Defence Science Journal, Vol 49, No 1, January 1999, pp. 27-30

SHORT COMMUNICATION

Hazard Classification Testing of Primers used in Small Arms Ammunition

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ABSTRACT

Primer is a small initiating device used for ignition of propellant charge and subsequent ejection of projectile from a weapon. Hitherto, primers were classified under safety class. Recent accidents however, have raised doubts about their classification. Field trials were therefore carried out to ascertain their correct behaviour under different conditions. It was observed that the nature of filling composition, its charge mass and the type of package had profound influence on the hazard classification which could change its classification from safety class to mass explosion hazard.

1. INTRODUCTION

Explosives are classified depending upon their chemical characteristics and expected behaviour when suitably initiated. The classification is an important requirement to stipulate conditions for their safe storage and transportation. It is assigned either by analogy with existing explosives or by conducting field trials. The packaging plays a major role on the classification of explosives when compared to other dangerous goods. In fact, a relatively minor change in packaging can become critical and may convert a simple projection hazard into a mass explosion hazard.

The possible hazard classification codes for primers are 1.1 B, 1.2 B and 1.4 B or 1.4 S depending upon the nature of primary explosive substance and the package design. The parameters which change the classification of the primer are : nature and quantity of primary explosive, its design and type of package as well as the condition under which it is handled. The primers are normally manufactured within the factory for in-house use and its transportation is resorted to from one unit to another in transit packages. In certain cases, when the primers have to be transported from one factory to another, they are transported in approved service packages.

A trial programme was formulated to establish the classification of various primers manufactured by Indian ordnance factories. In this programme, trials were planned with primers in different conditions (viz., bulk or loose) and in different packages (viz., transit or approved service packages) as encountered during different stages of their processing, handling, storage and transportation.

2. TRIAL PROGRAMME

For finalising the trial programme, the data on different primers under manufacture in Indian ordnance factories was collected. The analysis of data showed that mainly two types of compositions are used for filling of primers. These compositions

Received 19 August 1997

Figure 1. Preparation for box test in transit package

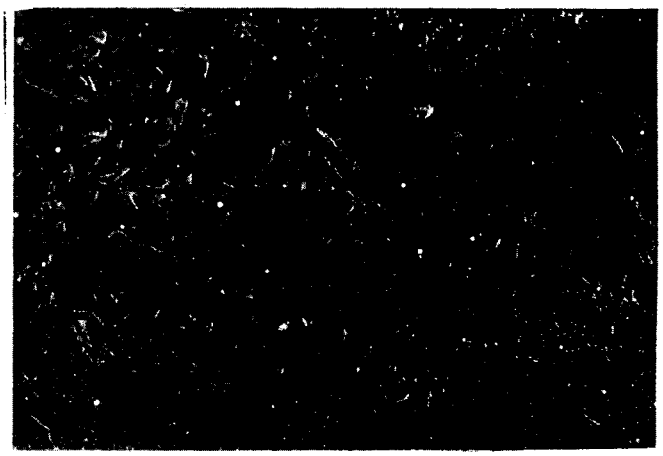

Figure 2. Trial site showing crater formation

are based on mercury fulminate and lead styphnate. The typical mercury fulminate-based composition is E-1 containing mercury fulminate, potassium chlorate, antimony sulphide, mealed gun powder, and sulphur, and is used in primers 0.303 in. 9 mm and schumine. In the mercury fulminate-based compositions, the percentage of mercury fulminate varies from 19 to 40 per cent. Likewise, typical lead styphnate-based composition is VH-2. It contains ingredients like barium nitrate, calcium silicide, antimony sulphide, lead peroxide, tetrazine and lead styphnate. This composition is used in caps for 84 mm, 0.22 in. and 12 bore ammunition. The percentage of lead styphnate varies from 38 to 90 per cent approximately. Representative primers containing the above compositions were selected to generate maximum data from the field trials. To ascertain the effect of charge mass on the classification of primers, field trials were also planned by varying charge mass of the same composition.

2.1 Assessment of Field Trial Results

The United Nations test procedure* was followed for the conduct of field trials and assessment of results. Using this procedure, three types of tests were carried out : (i) box test, (ii) stack test, and (iii) bonfire test.

3. EXPERIMENTAL DETAILS

The data collected from different ordnance factories revealed that about 17 types of primers are manufactured in India. For this field trial programme, test samples were selected based on the following parameters:

(a) Primers containing fulminate-based composition

(b) Primers containing lead styphnate-based composition

(c) Primers in loose condition

(d) Primers in approved packages

(e) Primers in transit packages.

The field trials were carried out under the following conditions:

3.1 Testing with Primers in Transit Packages

3.1.1 Box Test

A steel box containing the primers was placed on the ground and tamped with a sand bag. The primers at the centre of the box were initiated using electric detonator together with 10 g CE pellet. This resulted in mass explosion of the box with crater formation, and fragments from the box were scattered to varying distances. Figures 1 and 2 depict test preparation and the test site after firing, respectively.

* Manual of tests and criteria, Ed.2, revised United Nations, Geneva, 1995.

Figure 3. Stack of five packages with sand bags tamping

3.1.2 Stack Test

A stack of three steel boxes was prepared by placing these side by side, tamped with sand bags. The box at the middle was initiated using electric detonator and 10 g CE pellet. En-masse explosion of the stack with crater formation was observed and the fragments from the steel boxes were scattered to varying distances.

3.2 Testing with Primers in Approved Service Packages.

3.2.1 Box Test

Box test with approved service packages was conducted in the same manner as for transit package. On initiation, the steel box exploded and bulged open and a crater was formed. The lid of the box was also blown away from the test site.

Figure 4. Trial site after firing showing scattered packages

Figure 5. Trial setup for bonfire test

3.2.2 Stack Test

A stack of five packages was prepared on the ground and was tamped with sand bags on the top and on all sides. The box at the centre was initiated using electric detonator and 10 g CE pellet. Mass explosion of the steel box which was initiated, was observed. The other four steel boxes within the packages were found intact. Figures 3 and 4 show the stack setup with sand bags and the test site after firing, respectively.

3.2.3 Bonfire Test

A stack of five packages was prepared on a 1m high angle iron stand. It was covered with fire wood on all sides. On the three sides of the stack three aluminium screens of size 2 m × 2 m × .002 m were erected at a distance of 4 m. About 10 l of kerosene oil was sprinkled on the pyre and ignited

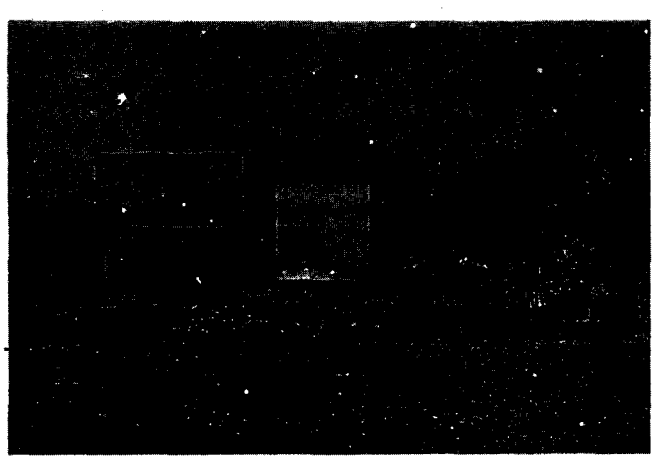

Figure 6. Trial site after firing showing indentation on aluminium sheet screen and remains of packages.

using a propellant trail. The boxes exploded one by one, and one package with all the four steel boxes was found intact at a distance of 3 m. A through hole of diameter 2 cm and prominent deep indentation marks on one of the screens were observed. Preparation of the stack for bonfire test is shown in Fig. 5 and test site showing indentation on the aluminium sheet screens as well as the remains of the stack are shown in Fig. 6.

4. CONCLUSIONS

From the analysis of the field trial results, the following conclusions are drawn:

(a) The nature of package has profound influence on hazard classification of primers. Primers when handled in loose or bulk condition as obtained in different manufacturing operations have mass explosion hazard, and are therefore classified under UN HD 1.1 B.

(b) Primers in transit packages, used within an ordanance factory for transportation from one production unit to another also carry mass explosion hazard, and are therefore classified under HD 1.1 B.

(c) Primers in approved service packages used for transportation from one factory to another have mainly projection hazard, and are therefore classified under UN HD 1.2 B.

(d) The charge mass has no significant effect on hazard classification of primers. The field trials have shown that the hazard classification depends on the nature of its compositions and not on its quantity.

ACKNOWLEDGEMENTS

The authors wish to express their sincere thanks to Ordnance Factory Board for providing all facilities for the field trials. They are also grateful to Dr A. K. Dutta, CC (R&D), New Delhi, for according permission to publish these findings.

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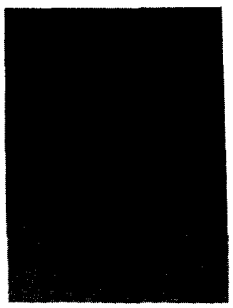

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