



SLOVENSKI STANDARD
oSIST prEN 17460:2020

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Železniške naprave - Lepilno spajanje za železniška vozila in dele

Railway applications - Adhesive bonding of rail vehicles and parts

Bahnanwendungen - Schienenfahrzeuge - Kleben von Schienenfahrzeugen und Schienenfahrzeugteilen

Applications ferroviaires - Assemblage par collage de véhicules et pièces ferroviaires

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ICS:

45.060.01	Železniška vozila na splošno	Railway rolling stock in general
83.180	Lepila	Adhesives

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Railway applications - Adhesive bonding of rail vehicles and parts

Applications ferroviaires - Assemblage par collage de
véhicules et pièces ferroviaires

Bahnanwendungen - Schienenfahrzeuge - Kleben von
Schienenfahrzeugen und Schienenfahrzeugteilen

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COMITÉ EUROPÉEN DE NORMALISATION
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CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

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prEN 17460:2019 (E)**Introduction**

Historically, the production of railway vehicles and their components, for the main part, comprises such materials as steels and aluminium alloys. Their methods of construction and assembly include such processes as bolting, screwing and welding.

Railway vehicles within the meaning of this standard are defined in EN 15380-1.

Technological developments have led to the availability of other materials, e.g. composites, and some of these traditional methods of construction and assembly are not necessarily appropriate or suitable for such materials.

For this reason, a process of adhesive bonding can be essential for the production of certain railway vehicles and their components, not only in the case of composites but for steels and aluminium alloys as well as glass and other materials.

The confirmation of the quality and integrity of the final adhesively bonded joints do not readily lend themselves to traditional inspection and testing techniques such as non-destructive testing.

Therefore, it is essential that the quality and control of the adhesively bonded joints of assemblies and components is managed to the best possible level by means of an appropriate process control procedure.

Whilst there are standards that deal with Quality Control and are taken into account, this standard aims to give the correct framework and includes additional detail necessary for all adhesive bonding and sealing activities performed on railway vehicles and its components as a special process.

NOTE EN ISO 9001 is such an example.

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1 Scope

This document defines the general terms and basic requests for adhesive bonding and sealing work as well as the requirements placed on adhesive users (hereafter called user-companies) and represents the state of the art for organizing adhesive bonding and sealing processes in the railway industry.

This document applies for adhesive bonding and sealing adherends for:

- the development of rail vehicles and its components (pre-production),
- production of rail vehicles and its components (in-production),
- the maintenance incl. repair of rail vehicles and its components (post-production), and
- the quality assurance of production, inspection, maintenance incl. repair of rail vehicles and its components.

This document is valid for every adhesively bonded joint in railway vehicles and its components independent of the material of the adherend. It is also valid for all kinds of adhesives independent of their solidification mechanism, their strength and their deformation properties.

This document is not valid for:

- screw retention by the usage of adhesives, if a pure screw assembly of the same design is sufficient for the purpose,
- hybrid joints, if the expected function is given exclusively by another joining technology e.g. welding, screwing, riveting,
- production of vulcanizates which do not lead to adhesively bonded joints,
- production of plywood,
- production of fibre reinforced plastic composites (FRP-composites),
- production of laminated sheet glass (LSG),
- pure encapsulating of electronic parts, and
- single-sided adhesive decorative films.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1465, *Adhesives — Determination of tensile lap-shear strength of bonded assemblies*

EN 923, *Adhesives — Terms and definitions*

EN ISO 10365, *Adhesives — Designation of main failure patterns (ISO 10365)*

ISO 37, *Rubber, vulcanized or thermoplastic — Determination of tensile stress-strain properties*

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ISO 16269-6:2014, *Statistical interpretation of data — Part 6: Determination of statistical tolerance intervals*

EN 14869-2, *Structural adhesives — Determination of shear behaviour of structural bonds — Part 2: Thick adherends shear test (ISO 11003-2:2001, modified)*

ISO 12107, *Metallic materials — Fatigue testing — Statistical planning and analysis of data*

ISO 4587, *Adhesives — Determination of tensile lap-shear strength of rigid-to-rigid bonded assemblies*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 923, modified, and the following apply.

NOTE An additional clarification of terminology associated with adhesive bonding technology is given in Annex L.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <http://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1 adhesion

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technical term for the interactions between the adhesive polymers and the adherend/substrate surface

Note 1 to entry: See also “adhesion forces”. Adhesion occurs in nm-dimensions.

3.2 cohesion

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internal strength, namely the forces which, for example, keep the molecules of an adhesive together

Note 1 to entry: Cohesion forces keep for example the molecules of an adhesive together and are based on attractive physical forces between the polymer chains, entanglement of the polymer chains, and chemical bonds inside and between the adhesive polymer chains.

3.3 adhesive

non-metal which bonds two adherends/substrates together via adhesion and cohesion

non-metal which bonds objects or semi-finished products together via adhesion and cohesion

3.4 adherend substrate

object or semi-finished product (e.g., sheet metal, wires, metal extruded, moulded plastic, fabrics, glass, etc.) on which an adhesive is applied

Note 1 to entry: In adhesive bonding processes, the term adherend is often used as a synonym for substrate.

3.5 adhesion forces

forces between the surface of the adherend/substrate and the adhesive film

Note 1 to entry: These adhesion forces include physical interactions, chemical bonds, and micro-mechanical adhesion.

3.6

adhesion promotor

liquid used in surface treatment to improve the adhesion of the adhesive to the adherend

Note 1 to entry: Adhesion promotors often are named as primers, accelerators or activators (see also L.2.2).

3.7

adhesive bonding

process of joining together the adherends by an adhesive

Note 1 to entry: The adherends/substrates can be made of the same as well as of different materials and can have different surface characteristics.

3.8

adhesive bonding area

area which is used to join two adherends/substrates using an adhesive

Note 1 to entry: The adhesive bonding area is usually the product of the overlap length and overlap width of the adherends/ substrates.

3.9

adhesive bonding coordinator

ABC

responsible adhesive bonding coordinator

rABC

qualified person with proven expertise in adhesive bonding technology responsible for the supervision of the adhesive bonding processes and for all linked activities

Note 1 to entry: The responsibilities of the adhesive bonding coordinators are shown in Table 1.

3.10

adhesive bonding operator

personnel with proven corresponding knowledge applying or executing the adhesive bonding process to manufacture, maintain, or repair components

3.11

adhesive bonding personnel

personnel involved in the design, planning, manufacturing, and maintenance/repair related to the adhesive bonding process

3.12

adhesive bonding procedure

all processes concerned with adhesive bonding such as surface treatment, processing the adhesive, application of the adhesive, joining the adherends/substrates and solidification (curing/hardening)

3.13

adhesively bonded joint

the connection of two or more substrates (adherends) from the same material or different materials with the use of an adhesive

Note 1 to entry: An adhesively bonded joint can be defined as rigid coupling, flexible coupling, or joint sealing. All three types of junction are based on the same principles of operation.

prEN 17460:2019 (E)**3.14****structural adhesively bonded joint**

adhesively bonded joint in which the adhesive bond makes a significant contribution to guarantee the load-transferring function of the component

3.15**component**

one part of an adhesive system

Note 1 to entry: In adhesive bonding technology, the parts of an adhesive system (resin and hardener) are called components (component A and component B).

3.16**Ageing**

changes in adhesively bonded joints and their properties over time

Note 1 to entry: Ageing can be simulated by storage of laboratory test samples under special climatic conditions in order to mimic, over a short period of time, the effects to which adhesives / adhesively bonded joints are exposed during their whole real lifetime

Note 2 to entry: Adhesives can age due to the effect of moisture, chemicals, oxygen, heat, light, mechanical stress, etc.

3.17**application**

application of the adhesive during the adhesive bonding procedure

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3.18**curing****chemical solidification of the adhesive**

chemical reactions leading to adhesive solidification (thermoplastic, elastomeric, or thermoset polymers)

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Note 1 to entry: This refers to chemically curing adhesives.

3.19**curing time**

period of time required to solidify a chemically curing adhesive

3.20**data sheet**

technical information sheet about an adhesive written by the adhesive manufacturer

Note 1 to entry: It gives information about the adhesive and how to process and apply the adhesive (also called: TDS).

3.21**safety data sheet****MSDS**

information sheet about product-related important safety instructions

3.22**destructive testing**

analyses, tests, or surveys carried out on a test specimen or system for the definition of information about qualitative/quantitative specific properties that destroys the test specimen or system

Note 1 to entry: The test specimen cannot be used afterwards.

3.23

non-destructive testing

NDT

analyses, tests, and measurements performed using methods that do not change the material and do not cause a damage or removal of samples of the test system, aimed at the investigation and identification of defects of the structure itself

Note 1 to entry: Each test specimen can be used afterwards without compromising the functioning of the product.

3.24

hot spot

small region or area with a high value of a quantity (e.g., stress, strain, energy)

3.25

joining

pairing or coupling of components to become a whole

Note 1 to entry: Adhesive bonding is just one joining method. Others are welding, screwing and riveting.

3.26

load

different types of external influences, which can act on an adhesively bonded joint, e.g. heat, moisture, mechanical force, and chemical effects (water, solvents, etc.)

3.27

mechanical properties

properties related to the behaviour of an adhesive or adhesively bonded joint when subjected to external physical forces (tensile forces, shear forces, abrasive forces, compressive forces, torsional forces, lap shear forces, etc.)

3.28

pot life

period of time during which a reactive adhesive is applied after mixing (the maximum processing time)

Note 1 to entry: This time depends on the rate of the chemical reactions responsible for the polymer formation (curing rate) and also on the external boundary conditions (temperature, quantity of mixture prepared). In order to create high-quality adhesively bonded joints the pot life is strictly observed. Chemically curing adhesives which have exceeded their pot cannot be applied any longer on the adherend's surface and are disposed.

3.29

qualification of an adhesive

an adhesive is deemed qualified if it meets minimum requirements, specifically defined for a particular application, and whether those requirements have been confirmed by tests (e.g., destructive testing)

3.30

security class

performance requirements of the adhesively bonded joint defined on the basis of the potential of damage effect that the failure of the joint can cause