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RAC EQUIPMENT TRIALS WING RAC CENTRE

REPORT

WEAPONS BRANCH REPORT

ON

CHARGES AND ADAPTORS, BLANK, FOR

105 mm TK GUN L7

LC-11115

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RAC EQUIPMENT TRIALS WING

File No WB-441

⑦ WEAPONS BRANCH REPORT ON

CHARGES AND ADAPTORS, BLANK, FOR 105mm

TK GUN L7 LC-M11A2.

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⑪ 31 March 1966,

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WEAPONS BRANCH RAC EQUIPMENT TRIALS WING

Report on

CHARGES AND ADAPTORS, BLANK, FOR 105mm TK GUN L7

Project WB 441

Authority

1. Verbal authority from MOD(AEP 17)

Aim

2. To determine the realistic effect and any limitations of this type of blank ammunition.

Equipment

3. Centurion Mk 12 No 43 BA 88
Barrel No L/1962 in 1st quarter of life.

Ammunition

4. This consists of
 - a. Adaptors, Blank are made from 105mm cartridge cases, into which is fitted the special adaptor head. (See photograph 1). This head has a cavity and two spring-loaded catches for holding and retaining the charge. At the base of the cavity is a coil spring which pushes the charge against the retaining catches and assists removal of the charge when the catches are released. An electrical connection runs from the base of the cavity to the normal primer contact at the base of the cartridge case.
 - b. Charges, Blank, which have the appearance of small truncated cones. (See photograph 2). A detonator is held in a brass plug at the smaller end of the cone. The charge fits into the adaptor (see photograph 3) by being lightly pushed against the spring, the lip at the base of the cone pushes the retaining plungers outwards against the action of their springs when the charge is inserted. When the charge is fully home the retaining catches springs reassert themselves and the charge is held in position. (See photograph 4). After firing the spent charge cone can be released by pressing the lower portion of the retaining plungers to allow the adaptor spring to push out the cone which can be removed by hand. The charge detonator cap makes contact with the electrical connector at the bottom of the adaptor cavity.
5. Once a charge has been fitted to the adaptor the complete blank round can be loaded and fired in the normal manner.
6. Adaptors and charges were marked as follows :
 - a. Adaptors marked on base

Adaptor L2A2
105mm Tk
RW 244

Lot 2 RLB

1965

b. Charges painted on side of cone

REQN PB AMM/1819

CY 2/65

Some charges received were manufacturing rejects (see photograph 2) but all subsequently functioned satisfactorily. Defects were high or low gauge measurement and faulty cone lip turnover.

Procedure

7. The following tests were carried out on two days during March.

Day ONE

8. Weather Dry and sunny. Windspeed 12 ft/sec during the tests.
9. Test 1. a. Experienced Officer and NCO observers were placed at ranges of 350, 400, 800, 1000 and 1400 metres from the firing tank.
b. Four series of three charges each were fired. In each series a defect charge was fired in random sequence. The three charges in each series were fired as quickly as possible.
c. The tank driver was in position, closed down for the first two series, opened up for the second two series. He wore headsets for all series.
10. Results 1. a. All observers reported that there was a very realistic flash and volume of smoke produced from each charge. The difference, if any, between charges was not noticeable. Although each observer knew the position of the firing tank, all agreed that the flash and smoke would be sufficiently distinctive to attract attention to a camouflaged position.
b. The driver reported that there was no discomfiture either opened up or closed down.
c. The turret crew was opened up and reported that the discomfiture from fumes was considerable after each three charges. The loaders duties were particularly uncomfortable as the breech had to be opened by hand and in bending forward to open and remove the adaptor he had to put his face into a cloud of fumes from the breech.
d. The adaptor head or catches did not become too hot (although warm) to handle with bare hands but the lip of each fired charge was very hot and could not be touched with bare hands.
11. Test 2. a. The tank was placed in front of a 7'x7' gridded canvas screen at successively 20, 15, 10 and 5 metres.
b. One observer was each side of the screen at a distance of 10 metres, looking at the screen. The driver was in position, without headsets, opened up.
c. At each tank position two charges were fired at the canvas screen.
12. Results 2. a. During each charge firing the observers noticed 'fragments' being projected forward from the muzzle. These were found to be the circular waxed paper base of each charge.
b. At no range was the screen marked in any manner. At only the 5 metre range was the screen affected by blast, when it was pushed back about 6 inches and then reasserted itself.
c. At no time did either observer feel any discomfiture from noise or blast. They did not at any time look directly at the gun muzzle but the flash was not troublesome.
d. Similar results to para 10.c. were reported by the turret crew.

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13. Test 3. Two observers were placed 20 metres forward of the tank with their backs toward it and two charges fired at a point two metres above their heads.
14. Results 3. Neither observer felt any discomfiture from noise or blast.
15. Test 4. A 4-pane window frame measuring 3'x1½' supported on a wooden frame 5' above the ground was placed 2 metres in front and 2 metres to a flank of the gun muzzle. Two charges were fired.
16. Results 4. There was no damage to the glass.
17. Test 5. The tank was placed in front of a 6-pane window frame measuring 4'x1½' supported in a wooden frame 5' above the ground at successive distances of 15, 10, 5 and 2 metres. Two charges were fired at each range with the gun pointed directly at the frame.
18. Results 5. The window panes were all blown out at 2 metres. There was no apparent damage before this range.
19. Test 6. An attempt was made to fire a charge which was not correctly held in place in the adaptor head.
20. Results 6. a. It proved impossible to fire a charge which had not been pushed home past the retaining plungers.
b. One charge was inserted at an angle so that it was held by one plunger only. This charge fired satisfactorily and on withdrawing the adaptor case it was found to have been set back into the second plunger and fully home.

Day TWO

21. Weather Dry and sunny. Wind speed 18 - 20 ft/sec during the trial.
22. Test 7. a. The tank was placed in dry heather with a background of dark coniferous trees. The sun was at approximately 30° elevation directly behind the tank.
b. Experienced observers were placed at 1000m and 2000m directly upwind of the tank. Observers knew the approximate location only of the tank and were looking into the sun.
c. A series of three charges were fired directly at the observers and into the wind. The gun was then traversed 1600 mils so that the line of fire was at right angles to the observers and wind and a further series of three charges fired.
23. Results 7. a. The flash and smoke were clearly visible to observers when the gun was fired into and across the wind at both ranges.
b. Observers at 1000m distinctly heard the sound of firing when the gun fired into and across the wind.
c. Observers at 2000m heard only two charges fired when the gun was fired directly into wind. Nothing was heard when the gun was fired across the wind.
d. After firing one charge it was discovered that the brass detonator plug of the charge had separated from the remainder of the charge case. This was subsequently found on the ground 3 metres forward of the gun muzzle. This malfunction occurred with a correctly manufactured charge.

Charge Residue

24. Firing the blank charges makes the gun barrel, chamber and breech mechanism very dirty. There is a very marked carbon deposit after firing each charge, some of which, because of lack of obturation, makes its way past the cartridge case into the breech mechanism. The carbon build-up in the chamber is considerable after 5 or 6 charges. After 19 charges had been fired the deposits in the barrel remained smouldering when the adaptor was removed. On one occasion when pointing directly into wind some of this smouldering deposit was blown back into the turret when the breech was opened.

25. At this stage a fresh charge was loaded into the chamber to see if a "cook-off" would occur. After $\frac{1}{2}$ minutes no cooking-off had taken place and the charge appeared to be completely unharmed although slightly warm. This charge subsequently fired satisfactorily.

26. After 10 - 12 charges had been fired the breech mechanism failed to close properly due to becoming fouled with carbon deposit. After wiping down and the mechanism worked satisfactorily for another 8 - 9 rounds before requiring further attention.

27. The adaptor head gets very dirty after one charge and the degree of fouling after 4 - 5 charges is such that the cup of the adaptor head needs wiping out if the charges are to be inserted properly. Failure to do this means that the charge has to be forced home and tends to jam so that the spring cannot push it out of the adaptor head when the plungers are released. This means removal by screwdriver or similar tool, it cannot be prised out by hand because it is too hot until allowed to cool off for 5 - 6 minutes.

28. Due to contact with the very dirty adaptor head the loader's hands and clothes quickly become fouled with the grey carbon deposit.

Cleaning

29. The main armament was stripped and thoroughly cleaned within 2 hours after firing. No difficulties were experienced in removing the dirt at this stage, but a definite circular mark just forward of C of R was left in the barrel which could not be removed by scrubbing. It is considered that cleaning must be done as soon as practicable after firing these blank charges since the carbon deposit may harden if allowed to remain for long periods (overnight) and will then be difficult to remove. Gunfitter's report is at Annexure 'A'.

30. a. One adaptor was cleaned immediately after use, and one allowed to stand for 24 hours. The length of time to thoroughly clean each is considerable (see Annexure 'A').
- b. Care must be taken to remove all surplus oil from the adaptor head cavity in the vicinity of the electrical contact to preserve insulation.

31. Since the fouling is in the form of a light grey dirty dust the barrel, breech mechanism and adaptors blank should be as dry as possible before using this type of ammunition. It is then possible to blow or brush off a great deal of the deposit as it builds up. Oiled or greased parts will cause the deposit to coagulate and clog the working parts.

31. Adaptor heads should be thoroughly wiped after every 5 - 6 charges fired and the breech mechanism brushed or wiped clean with dry rag as frequently as possible when using this type of blank ammunition.

Stowage

32. The adaptor, blank, will fit into the projectile stowage racks of Centurion Mk 12. In order to allow recharging to be carried out reasonably easily it is suggested that two adaptors are necessary for each tank.

33. The charges were provided loose for the trial. It is suggested that if accepted for Service use they are packed in cylindrical containers which can be fitted into Centurion ammunition racks. It is considered that most loaders will stow their 'ready' charges in the loaders oddments bin.

Reliability

34. There were no misfires. Three of the charge cases split during firing and the brass base plug of one charge was projected forward, (see para 23.d.).

Conclusions

35. The charges and adaptors, blank, 105mm, provide a realistic and apparently economical means of simulating tank gunfire.

36. The blast effects appear to be very small. It is apparent that personnel without ear protection can stand 20 metres in front or 10 metres to a flank of the muzzle without detrimental effects from blast. The possibility of window damage would appear to be small unless the charge is fired very close to the window. Both these points need checking by the Ordnance Board particularly in view of the possibility of larger fragments being projected forward (para 23/d.).

37. The firing of these charges produces a very considerable degree of dirt and fumes. The latter are uncomfortable in a tank opened up after firing 5 - 6 rounds rapid fire, particularly for the loader. If the fume extractor cannot operate, fumes must be accepted, but they are a serious nuisance.

Recommendations

38. It is recommended that the adaptor and charges be accepted for Service use, subject to safety clearance by the Ordnance Board, since they provide a simple means of simulating tank gunfire.

39. It is further recommended that

- a. The design authorities be urgently requested to consider altering the composition of the charge to reduce the amount of dirt deposited on the barrel, breech mechanism and adaptor after firing.
- b. The Ordnance Board be asked to confirm the blast effect distance recorded during the trial and to clear the blank charge for safety as a matter of urgency.

GUNFITTERS REPORT AFTER FIRING ON DAY ONE

ADAPTORS, BLANK, 105mm.

1. Cleaning after firing

Number of blanks fired per adaptor ... 17

Two adaptors were selected for cleaning trials, 'A' was cleaned immediately after firing, 'B' was cleaned 24 hours after firing.

2. Cleaning Materials

Cotton waste

Cleaning rag

Oil OMD 110

Oil OM 13

3. General

Both rounds were in a similar condition. The adaptor heads were covered externally with a carbon deposit, partly caked and partly loose. This deposit extended down to approximately 2" below the top of the brass case. Internally the deposit was mainly caked.

4. Blank 'A'

Cleaning time was approximately 30 minutes. The loose carbon was wiped off with an oily rag. Continuous application of the various oils removed most of the caked carbon but not all of it. The hard caked carbon remained, even after soaking in oil for several hours. This carbon was found in spots on the top of the adaptor head, under and on the clips, and internally on the cone seating.

5. Blank 'B'

Cleaning time was approximately 45 minutes. The cleaning procedure was the same as for Blank 'A'. The loose carbon was harder to remove and the hard caked deposit was more extensive, especially around the clips.

6. Conclusions

It would seem that an abrasive is the only practical way to remove all the hard caked carbon, and immediate cleaning is easier than delayed cleaning.

BARREL CLEANING AFTER FIRING

7. The number of rounds fired was 34. Barrel in first quarter of life. Cleaning was carried out within 2 hours of firing. Due to the large amount of loose carbon produced it was necessary to remove the breech block. Cleaning procedure was as normal for after firing.

8. Cleaning Materials

Cleaning rag

Oil OM 13

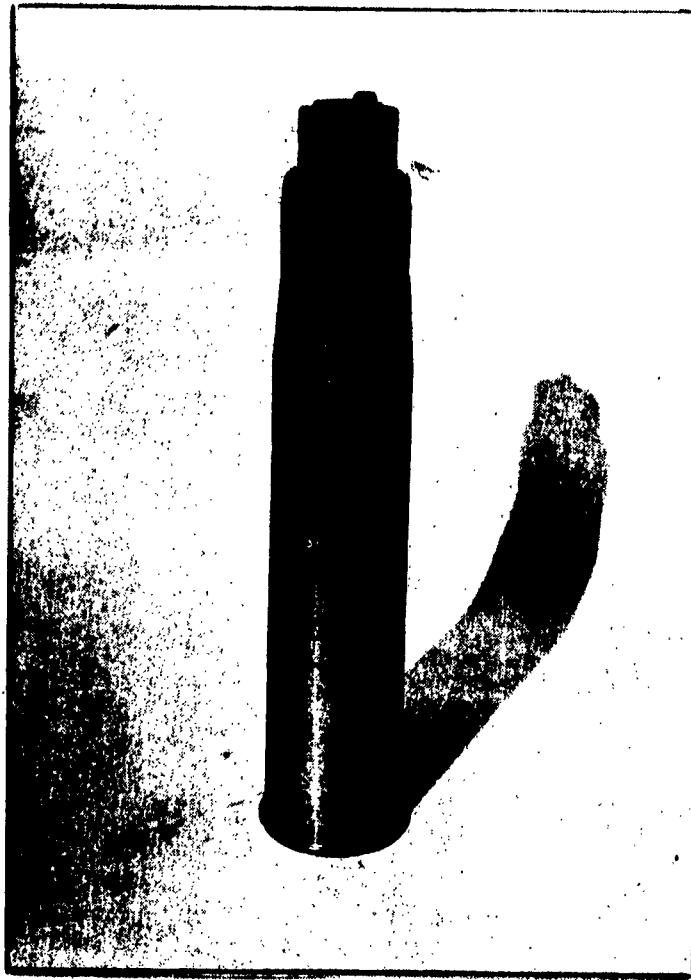
9. Observations

After cleaning the barrel was left dry and visually inspected. It was observed that a deposit of what appeared to be caked carbon was present starting at a point approximately 3" forward of C of R. The deposit started all around the bore from this point and was on the grooves and lands. Between 10 o'clock and 2 o'clock the deposit extended forward for approx 6". Between 2 o'clock and 10 o'clock the deposit extended forward for approx 2". After further scrubbing the deposit was reduced. At this point the gauge plug bore low limit was passed easily, with a slight stickiness at the point of the deposit. The following day two HESH Prac rounds were fired. After normal cleaning after firing there was still a slight deposit observed in the grooves at the point 3" forward of C of R between 2 o'clock and 6 o'clock. This deposit was reduced still further by scrubbing at that point, but was not removed entirely.

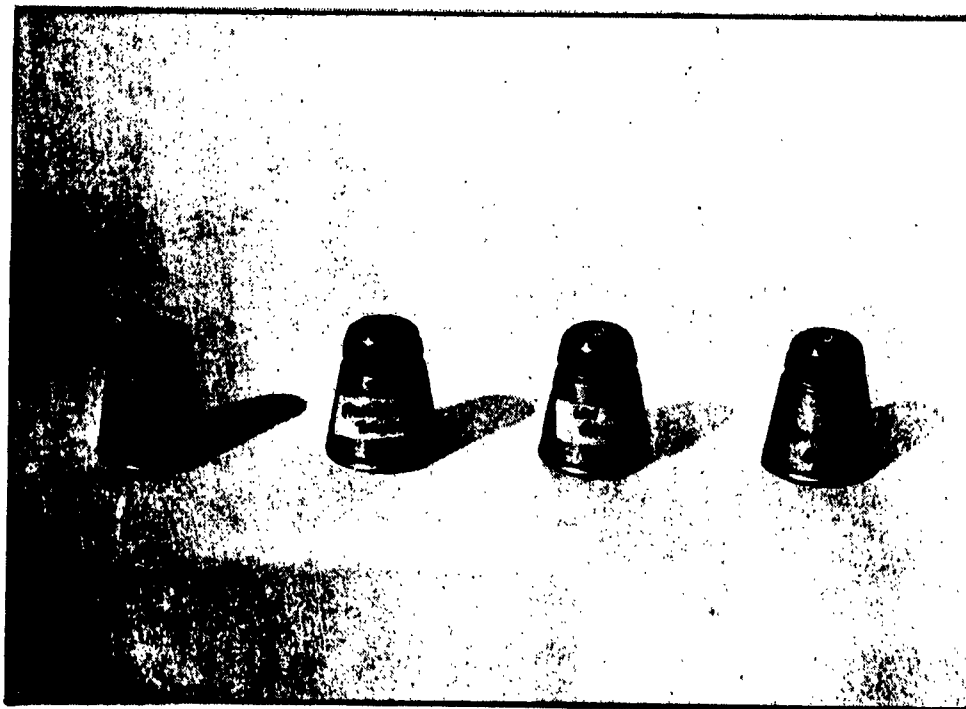
10. Conclusions

The hard carbon deposit is extremely difficult to remove and would appear to build up. A 'cleaner' round and scrubbing over a week would seem the best way to remove the deposits.

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Photograph 1 - Adaptor, Blank, 105mm Tk Gun L7



Photograph 2 - Charges, Blank, for 105mm Tk Gun L7



Photograph 3 -

Blank charge about to
be inserted into adaptor.



Photograph 4 -

Blank charge in firing
position in adaptor.



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