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RECOMMENDATION FOR USE

NB-RAIL COORDINATION GROUP

Administrative Decision according to Interoperability Directive
(EU) 2016/797 art. 30.6



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RFU-RST-305

Issue 02
Date 02/03/2021

TITLE

ASSESSMENT OF AXLE BOX HOUSING

ORIGINATOR

TÜV SÜD Nederland B.V.
VUD

SUBJECT RELATED TO

A/ Commission Regulation (EU) No 1302/2014 (TSI LOC&PAS), as amended by Reg. (EU)2018/868, (EU) 2019/776 and (EU) 2020/387
B/ Commission Regulation (EU) No 321/2013 (TSI WAG), as amended by Reg. 2019/776 and (EU)2020/387

AMENDMENT RECORD:

18-11-2019 First issue

25-02-2020 Legal reference updates and WAG TSI related sections added

DESCRIPTION AND BACKGROUND EXPLANATION

References:

- [1] TSI LOC&PAS (Commission Regulation (EU) No 1302/2014)
- [2] TSI CR LOC&PAS (2011/291/EU)
- [3] EN 13749:2011 Railway applications - Wheelsets and bogies - Method of specifying the structural requirements of bogie frames
- [4] EN 15827:2011 Railway applications - Requirements for bogies and running gears
- [5] TSI WAG (Commission Regulation (EU) N° 321/2013)
- [6] EN 12082:2007+A1:2010 Railway applications – Axle boxes - Performance testing
- [7] UIC 510-3:1994-07 Wagons – Strength testing of 2 and 3-axle bogies on test rig

The aim of this RFU is

- A/ To clarify if TSI LOC&PAS [1] requires that the axle box housing must undergo the same validation program as the bogie frame as specified in EN 13749 [3] section 6.2,
- B/ To clarify the NoBo assessment procedure of axle boxes for TSI WAG [5].

Background:

A/ TSI LOC&PAS section 4.2.3.5.1:

“4.2.3.5.1. Structural design of bogie frame

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(1) For units which include a bogie frame, the integrity of the structure of the bogie frame, axle box housing and all attached equipment shall be demonstrated based on methods as set out in the specification referenced in Appendix J-1, index 20 [= EN 13749:2011 [3], section 6.2 and Annex C]."

Note: The axle box itself (incl. the bearing) is considered to be part of the wheelset according to TSI LOC&PAS [1] section 4.2.3.5.2 "Wheelsets" without detailed definition on strength validation plan for the axle box.

Description of the situation:

EN 13749 [3], section 6.2, describes the validation program for the bogie frame. Depending on whether the bogie frame is a completely new design or not, the norm requires up to four validation stages (finite element analysis, static bench tests, fatigue bench tests, on-track tests). Where the design is a development of an earlier product any previous data, or other evidence of satisfactory performance that is still applicable, can be offered as validation of the revised product. This may lead to a reduced program for validation. Static tests and fatigue tests shall be carried out in accordance with the requirements defined in the technical specification and to a level that is considered necessary to validate the design satisfactorily.

While EN 13749 [3] section 6.2 itself focuses on bogie frames, TSI LOC&PAS Reg (EU) 1302/2014 explicitly mentions the bogie frame and the axle box housing when referring to EN 13749 [3] section 6.2. Means, according to the TSI the "several stages validation procedure" as set out in EN 13749 [3] section 6.2 shall be applied to the bogie frame and also shall be applied to the axle box, even if the word "axle box" is not explicitly mentioned in that section of the EN standard.

B / TSI WAG points 4.2.3.6.5 and 6.2.2.4:

"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."

"6.2.2.4 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." [6].

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EN 12082 clause 6, last paragraph

“The performance test consists of repeating identical cycles up to an agreed cumulative distance. The number of cycles and the required test distance reflect the service conditions of the intended application. Throughout the test, the performance of the bearings and the grease shall be monitored by measurement of temperature, the values of which, both absolute and relative, shall remain within limits. Finally, on completion of the test, the bearings and the grease shall be inspected and shall not show any changes beyond limits imposed.”

Description of the situation:

Based on the TSI WAG [5] point 4.2.3.6.5, the axle box shall be designed with consideration of mechanical resistance and fatigue characteristics. Demonstration of conformity is described in point 6.2.2.4. However, the point 6.2.2.4 of TSI WAG [5] does not contain any requirement for the axle box housing but only for the rolling bearing. Therefore, NoBos use to assess mechanical resistance and fatigue characteristics of axle box housings in different ways. Some of them accept finite element (FE) results, however others require tests in accordance with technical specifications UIC 510-3 [7], EN 13749 [3] or EN 12082 [6]. Moreover, rig performance tests in accordance with EN 12082 [6] only evaluate limits of the bearings and the grease.

RFU PROPOSAL

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A/ TSI LOC&PAS section 4.2.3.5.1:

The same validation program (in normal cases: including finite element analysis, static bench tests, fatigue bench tests and on-track tests) is required also for axle box housings because of the following reasons:

- TSI LOC&PAS requires EN 13749 [3] section 6.2 for the axle box housing together with the bogie frame.
- TSI LOC&PAS requires the methods of section 6.2 of EN 13749 [3] to be applied. The method described in section 6.2 of EN 13749 is the validation program. It is fully applicable also to the axle box housing.
- In the scope of EN 13749 [3] chapter 1 the axle box housing is included. It would not be logic to include the axle box in the scope if there were no requirements.
- TSI LOC&PAS 2014 has this additional requirement including the axle box housing, whereas the TSI CR LOC&PAS 2011 did not have it.
- Failure of the axle box housing can lead to derailment of the wheelset, i.e. the axle box housing has the same safety relevance as the bogie frame.
- As the axle box is below the primary suspension, loads on axle box are even higher than on bogie frame.
- In general, the aim of validation plan according EN 13749 [3], section. 6.1, is to prove the design of the bogie frame without adverse influence on the associated bogie components. The validation plan shall be compatible with that for the bogie as a whole, see also the definitions in EN 15827 [4] "requirements for bogies and running gears". EN 15827 [4] section 6.5.5 "axle box housing" defines that the axle box housing is to be designed following the procedures as defined in EN 13749 [3].

For many previous projects, the methods of section 6.2 of EN 13749 [3] were used for validation and approval of axle box housing, it is used as "code of practice".

B/ TSI WAG point 4.2.3.6.5:

The axle box housing shall be designed with consideration of mechanical resistance and fatigue characteristics. Then this part of subsystem should be analysed to demonstrate that it will carry the load to which it is subjected. The static and fatigue tests, if mandatory, should be carried out in accordance with the technical specification and applicable regulations and to a level that is considered necessary to validate the design satisfactorily.

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For the strength validation of axle boxes, applicants and NoBos may use a consolidated procedure to prove conformity to the TSI. The following procedures are proposed to demonstrate conformity to the TSI:

- **Existing axle box housing designs that have been proven in use before release of the TSI CR RST WAG (Commission Decision 2006/861/EC)** – for verifying the mechanical and fatigue characteristics a validation by analysis only (e.g. FEM) can be accepted.
(Note: designs existing at the time the TSI 2006/861/EC was applicable, are e.g. BA 182, BA 386, BA 381)

It is the responsibility of the Applicant to demonstrate the design was existing at the time the TSI 2006/861/EC became applicable.

- **New axle box housing designs** – after positive analysis (e.g. FEM) the mechanical and fatigue characteristics is to be verified based on *static and fatigue tests* in accordance with the procedure for “Validation and acceptance of the design” as described in chapter 6 of EN 13749 [3], also with loads derived from EN 13749 [3].
- **Modified axle box housing designs** – for verifying the mechanical and fatigue characteristics analysis (e.g. FEM) is to be used as minimum requirement.
(Note: Modified designs are developments on the basis of existing solutions on the market)

THIS RFU WAS AGREED ON

PLENARY MEETING 61

THIS RFU ENTERS INTO FORCE ON

02/03/2021 (DATE OF PUBLICATION)

FROM THIS DATE ON THIS RFU CAN BE APPLIED INSTEAD OF THE PREVIOUS MANDATORY VERSION.

RFU APPLICATION IS MANDATORY STARTING FROM

02/03/2021 AT THIS DATE ANY PREVIOUS OF THIS RFU WILL BE WITHDRAWN.

RFUS SHALL BE APPLIED BY ALL NOBOS. PLEASE REFER TO RFU-STR-702, CHAPTER 3 OF THE SECTION “DESCRIPTION AND BACKGROUND EXPLANATION”, FOR THE LEGAL BASIS SUPPORTING THIS OBLIGATION.

ERA COMMENTS

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PLENARY MEETING 61 – 25/02/2021: NO COMMENTS

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