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European Standard Freight Axle

ESFA25



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Foreword

An International Railway Solution (IRS) is a document drawn up by consensus and applied on a voluntary basis which aims to facilitate and harmonise railway operation.

IRSs are gradually replacing UIC leaflets.

Members of the International Union of Railways (UIC) participate in the creation of IRSs, of which they benefit in full. Furthermore, marketing to railway stakeholders contributes to the sharing and harmonisation of good practices, in accordance with UIC's primary goal.

While IRSs do not have the force of law, they are created and published in a professional manner and with technical approval on the basis of UIC procedures, and have full technical legitimacy in the railway sector.

The "General application" section constitutes the heart of the IRS and contains the working group's expertise applicable in the broadest manner. The addition of a "Specific application" aims to cover factors specific to a region, a type of service, etc.

Some provisions shall be implemented in all cases to ensure correct application and maintain the system's cohesiveness. Certain operational circumstances require that specific provisions be systematically applied by all users of the document.

For the purposes of understanding, the user acknowledges that the expression of:

- obligation indicates requirements to be respected in order to comply with the expertise expressed in the document (usually "shall");
- recommendation indicates options that are favourable but not essential (usually "should");
- permission indicates options that are recognised but without consequence (usually "may");
- capacity indicates possibilities from a technical standpoint and not permissions or probabilities (usually "can").

Obligation, recommendation and capacity can be expressed in the negative to indicate prohibiting, non-recommendation and incapacity.

If applicable, notably for the purposes of compliance with a UIC approval, passages that are recommended or mandatory for the cohesiveness of the system will be accompanied by the letters "R" and "MCS" respectively.

This IRS reflects the following UIC working group expertise:

Rolling Stock SET 06 "Running Gears"

It integrates in full or in part the following UIC leaflets:

...

It complements the following standards:

...

The following IRSs constitute a complementary series:

...

Executive summary

Two harmonized axle designs are used for most European freight traffic; UIC types A and B. In recent years, various measures have been taken to improve wheelset maintenance, in response to service experience. Taking these measures into account in developing a new harmonized wagon axle promotes harmonization and effective maintenance at a sustainable cost. Furthermore, an axle suitable for 25 tonne axle loads is of benefit for the development of rail freight.

The International Union of Railways (UIC) has therefore drawn up requirements for a new, international, harmonized and low-maintenance 25 tonne axle load axle with additional reinforcements to take operational aspects into account. Obviously, under current design rules, these new axles have a larger diameter.

All work on designing the specifications for this axle has taken account of the following:

- current rules (TSI regulations, CEN and UIC standards);
- the results of recent research projects (UIC and EURAXLES projects, etc.);
- the requirements of various European operators and associations (at national level these included VPI, DB, SNCF, SNCB, ÖBB, FS, etc. and at international level UIP, UIC, CER, JSG, etc.).

The result of this UIC project, summarized in this IRS, is a fully TSI compliant axle with improved safety margins and lower maintenance requirements. The deliverables included are a complete drawing, axle calculations, product and maintenance requirements and a TSI certificate.

Field of application

This IRS contains the specifications for a European standard axle, designated ESFA, for freight applications involving axle loads of up to 25 tonnes.

It contains the complete calculations, the drawing, the product requirements, the maintenance requirements and the TSI certificate for the ESFA.

Reference documents

The following documents are cited in this IRS or strongly support its requirements and recommendations:

1. International Railway Solution (IRS)

International Union of Railways (UIC)

- [1] *EN 13103-1: Railway applications - Wheelsets and bogies - Part 1: Design method for axles with external journals*, December 2017
- [2] *EN 13261: Railway applications - Wheelsets and bogies - Axles - Product requirements*, January 2011
- [3] *EN 15313: Railway applications - In-service wheelset operation requirements - In-service and off-vehicle wheelset maintenance*, 2010
- [4] *EN 50126-1: Railway applications - The specification and demonstration of Reliability, Availability, Maintainability and Safety (RAMS) - Part 1: Basic requirements and generic process*, 2000

2. Technical reports

International Union of Railways (UIC)

- [5] *B 169/RP 29: Reliability and safety of axles, wheels and axle bearings - Reliability, availability, maintainability, safety - Implementation of EN 50126 - for mechanical components in railways*, Paris, May 2015
- [6] *B 169/RP 45: European standard freight axle (ESFA25) - Development of a harmonized European freight axle*

3. Miscellaneous

Official Journal of the European Union (OJ)

- [7] *WAG TSI: Commission Regulation (EU) No. 321/2013 of 13 March 2013 concerning the technical specification for interoperability relating to the subsystem "rolling stock - freight wagons" of the rail system in the European Union and repealing Decision 2006/861/EC*

Abbreviations and Symbols

ECM	Entity in Charge of Maintenance
EVIC	European Visual Inspection Catalogue Note 1: EVIC activities are performed during light and medium maintenance of the wheelset
GCU	General Contract of Use for wagons Note 2: www.gcubureau.org .
IRS	International Railway Solution (EN)
NDT	Non-destructive testing
UIC	International Union of Railways

Concepts, terms and definitions

The subject of the glossary below is: vocabulary to describe IRSs

1. **ECM**

Entity in Charge of Maintenance (ECM) means an entity in charge of the maintenance of a vehicle, and registered as such in a vehicle register referred to in Article 47 of Directive (EU) 2016/797

European Standard Freight Axle

General Application

1 – Introduction

This IRS provides the complete specification for an axle design suitable for freight applications at axle loads of up to 25 tonnes.

1.1 – Context

In response to strong demand from the railway sector – freight in particular – the UIC has designed a new European Standard Freight Axle (ESFA). The design of this axle complies with the basic technical requirements of the sector.

1.2 – Objectives

The UIC has taken a further step in axle development, with the objective of reducing the life-cycle cost of the component. This was achieved primarily by reducing the maintenance requirements for such an axle. The biggest task of the project was to demonstrate that it was possible to combine a higher design safety margin and reduced maintenance activities, while satisfying general safety requirements. This was verified by an extensive FMECA analysis.

The ESFA axle offers four options with one geometry, a standard, patent-free and TSI-compliant design, a complete safety analysis compliant with CSM requirements, substantial maintenance reserve for use and repair and enhanced inspection capabilities.

1.3 – Prior knowledge

See report B 169/RP 45 [6] (see Reference documents - page 5).

2 – ESFA specification

2.1 – Axle drawing

Appendix A contains the drawing of the ESFA, which includes a margin on the shaft and the seats for maintenance. The calculation thereof complies with EN 13103-1 design requirements.

2.2 – Axle calculation

Appendix B contains the complete axle calculation at an axle load of 25 tonnes.

2.3 – Axle product requirements

The ESFA axle shall comply with the requirements set out in EN 13261.

2.4 – Axle maintenance requirements

2.4.1 – General axle maintenance requirements

The maintenance plan for freight wagon axles was subjected to detailed analyses after the Viareggio accident. The GCU (General Contract of Use) divides wagon maintenance into light wagon maintenance and heavy wagon maintenance, the latter corresponding to revision or major overhaul of the wagon. The axle must be inspected by a visual check in accordance with the European Visual Inspection Catalogue (EVIC), which is now integrated into EN 15313. Wheelsets with damaged axles must be repaired or sent for wheelset maintenance.

The maintenance of wheelsets is divided into three maintenance levels. The general principle of axle maintenance and the NDT (non destructive testing) required are now integrated into EN 15 313 and are defined as follows:

- Light wheelset maintenance or reprofiling only: This maintenance level corresponds to reprofiling of wheels and depends mainly on the wear of the wheel or the damage on the tread. During reprofiling, only the EVIC inspection is performed.
- Medium wheelset maintenance, corresponding to overhaul of wheelset (revision of bearing and if necessary reprofiling of wheels): This maintenance level is defined by the maintenance interval of the bearing. This corresponds to a mileage limit of between 600 000 and 800 000 km and a timeframe of up to 19 years. During medium wheelset maintenance, the EVIC inspection and the non-destructive test (UT or MT/UT) of the whole axle is required.
- Heavy wheelset maintenance, corresponding to the replacement of the wheels: This maintenance level is in principle defined by the wear limit of the wheel. During heavy wheelset maintenance, the whole axle, including the wheel seats, has to be checked by magnetic particle inspections (MT).

These maintenance intervals have been applied successfully for many years in throughout Europe and are the basis for safe service.