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Inland Transport Committee

Working Party on the Transport of Dangerous Goods

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Item 2 of the provisional agenda:

Tanks

Outcome of the intersessional discussion session on holding time of tanks for refrigerated liquid gases

Transmitted by the Government of the Netherlands

Introduction

1. A discussion group met virtual on the 13th of July 2023 for a discussion on holding time. The group consisted mainly of national experts from the Netherlands, EIGA was also presented.
2. Summarizing it may be concluded that in an ideal situation after filling the calculation of actual holding time is possible. However, in practical, real live situations, it proves to be very difficult to perform. The difficulty to perform is due to significant number of varying factors and spread of information and knowledge to perform such a complicated calculation by the persons involved at the various stages before the start of the journey.

Actual holding time

3. The principle is that the consignor bears the overall responsibility for the transport. However, the consignor may rely on the filler or carrier. The consignor can be different persons or organizations in the transport chain. The consignor may be a trading company, but for sure will not be aware of the details of actual temperature of the gas to be filled or density that may vary from loading point to loading point. The consignor will certainly not be aware of the remaining volume of gas in the tank, degree of insulation or the actual temperature of the tank before filling.
4. A difference may be seen for tanks to be filled that go on road and those that go by rail.

Calculating actual holding time of tank-wagons and tank-containers on rail

5. Tanks will be filled by a particular crew at the filling depot. Although this crew has no experience with a particular tank, it is expected that there is more time between filling and dispatch of the wagon or tank-container to the rail operator and its destination. In many cases tanks are pre-cooled, come into equilibrium between gas -, liquid phase and shell-wall, and the pressure properly adjusted to have a predictable actual holding time. The members of the filling crew may in most cases be aware of most details but not knowledgeable enough to make the complicated calculation. Supervisors higher up in the organization may be knowledgeable.
6. In general rail journeys with refrigerated liquid gases will be completed in 6 days. This time should not present any problem for tanks on which the insulation is functioning. The issue is if a tank-wagon is delayed and stays longer in marshalling yards. As these tank-wagons are not supervised, like on road journeys, activation of the safety valves is likely to occur here if this happens, leading to intervention of emergency responders and disruption of traffic.

Calculating actual holding time of tank-vehicles and tank-containers on road journeys

7. For road transport the driver of the vehicle will in most cases be the filler of the tank-vehicle or tank-container. Filling tanks for road journeys is a 24/7 business and the driver will be under time pressure to fill and leave, so that letting the gas -, liquid phase and shell-wall, come into equilibrium and adjust the pressure is difficult. Although, the driver in most cases will be aware how to handle these specific complicated tanks, but he will in most cases not be knowledgeable enough to complete the complicated calculations with all the variations possible.

8. Tank-vehicles will mostly be used on relative short journeys of not more than 3 days. For tank-vehicles the driver is available during the carriage, and he may intervene in case of an unexpected pressure rise. The driver in most cases has experience with a particular tank or tanks from experience. Tank-containers may be a different story as the driver may have no experience with a particular tank-container.

9. A particular case is distribution transport, where parts of the load are discharge at several addresses. It was expressed that by taking out gas by a pump or by developed gas pressure it is impossible to determine an actual holding time for each leg of the journey. On the other hand, the driver will be available to intervene, and the carriage is likely to be concluded in one working day.

Calculating actual holding time of tank-containers and portable tanks on sea journeys

10. It was also discussed that during carriage of tank-containers (and portable tanks) by sea the crew of the ship will check on the tank-pressure typically daily. When a tank has a rise in pressure the consignor may be contacted what should be done. Any necessary adjustment of pressure and discharge will cause less disturbance at sea.

Reference holding time

11. Reference holding time expresses the insulation offered by a tank and is one of the factors to determine the actual holding time. This is determined for a particular tank type at the time of type approval. Based on tests where the heat passing through the tank walls is measured a reference holding time for each gas allowed to be carried is calculated by the tank manufacturer.

12. This value presents the situation when the tank is new. Over time the insulation factor may decrease. Insulation is either by an insulating foam or double walled tank with a vacuum in the space between the walls.

13. Foam will deteriorate due to moisture entering the foam cells. In the EIGA document mentioned in the regulation a loss of 3% of insulation capacity is assumed (conservatively) for each year after initial test. Foam will be replaced or dried after a number of years, typically latest at the periodic inspections of the tank. Foam is used in particular for “warmer” gases like carbon dioxide.

14. Normally, vacuum remains over a very long time leaving the reference holding time valid, or vacuum fails completely due to a defect. In incidental cases a very small leak into the vacuum space may lead to undetected deterioration of the vacuum over time justifying a periodic measuring of the vacuum.

15. The representative of EIGA stressed the importance that vacuum should be measured regularly. It was noted that this was not always done during periodic inspections as it was felt that a way to lose vacuum is to measure it, and that other tell tales are available. Measuring the vacuum should only be done in workshops that are properly equipped to perform this measurement. It was also not clear what the correct go/no-go criteria would be. It was said that this also depended on the gas to be carried. In principle the value given by the tank-manufacturer should be followed.

16. The difference between the periodicity between 6.7 and 6.8 was also discussed. While for 6.7 every 2.5 years vacuum needs to be “determined”, for 6.8 the vacuum should be measured 6/8 years after the initial inspection and at the next periodic inspection after each 12 years. 12 Years between periodic inspections was felt to be a long time.

Calculating and marking of the actual holding time

17. In case all factors would be known it would be possible to calculate the actual holding time according to the formula in the standard ISO 21014:2006. It may be simplified, and fixed data could be used to make a conservative estimation. A practical example was given for the calculation, or determination of the actual holding time, for tank-containers used in particular for road journeys. Based on the calculation pressure of the tank, and related opening pressure of the safety valves, and basic data of the gases to be filled a very conservative actual holding time would be given in a table.

18. In the calculation the marked reference holding time of each particular tank was felt to be an uncertain value. In addition to this, following the correct procedures and regulation was felt to be most important.
