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

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RID: **11th Session of the RID Committee of Experts' standing working group**
(Vienna, 25 to 29 November 2019)

Subject: **Key differences between RID and GOST requirements for the manufacture, equipment, design and testing of tank-wagons**

Proposal transmitted by the Russian Federation

1. In invitation letter RID-19013-CE-GTP11 dated 24 September 2019, the OTIF Secretariat informed the Member States and organisations that under agenda item 7, the representative of Russia would provide information on the progress of work on the new Chapter 6.20 of SMGS Annex 2 (Construction and testing provisions for 1520 mm gauge tank-wagons) and address the questions that this work has raised in terms of the construction and testing provisions for standard gauge tank-wagons. The Secretariat has now received the relevant presentation from the Russian Federation and is sending it to representatives of the Member States and organisations in the annex to this document.

CENTRE FOR
TRANSPORTATION
TECHNOLOGY

Key differences between RID and GOST requirements for the manufacture, equipment, design and testing of tank-wagons

A. Differences in design and operation requirements

- weld strength factor λ (6.8.2.1.23);

- conditions for filling tank-wagons with Class 2 goods (6.8.3.4.4);

- periodic inspections of tank-wagons (6.8.2.4, 6.8.3.4);

- criteria for assessing the impact strength of the tank-wagon shell material (6.8.5);

- electrical conductivity of the structure (6.8.2.1.27);

B. Additional design requirements

- energy absorption elements for tank-wagons with automatic coupling device (6.8.4 TE 22);

C. Clarification of current requirements

- special provision TE 14 (thermal insulation) (6.8.4 TE 14);

D. Questions on current requirements

- heat treatment of material for manufacturing of welded shells (6.8.2.1.10, 6.8.2.1.11, 6.8.2.6.1);

- calculation of the minimum thickness of shell walls (6.8.2.1.13, 6.8.2.1.16, 6.8.2.1.17, 6.8.2.4.1);

- material of the shell for transportation of strong nitric acid UN 2031 (with a nitric acid content of more than 70%) (6.8.4 TC 6).

A. Differences in design and operation requirements

RID requirements	Requirements of regulatory documents of the Commonwealth of member states (1520 mm gauge)	Proposals for correcting the Agreement on International Goods Transport by Rail (chapter 6.20 - requirements for tank-wagons, 1520 mm gauge)
A.1 Weld strength factor (6.8.2.1.23):		
- λ= 0.8, with non-destructive checks of 10% of the total length of all types of welds;	- λ = 0.65 – 0.90, depending on the type of weld, with non-destructive checks from 10% to 50% of the total length of all types of welds;	- λ = 0.65 – 0.80, depending upon the type of weld, with non-destructive checks from 10% to 50% of the total length of all types of welds;
- λ= 0.9, with non-destructive checks of 100% of the total length of all the longitudinal welds and 25% of the total length of all other welds;		- λ = 0.9, with non-destructive checks of 50% of the total length of all the longitudinal welds and from 10% to 50% of the total length of all other welds;
- λ = 1.0, with non-destructive checks of 100% of the total length of all types of welds.	- λ = 0.8 – 1.0, depending on the type of weld, with non-destructive checks of 100% of the total length of all types of welds.	- λ = 0.8 – 1.0, depending on the type of weld, with non-destructive checks of 100% of the total length of all types of welds.
A.2 Conditions for filling tank-wagons with Class 2 goods (6.8.3.4.4):		
- the filling degree has been set: the maximum allowable mass of the goods per litre of the tank-wagon shell capacity;	- the filling degree has been set: the maximum allowable mass of the goods per litre of the tank-wagon shell capacity; *or* - the filling level has been set: the permissible filling level limits for the shell;	Without correcting
- in order to avoid the shell being overfilled with the goods at rapid changes of temperature, for each shell, the capacity shall be determined by weighing or measuring the volume of water filling the shell.	No requirements	- in order to exclude the shell being overfilled with the goods at rapid changes of temperature: a) when loading in compliance with the filling standard, for each shell, the capacity shall be determined by weighing or measuring the volume of water filling the shell; b) when loading in compliance with the filling level, the filling temperature should exceed the minimum permissible value.

A. Differences in design and operation requirements

RID requirements	Requirements of regulatory documents of the Commonwealth member states (1520 mm gauge)	Proposals for correcting the Agreement on International Goods Transport by Rail (chapter 6.20 - requirements for tank-wagons, 1520 mm gauge)
A.3 Periodic inspections of tank-wagons (6.8.2.4, 6.8.3.4):		
- tank-wagons for goods of all classes shall be inspected no later than every 8 years;	- tank-wagons for goods of all classes - it is recommended to inspect them at least every 8 years;	- tank-wagons for goods of all classes shall be inspected no later than every 8 years;
- tank-wagons for refrigerated liquefied gases shall be inspected after 8 years of operation, and then every 12 years.	- vacuum insulated tanks - it is recommended to inspect them at least every 10 years;	- tank-wagons for refrigerated liquefied gases shall be inspected after 8 years of operation, and then every 12 years;
	- tank-wagons for liquefied gases - it is recommended to inspect them at least every 10 years.	- tank-wagons for liquefied gases shall be inspected at least every 10 years.
A.4 Criteria for assessing the impact strength of the tank-wagon shell material (6.8.5):		
- for base metal $KCV^{-20} \geq 34\ \mathrm{J/cm^2}$	- for base metal $KCV^{-60} \geq 27\ \mathrm{J/cm^2}$ or $KCU^{-60} \geq 29\ \mathrm{J/cm^2}$	- for base metal $KCV^{-60} \geq 27\ \mathrm{J/cm^2}$ or $KCU^{-60} \geq 29\ \mathrm{J/cm^2}$
- for welds $KCV^{-20} \geq 34\ \mathrm{J/cm^2}$	- for welds $KCV^{-60} \geq 20\ \mathrm{J/cm^2}$ or $KCU^{-60} \geq 30\ \mathrm{J/cm^2}$	- for welds $KCV^{-60} \geq 20\ \mathrm{J/cm^2}$ or $KCU^{-60} \geq 30\ \mathrm{J/cm^2}$
A.5 Electrical conductivity of the structure (6.8.2.1.27):		
- all parts of tank-wagons shall be linked to the chassis by means of an electrical connection, and shall have devices for electrical earthing;	- the electrical resistance between all parts of the tank-wagon, from the roof to the rails, shall not exceed 0.15 ohm;	- the electrical resistance between all parts of the tank-wagon (from the roof platform to the rails) shall not exceed 0.15 ohm;
- applicable to tank-wagons for: a) liquids with $t_{\text{flash point}} \leq 60$℃ ; b) flammable gases; c) UN 1361 carbon; d) UN 1361 carbon black.	-applicable to all tank-wagons for transportation of solidifying, liquid, bulk goods and liquefied gases.	- applicable to tank-wagons for goods of all classes.

B. Additional design requirements

RID requirements	Requirements of regulatory documents of the Commonwealth member states (1520 mm gauge)	Proposals for correcting the Agreement on International Goods Transport by Rail (chapter 6.20 - requirements for tank-wagons, 1520 mm gauge)
B.1 Power capacity of energy absorption elements of tank-wagons (6.8.4 TE 22):		
- tank-wagons for goods with TE22 shall be equipped with a draft gear with a power capacity of not less than 130 kJ.		- tank-wagons for goods with TE22 - the nominal power capacity shall not be less than 140 kJ;
	- tank-wagons for goods of classes 1, 2, 6, 7 - the nominal power capacity shall not be less than 140 kJ.	- tank-wagons for goods of Class 2 - the nominal power capacity shall not be less than 140 kJ;
	- tank-wagons for goods of classes 3, 4, 5, 8, 9 – the nominal power capacity shall not be less than 100 kJ.	- tank-wagons for goods of all classes (except for Class 2 and goods with TE22) - the nominal power capacity shall not be less than 100 kJ.

GOST 32913-2014:

Parameter name	Draft gear class		
	T1	T2	T3
Static power capacity, not less than	30	40	60
Nominal power capacity, not less than	70	100	140
Maximum power capacity, not less than	90	130	190

C. Clarification of current requirements

RID requirements	Requirements of regulatory documents of the Commonwealth member states (1520 mm gauge)	Proposals for correcting the Agreement on International Goods Transport by Rail (chapter 6.20 - requirements for tank-wagons, 1520 mm gauge)
C.1 Special provision TE14 (thermal insulation) (6.8.4 TE 14):		
- The ignition temperature of thermal insulation: $t_{ign.}^{t.ins.} \geq t_{max}^{tank} + 50℃$, where t_{max}^{tank} is the maximum temperature for which the tank is designed, ℃.		- The ignition temperature of thermal insulation: $t_{ign.}^{t.ins.} \geq t_{max}^{shell} + 50℃$ and / or $t_{ign.}^{t.ins.} \geq t_{max}^{heat.} + 50℃$, where t_{max}^{shell} is the maximum calculation temperature of the shell, ℃ ; $t_{max}^{heat.}$ max is the maximum calculation temperature of the construction element of the heating system, ℃ . Note: this requirement is relevant for tank-wagons equipped with a heating system and thermal insulation, for example, tank-wagons for transportation of molten sulphur (UN 2448) and liquid pitch (UN 2810).

D. Questions on current requirements

D.1 Heat treatment of material for manufacturing of welded bodies

p. 6.8.2.1.10 – it is forbidden to use water-quenched steel for manufacturing welded steel shells;

p. 6.8.2.1.11 – it is forbidden to use steel with ratios of Re/Rm exceeding 0.85 for manufacturing of welded tanks:
Re - apparent yield strength for steels having a clearly-defined yield point (guaranteed 0.2% proof strength for steels with no clearly-defined yield point, 1% for austenitic steels);
Rm – tensile strength.

p. 6.8.2.6.1 – compliance with the requirements of subsection 6.8.2.1 is proved by compliance with standard EN 14025;

p. 4.1 EN 14025 – the tank material shall comply with the requirements of EN 13445-2;

In **EN 13445-2**, it is allowed to use steel in various delivery conditions:

- after normalization (EN 10028-3);
- after thermomechanical treatment (EN 10028-5);
- after quenching and tempering (EN 10028-6).

Table E.1-1 — European Standards for steels and steel components for pressure purposes

Product form	General requirements	Room temperature grades [a]	Elevated temperature grades	Fine grain steels			Low temperature grades	Stainless steels
				Normalised	Thermo-mechanically treated	Quenched and tempered		
Plate and strip	EN 10028-1	—	EN 10028-2	EN 10028-3	EN 10028-5	EN 10028-6	EN 10028-4	EN 10028-7

Proposal: to allow manufacturing of welded shells from steel after heat treatment (for example, after normalization or quenching with tempering).

D.2 Calculation of the minimum thickness of the shell walls

- p. 6.8.2.1.17 – the minimum shell thickness (e, mm) is determined on the basis of the calculation pressure (P_C, MPa) and the test pressure (P_T, MPa):

$$e = \frac{P_C\, D}{2\,\sigma} \qquad e = \frac{P_T\, D}{2\,\sigma\,\lambda}$$

- p. 6.8.2.1.13 – the pressure on which the shell thickness is based shall not be less than the calculation pressure;

- p. 6.8.2.4.1 – the values of the test pressure are established depending on the calculation pressure:

Calculation pressure (bar)	Test pressure (bar)
G[12]	G[12]
1.5	1.5
2.65	2.65
4	4
10	4
15	4
21	10 (4[13])

- p. 6.8.2.1.16 – sets the value of the permissible stress only under the action of the test pressure:

$$\sigma \leq 0.75\ Re \text{ or } \sigma \leq 0.5\ Rm$$

The value of the permissible stress under the action of the calculation pressure has not been established.

Question: What conditions (pressure, permissible stresses) shall be taken when determining the minimum shell thickness?

D.3 Material of the shell for transportation of strong nitric acid, UN 2031 (with a nitric acid content of more than 70%) (6.8.4 TC 6)

- transportation in a tank - special provision TC6 - if necessary, using aluminium for the manufacture of tanks - aluminium purity ≥ 99.5%;

- transportation in packagings - packing instruction P001 allows transportation in a single packaging (drums, jerricans), as per p.p. 6.1.4.2.1 and 6.1.4.4.1, body and heads shall be constructed of aluminium with a purity of ≥ 99% or of an aluminium base alloy;

- transportation in a portable tank - there are no requirements for the material (use of aluminium).

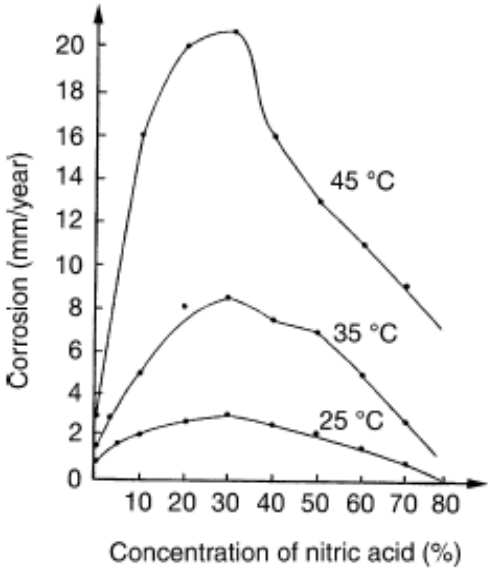
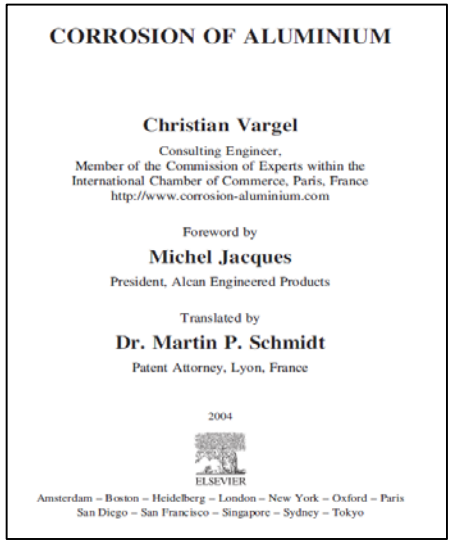


Figure E.5.2. Influence of the temperature on the dissolution rate of 3003 in nitric acid



CORROSION OF ALUMINIUM

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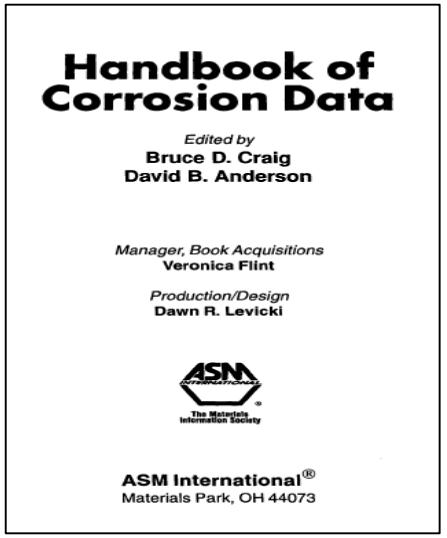

Handbook of Corrosion Data

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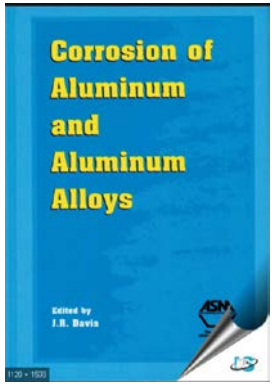
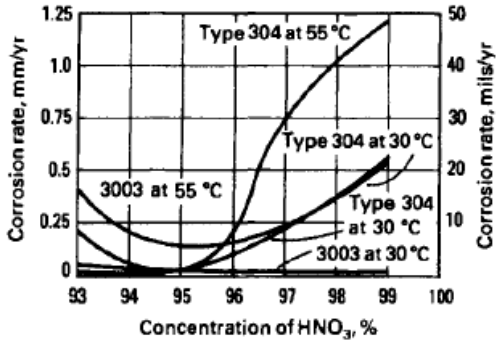
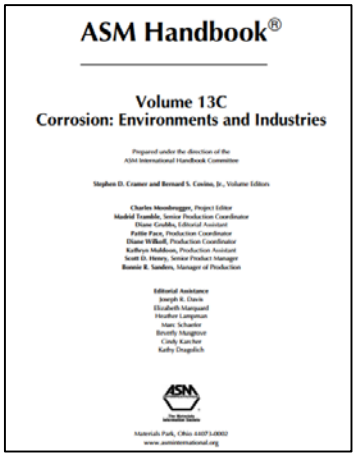
Commercially produced nitric acid is available in concentrations from 52 to 99%. Nitric acid over 86% is described as fuming. Nitric acid up to 95% is stored and shipped in type 304 stainless steel. Concentrated acid above 95% is handled in Aluminum Association (AA) aluminum alloys 1100 or 3003, because although the corrosion rate of type 304 stainless steel increases rapidly above 95% concentration, that of aluminum 3003 remains essentially constant to 100%. A new stainless steel

D. Questions on current requirements

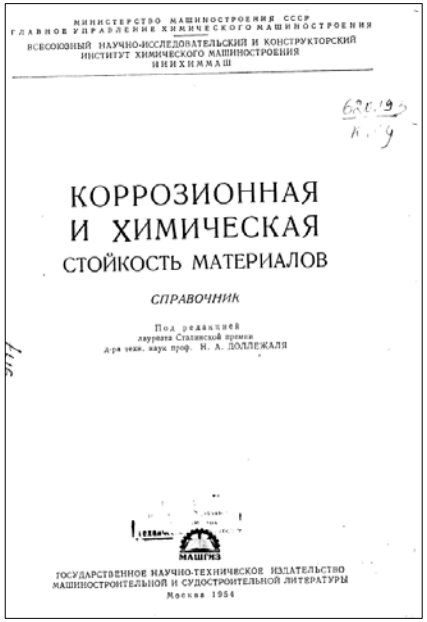




Concentrated acid above 95% is handled in aluminum alloys 1100 or 3003.



Aluminum alloys are good only for very high concentrations, for example, greater than 80% at room temperature and greater than 93% at 43 °C (110 °F). Aluminum alloys commonly used are UNS A91100, A93003, A95052, and A95454. Its primary application is found in rail and highway equipment tankage. UNS A95454 should be



Alloy	Corrosion rate, mm/yr
Al	0,006
Al-Mn	0,006

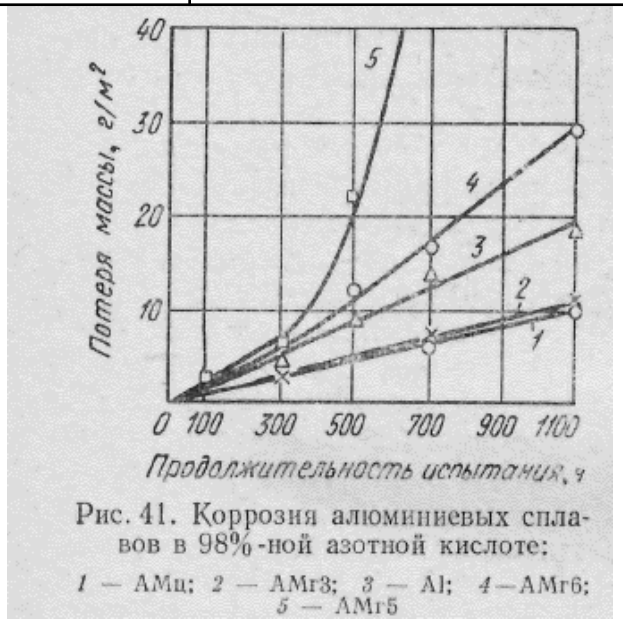


Рис. 41. Коррозия алюминиевых сплавов в 98%-ной азотной кислоте:
1 — АМц; 2 — АМг3; 3 — Al; 4 — АМг6; 5 — АМг5

D. Questions on current requirements

Aluminum contents in alloys

Alloy	Aluminum contents, %
1100	99,00
3003	96,80
5052	95,90
5454	94,50
АМц	96,35
АМг3	93,80
АМг6	91,10
АМг5	91,90

Laboratory studies of plates

Alloy	Aluminum contents, %	Corrosion rate in 99% HNO3, mm/yr
АД0	99,5	0,02
Al-Mn	97,7	0,02
Al-Mn	98,0	0,03
Al-Mg	96,7	0,04

Proposal: To allow transportation of strong nitric acid, UN 2031 (with a nitric acid content of more than 70%), in tank-wagons with shells made of aluminium alloys.