
**Railway infrastructure — Rail
fastening systems —**

**Part 3:
Proof load test method for pull-out
resistance**

*Infrastructure ferroviaire — Systèmes de fixation du rail —
Partie 3: Méthode d'essai de charge d'épreuve pour la résistance à
l'arrachement*

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 269, *Railway applications*, Subcommittee SC 1, *Infrastructure*.

A list of all parts in the ISO 22074 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Railway infrastructure — Rail fastening systems —

Part 3:

Proof load test method for pull-out resistance

1 Scope

This document specifies a test procedure to confirm that the force necessary to pull the anchorage of a rail fastening assembly out of the sleeper or other supporting element is greater than a prescribed value (i.e. it is a "proof load" test).

This test is for components of the fastening system which are:

- a) cast into concrete during the manufacture of sleepers or other supporting elements;
- b) glued into the cast or drilled holes in concrete; or
- c) screwed or otherwise attached to wood, polymeric composite or steel sleepers or other supporting elements.

This test is not applicable to embedded rails.

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.

ISO 22074-1, *Railway infrastructure — Rail fastening systems — Part 1: Vocabulary*

ISO 7500-1:2018, *Metallic materials — Calibration and verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Calibration and verification of the force-measuring system*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 22074-1 and the following apply.

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

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

3.1

insert

component of a fastening system which is embedded in the sleeper or other supporting element of track

4 Principle

A vertical upward force is applied to the anchored fastening element, directly above the point at which it is cast, glued or screwed into its support. The load is increased until the prescribed "proof load" is

reached. There should be no evidence of any damage which can reduce the strength or durability of the fastening system.

NOTE For general applications, values of proof load are given in the relevant standard for performance requirements of the fastening system.

5 Apparatus

5.1 Actuator, capable of applying an upward force of at least 25 % more than the specified proof load to an insert. A linkage shall be provided between the actuator and the fastening component which ensures that the vertical force is applied directly above the part of the component which is anchored to the sleeper or support without applying unrepresentative flexural or torsional moments to any component.

5.2 Force measuring instruments, which shall conform to ISO 7500-1:2018, class 2 over the required range of force.

6 Test specimens

6.1 Rail support

For sleepers or bearers, the test specimen shall consist of a sleeper or half sleeper (or bearer) with cast-in or glued-in fastening components or holes and rail seats as made without modification for this test.

For applications in ballastless track where sleepers are not used, a representative section of the support (e.g a concrete block) shall be used which has a depth equal to the depth of the proposed supporting element. If that dimension is not known, the block shall have a depth:

- great enough to avoid a bending failure of the concrete during the test; and
- not less than the embedded length of the insert plus 15 mm.

In plan view, the support used in the test may be of any shape but it shall:

- extend at least 150 mm from the centre line of the insert in all directions; or
- replicate the distance from the insert to the edge of the supporting element in track if that is less than 150 mm.

If a concrete block is used, it shall have a cube strength not greater than the cube strength of the concrete specified for application in the track. It shall also not contain steel reinforcing elements close to the fastening unless they are present in the application in the track. If it does contain steel reinforcing, there shall be at least 15 mm of concrete covering the steel.

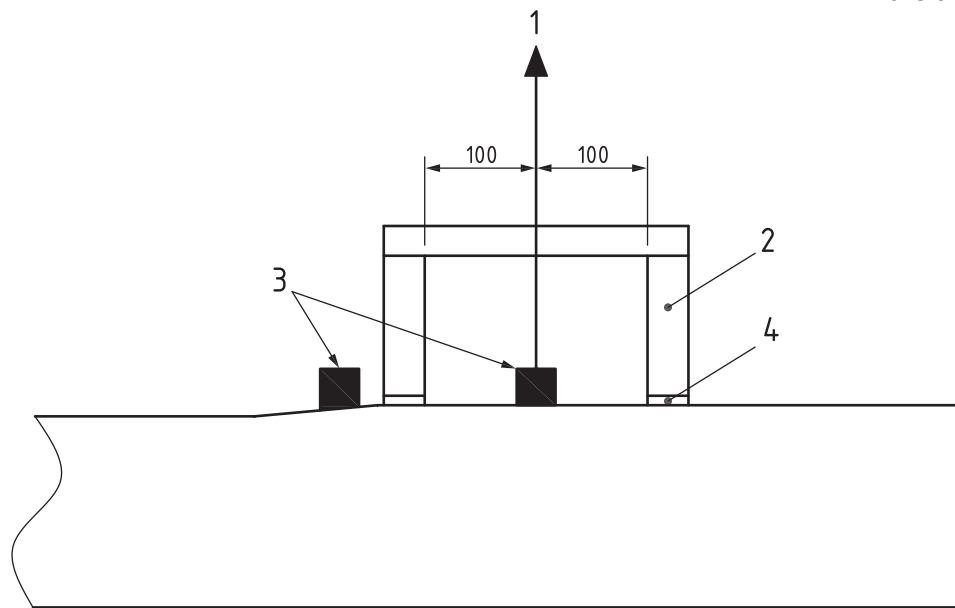
6.2 Fastening components

The test specimen shall consist of an insert as made and without modification for the test.

For inserts intended to receive a screw, the load shall be applied to the insert through a screw from the fastening system, inserted to the design depth. For fastening systems in which the design depth varies according to the amount of height adjustment used, the test shall be carried out in the adjustment condition which gives the smallest embedded length. For cast-in components intended to house a clip, the load shall be applied through the features that retain the clip.

It is not necessary to assemble any other elements of the rail fastening system for this test.

Dimensions in millimetres

**Key**

- 1 load centre line
- 2 support for load
- 3 fastening inserts
- 4 layer of suitable conformable material [e.g. plywood or low-density polyethylene (LDPE)]

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Figure 1 — Test arrangement

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7 Procedure**7.1 Preparation for test**

Ensure that the sleeper, bearer or supporting element is supported in a stable manner on a generally level surface and assemble the loading mechanism on top of it.

7.2 Loading and measurement of force

The loading arrangement is shown in [Figure 1](#). The distance between the line of action of the applied load and the inner edge of the supports shall be (100 ± 5) mm. If the load support coincides with a projecting insert position, the support shall be modified to bear the load symmetrically each side of the insert and retain the (100 ± 5) mm dimension. The load shall be applied to the insert at a constant rate of no more than 100 kN/min until the prescribed proof load is reached. The load shall be maintained for 3 min and then removed. The application and removal of the load shall be done so that shock or impact loads are never applied. In general, the load shall be applied normal to the rail seat. However, if the insert is inclined, the load shall be applied parallel to its longitudinal axis.

NOTE If the geometry of the top surface of the sleeper makes it necessary to place the inner edges of the supports less than 95 mm from the line of action of the load, a valid result can still be obtained if the expected failure mode is a shear failure of the insert or of the interface between the insert and the concrete. However, such a test configuration does not indicate a possible failure of the concrete surrounding the insert.

7.3 Inspection

After the test, the sleeper or supporting element shall be inspected to determine whether there is any evidence of damage to the fastening component, the sleeper or supporting element that can result in a loss of integrity or durability of the system.

8 Test report

The test report shall include at least the following information:

- a) a reference to this document (i.e. ISO 22074-3:2021);
- b) name and address of the laboratory performing the test;
- c) date when test was performed;
- d) description of the test specimens. For attachments to concrete, this description shall include a statement of whether the insert is cast-in or glued-in;
- e) origin of test specimens;
- f) maximum applied load;
- g) result of visual inspection after test.

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- [2] EN 13481-5, *Railway applications — Track — Performance requirements for fastening systems — Part 5: Fastening systems for slab track with rail on the surface or rail embedded in a channel*

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