



JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS E 1125 : 1995

(Reaffirmed : 2002)

Glued insulated rails

ICS 45.080

Descriptors : automatic train control systems, railway rails, railway control systems,
electrical insulating materials, adhesives

Reference number : JIS E 1125 : 1995 (E)

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Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of International Trade and Industry through deliberations at the Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law:

Date of Establishment: 1995-03-01

Date of Reaffirmation: 2002-03-20

Date of Public Notice in Official Gazette: 2002-03-20

Investigated by: Japanese Industrial Standards Committee
Divisional Council on Railways and Rolling
Stock

JIS E 1125:1995, First English edition published in 2004-05

Translated and published by: Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

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Printed in Japan

Glued insulated rails

1 Scope This Japanese Industrial Standard specifies glued insulated rails of 50 kgN and 60 kg rails used in track circuit⁽¹⁾ of railway track.

Note (1) The electric circuit to detect trains or rolling stocks using the rails as a circuit (see **JIS E 3013**).

Remarks : The normative references of this Standard are listed in Attached Table 1.

2 Definitions For the purposes of this Standard, the definitions in **JIS E 1001** and the following definitions apply.

- (1) **glued insulated rails** The rails that the insulating material is inserted between the facing rails and jointed with glued-insulated material between rail and glued joint bar.
- (2) **glued joint bar** The joint bars designed for the purpose to be used for glued insulated rails.
- (3) **dry adhesive** The material whose substrate is glass paper, impregnated with thermosetting epoxy resin adhesives and dried.
- (4) **primer** The preparation material beforehand coated on the surface of adherend to improve adhesive strength between adherend and adhesive or sealing material (see **JIS K 6800**).

3 Classification The classification of glued insulated rails shall be as shown in Table 1 with mark ○ according to the combination of the classification of rails and curve radius.

Table 1 Classification

Classification and symbol of rails		Curve radius R (m)						Straight
		300	600	1 000	3 000	4 000	5 000	
50 kgN or 60 kg	Ordinary rails	○	○	○	○	○	○	○
	HH340	○	○	○	—	—	—	—
	HH370	○	○	○	—	—	—	—

4 Quality

4.1 Tensile strength or compressive strength The tensile strength or the compressive strength of glued insulated rails shall be 2.25 MN or over for all test specimens tested in accordance with the method of 8.1.

4.2 Insulation resistance The insulation resistance of glued insulated rails shall be as follows.

- (1) The insurance resistance in dry condition shall be tested by the method of **8.2.1**, and the result shall be 5 MΩ or over.
- (2) The insulation resistance in wet condition shall be tested by the method of **8.2.2**, and the result shall be 0.5 MΩ or over.

4.3 Ultrasonic transmission attenuation The ultrasonic transmission attenuation of glued insulated rails shall be tested by the method of **8.3**, and the result shall be 45 dB or under.

4.4 Appearance The appearance of glued insulated rails shall be as follows.

- (1) There shall be no detrimental defects such as cracks, scars on the surface of rails.

Furthermore, there shall be no detrimental twist for the whole length of rails.

- (2) There shall be no gap of laminated part (dry adhesive) nor char by heating.

5 Shapes, dimensions, permissible dimension deviations and geometrical tolerances

5.1 Shapes and dimensions The shapes and dimensions of glued insulated rails shall be as shown in Table 2.

Table 2 Shapes and dimensions

Classification of rails	Attached Figure number	
	Glued insulated rails	Parts
50 kgN	1	1.1 to 1.5
60 kg	2	1.5, 2.1 to 2.4

Remarks : The offset⁽²⁾ of glued insulated rails for curve shall be in accordance with Attached Fig. 3.

Note ⁽²⁾ The value explaining the shapes and dimensions of curve or polygonal line and defining as a perpendicular distance from one straight line (see **JIS E 1311**).

5.2 Permissible dimension deviations and geometrical tolerances The permissible dimension deviations and geometrical tolerances of glued insulated rails shall be as shown in Table 3.

Table 3 Permissible dimension deviations and geometrical tolerances

Unit: mm

Item		Permissible dimension deviations and geometrical tolerances
Length		± 10
Irregularity of longitudinal level at top surface of rail (for 1 m centring the glued part)		± 0.1
Irregularity of longitudinal level at side surface of rail (for 1 m centring the glued part)		± 0.3
Gap at the top and the side surface of rail at the glued part		± 0.1
Distance between rail and glued joint bar at the end point of glued joint bar		± 0.3
Offset for curve	For 5 mm and over	+1.0, -0.5
	For under 5 mm	$\pm 10 \%$

6 Material

6.1 Rails The materials used for glued insulated rails shall comply with **JIS E 1101** and **JIS E 1120**.

6.2 Glued joint bar The materials for glued joint bar shall be equal or better than S45C to S55C of **JIS G 4051** in mechanical properties.

6.3 Bolts and nuts for joint bar The materials for bolts and nuts for joint bar shall at least comply with the bolts and nuts for joint bar for 60 kg rails specified in **JIS E 1114** in mechanical properties. The length of bolts shall be 120 mm.

6.4 Plain washer The plain washer shall be F35 of **JIS B 1186**.

6.5 Insulating material

6.5.1 Insulation plates⁽³⁾ and tubes⁽⁴⁾ The shapes and dimensions of insulation plates shall be in accordance with Attached Fig. 1.3 and Attached Fig. 2.3, and the shapes and dimensions of tubes shall be in accordance with Attached Fig. 1.5, and when tested by the method of **JIS E 3023**, the characteristics shall comply with Table 4. However, the thickness, t , of insulation plate shall be subjected to the agreement between the purchaser and the supplier.

Notes ⁽³⁾ The insulating material in a rail section shape to insulate the interval of rails by insertion into the opening of front and behind of rail joint (see **JIS E 3023**).

⁽⁴⁾ The tubular insulating material to insulate the bolt, rail and joint bar by fitting on the bolt of the joint bar (see **JIS E 3023**).

Table 4 Characteristics of insulation plate and tube

Item	Condition and treatment	Unit	Characteristics	
			Insulation plate	Tube
Absorption capacity	After 24 hours' immersion	%	1.0 max.	1.0 max.
Volume resistivity	After absorption capacity test	MΩ · m	2 000 min.	1 500 min.
Tensile strength	At normal temperature, normal humidity	MPa	240 min.	50 min.
	After 2 hours' heating at 60 °C			
	After 2 hours' cooling at -30 °C			
Elongation	At normal temperature, normal humidity	%	—	40 min.
	After 2 hours' heating at 60 °C			
	After 2 hours' cooling at -30 °C			
Compressive strength	At normal temperature, normal humidity	MPa	340 min.	340 min.
	After 2 hours' heating at 60 °C			
	After 2 hours' cooling at -30 °C			
Compressive strain (under 340 MPa stress)	At normal temperature, normal humidity	%	—	40 to 60
	After 2 hours' heating at 60 °C			
	After 2 hours' cooling at -30 °C			
Impact strength	At normal temperature, normal humidity	J/cm	6.0 min.	—
	After 2 hours' cooling at -30 °C			
Hardness	At normal temperature, normal humidity	HBS	40 min.	—
		HRM	—	60 to 80
Abrasion resistance	At normal temperature, normal humidity	cm ³	1.0 max.	1.0 max.
High and low temperature resistance	After 2 hours' heating at 60 °C		There shall be no noticeable change (such as split, cracks, swell, and so on) on the appearance.	There shall be no noticeable change (such as split, cracks, swell, and so on) on the appearance.
	After 2 hours' cooling at -30 °C			

- Remarks 1 The test specimen of insulation plate shall be preconditioned for one hour's heating at 200 °C in thermostatic air.
- 2 The normal temperature and normal humidity condition shall be in accordance with **JIS Z 8703**.

6.5.2 Dry adhesive and primer The dry adhesive and primer shall be as follows.

- (1) The shapes and dimensions of dry adhesive shall be in accordance with Attached Fig. 1.4 and Attached Fig. 2.4, and the tensile shear adhesive strength shall at least comply with the value listed in Table 5, when tested by the test method of **JIS K 6850**. However, the shape and dimensions of test specimen shall be as Attached Fig. 5.

Table 5 Tensile shear adhesive strength of adhesives

Unit: MPa

Condition and treatment	Average value	Minimum value
At normal temperature	25	24
After heating to higher than 60 °C	20	19
After cooling to lower than -8 °C	25	24

- (2) The primer shall be epoxidation phenol resin system, and the general characteristics shall comply with Table 6.

Table 6 General characteristics of primer

Item	Unit	Characteristics
Non-volatile material	%	50 ± 2
Viscosity (25 °C)	cm ² /s	0.50 to 1.40
Density (20 °C)	g/cm ³	0.94 to 0.99
Appearance		Yellow and transparent
Solvent		Butanol, isobutanol and xylene

Remarks 1 The usable period of dry adhesive is 120 days after manufacture, when stored under the condition of air-tight, free from the direct rays of the sun, and at a temperature of 0 °C to 5 °C.

2 The usable period of primer is 180 days after manufacture, when stored under the condition, free from the direct rays of the sun, and at a temperature of 30 °C or under.

6.6 Finishing paint The finishing paint shall be urethane paint.

7 Method of production and processing

7.1 Method of material processing

7.1.1 Processing of rails The processing of rails shall be as follows.

Furthermore, the rails shall be cut at the centre perpendicular to the longitudinal direction into two parts, and they shall be used as one pair of rails.

- (1) **Cutting** The cutting of rails shall be performed by machining.
- (2) **Bending** The bending or correcting of bend of rails shall be performed by a method which does not degrade the quality of the rail.
- (3) **Perforating** The perforating of rails shall be performed by machining, and the whole circumference shall be chamfered.
- (4) **Permissible dimension deviations** The permissible dimension deviations of processed rails shall be in accordance with Table 7.
- (5) **Cleanliness of surface** Rust of the joining part of rails shall be removed by sand blast, shot blast, or shot peening, and oil and fat on it shall be removed by solvent if necessary.

Table 7 Permissible dimension deviation of processed rails

Unit: mm

Item		Permissible dimension deviations
Difference of right angle cutting	Jointed part	± 0.3
	The others	± 1.0
Diameter of hole		± 0.5 0.0
Location of hole		± 0.5

7.1.2 Processing of glued joint bars The processing of glued joint bars shall be as follows.

- (1) **Shapes, dimensions and permissible dimension deviations** The shapes and dimensions of glued joint bars shall comply with Attached Fig. 1.2 and Attached Fig. 2.2, and shall be processed by forging, hot extrusion or machining. The permissible dimension deviations shall comply with Table 8.
- (2) **Heat treatment** The glued joint bars shall be heat treated by quenching and tempering, and the surface hardness shall be 255 to 331HBS by **JIS Z 2243**.
- (3) **Cleanliness of surface** The joining part of glued joint bars shall comply with 7.1.1 (5).