Organisation intergouvernementale pour les transports internationaux ferroviaires
Zwischenstaatliche Organisation für den internationalen Eisenbahnverkehr
Intergovernmental Organisation for International Carriage by Rail

OTIF/RID/CE/GTT/2022/INF.3

11 November 2022

(German and English only)

RID: **19th Session of the RID Committee of Experts' working group on tank and vehicle technology**

(Berne/hybrid, 22 and 23 November 2022)

Subject: **RID provisions with repercussions for the planned introduction of digital automatic coupling (DAC)**

Information from Germany

Introduction

1. At the ERA workshop on harmonising the provisions for the carriage of dangerous goods in the WAG TSI and RID on 12.10.2022, a document from Belgium was used to discuss the extent to which RID provisions should also be taken into account when introducing digital automatic coupling (DAC) and its legal basis in rail transport in the WAG TSI, see also INF.1 (ERA).

2. Essentially, the following RID provisions are concerned:
   – 6.8.2.1.29 (300 mm)
   – 6.8.3.1.6 (70 kJ buffers on gas tank-wagons)
   – 6.8.4/special provision TE 22
   – 6.8.4/special provision TE 25.

3. In this document, Germany wishes to provide information on the background to and formulation of protective aims, particularly with regard to introducing into RID the protective measures “energy absorption elements/crash elements” (special provision TE 22 as at 1 January 2005) and “devices to protect against the overriding of buffers” (special provision TE 25 as at 1 January 2007). The aim is to simplify the ongoing discussions.

4. The introduction of various protective measures was discussed at length from 1996 onwards, after several railway accidents had occurred in Germany.
   These discussions first took place in the national working group on tank and vehicle technology, which had investigated these accidents with international participation and in its final report in February 2002 proposed a total of 28 individual measures to improve safety in the carriage of dangerous goods – including “crash elements” and “devices to protect against the overriding of buffers”, see also document OCTI/RID/CE/38/5.

5. The results of the final report of the working group on tank and vehicle technology were subsequently introduced into the international dangerous goods bodies, in particular the RID Committee of Experts, which set up the formal working group on tank and vehicle technology in 2001 in order to discuss further these mostly technical issues, see also the final report of the 38th session of the RID Committee of Experts (Prague, 19-23.11.2001), paragraphs 46-69. This working group met for the first time in April 2002.

6. From the beginning, protective aims were formulated for the individual measures, see also the final reports of the following sessions of the working group on tank and vehicle technology:

   – Final report of the 1st session of the RID Committee of Experts’ working group on tank and vehicle technology (Bonn, 17-19.4.2002), paragraphs 9-14 (devices to protect against the overriding of buffers) and 17-18 (crash elements)

   – Final report of the 2nd session of the RID Committee of Experts’ working group on tank and vehicle technology (Bonn, 5-6.9.2002), paragraphs 5-23 (crash elements) and 29 (devices to protect against the overriding of buffers)

   – Final report of the 3rd session of the RID Committee of Experts’ working group on tank and vehicle technology (Bonn, 20-21.2.2003), paragraphs 22-32 and 42-43 (crash elements) and 33-41 and 44 (devices to protect against the overriding of buffers)

   – Final report of the 4th session of the RID Committee of Experts working group on tank and vehicle technology (Berne, 11-12.9.2003), paragraphs 5-10 (devices to protect against the overriding of buffers)

   – Final report of the 5th session of the RID Committee of Experts’ working group on tank and vehicle technology (Duisburg-Wedau, 24-25.6.2004), paragraphs 5-9 (crash elements) and paragraphs 18-34 (devices to protect against the overriding of buffers), paragraph 46 (300 mm protective distance)

   – Final report of the 6th session of the RID Committee of Experts working group on tank and vehicle technology (Bonn, 21-22.4.2005), paragraphs 28-29 (accidents involving crash buffers) and paragraphs 8-20 (devices to protect against the overriding of buffers)

   – Final report of the 7th session of the RID Committee of Experts’ working group on tank and vehicle technology (London, 21-22.4.2005), paragraphs 9-10 (devices to protect against the overriding of buffers).

7. The results of the discussions in the working group on tank and vehicle technology were discussed at the meetings of the RID Committee of Experts. As a result, it was decided to introduce special provisions TE 22 (RID 2005) and TE 25 (RID 2007), see also the final reports of the following sessions of the RID Committee of Experts:

   – Final report of the 39th session of the RID Committee of Experts (Berne, 18-21.11.2002), paragraphs 32-42 and Annex 2 (crash elements) and paragraph 43 (devices to protect against the overriding of buffers)

– Final report of the 40th session of the RID Committee of Experts (Sinaia, 17-21.11.2003), paragraphs 5-11 and Annex 1 (crash elements) and paragraphs 24-32 and Annex 1 (devices to protect against the overriding of buffers)

– Final report of the 41st session of the RID Committee of Experts (Meiningen, 15-18.11.2004), paragraphs 5-7 (crash elements) and paragraphs 16-35 and Annex 1 (devices to protect against the overriding of buffers)

– Final report of the 42nd session of the RID Committee of Experts (Madrid, 21-25.11.2005), paragraphs 64-72 and Annex 1 (devices to protect against the overriding of buffers)

– Final report of the 43rd session of the RID Committee of Experts (Helsinki, 2-5.10.2006), paragraphs 37-42 and Annex 1 (crash elements) and paragraphs 6-11 (devices to protect against the overriding of buffers).

8. The following document attempts to summarise, as far as possible, the extensive discussions on the background to and protective aims of these measures. This document is limited to the following measures:
   – Energy absorption elements/crash elements (RID 6.8.4/TE 22)
   – Devices to protect against the overriding of buffers (RID 6.8.4/TE 25)
   – Protective distance tank end - buffer beams (RID 6.8.2.1.29/UIC leaflet 573)

Energy absorption elements/crash elements (RID 6.8.4/TE 22)

9. The protective measure “energy absorption elements/crash elements” was based on the following basic assumptions:

   As a rule, in the event of an accident, absorption of the energy inherent in the moving unit occurs via the following devices and actions:
   - braking,
   - buffer springs (stroke),
   - elastic and plastic deformation of the framework,
   - energy absorption capacity of the tank and
   - deformation/expenditure of energy in the surroundings (e.g. throwing-up of soil).

   Particularly as regards elastic and plastic deformation of the framework, energy can to a large extent be dissipated in a carefully directed way by the integral construction of crash elements, as with the construction of motor cars.

   Attempts to do this are currently to be found in the field of locomotive construction (DB class 152), where crash absorption elements in the shape of pyramid stumps have been used, and also with the CeSa research project (tank for chemicals designed for higher safety), where two seamlessly joined round steel pipes with a deformation distance of a maximum of 350 mm are provided as energy absorption elements.

   In addition, the use of innovative high-performance buffers should also be examined further (see section 3.4), particularly in view of the results that are emerging of markedly improved possibilities for energy absorption from combining elastic and plastic deformation devices.

   The practicality of including energy absorption and crash elements in the construction of new wagons, taking into account knowledge gained through CeSa, should be examined further.

Concluding assessment/outlook:
In the future, the objective to be achieved is a combination of high-performance buffers and energy absorption element that can also be built onto existing wagons, without the "Bern space" restriction. In this respect, the problem free swapping of components will be important in order to bring the wagon to its destination. Preliminary tests on this give compensatory impact speeds of up to 36 km/h when an 80 t wagon collides with a stationary wagon equipped with the component. It would be possible to retrofit the existing wagon fleet without significant technical problems.
See also 2.3 in document OCTI/RID/CE/38/5 from the 38th session of the RID Committee of Experts (Prague, 19-23 November 2001).

10. The working group on tank and vehicle technology drafted the following protective aim for energy absorption elements:
"In the event of a collision shock or accident, energy absorption of at least 800 kJ by means of plastic deformation of defined components or by means of a procedure with similar effects, without it leading to a dangerous, direct transfer of energy to the tank. Crash elements can be an effective way of achieving this."
See also paragraph 18 of the final report of the 1st session of the working group on tank and vehicle technology (Bonn, 17-19.4.2002).

    The energy absorption of 800 kJ per wagon end was determined on the basis of what was actually achievable at the time, what buffer manufacturers had on the market and what was subsequently reflected in the standards (UIC leaflet 573/EN 15551:2009).

    This preliminary formulation of the protective aim was revised again at the 2nd meeting of the working group on tank and vehicle technology after intensive discussion:
"In the event of a collision shock or accident, tank-wagons with tank codes in accordance with Table 1 shall be capable of absorbing at least 800 kJ of energy by means of elastic or plastic deformation of defined chassis components at each end or by means of a similar procedure (e.g. crash elements).
Energy absorption by plastic deformation shall only occur in conditions other than those encountered during normal conditions of rail transport (impact speed above 12 km/h).
Energy absorption shall not lead to a direct transfer of energy to the tank that might cause plastic deformation of the tank."
See also paragraph 21 of the final report of the 2nd session of the working group on tank and vehicle technology.

11. As a result of further discussions, the newly formulated special provision TE 22 was included in RID on 1 January 2005.

Energy absorption of at least 130 kJ per wagon end for tank-wagons with an automatic coupling device

12. The discussions on the energy absorption of at least 130 kJ per wagon end for tank-wagons with an automatic coupling device took place in connection with checking the harmonisation of RID and SMGS Annex 2, see also:

    – Document -2013/18 (OTIF Secretariat): OSJD group of experts on Annex 2 to SMGS "Provisions for the Carriage of Dangerous Goods" and OSJD Commission for Transport Law in the field of provisions for the carriage of dangerous goods (Warsaw, 21-25 October 2013), paragraphs 34-35

    – Final report of the 2nd session of the RID Committee of Experts' standing working group (Copenhagen, 18-22.11.2013), paragraphs 86-87 and Annex I.

13. The corresponding addition to special provision TE 22 on 1 January 2015 resulted from the construction requirements for Russian wagons and also served to legalise border traffic with Finland.

Devices to protect against the overriding of buffers (RID 6.8.4/TE 25)

14. The protective measure “devices to protect against overriding of buffers” was based on the following basic assumptions:

    “Accidents and derailments during carriage and marshalling are frequently accompanied by overriding of the buffers. The buffers of the wagons slide over each other as they collide so that the normal distance between wagons and their superstructures (e.g. tanks) ceases to exist. Parts of the wagon structure and superstructure with a small diameter (e.g. drawbars, buffer guides, ladder parts) are able to penetrate the tank, especially the end. Because of the large mass of the wagons there is often failure of the wall of the tank (penetration) with subsequent spillage of contents.

    Devices to protect against overriding of buffers should prevent complete overriding and its effects. Because the existing wagon fleet has fixed geometric dimensions (length of front part, brake platform, etc.), devices to protect against overriding should mainly be fitted to new-build wagons.

    Concluding assessment/outlook:
    If the protective devices are fitted to existing components, e.g. in the tank coupling saddle, the increase in weight and cost of new wagons can be kept within justifiable limits.
    Equipping the existing fleet of wagons is not economically justifiable.”
    See also 2.1 in document OCTI/RID/CE/38/5 from the 38th session of the RID Committee of Experts (Prague, 19-23 November 2001).

15. The working group on tank and vehicle technology formulated the following protective aim for devices to protect against the overriding of buffers:
    “Measures to prevent the overriding of buffers (when they rise up) in the event of a violent collision between wagons resulting from incidents.
    Devices must be designed in such a way that allows ongoing/retrospective fitting and that prevents the potential for danger increasing during the period of fitment/refitment (i.e. different stage of fitment). In particular, the protective equipment must not have any negative effects on the body of the tank.
    The constructions must be mutually compatible and not lessen the objective of protection.”
    See also paragraph 13 of the final report of the 1st session of the working group on tank and vehicle technology (Bonn, 17-19.4.2002).

16. After corresponding discussions in the working group, at the 4th session of the working group on tank and vehicle technology, Germany submitted a revised proposal for a protective aim to avoid the overriding of buffers or to reduce the effect of overriding of buffers in driving and shunting operations as the basis for amending the rules:
    “Devices to protect against the overriding of buffers are rail tank-wagon components which effectively prevent the overriding of buffers from occurring and/or which reduce or prevent the effects of mechanical penetration of the tank of a rail tank-wagon.”

    Requirements the components/types of construction must meet:

    – prevent the overriding of buffers as a result of a wagon climbing, following an accident or collision;
    – the devices to protect against the overriding of buffers must be effective over the whole width of the wagon;

- compatibility of different types of construction/components with each other by providing spaces, i.e. spatially enclosed areas of the wagon, where devices to protect against the overriding of buffers can be placed;
- no increase in the potential danger where there is a combination of wagons fitted with protection against overriding and wagons with no protection against overriding;
- no increase in the potential danger where there is a combination of wagons fitted with differently functioning devices to protect against the overriding of buffers."

See also document INF. D 4 and paragraph 5 of the final report of the 4th session of the working group on tank and vehicle technology (Berne, 11-12.9.2003).

17. At subsequent meetings of the working group on tank and vehicle technology and the RID Committee of Experts, the various options for devices to protect against the overriding of buffers were discussed in detail (increasing the wall thickness of the tank ends, sandwich covers on the tank ends, protective shield at each end of the wagon).

18. As a result, the newly formulated special provision TE 25 was incorporated into RID on 1 January 2007.

Protective distance tank end – buffer beams 300 mm (RID 6.8.2.1.29/UIC leaflet 573)

19. The protective distance of 300 mm is regulated in UIC leaflet 573 – Technical conditions for the construction of tank wagons (No. 1.2) and is an easily comprehensible regulation for protection against the overriding of buffers.

    Following the railway accidents in Germany, the working group on tank and vehicle technology investigated whether it made sense to increase the previous minimum distance of 300 mm.
    The study concluded that "an increase in this distance on its own would not bring any major benefit or increased safety. However, this measure is sensible for new-builds in combination with devices to protect against buffer overriding and crash elements. A disadvantage in connection with this is the increase in tank-wagon weight along with loss of payload.", see also 3.6 of document OCTI/RID/CE/38/5 from the 38th session of the RID Committee of Experts (Prague, 19-23 November 2001).

20. As the protective distance of 300 mm was already regulated in UIC leaflet 573, and an extended stem alone does not result in a significant contribution to energy absorption in the event of an accident, this agenda item was closed.
    See also paragraph 46 of the final report of the 5th session of the working group on tank and vehicle technology (Duisburg-Wedau, 24-25.6.2004).

Summary

21. The protective measures referred to above have been brought into effect after years of intensive discussions with technical experts and representatives of the industry (manufacturers and users) and taking into account a balanced cost/benefit ratio. They have subsequently led to a reduction in the extent of damage in railway accidents, see for example the report on an accident in Ledsgård (Sweden) on 28.2.2005 – document INF. S 1 and paragraphs 28-29 of the final report of the 6th session of the working group on tank and vehicle technology (Bonn, 21-22.4.2005).

22. From Germany's point of view, the safety level achieved by these measures in the transport of dangerous goods must be maintained at all costs and must be taken into account when introducing the digital automatic coupling (DAC).