CBI

EXPLOSIVES INDUSTRY GROUP

A Guide to the Carriage by Road of Detonators with Blasting Explosive Substances

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Confederation of British Industry
Explosives Industry Group

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1. FOREWORD

This guide has been prepared to assist users, operators and manufacturers of vehicles for the carriage of explosives to design and build vehicles which may be used to carry detonators and blasting explosive substances simultaneously, and remain in compliance with the requirements of the Road Traffic (Carriage of Explosives) Regulations 1989 (CER) and the associated Approved Code Of Practice (ACOP).

Operators intending to transport blasting explosive substances in other European countries must consider the requirements of the countries through which vehicles will pass. Some countries prohibit the simultaneous carriage of detonators with explosives regardless of vehicle design. In particular, the International Carriage of Dangerous Goods by Road European Agreement (A.D.R.) prohibits such carriage, irrespective of any evidence that a vehicle can carry the joint load without any increase in danger.

The editions of the Regulations on which this guide has been based are:

- Road Traffic (Carriage of Explosives) Regulations 1989.
- Approved Code of Practice for C.E.R. pub.1989
- A.D.R. Edition dated 1990

The guide details the performance criteria which should be met to satisfy C.E.R. and outlines tests which could be conducted to demonstrate that a design and construction will meet the criteria.

In view of the wide range of potential combinations of detonator and blasting explosive substances and vehicle regimes the guide does not recommend any particular construction or materials.

Although this guide addresses the carriage of detonators with blasting explosive substances the principles embodied could be used to demonstrate that other mixtures of compatibility groups or explosives could be carried in compliance with the terms of C.E.R.

The Guide has been prepared by a working party of the Ad Hoc Working Group of the Health and Safety Executive and the Explosives Industry Group of the Confederation of British Industry. The Explosives Storage and Transport Committee of the Ministry of Defence also participated in preparing the Guide.

Readers should note that in publishing this guidance the C.B.I. takes no responsibility for the actions of users of the guide. Operators of explosives vehicles must ensure for themselves that their vehicles meet the requirements of the regulations.

2. INTRODUCTION

2.1. Scope of the Guidance

C.E.R. Regulation 7 requires that explosive substances and articles of mixed compatibility groups are not carried together unless effective measures are taken to ensure that the carriage of the mixed load is no more dangerous than the same quantity of any of the compatibility groups carried.

Usually blasting explosive substances are classified as 1.1D and may be carried in cartridge or bulk. Detonators are sometimes classified as 1.4S but more usually are 1.1B or 1.4B. Mixtures of compatibility groups S and D are permitted in schedule 3 of the A.C.O.P. but mixtures of groups B and D are only permitted when sufficient additional measures are taken to prevent an increase in the danger of the load.

The need for additional measures is identified as events and consequences which must be prevented to avoid the potential increased danger of joint carriage of detonators and explosives.

Most users will wish to carry detonators in some sort of box, container or compartment on the same vehicle as blasting explosive substances and it is these situations which the guide primarily addresses.

No particular design or construction is recommended because of the broad range of detonator and blasting explosive substances and the numerous operating regimes and vehicle types.

2.2. **Regulatory Requirements**

Schedule 3 of A.C.O.P. for C.E.R. Regulation 7 defines the only loads of explosives of mixed compatibility groups which may be transported, unless it can be demonstrated that the resultant mixed load is no more dangerous than the equivalent quantity of any one of the compatibility groups.

The A.C.O.P. requires operators wishing to carry mixed loads such as detonators and blasting explosive substances to take effective measures to ensure that the risk and consequence is no greater than the carriage of the same quantity of a single compatibility group.

A.D.R. does not permit the simultaneous carriage of compatibility groups B and D. (Marginal 11 403 refers.) Since most detonators and blasting explosive substances are classified in these categories their simultaneous carriage in countries applying A.D.R. is not permitted, *even if the operator can demonstrate that the carriage is no more dangerous than the carriage of a single compatibility group.*

2.3. **Risks of Mixing Detonators with Blasting Explosives**

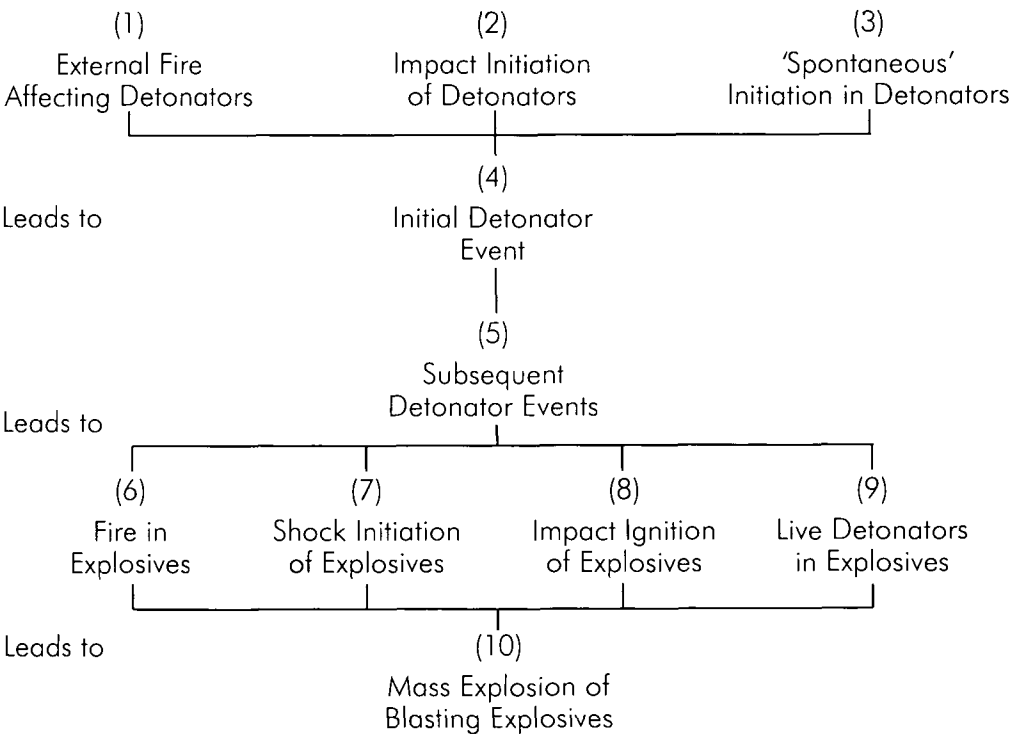
A clear purpose of the Regulations is to ensure that the greater potential for inadvertent initiation of detonators does not lead to the mass explosion of the blasting explosive substances. To this end the operator must show that the method which he wishes to use avoids this possibility.

The operator must consider all possibilities for accidental initiation and show by reference to experience, analogy to other situations, or by a series of tests to simulate an occurrence and consequence that this requirement has been satisfied.

3. PROPAGATION ROUTES

The following logic diagram displays the possible detonator initiation events and the routes by which they might propagate to explosion.

Propagation Routes and Events



N.B. Events 1,2,3 should not lead to events 6 - 10 otherwise the joint carriage could be construed as more dangerous than separate carriage.

4. CRITERIA TO SATISFY

The operator should demonstrate that:

4.1. Detonator events do not initiate the blasting explosive substances by shock waves.

4.2. Detonator events do not initiate the blasting explosive substances by impact of fragments of detonator or detonator container.

4.3. Detonator events do not lead to the possibility of live detonators approaching the blasting explosives so that subsequent initiatiion of the detonators could cause explosion of the explosives.

4.4. The construction of any separate compartment or container used for the carriage of detonators is such that it provides at least 15 minutes protection from a fire spreading to the other explosives as result of an internal detonator event. (See C.B.I. E.I.G. Guide to the Fire Resistance of Explosives Vehicles which describes tests to demonstrate the fire resistance of vehicle construction). The construction of any container carried in the same compartment or vehicle as the explosives should provide protection from fire at least as good as that of the compartment or vehicle itself.

5. TESTS TO CONDUCT

The tests described in this section are suggested to assist in proving the performance of the design and materials which a user may wish to adopt. The tests would need to be carried out on samples, sections or models of vehicle body and detonator container or compartment accurately representing the proposed construction.

Tests should be carried out safely, in a place and manner which prevents excessive spread of fragments and allows protection for personnel conducting the test.

5.1. Initiation test in the container

This test is to demonstrate the ability of the container or compartment to satisfy the Criteria given in Section 4 when subject to an internal explosion detonator event.

Test:-

A detonator container or compartment (or a simulation) is loaded to represent the load to be carried. A detonator is fired in the load in a position considered most likely to provide propagation of the explosion.

The test may need to be repeated sufficient times to ensure that the results are truly representative of the performance.

Observations:-

The test should be monitored by one or more cameras to record events. In addition it may be helpful to consider the following:-

- Witness screens may be placed to record the size/power of projections.
- Thermal effects may be monitored by using radiance monitors to measure the heat flux.
- Shock wave effects may be assessed by blast gauges or by placing samples of the most sensitive blasting explosive substances to be carried in a position of greatest exposure. (i.e. the position in which they may be carried, closest to the weakest point of the container.)

5.2. **External fire tests**

The purpose of this test is to demonstrate that a detonator container exposed to an external fire will satisfy the Criteria in Section 4.

Note: It is quite possible that the results of the initiation tests and data from other sources would provide sufficient information to draw conclusions about the behaviour of the detonator container in "fire" circumstances and may make this test unnecessary.
For example users may already have sufficient data on performance in fire to show that the construction and materials meet the requirements of the A.C.O.P. that any special goods vehicle compartment has fire resistance for 15 minutes (see C.B.I. E.I.G. Guide to the Fire Resistance of Explosives Vehicles).

Test:-

A detonator container or compartment (or simulation) loaded to represent the intended carriage is exposed to a fire. The severity and duration of the fire should be similar to the standard required to demonstrate 'fire resistance'. The fire is lit and the result monitored.

Observations:-

The fire and it's effects should be filmed for analysis by appropriately placed cameras. Additionally it may be helpful to adopt the following measures:-

- Witness screens may be placed to witness the power and size of projections.
- Blast gauges may be placed to record any blast effect to which the blasting explosive substances may be exposed.
- Thermal effects may be monitored by using radiance monitors to measure the heat flux.

6. PRINCIPLES OF CONSTRUCTION

The detonator container or compartment must be constructed to meet all of the Criteria of Section 4. In addition it must provide adequate security to prevent unauthorised access while allowing safe removal of the contents after a road traffic accident. A second means of access must be provided if the door opens to the side of the vehicle. (see A.C.O.P. Reg. 6 paragraph 34). As an example of an approach to this type of problem: The Institute of Makers of Explosives in the U.S.A. has published a Safety Publication, No.22 'Recommendations for the Safe Transportation of Detonators with Certain other Explosives.' This publication gives advice on the construction of containers for carrying detonators on explosives vehicles. A companion document 'Guide for the use of I.M.E.22 Container' has also been published. Readers should note however that the working party has no evidence that the I.M.E. container.will actually satisfy C.E.R. requirements.

In it's Safety Publication the I.M.E. recommends detonator containers should be made of laminate construction of either;

- 1/4" external plywood, 1/8" mild steel, 1/2" plasterboard, 1/2" plywood; laminated with waterproof glue and constructed with continuous fillet welds on the mild steel.

  or

- 22ga. sheetmetal, 1/2" plasterboard, 1/2" plywood, 1" hard wood and 1/4" plywood.

Containers must provide venting to relieve the effects of internal explosion and must provide direct access to the contents from outside the vehicle.

7. ACKNOWLEDGEMENTS

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