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TITLE

THE 25 PDR. BE/CHEM SHELL UNDER WINTER CONDITIONS

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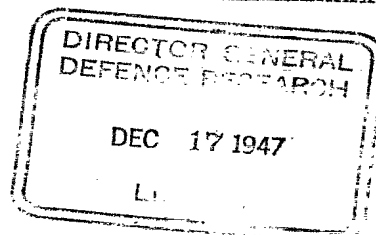
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EXPERIMENTAL STATION, SUFFIELD, ALBERTA	
REPORT NO.	<u>17</u>
SERIAL NO.	<u>10.</u>
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SUMMARY

34A THE 25 Pdr BE/CHEM SHELL UNDER WINTER CONDITIONS

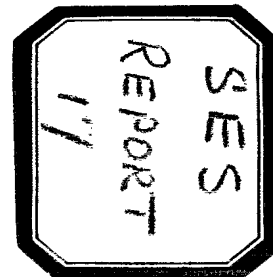
The 25 pdr BE/Chem shell to DD/L 10155 has been fired at all charges and various ranges, at a number of temperatures from 19°F to -20°F. Three types of service chargings were used, HM-V, HB-V and HT-V (all 12 poise at 100C). Charge III was found to be stable at all ranges and temperatures; Charge II stable below QJ 15° and Charge I unstable. The lower limit of temperature to give a satisfactory drop distribution of the charging appears to be about 0° - 30F for HT-V and 100F for HM-V and HB-V.

The 221 fuze appeared to burn slower under extreme cold weather conditions; otherwise the shell behaved correctly.

E.L. Davies

(E.L. Davies)
Chief Superintendent,
Experimental Station.

Classification / Designation u/u
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 Sur l'Autorisation de _____
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1946/1844

EXPERIMENTAL STATION, SUFFIELD, ALBERTA

REPORT NO. 17

SERIAL NO. _____

DATE 8th June, 1942THE 25 Pdr BE/CHEM SHELL UNDER WINTER CONDITIONS1. INTRODUCTION

The Priority Programme of Research for the Experimental Station includes the investigation of chemical shell charged mustard under Canadian winter conditions. It was considered necessary to make a complete study of this subject with the following objects in view.:-

1. To check the statement laid down by the Ordnance Board that the 25 pdr BE/Chem Shell should not be fired at temperatures below 40°F.
2. To determine the stability at low temperatures at all charges and various ranges.
3. To assess the shell contamination with production charges under winter conditions.
4. To obtain information of lowest temperatures at which these shell can be used.

2. EXPERIMENTAL DETAILS

All firing was carried out on the ranges at Suffield. Five trials as laid down in Field Experiments Nos. 7 and 20 were completed during the winter 1941-2, Dec. 12 and 30, Jan. 3 and Feb. 17 and 23. These trials are reported in nine firing series to simplify the various conditions of shell charging, temperature and results.

Firing was done over a layout 250 yards by 300 yards, the line of fire being parallel to the longer side of the layout. The layout consisted of large jump cards (36" X 36") in rows 10 yards apart with 5 yards between cards in each row. Firing was done as nearly as possible into the wind in every trial.

Programme Ammunition was fired as follows.

Series 1	Charges I	at range	2,500	yards-shell	charged	HT-V
"	2	II	"	3,000	"	"
"	3	III	"	3,500	"	"
"	4	III	"	3,500	"	"
"	5	III	"	6,500	"	HM-V
"	6	III	"	6,500	"	HB-V
"	7	III	"	10,000	"	HT-V
"	8	III	"	10,000	"	HB-V
"	9	III	"	10,000	"	HM-V

Temperatures during firing ranged from 19°F, all but one trial being carried out at 0°F or below. Wind speeds ranged from 4 mph to 14 mph. The ground was covered with about 2 inches of light powdery snow for all trials. One trial was carried out during a light snowfall.

All shell were stored out of doors for at least 24 hours prior to firing and in every case one round from each batch was opened and charging temperature recorded at the time of firing.

Where possible in each trial, times, where possible, of flight and heights of bursts were recorded. Stability was reported from both gun position and O.P. Assessments of cards were carried out where possible, in all trials where the charge reached the cards in drop form. (See below) It was found impossible to assess the contamination when it was ejected from the round in form of strings or plastic lumps- except insofar as to give an approximate value of the percentage of charging recovered.

Firing at Charge I was only carried out for one trial. All shell were wildly unstable and further trials were considered unnecessary.

Times of flight were taken using the method adopted by Porton. Three observers with stop watches at the O.P. recorded the time interval from the sound of the gun fired, transmitted over the telephone, to the burst of the round. Heights of burst were recorded from two windows in the target area.

RESULTS

i. Artillery details are shown in Appendix I and details of Ammunition in Appendix II. Meteorological observation and results of assessments of contamination are recorded in Appendix III. Appendix IV shows photographs of the shell chargings from Series 6 & 7.

ii. At Charge I and Q.E. of 21° 20' these shell were very unstable. At Charge II and Q.E. of 10° 35' all shell were stable and ranged correctly after the correction of the moment had been applied. The fuze appeared to burn correctly at 20°F, and gave a satisfactory zone. All shell were stable at Charge III over the entire temperature range. Fuzes appeared to burn longer than the range tables called for - the setting being from 0.2 to 0.4 longer in every case. The fuze zone, however, agreed with the Range Tables.

iii. All shell charged HT-V (12 poise) gave liquid contamination on the cards. With the exception of two or three rounds the drop spectrum was assessable by the normal methods after the cards had been allowed to dry out in a warm building. The drops from these shell were of a viscous and sticky nature adhering well to the card surface and to clothing. Even at the lowest temperatures (-20° F) the drops were liquid for at least 10 minutes after reaching the ground. The rounds which were not assessed produced stringy masses of mustard averaging 2 to 3 inches in length which adhered to the ground. (See RS 8505/9)

iv. It was found impossible to assess the shell charged HB-V and HM-V as the contents were ejected in the form of large plastic rope-like masses which failed to break up. The contents were, however, in the form of a very viscous liquid which adhered to the ground. The plastic pieces from shell were collected and gave recoveries of 80%, 95% and 60% of the shell charging, respectively. (See Appendix IV)

DISCUSSION OF RESULTS

i. As has been reported before, the shell were unstable at Charge I. This was expected as it is inherent in the shell.

ii. The fact that Charge III was stable seems to contradict the statement by the O.B. and indicates that the shell can be fired under low temperature conditions. (See Suffield Rep. No.6)

iii. The temperature limits on the shell chargings varies with the type of charging used. HT-V has a much lower range and at 10°F was still being ejected in drops although there was evidence of the charging being just on the border line. HM-V and HB-V appear to have reached their lower limit at 0°F. At this temperature it appears to be impossible to break up the large plastic mass in the shell. It would appear that the lower limit to give satisfactory performance in these shell is 0°F for shell charged HT-V and 10°F for shell charged HM-V and HB-V.

iv. The temperature effect on the drop size is noticeable in that the percentage of drops above 2.5 mm in diameter is increased while that below 1.0 mm is decreased.

v. Considerable difficulty was experienced in assessing the cards from these shoots. As the drops were frozen at the surface of the cards it was necessary to bring them into a warm atmosphere to be thawed and dried before they could be assessed correctly.

vi. Due to the extremely short and infrequent periods when temperatures were at or near 0°F the results are not as complete as was desired.

SERVICE APPRECIATION

i. It has already been reported that the 221 fuze burns rather longer than the range table calls for. This was experienced in the above cold weather trials. With experience in handling this fuze it is possible to allow for this condition although not as accurately as predicted shooting would call for.

ii. The results show that Charge III should be used whenever possible as no instability is experienced with this charge.

iii. Aside from the fuze time and the restriction on Charge I and II, firing this shell under winter conditions presents no particular difficulties to the gunner.

iv. From the point of view of anti-personnel effect, it is noticeable that the charging, whether ejected in form of drops or large plastic masses, was liquid enough to adhere to the ground or cards and hence would also adhere to service clothing. It is not considered that the drops would penetrate heavy winter clothing (i.e. sheep skin coat and battle dress). But the fact that they will adhere to the surface, freeze there and later on personnel entering warmer quarters will thaw, presents a problem in decontamination

4.

which must be met to avoid later casualties. This will cause considerable embarrassment to the supply of winter clothes (greatcoats etc,) of which a reserve of only 5% is nominally held. This in itself would seem to be sufficient reason for using shell charged mustard in winter months.

This report was written by Capt. J.T. Hugill, R.C.A. A/C.E.O.



(E.L. Davies)
Chief Superintendent;
Experimental Station,

JTH/EE

SUFFIELD REPORT NO. 17

Carried out

12/12/41
30-12-41
3/1/42
17/2/42
23/2/42

APPENDIX I

Artillery Details

Serial	Time of Firing	Nature of Shell	Shell Charging	Head Filling	Fuze & Setting	Ht. of Burst	Charge	Range	Angle of Descent	Time of Flight	Remaining Velocity	Bearing of Line of Fire	Ballistic Temp.	Wind Speed	Barometer	Wind Direction	Remarks.
1.	1340 12/12/41	25 pdr BE/ Chem Mtr ID to DD/L 10155	HT-V 12p at 10°C	1 1/4 oz. G-12	221 Set 7.6	---	I	False Range 2775 m & p range 2500				315°	26°F	4 mph	27.5	270°- 300°	5 rounds fired all unstable.
2	1415 1600 12/12/41	"	"	"	221 Set 4.7	11 rds fired 2 graze 2250' balance 50' - 200'	II	False Range 3250 M.R. 3500	12°38'	11.5 11.8 11.0	852 F/S	315°	20°F	4 mph	27.5	"	11 rounds fired. All stable. 4 Assessed.
3	1400 30/12/41	25 pdr BE/ Chem Mk. ID DD/L10155	HT-V 12 p	1 1/4 oz G-12	221 set 8.2	-	III	Map R 6500 False R. 6850	19°09'	18.0 18.2 18.5 20.0	905 F/S	315°	-20°F	14 mph	27.7	350°	11 rounds fired 2 Assessed.
4.	1315 31/1/42	"	"	"	221 set 10.3		III	False R 6850 M.R. 6500	19°09'	18.6	965 F/S	315°		14 mph	27.60	315° -000	12 rounds fired all stab.
5.	1300 17.2 142	"	EM-V 12 p	"	221 set 7.8	190 200 80	III	False R 6500	18°36'	18 19.2	911 F/S	315°		12 p.s.	27.60	280°	4 rds fired all shells stable.

12/12/41
30/12/41
3/1/42
17/2/42
23/2/42

Called out

SUFFIELD REPORT 17

APPENDIX I (cont)

Artillery Details.

	Time of Firing	Nature of Shell	Shell Charging	Head Filling	Fuze & Setting	Ht. of Burst ft.	Ht. of Charge	Range yds.	Angle of Descent	Time of Flight	Remaining Velocity F/Secs	Bearing of Line of Fire	Ball Temp. F.	Wind Speed mph	Barometer	Wind Dir.	Remarks
6	D1 1530	25 pdr BE/	HB-V	1 1/4 oz G-12	221 set	200	III	F.R. 6500	18°36'	18.6	911 F/S	315°	-20°F	12 f.s.	27.60	280°	All rds fired stable.
	D2 17.7	Chem MkID	12 p		7.8	150		Map R 6500	"	"							
	D3					9 range			"	"							
	D4					100			"	"							
7	4 1800	"	HT-V	"	221 set	627	III	F.R. 10,900	39°45'	Not Recorded	880 F/S	315°	0°F	22 f.s.	27.62	275°	15 rds fired. All stable.
	5 23.2		12 p		14.4	813		Map R 10,000	"	"							
	6 42					804			"	"							
	13					1314			"	"							
	14					981			"	"							
	15								"	"							
8	C7 "	"	HB-V	"	221 set	426	"	"	"	"	"	"	"	"	27.62	"	5 rds fired. All Stable.
	C8		12 p		14.4	1041			"	"							
	C13					660			"	"							
	C14					582			"	"							
	C16					221			"	"							
	C20					879			"	"							
	C21					607			"	"							
	C23					873			"	"							
	C28					363			"	"							
	C30					843			"	"							
9	D10 1800	25 pdr BE/	HM-V	"	"	663	"	"	"	"	"	"	"	"	"	"	10 rds fired. Shell stable fuze zone larger than Predicted.
	D13	Chem MkID	12 p			621			"	"							
	D14	DD/L 10155				474			"	"							
	D15					781		F.R. 10910	"	"							
	D19					279		Map R 10,000	"	"							
	D24					225			"	"							
	D29					531			"	"							
	D30					1041			"	"							
	D60					372			"	"							
	D31					837			"	"							

APPENDIX II

DETAILS OF AMMUNITION

Series No.	Shells	Cartridges	Fuzes	Temperature in Storage		Ballistic Temp.	Temp. in Field		Av. Wt. of Shell lbs. Oz.	Av. Depth of Filling ins.
				Shell Filling	Charge		Shell Filling	Charge		
1 & 2	QF 25 pdr BE/Chem. Mk ID DD/L 10155 charged Y 4 dr. band.	QF 25 pdr Mk II Cordite W.O. 16/057 Cart OG 49&50	T&P 221 Mk I lot 163 (Chem.)	35.6°F	40°F		31°F	25°F	20-1	1.73
3	do	do	do	-5°F	41°F		-2°F	-0°F	20-0	1.78
4	do	do	do	-5°F	41°F		-2°F	17.6	20-1	1.75
5	QF 25 pdr BE/Chem Mk ID DD/L 10155 Chgd Y 6-12p dr. band.	QF 25 pdr Mk II Cordite W.O. 16/057	T&P 221 Mk I lot 163.	-5°F	40°F		-20°F	21°F	20-5	1.75
6	do Chgd Y 14-12p	do	do	-5°F	40°F		-20°F	21°F	.5	1.75
7	do Chgd Y 4-12p	do	do	-10°F	40°F		0°F	18°F	20-5	1.75
8	do Chgd Y 6-12p	"	"	"	"		"	"	"	"
9	do Chgd Y 14-12p	"	"	"	"		"	"	"	"

SUFFIELD REPORT NO. 17

APPENDIX IV

Plate I Contents of Shell Charged HB-V Series 5 & 6.

Plate II Contents of Shell Charged HM-V Series 5 & 6.

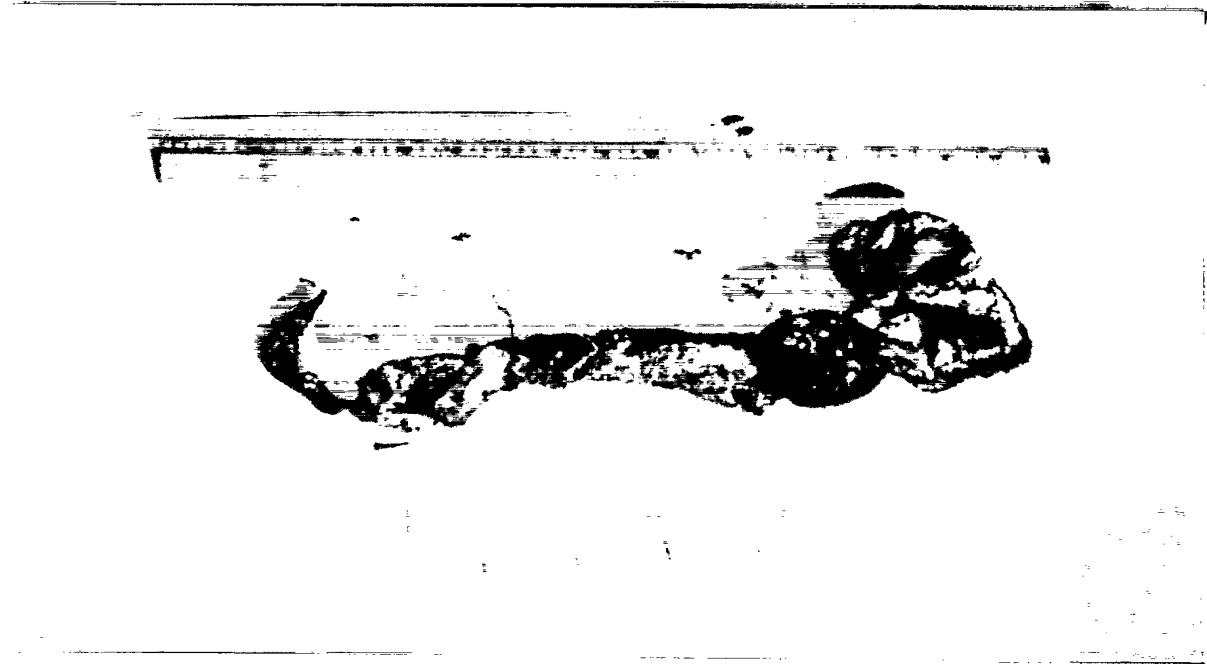


Plate I

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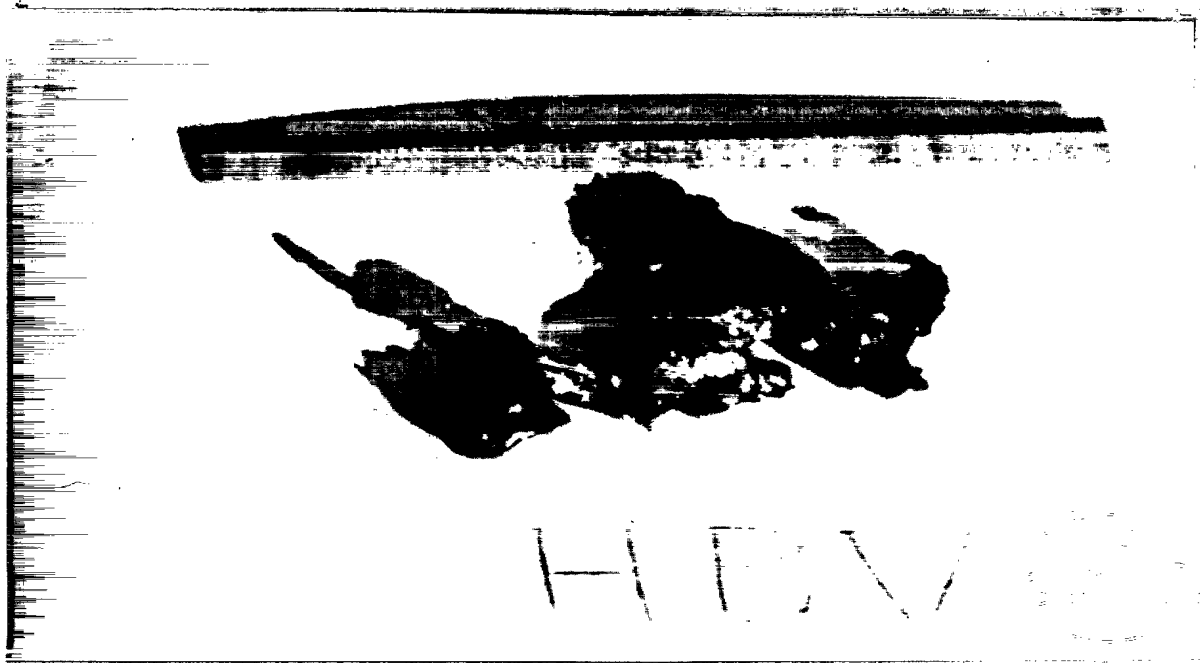


Plate II

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