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.1

21 October 2022

(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)

Item: **Digital automatic couplers (DAC)**

Information from European Union Agency for Railways (ERA)

Introduction

1. In accordance with the discussion held at the RID Committee of Experts' standing working group meeting in May 2022 (see OTIF/RID/CE/GTP/2022-A, paragraphs 23 to 27) and at the invitation of the European Union Agency for Railways (ERA) a workshop on harmonisation of requirements regarding dangerous goods in TSI WAG and RID was held on 12 October 2022.

2. In the workshop a presentation of DAC and TSI state of play regarding DAC was given (see Annex I).

3. The workshop worked on a document prepared by Belgium in which the clauses of RID in the scope of TSI WAG were identified. This document reproduced in Annex II is not yet finalised and will be further discussed in the next meeting of the workshop.

Annex I

Workshop on harmonization of requirements regarding dangerous goods in TSI WAG and RID

12 October 2022 - teleconference

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Agenda

10:00 - 10:30	Welcome and presentation of the Agenda.
10:30 – 11:30	Presentation of DAC and TSI state of play regarding DAC (EDDP, Agency)
11:30 – 12:00	Identify clauses of RID in the scope of TSI WAG
12:00 – 13:00	Lunch pause
13:00 – 15:30	Identify new requirements in DAC specification applicable to freight wagons dedicated to the transport of Dangerous Goods and propose a first wording in TSI /propose an interface document, if needed. Propose high level safety objectives to be included in RID.
15:30 – 16:30	Discussion, conclusions and next steps

Presentation of DAC and TSI state of play regarding DAC (EDDP, Agency)

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Presentation of DAC and TSI state of play regarding DAC

The digital automatic coupling for freight wagons and freight locomotives should at least cover the following functions:

- Transmission of mechanical forces between freight wagons
- Transmission of braking energy (pneumatical)
- Transmission of electric power to feed applications such as sensors, actuators, buffer batteries, etc.
- Transmission of communication such as train composition, train integrity, brake tests, etc.

Some key information:

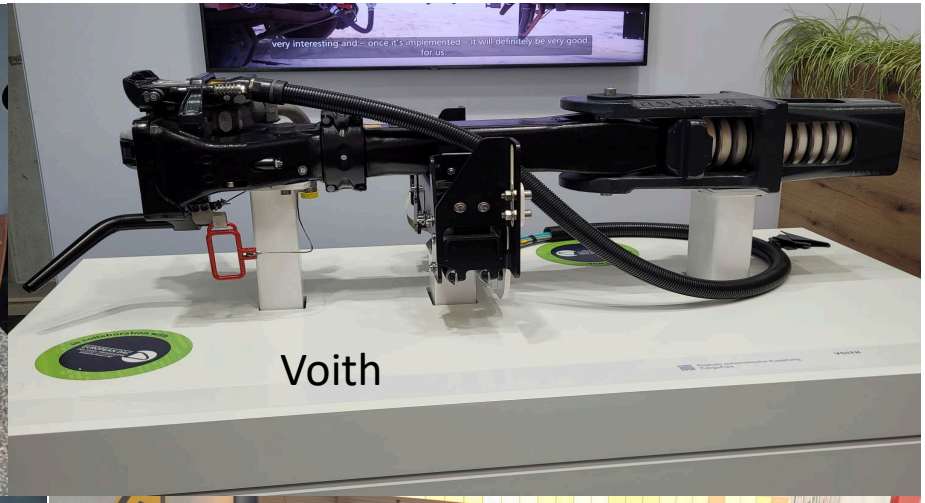
- Central coupler, variant of the Scharfenberg coupling system
- Traction / Compression forces without deformation:
  - 1.000 kN of tensile forces and
  - 2.000 kN of compression forces
- Electric connection: 400 Vac.

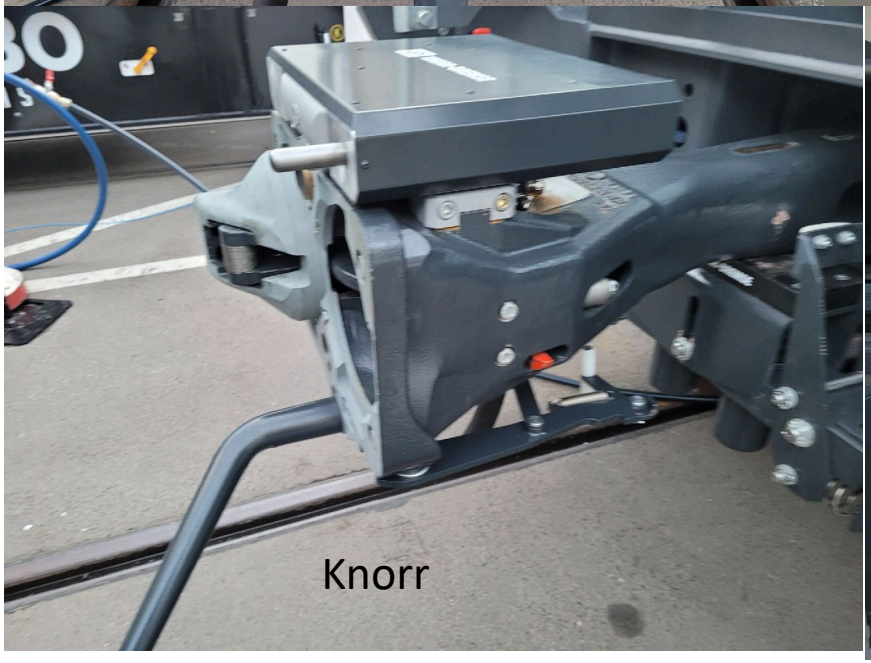
DAC is intended to be fitted in new and existing wagons (500.000 freight wagons to be retrofitted. Intermediate steps are foreseen DAC Ready and freight wagons with one DAC in one side and one UIC manual coupling in another.

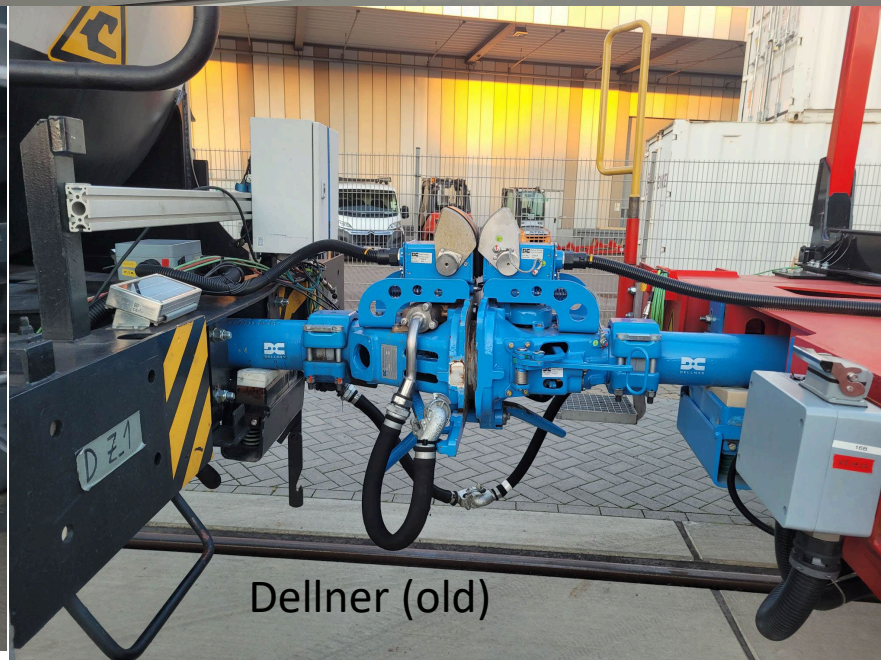
Freight locomotive will be retrofitted with hybrid couplers (compatible both with DAC and UIC coupling system)

→ See detailed presentation from EDDP/ERJU

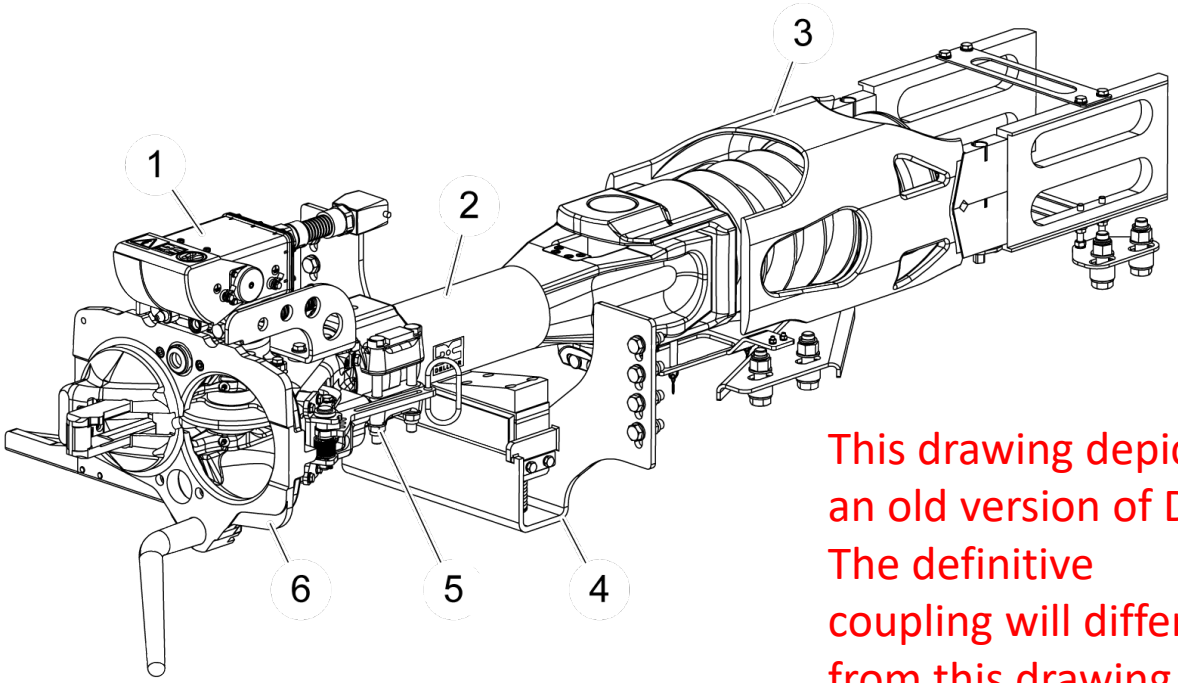
Presentation of DAC
Innotrans 2022: The DAC edition







Schema of DAC

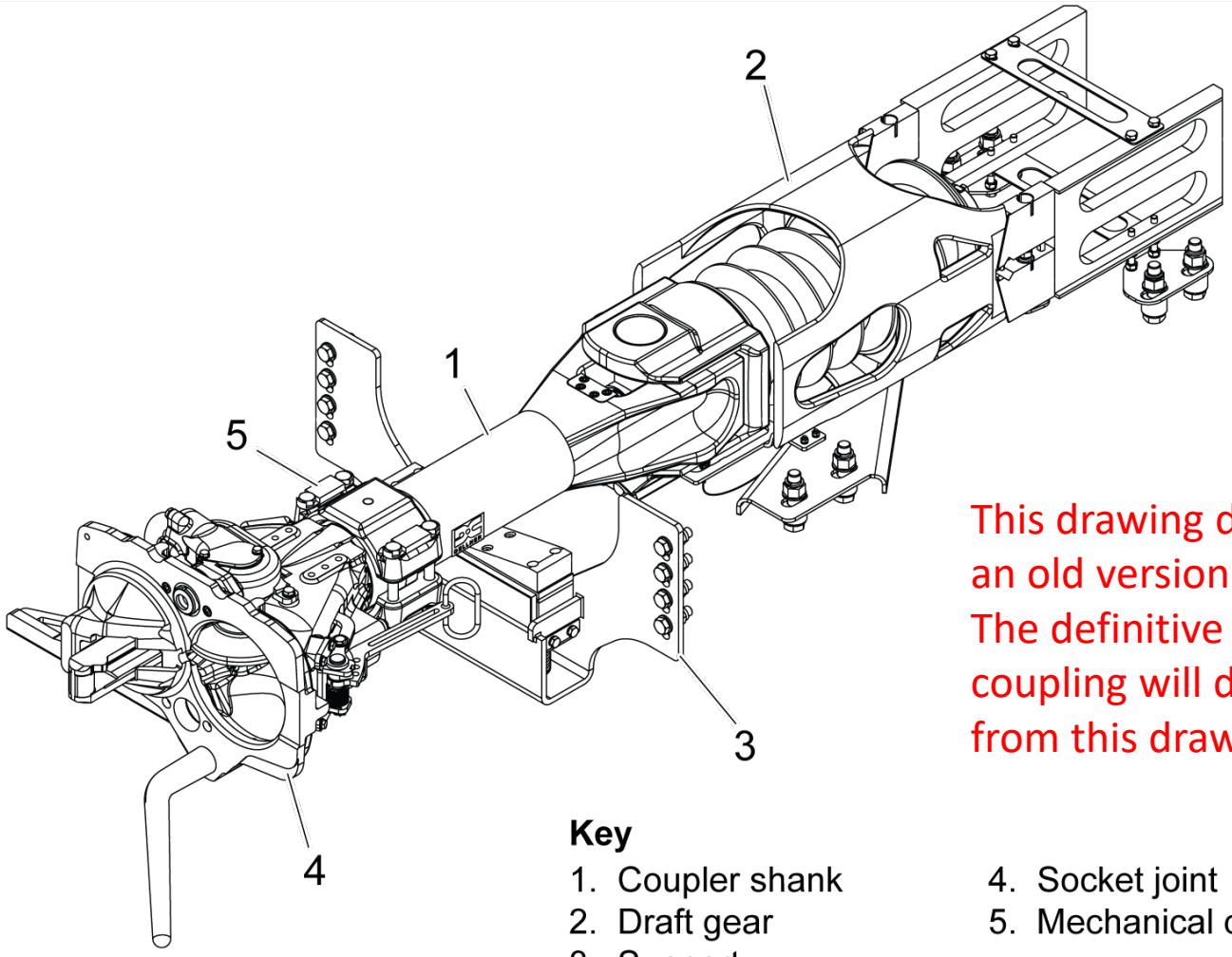


This drawing depicts an old version of DAC. The definitive coupling will differ from this drawing.

Key

1. Electrical coupler complete
2. Coupler shank
3. Draft gear
4. Support
5. Socket joint
6. Mechanical coupler complete

Schema of DAC



This drawing depicts an old version of DAC. The definitive coupling will differ from this drawing.

Key

1. Coupler shank
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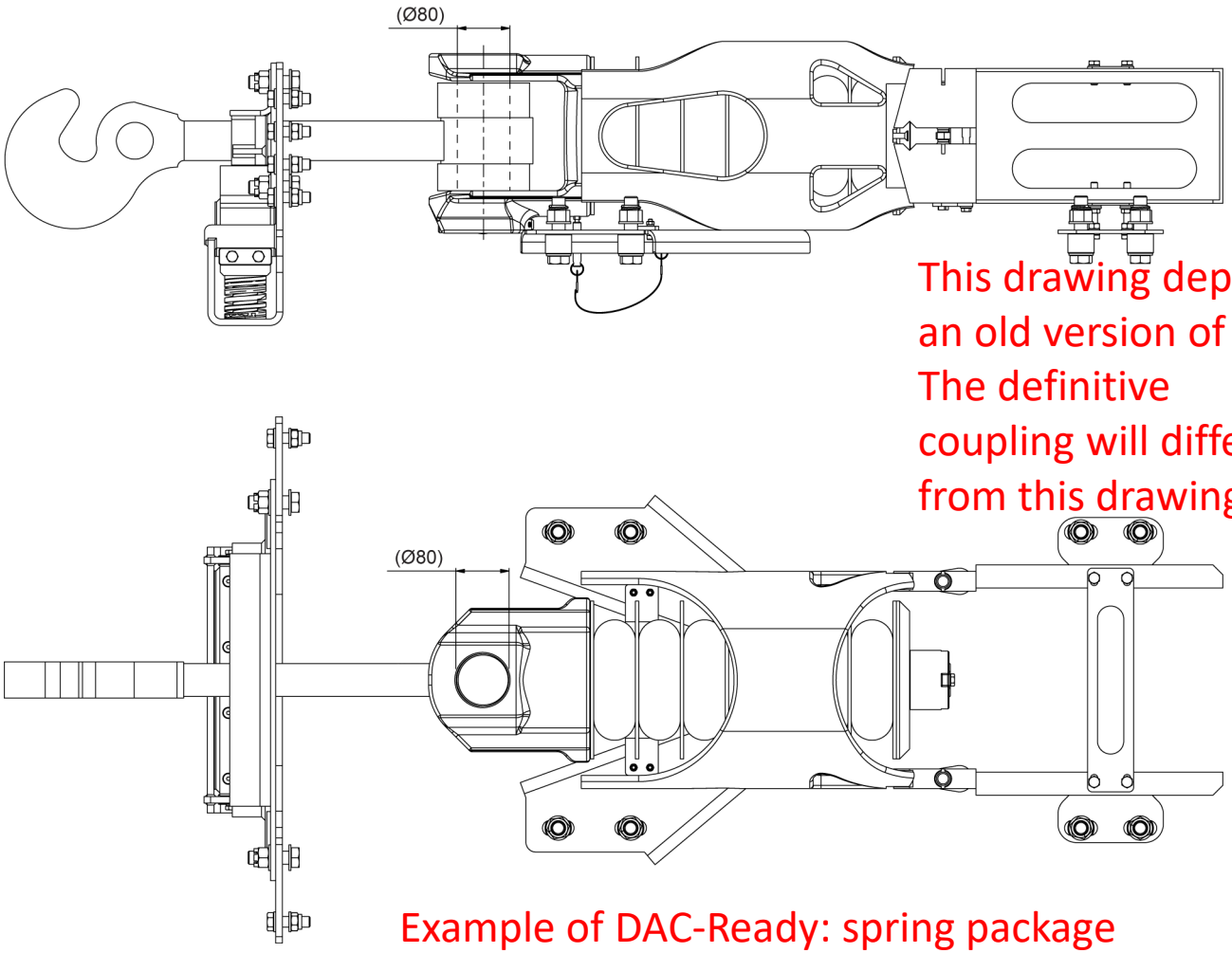
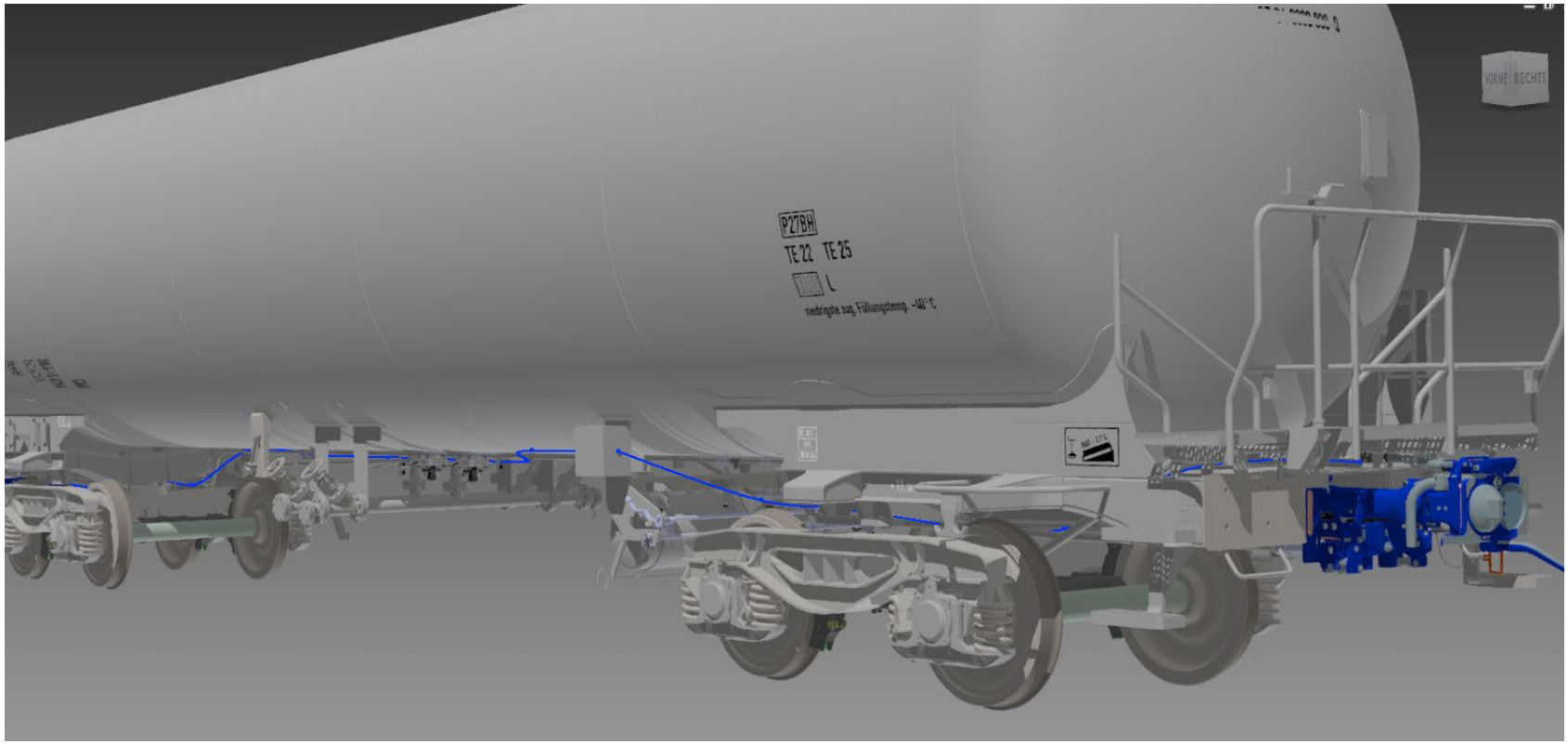
Schema of DAC



This drawing depicts an old version of DAC. The definitive coupling will differ from this drawing.

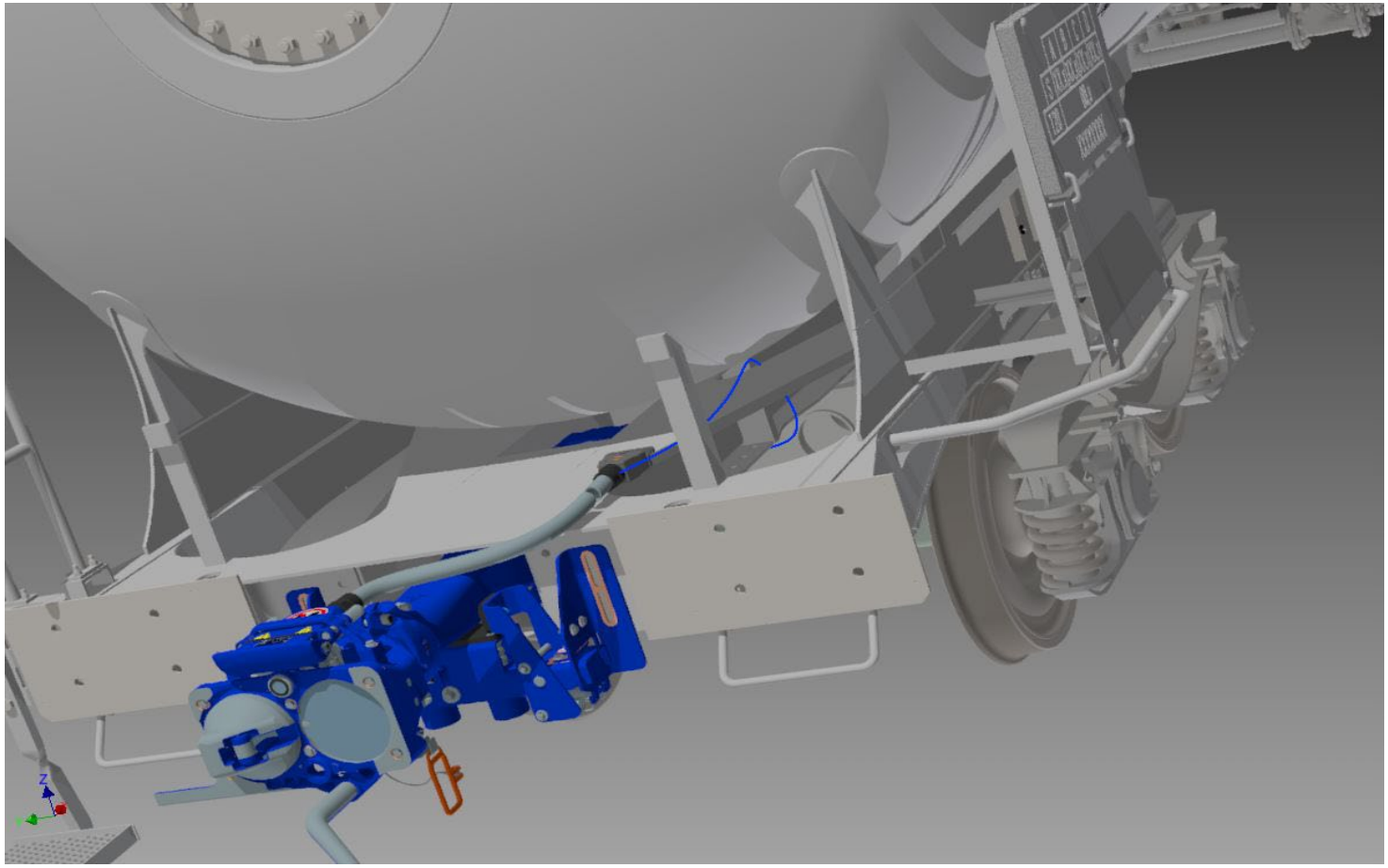
Example of DAC-Ready: spring package and UIC draw gear (note: the UIC buffers will be still mounted in the wagon in the DAC Ready phase)

Schema of DAC in a tank wagon (including electronic box and cabling)



This drawing depicts a first draft of DAC. The definitive coupling and the layout of all the elements (cabling, etc) may differ from this drawing.

Schema of DAC in a tank wagon (including electronic box and cabling)



This drawing depicts a first draft of DAC. The definitive coupling and the layout of all the elements (cabling, etc) may differ from this drawing.

Changes in the last available draft of the TSI

TSI WAG

- Basic drafting of the TSI text
- Basic drafting of ERA Technical Document (ERA TD), containing the detailed specification of the DAC for freight wagons. This document will be referred to in the TSI WAG and will be mandatory, at the same level as the TSI WAG.
- The ERA TD contains requirements and conformity assessment procedures both for the DAC at IC level and for the freight wagons, in order to ensure the safe integration of the Interoperable Constituent (IC) in both new and existing freight wagons.
- **So far, geometrical, mechanical and pneumatical requirements are defined both at IC level and freight wagon level.**
- Requirements relevant for operation that can be assessed at vehicle or IC level are also included.

TSI LOC&PAS

- Basic drafting of the TSI text
- Basic drafting of ERA TD, containing the detailed specification of the DAC for freight locomotives and the hybrid coupling system for locomotives. This document will be referred to in the TSI LOC&PAS and will be mandatory, at the same level as the TSI LOC&PAS.
- The ERA TD contains requirements and conformity assessment procedures both for the DAC and the hybrid coupling system at IC level and for the freight locomotives, in order to ensure the safe integration of the IC in both new and existing freight wagons. Regarding the DAC specifications, it mirrors the ERA TD referred to in the TSI WAG.
- **So far, geometrical, mechanical and pneumatical requirements are defined both at IC level and locomotive level.**

Remaining aspects to be covered in the TSI

Remaining technical aspects, such as:

- Technical requirements related to operation. This should include at least the required DAC positions/functional states, such as ‘Decoupled and ready for coupling’, ’Buffer position’, ‘Decoupled and not ready for coupling’, ‘Coupled and locked’ and ‘Coupled and unlocked’.
- These positions and their respective transitions should be clearly defined in the TSI, as well as new operational aspects such as directionality of the freight wagon.
- EP-brake
- Requirements for the compatibility with train detection systems
- Communication system
- Longitudinal compressive forces
- Maximum height of the DAC
- Dangerous goods related aspects, including but not limited to passive safety and the risk of sparking.
- Reliability and health and safety aspects

Remaining aspects to be covered in the TSI

- Migration aspects:
  - DAC-readiness concept.
    DAC-readiness means a set of changes brought to the freight wagons that are intended to be done without reauthorisation before the DAC is actually fitted. This would allow to check compatibility of the existing fleet with DAC, and greatly reduce the time window in which two systems (DAC and manual UIC) are simultaneously operated in the EU. The DACreadiness concept needs to be described in the Technical Document referred to in the TSI WAG or at least in the application guide of the TSI WAG.
  - Definition of a generic risk assessment covering all aspects of the retrofitting for the maximum possible amount of freight wagon types (including DAC-readiness).
  - Deadlines for authorising new freight wagons/locomotives with manual coupling and to retrofit existing freight wagons/locomotives
  - Introduce dedicated definitions for migration aspects (e.g, block trains)
  - Exempted rolling stock
- Assessment of the existing fleet intended for retrofitting, e.g. regarding structural strength, etc.
- Completion of the Impact assessment following the user's consultation
- Definition of Interoperability constituents 'DAC' and 'hybrid coupler' in the TSI LOC&PAS

Usage of DAC for TDG services – Identification of requirements and proposal of new wording

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Principle approach agreed at JCGE #5

- **Harmonized description of risk control measures in accordance with CSM ASLP regulation**
- **Respective content of RID / CSM ASLP / TSIs:**
  - RID: High level safety objective
  - CSM ALSP Regulation : List of Reference Risk Control Measures (RCMs) including RID safety measures
    - TE22 and TE25 safety measures
    - Derailment prevention and mitigation functions (DPF, DDF, DDAF)
    - DAC related safety measures
    - Any other risk control measures, as needed for harmonized reference
  - Technical Specifications for Interoperability: Functional and Operational requirements
- **RID and TSIs will refer to the list of reference RCMs, where needed.**

Note: JCGE (Joint Coordinating Expert Group) is a meeting for coordination of TDG and Railway regulators chaired by DG Move and OTIF

Future CSM ASLP (excerpt)
Risk Control Measure description

Dataset for reporting the describing of a 'Risk Control Measure'

1. General information

Reporting Entity	Operator ID
Risk Control Measure	RCM ID: RCM Name:
General description of risk control measure aim and expected functioning of the RCM:	Type of RCM (*): □ Reduction of the frequency of occurrence of event(s) □ Reduction of potential consequences (*) Tick the applicable box(es) Aim of the RCM: (free text) In accordance with Part D of Annex I–, the applicable RCMF code(s) and a summary description of the applicable functions:

Code of applicable RCM function(s)	Name	Short description	technical documentation (optional)
(code)	(free text)	(free text)	(reference)

(add rows if needed)

Note: Operators shall describe the applicable RCM functions. Optionally, a more detailed description of the subsystems containing the different RCM functions can be provided using a reference to technical documentation.

Other technical documentation reference (if applicable, optional):

(free text)

Note: Content of reported free text shall be in accordance with Part B, Section 3.2 of Annex IV.

2. Description of resulting events linked to an RCM

(in case multiple events, please provide this information for each event)

	Resulting event(s)	
Normal RCM functioning, as planned (prevented or mitigated resulting events)	Reference(s) of each possible resulting Event type (in accordance with the coding set out in Appendix 1 to Annex I)	(if not referenced yet) Name of the event Definition of the event Category of the event
In case of RCM failure (used only in case of failure reporting)	Reference(s) of each possible resulting Event type (in accordance with the coding set out in Appendix 1 to Annex I)	(if not referenced yet) Name of the event Definition of the event Category of the event

3. Expected effectiveness

Expected effectiveness ratio	Ratio of expected number of RCM failure per number of triggering events	(in %)

4. Management of Risk Control Measures

Provision type:	Description how provision is realized
Risk analysis (see 3.2.2.a *[Please provide a full reference.]*)	(References of relevant Risk assessments in SMS)
Measuring/Monitoring (see 3.2.2.c *[Please provide a full reference.]*)	(Leading indicators, and/or lagging indicators)
Resource Management (see 3.2.2.d *[Please provide a full reference.]*) Expected - Life cycle costs	Setting/Operation/Maintenance

Setting-up	Operation	Maintenance
€ …	€ … per year	€ … per year

Application example with RID requirements on ‘Protective Shields’ 1/3

<table>
<tr><td colspan="2">1.→General·information¤</td></tr>
<tr><td>Reporting·Entity¤</td><td>RID·Committee¤</td></tr>
<tr><td>Risk·Control·Measure¤</td><td>RCM·ID:· → RID_0001¶
RCM·Name:→Protective·Shield¤</td></tr>
<tr><td>General· description· of· risk·control·measure·aim· and· expected· functioning·of·the·RCM:¤</td><td>Type·of·RCM·(*):·↵
X:·Reduction·of·potential·consequences¶
¶
Aim·of·the·RCM:¶
To·limit·damage·to·the·shell·of·tank-wagons·carrying·dangerous·goods·when·buffers·override.¶
¶
<table>
<tr><td>Code·of· applicable· RCM· function(s)¤</td><td>Name·¤</td><td>Short·description·¤</td><td>technical·documentation·¤</td></tr>
<tr><td>RCMF.1.0¤</td><td>TE25-PS¤</td><td>The·RCM·does·not·incorporate·a·detect·function.¤</td><td>N/A¤</td></tr>
<tr><td>RCMF.2.0¤</td><td>TE25-PS¤</td><td>The·RCM·does·not·incorporate·a·diagnose·function.¤</td><td>N/A¤</td></tr>
<tr><td>RCMF.3.1.¤</td><td>TE25-PS¤</td><td>The·mere·presence·of·the·shield·mitigates·the·risk·of· puncture·of·the·tank·shell,·or·the·rupture·of·tank· equipment·potentially·impacted·by·buffers· overriding·from·a·collision·with·other·wagons.¶
link·to·public·documentation¶
¤</td><td>Applicable·Specifications:¶
TSI·WAG·¶
(TE25·(d)·and·TE25·(e))¶
¤</td></tr>
</table>
Note:·When·impacted,·the·protective·shield·may·be·damaged·and·RID·provision·1.4.3.5(b)·shall·be·applied.¤</td></tr>
</table>

Example with ‘Protective Shields’ 2/3

2.→Description·of·resulting·events·linked·to·an·RCM¶ → *(in·case·multiple·events,·please·provide·this·information·for·each·event)*¤		
¤	Resulting·event(s)·¤	
Normal· RCM· functioning,· as· planned (prevented· or· mitigated· resulting·events)¤	Reference(s)·of·each·possible·resulting·Event·type·¶ Mitigated·events:·¶ A.1.3·**(Collision·of·one·or·more·rail·vehicle·with·another·rail·vehicle)**¶ ¶ Prevented·events:·A.6.4·**(Other)**·¶ –· **Rupture· of· the· tank-shell· and/or· tank· equipment· followed· by· a· Loss· of· Dangerous·Goods·substance**¶ ¤	(if·not·referenced·yet)¶ Name·of·the·event¶ Definition·of·the·event¶ Category·of·the·event¤
In·case·of·RCM·failure¶ ¤	Reference(s)·of·each·possible·resulting·Event·type·¶ A.6.4·**(Other)**·¶ –· **Rupture· of· the· tank-shell· and/or· tank· equipment· followed· by· a· Loss· of· Dangerous·Goods·substance**¶ ¤	(if·not·referenced·yet)¶ Name·of·the·event·¶ Definition·of·the·event¶ Category·of·the·event¤

Example with 'Protective Shields' 3/3

3.→Expected·effectiveness¤		
Expected· effectiveness· ratio¤	Ratio·of·expected·number·of·RCM·failure·per·number·of·triggering· events¤	(in·%)·¤

¶

4.→Management·of·Risk·Control·Measures¤	
Provision·type:¤	Description·how·provision·is·realized¤
Risk·analysis·¤	(References·of·relevant·Risk·assessments)¶ In·accordance·with·RID·experts'·analysis,·this·RCM·is·one·of·the·possible·measures·which·can·be·applied·to·comply·with·RID·TE25·for·the·carriage·of·applicable·UN·numbers.¶ ¤
Measuring/Monitoring·¤	(Leading·indicators,·and/or·lagging·indicators)¶ An·estimator·of·this·RCM·effectiveness·could·be·approached·by·the·ratio·between·the·number·of·A6.4·event·type· as·indicated·above·in·part·2·and·the·number·of·A1.3·events·involving·TDG·wagons·equipped·with·this·RCM.·¶ It·could·also·be·estimated·with·field·experiments.¤
Resource· Management·· Expected·-·Life·cycle· costs¤	Setting/Operation/Maintenance¶

Setting-up¤	Operation¤	Maintenance¤
€·…¤	€·…·per·year¤	€·…·per·year¤

Next steps (1/3)

- **Risk Analysis**

Need to identify the risk control measures that would be necessary to prevent or mitigate the potential effect of energy supply and usage of DAC on the carriage of dangerous goods

1) in normal operation,
2) in case of accident

Current hazards considered by RID concerning railway operations (potentially related to DAC) - (not exhaustive)

- puncture of tank shells shall be prevented until a certain level of impact
  - in case of shunting,
  - in case of collision or derailment,

- protection against electric sparks (not explicitly covered in RID / no explicit risk control measure)

Current assumption: sparks are existing and unavoidable in normal railway operations, thus current containments of the dangerous substances and related operation requirements shall prevent ignition

-> Will the electric energy in freight wagons, and the DAC in particular change this situation?
-> Could DAC-related sparks be allowed without new risk control measures?
-> What should be the operational measure to fill/unfill tank with highly flammable substances
-> What should be the operational measure to load/unload explosives
-> Is there a specific DAC operation mode for TDG services?, for which operation type/locations?

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Next steps (2/3)

- **Definition of needed Risk Control Measures (not exhaustive)**

-> (Existing ‘buffer-related’ / ‘collision-related’ measures)

Described in accordance with CSM ASLP Regulation and integrated in the List of Reference RCMs

-> (Energy supply / DAC related measures, if any)

As a result of a thorough risk analysis, identified and needed risk control measures are also described in accordance with CSM ASLP Regulation and integrated in the List of Reference RCMs

Next steps (3/3)

- **Amendment of RID, as needed, based on the Risk Analysis and RCM description**

-> High level safety objectives:
For example

1) Measures to prevent or mitigate the effect of collisions

- RID requirements with reference to the List of Reference RCMs
- Application scope
- Transition measures during migration

2) Measures to prevent or mitigate the effect of derailments

- …

3) Measures to prevent or mitigate the effect of energy supply failures

- …

Inputs received before the meeting

CER/UIP inputs:

- Possibility to specify requirements for wagons intended for the transport of dangerous goods in a dedicated place holder as e.g. WAG TSI Appendix

Justification:

- Provide wagon manufacturers with all necessary requirements for wagons only (tank requirements to remain in RID)
- Promoting in WAG TSI the necessary importance of requirements for wagon intended for the transport of dangerous goods
  - 130kJ is assessed as relevant value for the design of DAC energy absorption elements.
  - Sector work further necessary in EDDP FA.5 setting accident scenarios and analyzing crush scenarios, in particular with regards to the speed and the triggering the force.
  - ATEX requirements for DAC (currently category 2 zones 1 and 21) to be further (re) evaluated based on end users requirements as manufacturing sites (e.g. refineries). ATEX requirements not needed previously (before DAC) as neither electrical nor electronical onboard equipments of wagons.

NSA BE input → see e-mail

Conclusion, Discussion and next steps

Conclusions:

Working methodology agreed and analysis started with existing RID requirements

Next meeting Tentative agenda:

- Continue with the analysis, taking into account the results of the tank and vehicle technology working group
- Identify specific risks related to DAC

Date for next TEAMS meeting from 25th November to 2nd December, to be agreed in Doodle.

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Annex II

Workshop on harmonization of requirements regarding dangerous goods in TSI WAG and RID, October 12, 2022.

Informal document from Belgium, amended during the workshop (working document)

1) Identify clauses of RID in the scope of TSI WAG

Belgium produced the following table in relation with the point "*Identify clauses of RID in the scope of TSI WAG*" of the agenda. This document was reviewed during the ERA workshop with the contributions of the participants. It is to be considered as a working document.

- First column contains existing rules of the RID 2021/2023.

Existing rules in RID	Hazard to be covered and safety objective	Is this rule technically possible for wagon with DAC? (Specify the phase and justify)	Is this rule relevant for wagon with DAC? (Specify the phase and justify)	Is it sufficient to keep the rule to achieve the same safety target? If no, add alternative requirements.
6.8.2.1.29 The **minimum distance** between the headstock plane and the most protruding point at the shell extremity on tank-wagons shall be **300 mm**.	Granting a minimum distance between UIC buffer and tank in case of collision with buffer overriding, to prevent the buffer from puncturing the tank.	Yes, for DAC-Ready Justification: UIC buffers are still fitted Yes, for fully retrofitted freight wagons compliant with this distance Yes, for new freight wagons fitted with DAC	Yes, for DAC-Ready. No, for fully retrofitted freight wagons (compliant or not). No, for new freight wagons fitted with DAC	Yes, as far as no changes are introduced in DAC ready.
For transport of gas				
6.8.3.1.6 "**Tank-wagons and battery-wagons shall be fitted**	Avoid excessive stress in the tank	Spring packages of up to 140 kJ can be	To be further analysed, for	To be further analysed.

with buffers with a minimum energy absorption capacity of 70 kJ. This provision does not apply to tank-wagons and battery-wagons fitted with energy absorption elements in accordance with the definition in 6.8.4, special provision TE 22.”	when hump shunting at a maximum speed of 12 km/h. This stress caused cracks in the supports of the screws, as well as mechanical fatigue in the tank itself (old tanks) Coming from UIC 573. This leaflet required C-type buffer with a capacity of 70 kJ. This was an early stage of implementation of high energy absorption buffers for hydraulic systems.	introduced and leave space to a passive safety device if needed. ➔ To be confirmed by manufacturer. In this case, a special hydraulic system is needed to achieve the 140 kJ. ➔ This requirement may not be needed for new and existing freight wagons, depending on the tank design and its fixation system to the carbody. The absorption capacity of the standard DAC (75 kJ) may be sufficient.	both DAC-Ready, fully retrofitted and new freight wagons fitted with DAC	

For transport of - **gases of Class 2 with classification codes containing the letter(s) F, T, TF, TC, TO, TFC or TOC** - **substances of classes 3 to 8 carried in the liquid state and to which tank code L10BH, L10CH or L10DH, L15CH, L15DH or L21DH is assigned**				
6.8.4/TE22 In order to reduce the extent of damage in the event of a collision shock or accident, each end of tank-wagons for substances carried in the liquid state and gases or battery-wagons shall be capable of absorbing at least 800 kJ of energy by means of elastic or plastic deformation of defined components of the subframe or by means of a similar procedure (e.g. crash elements) … The requirements of this special provision are deemed to be met by **tank-wagons with an automatic coupling device** equipped with **energy absorption elements capable of absorbing at least 130 kJ at each end of the wagon**[1].	— limiting deceleration — maintaining structural integrity of the tank — reducing the risk of overriding — reducing the risk of derailment	No answer today. We think it could be possible on new wagon design (chassis deformation in the area of the attachment of the DAC to the chassis). Yes	Yes Yes	Yes No, compared with the 800 kJ with standard crash-buffers ➔ Need to be discuss (see point 12[2] of document OTIF/RID/CE/GTP/2022/6 produced by UIP in the 14th Session of the RID Committee of Experts' standing working group)

For transport of: - **gases of Class 2 with classification codes containing the letter(s) T, TF, TC, TO, TFC or TOC, and** - **for liquids of classes 3 to 8 to which tank code L15CH, L15DH or L21DH is assigned**				
TE 25				
TE25 (a) Device to protect against the overriding of buff-ers. …. The device to protect against the overriding of buffers shall withstand a vertical force (up-wards or downwards) of 150 kN. **OR**		To our knowledge, there is presently some development, such as what is being done in the USA, as the chosen DAC is limiting the possibility of vertical movements	Yes	Yes Additional consideration: if the DAC withstands a vertical force of 150 kN, can we consider that TE 25 (A) is fulfilled? If yes, TE25 could be marked on the tank (and TE25 (b), (c) or (d) will not be necessary). Is it correct?
TE25 (b) Increasing the wall thickness of the tank ends or using other materials with a greater energy ab-sorption capacity In this case, the wall thickness of the tank ends shall be at least **12 mm**. However, the wall thickness of the ends of tanks for the carriage of gases UN 1017 chlorine, UN 1749 chlorine trifluoride, UN 2189 di-chlorosilane, UN 2901 bromine chloride and UN 3057		Yes	Yes	Yes

trifluoroacetyl chloride shall in this case be at least **18 mm**. **OR**				
TE25 (c) Sandwich cover for tank ends **OR**		Yes	Yes	Yes
TE25 (d) Protective shield at each end of the wagon		Yes	Yes	Yes

[1] Originally this provision was foreseen for Russian wagon which are equipped with protective shield at each end of the wagon.
[2] UIP proposes that the last paragraph of special provision TE 22 be worded as follows or that agreement be given to the drafting of some new wording.
"The requirements of this special provision are deemed to be met by tank-wagons with an automatic central coupling device equipped with energy absorption elements capable of absorbing at least 130 kJ at each end of the wagon and whose coupling device enables the safe catching, locking and securing of wagons in accident scenarios at impacts > 12 km/h. Alternatively, equipment shall be provided on wagons to limit damage caused by the overriding of buffers in accordance with special provision TE 25 (e)."

2) Propose high level safety objectives to be included in RID

In relation with the last point of the agenda "Propose high level safety objectives to be included in RID", there is indeed a principle agreement on the aim of limiting RID to protection objectives and transferring the technical requirements for wagons to the TSIs or to standards.
In the document RID_CE_GTP_2021_INF_06 in the 13th Session of the RID Committee of Experts' standing working group, UIP talks about 3 levels of protection in relation to different risks concerning the sub-stances to be carried:

- Level 1: normal protection. Should apply to all dangerous goods.

- Level 2: Measures that are suitable to reduce the risk of buffers overriding (e.g. crash buffers or devices to protect against the overriding of buffers). These measures apply to those substances to which special provision TE 22 is currently as-signed.

- Level 3: Measures that are suitable to reduce the damage caused by the overriding of buffers (e.g. protective shield, strengthened tank ends or sandwich cover). These measures apply to all substances to which special provision TE 25 is currently assigned.

It would be logical to determine the protective objective in RID in terms of *tank resistance.* For example, the resistance of the tank in case of an impact by a well defined object at a well defined speed. But for the time being, no concrete proposition in that direction was made.