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Assessment of the conformity with the requirements in point 4.2.2.4 of the WAG TSI on securing of semi-trailers

Technical Document ERA/TD 2025-1/Securing of Semi-Trailers

Version 1.0

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1 Introduction

1.1 Preamble

The point 4.2.2.4 of the WAG TSI "securing of semi-trailers" contains requirements regarding the link between the unit (in the context of this ERA TD a freight wagon for the transport of semi-trailers) and the semi-trailer, the so-called device to secure semi-trailers. These requirements refer to :

- the strength (point 4.2.2.4.1),
- the locking force (point 4.2.2.4.2),
- the indications of correct loading and securing (point 4.2.2.4.3)
- the marking with information regarding these devices (point 4.2.2.4.4).

The point 5.3.6. of the WAG TSI "Devices to secure semi-trailers" defines these devices as an interoperability constituent together with its area of use.

The point 6.1.2.7. of the WAG TSI "Devices to secure semi-trailers" describes the way how conformity to the TSI requirements in points 4.2.2.4.1, 4.2.2.4.2, 4.2.2.4.3 and 5.3.6 shall be assessed at interoperability constituent level or at subsystem level, respectively.

The requirement concerning the marking of information in point 4.2.2.4.4 shall be assessed at subsystem level.

Regarding the assessment of conformity, the TSIs usually refer to European standards. Suitable standards are currently not available for the requirements described above. Therefore, and until suitable standards are published, the WAG TSI refers to this ERA Technical Document.

1.2 Reference documents

Acronym	Name	Reference
IOD	Railway Interoperability Directive	Directive (EU) 2016/797 of the European Parliament and of the Council of 11 May 2016 on the interoperability of the rail system within the European Union (recast)
WAG TSI	Technical specification for interoperability relating to freight wagons	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, including all subsequent amendments and the contents of the Change Request no. 680 (developed following the JNS Normal Procedure "Crosswind").
ECE R55	Economic Commission for Europe of the United Nations Regulation No 55	Regulation No 55 of the Economic Commission for Europe of the United Nations (UN/ECE) — Uniform provisions concerning the approval of mechanical coupling components of combinations of vehicles including all subsequent amendments and corrigendum.
EN 12663-2	European Standard	EN 12663-2:2010+A1:2023 Railway applications – Structural requirements of railway vehicle bodies – Part 2: Freight wagons

1.3 Definitions

Unit: A 'unit' is the generic term used to name the rolling stock. See more details in section 2.2 "Definitions" of WAG TSI. In the context of this ERA TD, the 'unit' is a freight wagon used for the transport of semi-trailers.

Semi-trailer: A semi-trailer is a trailer without a front axle. It is designed to be pulled via a pivoting arrangement which also partially supports its weight.

Device to secure semi-trailers: A device which holds and locks semi-trailers in a safe position by using the H50-type king-pin complying with ECE Regulation 55.

King-pin: An mechanical coupling device that connects a semitrailer to the towing vehicle, and that complies with the specifications for the H50-type king-pin of ECE Regulation 55.

2 Assessment of the conformity with the WAG TSI requirements in point 4.2.2.4 - securing of semi-trailers

The sections below describe the assessment of conformity with the WAG TSI requirements in points 4.2.2.4.1, 4.2.2.4.2, 4.2.2.4.3 and 4.2.2.4.4.

2.1 Point 4.2.2.4.1: Devices to secure semi-trailers - Strength

WAG TSI Requirement:

"Devices to secure semi-trailers shall hold semi-trailers in a safe position by withstanding the longitudinal, lateral and vertical downwards directed forces in accordance with the design operating state."

The assessment of conformity of the device to secure semi-trailers with point 4.2.2.4.1 of the WAG TSI shall be assessed for the combination of the device with each unit type on which it is intended to be used.

For this assessment, a bumping test of the device to secure semi-trailers affixed to a unit of the envisaged unit type and loaded with a maximum loaded semi-trailer shall be carried out in accordance with point 8.2.5.1 of EN 12663-2, for the relevant device settings.

The conformity is positively assessed if there are no visible damages or permanent deformations to any of the following items:

A. mechanism to lock the king-pin,
B. the device itself,
C. the connection between the device and the unit,

and if the functionality of the mechanism to lock the king-pin and the device itself is not negatively impacted.

In addition, the values for static and fatigue forces as defined in EN 12663-2 shall be used within a validated Finite Element Analysis (validated in accordance with point 9 of this standard).

The conformity is positively assessed if the validated Finite Element Analysis shows that the forces and combinations of forces would not lead to any visible damages or permanent deformations to any of the following the items:

A. mechanism to lock the king-pin,
B. the device itself,
C. the connection between the device and the unit,

and that the functionality of the mechanism to lock the king-pin and the device itself would not be negatively impacted.

2.2 Point 4.2.2.4.2: Devices to secure semi-trailers - Locking force

WAG TSI requirement:

"*Devices to secure semi-trailers shall lock semi-trailers in a safe position by withstanding the vertical upwards directed forces in accordance with the design operating state.*"

The conformity of the device to secure semi-trailers with point 4.2.2.4.2 of the WAG TSI shall be assessed for the combination of the device with each unit type on which it is intended to be used.

For the assessment, the following static force shall be determined:

Vertical upwards direction: $F_{static\ zu} = n_w * g * m_{od}$

n_w: mean value of the acceleration in vertical upwards direction caused by crosswind at the minimum crosswind stability of freight wagons divided by g

Note: In absence of a TSI requirement on a minimum crosswind stability for freight wagons $F_{static\ zu}$ shall be at least 85kN. No additional safety coefficient shall apply.

Afterwards, the above determined static force shall be used in the following test in accordance with Figure 1.

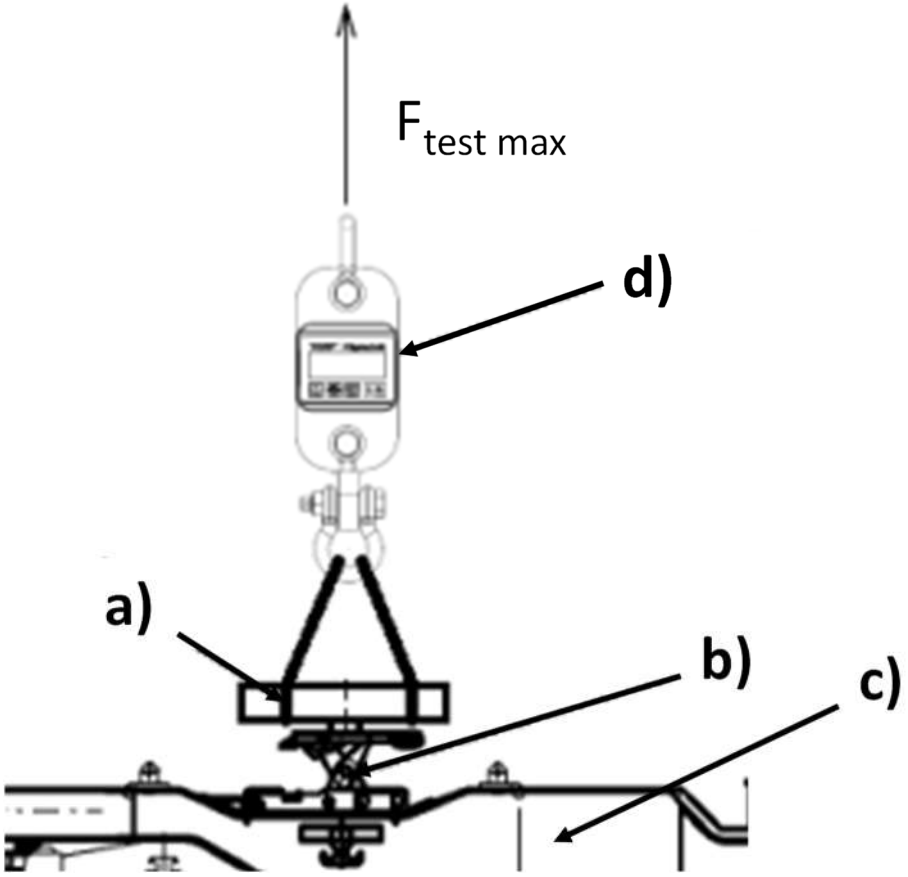

Figure 1: test rig for the assessment of the conformity of the device to secure semi-trailers with requirement 4.2.2.4.2 of the WAG TSI.

The device (b) shall be affixed on a unit or on a ground plate (c) representing the connection between the device and the envisaged unit type.

The following test steps must then be carried out three times for each position of the device, at least for the extreme positions:

1. The test piece (a) and any other element that charges the device during the test shall be weighted, summed up and documented ($m_{equipment}$ [kg]);
2. Insert the test piece with the king-pin that complies with the with the specifications in ECE Regulation 55 for the "H50-type king-pin" in the device (b);
3. Lock the king-pin (if not automatically done) and check the correct locking;
4. Apply the vertical tensile load up to the test force $F_{test\ max}$ = $F_{static\ zu}$ as determined above at least 85kN) + $m_{equipment} * g$;
5. Document the tensile force applied (d) and irregularities that occur, if any;
6. Reduce the tensile force to zero;
7. Unlock the king-pin;
8. Lift the test piece from the device;
9. Verify the absence of any visible damages or deformations to the mechanism to lock the king-pin, the device itself and the connection between the device and the unit, respectively the ground plate;

10. Check the functionality of the mechanism to lock the king-pin and the device itself.

The conformity is positively assessed if there is no visible damage or permanent deformation to any of the following items:

A. mechanism to lock the king pin,
B. the device itself,
C. the connection between the device and the unit, respectively the ground plate,

and if the functionality of the mechanism to lock the king-pin or the device itself is not negatively impacted.

2.3 Point 4.2.2.4.3: Devices to secure semi-trailers – Indications

WAG TSI Requirement:

"Devices to secure semi-trailers shall indicate reliably if the king-pin of the semi-trailer is correctly positioned and the semi-trailer is correctly locked.

The correct position of the king-pin of the semi-trailer and the locking of the semi-trailer shall be detected independently.

The indication shall be visible for the loading and checking staff in any loading situation of the unit."

The assessment of conformity of the device to secure semi-trailers with point 4.2.2.4.3 of the WAG TSI shall be assessed for the combination of the device with each unit type on which it is intended to be used.

For a positive assessment, the device to secure semi-trailers shall directly detect, either mechanically or electronically, if…

- … the king-pin is correctly positioned so that it can be secured properly (e.g. if the king-pin is entirely in the hitch funnel), and
- … the element(s) locking the king-pin against upwards directed vertical forces is (are) at the right position to lock the king-pin.

Both detections shall be independent from each other, and the detection result(s) shall be indicated at both sides of the unit in a way which allows loading and checking staff to recognise it visually without additional tools in any loading situation.

For mechanical and electronic indications based on colours, the detection results shall be indicated using the following colours :

Detection result	**Indication colour**
Positive: Kingpin correctly positioned	blue
Negative: Kingpin not correctly positioned	red
Positive: Kingpin locked	blue
Negative: Kingpin not locked	red

In case both detection results are combined in one single indication, it shall be ensured that one negative detection result always leads to a negative indication (e.g. red indication in case of colour-based indications).

In case electronic systems are used, the devices to secure semi-trailers shall control their correct functioning. In case the correct functioning cannot be guaranteed, the respective information shall be indicated in a way, which allows loading and checking staff to recognise it visually without additional tools in any loading situation and which cannot be confused with a positive indication.

2.4 Point 4.2.2.4.4: Marking on the unit

WAG TSI Requirement:

"The unit shall have a marking related to the device to secure semi-trailers on both sides for each device to secure semi-trailers, which contains:

- *All information relevant for the safe use of the devices to secure semi-trailers by loading and checking staff;*
- *The compliance with point 4.2.2.4.2."*

For the positive assessment of the conformity of the unit with the requirement 4.2.2.4.4 of the WAG TSI, markings shall be affixed that comply with the requirements of point 2.4.1 and 2.4.2.

In case the information defined in point 2.4.2 is managed in digital form via a TAF TSI compliant solution making the information available to the checking staff of

- terminals and
- railway undertakings and
- national safety authorities,

it is not required to physically mark the unit and point 2.4.1 does not apply.

2.4.1 General requirements

2.4.1.1 General principles (from EN 15877-1:2024)

a. The marking shall be located on the unit at a position easily visible by staff standing at ground level and presented in a way clearly understandable to persons concerned. It shall not be located at a level higher than 2 000 mm above the running surface.
b. Advertising, designs or other text or pictures not related to the marking applied to the unit shall not affect the visibility and the clear and unambiguous understanding of the marking. The background around the marking shall be framed with a contrasting background of at least 5 mm.
c. The marking shall be placed for each device to secure semi-trailers on both sides of the unit.
d. The marking shall ensure durable, non-degraded marking for a period of at least 6 years under a temperature range of -40 °C to +90 °C. If the marking is defective or illegible, it shall be restored. It shall be weather-resistant and resistant to cleaning agents, high pressure water or air cleaning and cleaning machines with brushes.
e. Alphanumeric characters used on the marking shall use Latin characters and Arabic numerals. The font to be used shall be non-italic, sans serif and of a type such as Univers 67, Helvetica or Arial.
f. The distances between value and unit (e.g. kN/months/m/etc..) shall be clearly separated by space (see EN ISO 80000-1:2022, e.g. 7.1.4.)
g. The dimensions given in 2.4.2 may have a tolerance of plus or minus 10 %. For better readability, it is recommended to use industrial foils or stencils for hand produced markings.

2.4.1.2 Colour (from EN 15877-1:2024)

h. Colours used shall be in accordance with ISO 3864-4:2011, see Annex A of EN 15877-1:2024.
i. The colours need not be made of retro reflecting material.
j. The luminance contrast C shall be in accordance with ISO 3864-4:2011.
k. The colour of the informative part (the symbol, letters/numbers, borders and lines) shall be black on a light background or white on a dark background.

2.4.1.3 Positioning (from EN 15877-1:2024)

l. The marking shall be positioned as close as possible to the device to secure semi-trailers, on both sides of each unit.

2.4.2 Details of the marking

Key:

1. Type of the device to secure semi-trailers or uniform resource locator (URL) to the manual of the device to secure semi-trailers (can also be provided in the form of a quick-response (QR) code).
2. Date of the next intermediate check (as stipulated in the maintenance manual) (position 1 in Figure 2) and code of entity that performed the last intermediate check (position 2 in Figure 2), indicated in a table. The table can be expanded to contain more dates.
3. Foreseen interval between subsequent intermediate checks.
4. Positively assessed conformity with requirement 4.2.2.4.2 of the WAG TSI (locking force of 85kN), indicated by a green dot.

Figure 2 shows the empty marking with its dimensions in millimetre and Figure 2 shows a marking with fictional entries.

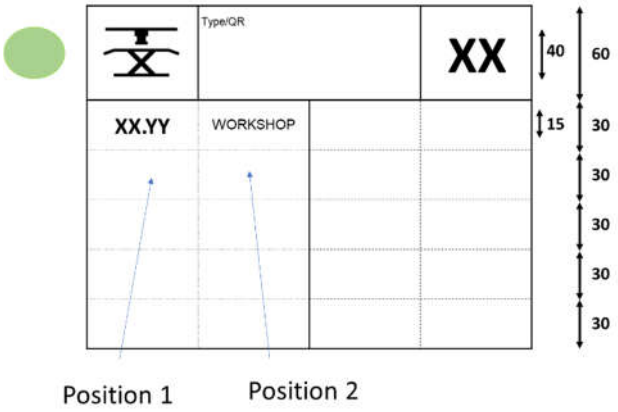

Figure 2: Empty marking with dimensions.

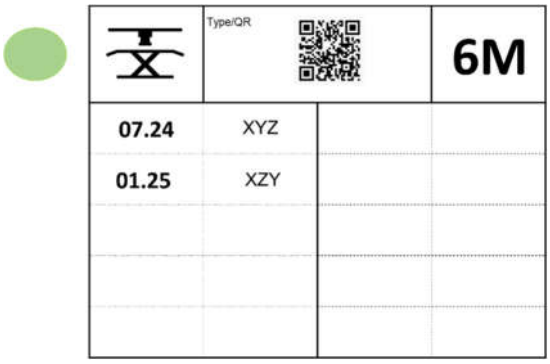

Figure 3: Marking with fictional entries.