

**ECONOMIC COMMISSION FOR EUROPE**

**INLAND TRANSPORT COMMITTEE**

**Working Party on the Transport  
of Dangerous Goods**

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Sub-section 8.1.4 of ADR

Amendments to the requirements for fire-fighting equipment

Comments on the proposal from Germany in doc. TRANS/WP.15/2002/9

Submitted by the Government of Norway

**SUMMARY**

Executive Summary: Germany proposes in TRANS/WP.15/2002/9 that motor vehicles with a permissible mass of more than 7.5 tons shall have two fire extinguishers with a minimum capacity of at least 12 kg dry powder. Based on recent test results described below, Norway strongly supports this proposal.

Action to be taken: Adopt the proposal as set forth in TRANS/WP.15/2002/9.

According to the ADR regulations (Section 8.1.4) vehicles transporting dangerous goods shall have as minimum a 6 kg dry powder portable fire extinguisher suitable against fires in brakes, tyres or in the goods. Due to the fact that there is a doubt in whether a 6 kg dry powder portable fire extinguisher will be sufficient to extinguish a severe fire in a twin tyre, the Directorate for Fire and Explosion Prevention in Norway initiated a test programme at Norges branntekniske laboratorium AS (NBL) (Norwegian Fire Research Laboratory) for testing of different types of portable fire extinguishers against tyre fires. In addition, a literature study was carried out in order to obtain updated information concerning fire fighting of tyre fires.

The objective of the test programme was to achieve reliable information concerning the fire extinguishing efficiency of different fire extinguishants or agents and to select the best-suited portable fire extinguisher or agent against tyre fires.

A series of trials involving testing of different portable fire extinguishers against fires in twin tyres has been carried out at Norges branntekniske laboratorium as (NBL) (Norwegian Fire Research Laboratory). The test programme included in all twenty-two tests with fourteen different portable fire extinguishers as well as some preliminary trials. The following five different types of agents were tested in order to determine the best suited fire extinguisher or agent against fires in tyres of dimension 295/80R 22,5 (with the number of experiments in parenthesis):

- A Dry powder (12)
- B Foam (6)
- C Water mist (1)
- D IFEX Impulse Fire Extinguisher (2)
- E Wet chemical (1)

The tyre fire trials were carried out under as realistic and equal conditions as possible. Consequently, tests with twin tyre fires were carried out under a mock-up of a fender built in accordance with the ADR regulations. All tyres were second hand tyres and of the same size, but not of the same make of tyre. A heat release rate of the tyre fire of 500 kW was used as a criterion for starting the fire extinguishment. At a heat release rate of 500 kW, which was achieved after 9-15 minutes, huge flames of 2-3 m of length emerged from the top of the twin wheel. Because tyre fires are not very repeatable, the criterion of 500 kW was achieved at highly different times.

The tests were carried out in NBL's test hall, in which varying conditions with respect to wind or draft were prevented. Hence, the fire extinguishing efficiency of the fire extinguishers was tested independently of varying wind and draft conditions. However, due to the fact that the cost budget was limited, some simplifications in relation to the real situation were carried out. For example, instead of using inflated tyres on a felly, deflated tyres were mounted on a Ø545 mm x 2 mm thick x 970 mm long steel pipe with a significantly larger weight than a felly. Further, the number of experiments was limited to 22 tests. Hence, not all the fourteen fire extinguishers were tested twice.

## **RESULTS**

### **A Dry Powder**

Already during the preliminary tests for determination of a suitable heat release rate at which fire fighting should start, it was experienced that the dry powder fire extinguishers were rather effective against tyre fires. This was the main reason for the extensive and thorough testing of the dry powder fire extinguisher (12 tests). The heat release rate has to be increased as much as to 500 kW, i.e. after a preburn time of 9-15 minutes, before some of the dry powder fire extinguishers were incapable of extinguishing the tyre fire permanently.

The fire was extinguished rather efficiently in all the tests by applying dry powder onto the fire until the fire extinguisher was emptied. However, in some tests the fire reignited after a certain time (4-11 min.). This was probably because the fire had burned through the walls of the tyre. Thus, there was a fire inside the tyre, which was hidden for the agent. Hence, the

main reasons for the occurrence of a reflash was not insufficient cooling of the tyre by the agent, but because the fire was not accessible for the agent.

In six of twelve tyre fire trials with dry powder fire extinguishers the extinguisher succeeded in extinguishing the tyre fire permanently. In the other six tests a reflash of the tyre occurred 4 - 11 minutes after fire extinguishment. None of the dry powder fire extinguishers were clearly different from the other with respect to fire extinguishing efficiency or preventing a reflash of the tyre. Different percentages of MAP (MonoAmmoniumPhosphate) appeared not to affect the fire extinguishing efficiency of dry powder fire extinguishers very much.

## **B Foam**

The *foam fire extinguishers* had not as good fire extinguishing properties as the dry powder fire extinguishers. In only two of six tests with foam fire extinguishers the tyre fire were extinguished permanently after an average extinguishing time of 77 seconds, compared to 22 seconds for dry powder. Reflash of the tyre occurred in three of the six tyre fire trials. In one test the foam fire extinguisher was not capable of extinguishing the fire. Both trials in which the fire fighting of the tyre fires were successful, the *Amerex Tyre Fire* 9,5 litre foam fire extinguisher was used. This fire extinguisher was the only fire extinguisher tested twice which succeeded in extinguishing the fire in both trials. Most of the foam fire extinguishers had a weight above 14 kg, which may be somewhat too heavy for effective fire fighting. Due to freezing of the foam liquid, the foam fire extinguisher will not work in severe cold, apart from *Amerex Tyre Fire*, which can be used down to  $-40^{\circ}\text{C}$ . The Niagara, Forexpan and Imprex foam fire extinguishers can be used down to  $0^{\circ}\text{C}$ .

## **C Water based fire extinguishers**

The *IFEX 3035* Impulse Gun and *Amerex Water Mist* fire extinguishers were both effective in the fire fighting of the tyre fires and preventing reflash. Of these two types of fire extinguishers Water Mist was the fire extinguisher that had the best fire extinguishing performance. The *Amerex Water Mist* fire extinguisher had a fire extinguishing efficiency close to that of dry powder. However, preventing reflash is a far more important property of a fire extinguisher, because it is of no help at all that a fire is extinguished efficiently, if a reflash of the tyre fire occurs.

Further, the *Amerex Water Mist* fire extinguisher was considerably more handy and easy to use than the *IFEX impulse gun*. In addition, *IFEX 3035* requires a disproportionately large storage space. However, there exists also a smaller backpack version of IFEX, i.e. *IFEX 3012*. Neither of these fire extinguishers will work in severe cold because they are not prepared for use in connection with ant-freeze solutions.

## **D Wet Chemical**

In the single tyre fire trial carried out with the *Amerex Wet Chemical* fire extinguisher, the fire was extinguished almost as effective as in the test with the *Amerex Water Mist* fire extinguisher, but there was a reflash in the tyre after a relatively short time..

## **MAIN CONCLUSIONS AND RECOMMENDATIONS**

On the basis of the tests run, one may conclude that *all* the fire extinguishers/agents have evident advantages and disadvantages. The most important property of a fire extinguisher used

to fight tyre fires is that it provides a permanent fire extinguishment. That is, when the twin tyre is extinguished, a reflash of the tyre must not take place.

*Dry powder* in general as well as the 'Amerex Water Mist' and 'Amerex Tyre Fire' extinguishers showed in all the best properties. Dry powder fire extinguishers have the best fire extinguishing performance, but in case of large tyre fires (i.e. above 4-500 kW) there may be a certain probability of reflash of the tyre fire after extinguishment.

All the six different dry powder fire extinguishers were tested twice. All the extinguishers had one test with successful and permanent fire extinguishment and one test in which reflash occurred. Consequently, none of the fire extinguishers tested were clearly different from the other with respect to fire extinguishing efficiency or in preventing reflash of the tyre.

***Due to the fact that a tyre fire will probably not have a heat release rate higher than 4-500 kW when the fire fighting starts, a dry powder fire extinguisher will in most cases extinguish the fire permanently. However, the driver must have accessible at least two 6 kg dry powder fire extinguishers on the vehicle. The driver should have instructions in bringing both fire extinguishers to the fire scene. Two dry powder fire extinguishers should be sufficient to extinguish the fire permanently.***

Dry powder fire extinguishers should be equipped with an *application wand*, which will improve accessibility to the fire and the safety of the fire fighter. Inflated tyres can in case of an explosion of the tyre have a much stronger probability of launching embers and burning parts of the tyre, which may represent a threat to the fire fighter. Consequently, the fire fighter should also wear a *face guard* and *protective clothing* during the fire fighting.

The 'Amerex Water Mist' and 'Amerex Tyre Fire' extinguishers were also effective in extinguishing tyre fires and in preventing reflash of the fire. The main reason for not recommending the water mist fire extinguishers is that it may be useless in severe cold, because this fire extinguisher is neither approved nor prepared for anti-freeze solution additives.

**A main conclusion from the tyre fire trials is that two dry powder fire extinguishers most likely are sufficient to extinguish tyre fires on vehicles transporting dangerous goods.**

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