

# Australian Dangerous Goods Code Comprehensive Review

Working group paper #5



## Fire extinguishers for dangerous goods transport

May 2023

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Chair – Tanks, vehicles and emergencies working group

# Report outline

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<b>Title</b>	Australian Dangerous Goods Code Comprehensive Review – Fire extinguishers for dangerous goods transport
<b>Type of report</b>	Discussion paper
<b>Purpose</b>	For public consultation
<b>Abstract</b>	<p>In November 2020, transport and infrastructure ministers approved the NTC’s recommendation to conduct a comprehensive review of the Australian Code for the Transport of Dangerous Goods by Road &amp; Rail (the Code)</p> <p>This paper is the fifth of a series of topic specific discussion papers. It discusses the firefighting equipment required to be carried on vehicles that are transporting dangerous goods. This paper explores the differences between the current code and the Agreement for the International Transport of Dangerous Goods by Road (ADR), with a view to making the system risk-appropriate and easier to use.</p>
<b>Submission details</b>	<p>The NTC will accept submissions until 9 July 2023 online at <a href="http://www.ntc.gov.au">www.ntc.gov.au</a> or by email to: <a href="mailto:dkirk@ntc.gov.au">dkirk@ntc.gov.au</a></p>
<b>Attribution</b>	<p>This work should be attributed as follows, Source: National Transport Commission, fire extinguishers for dangerous goods transport – discussion paper #5.</p> <p>If you have adapted, modified or transformed this work in anyway, please use the following, Source: based on National Transport Commission, fire extinguishers for dangerous goods transport – discussion paper #5.</p>
<b>Key words</b>	Dangerous goods, ADG Code review, safety equipment, transport, ADR, fire extinguishers
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# Have your say

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## What to submit

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This paper asks several questions relating to the fire extinguishers that are required to be carried when transporting dangerous goods. It does not include information on other safety equipment, which is the subject of working group paper #4.

Please provide any relevant supporting information, explanation for your reasons, or data that you have when answering these questions; or when providing information in addition to the questions.

The experiences of individuals or organisations with experience in transporting placard loads of dangerous goods, and who are responsible for emergency response will be useful in understanding the current and future needs of the dangerous goods industry.

## When to submit

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We are seeking submissions on this issues paper by 9 July 2023

## How to submit

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Any individual or organisation can make a submission to the NTC.

### Making a submission

 Visit [www.ntc.gov.au](http://www.ntc.gov.au) and select 'Have your say' on the homepage.

Or

 Email your submission to [dkirk@ntc.gov.au](mailto:dkirk@ntc.gov.au).

Where possible, you should provide evidence, such as data and documents, to support the views in your submission.

### Publishing your submission

Unless you clearly ask us not to, we publish all the submissions we receive online. We will not publish submissions that contain defamatory or offensive content.

The *Freedom of Information Act 1982* (Cwlth) applies to the NTC.

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# Purpose of this paper

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The National Transport Commission (NTC) is conducting a comprehensive review of the Australian Code for the Transport of Dangerous Goods by Road & Rail (the Code).

In conducting the review, the NTC will seek to achieve greater alignment with the internationally recognised land mode-specific requirements contained in the Agreement for the International Transport of Dangerous Goods by Road (ADR) and the Agreement for the International Transport of Dangerous Goods by Rail (RID).

The review is focused on outcomes that serve the best interest of all parties involved in the transport of dangerous goods. This includes those parties on which the requirements are imposed, those who regulate and administer the requirements, and those who must maintain them.

This paper examines the requirements for fire extinguishers in ADR and the current code. It explores some of the advantages of the ADR system, and how this system could be modified for use in an Australian context.

It also explores some of the potential further modifications that may deliver increased safety in dangerous goods transport in Australia.

This paper uses edition 7.7 of the Code, and the 2021 edition of ADR as the source for the provisions. While these editions have now been superseded, this does not affect the content of this paper.

This paper relates to:

the Code – Part No.	<input type="checkbox"/>	Working group	<input checked="" type="checkbox"/>	Discrete issue	<input checked="" type="checkbox"/>
		Tanks, vehicles and Emergencies		Fire extinguishers	

# Executive summary

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The current code contains a table of fire extinguishers that must be carried when transporting a placard load of dangerous goods. The extinguishers to be carried varies by load type and package size. By contrast, ADR provides a simpler list based on maximum vehicle weight.

The paper explores some of the modifications that may be necessary to suit Australian conditions and experiences.

## Context

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A full review of the Australian Dangerous Goods Code (the Code) has not been conducted for over a decade.

The Code is applicable across Australia, and adherence to it by all relevant parties ensures specific risks posed through transport of dangerous goods by land are effectively managed.

In 2020, transport and infrastructure ministers agreed for the NTC to conduct a full review of the Code. The NTC's responsibility for the Code's content and stakeholder engagement over several years, highlighted that the road and rail specific requirements of the Code in particular, do not fully support the smooth and safe movement of dangerous goods across borders and transport modes.

The purpose of the review, therefore, is to ensure that the Code is reflective of the Australian transport environment, draws upon road and rail mode specific concepts used elsewhere in the world where appropriate, and considers inclusion of explosives as regulated dangerous goods under the Code's requirements.

Given the scale of the review, the content of the Code has been broken into a series of topics. This paper focuses on the approval of tanks, bulk containers, and vehicles for dangerous goods transport.

## Themes

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### **Chapter 1 – Project to Review the Australian Dangerous Goods Code**

In November 2020, transport and infrastructure ministers approved the NTC's recommendation to conduct a comprehensive review of the Code.

The review seeks to better align Australia with international practices contained in the road and rail mode specific versions of the UN Model Regulations and will focus on improving transport of dangerous goods safety outcomes.

### **Chapter 2 – primary causes of non-impact fires in heavy vehicles**

Having ready access to appropriate firefighting equipment can mean the difference between a small, localised fire, e.g., in a wheel end or engine, and full engulfment of the load.

Being able to contain and extinguish a fire before it reaches the load can be the difference between a damage bill of around \$4,000 compared to in excess of \$500,000 plus freight, recovery and clean-up costs.

Incident data shows wheel end fires and fires in the engine or cabin as the predominant cause of non-impact fires.

#### **Chapter 4 – Purpose of fire extinguishers**

There is no clear guidance in the current code on the role of the driver in responding to a fire event. The ADR includes Instructions in Writing, which include the following instructions:

- Where appropriate and safe to do so, use the fire extinguishers to put out small/initial fires in tyres, brakes, and engine compartments
- Fires in load compartments shall not be tackled by members of the vehicle crew

A fully involved vehicle fire will be 1 or 2 orders of magnitude more intense than a tyre fire. A portable fire extinguisher, of an appropriate firefighting medium, may be successful in combating a tyre fire but is unlikely to be useful in combating a fire that has reached the load.

#### **Chapter 5 – Suitability and quantity of firefighting medium**

The volume and type of firefighting medium needs to be suitable for the types of fires that a driver is likely to encounter. The primary aim being to extinguish a fire in its early stages to prevent it reaching the load.

Dry chemical powder does not provide the necessary cooling to remove heat from a wheel end fire to prevent autoignition or reignition. Water or foam are recommended for these types of fire. Fixed firefighting systems are widely used in some transport operations, as they can provide larger quantities of water or foam.

While dry chemical powder extinguishers are recognised as the most suitable for fires in the engine bay of a vehicle, automatic fire suppression systems are becoming widely available and used.

Given the primary causes of fires, the maximum permissible mass of the transporting vehicle may be the most appropriate means of determining requirements for the volume of firefighting medium.

### **Next steps**

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The responses to this paper will be used to develop a consultation draft of the fire extinguishers for the future code. It is likely that the responses to multiple papers will be combined and developed as a single draft.

#### **List of questions**

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# 1 About this project

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## Key points

- In November 2020, transport and infrastructure ministers approved the NTC's recommendation to conduct a comprehensive review of the Australian Code for the Transport of Dangerous Goods by Road and Rail (the Code).
- Mode-specific requirements of the current code consist of a repository of often disjointed, contradictory requirements that fall apart when closely examined.
- The review seeks to better align Australia with international practices as set out in the ADR and RID.
- The review will focus on outcomes that serve the best interest of all parties involved in the transport of dangerous goods.
- Given the scale of the review, the content of the code has been broken into a series of topics, each allocated to a topic specific working group.

## 1.1 Project objectives

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In November 2020, transport and infrastructure ministers approved the NTC's recommendation to conduct a comprehensive review of the Australian Code for the Transport of Dangerous Goods by Road and Rail (the Code). Ministers also supported the proposal to incorporate into the Code principles from both:

- The Agreement for the International Transport of Dangerous Goods by Road (ADR); and
- the Agreement for the International Transport of Dangerous Goods by Rail (RID).

The ADR and RID are used extensively throughout Europe, Africa and Asia. As with the Australian code, both the ADR and RID are based on the United Nations Recommendations on the Transport of Dangerous Goods - Model Regulations (UN Model Regulations). In general, the requirements of the ADR and RID are the same. They only differ where requirements need to apply specifically to either road transport or rail transport.

Stakeholder feedback over the years and a literature review of relevant materials suggests that the mode-specific requirements of the current code consist of a repository of often disjointed, contradictory requirements that fall apart when closely examined. In many instances, there was no supporting evidence or data for their introduction and there is no evidence that they have contributed to safer outcomes. The lack of consistency and cohesiveness in these requirements coupled with a lack of a framework for maintaining the mode-specific requirements results in a continuing cycle of ad-hoc, random amendments without consideration of the consequential inconsistencies or contradictions.

### Goal of the review

The goal of the review is to deliver a code that:

- addresses the specific risks of transport by land, while also recognising any risks unique to the Australian transport environment;
- remains contemporary; and

- is aligned to international practices that support the smooth and safe movement of dangerous goods across borders and transport modes.

The review is focused on outcomes that serve the best interest of all parties involved in the transport of dangerous goods. This includes:

- parties that must meet the requirements;
- parties that regulate and administer the requirements; and
- parties that must maintain the requirements.

The aim of the review is to deliver more than just a cohesive and contemporaneous code. We also aim to deliver a framework for making sure the Code remains up to date and aligned with international standards.

## 1.2 Background

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In 2020, the NTC released an issues paper on the land transport of dangerous goods. The paper focused on the legislative framework that supports the dangerous goods code. However, the responses we received highlighted several problems with the code itself.

A major concern raised in submissions centred on the Australia-specific chapters of the current code. The biennial maintenance cycle of the Code, which keeps it aligned to the UN Model Regulations, is appreciated. However, many submissions noted the Australia-specific chapters have not been reviewed or revised. Many of these chapters were carried over from the sixth edition of the Code (ADG 6), either in full or in part, without examination. They have not been critically reviewed for over 15 years and are now outdated. In the case of some requirements, no evidence base, or justification can be found to support their original introduction.

Industry and regulators also noted the Australian Explosives Code is outdated and has no responsible agency. They expressed a strong preference for the dangerous goods code to be expanded to include Class 1 Explosives, and for the Australian Explosives Code to be made obsolete.

After analysing the submissions received, the NTC made recommendations to infrastructure and transport ministers. All recommendations were endorsed, including the following:

### **Recommendation 4:**

Conduct a full review of the Australian Dangerous Goods Code to update outdated chapters, identify and correct translation errors, incorporate relevant ADR concepts and incorporate requirements for Class 1 and Division 6.2. Note: the technical requirements for Class 1 and Division 6.2 will be incorporated into the [ADG] Code but the legal requirements will not be incorporated into the regulations.

## 1.3 Approach

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A set of Review Principles has been developed to guide the review and give it the best chance of delivering the right outcome. These principles were developed with regard to the following key considerations:

- Impacts and benefits;

- stakeholder engagement; and
- maintaining currency of the Code and associated model laws.

Given the scale of the review, the content of the code has been broken into a series of topics, each allocated to a topic specific working group.

This discussion paper deals specifically with the fire extinguishers that are required to be carried on vehicles transporting dangerous goods. In doing this, it also examines the appropriateness of required firefighting medium, and alternative fire suppression systems.

Previous consultation papers for this review include:

- Classification of dangerous goods – Working group paper #1, January 2023
- Dangerous Goods List – UN entries – Working group paper #2, February 2023
- Tank provisions in ADR – Terminology – Supplementary paper #S1, March 2023
- Approval of tanks, bulk containers and vehicles – Working group paper #3
- Safety equipment for dangerous goods transport – Working group paper #4

## 2 Context of issues

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### Key points

- The major causes of non-impact fires in heavy vehicles are engine fires and wheel end fires.
- Extinguishing a fire before it reaches the load can significantly reduce the impact of fire.
- Vehicles transporting dangerous goods should be equipped to deal with a fire in its early stages to prevent escalation.

### Minimising the impacts of fire

Fire extinguishers and other firefighting equipment are required equipment for vehicles transporting dangerous goods in placard quantities. Having ready access to appropriate firefighting equipment can mean the difference between a small, localised fire, e.g., in a wheel end or engine, and full engulfment of the load.

Being able to contain and extinguish a fire before it reaches the load can be the difference between a damage bill of around \$4,000 compared to in excess of \$500,000 plus freight, recovery and clean-up costs.

A driver can be reasonably expected to respond, where safe to do so, to a fire in the engine, or wheel end of a vehicle to prevent it impacting the load. However, a driver should not attempt to tackle a fire in the load unless they have been specifically trained to do so and can do so safely. This reinforces the importance of being equipped to deal with a fire in its early stages to prevent escalation.

### Causes of truck fires

Understanding the types of fires that occur on vehicles is an important step in determining the correct type of firefighting medium.

The NTI's **Major Accident Investigation Report**, published in 2019, includes a breakdown of the major causes of non-impact fires in heavy vehicles. The reports analyses of non-impact fire losses for the period 2011 to 2017 showed that the causes of fires had remained consistent over that period. The report stated that approximately 60% - 65% of non-impact fires started in the engine/cabin and 33% were caused by wheel end fires.

The NTI NTARC **Major Crash Investigation 2022 Report** analysed incident data for 2021. The 2021 data showed an unusual increase in non-impact fires commencing in the load. However, the predominant cause of non-impact fires continued to be engine bay and cabin fires (53.1%) or wheel end fires (34.6%).

An analysis in 2017 by the Explosives Expectorate, Mines Safety & Health of the Western Australian Department of Mines, Industry Regulation and Safety (DMIRS) of past incident investigations showed that for heavy vehicles transporting dangerous goods, most non-impact fires started in the wheel end. The majority being caused by brake or bearing failures. The incidence of fires starting in the cabin or engine was considerably lower for dangerous goods vehicles when compared to other heavy vehicles. While no data was available to understand the difference in fire causation between vehicles transporting dangerous goods

vs those transporting general freight, it was generally believed that dangerous goods vehicles were better maintained. It's also likely that the high-value, high-risk nature of dangerous goods transport leads to the use of newer prime movers.

### **Previous consultation – 2017**

In 2017, the NTC consulted with industry and regulators on fire extinguishers for dangerous goods vehicles. A key comment received during this consultation was that “future policy should focus on ensuring there are sufficient extinguishers of an appropriate type, always present in consistent and expected locations on the vehicle, accessible by anyone”. The discussion in this paper aims to implement this policy, while also retaining the flow and integrity of the future code through alignment with the structure and principles in the ADR.

### **Scope of this paper**

This paper examines the purpose of fire extinguishers that vehicles transporting dangerous goods are required to carry. In doing so, it raises questions as to the type and number of fire extinguishers (or other firefighting systems) to enable this purpose. It does not address other safety equipment that is required to be carried during dangerous goods transport such as personal protective equipment, which is the subject of discussion paper #4.

This paper aims to develop risk-based requirements for firefighting equipment, considering the types of fires that occur in transport. It then looks at how the requirements can be expressed following the format and construction used in the ADR. This approach is aimed at minimising impacts on the flow and structure of the future code. It does not assume that requirements in either the ADR or the current code are appropriate for use in the future.

The responses to the questions in this paper will be used to develop provisions for the future code on the basis of ADR. Responses to questions should be accompanied by supporting data or an explanation for the response.

# 3 Terms used in this paper

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## Key points

- Different terminology is used between the ADR and the current code. This chapter examines those differences and explains how they are used throughout this paper.

The following terminology and conventions have been used in this paper to compare the system used by ADR and the system used by the current code.

## 3.1 Transport unit mass

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The ADR uses the maximum permissible mass of the transport unit to determine which extinguishers must be carried on a dangerous goods vehicle. In comparison the current code uses the load being carried, in particular the receptacle size and whether it is flammable, to determine which extinguishers are required.

For the purposes of this paper, the transport unit mass is taken to be the maximum permissible mass of the vehicle, such as a rigid truck or an individual trailer.

## 3.2 Fire classification

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Fire extinguisher markings (ratings) include the class of the type(s) of fires they are suitable for. Australian Standards provide the following six fire classifications:

- Class A – combustible materials – e.g., wood, paper or fabric
- Class B – flammable liquids – e.g., petrol, turpentine or paint (Class 3 DG)
- Class C – flammable gases – e.g., LPG, hydrogen, butane or methane (Class 2.1 DG)
- Class D – combustible metals – e.g., magnesium, aluminium or lithium
- Class E – electrical equipment – e.g., wiring systems, generators or alternators (when energised)
- Class F – cooking fats and oils e.g., a chip-pan fire or hot bitumen

European and Australian standards use a very similar classification for fires. However, EN 2:1997 which is used by ADR to define fire classification specifically notes that electrical fires are not a class of fire.

Dry chemical powder extinguishers are categorised according to the fire types they are suitable for. For the purposes of this paper, ABC fire extinguishers (European) are considered functionally equivalent to AB(E) fire extinguishers (Australian) as both are dry chemical powder (DCP) extinguishers.

### 3.3 Fire extinguisher capacity

ADR defines the extinguishing capacity based on weight of DCP. In Australia, a rating system is used for the different classes of fire. For comparison, the following are common extinguishing capacities for class B fires, a graphical depiction of the relation is also shown (this is included to demonstrate that it is non-linear):

Extinguisher capacity	Typical DCP mass
10B	1 kg
20B	1.5 kg
30B	2 kg
40B	2.5 kg
60B	4.5 kg
80B	9 kg



Fire extinguisher capacities and DCP mass do not share a linear relationship above 2.5 kg/40B, and so are not simply additive. For example, a 9kg DCP extinguisher is rated as an 80B extinguisher but 2 x 40B extinguishers would have a DCP mass of 5 kg (2 x 2.5 kg).

The European standard for fire extinguishers also includes an extinguisher rating in a similar format to the Australian Standard, however these are not the same scale as used in Australia, so it is not used here to reduce the potential for confusion.

Fire extinguishers in Australia are commonly sold by weight (or volume) of extinguishing agent (e.g., 2 kg), or ratings against particular fires (30B). Often both values are quoted. An initial search of fire extinguishers available in Australia indicates that 6 kg DCP fire extinguishers are not commonly available, though this size is mentioned in ADR.

For the purposes of this paper, the above conversions are used between the different capacity ratings. An advantage of the “weight” method is that it is independent of the testing method that is used and is relatively easy to add values to determine the capacity to be carried.

## 4 Purpose of fire extinguishers

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### Key points

- The role of the driver in responding to a vehicle fire is poorly understood.
- Portable extinguishers of an appropriate firefighting medium may be successful in combating a tyre fire but are unlikely to be useful in combating a fire that has reached the load.

The current code does not provide guidance on when the extinguishers should be used. However, there is general acceptance that portable fire extinguishers are provided as "first attack" units in firefighting and should be used only in the early stages of fire before the fire grows to a stage that is beyond the capacity of the extinguisher.

The ANZ-ERG 2021 provides advice on fire control but does not provide specific guidance on the use of fire extinguishers in a transport incident. Questions are raised in working group paper #4 – Safety equipment for dangerous goods transport as to whether the ANZ-ERG is intended for drivers or is aimed at emergency responders.

It is possible that a driver may also be an emergency responder for fires involving the load. Due to the following factors, these situations are beyond the scope of determining the minimum fire extinguishing equipment for dangerous goods transport. In particular:

- This must be based on a risk assessment and include appropriate training, taking into consideration the hazards of the specific dangerous goods.
- It may not be appropriate to assume this is a core skill of all drivers.
- Not all drivers will have the attributes or abilities to take on this role.
- It may require additional extinguishing systems or capacity beyond the minimum equipment specified in the Code.

The ADR's instructions in writing<sup>1</sup> include the following instructions relating to fire extinguishers and firefighting:

- Where appropriate and safe to do so, use the fire extinguishers to put out small/initial fires in tyres, brakes, and engine compartments
- Fires in load compartments shall not be tackled by members of the vehicle crew

While the current code is not explicit, there is a general understanding that the driver's role is to try to prevent a fire getting to the load. Once a fire enters the load, general expectation is that the driver will move themselves and others to a safe distance. There have been several instances of drivers decoupling from burning trailers and moving the prime mover to a safe distance. This is preferred policy for many transport organisations. This practice also aligns with the ADR instructions in writing.

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<sup>1</sup> Initial discussion on the possible use of instructions in writing is contained in working group paper #4 – Safety equipment for dangerous goods transport. Responses to this paper (#5) may be used in to inform more detailed discussion.



In 1995, the Norwegian Fire Research Laboratory found that the peak heat release rate of a dual-tyre fire is almost 1 megawatt. By contrast, the peak heat release rate for fully involved heavy goods vehicle fire (not transporting dangerous goods) is on the order of 20 – 200 megawatts. Note that these tests are not equivalent, and so cannot be directly compared. However, it demonstrates that a fully involved vehicle fire is 1 or 2 orders of magnitude more intense than a tyre fire. While a portable extinguisher, of an appropriate firefighting medium, may be successful in combating a tyre fire, it is unlikely to be useful in combating a fire that has reached the load.

If we assume that the core role of the driver is to fight small/initial fires in tyres, brakes, or engine compartments, then the extinguishers provided need to be appropriate for this purpose. This includes having the most appropriate firefighting medium for the anticipated types of fire events.

**Question 1:** Should the future code provide clearer guidance on the expectation of the driver in a fire situation? Please provide suggested wording you consider appropriate.

# 5 Suitability and quantity of firefighting medium

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## Key points

- Requirements in the current code are based on the type and volume of the dangerous goods in the load.
- Current requirements do not consider the most common types of non-impact fires and are not the most appropriate for responding to such fires.

## 5.1 Suitability of firefighting medium

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### 5.1.1 Problem with the current code

The current code requires all vehicles transporting a placard load of dangerous goods to carry fire extinguishers as specified in table 12.1. All extinguishers specified in table 12.1 are DCP. Although Note 3 to table 12.1 does permit a foam or water extinguisher to be substituted for a DCP extinguisher in some circumstances:

If more than one dry powder fire extinguisher is required in the load area, one may be replaced with a foam or water fire extinguisher of at least 9L capacity. If a foam or water fire extinguisher is used it must be suitable for the types of fire scenarios likely to be encountered and selected with the aim of preventing the spread of fire to the load.

Note 3 of table 12.1 is contradictory to Note 4 of the same table, which allows full substitution of DCP extinguishers where fixed foam or water firefighting (FFFS) systems are used (see 5.3 of this paper).

The blanket requirement for DCP does not consider the types of fires that a driver is most likely to have to deal with.

Incident data shows the major causes of non-impact fires in heavy vehicles are electrical fires and wheel end fires. In May 2021, ARTSA-i, the National Bulk Tanker Association (NBTA) and the Truck Industry Council (TIC) released a **Truck Fires Safety Program** consisting of 4 manuals and 6 videos. **Part 1** of the manuals contains a detailed look at causes of fire in trucks and trailers. To prevent fires spreading and impacting the load, fire extinguishing medium needs to be appropriate for these types of fires. Each of these is discussed in further detail below.

### Wheel end fires

Wheel end fires can be categorised into four primary causes, brakes, wheel bearings, spring brake relay valves and tyres. While the initiating causes of wheel end fires may vary, they all cause excessive heating of components, leading to autoignition of the tyre rubber. The high temperatures involved significantly reduce the effectiveness of DCP extinguishers. While DCP may extinguish the initial fire it does not reduce the heat sufficiently to prevent reignition.

Both industry and regulators recognise the limited effectiveness of dry chemical powder extinguishers in responding to wheel end fires. Foam or water extinguishers are known to be much more effective at combating wheel and tyre fires.

A dry chemical fire extinguisher is unlikely to stop a tyre fire because it does not remove heat from the tyre and the brake drum. A water extinguisher or a garden water supply (if available) will be more effective. Use soft drink or any other non-flammable liquid you have if you don't have water. **Preventing fires – truck driver guidance**, EPA NSW.

ADR also permits extinguishers, other than one for the cabin and engine, to be substituted insofar as it is an equivalent capacity of a “suitable extinguishing agent”.

### **Electrical systems and engine compartment fires**

Dry chemical powder and carbon dioxide are universally recommended as appropriate for fires in charged electrical systems or engine fires. Water or foam are generally not considered suitable for fires involving energised electrical equipment. However, most conventional vehicle electrical equipment is 24V or less, and so the use of water or foam is not understood to present a risk in practice, especially in comparison to the benefits they provide in preventing wheel fires spreading to the load.

ADR requires one fire extinguisher (of 2kg capacity) as needing to be “suitable for [an] engine or cabin fire”. This is presumed to be a DCP extinguisher.

### **Fires in the load area**

Fires in the load will vary significantly depending on the type of dangerous goods being transported and the packaging materials. In addition to the actual dangerous goods being transported, there may also be significant amounts of combustible materials present, for example, cardboard packaging, wooden pallets, and the like. While DCP is recognised as having the broadest application for fires in the load, foam is also recommended for both Class A and Class B fires.

**Question 2:** Should the future code permit, recommend, or require different extinguishing agents be carried? Please explain your reasoning.

**Question 3:** Should the future code mandate the carrying of water or foam extinguishers? Please provide your reasoning.

**Question 4:** Are there specific criteria that should be applied if substitution is permitted, recommended, or required? For example, there may be particular load or vehicle configurations where this would be appropriate.

## **5.2 Quantity (volume) of firefighting medium**

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### **5.2.1 Less than a placard load**

The current code does not mandate an extinguisher to be carried when transporting less than a placard load. With the exception of tow trucks, there are also no regulations requiring fire extinguishers for general freight vehicles, regardless of their GVM. By contrast, the ADR mandates that vehicles using the “small loads” provisions of 1.1.3.6 carry a single 2 kg DCP extinguisher. This would be similar to requiring a 2kg extinguisher (30B DCP) when transporting less than a placard load.

ADR 8.1.4.2 - "Transport units carrying dangerous goods in accordance with 1.1.3.6 shall be equipped with one portable fire extinguisher for the inflammability classes A, B and C, with a minimum capacity of 2 kg dry powder (or an equivalent capacity for any other suitable extinguishing agent)."

**Question 5:** Should the future code include a minimum fire extinguisher requirement for vehicles transporting less than a placard load of dangerous goods? Please provide your reasoning.

## 5.2.2 Placard load

### Problem with the current code

The number of fire extinguisher (volume of firefighting medium) in the current code is based on the type and quantity of dangerous goods in the load. If the purpose of the fire extinguishers is extinguishing a fire before it can involve the load, this may not be the most appropriate basis (see sections 2, 3 and 5.1 of this paper).

It may be more appropriate to follow the approach in the ADR, which is based on the maximum permissible mass of the transport unit. This approach more closely reflects the size of wheel end fire that may occur.

Table from ADR section 8.1.4.1:

Transport unit maximum permissible mass	Minimum number of fire extinguishers	Minimum total capacity per transport unit	Extinguisher suitable for engine or cab fire. At least one with a minimum capacity of:	Additional extinguisher(s) requirement. At least one extinguisher shall have a minimum capacity of:
≤ 3.5 tonnes	2	4 kg	2 kg	2 kg
> 3.5 tonnes ≤ 7.5 tonnes	2	8 kg	2 kg	6 kg
> 7.5 tonnes	2	12 kg	2 kg	6 kg

The capacities are for dry powder devices (or an equivalent capacity for any other suitable extinguishing agent).

**Question 6:** Does the quantity of dangerous goods in the load matter for defining extinguisher capacity on a vehicle? Please explain your reasoning.

**Question 7:** If the type of dangerous goods carried affects the required amount of extinguisher capacity, what parameters should be used to decide how this should be changed? Please explain your reasoning.

**Question 8:** Is using the maximum permissible mass of the transport unit a suitable means of determining the fire extinguisher (volume) requirements in the future code? Please explain your reasoning.

### Combination vehicles

ADR does not ordinarily permit more than one trailer or semi-trailer to be used to transport dangerous goods. As a result, the ADR table does not consider how to apply these requirements to a B-double or road train. There is no suggestion of such a restriction in Australia.

With the exception of the extinguisher to be carried in the cabin, the requirements in Table 12.1 of the current code are also based on a single vehicle or trailer as evidenced by Note 2 to Table 12.1:

NOTE 2: In cases of combination vehicles, these directions apply to every separate trailer transporting a placard load.

The proposed in draft table below suggests an alternative solution for combination vehicles, integrating the additional requirements into the table.

### Draft provisions for future code

The table below provides one way the ADR table could be adapted to reflect Australian practice. It is not the only way but has been provided here to form a basis for discussion. Responses to the questions in this paper will help further refine the proposed table. In particular the types, number and capacity of firefighting extinguishers.

Notes below the table explain why the values have been selected.

Note: the table below includes changes from the text found in ADR. Deleted text is struck out (~~like this~~), and new text is underlined (like this)

Transport unit maximum permissible mass	Minimum number of fire extinguishers	Minimum total capacity per transport unit	Extinguisher suitable for engine or cab fire. At least one with a minimum capacity of:	Additional extinguisher(s) requirement. At least one extinguisher shall have a minimum capacity of:
<del>≤ 4.5</del> <del>3-5</del> tonnes	2	4 kg	2 kg ( <i>30B</i> )	2 kg ( <i>30B</i> )
> <del>4.5</del> <del>10</del> tonnes	2	<u>11</u> <del>12</del> kg	2 kg ( <i>30B</i> )	<u>4.5</u> <del>6</del> kg ( <i>60B</i> )
<u>Each additional trailer*</u>	<u>≥</u>	<u>+9 kg (per additional trailer)</u>	<u>N/A</u>	<u>4.5 kg (60B)</u>

The capacities are for dry powder devices (or an equivalent capacity for any other suitable extinguishing agent).

\* Required for each additional trailer in a combination transporting a placard load

### Notes on changes

- The transport unit masses have been aligned to:
  - The 4.5 tonne Gross Vehicle Mass (GVM) threshold defined under the *Heavy Vehicle National Law*; and
  - The middle band (3.5 – 10 tonnes) has been deleted to reduce complexity.

- The weight of fire extinguishing medium has been based off commonly available extinguishers in Australia
  - An initial search found that 6 kg DCP fire extinguishers are not readily available in Australia, though appear to be common in ADR countries.
  - B-rating capacities have been provided where a value for a single extinguisher is specified. This has not been done for total capacity, as extinguishing capacity and extinguishing agent mass are not directly additive. It is expected that in practice, these would not be included in the table.
- The additional trailer extinguisher requirements are based off the total capacity required, less the requirement for the engine or cab fire extinguisher, with modifications to reflect the actual size of extinguishers that are commercially available.
- The modified table would simplify the extinguisher requirement and base it on the size of the vehicle. Vehicles with changing loads would not require different extinguishers.
- This would generally result in increased extinguisher requirements for non-flammable loads and flammable goods in IBCs up to 10,000 L, and similar requirements for flammable loads in tanks, tank vehicles and IBCs greater than 10,000 L.
- The decision to select 11 kg total, and 4.5 kg as the minimum additional extinguisher size for >12 tonnes means that a transporter can elect to carry a single 2 kg extinguisher; along with either a single 9 kg extinguisher, or two 4.5 kg extinguishers.
  - This would also mean that the current 80B (9kg) DCP + 20B (9L) foam extinguisher option for flammable vehicles would be compliant.
- The additional trailer requirement would mean that two 4.5 kg extinguishers per additional trailer would comply.
- A more detailed comparison of the two systems has been provided in Appendix B.

**Question 9:** Does the proposed alignment to the heavy vehicle threshold make sense? If not, what should they be changed to, and why?

**Question 10:** Will transporters (and drivers) be able to easily understand and implement the modified requirements?

**Question 11:** Is including the requirements for additional trailers into the table an acceptable option?

**Question 12:** If the selected values in the modified table are inappropriate, what do you consider to be suitable amendments? Please provide your reasoning.

## 5.3 Fire extinguishers – portable vs fixed

### Key points

- Fixed water or foam firefighting systems are common on some vehicles.
- Competent Authorities are considering mandating fixed water or foam systems on vehicles transporting ammonium nitrate.
- Fixed automatic fire systems are available for engine compartments.

Table 12.1 in the current code is based on portable fire extinguishers. It does however permit those in the load area to be replaced by a fixed firefighting system. Such systems are known to be especially common on ammonium nitrate vehicles. The primary intent being to combat wheel fires and prevent spread to the load, due to the explosion risk presented by ammonium nitrate. Note 4 to the current code table 12.1 states:

A foam or water firefighting system using compressed air, electric pumps or other means, may be used in place of portable fire extinguishers in the load area. The firefighting system must be operational even when the engine of the vehicle is turned off and must be suitable for the types of fire scenarios likely to be encountered with the aim of preventing the spread of fire to the load.

Similarly, the ADR states that “if the vehicle is equipped with a fixed fire extinguisher, automatic or easily brought into action for fighting a fire in the engine, the portable extinguisher need not be suitable for fighting a fire in the engine. The extinguishing agents shall be such that they are not liable to release toxic gases into the driver’s cab or under the influence of the heat of the fire.” ADR does not recognise the use of a fixed system as a substitute for portable extinguishers in the load area, though there is no prohibition on such a system.

### **Mandatory additional requirements for certain loads**

In response to several incidents involving ammonium nitrate vehicles in Australia, there is presently work underway (led by Western Australia, supported by the Competent Authorities Panel) to consider mandating such systems on vehicles transporting ammonium nitrate.

This work may result in mandates for:

- Fixed water or foam firefighting systems
- Additional water or foam portable extinguishers
- Tyre pressure or temperature monitoring (while not directly the subject of this paper, it is noted for completeness)

Any work on this is likely to be developed in parallel to the ADG Code Review. As a result, it will need to be integrated into the Code, the timing of this is not certain at this time but could be included as part of the ADG Code Review or future maintenance processes as appropriate.

### **ADR 23**

New requirements for the fitting of thermal protection capable of mitigating the propagation of a fire from vehicles has also been introduced in ADR 23 for the following vehicle types:

- FL vehicles carrying flammable gases
- FL vehicles carrying PG I and PG II flammable liquids
- EX/III vehicles

Details of this requirement will be discussed in more detail in a future paper on dangerous goods vehicles.

**Question 13:** If a fixed firefighting system is permitted, what alternative criteria should be applied to this system?

**Question 14:** Should these systems be “an alternative to” or “in addition to” the mandated extinguishers?

**Question 15:** When is it appropriate to mandate these systems? Provide information on the types of dangerous goods; container types; sizes; and transport scenarios where you consider these systems should be mandated.

### **Electrical systems and engine compartment fires**

The current code does not mandate an extinguisher to be carried when transporting less than a placard load. By contrast, ADR mandates that vehicles using the “small loads” provisions of 1.1.3.6 carry a single 2 kg DCP extinguisher. This would be similar to requiring a 2kg extinguisher (30B DCP) when transporting less than a placard load.

“Transport units carrying dangerous goods in accordance with 1.1.3.6 shall be equipped with one portable fire extinguisher for the inflammability classes A, B and C, with a minimum capacity of 2 kg dry powder (or an equivalent capacity for any other suitable extinguishing agent).”

In recent years, the fitting of fire suppressant dispersing devices in engine bays has become more common. These devices are designed to activate automatically in a fire situation, dispersing a fire extinguishing agent or aerosol. Recent changes to the classification of these devices will make them more accessible on the market, likely increasing their use.

### **ADR**

The ADR requires an automatic fire suppression system to be fitted in the engine compartment of the following vehicle types:

- FL vehicles carrying flammable gases
- FL vehicles carrying PG I and PG II flammable liquids
- EX/III vehicles

**Question 16:** If an automatic fire suppressant dispersing device is fitted in the engine compartment, should a DCP fire extinguisher still be required for use in the cabin? Please provide your reasoning.



# 6 Location and accessibility

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## Current code

Section 12.1.2.4 of the current code requires the extinguisher(s) to be secured with a “quick-release attachment”, though no further information on this is provided. The current code also mandates certain placement of extinguishers in 12.1.2.5. In particular:

- 12.1.2.5.1 Each fire extinguisher required by this Section must be located so as to be readily accessible for use.
- 12.1.2.5.2 On road tank vehicles, fire extinguishers must be located and stowed in accordance with AS 2809.1.
- 12.1.2.5.3 Where two or more fire extinguishers are required for the load area of any vehicle, one should be located on the left (near) side towards the rear of the vehicle and, wherever practicable, another should be mounted on the right (off) side towards the front of the vehicle.
- 12.1.2.5.4 Except in the case of a combination vehicle, if only one fire extinguisher is required for any vehicle, wherever practicable it should be located:
  - (a) on the discharge side of a road tank vehicle; or
  - (b) in the cabin for all other vehicles.
- 12.1.2.5.5 If 12.1.2.5.4 or Table 12.1 requires that a fire extinguisher be located in the cabin, as an alternative to being located in the cabin the fire extinguisher may be located directly behind the cabin or may be mounted on the rear of the cabin.

Note: AS 2809.1:2020 does not define where extinguishers must be located or stowed. This is not expected to change, so the code should either define this requirement more clearly or delete it.

## ADR Sub-section 8.1.4.5 – Installation

The ADR requirements on installation are less prescriptive than the current code. They state, “The fire extinguishers shall be installed on the transport units in a way that they are easily accessible to the vehicle crew. The installation shall be carried out in such a way that the fire extinguishers shall be protected against effects of the weather so that their operational safety is not affected. During carriage, the date required in 8.1.4.4 shall not have expired.”

**Question 17:** Should the future code retain the “quick-release attachment” requirement? If yes, why, or are their alternatives?

**Question 18:** Should the future code incorporate the requirements for where extinguishers should be located on the vehicle? Please explain your reasoning.

# 7 Design and maintenance

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The content in this section is based on the requirements in the ADR and discusses how these could be modified for use in the future code.

## Design and selection

ADR 8.1.4.3 - “The portable fire extinguishers shall be suitable for use on a vehicle and shall comply with the relevant requirements of EN 3 Portable fire extinguishers, Part 7 (EN 3-7:2004 + A1:2007).

EN 3-7:2004 + A1:2007 is the European Standard that deals with fire extinguisher selection. The relevant equivalents in Australia are understood to be:

- AS/NZS 1841 series of standards for design and construction requirements.
- AS/NZS 1850 series of standards for classification, rating, and performance testing.

It is expected that these standards would be substituted for the future code in place of the EN standard.

**Question 19:** Are AS/NZS 1841 and AS/NZS 1850 appropriate substitutions for the EN 3-7:2004 + A1:2007? If not, please provide alternative substitutions.

## Inspection and standards

ADR 8.1.4.4 – “The portable fire extinguishers conforming to the provisions of 8.1.4.1 or 8.1.4.2 shall be fitted with a seal which allows verifying that they have not been used.

The fire extinguishers shall be subjected to inspections in accordance with authorized national standards in order to guarantee their functional safety. They shall bear a mark of compliance with a standard recognized by a competent authority and a mark indicating the date (month, year) of the next inspection or of the maximum permissible period of use, as applicable.”

A seal is not mandated by the current code, though this may be a common practice for many extinguishers. AS 1851 requires a service tag showing the last date, and most extinguishers are equipped with a pressure gauge showing whether the extinguisher has sufficient pressure to operate.

As ADR operates in an environment where multiple national standards may apply, it does not specify a standard. In Australia, inspection and servicing of portable extinguishers is defined by AS 1851. AS 1851 does not require a “next inspection” mark, so including such a requirement would be additional to the current requirements of AS 1851.

The only place that the extinguisher validity period (six months) is found is in AS 1851. Thus, there is no clear direction in the current code about how to determine whether a particular fire extinguisher complies with this requirement or not.

**Question 20:** Should the future code include the seal requirement?

**Question 21:** Should the future code include information regarding AS 1851 inspection frequencies to support clearer communication of this requirement?

## 8 Next steps

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Consultation on this paper will close at 5:00 pm 9 July 2023.

Submissions received will be used to develop proposed provisions for the future code. Due to the complexity of these provisions, the proposed provisions may be prepared after other papers containing critical questions have completed consultation.

Opportunities to comment on other provisions in the code will be provided over the next 12 months. A complete draft code will be released for public comment in early 2024.

# Appendix A Current code requirements

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## 12.1.2 FIRE EXTINGUISHERS

- 12.1.2.1 A road vehicle transporting a placard load of dangerous goods must be equipped with a fire extinguisher or fire extinguishers in good working order and in accordance with Table 12.1.
- 12.1.2.2 On a combination vehicle, each separate unit on which a placard load of dangerous goods is transported must be equipped with fire extinguishers in good working order and in accordance with Table 12.1.
- 12.1.2.3 A fire extinguisher required by this Section must comply with:
- (a) AS/NZS 1841.1 and AS/NZS 1850 and AS1851; and
  - (b) AS/NZS 1841.4 or 5 as appropriate for the vehicle and load being carried.
- 12.1.2.4 Each fire extinguisher required by this Section must be mounted securely by means of a quick-release attachment.
- 12.1.2.5 Extinguisher Location
- 12.1.2.5.1 Each fire extinguisher required by this Section must be located so as to be readily accessible for use.
- 12.1.2.5.2 On road tank vehicles, fire extinguishers must be located and stowed in accordance with AS 2809.1.
- 12.1.2.5.3 Where two or more fire extinguishers are required for the load area of any vehicle, one should be located on the left (near) side towards the rear of the vehicle and, wherever practicable, another should be mounted on the right (off) side towards the front of the vehicle.
- 12.1.2.5.4 Except in the case of a combination vehicle, if only one fire extinguisher is required for any vehicle, wherever practicable it should be located:
- (a) on the discharge side of a road tank vehicle; or
  - (b) in the cabin for all other vehicles.
- 12.1.2.5.5 If 12.1.2.5.4 or Table 12.1 requires that a fire extinguisher be located in the cabin, as an alternative to being located in the cabin the fire extinguisher may be located directly behind the cabin or may be mounted on the rear of the cabin.

Table 12.1: Minimum Fire Extinguisher Requirements for Road Vehicles Transporting a Placard Load of Dangerous Goods

**Note:** this table has been edited to include the typical extinguishing agent weight/volumes to support comparison.

<p>Load:</p> <p>All types of dangerous goods packed in:</p> <ul style="list-style-type: none"><li>• packages, drums, overpacks, segregation devices</li><li>• intermediate bulk containers (IBCs) containing non-flammables – any quantity</li><li>• IBCs containing flammables with up to (and including) 10,000 L total capacity or containing up to (and including) 10,000 kg in total</li></ul> <p>Required extinguishers:</p> <p>1 × 30B (1 × 2 kg) dry powder that is to be placed in the cabin (see 12.1.2.5.5), or at the front of any trailer transporting a placard load</p>
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Load:

Non-flammable goods packed in:

- pressure drums, tubes, multiple element gas containers (MEGCs), tanks, bulk containers (solids)

Required extinguishers:

1 × 60B (1 × 4.5 kg) dry powder, or 2 × 30B (2 × 2 kg) dry powder, in the load area

1 × 10B (1 × 1 kg) dry powder in the cabin (see 12.1.2.5.5)

Load:

Flammable goods packed in:

- pressure drums, tubes, MEGCs, tanks, bulk containers (solids)
- IBCs > 10,000 L total capacity or containing >10,000 kg. in total

Required extinguishers:

2 × 60B (2 × 4.5 kg) dry powder, or 1x 80B (1 × 9 kg) dry powder and 1 × 20B (1 × 9 L) foam, in the load area

1 × 10B (1 × 1 kg) dry powder in the cabin (see 12.1.2.5.5)

## Appendix B Comparison of ADR and possible modifications

Note: this table compares the possible modifications used in chapter 5 with the current code requirements. The actual requirements that are developed may vary from this, and this table is included for illustrative purposes only.

ADG 7 Scenario	ADG 7	Modified ADR <4.5 t	Modified ADR ≥4.5 t	Each additional trailer
Less than placard load	None	1x2kg	1x2kg	None
Placard load of DG in packages, drums, overpacks, segregation devices	1x2kg	2x2kg	1x2kg + 1x9kg	1x9kg
Any non-flammable DG in intermediate bulk containers (IBCs) – any quantity	1x2kg	2x2kg*	1x2kg + 1x9kg	1x9kg
Any flammable DG in IBCs with up to (and including) 10,000 L total capacity or containing up to (and including) 10,000 kg in total	1x2kg	2x2kg*	1x2kg + 1x9kg	1x9kg
Non-flammable goods packed in pressure drums, tubes, multiple element gas containers (MEGCs), tanks, bulk containers (solids)	1x1kg + 1x4.5kg OR 1x1kg + 2x2kg	2x2kg*	1x2kg + 1x9kg	1x9kg
Flammable goods packed in pressure drums, tubes, MEGCs, tanks, bulk containers (solids)	1x1kg + 2x4.5kg OR 1x1kg + 1x9kg + 1x9L (foam)	2x2kg*	1x2kg + 1x9kg	1x9kg
Flammable goods packed in IBCs > 10,000 L total capacity or containing >10,000 kg in total	1x1kg + 2x4.5kg OR 1x1kg + 1x9kg + 1x9L (foam)	2x2kg*	1x2kg + 1x9kg	1x9kg

\* These scenarios are considered less likely to occur due to the combination of vehicle and load type. Light vehicles very rarely transport these kinds of loads.

The modified ADR proposal requires greater extinguisher capacity than the current code.

The current code requires a greater extinguishing capacity than the modified ADR proposal.

The modified ADR proposal requires more extinguishing capacity, when compared to the current code's DCP-only requirements. The modified ADR proposal provides less capacity when the DCP & foam option is selected.

# Glossary

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Include a glossary of terms for complex or technical documents.

Term	Definition
the Code	Refers to the Australian Code for the Transport of Dangerous Goods by Road & Rail – np specific edition
current code	Refers to edition of 7.8 of the Code
future code	Revised to the revised Code
ADR	Agreement concerning the International Carriage of Dangerous goods by Road
DCP	Dry chemical powder
FFFS	Fixed firefighting system
RID	Agreement concerning International Carriage of Dangerous Goods by Rail

# References

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