Solaris Standards for powder-coated parts

Solaris Bus & Coach sp. z o.o.
(hereinafter “Solaris”)

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with its registered seat in Bolechowo-Osiedle, at 46 Obornicka Street, 62-005 Owińska, entered in the Register of Entrepreneurs of the National Court Register by the District Court Poznań Nowe Miasto and Wilda in Poznań VIII Economic Department of the National Court Register under the KRS number 0000236619, NIP 524-00-15-630, share capital 160 169 580,00 PLN, fully paid up

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1. General guidelines

1.1. The standard applies to Solaris.
1.2. The standard is the basic document specifying Solaris' requirements for manufacturers of powder-coated parts.

2. Requirements

2.1. All parts should:

a) Be properly protected for transportation (in accordance with the *Packaging Standards*);
b) have a properly hardened coating;
c) have a smooth surface;
d) be identifiable, labeled with correct indexes in accordance with delivery documents;
e) have a color consistent with the order; in case of non-compliance, the item will be compared with a color standard (e.g., RAL), a spectrophotometer, or a sample previously provided for approval by the delivery control department.

2.2. Proper preparation of the surface for powder coating (in accordance with the technology used).
If the technology does not specify this, the required degree of surface preparation is: St 3 or Sa 2 1/2 according to PN EN ISO 12944-4.
The drying process should ensure that all traces of moisture are removed from both the painted surface and the interior of the profiles.

2.3. The technology used must be presented for approval before deliveries commence, and at the latest together with the documentation for approval of the first part.

2.4. Coating thickness
It must be compatible with the technology used, which the supplier is required to submit to Solaris for approval. Measurement of coating thickness in accordance with our instructions.:
Procedure for measuring the thickness of paint layers.

It is not acceptable to apply another additional layer of powder paint if repainting is necessary. Before powder coating, the old paint layer must be removed.

2.5. Adhesion
Testing in accordance with PN-EN ISO 2409.
The requirements for coatings in terms of this parameter are adhesion classes 0-1.

2.6. The corrosion resistance achieved through powder coating should provide corrosion protection equivalent to that achieved through aging tests.

For parts installed in external areas of the bus and in contact with the floor, we require:

Evaluation of the coating system after artificial aging:

- Option 1: based on ISO 12944-6, artificial aging according to ISO 9227 for a minimum of 720 hours and ISO 6270-1 for a minimum of 480 hours

- Option 2: based on ISO 11997-1, artificial aging should be carried out according to cycle B (VDA 621-415) for a period of 6 weeks.

For parts installed in the passenger compartment, we require:

Evaluation of the coating system after artificial aging:

- Option 1: based on ISO 12944-6, artificial aging according to ISO 9227 for a minimum of 480 hours and ISO 6270-1 for a minimum of 240 hours

- Option 2: based on ISO 11997-1, artificial aging should be carried out according to cycle B (VDA 621-415) for a period of 4 weeks.

2.7. Evaluation of the paint coating before and after testing:

Information on the evaluation of coating systems before artificial aging, based on ISO 12944-6 and ISO 11997-1

1. Adhesion of the coating to the substrate, using the cross-cut method, according to ISO 2409.
Classification from 0 to 1.

Information on the evaluation of the coating system after artificial aging, based on ISO 12944-6 and ISO 11997-1

Requirements:

1. Blistering, according to ISO 4628-2. Required 0 (S0)
2. Rusting, according to ISO 4628-3. Required Ri 0
3. Cracking, according to ISO 4628-4. Required 0 (S0)
4. Flaking, according to ISO 4628-5. Required 0 (S0)
5. Corrosion on the cut line, according to ISO 4628-8. Maximum 2 mm
6. Adhesion of coating to substrate, cross-cut method, according to ISO 2409.
Classification from 0 to 2

2.8. Division of evaluated details into 2 zones:
A – decorative/visible surface;
B – invisible surface.

Visual assessment is carried out in good lighting conditions (natural light and artificial light). Assessment distance: 0.6 m for all criteria. The color and degree of gloss must comply with the requirements specified in the technical documentation or order.

2.9. Gloss level
The gloss level should be specified in the order. Otherwise, semi-matt applies.

2.10. The contractor performing the powder coating process for Solaris must meet the requirements for the special process and be able to present the technology used and the results of environmental resistance tests confirming the quality of the product from production batches not older than 6 months at any time upon request by Solaris.

2.11. A change in technology by the supplier requires the application of the *First Part Approval manual for Suppliers.*
The supplier is obliged to repeat the tests, submit the results for approval by Solaris, and deliver painted samples of the material.

3. The most common paint defects

3.1. Corrosion - damage to the paintwork manifested by the appearance of irregular blisters, under which rust forms.

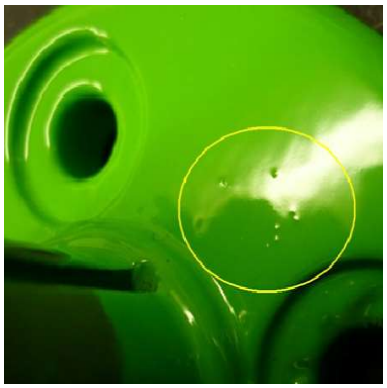
Unacceptable defect

3.2. Orange peel - the paint has an uneven surface resembling orange peel.

Unacceptable defect in zone A

Acceptable defect in zone B

3.3. Coating contamination – inclusions, dust deposited on the surface of the part together with contaminants.



Unacceptable defect in zone A

Acceptable defect in zone B
(a few isolated, unfocused, ≤3mm)

3.4. Scratches

Unacceptable defect

3.5. Mechanical damage – cracking of the paint coating under impact caused by improper surface preparation, insufficient heating of the element, or an excessively thick layer of paint.

Unacceptable defect

3.6. Craters (fish eyes) – round depressions with a diameter of 0.5 to 3 mm.

Unacceptable defect in zone A

Acceptable defect in zone B (≤1mm)

3.7. Run marks – droplet-shaped or furrowed thickening of the paint on vertical surfaces, forming run marks and tears.

Unacceptable defect

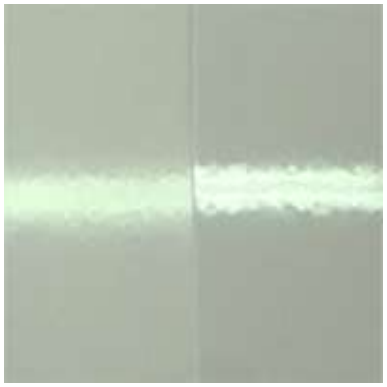
3.8. Needling – visible numerous small depressions caused by excessive coating thickness and/or moist powder/metal surface.

Unacceptable defect

3.9. Color mismatch – visible differences in color between the delivered items.

Acceptable defect in the following ranges:
ΔE 00 ≤ 1.0 details are not adjacent to each other
ΔE 00 ≤ 0.5 details are directly adjacent to each other

3.10. Dulling – after annealing, the elements are dull and have a milky hue.



Unacceptable defect

3.11. Yellowing – applies to white paints.

Unacceptable defect

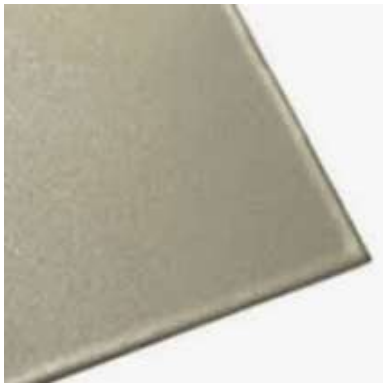
3.12. Lack of adhesion, spalling.

Unacceptable defect

3.13. Poor coverage – variations in coating thickness.

Unacceptable defect

3.14. Frame effect – paint accumulation on edges and corners.



Unacceptable defect

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