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OPINION

OPI 2019-1

OF THE EUROPEAN UNION AGENCY FOR RAILWAYS

for

THE EUROPEAN COMMISSION

regarding

WAG TSI 321-2013 potential deficiency - innovative bogies

Disclaimer:

The present document is a non-legally binding opinion of the European Union Agency for Railways. It does not represent the view of other EU institutions and bodies, and is without prejudice to the decision-making processes foreseen by the applicable EU legislation. Furthermore, a binding interpretation of EU law is the sole competence of the Court of Justice of the European Union.

1. General Context

In its letter dated 26 April 2019 and referenced Ares(2019)2820900 - 26/04/2019, the Commission has requested the Agency to issue an opinion concerning a request from PROSE Ltd ('PROSE') for the application of an innovative solution in order to apply Regulation (EU) No 321/2013¹ ('TSI WAG') for bogies of freight wagons with innovative bearing concepts, including inboard bearings.

Although the request from PROSE of 13 March 2019 concerns an innovative solution, the Commission and the Agency consider that this request should be better dealt with as a Technical Opinion which constitute acceptable means of compliance concerning the lack of applicability of the TSI WAG to bogies fitted with wheelset designs not covered by the EN Standards referred to in this TSI. The complete analysis justifying this is provided in chapter 3.

This present opinion clarifies the applicability of the TSI WAG on bogies with wheelsets not covered by this TSI, including wheelsets fitted with inboard bearings.

2. Legal Background

According to the provisions of Article 19(1)(d) of Regulation (EU) 2016/796 of the European Parliament and of the Council of 11 May 2016 on the European Union Agency for Railways and repealing Regulation (EC) No 881/2004² (Agency Regulation), the Agency has the possibility to issue opinions which constitute acceptable means of compliance concerning deficiencies in TSIs, in accordance with Article 6(4) of Directive (EU) 2016/797, and provide those opinions to the Commission.

¹ 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 (OJ L 104, 12.4.2013, p. 1) subsequently amended by Regulation (EU) No 1236/2013, Regulation (EU) 2015/924 and Implementing Regulation (EU) 2019/776.

² OJ L 138, 26.5.2016, p. 1.

3. Analysis

3.1. Current relevant requirements in TSI WAG

3.1.1. The TSI WAG text

The requirements of the TSI on wheelsets, wheels, axles and axleboxes are set out in points:

- 4.2.3.6.2 to 4.2.3.6.5,
- 6.1.2.2 to 6.1.2.4, and
- 6.2.2.4

The relevant part of these clauses are reproduced below in italics.

4.2.3.6.2. Characteristics of wheelsets

The wheelset assembly shall be able to transmit forces and torque between the fitted parts in accordance with the area of use.

[...]

The demonstration of conformity is described in point 6.1.2.2.

4.2.3.6.3. Characteristics of wheels

[...]

The mechanical characteristics of the wheels shall ensure the transmission of forces and torque as well as the resistance against thermal load where so required in accordance with the area of use.

The demonstration of conformity is described in point 6.1.2.3.

4.2.3.6.4. Characteristics of axles

The characteristics of the axle shall ensure the transmission of forces and torque in accordance with the area of use.

The demonstration of conformity is described in point 6.1.2.4.

[...]

4.2.3.6.5. Axle boxes/bearings

The axle box and the rolling bearing shall be designed with consideration of mechanical resistance and fatigue characteristics. Temperature limits reached in service relevant for the hot box detection shall be defined.

The demonstration of conformity is described in point 6.2.2.4.'

'6.1.2.2. Wheelset

The demonstration of conformity for the mechanical behaviour of the wheelset assembly shall be carried out according to clause 3.2.1 of EN 13260:2009+A1:2010, which defines limit values for the axial assembly force and the associated verification test.

A verification procedure shall exist to ensure at the assembly phase that no defects may detrimentally affect safety due to any change in the mechanical characteristics of the fitted parts of the axle. This procedure shall contain the determination of the interference values and, in case of press-fitted wheelsets, the corresponding press-fitting diagram.

6.1.2.3. Wheel

(a) Forged and rolled wheels: The mechanical characteristics shall be proven following the procedure as specified in clause 7 of EN 13979-1:2003+A1:2009+A2:2011.

If the wheel is intended to be used with brake blocks acting on the wheel running surface, the wheel shall be thermo mechanically proven by taking into account the maximum braking energy foreseen. A type test, as described in clause 6.2 of EN 13979-1:2003+A1:2009+A2:2011 shall be performed in order to check that the lateral displacement of the rim during braking and the residual stress are within the specified tolerance limits.

The decision criteria of residual stresses for forged and rolled wheels are set out in EN 13979-1:2003+A1:2009+A2:2011.

[...]

6.1.2.4. Axle

In addition to the requirement for the assembly above, the demonstration of conformity of the mechanical resistance and fatigue characteristics of the axle shall be based on Clauses 4, 5 and 6 of EN13103:2009 + A2:2012.

The decision criteria for the permissible stress are specified in Clause 7 of EN 13103:2009 + A2:2012. A verification procedure shall exist to ensure at the production phase that no defects may adversely affect safety due to any change in the mechanical characteristics of the axles. The tensile strength of the material in the axle, the resistance to impact, the surface integrity, the material characteristics and the material cleanliness shall be verified. The verification procedure shall specify the batch sampling used for each characteristic to be verified.'

'6.2.2.4. Axle box/bearings

The demonstration of conformity for mechanical resistance and fatigue characteristics of the rolling bearing shall be in accordance with clause 6 of EN 12082:2007+A1:2010.

It is permitted to use other standards for the above demonstration of conformity where the EN standards do not cover the proposed technical solution; in that case the notified body shall verify that the alternative standards form part of a technically consistent set of standards applicable to the design, construction and testing of the bearings.

Only standards that are publicly available can be referred to in the demonstration required above.

In the case of bearings manufactured according to a design developed and already used to place products on the market before the entry into force of relevant TSIs applicable to those products, the applicant is allowed to deviate from the demonstration of conformity above and refer to design review and type examination performed for previous applications under comparable conditions instead; this demonstration shall be documented and is considered as providing the same level of proof as type examination according to module SB or design examination according to module SH1.'

3.1.2. Standards referred to in the TSI WAG text

The scope of the standard EN 13103:2009+A2:2012 as defined in its clause 1, point 2, states:

'This standard

[...]

2. gives the stress calculation method for axles with outside axle journals.'

This is consistent with the calculation method set out in clauses 4, 5 and 6 of the standard EN 13103:2009+A2:2012 which are referred to in the section 6.1.2.4. of the TSI WAG, specially in clause 5, which defines the forces and moments to be taken into consideration and which are tailored for axles with outside axle journals only.

EN 13260:2009+A1:2010 establishes as a precondition that axles have to be manufactured in accordance with EN 13261³, which applies to forged and rolled axles of EA1N steel grade, and that wheels have to be designed and built in accordance with EN 13261, which also fixes the steel grade and establishes as an additional precondition the fulfilment of the complete EN 13979-1:2003+A1:2009+A2:2011 for the wheel design, which requires that the wheel must be monobloc, and compliant with the product requirements of EN 13262⁴ (allowed steel grades, etc.)

Therefore, the possible technical solutions are limited by the standards which the TSI refers to:

- › EN 13103:2009+A2:2012 restricts the TSI WAG to axles with outside axle journals
- › EN 13260:2009+A1:2010 restricts the TSI WAG to forged and rolled axles made of EA1N steel grade and wheels fulfilling completely EN 13979-1:2003+A1:2009+A2:2011, which requires monobloc wheels compliant with the product requirements set out in EN 13262.

3.2. LOC&PAS TSI Requirements

Regulation (EU) No 1302/2014⁵ ('TSI LOC&PAS') also mandates the application of the same EN Standards referred to in the TSI WAG (EN 13103:2009+A2:2012, EN 13260:2009+A1:2010, etc.) but accepts alternative solutions for wheelset designs other than those in the scope of these Standards, as set out in its clauses 4.2.3.5.2.1 and 6.2.3.7, specially in clause 6.2.3.7(7):

³ This EN Standard is referred to in the EN 13260:2009+A1:2010 without specifying the year

⁴ This EN Standard is referred to in the EN 13260:2009+A1:2010 without specifying the year

⁵ Commission Regulation (EU) No 1302/2014 of 18 November 2014 concerning a technical specification for interoperability relating to the 'rolling stock — locomotives and passenger rolling stock' subsystem of the rail system in the European Union (OJ L 356, 12.12.2014, p. 228) amended by Implementing Regulation (EU) 2016/919, Implementing Regulation (EU) 2018/868 and Implementing Regulation (EU) 2019/776.

‘4.2.3.5.2.1. Mechanical and geometric characteristics of wheelsets

Mechanical behaviour of wheelsets

(1) The mechanical characteristics of the wheelsets shall ensure the safe movement of rolling stock.

The mechanical characteristics cover:

- assembly*
- mechanical resistance and fatigue characteristics*

The conformity assessment procedure is described in clause 6.2.3.7 of this TSI.

Mechanical behaviour of axles

(2) The characteristics of the axle shall ensure the transmission of forces and torque.

The conformity assessment procedure is described in clause 6.2.3.7 of this TSI.

Case of units equipped with independently rotating wheels

(3) The characteristics of the end of axle (interface between wheel and running gear) shall ensure the transmission of forces and torque.

The conformity assessment procedure shall be in accordance with point (7) of clause 6.2.3.7 of this TSI.

Mechanical behaviour of the axle boxes

(4) The axle box shall be designed with consideration of mechanical resistance and fatigue characteristics.

The conformity assessment procedure is described in clause 6.2.3.7 of this TSI.

[...]

‘6.2.3.7. Mechanical and geometric characteristics of wheelsets (clause 4.2.3.5.2.1)

Wheelset:

(1) The demonstration of compliance for the assembly shall be based on the clause 3.2.1 of EN 13260:2009+A1:2010+A2:2010, which defines limit values for the axial force, and the associated verification tests.

Axles:

(2) The demonstration of compliance for mechanical resistance and fatigue characteristics of the axle shall be in accordance with the EN 13103:2009+A2:2012, clauses 4, 5 and 6 for non-powered axles [...].

The decision criteria for the permissible stress is specified in the specification referenced in EN 13103:2009+A2:2012, clause 7 for non-powered axles [...].

(3) The assumption of the load conditions for the calculations shall be explicitly stated in the technical documentation as set out in clause 4.2.12 of this TSI.

Verification of the axles:

(4) A verification procedure shall exist to ensure at the production phase that no defects may detrimentally affect safety due to any change in the mechanical characteristics of the axles.

(5) The tensile strength of the material in the axle, the resistance to impact, the surface integrity, the material characteristics and the material cleanliness shall be verified.

The verification procedure shall specify the batch sampling used for each characteristic to be verified.

Axle boxes/bearings:

(6) *The demonstration of compliance for mechanical resistance and fatigue characteristics of the rolling bearing shall be in accordance with the clause 6 of EN 12082:2007+A1:2010.*

(7) *Other conformity assessment method applicable to wheelsets, axles and wheels where the EN standards do not cover the proposed technical solution:*

It is permitted to use other standards where the EN standards do not cover the proposed technical solution; in that case the notified body shall verify that the alternative standards form part of a technically consistent set of standards applicable to the design, construction and testing of the wheelsets, containing specific requirements for wheelset, wheels, axles and axle bearings covering:

- wheelset assembly,*
- mechanical resistance,*
- fatigue characteristics,*
- permissible stress limits,*
- thermomechanical characteristics.*

Only standards that are publicly available can be referred to in the demonstration required above⁶.

[...]'.

3.3. Requirements of both TSIs compared

Both TSIs contain similar requirements for the mechanical characteristics of wheelsets and axles, especially the application of clauses 4, 5 and 6 of EN 13103:2009+A2:2012 for mechanical resistance and fatigue characteristics of the axle and clause 3.2.1 of EN 13260:2009+A1:2010+A2:2010 for demonstration of compliance of the assembly wheel + axle.

However, the TSI LOC&PAS recognises that the set of requirements and corresponding EN standards restrict the possible technical solutions and therefore it allows via clause 6.2.3.7(7) the use of an alternative set of standards applicable to the design, construction and testing of the wheelsets, wheels, axles and axle bearings covering:

- wheelset assembly,
- mechanical resistance,
- fatigue characteristics,
- permissible stress limits,
- thermomechanical characteristics.

The additional flexibility provided in the TSI LOC&PAS was provided as there are plenty of technical solutions on the market for vehicles in the scope of this TSI which do not fulfil neither EN 13103:2009+A2:2012 nor other standards referred to in the TSI covering the wheelset assembly (axle, wheels, axle box/bearings). This is not the case of the vehicles in the scope of the TSI WAG, as technical solutions are in general more standardised, so providing this additional flexibility was not deemed necessary when the TSI WAG was drafted, except in the case of the rolling bearings. The last amendment of the TSI WAG (Implementing

⁶ Subparagraph 7 underlined by us.

Regulation (EU) 2019/776) introduced the same text as in clause 6.2.3.7(7) of TSI LOC&PAS for rolling bearings only.

The TSIs establish functional and technical specifications in order to achieve interoperability, as set out in Article 4(3)(c) of Directive (EU) 2016/797:

'[...] establish the functional and technical specifications to be met by the subsystem and its interfaces in relation to other subsystems. [...]

Unless it is absolutely needed (e.g. in order to grant technical compatibility), TSIs are not supposed to impose concrete technical solutions in order to achieve these functional requirements. The reason for this is to provide room for innovation while preserving interoperability, as set out in whereas 34 of Directive (EU) 2016/797:

'The drawing-up of TSIs and their application to the Union rail system should not impede technological innovation, which should be directed towards improving economic performance.'

4. The opinion

Based on the considerations above, the unjustified lack of flexibility provided in the TSI WAG compared to the TSI LOC&PAS constitute a deficiency which could be corrected as already done for the rolling bearing in the last amendment of the TSI WAG (Implementing Regulation (EU) 2019/776).

Therefore, the Agency recommends to amend the TSI WAG by inserting the bold text below, and recommends as well that this opinion constitutes an acceptable means of compliance as foreseen in Article 6(3) of Directive (EU) 2016/797:

6.1.2.2. Wheelset

The demonstration of conformity for the mechanical behaviour of the wheelset assembly shall be carried out according to clause 3.2.1 of EN 13260:2009+A1:2010, which defines limit values for the axial assembly force and the associated verification test.

Alternative demonstration of conformity is allowed in accordance with point 6.1.2.4a.

A verification procedure shall exist to ensure at the assembly phase that no defects may detrimentally affect safety due to any change in the mechanical characteristics of the fitted parts of the axle. This procedure shall contain the determination of the interference values and, in case of press-fitted wheelsets, the corresponding press-fitting diagram.

6.1.2.3. Wheel

(a) Forged and rolled wheels: The mechanical characteristics shall be proven following the procedure as specified in clause 7 of EN 13979-1:2003+A1:2009+A2:2011.

If the wheel is intended to be used with brake blocks acting on the wheel running surface, the wheel shall be thermo mechanically proven by taking into account the maximum braking energy foreseen. A type test, as described in clause 6.2 of EN 13979-1:2003+A1:2009+A2:2011 shall be performed in order to check that the lateral displacement of the rim during braking and the residual stress are within the specified tolerance limits.

The decision criteria of residual stresses for forged and rolled wheels are set out in EN 13979-1:2003+A1:2009+A2:2011.

Alternative demonstration of conformity is allowed in accordance with point 6.1.2.4a.

(b) Other types of wheels: Other types of wheels are permitted for units in national use. In that case the decision criteria and the fatigue stress criteria shall be specified in national rules. Those national rules shall be notified by Member States in accordance with Article 17(3) of Directive 2008/57/EC.

A verification procedure shall exist to ensure at the production phase that no defects may adversely affect safety due to any change in the mechanical characteristics of the wheels. The tensile strength of the material in the wheel, the hardness of the rim, the fracture toughness (only for tread-braked wheels), the resistance to impact, the material characteristics and the material cleanliness shall be verified. The verification procedure shall specify the batch sampling used for each characteristic to be verified.

6.1.2.4. Axle

In addition to the requirement for the assembly above, the demonstration of conformity of the mechanical resistance and fatigue characteristics of the axle shall be based on Clauses 4, 5 and 6 of EN13103:2009 + A2:2012.

The decision criteria for the permissible stress are specified in Clause 7 of EN 13103:2009 + A2:2012. A verification procedure shall exist to ensure at the production phase that no defects may adversely affect safety due to any change in the mechanical characteristics of the axles. The tensile strength of the material in the axle, the resistance to impact, the surface integrity, the material characteristics and the material cleanliness shall be verified. The verification procedure shall specify the batch sampling used for each characteristic to be verified.

Alternative demonstration of conformity is allowed in accordance with point 6.1.2.4a.

6.1.2.4a Alternative assessment procedure applicable to wheelsets, wheels and axles

It is permitted to use other standards where the EN standards referred to in points 6.1.2.2, 6.1.2.3 and 6.1.2.4 do not cover the proposed technical solution; in that case the notified body shall verify that the alternative standards form part of a technically consistent set of standards applicable to the design, construction and testing of the wheelsets, containing specific requirements for wheelset, wheels and axles covering:

- wheelset assembly,***
- mechanical resistance,***
- fatigue characteristics,***
- permissible stress limits,***
- thermomechanical characteristics.***

Only standards that are publicly available can be referred to in the demonstration required above.'

Valenciennes, 08.10.2019


Josef DOPPELBAUER
Executive Director

ANNEX 1 – Copy of the original request**Request of the Commission to the Agency for an Opinion/Advice**

Requesting Organisation (name, address)	DG MOVE, C4	
Contact Information	Bertrand COLLIGNON (bertrand.collignon@ec.europa.eu)	
Legal base	Opinion	<ul style="list-style-type: none"> Agency Regulation Art. 25 and 26 Agency Regulation Art. 10.1 Agency Regulation Art. 10.2 Agency Regulation Art. 19 Agency Regulation Art. 42
	Advice	<ul style="list-style-type: none"> Agency Regulation Art. 41
Objective	Evaluation and technical opinion	
Scope	WAG TSI 321/2013 potential deficiency - Possibility for the development of bogies for freight wagons with innovative bearing concepts, including inboard bearings.	
Task Description	<p>Evaluation, technical opinion.</p> <p>The Agency's opinion shall constitute an acceptable means of compliance.</p>	
Key input documents	<u>Background information and justification for the request:</u> Request from PROSE Ltd. Request for similar provision as in LOC&PAS TSI for conformity assessment of axles/wheels/wheelsets of 'nontraditional' design.	
Request to be sent to:	opinionadvice@portal.era.europa.eu	