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Working Party on the Transport of Dangerous Goods
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PROPOSALS FOR AMENDMENTS TO ANNEXES A AND B OF ADR

Introduction of Alternative Arrangements in Connection with Protection against Damage

ADR Marginals 21x 100 and 21x 127 (5)

Transmitted by the Government of Germany

Foreword

The matter had already been discussed on the basis of documents TRANS/WP.15/1999/48 and -/51 during the sixty-seventh session of WP.15. The WP.15 decided to discuss the included proposal during the meeting of a new founded Working Group "Tanks", bringing together experts of interested countries. This meeting was held on 11-12 January 2000, in Berlin (for details see document TRANS/WP.15/2000/4). As a result of the meeting of the Working Group "Tanks" the proposal on alternate arrangements (document TRANS/WP.15/1999/51) should be revised with regard to some details of the proposal and its justification. The revised proposal is now submitted to the sixty-eighth session of WP.15.

Proposal

1. Add the following text after the first sentence of marginal 21x 100:

   "In recognition of scientific and technological advances, the technical requirements of this Appendix may be varied by alternative arrangements. These alternative arrangements shall offer a level of safety not less than that given by the requirements of this Appendix with respect to the compatibility with substances transported and the ability of the fixed tank (tank vehicle), demountable tank or battery-vehicle [tank-container] to withstand [impact, loading and fire] conditions. Alternative arrangement tanks shall be approved by the applicable competent authorities."

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2. Delete paragraph 1. and 4. of marginal 211 127 (5) (b).

3. As a consequential amendment former paragraph 2. of marginal 211 127 (5) (b) shall be paragraph 1. and former paragraph 3. shall be paragraph 2., now.

4. Add a new paragraph to marginal 211 127 (5) (b) as follows:

"3. these shells or tanks (shells fitted with service and structural equipment) offer otherwise a level of safety not less than that given by the requirements of marginal 211 127 (3) referring to marginal 211 100. The assessment of the level of safety shall refer to a tank having basic properties as follows:

- Material: Reference mild steel,
- Wall thickness: 6 mm,
- Design pressure: 0.4 MPa,
- No strengthening members like partitions, surge plates, stiffening rings a.s.o.

and it shall result in a level of safety which is higher than the level of safety of the above-mentioned tank. Especially the properties regarding the ability to withstand global impact and local loads have to be assessed.
For international transport, alternative arrangement tanks shall be approved by the applicable competent authorities."

5. The last sentence in the present marginal 211 127 (5) (b) - "For demountable tanks this protection is not required when they are protected on all sides by the drop sides of the carrier vehicles." - remains the last sentence in the new-worded marginal 211 127 (5) (b), too.

6. Add a new paragraph to marginal 212 127 (5) before 212 127 (6) as follows:

"The protection referred to under (4) may also consist of shell or tank related measures leading to a level of safety not less than that given by the requirements of marginal 212 127 (3) referring to marginal 212 100. The assessment of the level of safety shall refer to a tank having basic properties as follows:

- Material: Reference mild steel,
- Wall thickness: 6 mm,
- Design pressure: 0.4 MPa,
- No strengthening members like partitions, surge plates, stiffening rings a.s.o.

and it shall result in a level of safety which is higher than the level of safety of the above-mentioned tank. Especially the properties regarding the ability to withstand global impact and local loads have to be assessed. For international transport, alternative arrangement tanks shall be approved by the applicable competent authorities."

Justification

Where protection of the shell is provided, the required basic wall thickness of 6 or 5 mm related to mild steel may be reduced in the proportion to the protection provided (up to a maximum reduction of 2 mm related to mild steel - see marginal 21x 127 (3) and (4)). So, reduction of the wall thickness is permitted only if the remaining wall thickness and the protection added will reach an equivalent level of safety with regard to the safety level of the shell wall not being reduced, in principle. In other words, the combination of the remaining wall thickness with the protection added shall offer a level of safety not less than that given by the wall thickness not being reduced.

The decrease of the level of safety caused by the reduction of the wall thickness for tank-vehicles can be compensated completely only by double-wall designs of certain characteristics (vacuum-insulation or intermediate layer of solid materials - e.g. see marginal 211 127 (5) (b) 2. and 3. of the present ADR.

However, the material/wall thickness combination is only one important detail of the totality of measures influencing the overall level of safety of a certain kind of tank, as long as no real accident-proof tank is required. Moreover the level of safety depends as well on the

- choice of material and wall thickness,
- kind of additional protection

as on the

- accidental behaviour of the whole structure,
- effects of details of the design (equipment e.g.),
- quantity of the substances being released during an accident, probably,
- hazardous properties/characteristics of the substances being released

and even the

- level of safety of the vehicle (concerning tilt stability, breaking power e.g.).

Therefore, the decrease of the level of safety caused by the reduction of the wall thickness may be compensated not only by tank wall related measures but also by measures increasing the structure of the whole tank, eliminating the effects of bad design and weak service equipment, completed by knowledge about the accidental behaviour of the whole tank and its components.

For tank containers some of these ideas had been taken up along time ago, already. For tank containers the loss of properties by the reduction of wall thickness may be compensated completely by double wall design on one hand, but by a certain level of the properties of the external structural equipment on the other hand. By means of this structural additional protection it will be avoided that global impact will affect the shell wall of the tank container severely (see marginal 212 127 (5)).

The basic principles of the above-mentioned solution have been taken over later on for tank-vehicles, as well, but in contrast to the structural reinforcement of tank-containers, which is arranged separately from the tank shell itself, the structural protection of tank-vehicles is arranged inside or outside the tank shell, but in direct connection to it in any case. So, impact will affect the tank shell directly (see marginal 211 127 (5) (b) 1.). Thus, the structural reinforcement of tank-vehicles does not work as well as the structural reinforcement of tank-containers. Therefore the structural protection of tank-vehicles does not compensate the loss of properties of the shell wall by reduction of wall thickness completely.

Another kind of additional protection of tank vehicles is just as incomplete as the above-mentioned solution. The longitudinal additional protection (belly-belt) required in marginal 211 127 (5) (b) 4. leads only for a certain percentage of the shell area to a compensation of the loss of properties of the tank shell caused by the reduction of wall thickness. In this case, no additional structural protection has to be applied, in principle.

For tank-vehicles intended for the transport of similar quantities of dangerous goods showing identical hazards, the application of the above mentioned different measures concerning additional protection results in different levels of safety of these tank-vehicles.

Against this background, it is advisable to introduce a system which comprises all possibilities of compensation with regard to the reduction of wall thickness

- directly by increasing the properties of the tank shell,
- indirectly by increasing the level of safety of the whole tank.

The above-mentioned solutions which do not completely compensate the loss of properties of the shell wall concerning the reduction of the wall thickness, may become part of measures to increase the level of safety of the whole tank.

The level of safety of the tank in a whole should be the directional aspect for safety evaluations of tanks in the future (“future work”, possibly by CEN TC 296).

The basic level of safety should be indirectly defined by fixing a set of characteristics of a reference tank which could be looked at as a solution safe enough to be intended for the transport of a certain quantity of dangerous goods with certain hazardous properties. Thus, tanks may be put into service only if they represent the same or a multiple level of safety, like the level of safety of the reference tank, depending on the hazards of the substances to be transported and so on.

As a consequence, the appendices B.1a and B.1b should contain only examples of fully compensating measures on the one hand, and a new general requirement concerning the application of safety level related solutions based on the level of safety of a certain kind of reference tank on the other hand; all insufficient compensating measures should be deleted.

The German proposal has been worded bearing in mind all the above-mentioned aspects and in consideration of the UN-Recommendations on the Transport of Dangerous Goods and the IMDG-Code concerning the recommandations/requirements for the application of alternative arrangements.