Report No. 41

NAT/emh
Aberdeen Proving Ground, Md.
March 11, 1936

EFFECT OF SEASONAL CHANGES ON THE VELOCITY AND PRESSURE OF STANDARD POWDERS STORED IN LEAKY CONTAINERS

Project KV 171 - Effect of Storage of Standard Powders in Leaky Containers.

Abstract

Firings were made of standard powders which had been stored in leaky and tight containers. The velocities of the powders from leaky boxes were about 4 f/s lower than those of the tight boxes. Comparisons were obtained of the velocities of powders from leaky and tight boxes which had been fired in June and September. The differences in velocity between leaky and tight boxes were about the same for the two dates of test.

Introduction

An earlier investigation* showed that many of the powder boxes used for storing standard powder are leaky. The leakiness of the boxes tested was due to leaks in the box liner. However, leaks could also occur around the closure gaskets, if the gaskets were defective.

The firings of this earlier investigation, made in June 1935, were made with two Lots of 75 mm powder and one Lot of 155 mm powder. The velocities of the 75 mm powders from leaky boxes were about 4 f/s lower than those of the tight boxes. The velocities of the 155 mm powder from leaky boxes were about 23 f/s lower, which

*Effect of Storage of Standard Powders in Leaky Containers on Velocity and Pressure, August 15, 1935.

appeared to be unquestionably significant because of the large difference in velocity.

The firings of the present investigation, made in September 1935, were a continuation of the previous firings with the added purpose of determining the effect of seasonal changes in the powder stored in leaky containers.

Preparation of powder charges.

Before weighing out the charge, the powders from the leaky boxes were poured out and blended. Samples of the powders, obtained while weighing the charges, were sent to Picatinny Arsenal for laboratory examination. One pyro and one FNH powder were used in the tests. The lot numbers were the same as the 75 mm powders used in the firing of June, 1935.

Firings Made

The following firings were made:

Date 1935	Gun	Powder Lot	Condition of box	Wt. of Charge ozs.	Wt. of Proj., lbs.	No. of Rds.
Sept. 20	75 mm Model 1897	X-1164-S	Tight	21.06	11.72	5
" "	"	"	Leaky	"	"	"
" "	"	X-3578-S	Tight	22.10	12.37	"
" "	"	"	Leaky	"	"	"

The rounds from the tight and leaky boxes were fired alternately. Velocities were obtained by Boulenge and Solenoid chronographs.

Results of Firings

The results of the firings are given in the attached firing record No. 8598. The following table shows the average velocities and pressures, and the probable errors of the mean.

Powder	Condition of box	Mean Sol. Vel. f/s	P.E. of Mean	Mean Boul. Vel. f/s	P.E. of Mean	Mean Pressure lb/in^2	P.E. of Mean
X-1164-S (Pyro)	Tight	1811.2	1.9	1803.8	2.5	23,700	25
"	Leaky	1806.6	.9	1798.4	1.9	23,510	90
	Diff.	4.6		5.4		190	
X-3578-S (FNH)	Tight	1794.8	2.3	1788.2	2.5	28,460	149
"	Leaky	1791.8	1.6	1782.0	1.9	28,460	166
	Diff.	3.0		6.2		0	

From the above results, it appears that the powders from leaky boxes gave lower velocities in every instance. Although the differences in velocity are small, the probable errors indicate that they are significant, but just barely so. Greater pressures were obtained with the pyro powder from the tight box. The pressures of the FNH powder from leaky and tight boxes averaged the same, but in view of the probable error the pressures from the tight box could have been the higher.

Comparison of June and September Firings.

The results of the firings of June and September are compared in the following table:

Powder	Time of Firing 1935	Condition of box	Mean Sol. Vel. f/s	Mean Boul. Vel. f/s	Mean Pressure lbs/in^2
X-1164-S (Pyro)	June	Tight	1810.0	1811.0	23,850
"	"	Leaky	1806.6	1808.4	23,590
	Diff.		3.4	2.6	260
"	Sept	Tight	1811.2	1803.8	23,700
"	"	Leaky	1806.6	1798.4	23,510
	Diff.		4.6	5.4	190
X-3578-S (FNH)	June	Tight	1802.0	1806.4	28,890
	"	Leaky	1798.0	1801.0	28,630
	Diff.		4.0	5.4	260
"	Sept	Tight	1794.8	1788.2	28,460
"	"	Leaky	1791.8	1782.0	28,460
	Diff.		3.0	6.2	0

The above comparison indicates that the relative difference in velocity of powder from tight and leaky boxes was about the same in June as in September. Hence no seasonal effect on velocity of powders from leaky containers is shown by the firings. Because of the greater humidity of the summer months, there should certainly be a seasonal effect, but in view of the results of the firings, it appears that the effect may be rather small and that a more extensive program of firings would be necessary to show definitely the effect.

Results of laboratory examination of samples.

Picatinny Arsenal Chemical Laboratory Report No. 44411 gives the results of the analyses of the September samples of powder.

The analyses of the June and September samples are compared in the following table:

Powder	Date of Sampling 1935	Ingredient	Tight box per cent	Leaky box per cent
X-1164-S (Pyro)	June	Total volatile	3.52	3.21
		External moisture	1.19	1.20
"	Sept	Total volatile	3.57	3.52
		External moisture	1.24	1.30
X-3578	June	Total volatile	.60	.62
		External moisture	-	-
"	Sept	Total volatile	.74	.73
		External moisture	.62	.66

From the results of the analyses it appears that the pyro powder in leaky boxes may have gained slightly in total volatile and external moisture from June to September. The seasonal change in the FNH powder does not appear to be appreciable since the tight and leaky boxes differ equally.

Effect of Storing previously weighed charges in leaky Containers.

In paragraph 3, 3rd indorsement of 0.0 471.5/7054, APG 471.5/526 misc., it is suggested that firings be made of charges that had been weighed before storage in leaky containers. For the purpose of carrying out this phase of the investigation, 10 charges each of Lots X-1164-8 (pyro) and X-3578-S(FNH) from tight boxes were weighed in September 1935, placed in bags, and stored in leaky boxes. These charges were reweighed in February 1935, and it was found that the change in weight was very slight. The weights of the FNH charges were almost exactly the same, but there was some slight increase in the weight of the pyro charges averaging .01 ounce. It is planned to fire these charges when the change in weight becomes appreciable.

Summary

1. The velocities of the standard powders from leaky boxes were lower than those of the tight boxes. However, the difference in velocity was small.

2. An appreciable seasonal effect on the velocities of powder stored in leaky containers was not shown by the firings.

3. Laboratory analyses indicate that the pyro powder stored in leaky containers may have gained slightly in total volatiles during the summer months. The seasonal changes in the FNH powder does not appear to be appreciable.

4. In September 1935, a number of charges were weighed and stored in leaky containers for the purpose of determining the effect of such storage on previously weighed charges. It is planned to fire these charges when the change in weight bdcomes appreciable, but at the present time, the change is very small.

N. A. Tolch.

H. H. Zornig
Lt. Col., Ord. Dept.,
Chief Research Division