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# MALAYSIA RAILWAY INDUSTRY STANDARD

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**MRIS xx:2022**

ICS: 45.080

## **Railway track - Fasteners and clips**

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## **MALAYSIA RAILWAY INDUSTRY STANDARD**

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**Foreword**

This standard was developed by the Working Group on Fasteners and Clips, established by SIRIM Berhad.

This standard was developed with the following objectives:

- a) to provide guidance on the performance requirements of fastening system;
- b) to be used as guidance for procurement requirements of fastening system; and
- c) to ensure the quality and safety of fastening system.

This standard will be reviewed periodically, and if necessary, revised, to ensure that it reflects current needs and conditions. Users and other interested parties may submit comments on the contents of this standard for consideration in future versions.

Compliance with this standard does not by itself grant immunity from legal obligations.

## Railway track - Fasteners and clips

### 1. Scope

This standard specifies the performance requirements and test methods for fastening systems. This standard also specifies information required for the procurement of fastening system.

### 2. Normative references

The following standards, in whole or in part, are normatively referenced in this standard and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 17668, *Zinc diffusion coatings on ferrous products - Sherardizing - Specification*

BS EN 10089, *Hot-rolled steels for quenched and tempered springs - Technical delivery conditions*

BS EN 13146 series, *Railway applications - Track - Test methods for fastening system*

BS EN 13481 series, *Railway applications - Track - Performance requirements for fastening system*

BS EN 13674-1, *Railway applications. Track. Rail Vignole railway rails 46 kg/m and above*

BS EN 13674-4, *Railway applications. Track. Rail Vignole railway rails from 27 kg/m to, but excluding 46 kg/m*

BS EN 15461, *Railway applications. Noise emission. Characterization of the dynamic properties of track selections for pass by noise measurements*

### 3. Terms and definitions

For the purposes of this standard, the terms and definitions given in BS EN 13481-1 and the following apply.

#### 3.1 categories of fastening system

Typical types of fastening system related to speed and axle load of trains on tracks, for which they are designed, and the rail section used.

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### **3.1.1 category A fastening system**

Fastening system designed for urban light rail and some industrial tracks, with a typical axle load of 100 kN, a typical curve radius of 80 m, a typical maximum speed of 100 km/h, a typical rail section of 40E1 and a typical sleeper or support spacing of 800 mm.

NOTE. Rail sections are specified in the EN 13674 series.

### **3.1.2 category B fastening system**

Fastening system designed for urban light rail and some industrial tracks, with a typical axle load of 160 kN, a typical curve radius of 100 m, a typical maximum speed of 140 km/h, a typical rail section of 54E1 and a typical sleeper or support spacing of 600 mm.

NOTE. Rail sections are specified in the EN 13674 series.

### **3.1.3 category C fastening system**

Fastening system designed for conventional main line railways, with a typical axle load of 225 kN, a typical curve radius of 400 m, a typical maximum speed of 250 km/h, a typical rail section of 60E1 and a typical sleeper or support spacing of 600 mm.

NOTE. Rail sections are specified in the EN 13674 series.

### **3.1.4 category D fastening system**

Fastening system designed for lines with large radius curves, often used for high-speed trains and having a typical axle load of 180 kN, a typical curve radius of 800 m, a typical rail section of 60E1, a typical sleeper or support spacing of 600 mm and any typical maximum speed.

NOTE. Rail sections are specified in the EN 13674 series.

### **3.1.5 category E fastening system**

Fastening system designed for mixed traffic line carrying heavy freight trains, with a typical axle load of 300 kN, a typical curve radius of 150 m, a typical maximum speed of 200 km/h, a typical rail section of 60E1 and a typical sleeper or support spacing of 600 mm.

NOTE. Rail sections are specified in the EN 13674 series.

## **3.2 fastening system**

Assembly of components which secures a rail to the supporting structure and retains it in the required position whilst permitting any necessary vertical, lateral and longitudinal movement.

NOTE. Such an assembly includes components to distribute the loads from the rail into the supporting structure, and where necessary to prevent wear of the contact surfaces on the supporting structure and to electrically insulate the rail from the supporting structure.

### 3.3 rail fastening

Devices used to secure the running rails to chairs, base plates or directly to sleepers, bearers or other rail support systems.

### 3.4 self-tensioning fastening

Fastening system that creates the required tension through insertion without the need for any post-tension through tightening of screws, bolts or nuts etc.

## 4. General requirements

4.1 The fastening system used for railway track may be any of the following types:

a) Direct fastening system

Assembly in which a rail is directly secured to the supporting structure with or without a baseplate.

b) Indirect fastening system

Assembly in which a rail is secured to a baseplate independently of the fastening of the baseplate to the supporting structure.

c) Rigid fastening system

Assembly which is designed to clamp the rail tightly to the sleeper and does not incorporate a resilient component apart from any rail pad.

NOTE. A fully compressed spring washer is not a resilient component.

d) Web support fastening system

Assembly in which the principal means of securing the rail to its support is by action on the web of the rail and under the head of the rail.

e) Noise and vibration attenuation fastening

Two level elasticity of the fastenings and elastomeric layer to reduce the structural borne noise and vibration and provides a smoother train ride.

f) Embedded fastening system

Embedded fastening system should be performed on lateral stability and will certainly have a service life of minimum requirement set by Client. When used with vignole rail the flange way is maintained alongside the gauge face of the rail and the rail is secured by adhesion of the surrounding material or by mechanical fastenings.

4.2 The category of fastening system shall be in accordance with BS EN 13481-1 as specified in Table 1.

**Table 1. Category of fastening system**

Track Category	Typical axle load (kN)	Maximum axle load (kN)	Typical curve radius (m)	Minimum curve radius (m)	Typical maximum speed (km/h)
A	100	130	80	40	100
B	160	180	100	80	140
C	225	260	400	150	250
D	180	260	800	400	any typical maximum speed
E	300	350	200	150	200

4.3 The following information shall be determined and provided for the procurement of fastening system:

- a) category of fastening system (see 4.2);
- b) support system (e.g., concrete, steel, composite sleepers, slab track, etc.);
- c) toe load and deflection of the clip;
- d) surface hardness of the clip;
- e) electrical resistance;
- f) vibration attenuation requirement;
- g) anti-creep requirement;
- h) clips and cast in components surface protection against corrosion; and
- i) rail pad raw material - natural rubber, synthetic rubber, or plastics materials such as High-density polyethylene (HDPE) or Ethylene vinyl acetate (EVA).

4.4 The manufacturer/supplier shall provide all documentation necessary to gain approval for the proposed fastening system, including independent verification if required.

**4.5** During operation, the fastening system shall provide and maintain high and constant degree of gauge and rail inclination accuracy within stipulated tolerances.

**4.6** The fastening system shall provide longitudinal stability to resist rail creep, thermal, braking and acceleration forces.

**4.7** The fastening system shall be robust and comply with the performance requirements.

**4.8** The fastening system should be theft deterrent and vandal resistance.

**4.9** The rail fastening system may consist of the following:

- a) a self-tensioning, maintenance free type of spring steel clip system that can hold the rail upright to the correct inclination, fix the rail longitudinally by exerting and providing controlled toe load on the foot of the rail via the rail insulator; or
- b) a non-self-tensioning rail fastening system which creates a toe load directly on the foot of the rail through a tension clamp by the tightening of a coach-bolt within the cast-in socket.

**4.10** Fasteners shall be installed, loosened, or withdrawn from the sleepers only with the use of proper tools designated for the type of fastening. Only approved specific tools or supplied/recommended by the manufacturer of the fastening shall be used.

**4.11** Sherardization of fastenings against corrosion and wear, where necessary, shall be in accordance with EN ISO 17688 or other approved or equivalent standards for corrosion resistance coating (e.g., epoxy powder coating).

## **5. Requirements for clips**

**5.1** Clips shall be manufactured from alloy spring steel in accordance with BS EN 10089.

**5.2** Clips shall be corrosion protected by sherardization accordance with EN ISO 17688 or other approved or equivalent standards for corrosion resistance coating (e.g., epoxy powder coating).

## 6. Performance requirements and test methods for fastening systems

6.1 BS EN 13481 Parts 1, 2, 3, 4, 5, 7 and 8 shall be used to assess the performance and suitability of fastening systems for use in railway track, as in Table 2:

**Table 2. Performance requirements and test methods for fastening systems**

Performance Requirements	Fastening systems for concrete sleepers (BS EN 13481-2)	Fastening systems for wood sleepers (BS EN 13481-3)	Fastening systems for steel sleepers (BS EN 13481-4)	Fastening systems for slab track with rail on the surface or rail embedded in a channel (BS EN 13481-5)	Special fastening systems for switches and crossings and check rails (BS EN 13481-7)	Fastening systems for track with heavy axle loads (BS EN 13481-8)	Test Methods
Longitudinal rail restraint	✓	✓	✓	✓	✓	✓	BS EN 13146-1
Torsional resistance	✓	✓	✓	NA	✓	✓	BS EN 13146-2
Attenuation of impact loads	✓	NA	NA	NA	✓	✓	BS EN 13146-3
Pad and assembly stiffness	✓	✓	✓	✓	✓	NA	BS EN 13146-8 BS EN 13146-9
Effect of repeated loading	✓	✓	✓	✓	✓	✓	BS EN 13146-4

Table 2. Performance requirements and test methods for fastening systems (continued)

Performance Requirements	Fastening systems for concrete sleepers (BS EN 13481-2)	Fastening systems for wood sleepers (BS EN 13481-3)	Fastening systems for steel sleepers (BS EN 13481-4)	Fastening systems for slab track with rail on the surface or rail embedded in a channel (BS EN 13481-5)	Special fastening systems for switches and crossings and check rails (BS EN 13481-7)	Fastening systems for track with heavy axle loads (BS EN 13481-8)	Test Methods
Electrical resistance	✓	NA	✓	✓	✓	✓	BS EN 13146-5
Effect of exposure to severe environmental conditions	✓	✓	✓	✓	✓	✓	BS EN 13146-6
Dimensions	✓	✓	✓	NA	NA	✓	Refer respective BS EN 13481 standards
Effect of fastening system tolerances on track gauge	✓	✓	✓	✓	✓	✓	As per manufacturer's calculation based on design dimension of rail as in BS EN 13674-1 or BS EN 13674-4

**Table 2. Performance requirements and test methods for fastening systems (concluded)**

Performance requirements	Fastening systems for concrete sleepers (BS EN 13481-2)	Fastening systems for wood sleepers (BS EN 13481-3)	Fastening systems for steel sleepers (BS EN 13481-4)	Fastening systems for slab track with rail on the surface or rail embedded in a channel (BS EN 13481-5)	Special fastening systems for switches and crossings and check rails (BS EN 13481-7)	Fastening systems for track with heavy axle loads (BS EN 13481-8)	Test Methods
Clamping force	✓	✓	✓	NA	✓	✓	BS EN 13146-7
Cast-in and glued-in fastening components	✓	NA	NA	✓	✓	✓	BS EN 13146-10
In-service testing	✓	✓	✓	✓	✓	✓	BS EN 13146-8
Attenuation of noise and vibration	✓	✓	✓	✓	✓	NA	BS EN 13146-9 BS EN 15461
✓ Detail requirements are specified in the respective BS EN 13481 standards							

## 7. Marking

Where there is adequate space for legible marking and performance is not affected, each component shall be permanently marked with the following information:

- a) the manufacturer;
- b) the year of manufacture; and
- c) identification marking.

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### Bibliography

- [1] ISO 22074 series, *Railway infrastructure - Rail fastening systems*
- [2] BS EN 13230-1, *Railway applications. Track. Concrete sleepers and bearers. General requirements*
- [3] AS 1085.14, *Railway track material, Part 14: Prestressed concrete sleepers*

## Acknowledgements

SIRIM Berhad would like to thank the members of the Working Group on Fasteners and Clips who have contributed their ideas, time and expertise in the development of this standard.

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