



SOLARIS
A **CAF** GROUP COMPANY

WORKS STANDARD

SN17-011-00D Release 5

Laminates

based on resins, fiber reinforced

**Solaris Bus & Coach sp. z o.o. (hereinafter
referred to as "Solaris")**

version as of: June 2021

Solaris Bus & Coach sp. z o.o. with its registered seat in Bolechowo-Osiedle, ul. Obornicka 46, 62-005 Owinska, Poland; entered into the business register of the National Court Register maintained by the District Court Poznan – Nowe Miasto i Wilda in Poznan, Poland, VIII Commercial Division under the reference number KRS 0000856560, Tax ID: NIP 524-00-15-630, share capital of 160.169.580 PLN, fully paid-up

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This English version is a translation. In case of doubt or conflict the valid polish – language original will govern.

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1. Application and purpose

- 1.1. This standard is valid in Solaris Bus & Coach sp. z o.o.
- 1.2. For the purposes of subcontractors, this standard can be attached utilized by them and attached to technical documentation.
- 1.3. This standard is a base document determining requirements of Solaris Bus & Coach sp. z o.o. for manufacturers of laminated parts.

2. Normative references

In this standard following referenced standards and regulations are referenced:

- 2.1. PN-K-02511 Tabor kolejowy - Bezpieczeństwo przeciwpożarowe materiałów - Wymagania
- 2.2. PN-EN 45545-2 Kolejnictwo - Ochrona przeciwpożarowa w pojazdach szynowych - Część 2: Wymagania dla materiałów i elementów w zakresie właściwości palnych
- 2.3. PN-EN ISO 1043-1 - Tworzywa sztuczne - Symbole i skróty nazw -- Część 1: Polimery podstawowe i ich cechy charakterystyczne
- 2.4. PN-EN ISO 11469 - Tworzywa sztuczne - Identyfikacja rodzaju tworzywa i znakowanie wyrobów z tworzyw sztucznych
- 2.5. PN-EN ISO 75-1 Tworzywa sztuczne - Oznaczanie temperatury ugięcia pod obciążeniem - Część 1: Ogólna metoda badania
- 2.6. PN-EN ISO 75-3 Tworzywa sztuczne - Oznaczanie temperatury ugięcia pod obciążeniem - Część 3: Laminaty termoutwardzalne o dużej wytrzymałości
- 2.7. SN22-004-000 Znakowanie – Określenie miejsc, informacji i zakresu znakowania
- 2.8. CNTK 46/98/n01 Laminaty poliestrowo-szklane stosowane w taborze szynowym
- 2.9. Regulamin nr 118 Europejskiej Komisji Gospodarczej Narodów Zjednoczonych (EKG ONZ) – Jednolite wymagania techniczne dotyczące palności materiałów używanych w konstrukcji wnętrza niektórych kategorii pojazdów samochodowych
- 2.10. Rozporządzenie Ministra Gospodarki z dnia 28 grudnia 2005 r. w sprawie sposobu oznaczania oraz rodzajów oznaczeń przedmiotów wyposażenia i części pojazdów (Dz.U. 2006 nr 2 poz. 9)

3. Terms and definitions

- 3.1. Laminate – material made of several layers of different physical and mechanical properties, in which exists at least reinforcing and filling ingredients.
- 3.2. HDT – Heat deflection temperature. Temperature at which a polymer deforms under specific load.

4. Requirements

Note!

Requirement for suppliers are stated in point 4 and 7.

4.1. General requirements.

Whole laminate shell possess the same properties in terms of density, durability, cross – section and color. It shouldn't shrink or warp over tolerance limits. The laminate's surface shell

be suitable for painting. Amount of hardener shall be in compliance with resins technology sheet. It is preferred to use low styrene resins. Resins to enforcing fiber ratio shall be constant for the same product.

4.2. Basic properties

Table 1 shows minimal mechanical and physical properties measured at ambient conditions which product made of laminate shall have at the moment of receipt of delivery.

Table 1 Basic properties of laminates

Property	Definition according to	Value
Amount of Glass and mineral fillings	CNTK 46/98/n01	≥ 30%
HDT of laminate	ISO 75	≥ 70°C
Combustibility	R118 EKG ONZ	According to directive 9 R118 EKG ONZ *

*Additional requirements related to combustibility should be stated in exceptional cases only (customer requirement).

4.3. Dimensional tolerances

- a) In relation to all linear dimensions except thickness, following tolerances show in table 2 are required.

Table 2 Tolerances of laminates linear dimensions.

dimensional range in mm	below 30	from 30 up to 120	from 120 up to 400	from 400 up to 1000	from 1000 up to 2000	above 2000
deviation in mm	±0,5	±0,8	±1,2	±2	±3	±4

- b) For laminates wall thickness, tolerance according to table 3 is required.

Table 3 Tolerance of laminates thickness

nominal thickness in mm	below 3	from 3 up to 5	above 5
deviation in mm or in %	±15%	±0,6	±1

for $s \leq R/2$, where

s – wall thickness

R – radius

It is allowed to exceed upper tolerance of wall thickness

This is due to technology of manufacturing of the laminate. The designer should apply necessary tolerances or signs on the drawing so that too large bold in corners of laminate doesn't hinder the assembly.

- c) All remaining tolerances, including form and position of laminated parts, should be stated by designer through application of specific signs on the drawing.

4.4. Resistance to corrosion of metal parts.

Required anticorrosion protection of metal parts (hinges, locks, handles) is stated by the designer on the drawing of laminate.

5. Surface structure of laminate

Following drawing symbols regarding surface of laminates shall be used:

- a) SM – smooth mat RALXXXX / color in compliance with index description
- b) SQ – shine RALXXXX / color in compliance with index description
- c) BS – orange peel RALXXXX / color in compliance with index description
- d) Paint in backing (for external, visible parts) RALXXXX / color in compliance with index description
- e) Keep gelcoat under varnish in grey (underbody)

6. Information which should be included on the drawing by designer

- reference to standard SN17-011-000.
- name of laminate and surface structure (point 5).
- information of location and place of painting. Color shall be stated in compliance with RAL.
- decorative surface shall be marked with arrow and description.

Moreover, „technical information” shall contain drawing of laminate installation or different attachment that allow identification of function of laminate. This document should be transferred to supplier together with drawing of the laminate.

7. Guideline for quality control

Laminate can be deformed under its own weight. For this reason validation of dimensions according to values in drawing can be performed only when support points correspond same points in place of assembly on car.

Finisher good shall not emit odor or harmful gases.

According to „rozporządzenie Ministra Gospodarki z dnia 28 grudnia 2005 r. w sprawie sposobu oznaczania oraz rodzajów oznaczeń przedmiotów wyposażenia i części pojazdów”, marking of laminates shall be performed in correspondence to PN-EN ISO 11469 and PN-EN ISO 1043 (part 1 and 2). Remaining matters are regulated by company standard SN22-004-000. Marking shall be made from non-decorative side as permanent marking. Exact place and content of marking is specified by the designer on drawing.

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