UNCLASSIFIED

AD NUMBER
AD143734
CLASSIFICATION CHANGES
TO: unclassified
FROM: confidential
LIMITATION CHANGES
TO: Approved for public release, distribution unlimited
FROM: Controlling DoD Organization: Picatinny Arsenal, Dover, NJ.
AUTHORITY
ARRADCOM ltr dtd 8 Jul 1982; ARRADCOM ltr dtd 8 Jul 1982

THIS PAGE IS UNCLASSIFIED

THIS REPORT HAS BEEN DELIMITED
AND CLEARED FOR PUBLIC RELEASE
UNDER DOD DIRECTIVE 5200.20 AND
NO RESTRICTIONS ARE IMPOSED UPON
ITS USE AND DISCLOSURE.

DISTRIBUTION STATEMENT A

APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION UNLIMITED.

UNCLASSIFIED

AD 143 734

DEFENSE DOCUMENTATION CENTER

FOR

SCIENTIFIC AND TECHNICAL INFORMATION

CAMERON STATION ALEXANDRIA, VIRGINIA

DOWNGRADED AT 3 YEAR INTERVALS:
DECLASSIFIED AFTER 12 YEARS
DOD DIR 5200.10

UNCLASSIFIED

AD 443734

Armed Services Technical Information Agency

Reproduced by

DOCUMENT SERVICE CENTER

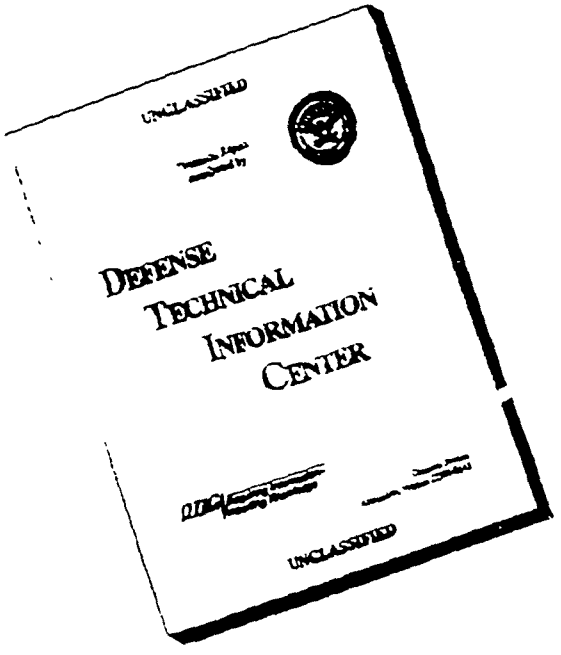
KNOTT BUILDING, DAYTON, 2, OHIO

On MICRO-CARD CONTROL ONLY

1 OF 1

NOTICE: WHEN GOVERNMENT OR OTHER DRAWINGS, SPECIFICATIONS OR OTHER DATA ARE USED FOR ANY PURPOSE OTHER THAN IN CONNECTION WITH A DEFINITELY RELATED GOVERNMENT PROCUREMENT OPERATION, THE U. S. GOVERNMENT THEREBY INCURS NO RESPONSIBILITY, NOR ANY OBLIGATION WHATSOEVER; AND THE FACT THAT THE GOVERNMENT MAY HAVE FORMULATED, FURNISHED, OR IN ANY WAY SUPPLIED THE SAID DRAWINGS, SPECIFICATIONS OR OTHER DATA IS NOT TO BE REGARDED BY IMPLICATION OR OTHERWISE AS IN ANY MANNER LICENSING THE HOLDER OR ANY OTHER PERSON OR CORPORATION, OR CONVEYING ANY RIGHTS OR PERMISSION TO MANUFACTURE, USE OR SELL ANY PATENTED INVENTION THAT MAY IN ANY WAY BE RELATED THERETO.

DISCLAIMER NOTICE



THIS DOCUMENT IS BEST QUALITY AVAILABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

BEST

AVAILABLE

COPY

This document is the property of the United States Government. It is furnished for the duration of the contract and shall be returned when no longer required, or upon recall by ASTIA to the following address:
Armed Services Technical Information Agency, Document Service Center, Knott Building, Dayton 2, Ohio.

NOTICE: THIS DOCUMENT CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE 18, U.S.C., SECTIONS 793 and 794. THE TRANSMISSION OR THE REVELATION OF ITS CONTENTS IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW

AD No. 143234
ASTIA FILE COPY

[redacted]

NATIONAL NORTHERN CORPORATION

West Hanover, Massachusetts

NNC-M-29

PROGRESS REPORT 2010-5

FC
BAC

10 August to 9 September 1957

SENSITIVITY OF EXPLOSIVES TO SETBACK PRESSURE

Contract DAI-19-020-501-ORD-(P)-59

Project TA1-3501

Submitted by:

Arthur W. O'Brien, Jr.
Charles W. Plummer

Approved by:
C. M. Saffer, Jr.
C. M. Saffer, Jr.
Technical Director

Approved by:
S. J. Porter
Vice President and
General Manager

NOTICE: This document contains information affecting the National Defense of the United States within the meaning of the Espionage Laws, Title 18, U. S. Code, Sections 793 and 794. Its transmission or the revelation of its contents in any manner to unauthorized persons is prohibited by law.

[redacted]

A Subsidiary of American Potash and Chemical Corporation

SCOPE OF WORK

Terms of Supplement provide: "Contractor, as an independent Contractor and not as an agent of the Government, shall continue to devote its best efforts and facilities for a period of twelve months from the effective date of this supplemental agreement in research and investigation of the sensitivity of explosives to setback pressure. Pursuant thereto, it is understood that Contractor shall engage in approximately 1500 additional shots or firings.

SUMMARY

Under the sponsorship and direction of Picatinny Arsenal, Mr. Samuel Stein, Project Officer, we have been investigating the principal factors believed to contribute to increased sensitivity of high explosives to "setback" pressures.

An initial survey of cavitation as a major cause of increased sensitivity of Composition B has been completed. Supplementary work, based on this initial survey, is now underway. This supplementary work has broadened our investigation to include grit additive and rough interior-wall finishes, with cavitation, as principal factors in increased sensitivity of Composition B.

I. GENERAL

The first part of our current effort consists of "staircase" testing of various combinations of cavitation, added grit, and roughened interior surfaces of sample sleeve to determine the general statistical behavior caused by these defects in samples of Composition B.

A first run-through on "staircase" testing provided a number of test conditions in which normal staircase testing could not be maintained because of the physical limits of the test fixture. We had set 70,000 pounds-per-square-inch setback pressure as our limit, in order to prevent damage to the fixture. The less sensitive conditions, where 50% of the samples could be expected to detonate at 70,000 psi, or above, were not completed to sixteen samples for each test condition, but were stopped after the first run-through of eight samples. We have now been requested to complete these series to sixteen samples, still maintaining our 70,000 psi limit.

We are now conducting single-pressure-level testing, designed to determine lower probability-of-detonation levels, where 7%-10% of the samples are ex-

[redacted]

pected to detonate. These single-pressure-level tests are planned for the more sensitive sample conditions.

II. THE EXPERIMENTAL APPARATUS

The experimental apparatus is essentially a piston-cylinder machine, the piston acting on a sleeve-and-punch assembly containing the sample to be tested. The force on the piston is developed by burning a carefully weighed quantity of propellant powder in the cylinder. This quantity varies from one to five grams, approximately, to produce desired "setback" pressures from about 10,000 to 70,000 pounds-per-square-inch on the sample pellet. The sample pellets are cylindrical and have basic dimensions of one-half inch diameter and one-inch length. The propellant used is M-9 60 mm. mortar propellant. Pressure measurements are made by Baldwin High Frequency Pressure Cell and, recently, a cell provided by Picatinny Arsenal. Pressure is recorded by camera from an oscillograph.

During all of this testing, we have encountered a number of difficulties with our apparatus. The most troublesome difficulty has been frequent failure of our pressure cells. It is believed that the cell is subjected to extreme vibration by the machine, especially with detonation of a sample. This vibration is accentuated by the manner in which the cell is mounted, normal to the piston-cylinder axis. A frequent difficulty has been the breaking of internal electrical connections without any apparent damage to the cell, externally. We have a smaller and more rugged cell, now in use, provided by Picatinny Arsenal. This cell has been operating for over a month now, with no breakdown. It is apparently better able to stand vibration because of its physical characteristics.

III. EXPERIMENTAL DATA

The following single-pressure-level testing has been accomplished during

this report period. The prior staircase-testing is included with each sample condition for completeness.

SETBACK SENSITIVITY STUDIES

Sample	Propellant Weight (grams)	Test Result	Setback Pressure (psi)	Time to Peak (ms)	Rate of Rise (psi/ms)
Test 5 - 12II 3/8 x 1/4 inch cavity, center of pellet, smooth sleeve, sand added.					
Staircase Testing					
1	4.30	Negative	59700	2.0	29800
2	4.80	POSITIVE	67600	1.7	39800
3	4.10	POSITIVE	53900	1.9	28400
4	3.50	POSITIVE	42600	2.1	20200
5	2.75	Negative	38000	(estimated)	
6	3.50	Negative	47000	(estimated)	
7	3.70	POSITIVE	53400	1.8	29800
8	3.00	Negative	39200	2.1	18700
9	3.70	POSITIVE	51400	1.0	51400
10	3.10	Negative	41000	1.0	41000
11	3.60	Negative	49000	1.5	33000
12	4.30	Negative	59000	1.0	59000
13	5.00	POSITIVE	69200	1.0	69200
14	4.20	Negative	61600	1.0	61600
15	5.00	Negative	71600	1.0	71600
16	5.00	Negative	71000	1.0	71000
Single - Pressure Testing					
17	3.40	POSITIVE	51000	1.0	51000
18	3.30	POSITIVE	48500	1.0	48500
19	3.20	POSITIVE	47800	1.0	47800
20	3.10	Negative	58000	1.0	58000
21	3.10	POSITIVE	58000	1.0	58000
22	2.90	POSITIVE	52000	(estimated)	
23	2.70	Negative	45000	2.0	23000
24	2.75	Negative	46000	1.0	46000
25	2.75	Negative	46000	1.0	46000
26	2.80	POSITIVE	46000	2.0	23000
27	2.85	POSITIVE	49800	1.0	49800
28	2.80	POSITIVE	47700	2.0	23900
29	2.79	POSITIVE	48000	1.0	48000
30	2.75	POSITIVE	47000	1.0	47000
31	2.75	POSITIVE	47000	3.0	15600

DAI-19-020-501-ORD-(P)-59

Sample	Propellant Weight (grams)	Test Result	Setback Pressure (psi)	Time to Peak (ms)	Rate of Rise (psi/ms)
Test 5					
Single - Pressure Testing (Cont.)					
32	2.75	Negative	47000	3.0	15600
33	2.75	Negative	47300	2.0	23700
34	2.75	POSITIVE	47500	1.0	47500
35	2.75	POSITIVE	47500	(estimated)	
36	2.75	POSITIVE	47000	1.0	47000
37	2.75	Negative	50500	3.0	17000
38	2.75	Negative	47500	2.0	23800
39	2.75	Negative	47500	1.0	47500
40	2.75	Negative	47100	2.0	23600
41	2.75	Negative	47000	1.0	47000
Test 17 - 3111 1/4 x 1/4 inch cavities at center and end of pellet, smooth sleeve, sand added.					
Staircase Testing					
1	4.80	POSITIVE	65000	1.8	36200
2	3.80	Negative	50800	2.0	25400
3	5.00	Negative	68600	1.8	38100
4	5.50	POSITIVE	(See Note A)		
5	5.50	POSITIVE	78800	1.3	60600
6	5.00	POSITIVE	68400	1.6	42800
7	4.05	POSITIVE	57100	2.1	27200
8	3.30	Negative	42900	2.8	15300
9	3.90	POSITIVE	55000	(estimated)	
10	3.20	POSITIVE	46200	1.5	31000
11	2.70	Negative	38500	2.0	19200
12	3.10	Negative	44000	1.0	44000
13	3.80	Negative	58200	1.0	58200
14	5.00	POSITIVE	70000	(estimated)	
15	4.10	POSITIVE	58200	1.0	58200
16	3.20	POSITIVE	44500	1.5	30000
Single - Pressure Testing					
17	2.80	Negative	41000	(estimated)	
18	2.80	POSITIVE	41000	(estimated)	

DAI-19-020-501-ORD-(P)-59

Sample	Propellant Weight (grams)	Test Result	Setback Pressure (psi)	Time to Peak (ms)	Rate of Rise (psi/ms)
19	2.80	POSITIVE	41500	1.0	41500
20	2.00	POSITIVE	30700	1.0	30700
21	2.50	Negative	44700	1.0	44700
22	2.41	Negative	41100	1.0	41100
23	2.40	Negative	38100	2.0	19600
24	2.40	Negative	39500	1.0	39500
25	2.40	Negative	40000	1.0	40000
26	2.40	Negative	40000	2.0	20000
27	2.40	POSITIVE	39000	1.0	39000
28	2.40	POSITIVE	43300	1.0	43300
29	2.40	POSITIVE	41000	2.0	20500
30	2.40	Negative	40000	3.0	13300
31	2.40	POSITIVE	40000	1.0	40000
32	2.40	POSITIVE	40000	1.0	40000
33	2.40	Negative	43300	1.0	43300
34	2,40	POSITIVE	39700	2.0	19900
35	2.40	POSITIVE	32000	2.0	16000
36	2.40	POSITIVE	40000	1.0	40000
37	2.40	POSITIVE	39400	1.0	39400
38	2.40	Negative	39100	3.0	13000
39	2.40	Negative	40000	1.0	40000
40	2.40	Negative	40000	1.0	40000
41	2.40	Negative	40000	2.5	16000

Test 4 - 1122 1/4 x 1/4 inch cavity in center of pellet, rough sleeve, no sand added.

Staircase Testing

1	3.10	Negative	44500	2.0	22300
2	4.05	Negative	65800	1.4	47000
3	4.60	Negative	79200	0.5	158400
4	5.00	POSITIVE	87800	0.5	177000
5	4.60	POSITIVE	72200	1.0	72200
6	4.00	POSITIVE	57400	2.0	28700
7	3.50	Negative	43600	1.4	31000
8	4.20	POSITIVE	71900	1.2	59900
9	3.80	Negative	53000	1.5	35500
10	4.80	Negative	70000		(estimated)
11	4.80	Negative	66000	1.0	66000
12	4.90	Negative	72700	1.0	72700
13	4.90	Negative	70300	1.0	70300
14	4.90	Negative	72700	1.0	72700
15	4.85	Negative	72200	1.0	72200
16	4.80	Negative	65200	1.0	65200

Sample	Propellant Weight (grams)	Test Result	Setback Pressure (psi)	Time to Peak (ms)	Rate of Rise (psi/ms)
Test 4 (Cont.)					
Single - Pressure Testing					
17	2.65	Negative	44000	1.0	44000
18	2.68	Negative	43000	1.0	43000
19	2.70	Negative	44500	1.0	44500
20	3.10	Negative	52200	1.0	52200
21	3.00	Negative	51200	2.0	25600
22	2.95	Negative	49500	2.0	24800
23	2.96	Negative	50000	1.0	50000
24	2.96	Negative	50000	2.0	25000
25	2.96	Negative	45500	1.0	45500
26	2.96	Negative	50000	2.0	25000
27	2.96	Negative	48100	2.0	24000
28	2.96	Negative	51200	2.0	25600
29	2.96	Negative	50000	2.0	25000
30	2.96	Negative	52000	2.0	26000
31	2.96	Negative	50000	2.5	20000
32	2.96	Negative	50000	1.0	50000
33	2.96	Negative	50000	2.0	25000
34	2.96	Negative	50000	3.0	16700
35	2.96	Negative	52000	3.0	17300
36	2.96	Negative	50000	1.0	50000
37	2.96	Negative	50000	2.5	20000
38	2.96	Negative	50000	2.0	25000
39	2.96	Negative	50000	3.0	16700
40	2.96	Negative	51300	2.0	25700
41	2.96	Negative	50000	2.0	25000
Test 13 - 2211 3/8 x 1/4 inch cavity at one end of pellet, smooth sleeve, sand added.					
Staircase Testing					
1	3.60	POSITIVE	54800	1.0	54800
2	2.20	Negative	30300	2.0	15200
3	3.60	POSITIVE	48300	1.0	48300
4	3.00	POSITIVE	41100	2.0	20500
5	2.20	Negative	29100	2.5	11700
6	3.00	POSITIVE	43700	2.0	21800
7	2.30	Negative	32200	2.5	12900
8	3.00	POSITIVE	51200	1.0	51200
9	3.10	POSITIVE	38300	2.0	19000
10	2.20	Negative	32700	1.5	21000

DAI-13-020-501-(XD-(P)-59

Sample	Propellant Weight (grams)	Test Result	Setback Pressure (psi)	Time to Peak (ms)	Rate of Rise (psi/ms)
Staircase Testing (Continued)					
11	3.20	Negative	49000	1.0	49000
12	4.30	POSITIVE	68400	1.0	68400
13	3.80	POSITIVE	51000		(estimated)
14	3.10	POSITIVE	39000		(estimated)
15	2.20	Negative	34000	2.0	17000
16	3.10	POSITIVE	41000	1.0	41000
Single - Pressure Testing					
17	2.00	Negative	32300	2.0	16100
18	2.00	Negative	32300	2.0	16100
19	2.00	Negative	31400	2.0	15700
20	2.00	Negative	31200	3.0	10400
21	2.00	Negative	32000	5.0	6400
22	2.00	POSITIVE	32000		(estimated)
23	2.00	Negative	32000	1.0	32000
24	2.00	Negative	32400	2.0	16200
25	2.00	Negative	32000	2.0	16000
26	2.00	Negative	32600	2.0	16300
27	2.00	Negative	31500	3.0	10500
28	2.00	Negative	32000	2.0	16000
29	2.00	Negative	32000	5.0	6400
30	2.00	Negative	31200	4.0	7800
31	2.00	Negative	32800	2.0	16400
32	2.00	Negative	32300	2.0	16100
33	2.00	POSITIVE	30200	1.0	30200
34	2.00	Negative	32500	5.0	6500
35	2.00	Negative	32200	4.0	8500
36	2.00	Negative	32800	3.0	10100
37	2.00	Negative	28200	4.0	7000
38	2.00	Negative	31400	2.0	15700
39	2.00	Negative	31400	3.0	10500
40	2.00	Negative	29300	4.0	7300
41	2.00	Negative	32000	1.0	32000

Test 11 - 2121 1/4 x 1/4 inch cavity at one end of pellet, rough sleeve, sand [illegible]ded.

Staircase Testing

1	4.30	Negative	51300	2.0	25700
2	5.00	POSITIVE	69200	1.3	53200
3	4.50	POSITIVE	65000	1.2	54100

DAI-19-020-501-ORD-(P)-59

Sample	Propellant Weight (grams)	Test Result	Setback Pressure (psi)	Time to Peak (ms)	Rate of Rise (psi/ms)
Staircase Testing (Cont.)					
4	4.00	POSITIVE	59000	(estimated)	
5	4.00	POSITIVE	59000	(estimated)	
6	4.00	POSITIVE	62100	1.5	41400
7	3.50	POSITIVE	50800	1.2	42400
8	2.30	POSITIVE	33200	2.6	12800
9	1.80	Negative	22300	1.5	15000
10	2.40	Negative	31200	1.0	31200
11	2.90	POSITIVE	42800	1.0	42800
12	2.40	Negative	31700	1.5	21500
13	2.85	POSITIVE	39600	1.0	39600
14	2.45	POSITIVE	30800	1.0	30800
15	1.80	POSITIVE	21100	2.0	10500
16	1.00	Negative	11100	5.0	2000
Single - Pressure Testing					
17	1.00	Negative	6900	10.0	700
18	1.50	Negative	26000	5.0	5200
19	1.25	Negative	17700	5.0	3500
20	1.20	Negative	16200	20.0	800
21	1.18	Negative	11900	20.0	600
22	1.18	Negative	16200	10.0	1600
23	1.18	Negative	16300	5.0	3300
24	1.18	Negative	15000	11.0	1400
25	1.18	Negative	15200	7.0	2200
26	1.18	Negative	16700	5.0	3300
27	1.18	Negative	15100	10.0	1500
28	1.18	Negative	15000	13.0	1100
29	1.18	Negative	15000	10.0	1500
30	1.18	Negative	16200	8.0	2000
31	1.18	Negative	15200	5.0	3000
32	1.18	Negative	16500	5.0	3300
33	1.18	Negative	16700	7.0	2400
34	1.18	Negative	17300	5.0	3400
35	1.18	Negative	18400	6.0	3000
36	1.18	Negative	17200	4.0	4300
37	1.15	Negative	15000	12.0	1300
38	1.15	Negative	14100	12.0	1200
39	1.15	Negative	16300	6.0	2700
40	1.15	Negative	16200	7.0	2200
41	1.15	Negative	15100	5.0	3000

Sample	Propellant Weight (grams)	Test Result	Setback Pressure (psi)	Time to Peak (ms)	Rate of Rise (psi/ms)
Test 26 - 4112 1/4 x 1/4 inch cavities at either end of pellet, smooth sleeve, no sand added.					
Staircase Testing					
1	4.70	POSITIVE	68000		(estimated)
2	3.50	Negative	42000	3.0	14000
3	4.50	Negative	64400	1.5	43000
4	4.70	POSITIVE	70400	1.0	70400
5	4.00	Negative	54600	1.5	35700
6	4.70	POSITIVE	81400	1.0	81400
7	4.00	Negative	56600	1.5	37700
8	4.70	POSITIVE	68500	1.0	68500
9	4.05	Negative	60300	1.0	60300
10	4.65	Negative	69500	1.0	69500
11	4.65	Negative	68200	1.0	68200
12	4.70	Negative	66400	1.0	66400
13	4.75	POSITIVE	73000	1.0	73000
14	4.35	POSITIVE	67400	1.0	67400
15	4.00	Negative	62000	1.0	62000
16	4.40	POSITIVE	64200	1.0	64200
Single - Pressure Testing					
17	2.94	Negative	49800	3.0	16600
18	2.93	Negative	51000	2.0	25500
19	2.93	Negative	48100	1.0	48100
20	2.93	Negative	49000	2.0	24500
21	2.93	Negative	48100	3.0	16000
22	2.93	Negative	47600	2.0	23800
23	2.93	Negative	47600	3.0	15800
24	2.94	Negative	47000	2.0	23500
25	2.94	Negative	41000	3.0	13600
26	2.94	Negative	40000	2.5	16000
27	2.96	Negative	42000	1.0	42000
28	2.98	POSITIVE	36000	2.0	18000
29	2.98	Negative	43300	2.0	21600
30	3.00	Negative	43000	2.0	21500
31	2.94	Negative	43000	2.0	21500
32	3.00	Negative	43500	2.0	22700
33	3.00	Negative	46500	2.0	23300
34	3.00	Negative	43200	2.0	21600
35	3.20	Negative	43700	2.0	21800

Sample	Propellant Weight (grams)	Test Result	Setback Pressure (psi)	Time to Peak (ms)	Rate of Rise (psi/ms)
Single - Pressure Testing (Cont.)					
36	3.20	Negative	45200	3.0	15000
37	3.40	Negative	45500	2.0	22700
38	2.93	Negative	50100	2.0	25000
39	2.93	Negative	50200	2.0	25100
40	2.92	Negative	50200	2.0	25100
41	2.92	Negative	50200	2.0	25100

In addition to the preceding single - pressure tests, we have completed a series of control tests.

Control Test 33 - No cavities, smooth sleeve, sand added.

1	4.00	Negative	61300	1.0	61300
2	4.50	Negative	67700	1.0	67700
3	4.60	Negative	68200	1.0	68200
4	4.90	Negative	76000	1.0	76000
5	4.90	Negative	74200	1.0	74200
6	4.70	Negative	67200	1.0	67200
7	4.80	Negative	72300	1.0	72300
8	4.80	Negative	75000	1.0	75000

Control Test 34 - No cavities, smooth sleeve, no sand added.

1	4.70	Negative	68500	1.0	68500
2	4.80	Negative	72000	1.0	72000
3	4.70	Negative	70000		(estimated)
4	4.70	Negative	70000		(estimated)
5	4.70	Negative	71200	1.0	71200
6	4.70	Negative	68200	1.0	68200
7	4.70	Negative	65000	1.0	65000
8	4.70	Negative	68200	1.0	68200

Control Test 35 - No cavities, rough sleeve, sand added.

1	4.00	POSITIVE	90000	1.0	90000
2	3.00	Negative	41000	2.0	20000
3	3.50	Negative	65000	1.0	65000
4	3.55	Negative	65000	1.0	65000
5	4.00	Negative	73300	1.0	73300
6	3.57	Negative	68000	1.0	68000
7	3.58	Negative	65000	2.0	32500
8	3.58	Negative	65000	2.0	32500

Sample	Propellant Weight (grams)	Test Result	Setback Pressure (psi)	Time to Peak (ms)	Rate of Rise (psi/ms)
Control Test 36 - No cavities, rough sleeve, no sand added.					
1	3.50	Negative	67000	1.0	67000
2	3.58	Negative	69400	1.0	69400
3	3.59	Negative	67400	1.0	67400
4	3.60	Negative	69400	1.0	69400
5	3.60	Negative	68400	1.0	68400
6	3.60	Negative	69200	1.0	69200
7	3.65	Negative	65000	2.0	32500
8	3.65	POSITIVE	70000	1.0	70000

NOTE A:

In these tests, the pressure-time record indicates some abnormality. The oscillograms show a high and rapid peak of pressure followed by an unusually low sustained chamber pressure, less than half that usually obtained by the same propellant weight.

IV. MAN-HOURS

A total of 546 $\frac{1}{2}$ man-hours has been expended on this contract during this report period.

[redacted]

DAI-19-020-501-ORD-(R)-59

DISTRIBUTION LIST

MONTHLY PROGRESS REPORTS

	No. of Copies
Commanding Officer Picatinny Arsenal Dover, New Jersey Attn: Samuel Feltman Ammunition Laboratories, Contract Section	3
District Chief, Boston Ordnance District Army Base, Boston 10, Mass. Attn: Contracting Officer	1
Chief of Ordnance, Dept. of the Army Washington 25, D. C. Attn: ORDTA	1
Armed Services Technical Information Agency Document Service Center Knott Bldg., Dayton 2, Ohio	2
Commanding Officer, Picatinny Arsenal Dover, N. J. Attn: Samuel Feltman Ammunition Laboratories, High Explosives Section Mr. P. B. Tweed	1
Armour Research Foundation Illinois Institute Of Technology Technical Center Chicago 16, Illinois	1
Arthur D. Little Inc. 30 Memorial Drive Cambridge 42, Mass. Attn: Virginia Valeri	1
Dr. Walter C. McCrone, Jr. 500 East 33rd St. Chicago 16, Illinois	1

[redacted]