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MINIMUM THICKNESS OF TANK WALLS

Transmitted by the International Union of Private Wagons (UIP) */

Introduction

The RID/ADR stipulates as follows in point 4.3.2.3.1: 'The thickness of the wall of the tank body shall be greater than or equal to the minimum value laid down in paragraphs 6.8.2.1.17 to 6.8.2.1.20, throughout the duration of operation'.

In view of the weight problems, it is essential to construct transport tanks that are as light as possible, while taking into consideration all the demands encountered. In these optimised tanks, which across Europe are built with only a tiny margin for corrosion, we often find localised areas of wear and tear during operation (for example the formation of

*/ Circulated by the Central Office for International Carriage by Rail (OCTI) under the symbol OCTI/RID/GT/III/2003/39.

spots of corrosion on the tank bottom) which mean that the minimum thickness of the wall is not completely achieved. Repairing these signs of corrosion by means of welding does not deliver any safety increase (because of the constraints inherent to welding, etc), and scrapping these tanks because of a negligible disparity which is limited compared to the minimum wall thickness is not economically sensible. In Germany, a technical directive (TRT 0103) has been drafted to give experts an instrument to allow them, when making their checks, to gain a better picture of whether, and to what extent, a limited failure to achieve the minimum wall thickness would be acceptable. The limit values recorded in this way should allow a solution to be found to the problem set out above, without leading to any safety deficits. In France, the SNCF has a similar arrangement in place. As far as we know, experts in other countries also accept variable lower tolerances. As to the national European codes relating to pressurised tanks, for example the AD regulation, regulations relating to the evaluation of these local shortfalls in the minimum wall thickness have been integrated for the same reasons.

Such a regulation applicable to tanks, in accordance with part 6.8 of the RID, is, however, in contradiction with the text of the RID (see above). In the case of the tanks covered by 6.7, no such restrictive demand is included in the RID/ADR. UIP has an interest in finding a solution to make it possible to accept minor and localised limited failures to reach the minimum thickness, caused by wear and tear during operation, without this affecting the level of safety of the tanks.

Solution proposed:

The integration of a regulation inspired by the first part of the regulation attached (advocated by tank experts in Germany) in the RID/ADR. Likewise, reference to this regulation in the case of mobile tanks pursuant to 6.7.

Technical directives on tanks (TRT)	
Thickness of wall of body of tank throughout the duration of operation	TRT 013
To 4.3.2.3.1 ADR/RID	

Throughout the duration of operation, the minimum thickness of the wall may be deemed to be respected where the thickness of the wall required by 6.8.2.1.17 to 6.8.2.1.21, for example thanks to local or extensive corrosion during operation, is lower only insofar as the admissible tensions caused by high temperatures in operation and the tensions admissible in pursuance of 6.8.2.1.15 and .16 are not exceeded and where the following conditions are also respected:

1. Locally limited shortfalls in minimum wall thickness
- .1. Tanks with a theoretical pressure of up to 4 bar
- .1. A shortfall in the minimum wall thickness of up to 20% may be accepted insofar as the minimum wall thickness laid down by the formulas stipulated in 6.8.2.1.17

is respected. In such cases, a theoretical (fictive) pressure of 4 bar must be systematically applied. In the case of tanks whose theoretical and fictive pressure is 4 bar, a welding seam factor of 0.8 must be applied, unless a higher welding seam factor is proved.

The zone of the shortfalls in the minimum wall thickness at the local level is to be described as a circle with a diameter of ≤ 200 mm.

- 1.1.2. The minimum permissible distance between the two zones with a local shortfall in the wall thickness shall be at least

$\frac{D}{2} \times e$.

Explanation:

D = External diameter of the tank

e = Minimum wall thickness laid down by 6.8.2.1.17

- 1.1.3. The total of all the surfaces with a local shortfall in the minimum wall thickness shall not account for more than 5% of the surface of the tank.

- 1.2. Tanks with a theoretical pressure of more than 4 bar

A shortfall in the minimum wall thickness may be accepted in the case of tanks of a test pressure of 4 bar or higher, and a fictive theoretical pressure of more than 4 bar, in accordance with the provisions in sheet AD HP 1 number 4 (January 1995 edition). As to the possible calculation as per sheet AD HP 1 number 4 (January 1995 edition), as per sheet B 9 (July 1995 edition), the fictive theoretical pressure referred to above shall be applicable.

1. Shortfall in the minimum wall thickness over a large surface

Shortfalls in the minimum wall thickness over a large surface shall be construed as being those zones with a dimension greater than the zones stipulated in point 1.

- 2.1. As to the maximum admissible shortfall in the minimum wall thickness, point 1.1. or 1.2 respectively shall be applicable.

- 2.2. The zone of shortfall in the minimum wall thickness over a large surface shall have to be reinforced by appropriate safety measures (for example, sandwich cover) in such a way as to cover a specific resilience potential that is at least equivalent to that of the wall with the minimum wall thickness. This specific resilience potential shall be substantiated in pursuance of directive TRT 001 (A). Where welding repair work is carried out over a large surface, a justification of the special procedure shall be required.

2.3. At any event, the tanks shall have a minimum wall thickness of 3 mm, if they are made from structural steel, or an equivalent wall thickness if they are made from other metals. The term 'equivalent wall thickness' shall be deemed to apply to those defined by the formula provided by point 6.8.2.1.18. Structural steel shall be that defined in pursuance of note 3 concerning the explanatory footnotes at the bottom of the page or the marginal notes mentioned.

In the case of fixed tanks, dismountable tanks and battery-driven vehicles as per the ADR, the minimum wall thickness shall be equivalent to the values stipulated in point 6.8.2.1.19.

2.4. Structural reinforcements may be taken into consideration.

1. Shortfalls in the minimum wall thickness caused by corrosion during operation

In the case of shortfalls in the minimum wall thickness caused by corrosion during operation, the following opinion shall apply:

A shortfall in the minimum wall thickness caused by corrosion during operation shall depend upon the operating conditions, with regard to the temperature, the dynamic wear and tear and the progressive corrosion behaviour. For the purposes of an evaluation, consideration should be taken of the likely operating conditions until the next tank check, in accordance with point 6.8.2.4.2 ff. In order to evaluate the progressive corrosion behaviour, it is possible to make use of the justification methods mentioned in the annex to the present TRT.

Annex to technical directive TRT 013

Justification methods making it possible to evaluate the corrosion behaviour of tank materials and surfaces which have been treated later.

The weakening of the materials and the surfaces re-treated depends upon the type of materials, the goods being transported, and the operating conditions. To this end, an appropriate treatment, for example appropriate cleaning before every change of goods transported, is a sine qua non. The tangible weakening of the materials and the surfaces re-treated during the period elapsing before the next repeat test involving an internal inspection will be evaluated in light of the following criteria:

1. The corrosion process is evaluated at an average temperature of 25° C. Higher temperatures due to operation will need to be taken into consideration during the evaluation of the corrosion behaviour.

2. In order to evaluate the degrees of corrosion caused by the corrosion of surfaces and local corrosion phenomena, it will be necessary to use at least one of the justification methods mentioned below:

1. Bibliographical references

For the bibliographical references, account should be taken of the average values. The data indicated, such as, for example, 0.05 mm/year or 0.5 mm/year, mean that there is wear and tear caused by corrosion of 0 to 0.05 mm/year or 0 to 0.5 mm/year. Accordingly, the average values resulting from this are 0.025 mm/year or 0.25 mm/year. For a general case, it is possible to use the BAM list¹.

1. Experience gathered in operation

Compulsory declaration relating to experiences with regard to the corrosion behaviour of re-treated materials on the body of the tank under the influence of the goods being transported. This experience may be substantiated in the form of operating data on transport tanks which are documented appropriately. But it is also possible to use operating data on stationary tanks or equipment, insofar as the latter can be transferred to a transport tank (cf. TRT 007).

¹Published by the Federal Office for Materials Research and Testing (Bundesamt für Materialforschung und -prüfung - BAM).

BAM list: Requirements imposed on tanks for the transport of hazardous goods. Amts- und Mitteilungsblatt (Official journal), BAM, Unter den Eichen 87, 12205 Berlin, respectively in the version in force.