1. Target and purpose

This standard describes a clear guideline as a uniform basis for the evaluation of decorative surfaces during the Customer Product Audit (CPA) as well as during the inspection at the supplier. The subjective view from the customer's perspective is decisive. The objective is to prevent any conspicuous defects for the end customer.

Any deviations from this specification with regard to surface quality must be agreed accordingly (e.g. by means of deviation approvals; see 2.7).

The HWA Quality Management (QM) is responsible for the definition of the scale.

2. Description

2.1 Assessment conditions

The assessment of the complete vehicle/component is carried out on the basis of the process specification (PV) CPA. Corresponding specifications for illumination, component position and assessment positions (incl. distance specifications) can be found in this PV.
A subjective assessment of the components at a distance of at least 0.7 m is decisive for the supplier. VDA 16 for decorative surfaces can also be used for advice.

2.2 Basic requirements for the component optics

The overall impression of the component surfaces must have a homogeneous appearance, both on their own and, if necessary, in combination with other components. Drawing specifications are to be regarded as mandatory specifications.

Basic surface characteristics include structure, coloration and gloss level.

2.3 Definition and methodology of visible areas (exterior/interior):

In order to give weighting to the varying visibility and extent of different defect patterns, the vehicle surface is divided into separate assessment zones. The component geometry and the installation position on the vehicle are used as reference points for the division into zones. The demarcation takes place at the respective component boundaries or on the basis of the contour shape.

A distinction is made between the following three areas:

A-Area

Describes the direct viewing surface (usually directed upwards), as well as distinctive viewing areas that stand out, for example, due to their geometry. On these surfaces, defects or irregularities are immediately perceived by the observer and registered as disturbing (positive angle to the vehicle/component contour).

B-Area

Inclined viewing surfaces (mostly neutral or slightly downward) and slightly concealed viewing surfaces or surfaces in the lower area of the vehicle are not in the direct field of view of the observer. Corresponding irregularities are not perceived as particularly disturbing in relation to viewing zone A, due to the fact that these are proportionately less distracting. This is also due to the fact that they are relatively less noticeable (neutral or slightly negative angle to the vehicle/component contour).

C-Area

Mainly concealed surfaces (also due to shadows or downward facing surfaces), or surfaces that are outside the direct field of view or are only viewed for a short time (negative angle to the vehicle contour).

All other surfaces are only viewed extremely rarely or are largely covered after assembly and are therefore not in the direct field of view of the viewer. The finishing of these surfaces is usually only carried out for process-related reasons. These surfaces must also be protected from chemical and mechanical influences. The optical appearance takes on a secondary role.

After a rough division of the zones, deviations from the above methodology can be defined due to conceptual characteristics of the vehicle or the component. The decisive factor here is the visibility range of the component on the vehicle or whether the component is viewed from different angles during vehicle use.
NOTE:
The visibility zone requirement can be taken from an info box including the decorative component specification on the respective official HWA component drawing, respectively will be made available by HWA AG on request.

2.4 General handling of surface defects

Complaints are assessed on the basis of their intensity and conspicuousness. The visual impression of the observer is initially decisive.
However, a functional impairment due to a finding is not acceptable here either (e.g. damage to the primer).
Defects are assigned on the basis of the visual zones described above. In this way, a rating of complaints can be made.

2.5 Scale definition countable error patterns

Countable errors can be described by the following characteristics:

- defect size	Longest cross-section (diameter incl. edge surfaces)
- error accumulations	The permissible number of defects on surfaces is specified by the minimum distance from each other, as well as by a maximum value.
- minimum distance:	For defect accumulations (including different sizes), the distance to the largest defective location is applied as a reference
- cluster	Only permissible insofar as not perceived as disturbing (diameter <0.5mm)

Countable defect patterns include the following:

- inclusions
- pores
- pinholes
- paint splashes (same color)
- clear coat drops (not allowed within "A" area)
- bubbles

	Tolerable expression per visible area					
	A		B		C	
diameter	max. ammount	min. distance	max. ammount	min. distance	max. ammount	min. distance
D ≤ 1 mm	2	300	5	150	7	150
1 mm < D ≤ 1,5 mm	0	/	4	300	4	150
1,5 mm < D ≤ 2 mm	0	/	1	/	2	150
D > 2 mm	0	/	0	/	0	/
max. number per area	2		5		7	

2.6 Determination of the acceptability of defect patterns

On the following pages, the non-permissible defect patterns per visual area are described in detail. Any deviation from the specification must be officially requested in advance by the supplier by means of a deviation request (see https://www.hwaag.com/de/impressum-de.html). Otherwise, we reserve the right to refuse acceptance of the components or to issue a non-conformity report.
In the document, in some cases there is a reference to limit samples. This applies primarily to defects that cannot be counted. Limit samples are to be agreed upon and documented with the participation of the responsible quality manager of HWA AG. See also the corresponding template in the enclosed appendix. Deviations are only permissible if they have been officially confirmed by HWA QM.
The parts to be delivered must be checked against these specifications before dispatch of the goods. Further inquiries can be sent toQM@hwaag.com.

HWA- internal:
In general, the guidelines for design change management (KÄM) must be observed here. The process flow incl. authorized persons are to be understood in the same way.
Mention: Temporary deviations are to be applied for via Concession Request.

Seq. no.	Fault indication
31	Resin accumulation

Characteristic definition

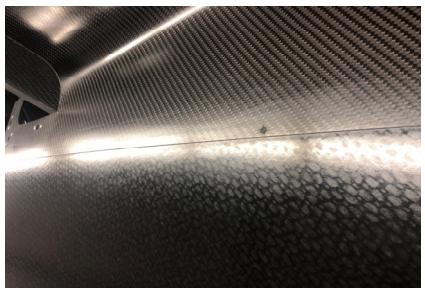
local accumulation of resin material on the laminate surface

Category	TIER I	TIER II
A	not allowed	not allowed
B	not allowed	not allowed
C	not permitted on exposed edges; Along edge, max. length 20 mm and width 5 mm	not permitted on exposed edges; Along edge, max. length 20 mm and width 5 mm

Seq. no.	Fault indication
32	Parting edge/line (visible area)

Characteristic definition

Parting edge / offset in the surface due to tool parting

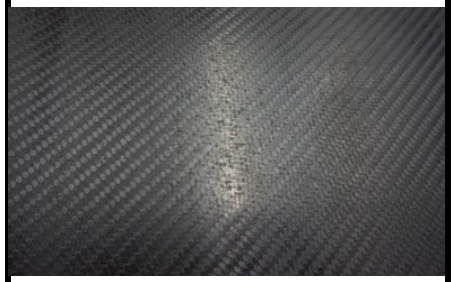


Category	TIER I	TIER II
A	not allowed	not allowed
B	visible from 1 m distance but not noticeable	visible from 1 m distance but not noticeable
C	max 1 mm step at tool parting	max 1 mm step at tool parting

Seq. no.	Fault indication
33	Inconsistent appearance

Characteristic definition

partly also haptically noticeable; uneven surface appearance, patchy

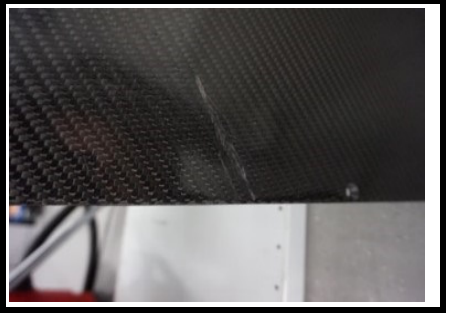


Category	TIER I	TIER II
A	not allowed	not allowed
B	not allowed	not allowed
C	permissible on the surface insofar as smaller than 1 cm^2	permissible on the surface insofar as smaller than 2 cm^2

Seq. no.	Fault indication
34	Loose fibers

Characteristic definition

continuous or loose fiber in the fabric

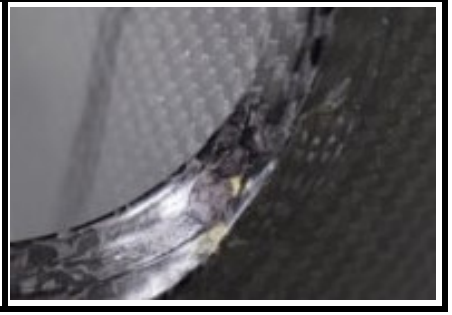


Category	TIER I	TIER II
A	not allowed	not allowed
B	not perceptible from 100 cm	not perceptible from 100 cm
C	allowed	allowed

Seq. no.	Fault indication
35	Wrinkling

Characteristic definition

sharp edges of the folds are generally not allowed

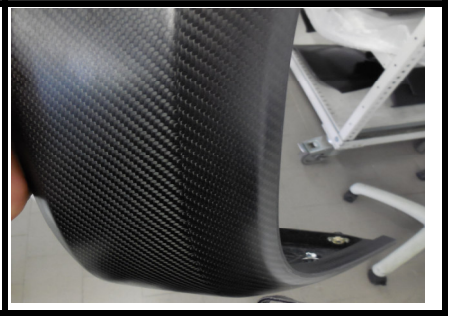


Category	TIER I	TIER II
A	not allowed	not allowed
B	not allowed	not allowed
C	max. shaping: height 1 mm	max. shaping: height 1 mm

Seq. no.	Fault indication
36	Counter directing fiber

Characteristic definition

offset in the opposing fabric pattern at the transition to neighboring components



Category	TIER I	TIER II
A	if specified on drawing: offset < 1 mm and not perceptible from 100 cm	if specified on drawing: offset < 1 mm and not perceptible from 100 cm
B	if specified on drawing: offset < 1 mm and not perceptible from 100 cm	if specified on drawing: offset < 1 mm and not perceptible from 100 cm
C	offset allowed	offset allowed

Seq. no.	Fault indication
37	Visible cracking

Characteristic definition

Unclean trim

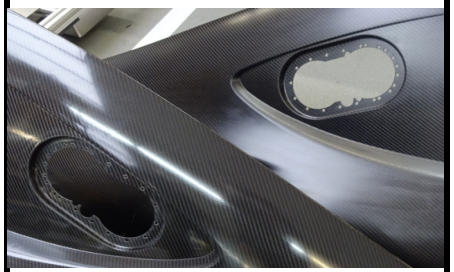
Special case: change of trim contour

Category	TIER I	TIER II
A	not allowed	not allowed
B	not allowed	not allowed
C	deviation from trim max. 1 mm; functional restrictions excluded	deviation from trim max. 1 mm; functional restrictions excluded

Seq. no.	Fault indication
38	Gloss level deviation

Characteristic definition

Deviation from specification: Gloss on partial or complete areas

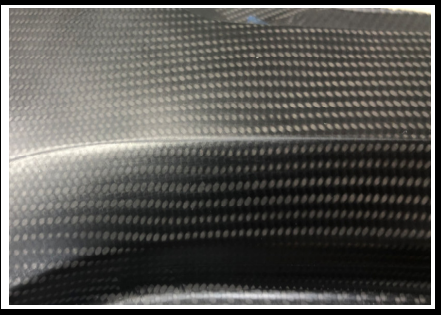


Category	TIER I	TIER II
A	similar to gloss level specification	similar to gloss level specification
B	similar to gloss level specification	similar to gloss level specification
C	similar to gloss level specification	similar to gloss level specification

Seq. no.	Fault indication
39	Irritated fiber orientation / fiber distortion

Characteristic definition

Distortion or compression of the laminate pattern



Category	TIER I	TIER II
A	reference pattern/direction specification techn. drawing +/- 5°	reference pattern/direction specification techn. drawing +/- 5°
B	reference pattern/direction specification techn. drawing +/- 5°	reference pattern/direction specification techn. drawing +/- 5°
C	reference pattern/direction specification techn. drawing +/- 10°	reference pattern/direction specification techn. drawing +/- 10°

Seq. no.	Fault indication
40	Sratch

Characteristic definition

mech. abrasive impact on the component, which leaves permanently visible marks

Category	TIER I	TIER II
A	not allowed	< 1 mm and not perceptible from 70 cm
B	< 1 mm and not perceptible from 70 cm	< 2 mm and not perceptible from 70 cm
C	areal permissible insofar as smaller than 1 cm^2; see restrictions on countable defects	areal permissible insofar as smaller than 2 cm^2; see restrictions on countable defects

Seq. no	Fault indication
41	Inclusions

Characteristic definition

Inclusions of foreign objects during the manufacturing process

Category	TIER I	TIER II
A	not allowed	not allowed
B	not allowed	not allowed
C	see limitations countable error patterns	see limitations countable error patterns

Seq. no	Fault indication
42	Pinholes

Characteristic definition

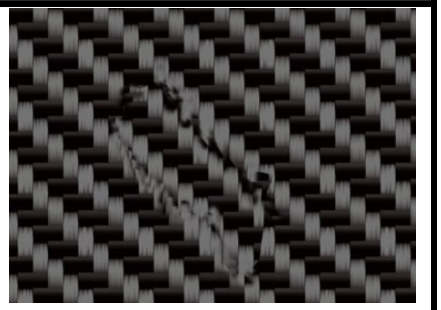
Pinholes in the fiber crossing points

Category	TIER I	TIER II
A	not allowed	not allowed
B	not allowed	not allowed
C	permissible insofar as on an area of 10 cm^2 number of spots less than 3	permissible insofar as on an area of 10 cm^2 number of spots less than 5

Seq. no.	Fault indication
43	Defects in the fabric

Characteristic definition

local irritation of the optical fabric in the form of, among other things, fabric folds, tears in the fabric, gaps in the fabric

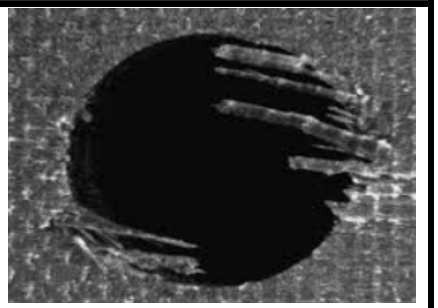


Category	TIER I	TIER II
A	not allowed	not allowed
B	< 1 mm and not perceptible from 100 cm	permissible on the surface if smaller than 10 cm^2 and not perceptible from a distance of 100 cm
C	areal permissible insofar as smaller than 100 cm^2; see limitations countable error patterns	areal permissible insofar as smaller than 100 cm^2; see limitations countable error patterns

Seq. no.	Fault indication
44	Frayed fabric

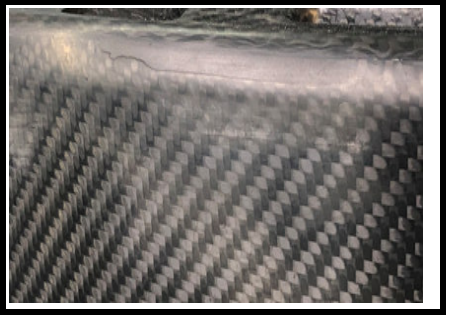
Characteristic definition

Overhanging fibers due to unclean processing



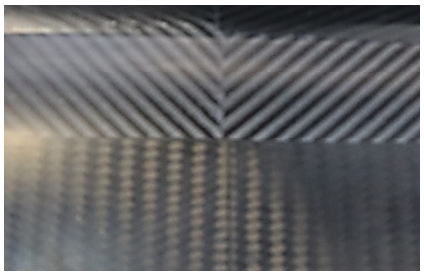
Category	TIER I	TIER II
A	not allowed	not allowed
B	not allowed	not allowed
C	permissible insofar as residues < 1 mm; sharp edges excluded and functionality given	permissible insofar as residues < 2 mm; sharp edges excluded and functionality given

Seq. no.	Fault indication
45	Filled areas (adhesive according to CFRP color scheme)

Characteristic definition	
Visible reworking of defects by means of adhesive	

Category	TIER I	TIER II
A	not allowed	not allowed
B	not perceptible from 100 cm	not perceptible from 100 cm
C	area limitation to max. 4 cm; see limitations countable error patterns	area limitation to max. 4 cm; see limitations countable error patterns

Seq. no.	Fault indication
46	Fishbone

Characteristic definition	
Offset in the opposing mesh pattern (see also 36)	

Category	TIER I	TIER II
A	fabric distortion not permissible	fabric distortion not permissible
B	reference pattern/specification +/- 5°	reference pattern/specification +/- 5°
C	not relevant	not relevant

Seq. no.	Fault indication
47	missing edges or clusters

Characteristic definition

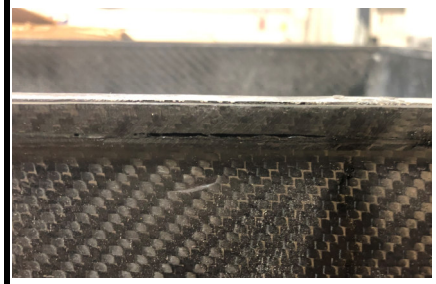
Material elevations or flaws due to poor tool quality

Category	TIER I	TIER II
A	not allowed	not allowed
B	not allowed	not allowed
C	not allowed	not allowed

Seq. no.	Fault indication
48	Cracks in bonded parts

Characteristic definition

Visible defects/voids along the adhesive weld



Category	TIER I	TIER II
A	not allowed	not allowed
B	not allowed	not allowed
C	Not permissible on exposed edges; along edge, filling with adhesive permissible	Not permissible on exposed edges; along edge, filling with adhesive permissible

AA-QS-0201 HWA Surface Appearence Standard

HWA material designation	
HWA material number	

OK illustration	nOK illustration

Fault name	Category	Acceptance criteria
	A	
	B	
	C	

AA-QS-0201 HWA Surface Appearence Standard

HWA material designation	
HWA material number	

OK illustration	nOK illustration

Fault name	Category	Acceptance criteria
	A	
	B	
	C	

3 Changes / History

Version	Date	Created	Change and reason	Status
00	01.03.2021	P.Grunau	Erstellung HWA Standard	Genhemigt