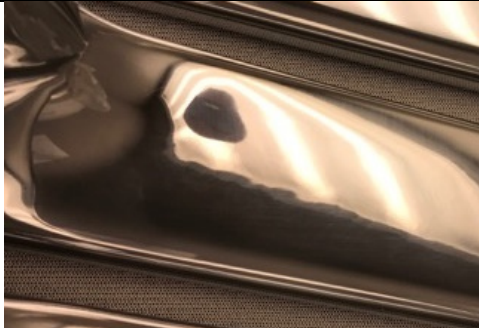
12	(water) stains, marbling		<p>Marbling effects are visually shimmering irregularities that appear bright/darker depending on the viewing angle / angle of light.</p>
13	Dent, bump		<p>dents are round/oval deepening on the surface without damage to the coating due to poor parts handling. Bumps are round/oval elevations on the surface without damage to the coating.</p>
14	Dull spot / gloss finish		<p>Dull spots are e.g. local gloss differences that are process related while coating. The gloss difference can occur within a part or between two parts.</p>
15	Polishing stripe mark		



			
16	Chromium accumulation		
17	Heat crack		
18	Contact/mounting point, clamping point		





Small scratches caused by polishing treatment  
Due to e.g. a foreign particle, a pore or other preconditioning from pre-processes (e.g. grinding)

Chromium accumulations are increased layer thicknesses at edge, corners and breakthroughs e.g. due to edge geometry.

Heat cracks, visible as small sharp-edged elevations on the components, are small surface cracks in the die casting tool due to e.g. material fatigue of the tool material. Heat cracks must be removed by grinding, by only polishing they can remain visible.

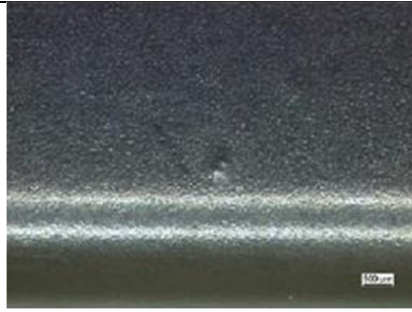
		mostly small round, bare coating defects (in the visible area), caused e.g. by clamps, product carrier, etc
19	Nickel spots	 <p>Yellowish spots in the contact area and in the area e.g. lower current density. Chrome covered insufficient.</p>
20	Deburring error	Too deep, sharp/flat sanded
21	Flash, burr at mould parting and edges	Not sufficiently removed flash, burr
22	Tool Offset, visible mould separation	 <p>tool offset, mould separation are form defects, e.g. due to inadequately accurate tool construction.</p>
23	Ripple, surface unevenness	 <p>Ripple and surface unevenness are irregularities visible when mirroring straight lines in the surface due to imprecise manual rework when grinding and polishing.</p>

24	Orange peel effect	
25	Paint runs, paint accumulation, edge build-up	
26	Scuff marks	
27	Blisters	

28	Mechanical damage prior to coating	
29	Inclusions	
30	Pore	 <p>Pores are fine holes in the coating, or base material, due to e.g. air inclusions which gas out when heated, or are opened by sanded.</p>
31	Scratch	 <p>Scratches are line-shaped mechanical damage to the Surface due to e.g. inadequate attention while handling of the parts.</p>



32 Inclusion



Inclusions are visible, foreign particles in the chrome-plated surface due to impurities in the coating bath.