

AD 606683



COPY	2	OF	3	1st
HARD COPY	\$ 4.00			
MICROFICHE	\$ 0.75			

AD

WVT-11-6412

AUGUST 1964

104p

BORE EVACUATOR VALVE TEST, CANNON 155MM HOWITZER, M125

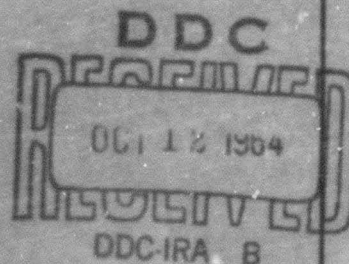
TECHNICAL REPORT

BY

J. M. GIESEY
MECHANICAL ENGINEER

E. R. LAWSON
MECHANICAL ENGINEER

R. L. ROSENBLUM
MECHANICAL ENGINEER



OL CODE NO. 4020.24.2223.2.10.04

WVT-11-6412

BENET R & E LABORATORIES
WATERVLIET ARSENAL
WATERVLIET - NEW YORK

DISTRIBUTED BY
OFFICE OF TECHNICAL SERVICES
DEPARTMENT OF COMMERCE
1200 S. EADS ST.
ARLINGTON, VA.

DDC AVAILABILITY NOTICE

Qualified requesters may obtain copies of this report from DDC.

Copies available at Office of Technical Services ~~11-52~~

DISPOSITION

Destroy this report when it is no longer needed. Do not return it to the originator.

DISCLAIMER

The findings in this report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents.

CLEARINGHOUSE FOR FEDERAL SCIENTIFIC AND TECHNICAL INFORMATION CFSTI
DOCUMENT MANAGEMENT BRANCH 410.11

LIMITATIONS IN REPRODUCTION QUALITY

ACCESSION #

AD 606663

- ☒ 1. WE REGRET THAT LEGIBILITY OF THIS DOCUMENT IS IN PART UNSATISFACTORY. REPRODUCTION HAS BEEN MADE FROM BEST AVAILABLE COPY.
- ☒ 2. A PORTION OF THE ORIGINAL DOCUMENT CONTAINS FINE DETAIL WHICH MAY MAKE READING OF PHOTOCOPY DIFFICULT.
- ☐ 3. THE ORIGINAL DOCUMENT CONTAINS COLOR, BUT DISTRIBUTION COPIES ARE AVAILABLE IN BLACK-AND-WHITE REPRODUCTION ONLY.
- ☐ 4. THE INITIAL DISTRIBUTION COPIES CONTAIN COLOR WHICH WILL BE SHOWN IN BLACK-AND-WHITE WHEN IT IS NECESSARY TO REPRINT.
- ☐ 5. LIMITED SUPPLY ON HAND: WHEN EXHAUSTED, DOCUMENT WILL BE AVAILABLE IN MICROFICHE ONLY.
- ☐ 6. LIMITED SUPPLY ON HAND: WHEN EXHAUSTED DOCUMENT WILL NOT BE AVAILABLE
- ☐ 7. DOCUMENT IS AVAILABLE IN MICROFICHE ONLY.
- ☐ 8. DOCUMENT AVAILABLE ON LOAN FROM CFSTI (TT DOCUMENTS ONLY).
- ☐ 9.

PROCESSOR: *cat*

BORE EVACUATOR VALVE TEST, CANNON 155mm HOWITZER, M126

ABSTRACT

The limited life of Bore Evacuator Valve Assembly 8769384 during firing tests led to the authorization of a test program to find a valve assembly with a longer life. The cost of testing in the gun (155mm How. M126) made it economical to build a test apparatus which simulated the weapon. The test program was the basis for the incorporation of valve assembly 8769531 into the weapon system. A comparison of the strain level of the modification is presented. The life of the then current production valve assembly and the new production valve assembly under different charges is also given.

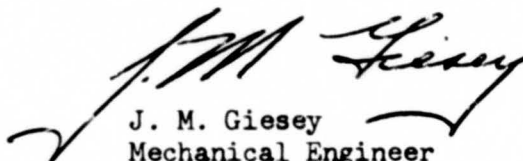
Cross-Reference
Data

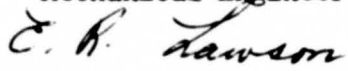
Artillery
Howitzers
Cannon, 155mm T255E3
Cannon, 155MM How M126
Bore Evacuation
Valves
Bore Scavenging

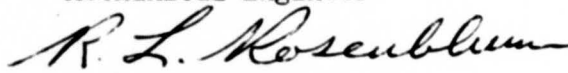
CONCLUSIONS AND RECOMMENDATIONS

Instrumented firing resulted in the choice of new valve assembly 8769531 as the assembly to be fatigue tested against the current production valve assembly 3769384. The former combination of components had the lowest strain level of all the assemblies tested.

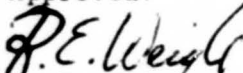
During the fatigue test on valve assemblies 8769531 and 8769384 each had an average life of 6890 and 400 rounds, respectively, before crack initiation.


J. M. Giesey
Mechanical Engineer


E. R. Lawson
Mechanical Engineer


R. L. Rosenblum
Mechanical Engineer

Approved:


R. E. Weigle
Technical Director
Benet Research & Engineering Laboratories

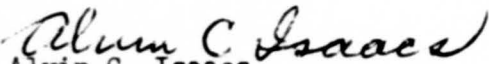

Alvin C. Isaacs
Lt Col Ord Corps
Chief, Benet Research & Engineering Laboratories

TABLE OF CONTENTS

Abstract	1
Conclusions and Recommendations	2
Introduction	6
Objective	6
Material and Apparatus	6
Procedure	8
Results and Discussions	10
Acknowledgement	11
Appendix	12
Distribution List	57

Tables

1. Bore Evacuator Valve Test Firing Data with Optimum Orifice .1562" in Diameter	15
2. Reduction in Strain with Various Valve Components	19
3. Number of Rounds on Valve Assemblies at Proof House of Watervliet Arsenal	20
4. Average Number of Rounds on Valve Assemblies from Different Charges	20

Figures

1. Test Apparatus (Firing Position)	21
2. Bore Evacuator Valve, Test Assembly RDI-B7231	22
3. Test Instruments	23
4. Wiring Diagrams (Valve Tests) RDI-B7246	24
5. Adapter, Valve WTV-C11450	25
6. Plug, Adapter	26

7. Valve B8769383	27
8. Valve RDI-B7214	28
9. Valve RDI-B7215	29
10. Valve A8769529	30
11. Body (Valve) B8769382	31
12. Body (Valve) RDI-B7212	32
13. Body (Valve) B8769530	33
14. Plug B8769381	34
15. Plug RDI-B7213	35
16. Valve Assembly B8769384	36
17. Valve Assembly RDI-B7216	37
18. Valve Assembly RDI-B7217	38
19. Valve Assembly RDI-B7218	39
20. Valve Assembly RDI-B7222	40
21. Valve Assembly RDI-B7223	41
22. Valve Assembly RDI-B7224	42
23. Valve Assembly RDI-B7225	43
24. Valve Assembly RDI-B7219	44
25. Valve Assembly RDI-B7220	45
26. Valve Assembly RDI-B7221	46
27. Valve Assembly B8769531	47
28. Body Development for Strain-Gage Locations RDI-B7226	48
29. Body Development for Strain-Gage Locations RDI-B7227	49
30. Body Development for Strain-Gage Locations RDI-B7228	50
31. Body Development for Strain-Gage Locations RDI-B7229	51

32. Four Views of the Valve Body to Which "Stress Coat" Had Been Applied	52
33. View Showing Magnetic Particle Indication on S.V. After 1000 Rounds	53
34. View Showing Magnetic Particle Indication on M.V. After 10,000 Rounds	54
35. Photomacrographs of M.V. 3 After 10,000 Rounds Macro-etched with 50% HCL Solution and Magnified 65X	55
36. Photomacrographs of Valve Bodies Macroetched with 50% HCL Solution and Magnified 65X	56

INTRODUCTION

During test firing of Cannon, 155mm Howitzer, M126, it was found that the life expectancy of the bore evacuator valve assemblies could be markedly increased. A design change was authorized as a product improvement measure. To obtain correlation with calculated stress data, limited tests were made on valves fitted with strain gages and fired in the cannon.

Since it was planned to test several design modifications, and the cost to fire the valves in the cannon was expected to be high, equipment was designed which would simulate conditions of pressure and stress of the valve body while using the facilities available at Watervliet Arsenal.

OBJECTIVE

The object of this program was to test several valve modifications of bore evacuator valve design for Cannon, 155mm How., M126. The valve modification with the lowest stress level was to be test fired along with valve assembly 8769384 to determine relative life expectancy.

MATERIAL AND APPARATUS

A 30 caliber M1903 Springfield bolt action rifle, firing grenade launcher ammunition, was used as the pressure generator for the test. An adapter (Figure 5) was made to secure the valve assembly in line with the muzzle end of the barrel, which allowed the charge to be fired directly into the valve. Another adapter (Figure 6) was made to give end pressure readings from the first adapter. The weapon was mounted in a specially built stand shown in Figures 1 and 2.

Figure 2 is a cross section drawing of the valve and adapter installed on the end of the rifle barrel. The length of the barrel was modified to obtain pressures similar to those the valve would experience when installed in the cannon.

Two oscilloscopes shown on Figure 3a were used to record the data, a Tektronix Type 535 scope with a 53-54C dual trace plug-in unit recorded pressures in conjunction with a Kistler Pressure Pickup Unit and a Tektronix Type 502 scope which took the strain readings. Figure 3b shows a closeup of the strain gage junction box, the compensating gages and a strain gaged valve body. A schematic wiring diagram, for both pressure and strain gage circuits, is shown in Figure 4.

The eleven valve assemblies compared with the current production valve assembly were made by combining the different modifications proposed. There were four different valves used in the assemblies. Figure 7 shows Valve 8769383, which was the then current production valve. The first modified Valve RDI-B7214, is shown in Figure 8. It was made by drilling a $3/8$ " diameter by $1/2$ " deep hole in the center of the top of the valve. Modification two, Valve RDI-B7215, shown in Figure 9, extended this hole to a depth of $5/8$ " and the third valve modification, Valve 8769529 (Figure 10), continued this hole to a depth of 1.8 inches. The then current production valve body, Body (Valve) 8769382, is shown in Figure 11. Body (Valve) RDI-B7212, Figure 12, was made by shortening Body (Valve) 8769382 by .272 inches. The other modified valve body, Body (Valve) 8769530, Figure 13, replaced the multiple holes with two long slots. Figure 14 shows Cap 8769381 used with valve bodies 8769382

and 8769530. Cap RDI-B7213, Figure 15, was used with Body (Valve) RDI-B7212.

The twelve valve assemblies are shown in Figures 16 - 27. Figures 16 - 19 are of Body (Valve) 8769382 with its Cap 8769381, and the four valves 8769381, RDI-B7214, RDI-7215 and 8769529 in this order. Figures 20, 21, 22 and 23 show Body (Valve) RDI-B7212 and its Cap RDI-B7213 with the various valves in the order above. Finally, Figures 24-27 show Body (Valve) 8769530 and Cap 8769381 with the four valves as listed above.

PROCEDURE

The 30 caliber Springfield rifle was modified to accomodate the bore evacuator valve adapter on its barrel. It was found necessary to insert an orifice in the adapter to raise the pressure and completely burn the propellant. As maximum pressure obtainable with the full barrel was too low, the length of the barrel was reduced. This raised pressure level permitted changes to the orifice size for the desired pressure, and/or strain.

With each change in orifice size, a series of rounds was fired using a valve assembly of the type shown in Figure 16, which had been fitted with strain gages and the strains were recorded. The strain gages were located on the valve body in the same position as those on the valve body which had been fired several rounds in a Cannon, 155mm Howitzer, M126 at Erie Proving Ground (see Figure 28). It was decided to change the orifice size until strains in the valve body on the test rig approached as nearly as possible the strains recorded from the valve assembly fired at the proving ground. The data from the proving ground is contained in the

memo dated 18 September 1963 titled "Firing Test to Determine Strains in the 155mm Howitzer T255E3, Bore Evacuator Valve During Firing", which is included in Appendix I.

After the optimum orifice size was determined, each of the modified assemblies was tested and the strain levels were compared with those recorded on Valve Assembly 8769384, Figure 16. Figure 29 shows the location of the strain gages on the short valve body, Body (Valve) RDI-B7212. The strain gage locations for the slotted valve body, Figure 13, are shown in Figure 30. Observation of the stress pattern on a valve body, shown in Figure 32, to which "Stress Coat", manufactured by the Magnaflux Corp., had been applied, led to the relocation of four strain gages on Body (Valve) 8769382. This can be seen by comparing Figures 28 and 31. The results of the test firing are given in Table I. Table II shows the "Reduction in Strain with Various Modifications." Valve Assembly 8769531, Figure 21, had the lowest strain readings and was chosen for use in the life test.

Seven (7) valve assemblies were used in the fatigue test. Four (4) were valve assembly 8769384. These were designated standard valves 1 through 4 or S.V. 1, etc. Three (3) valve assemblies 8769531 were designated modified valves 1 through 3, abbreviated M.V. 1, etc. Table 4 shows the average life obtained for the valve assemblies fired in the test program and in the cannon with different propellant charges. Table 3 gives the life of each of the valves fired in the Watervliet Arsenal test program.

During the life test, the valve assemblies were subjected to magnetic

particle inspection every 50 rounds. Figures 33 and 34 are standard valve 1 after 1000 rounds and modified valve 3 after 10,000 rounds, respectively. These pictures are taken under the conditions of magnetic particle inspection and the crack indications in the thread runout are shown by the arrows. Both valve assemblies were macroetched with a 50 per cent HCL solution for 30 to 45 minutes. Figure 35 shows 3 photos of modified valve 3. Figure 36 shows standard valve 1 and a Body (Valve) 8769530 cut and etched as above, after 1000 rounds of 100-115 per cent RMP at Erie Proving Ground.

Due to the long life experienced, an attempt was made to shorten this life by means of a cold test. It was felt that if the temperature of the valve body could be lowered to the vicinity of the ductile-brittle transition temperature, the fatigue life of the test pieces could be shortened. Although the cold test apparatus lowered the initial valve body temperature, the rate of fire to keep the temperature of the valve body at a low temperature was so slow that this procedure was unsatisfactory. This phase of the test was abandoned after 300 rounds, due to the problems of additional time to fire, shorter runs, and inaccessibility of the valve assembly to check the valve between rounds.

RESULTS AND DISCUSSION

The slotted valve body, Figure 13, reduced the stress concentration in the body area caused by the multiple hole configuration of the Body (Valve) 8769382, Figure 11. The more uniform stress distribution allowed the body to absorb more of the impact energy as the impact wave traveled to the fixed end; this also helped to reduce the strain at that end.

A well rounded, larger, radius in the thread runout did not reduce the strain level in this area. Therefore, the slotted body with the normal thread runout was chosen as the best possibility.

Table IV shows a comparison of the proof house life tests results with the firing data from Erie Proving Ground and Aberdeen Proving Ground. Since the proof house testing was based primarily on the strains registered on gages attached to the valve body and pressure was a secondary consideration, it seems reasonable that the increase in valve life obtained in the proof house must be reduced by a factor which allows for differences in pressures, volume of gases, and time of exposure. This is especially true as the stresses induced approach the endurance limit of the material. A slight decrease in stress would result in a substantial increase in life. The XM119E1 charge increased the initial pressure experienced by the valve to 120 per cent of the pressure generated by the 115 per cent RMP round. This great increase in pressure and consequently in stress decreases the life significantly. Another possibility, at present not fully investigated, is that one round in the 155mm M126 may result in more than one cycle of stress applied to the valve body.

ACKNOWLEDGEMENT

The authors wish to express their appreciation for the assistance given them by the Experimental Mechanics and Thermodynamics Lab of the Research Laboratories at Watervliet Arsenal in conducting the firing tests and obtaining the necessary data.

APPENDIX

DISPOSITION FORM

(AR 340-15)

OFFICE SYMBOL OR FILE REFERENCE	SUBJECT		
SWEWV-RDR:rrl	FIRING TEST TO DETERMINE STRAINS IN THE 155MM HOW. T255E3 BORE EVACUATOR VALVES DURING FIRING		
TO Industrial Engineering	FROM Mr. Ralph Lasselle	DATE 18 Sept 63	CMT 1
		Mr. Lasselle/maf/5518	

1. Four valves were strain gaged at Watervliet Arsenal and taken to Erie Proving Ground for test. The valves were designated A thru D and are as follows:

Valve A (drawing number 8769384) is the valve currently in production. This valve had eight gages symmetrically spaced on the cylindrical portion of the body just above the conical valve seat. All gages were orientated to measure axial strain.

Valve B was similar to valve A in both geometry and gaging.

Valve C (drawing number WTV-C9640) had the same overall dimensions as valves A and B, but had two longitudinal slots cut in the side for passage of the propellant gases rather than the fourteen holes and the radius of the relief for the mounting threads had been increased to decrease the stress concentration factor. The valve also had a poppet which weighed 3 3/8 oz. compared to the 3 3/4 oz. for the ones in valves A and B. The gaging on this valve was the same as on valves A and B plus four additional gages mounted in the thread relief. All gages were orientated to measure axial strain.

Valve D was similar to valve C except that it had a cap weighing 3 5/8 oz. compared to the cap on valves A, B and C which weighed 5 7/16 oz. The gaging on valve D was the same as on valve C.

2. The axis of the valves were at an angle of 30° to the axis of the gun tube providing only a partial seat on the side of the valve away from the gun tube. This caused a non-uniform strain in the thread relief when torqued down to the 75 ft. lbs. recommended. The strain as measured in the gages on valve C due to mounting torque were 200 μ in/in compression in the gages adjacent to the partial seat and 500 μ in/in tension in the gages opposite the previously mentioned gages (gages between the axes of the bore evacuator valve and gun tube).

3. The strain gage data consisted of damped oscillations whose frequency ranged between 600 cps and 1,000 cps. There are two separate blocks of oscillation for each firing. The first one starts with initiation of weapon recoil and is probably due to setback forces loading the valve as a cantilever. The vibrations last for about 6 to 7 milliseconds and then are overridden by larger vibrations which occur at about the time the projectile passes the valve port. These vibrations are probably set up by the poppet action. These oscillations are damped out in approximately ten cycles. The strains reported are peak to peak vibrations with the first figures for the setback initiated vibrations and the second figures for the poppet initiated vibrations.

DA FORM 2496
1 FEB 62REPLACES DD FORM 96, EXISTING SUPPLIES OF WHICH WILL BE
ISSUED AND USED UNTIL 1 FEB 63 UNLESS SOONER EXHAUSTED.

U.S. GOVERNMENT PRINTING OFFICE: 1962 O-622105

BORE EVACUATOR VALVE FIRING TEST
TABLE OF STRAIN GAGE READINGS

<u>Gage Location</u>	<u>A (Body)</u>	<u>B (Body)</u>	<u>C (Body)</u>	<u>C (Seat)</u>	<u>D (Body)</u>	<u>D (Seat)</u>
Between axes of valve and gun tube	0 - lost	0 - lost	200 - lost	lost - lost	200 - lost	
	400 - lost	400 - lost	200 - lost		300 - lost	lost - lost
	400 - lost	400 - lost	300 - lost	lost - lost	300 - lost	
	400 - 888	400 - 2000 ten 90- 100% cycles at 1000 cps	300 - 960		0 - lost	lost - lost
Opposite first gage listed (adjacent to partial bore evacuator valve seat)	200 - 640	lost - lost	100 - 960	300 - 3555 twelve 90- 100% cycles at 600 cps	200 - lost	
	200 - 1600	300 - 710	200 - 1000		300 - 1600 six 90-100% cycles at 600 cps	lost - lost
	lost - lost	300 - lost	100 - lost	500 - 2000 nine 90- 100% cycles at 800 cps	300 - lost	
	200 - lost	500 - lost	lost - lost		0 - lost	lost - lost

Gages are spaced every 450 about valve body.

SUBJECT: FIRING TEST TO DETERMINE STRAINS IN THE 155MM HOW.
T255E3 BORE EVACUATOR VALVES DURING FIRING

4. Conclusions and Recommendations:

Due to the urgency of the project there was not sufficient time to develop a strain gage technique to get a complete set of data on all the gages, nor could one valve be fired more than one round with the same gages which is necessary to obtain the effects of reducing poppet or cap weight. One strain reading in the thread relief of valve C gave a strain of 3555μ in/in which corresponds to a simple stress of 105,000 psi. All gages in the area between the axes of the valve and gun tube were lost at the time the gases opened the poppet (as can be seen in the first line of the table), and so no peak dynamic strains were obtained at this point experiencing 500μ in/in tension due to assembly torque. It should also be remembered that the measured strains are not necessarily the maximum strains in the piece because the strain gage is an averaging device being used in a stress concentration area and that there is no guarantee that the gage was placed at the point of maximum strain.

A check of the frequency associated with various modes of vibrations of the valve indicates that the strains measured which were at 600 to 1000 cps were probably due to the valve vibrating as a cantilever beam with a mass at the end even though the major excitation was an axial impulse. The longitudinal shock wave mode might have been excited, but because its natural frequency is in the order of 15kc, it could not have been picked up by the instrumentation used.

The data seems to indicate quite clearly that the strains caused by poppet action are several times larger than those caused by setback forces. If it is determined that the fatigue lives of these valves are not satisfactory, even when it is considered that for each round fired the valve experiences approximately ten major stress cycles, it is recommended that a test device be developed that will primarily simulate poppet action.



RALPH R. LASSELLE

TABLE I

BORE EVACUATOR VALVE TEST FIRING DATA
WITH OPTIMUM ORIFICE .1562" IN DIAMETER

ROUND	PRESSURE KSI	GAGE NO	STRAIN μ IN./IN.	GAGE NO	STRAIN μ IN./IN.	BODY VALVE	VALVE
153	10.	8	1500	2	1499	STD ¹	ST ²
157	10.	8	1392	2	1564	STD	ST
160	10.	8	1294	2	1514	STD	ST
161	10.	8	1294	3	929	STD	ST
162	10.	8	1270	4	1515	STD	ST
163	10.5	8	1343	6	1344	STD	ST
164	10.	8	1343	7	684	STD	ST
165	10.	8	1171	7	489	STD	M1 ³
166	10.	8	1146	6	1171	STD	M1
167	10.5	8	1303	4	1564	STD	M1
168	9.5	8	1320	3	732	STD	M1
169	--	8	1171	2	1367	STD	M1
170	11.5	8	1292	2	1463	STD	M1
171	10.	8	805	2	927	STD	M2 ⁴
172	10.5	8	879	3	464	STD	M2
173	10.	8	879	4	976	STD	M2
174	10.	8	879	6	830	STD	M2
175	10.	8	879	7	244	STD	M2
176	9.5	8	488	7	196	STD	M3 ⁵
177	10.	8	439	7	196	STD	M3
178	10.	8	488	6	487	STD	M3
179	10.	8	438	4	544	STD	M3
180	10.5	8	439	3	342	STD	M3
181	10.5	8	410	2	512	STD	M3
183	10.75	1	214	8	1045	MB1 ⁶	ST
184	9.5	8	1522	1	192	MB1	ST
185	9.75	8	1423	2	1205	MB1	ST
186	9.5	8	1423	3	482	MB1	ST
187	10.5	8	1545	4	1260	MB1	ST
188	11.	8	1708	5	341	MB1	ST
189	10.5	8	1708	6	1783	MB1	ST
190	10.5	8	1611	7	684	MB1	ST
191	10.	8	1516	9	---	MB1	ST
192	10.	8	1439	9	3710	MB1	ST
193	10.	8	1805	10	4500 ⁺	MB1	ST
194	10.	8	1689	11	4340	MB1	ST
195	10.	8	1196	11	2976	MB1	M1
196	10.	8	1408	9	3705	MB1	M1
197	10.5	8	1630	7	684	MB1	M1
198	10.5	8	976	6	889	MB1	M1

TABLE I (CONT.)

BORE EVACUATOR VALVE TEST FIRING DATA
WITH OPTIMUM ORIFICE .1562" IN DIAMETER

ROUND	PRESSURE KSI	GAGE NO	STRAIN μ IN./IN.	GAGE NO	STRAIN μ IN./IN	BODY VALVE	VALVE
199	10.	8	1333	5	297	MB1	M1
200	11.5	8	1300	4	1250	MB1	M1
201	11.	8	1234	3	643	MB1	M1
202	10.	8	1333	2	1284	MB1	M1
203	10.	8	1300	1	198	MB1	M1
207	--	8	1043	1	174	MB1	M2
208	10.	8	843	1	88	MB1	M2
209	9.5	8	913	2	740	MB1	M2
210	10.5	8	804	3	326	MB1	M2
211	10.5	8	956	4	807	MB1	M2
212	10.5	8	914	5	174	MB1	M2
213	10.5	8	826	6	913	MB1	M2
214	10.	8	870	7	383	MB1	M2
215	9.25	8	739	9	1956	MB1	M2
216	11.25	8	956	11	2366	MB1	M2
217	10.	8	326	11	870	MB1	M3
218	9.75	8	326	9	913	MB1	M3
219	9.25	8	356	9	847	MB1	M3
220	11.	8	345	7	165	MB1	M3
221	10.	8	354	6	441	MB1	M3
222	9.75	8	322	5	66	MB1	M3
223	12.	8	418	4	315	MB1	M3
224	10.	8	444	3	152	MB1	M3
225	11.5	8	409	2	380	MB1	M3
226	8.75	8	261	1	---	MB1	M3
230	10.	8	862	2	805	MB2 ⁷	ST
231	10.5	8	840	3	892	MB2	ST
232	8.	8	831	4	1273	MB2	ST
233	9.	8	817	5	846	MB2	ST
234	10.75	8	953	6	646	MB2	ST
235	10.	8	1021	7	768	MB2	ST
236	11.5	8	1134	9	---	MB2	ST
237	10.5	8	1158	9	---	MB2	ST
238	10.5	8	1169	9	5910	MB2	ST
239	10.	8	844	9	4775	MB2	ST
240	10.	8	977	10	4555	MB2	ST
241	9.	8	933	11	5540	MB2	ST
242	10.5	8	965	12	4345	MB2	ST
248	--	8	910	12	4505	MB2	M1
249	9.	8	998	12	4395	MB2	M1

TABLE I (CONT.)

BORE EVACUATOR VALVE TEST FIRING DATA
WITH OPTIMUM ORIFICE .1562" IN DIAMETER

ROUND	PRESSURE KSI	GAGE NO	STRAIN μ IN./IN.	GAGE NO	STRAIN μ IN./IN	BODY VALVE	VALVE
250	9.5	8	910	11	5420	MB2	M1
251	10.	8	955	10	3904	MB2	M1
252	10.5	8	933	9	4830	MB2	M1
253	9.5	8	907	7	653	MB2	M1
254	10.5	8	1066	6	609	MB2	M1
255	10.	8	953	5	764	MB2	M1
256	10.	8	908	4	1031	MB2	M1
257	12.25	8	726	3	733	MB2	M1
258	10.	8	1134	2	653	MB2	M1
259	11.	8	1089	1	702	MB2	M1
262	9.	8	636	12	2750	MB2	M2
263	11.25	8	635	11	4180	MB2	M2
264	9.5	8	636	10	3190	MB2	M2
265	8.75	8	704	9	4180	MB2	M2
266	11.5	8	746	7	638	MB2	M2
267	11.	8	704	6	440	MB2	M2
268	9.5	8	590	5	618	MB2	M2
269	9.5	8	703	4	880	MB2	M2
270	10.	8	749	3	704	MB2	M2
271	9.5	8	704	2	616	MB2	M2
272	10.75	8	703	1	440	MB2	M2
273	9.5	8	322	12	1650	MB2	M3
274	10.	8	242	12	1363	MB2	M3
275	8.75	8	356	11	--	MB2	M3
276	9.75	8	322	11	2284	MB2	M3
277	9.	8	230	9	1584	MB2	M3
278	10.	8	345	10	1716	MB2	M3
279	9.5	8	276	7	264	MB2	M3
280	9.5	8	311	6	264	MB2	M3
281	10.	8	368	5	418	MB2	M3
282	9.5	8	299	4	451	MB2	M3
283	10.	8	368	3	377	MB2	M3
284	8.	8	291	2	244	MB2	M3
285	9.25	8	356	1	189	MB2	M3
286	--	3	1862	6	225	S3 ⁸	ST
287	9.5	3	1842	6	270	S3	ST
288	10.	3	1910	4	1012	S3	ST
289	9.	3	1793	2	2709	S3	ST
290	10.25	-	----	2	2812	S3	ST
291	9.25	3	1931	2	2655	S3	ST

TABLE I (CONT.)

BORE EVACUATOR VALVE TEST FIRING DATA
WITH OPTIMUM ORIFICE .1562" IN DIAMETER

ROUND	PRESSURE KSI	GAGE NO	STRAIN μ IN./IN.	GAGE NO	STRAIN μ IN./IN.	BODY VALVE	VALVE
292	11.	3	2022	7	3330	S3	ST
293	9.25	3	1840	8	2790	S3	ST
294	9.75	3	604	8	1229	S3	M3
295	9.5	3	644	8	1137	S3	M3
296	9.75	3	605	7	1023	S3	M3
297	10.75	3	651	2	1136	S3	M3
298	10.25	3	628	2	1146	S3	M3
299	9.5	3	697	7	1318	S3	M3
300	8.25	3	604	8	1000	S3	M3
301	--	3	628	-	--	S3	M3
302	9.75	3	651	-	--	S3	M3
303	10.25	3	1161	-	--	S3	M2
304	11.	3	1674	-	--	S3	M1
305	10.	3	1720	-	--	S3	ST
308	10.5	3	1862	-	--	S3	M1
309	10.5	3	1884	-	--	S3	M1
310	11.	3	1242	-	--	S3	M2
311	11.5	3	621	-	--	S3	M3

1 BODY (VALVE) B8769382, FIGURE 11; STRAIN GAGE LOCATIONS, FIGURE 28.

2 STANDARD PRODUCTION VALVE AT TIME OF TEST, FIGURE 7.

3 FIRST MODIFIED VALVE 1/2" DEEP HOLE FIGURE 8.

4 MODIFIED VALVE TWO 5/8" DEEP HOLE, FIGURE 9.

5 ADOPTED MODIFICATION FIGURE 10.

6 SHORTENED BODY (VALVE) RDI-B7212, FIGURE 12; STRAIN GAGE LOCATIONS, FIGURE 29.

7 ADOPTED MODIFIED BODY (VALVE) B8769530, FIGURE 13; STRAIN GAGE LOCATIONS, FIGURE 30.

8 BODY (VALVE) B8769382, FIGURE 11, STRAIN GAGE LOCATIONS, FIGURE 31.

TABLE II
REDUCTION IN STRAIN
WITH VARIOUS
VALVE COMPONENTS

		STRAIN μ IN./IN.				% OF ST VALVE		
VALVE*		ST ²	M1 ³	M2 ⁴	M3 ⁵	M1	M2	M3
BODY VALVE*	GAGE NO							
STD ¹	2	1536	1275	925	480	83.0	60.3	31.2
	3	930	770	440	325	82.9	47.4	35.0
	4	1515	1490	975	545	98.5	64.4	36.9
	6	1280	1170	830	480	91.5	64.8	37.5
	7	680	460	240	190	67.7	35.4	28.0
	8	1300	1185	855	445	91.2	68.0	34.2
MB1 ⁶	1	205	195	88	---			
	2	1230	1280	780	330	104.0	63.4	26.8
	3	510	590	310	160	115.5	52.6	27.1
	4	1200	1090	760	260	91.8	63.4	21.7
	5	310	290	170	65	93.6	59.9	21.0
	6	1700	845	870	445	49.7	51.1	26.2
	7	650	650	385	145	100.0	59.3	22.3
	8	1560	1250	900	350	80.2	57.7	22.4
	9	3700	3700	2125	875	100.0	57.5	23.7
	11	4300	2950	2100	875	68.6	48.8	20.3
MB2 ⁷	1	610	630	410	200	103.0	67.2	32.8
	2	805	655	650	305	81.4	80.7	37.9
	3	850	600	700	375	70.6	82.4	44.1
	4	1590	1035	925	480	65.0	58.2	30.2
	5	890	765	650	365	85.0	73.0	41.0
	6	600	590	400	420	98.5	65.7	70.0
	7	765	690	555	275	90.2	72.5	35.9
	8	940	990	685	335	105.2	72.9	35.6
	9	5200	4600	4750	1740	88.5	91.4	33.5
	10	4550	3900	3350	1740	85.7	73.6	38.2
	11	6150	5700	3725	2350	93.5	60.6	38.2
	12	4150	4850	3040	1550	117.0	73.4	37.4

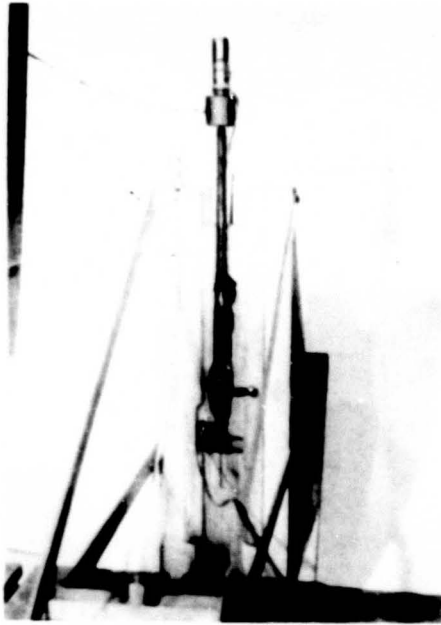
* KEY AT BOTTOM OF TABLE I APPLIES

TABLE III
NUMBER OF ROUNDS ON VALVE ASSEMBLIES
AT PROOF HOUSE OF WATERVLIET ARSENAL

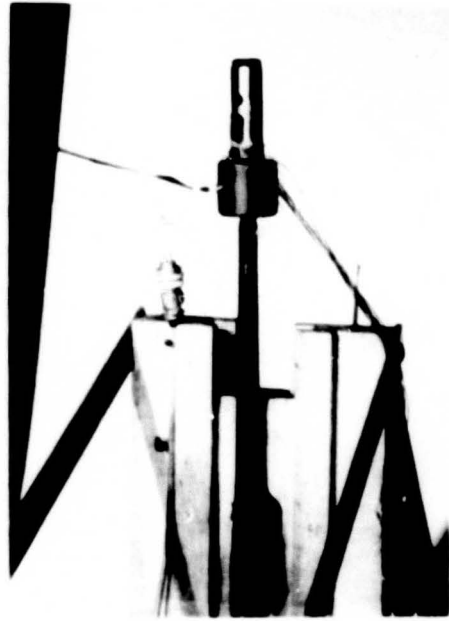
ASSEMBLY NUMBER	TEST DESIGNATION	ROUNDS UNTIL FIRST INDICATION	TOTAL NUMBER OF ROUNDS
B8769384	S.V. 1	455	1000
B8769384	S.V. 2	501	1300
B8769384	S.V. 3	393	1000
B8769384	S.V. 4	145	1000
B8769531	M.V. 1	8051	10000
B8769531	M.V. 2	----	5000
B8769531	M.V. 3	5711	10000

TABLE IV
AVERAGE NUMBER OF ROUNDS
ON VALVE ASSEMBLIES
FROM DIFFERENT CHARGES

LOCATION OF FIRING	PROOF HOUSE	EPG	EPG	APG
PROPELLANT CHARGE	TEST APPARATUS	100%+ 115%RMP	100%RMP	XM119E1
VALVE ASSEMBLY				
B8769531	6890	1000	----	230
B8769384	400	----	280	100



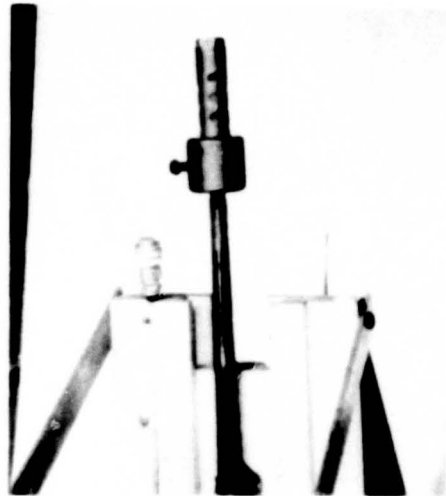
A



B



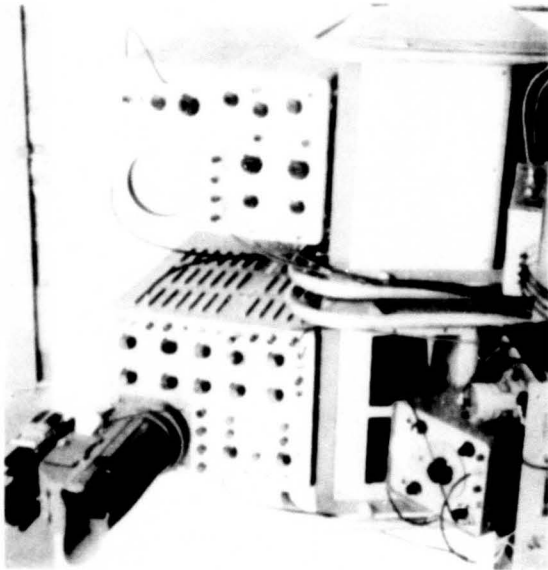
C



D

Figure 1: Test Apparatus

- A. General View of Test Stand.
- B. Close-up of strain-gaged valve assembly and side pressure pick-up.
- C. End pressure adapter and pressure pick-up in place of valve.
- D. Valve installed for fatigue test.



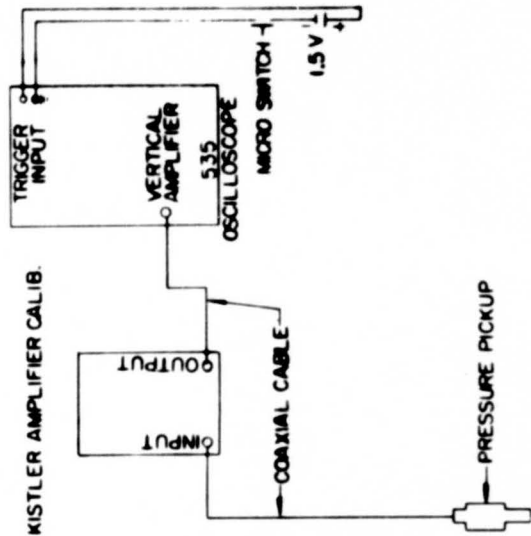
To the left Figure 3A
Two oscilloscopes used to record data.
Oscilloscope on left records pressure.
Kistler calibration unit is shown below
scope. Scope on right records strains.
The strain gage calibration junction
box is shown below scope.



To the right Figure 3B
Close-up showing equipment
used in Strain Gage Circuit.

B

Figure 3: Test Instruments

[illegible]

PRESSURE TRANSDUCER CIRCUIT

QTY	DESCRIPTION	DATE	APPRO	TIME

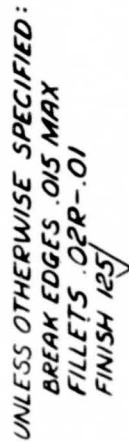


FIGURE 8

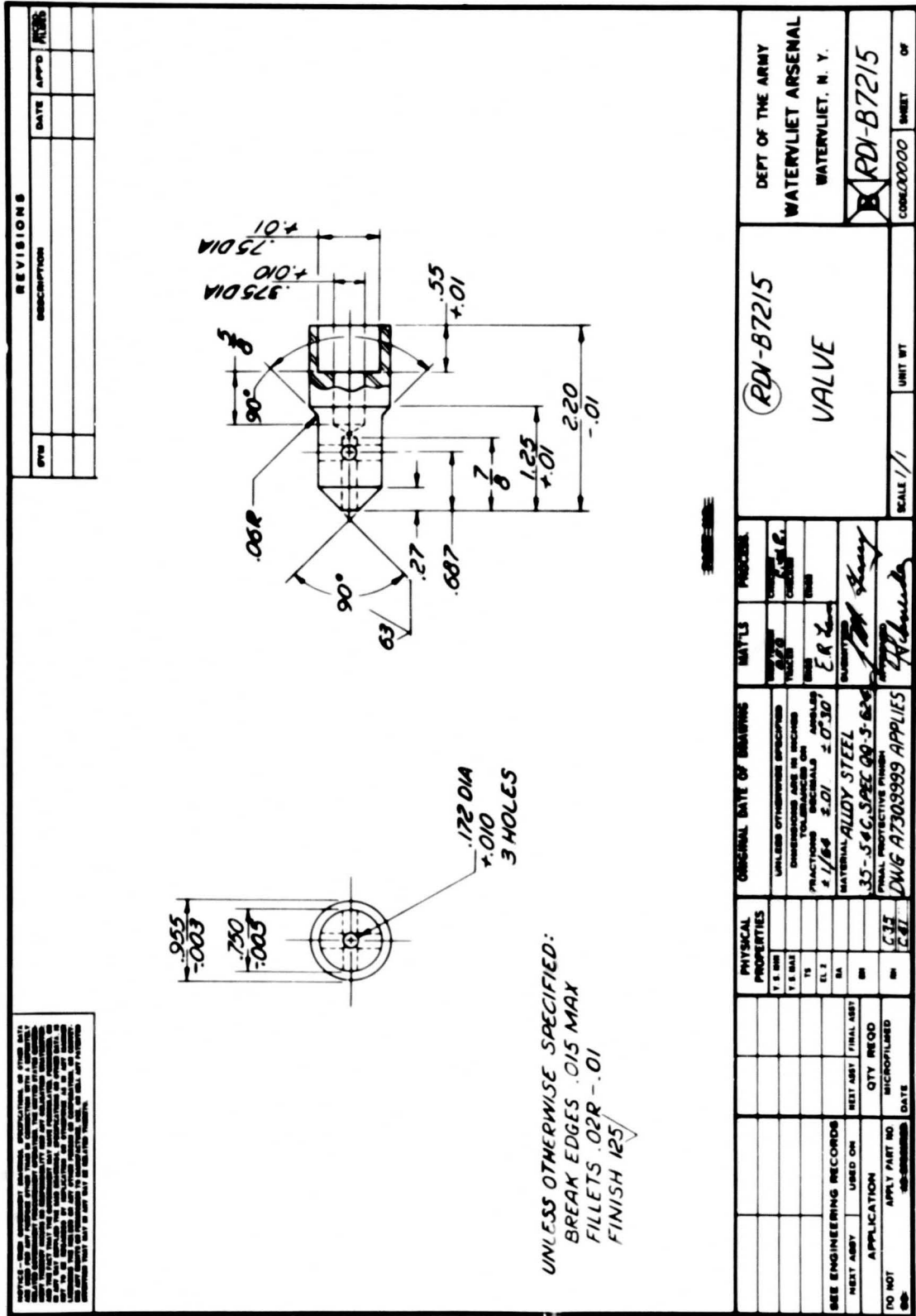


FIGURE 9

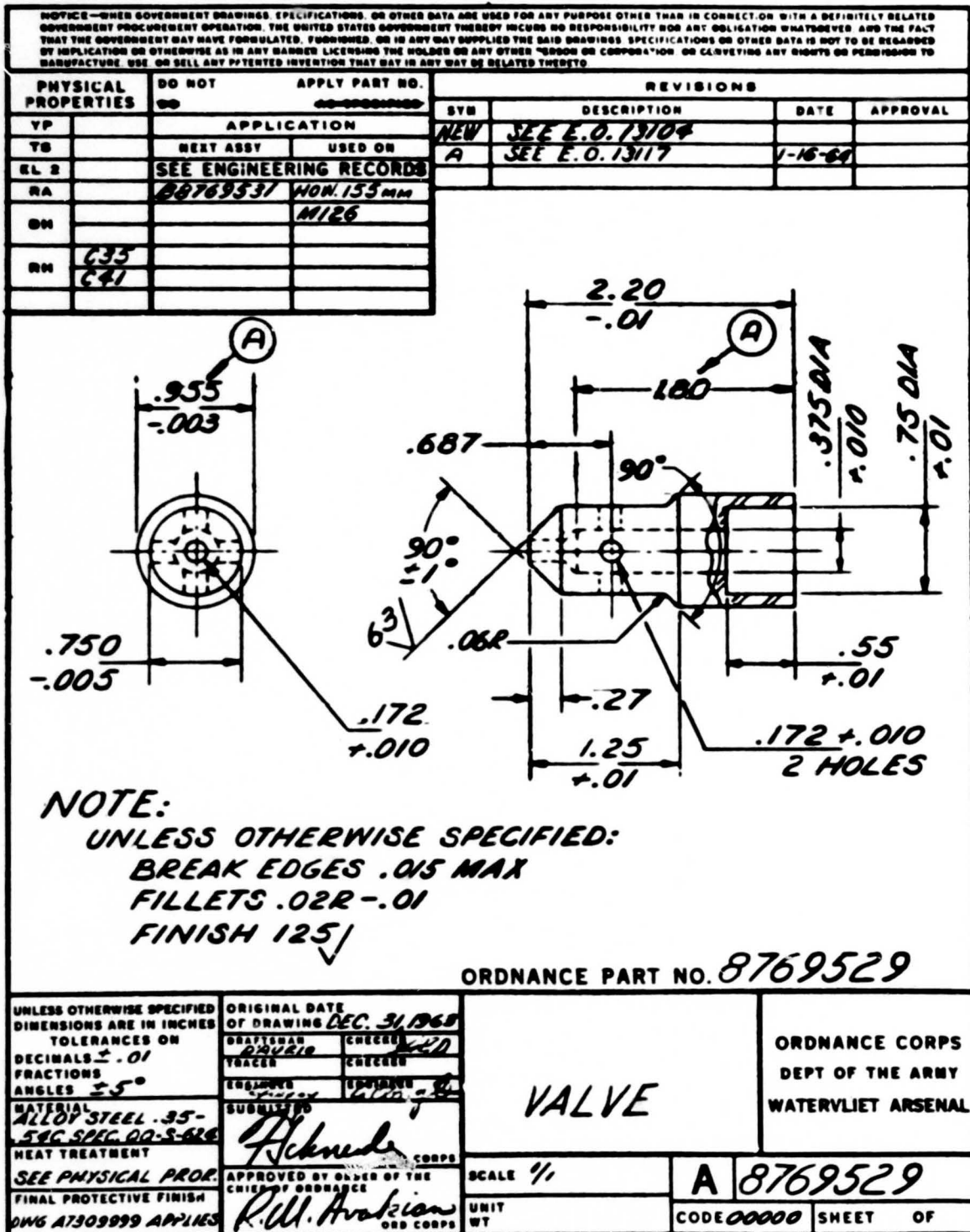


FIGURE 10

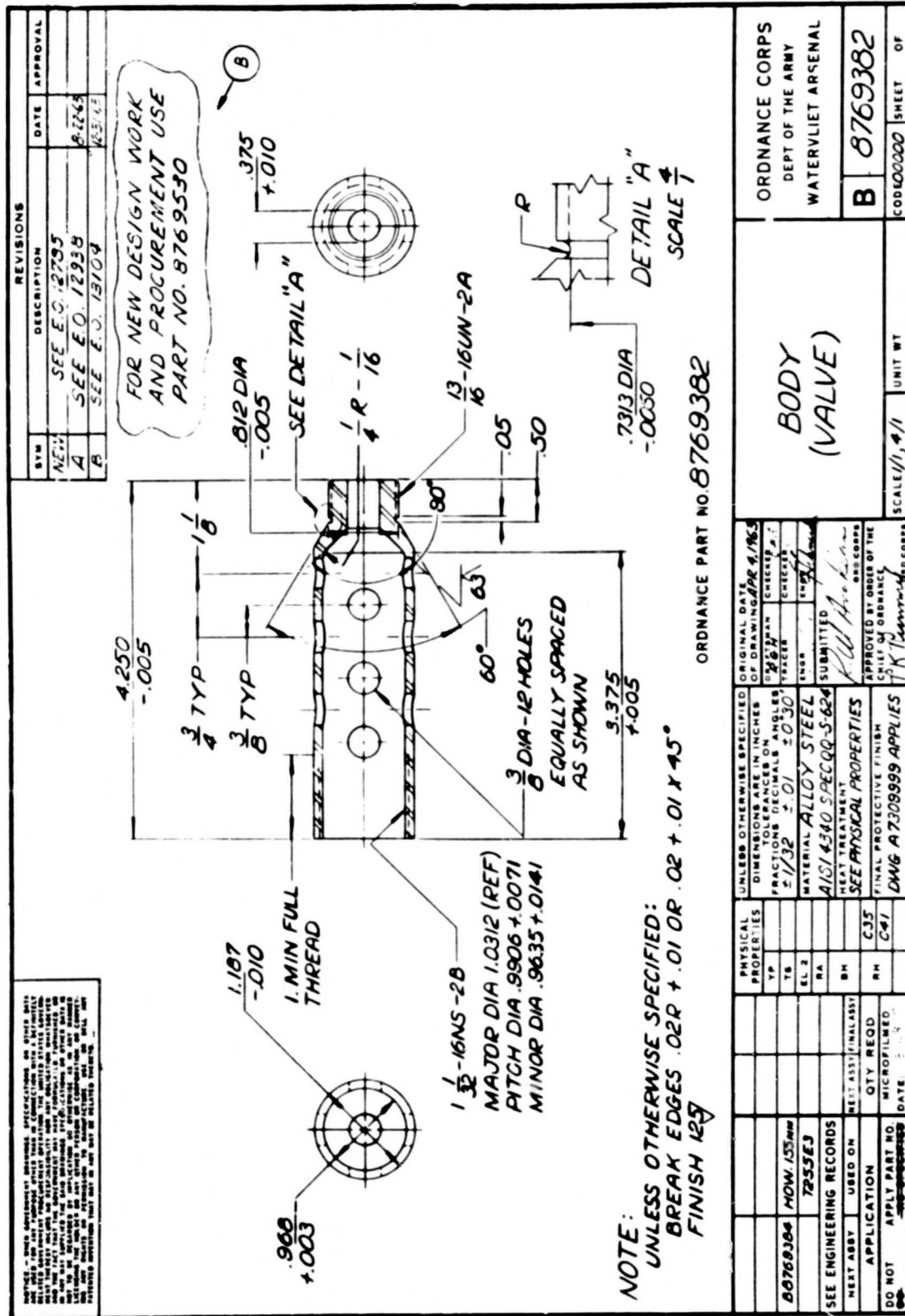


FIGURE 11

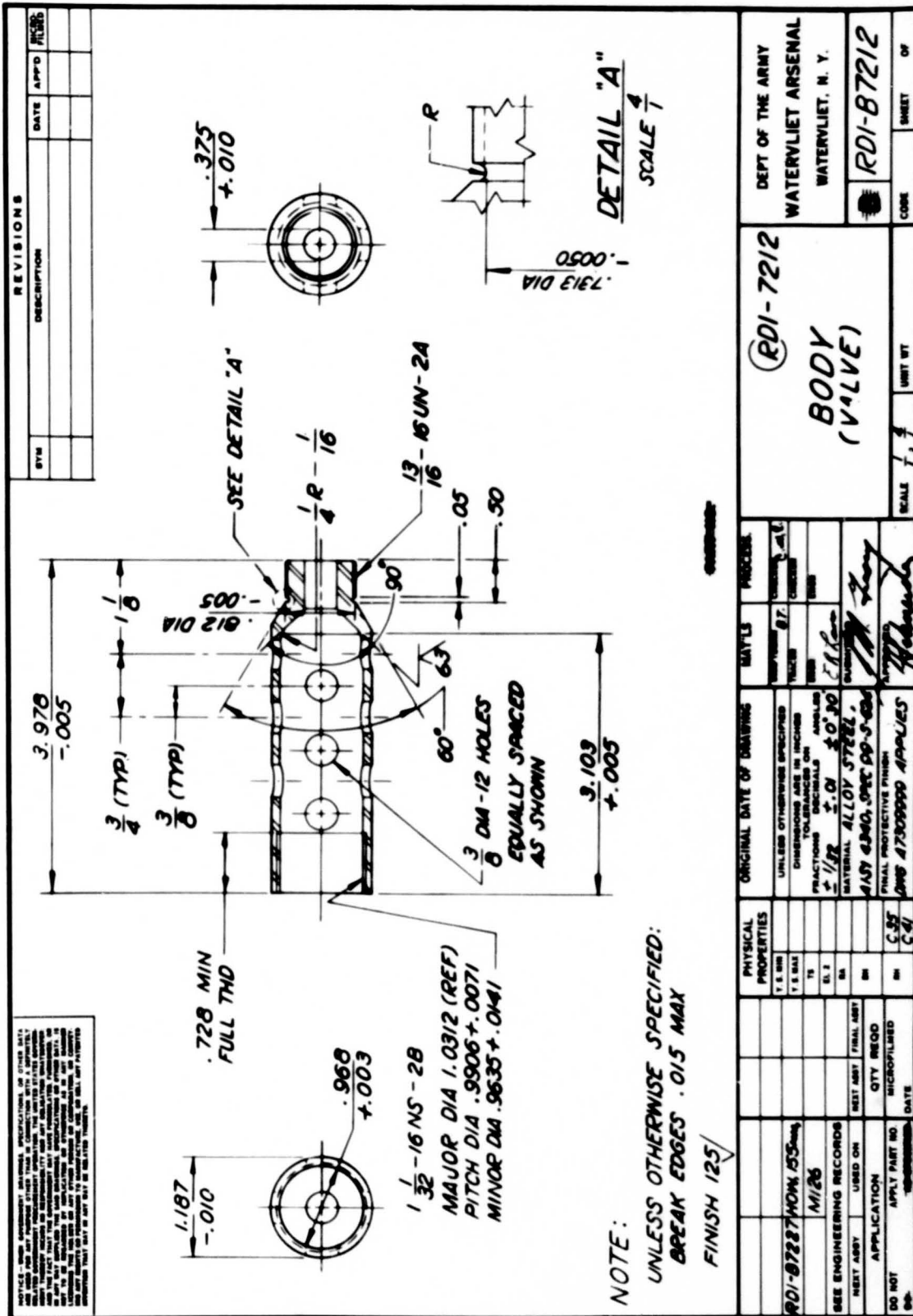
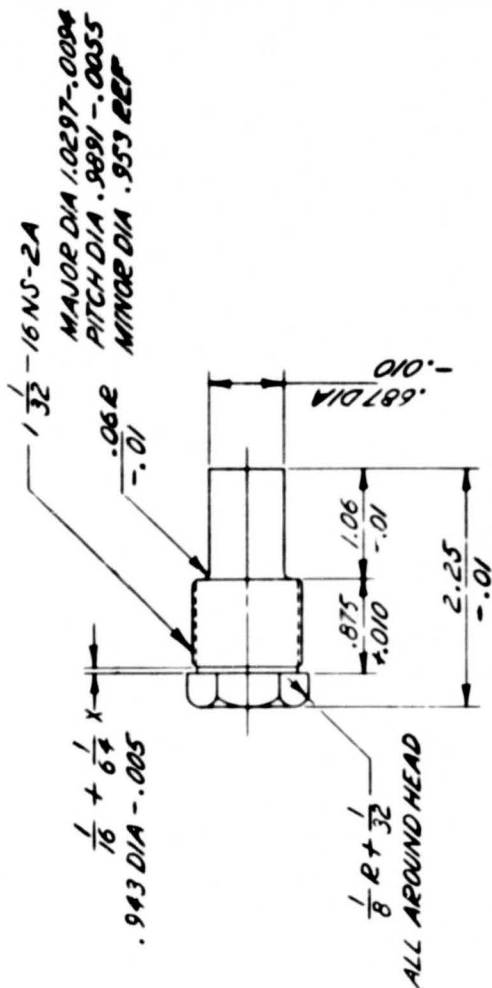


FIGURE 12

REVISIONS

SYM	DESCRIPTION	DATE	APPROVAL
NEW	SEE EO. 12785		



UNLESS OTHERWISE SPECIFIED:
BREAK EDGES .02 R ± .01 OR .02 ± .01 X 45°.
FILLETS .03 R ± .01

ORDNANCE PART NO. 8769381

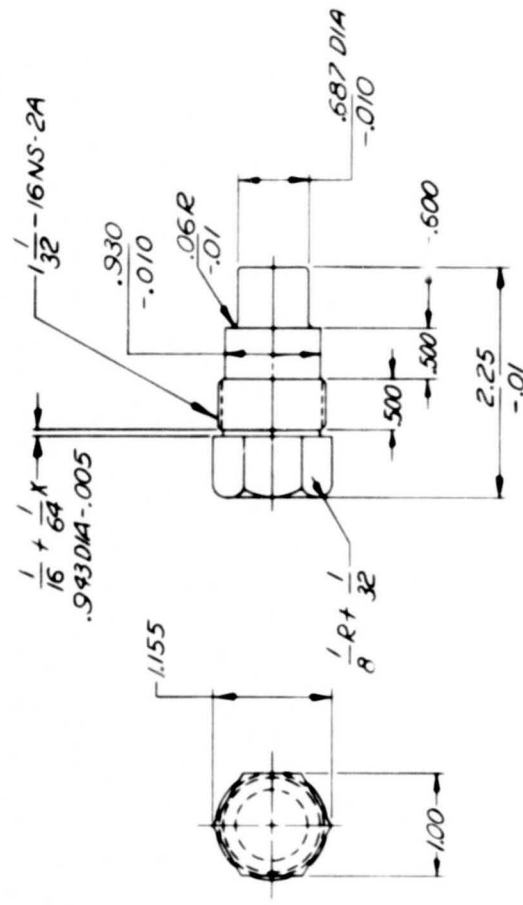
[illegible]

FIGURE 14

NOTICE - THESE SUPERSEDE DRAWINGS, SPECIFICATIONS, OR OTHER DATA
 PREVIOUSLY ISSUED FOR THIS PROJECT. THE DRAWING IS THE PROPERTY OF
 THE ARMY AND IS LOANED TO YOU. IT IS NOT TO BE REPRODUCED OR
 TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL,
 INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE
 AND RETRIEVAL SYSTEM, WITHOUT PERMISSION IN WRITING FROM THE ARMY.
 IF YOU HAVE ANY COMMENTS OR SUGGESTIONS, PLEASE CONTACT THE
 DRAWING ENGINEER OR THE DRAWING OFFICE. THE ARMY ASSUMES NO
 LIABILITY FOR ANY LOSS OR DAMAGE TO THIS DRAWING OR FOR ANY
 CONSEQUENCES ARISING FROM THE USE OF THIS DRAWING.

REVISIONS

SYM	DESCRIPTION	DATE	APPD	RECD



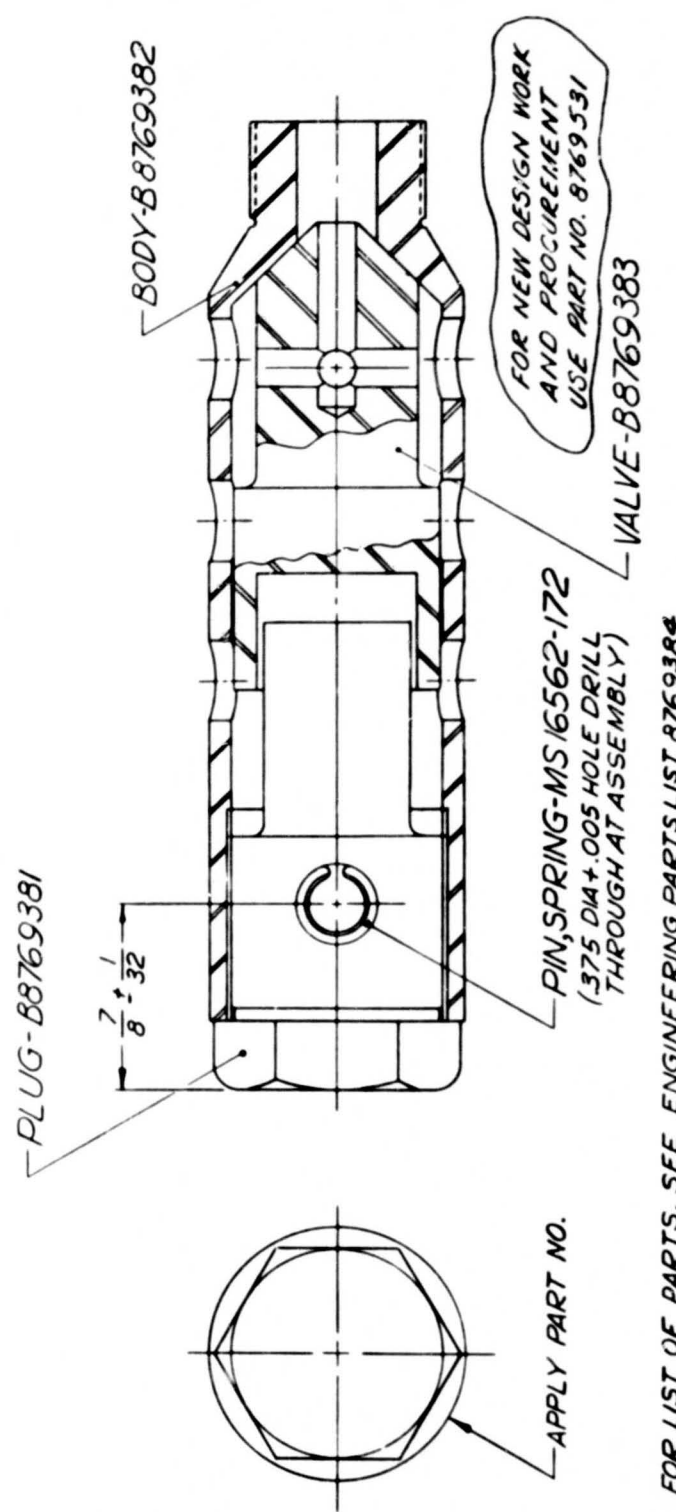
35

DEPT OF THE ARMY WATERVLIET ARSENAL WATERVLIET, N. Y.		B RDI-B7213	
PLUG	SCALE 1/1	UNIT WT	SHEET OF
ORIGINAL DATE OF DRAWING	MAT'L S	PROCESS	
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON ANGLES FRACTIONS ±.01	TYPE TUBES TENS C. P. L.	CHECKED CHECKER ENG	
MATERIAL ALLOY STEEL .35 SAC SPEC QQ-S-624 FINAL PROTECTIVE FINISH	SUBMITTAL F. H. H.	APPROVED H. H. H.	
PHYSICAL PROPERTIES	Y S MIN	Y S MAX	TS
	EL 2	RA	BA
SEE ENGINEERING RECORDS	USED ON	FINAL ASBY	QTY REQD
DO NOT	APPLY PART NO	MICROFILMED	DATE

FIGURE 15

REVISIONS			
NEW	DESCRIPTION	DATE	APPROVAL
A	SEE E.O. 12785		
B	SEE E.O. 12967	9-18-63	
	SEE E.O. 13104	12-3-63	

NOTICE: THIS DRAWING IS THE PROPERTY OF THE UNITED STATES GOVERNMENT. IT IS TO BE USED FOR THE PURPOSES SPECIFIED IN THE CONTRACT AND NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT PERMISSION IN WRITING FROM THE UNITED STATES GOVERNMENT. THE UNITED STATES GOVERNMENT MAKES NO WARRANTY, EXPRESS OR IMPLIED, FOR THE USE OF THIS DRAWING FOR ANY PURPOSES OTHER THAN THAT FOR WHICH IT WAS SPECIFICALLY DESIGNED.



ORDNANCE PART NO 8769384

FOR LIST OF PARTS, SEE ENGINEERING PARTS LIST 8769384

F8769478		WOW 155mm FPC		PHYSICAL PROPERTIES		UNLESS OTHERWISE SPECIFIED		ORIGINAL DATE		ORDNANCE PART NO 8769384		ORDNANCE CORPS DEPT OF THE ARMY WATERVLIET ARSENAL	
F8768725		WOW 155mm		DIMENSIONS ARE IN INCHES		DIMENSIONS ARE IN INCHES		APR 4/63				B 8769384	
SEE ENGINEERING RECORDS		T255E3		TOLERANCES ON FRACTIONS DECIMALS ANGLES		TOLERANCES ON FRACTIONS DECIMALS ANGLES		CHECKED				CODE 000000 SHEET OF	
NEXT ASSY USED ON APPLICATION				MATERIAL		MATERIAL		TRACER				SCALE 2/1	
NEXT ASSY USED ON APPLICATION				HEAT TREATMENT		HEAT TREATMENT		SUBMITTED				UNIT WT	
NEXT ASSY USED ON APPLICATION				FINAL PROTECTIVE FINISH		FINAL PROTECTIVE FINISH		APPROVED BY ORDER OF THE CHIEF OF ORDNANCE				8769384	
NEXT ASSY USED ON APPLICATION				QTY REQD		QTY REQD		APPROVED BY ORDER OF THE CHIEF OF ORDNANCE				8769384	
NEXT ASSY USED ON APPLICATION				MICROFILMED		MICROFILMED		APPROVED BY ORDER OF THE CHIEF OF ORDNANCE				8769384	
NEXT ASSY USED ON APPLICATION				DATE		DATE		APPROVED BY ORDER OF THE CHIEF OF ORDNANCE				8769384	

FIGURE 16

NOTICE AND PREPARATION: DRAWING IS FOR THE USE OF THE USER ONLY. IT IS NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT PERMISSION IN WRITING FROM THE ARMY. THE ARMY WILL NOT BE RESPONSIBLE FOR ANY DAMAGE TO OR LOSS OF DATA OR INFORMATION, OR FOR ANY CONSEQUENCES ARISING FROM THE USE OF THIS DRAWING. THE ARMY WILL NOT BE RESPONSIBLE FOR ANY DAMAGE TO OR LOSS OF DATA OR INFORMATION, OR FOR ANY CONSEQUENCES ARISING FROM THE USE OF THIS DRAWING.		REVISIONS	
SPN	DESCRIPTION	DATE	APPRO

VALVE RDI-B 7214

PIN, SPRING MS16562-172

PLUG-B8769381

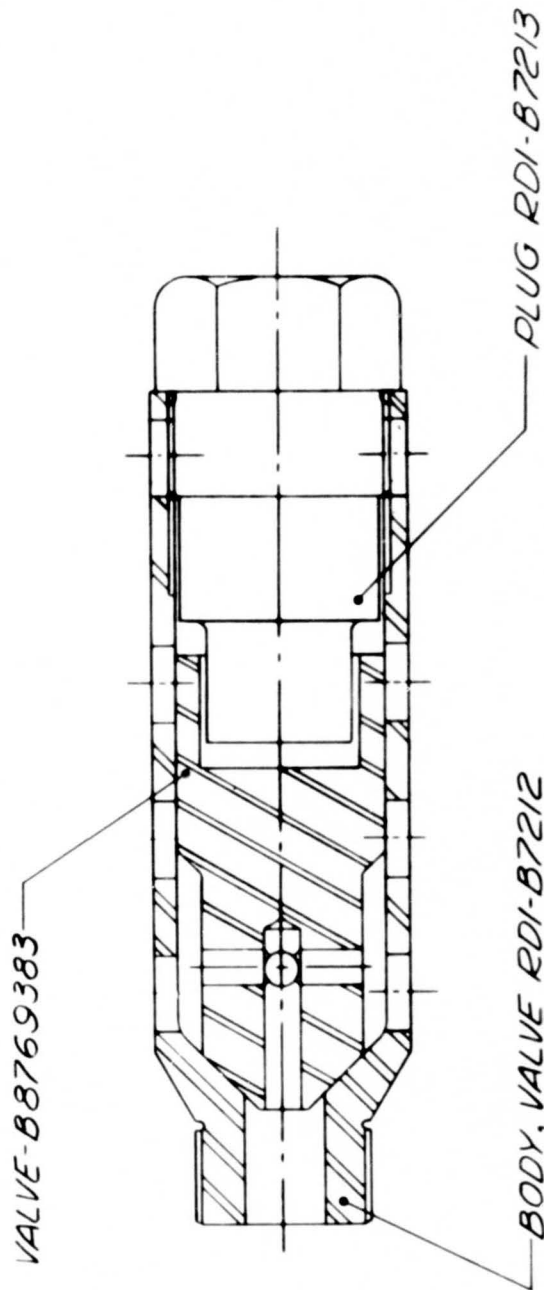
BODY, VALVE-B8769382

ASSEMBLY

DEPT OF THE ARMY WATERVLIET ARSENAL WATERVLIET, N. Y.		RDI-7216 VALVE ASSEMBLY		RDI-B7216
SCALE 1/1	UNIT WT	SHEET	OF	RDI-B7216
ORIGINAL DATE OF RECORD		DATE		REVISION
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES FRACTIONS DECIMALS ANGLES		FRACTIONS		DECIMALS
MATERIAL		FINISH		TOLERANCES
FINAL PROTECTIVE FINISH		HANDS		FINISH
SEE ENGINEERING RECORDS		NEXT APPY		FINAL APPY
NEXT APPY		USED ON		QTY REQD
APPLICATION		REPRODUCTION		DATE
DO NOT		APPLY PART NO		AS SPECIFIED

FIGURE 17

REVISIONS

[illegible]

DEPT OF THE ARMY		WATERVLIET ARSENAL		WATERVLIET, N Y	
RD-1-7222		VALVE		ASSEMBLY	
SCALE 1/1		UNIT WT		CODE	
RD-1-87222		SHEET		OF	
GENERAL DATE OF ENGINEERING		DATE		PROCESS	
PHYSICAL PROPERTIES		MATERIAL		DESIGN	
1.1 DIM		1.1 DIM		1.1 DIM	
1.2 DIM		1.2 DIM		1.2 DIM	
1.3 DIM		1.3 DIM		1.3 DIM	
1.4 DIM		1.4 DIM		1.4 DIM	
1.5 DIM		1.5 DIM		1.5 DIM	
1.6 DIM		1.6 DIM		1.6 DIM	
1.7 DIM		1.7 DIM		1.7 DIM	
1.8 DIM		1.8 DIM		1.8 DIM	
1.9 DIM		1.9 DIM		1.9 DIM	
1.10 DIM		1.10 DIM		1.10 DIM	
1.11 DIM		1.11 DIM		1.11 DIM	
1.12 DIM		1.12 DIM		1.12 DIM	
1.13 DIM		1.13 DIM		1.13 DIM	
1.14 DIM		1.14 DIM		1.14 DIM	
1.15 DIM		1.15 DIM		1.15 DIM	
1.16 DIM		1.16 DIM		1.16 DIM	
1.17 DIM		1.17 DIM		1.17 DIM	
1.18 DIM		1.18 DIM		1.18 DIM	
1.19 DIM		1.19 DIM		1.19 DIM	
1.20 DIM		1.20 DIM		1.20 DIM	
1.21 DIM		1.21 DIM		1.21 DIM	
1.22 DIM		1.22 DIM		1.22 DIM	
1.23 DIM		1.23 DIM		1.23 DIM	
1.24 DIM		1.24 DIM		1.24 DIM	
1.25 DIM		1.25 DIM		1.25 DIM	
1.26 DIM		1.26 DIM		1.26 DIM	
1.27 DIM		1.27 DIM		1.27 DIM	
1.28 DIM		1.28 DIM		1.28 DIM	
1.29 DIM		1.29 DIM		1.29 DIM	
1.30 DIM		1.30 DIM		1.30 DIM	
1.31 DIM		1.31 DIM		1.31 DIM	
1.32 DIM		1.32 DIM		1.32 DIM	
1.33 DIM		1.33 DIM		1.33 DIM	
1.34 DIM		1.34 DIM		1.34 DIM	
1.35 DIM		1.35 DIM		1.35 DIM	
1.36 DIM		1.36 DIM		1.36 DIM	
1.37 DIM		1.37 DIM		1.37 DIM	
1.38 DIM		1.38 DIM		1.38 DIM	
1.39 DIM		1.39 DIM		1.39 DIM	
1.40 DIM		1.40 DIM		1.40 DIM	
1.41 DIM		1.41 DIM		1.41 DIM	
1.42 DIM		1.42 DIM		1.42 DIM	
1.43 DIM		1.43 DIM		1.43 DIM	
1.44 DIM		1.44 DIM		1.44 DIM	
1.45 DIM		1.45 DIM		1.45 DIM	
1.46 DIM		1.46 DIM		1.46 DIM	
1.47 DIM		1.47 DIM		1.47 DIM	
1.48 DIM		1.48 DIM		1.48 DIM	
1.49 DIM		1.49 DIM		1.49 DIM	
1.50 DIM		1.50 DIM		1.50 DIM	
1.51 DIM		1.51 DIM		1.51 DIM	
1.52 DIM		1.52 DIM		1.52 DIM	
1.53 DIM		1.53 DIM		1.53 DIM	
1.54 DIM		1.54 DIM		1.54 DIM	
1.55 DIM		1.55 DIM		1.55 DIM	
1.56 DIM		1.56 DIM		1.56 DIM	
1.57 DIM		1.57 DIM		1.57 DIM	
1.58 DIM		1.58 DIM		1.58 DIM	
1.59 DIM		1.59 DIM		1.59 DIM	
1.60 DIM		1.60 DIM		1.60 DIM	
1.61 DIM		1.61 DIM		1.61 DIM	
1.62 DIM		1.62 DIM		1.62 DIM	
1.63 DIM		1.63 DIM		1.63 DIM	
1.64 DIM		1.64 DIM		1.64 DIM	
1.65 DIM		1.65 DIM		1.65 DIM	
1.66 DIM		1.66 DIM		1.66 DIM	
1.67 DIM		1.67 DIM		1.67 DIM	
1.68 DIM		1.68 DIM		1.68 DIM	
1.69 DIM		1.69 DIM		1.69 DIM	
1.70 DIM		1.70 DIM		1.70 DIM	
1.71 DIM		1.71 DIM		1.71 DIM	
1.72 DIM		1.72 DIM		1.72 DIM	
1.73 DIM		1.73 DIM		1.73 DIM	
1.74 DIM		1.74 DIM		1.74 DIM	
1.75 DIM		1.75 DIM		1.75 DIM	
1.76 DIM		1.76 DIM		1.76 DIM	
1.77 DIM		1.77 DIM		1.77 DIM	
1.78 DIM		1.78 DIM		1.78 DIM	
1.79 DIM					

FIGURE 20

REVISIONS									
DATE	DESCRIPTION	DATE	DESCRIPTION	DATE	DESCRIPTION	DATE	DESCRIPTION	DATE	DESCRIPTION

VALVE RDI-B7214

PLUG RDI-B7213

BODY, VALVE RDI-B7212

DEPT OF THE ARMY WATERVLIET ARSENAL WATERVLIET, N. Y.		RDI-B7223	
VALVE ASSEMBLY		RDI-B7223	
SCALE 1/1	UNIT WT	SHEET	OF

ORIGINAL DATE OF DRAWING	MAT'L	PROCESS
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES	BRASS EPC TECH EPC	CHECK CHECK CHECK CHECK
MATERIAL	BRASS	VALVE
FINAL PROTECTIVE FINISH		

PHYSICAL PROPERTIES	TEST AMT	FINAL AMT
Y S MIN		
Y S MAX		
TS		
ELI		
GM		
BN		

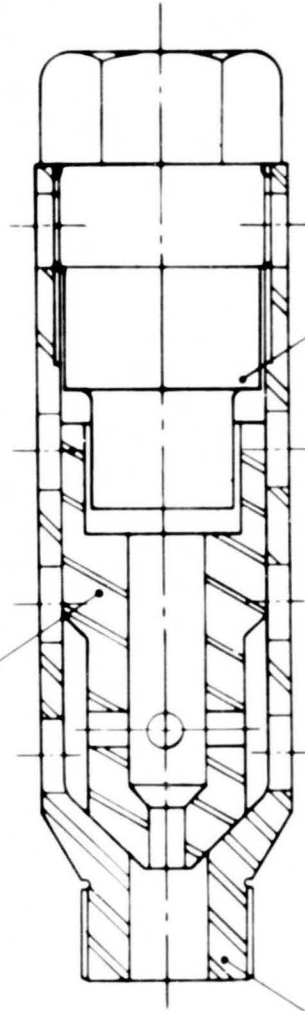
SEE ENGINEERING RECORDS	USED ON	QTY REQD

DO NOT	APPLY PART NO	DATE

FIGURE 21

THIS DRAWING IS THE PROPERTY OF THE ARMY. IT IS TO BE KEPT IN THE OFFICE OF THE ORIGINATOR AND NOT REPRODUCED OR COPIED IN ANY MANNER WITHOUT THE WRITTEN PERMISSION OF THE ARMY. IT IS TO BE KEPT IN THE OFFICE OF THE ORIGINATOR AND NOT REPRODUCED OR COPIED IN ANY MANNER WITHOUT THE WRITTEN PERMISSION OF THE ARMY.		REVISIONS	
SYM	DESCRIPTION	DATE	APP'D

VALVE-A8769529



BODY, VALVE RDI-B7212

PLUG RDI-B7213

DEPT OF THE ARMY WATERVLIET ARSENAL WATERVLIET, N. Y.		RDI-7225 VALVE ASSEMBLY		RDI-B7225	
SCALE 1/1		UNIT WT		SHEET OF	
ORIGINAL DATE OF DRAWING		MAT'L		PROCESS	
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES		CHECKED EPC		CHECKED J. L. E.	
MATERIAL		FINISHED		FINISHED	
FINAL PROTECTIVE FINISH		FINISHED		FINISHED	
PHYSICAL PROPERTIES		Y'S MIN		Y'S MAX	
TS		EL 1		EL 2	
NEXT ASSY		FINAL ASSY		QTY REQD	
USED ON		MICROFILMED		DATE	
SEE ENGINEERING RECORDS		APPLY PART NO		AS SPECIFIED	
DO NOT		DO		DO	

FIGURE 23

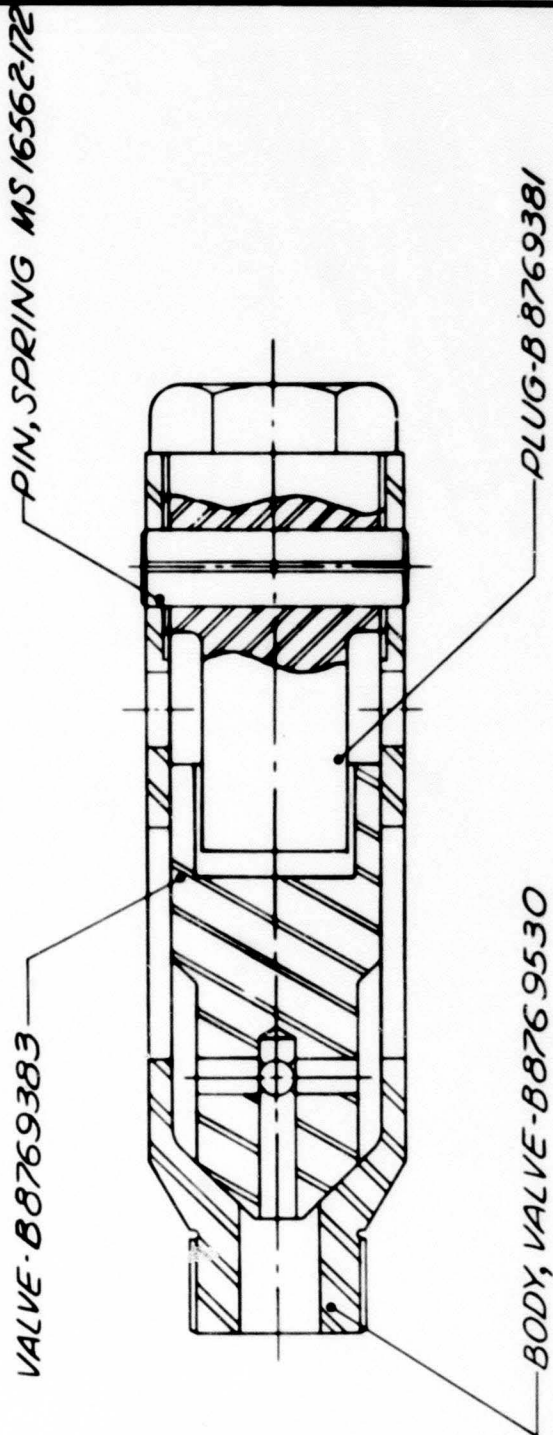
[illegible][illegible]

FIGURE 24.

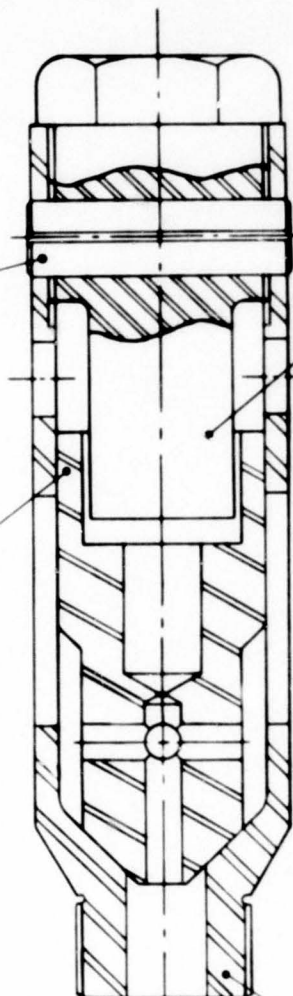
NOTE: - THIS DOCUMENT, DRAWING, SPECIFICATION, OR PART MAY BE USED FOR ANY PURPOSE, BUT THE USER ASSUMES ALL LIABILITY FOR THE RESULTS OF SUCH USE. THE U.S. GOVERNMENT MAKES NO WARRANTY, REPRESENTATION, OR GUARANTEE, EXPRESS OR IMPLIED, THAT THE INFORMATION CONTAINED HEREIN IS CORRECT, COMPLETE, OR UP-TO-DATE. THE U.S. GOVERNMENT SHALL NOT BE RESPONSIBLE FOR ANY DAMAGE TO PERSONS OR PROPERTY, OR FOR ANY CONSEQUENCES ARISING FROM THE USE OF THE INFORMATION CONTAINED HEREIN.										REVISIONS <table border="1"> <tr> <th>DATE</th> <th>DESCRIPTION</th> <th>APPROVED</th> <th>BY</th> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </table>										DATE	DESCRIPTION	APPROVED	BY												
DATE	DESCRIPTION	APPROVED	BY																																
VALVE RDI-B7214										PIN, SPRING - MS16562-172																									
										PLUG - B8769381																									
SEE ENGINEERING RECORDS										GENERAL DATA OF RECORDS																									
NEXT ASST. USED ON										UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. FRACTIONS DECIMALS ANGLES																									
APPLICATION										MATERIAL																									
QTY REQD										FINAL RESPECTIVE FROM																									
APPLY PART NO. AS SPECIFIED										DATE																									
DEPT OF THE ARMY										WATERVLIET ARSENAL																									
WATERVLIET, N. Y.										RD1-7220																									
VALVE ASSEMBLY										SCALE 1/2" = 1"																									
DATE										BY																									

FIGURE 25

REVISIONS

SYM	DESCRIPTION	DATE	APP'D	INSTR. FILED

DIN, SPRING MS 16562-172

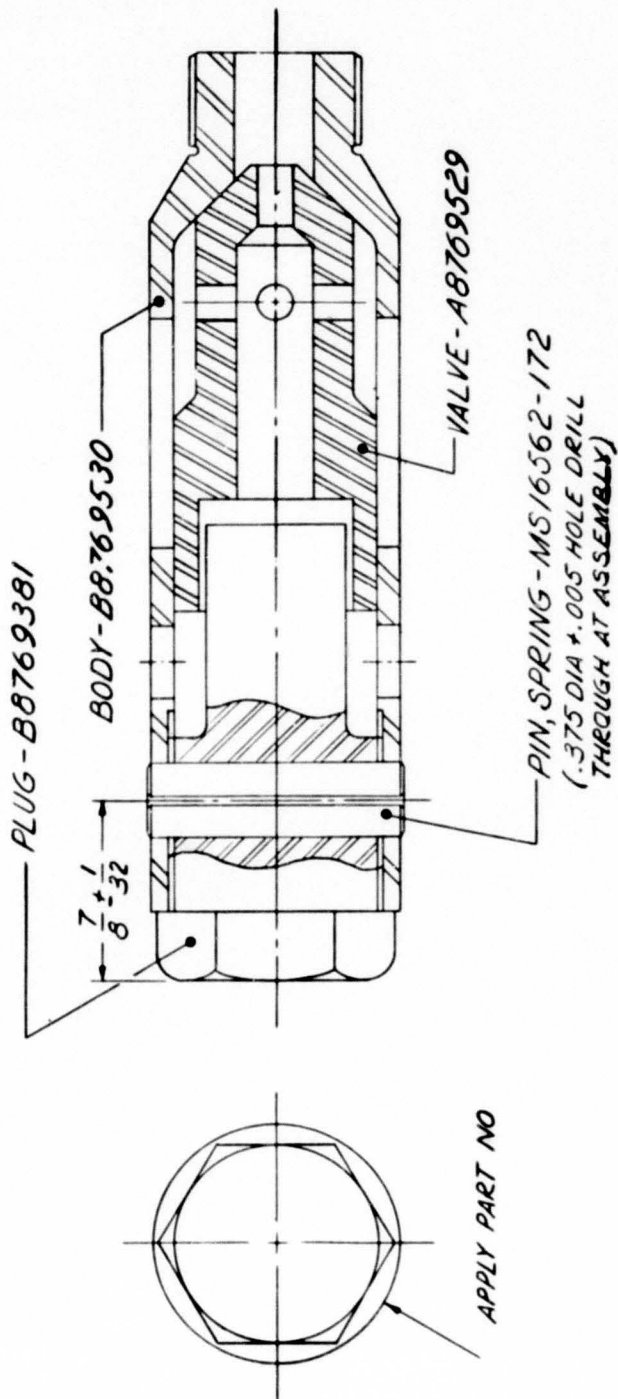


BODY, VALVE - B8769530

PLUG-B8769381

DEPT OF THE ARMY		WATERVLIET ARSENAL		WATERVLIET, N. Y.		RD1-87221	
RD1-7221		VALVE		ASSEMBLY		RD1-87221	
ORIGINAL DATE OF DESIGN		DATE		PROCESS		SCALE	
UNLESS OTHERWISE SPECIFIED		MATERIAL		DRAWING		UNIT WT	
DIMENSIONS ARE IN INCHES		FINISH		TOLERANCE		CROSS SECTION	
FRACTIONS DECIMALS		TOLERANCE		TOLERANCE		TOLERANCE	
MATERIAL		MATERIAL		MATERIAL		MATERIAL	
FINAL PROTECTIVE FINISH		FINAL PROTECTIVE FINISH		FINAL PROTECTIVE FINISH		FINAL PROTECTIVE FINISH	
SEE ENGINEERING RECORDS		NEXT ASBY		USED ON		APPLICATION	
NEXT ASBY		QTY REQD		APPLY PART NO		AS SPECIFIED	
DATE		DATE		DATE		DATE	

FIGURE 26

[illegible]

PART NO. 8769531

FOR LIST OF PARTS SEE ENGINEERING PARTS LIST 8769531

[illegible]

FIGURE 27

REVISIONS

BY	DATE	APP'D

BODY-B8769382

BODY DEVELOPMENT FOR STRAIN-GAGE LOCATIONS		DEPT OF THE ARMY WATERVLIET ARSENAL WATERVLIET, N. Y.	
SCALE	1	UNIT WT	
CODE		RDI-B7226	
SHEET		OF	

NOTICE: THIS DOCUMENT CONTAINS INFORMATION OF A SECRET NATURE AND IS NOT TO BE RELEASED TO THE PUBLIC OR TO ANY OTHER PERSON OR ORGANIZATION WITHOUT THE WRITTEN AUTHORIZATION OF THE ARMY. IT IS THE POLICY OF THE ARMY TO PROTECT SUCH INFORMATION AND TO PREVENT THE DISCLOSURE OF THE SAME TO THE ENEMY OR TO ANY OTHER PERSON OR ORGANIZATION. IT IS THE POLICY OF THE ARMY TO PROTECT SUCH INFORMATION AND TO PREVENT THE DISCLOSURE OF THE SAME TO THE ENEMY OR TO ANY OTHER PERSON OR ORGANIZATION. IT IS THE POLICY OF THE ARMY TO PROTECT SUCH INFORMATION AND TO PREVENT THE DISCLOSURE OF THE SAME TO THE ENEMY OR TO ANY OTHER PERSON OR ORGANIZATION.

GENERAL DATA OF DRAWING		DATE		PROJECT	
UNLESS OTHERWISE SPECIFIED		DATE		PROJECT	
ENGINEERING ARE TO BE USED		DATE		PROJECT	
FRACTIONS DECIMALS		DATE		PROJECT	
MATERIAL		DATE		PROJECT	
FINAL PROTECTIVE FINISH		DATE		PROJECT	
PHYSICAL PROPERTIES		DATE		PROJECT	
TENSILE		DATE		PROJECT	
YIELD		DATE		PROJECT	
ELONGATION		DATE		PROJECT	
HARDNESS		DATE		PROJECT	
THERMAL		DATE		PROJECT	
ELECTRICAL		DATE		PROJECT	
MECHANICAL		DATE		PROJECT	
CHEMICAL		DATE		PROJECT	
ENVIRONMENTAL		DATE		PROJECT	
OTHER		DATE		PROJECT	
SEE ENGINEERING RECORDS		DATE		PROJECT	
NEXT APPY USED ON		DATE		PROJECT	
APPLICATION		DATE		PROJECT	
DO NOT APPLY PART NO. AS SPECIFIED		DATE		PROJECT	
DO		DATE		PROJECT	

FIGURE 28

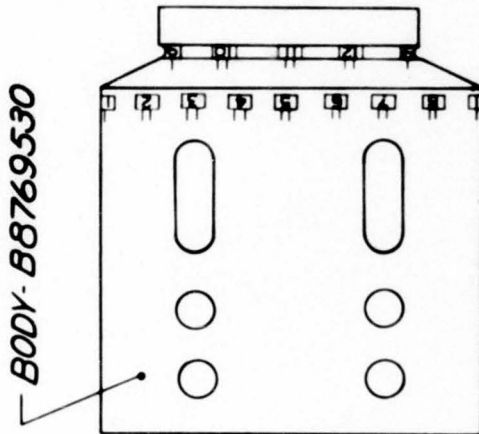
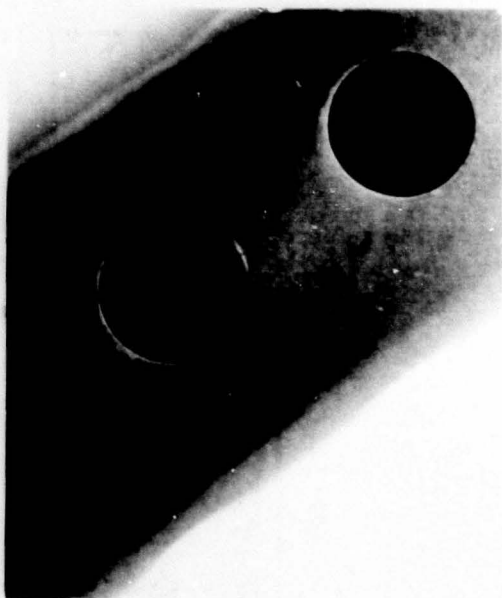
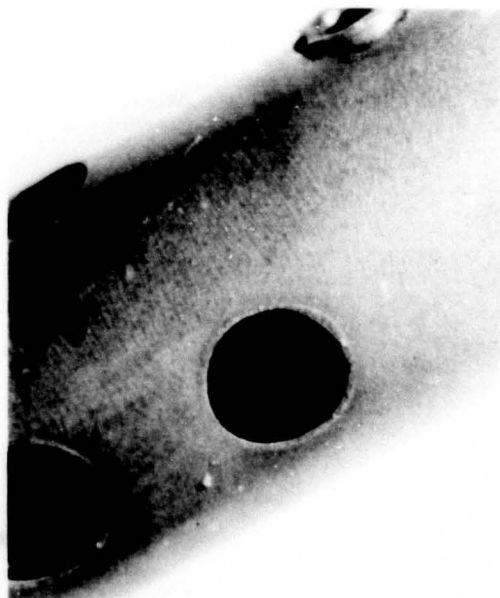
[illegible][illegible]

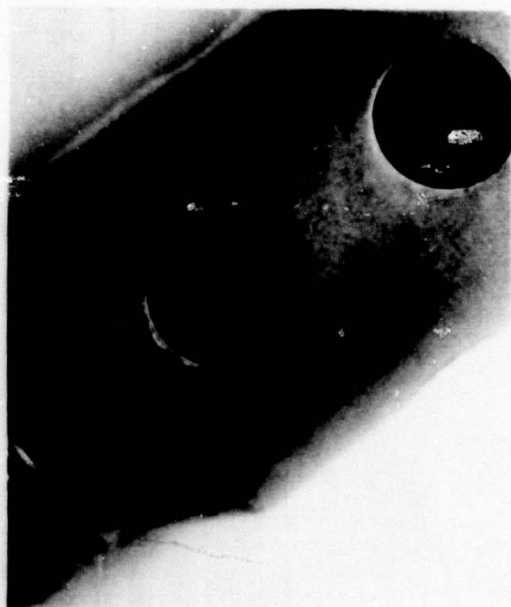
FIGURE 30



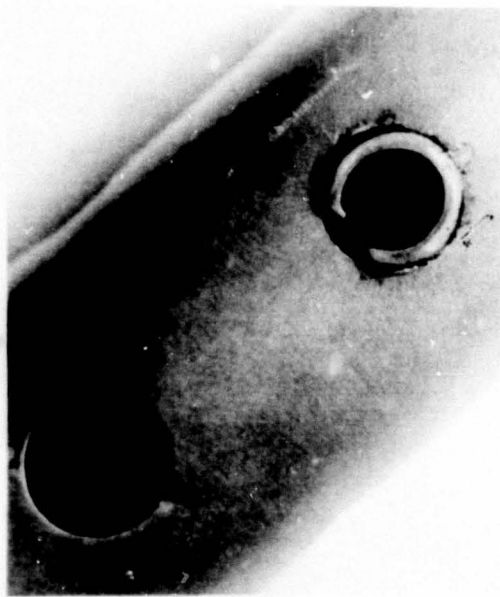
A



B



C



D

Figure 32: Four Views of the Valve Body to which
"Stress Coat" had been applied.

A and B are in Line.
C and D are 90° from A and B and in line.



Figure 33: View showing Magnetic Particle Indication
On S.V. 1 after 1000 rounds.

Arrow Points out Indication



Figure 34: View showing Magnetic Particle Indication
on M.V. 3 after 10,000 Rounds.

Arrow Points out Indication

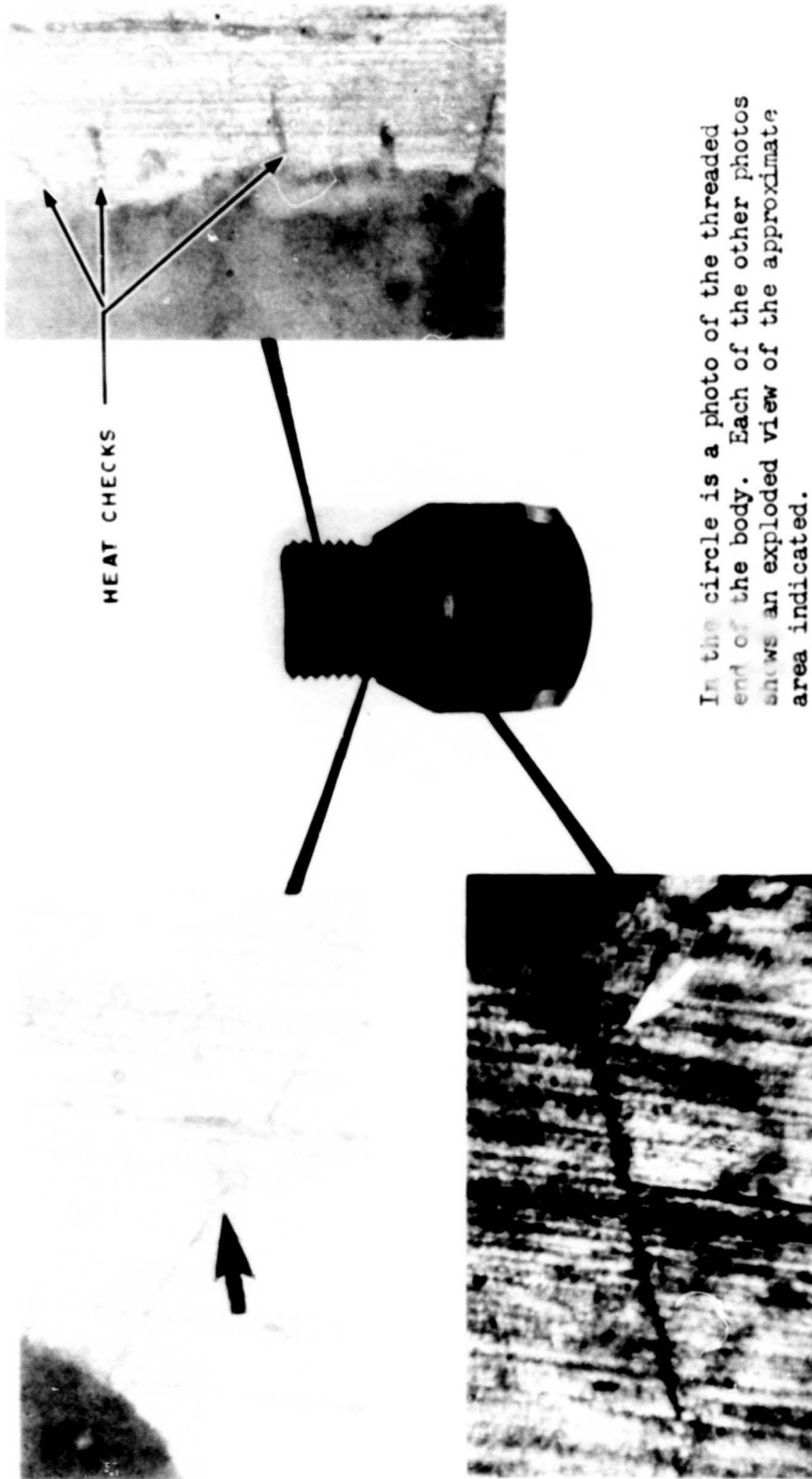
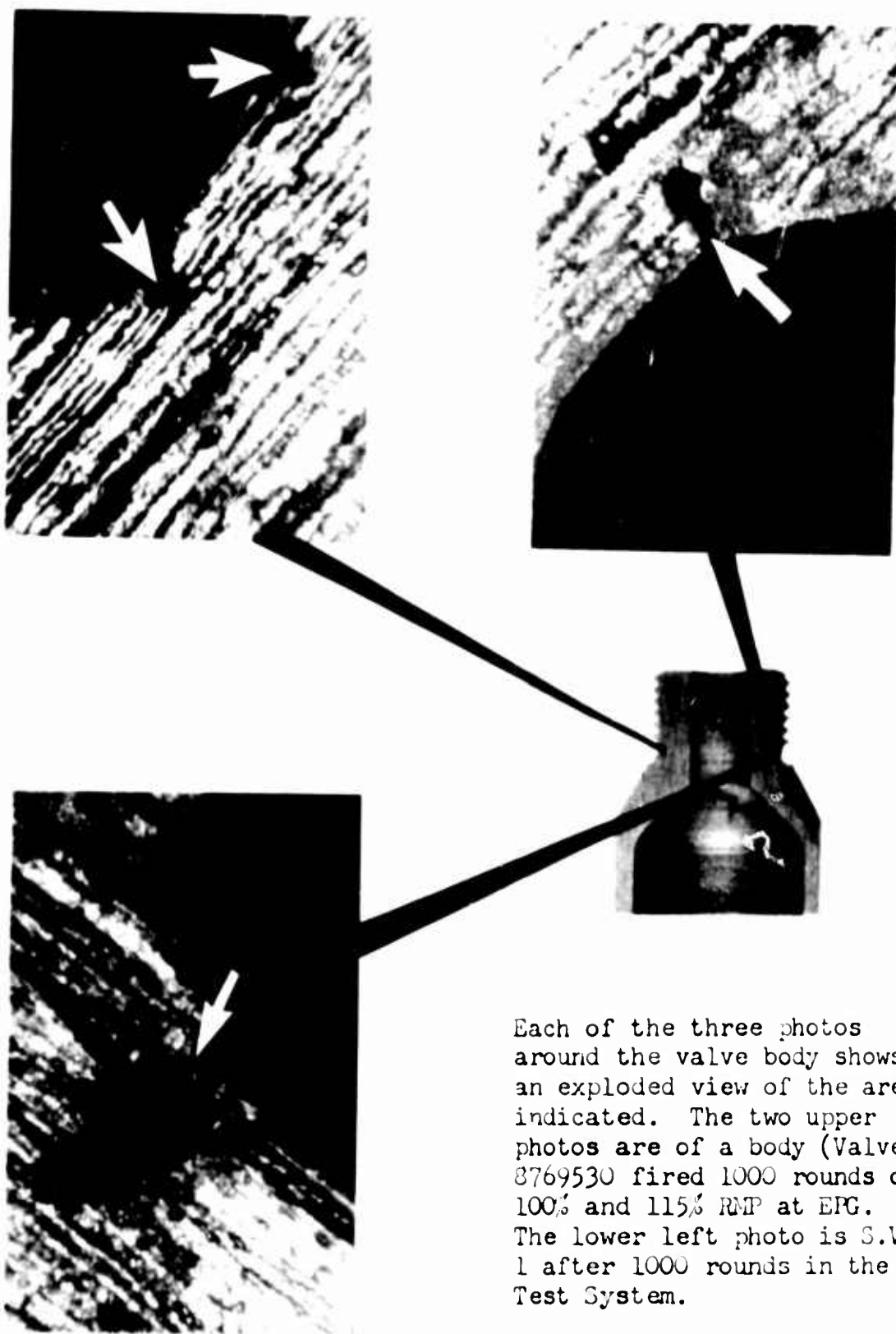


Figure 35: Photomicrographs of M.V. 3 after 10,000 rounds;
Macroetched with 50% HCL Solution and Magnified 65x



Each of the three photos around the valve body shows an exploded view of the area indicated. The two upper photos are of a body (Valve) 8769530 fired 1000 rounds of 100% and 115% RMP at EPG. The lower left photo is S.V. 1 after 1000 rounds in the Test System.

Figure 36: Photomacrographs Of Valve Bodies Macroetched with 50% HCL Solution and Magnified 65x

DISTRIBUTION LIST

Copies

Office of the Director of Defense Research & Engineering

ATTN: Dr. Earl T. Hayes

Assistant Director (Materials)

The Pentagon

Washington, D.C. 20315

1

Commander

Defense Documentation

Center

Cameron Station, Bldg. 5

5010 Duke Street

Alexandria, Virginia 22314

20

Commanding General

U.S. Materiel Command

Room 2502, Bldg. T-7

ATTN: AMCRD-RC-M

AMCRD-RS-CM

AMCRD-DE

Washington, D.C. 20315

1

1

1

Commanding General

U. S. Army Weapons Command

Rock Island Arsenal

ATTN: AMSWE-RDR

AMSWE-RDA

AMSWE-LCD

Rock Island, Illinois 61202

1

1

1

Commanding General

U. S. Army Mobility Command

ATTN: AMSMO

Warren, Michigan 48090

1

Commanding Officer

Army Research Office

Office, Chief Research & Development

ATTN: Physical Sciences Division

3045 Columbia Pike

Arlington, Virginia

2

	Copies
Commanding Officer U.S. Army Research Office (Durham) Box CM, Duke Station Durham, North Carolina 27706	6
Commanding Officer U. S. Army Materials Research Agency ATTN: AMXMR - Technical Information Center Watertown, Mass. 02172	2
Commanding General Aberdeen Proving Ground ATTN: Dr. C. Pickett AMXCC Technical Library Aberdeen, Maryland	1 1
Commanding Officer U. S. Army Engineer Research & Development Laboratories ATTN: STINFO Branch Fort Belvoir, Virginia	2
Commanding Officer ATTN: Materials Branch U. S. Army Signal R&D Laboratory Fort Monmouth, New Jersey	1
Commandant HQ., U. S. Army Aviation School ATTN: Office of the Librarian Fort Rucker, Alabama	1
Commanding Officer Frankford Arsenal ATTN: SMUFA Philadelphia, Pa. 19137	1
Commanding Officer Harry Diamond Laboratories ATTN: AMSDO-Technical Reference Section Connecticut Ave. & Van Ness St., N.W. Washington, D.C. 20438	1

	Copies
Commanding Officer Picatinny Arsenal ATTN: SMUPA Dover, New Jersey 07801	1
Commanding General U. S. Army Missile Command ATTN: Documentation & Technical Information Branch Mr. R. E. Ely, AMSMI-RRS Mr. R. Fink, AMSMI-RKX Mr. W. I. Thomas AMSMI Mr. E. J. Wheelahan, AMSMI-RSM Redstone Arsenal, Alabama 35809	2 1 1 1 1
Commanding Officer Rock Island Arsenal ATTN: SWERI-RDD Rock Island, Illinois 61202	1
Commanding Officer Springfield Armory ATTN: SWESP-PRD Springfield, Mass. 01101	1
Commanding Officer Watertown Arsenal ATTN: SMIWT-EX Watertown 72, Mass. 02172	1
Commander HQ., Aeronautical Systems Division ATTN: ASRCEE Wright-Patterson Air Force Base, Ohio	5
National Aeronautics & Space Administration ATTN: R. V. Rhode G. C. Deutsch B. G. Achhammer Washington, D.C. 20546	1 1 1

George C. Marshall Space Flight Center	Copies
ATTN: Dr. W. R. Lucas, M-S&M-M	1
W. A. Wilson, M-F&AE-M, Bldg 4720	1
Huntsville, Alabama	

Director	
Naval Research Laboratory	
ATTN: Technical Information Officer	
Anacostia Station	
Washington, D. C.	1

Commander	
Department of the Navy	
Office of Naval Research	
ATTN: Mr. M. E. Jansson-1065	1
Technical Library	1
Washington, D. C. 20315	

Robert L. Shannon, Extension Manager	
U. S. Atomic Energy Commission	
Division of Technical Information Extension	
P. O. Box 62	
Oak Ridge, Tennessee 37831	2

Office of Technical Services	
Department of Commerce	
ATTN: Chief, Acquisition Section, Annex 1	
Washington 25, D. C.	2

Office of Technical Services	
Department of Commerce	50
1200 South Eads Street	
Arlington, Va.	

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

NOTES

[illegible]

[illegible]

[illegible]

NOTES

[illegible]

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

NOTES

[illegible]

[illegible]

UNCLASSIFIED	AD	Accession No.	UNCLASSIFIED	AD	Accession No.	UNCLASSIFIED
Artillery	Watervliet Arsenal, Watervliet, N. Y.		Artillery	Watervliet Arsenal, Watervliet, N. Y.		Artillery
Howitzers	BORE EVACUATOR VALVE TEST, CANNON 155MM HOWITZER, M126, by J. M. Giesey, Mechanical Engineer; E. R. Lawson, Mechanical Engineer and R. L. Rosenblum, Mechanical Engineer.		Howitzers	BORE EVACUATOR VALVE TEST, CANNON 155MM HOWITZER, M126, by J. M. Giesey, Mechanical Engineer; E. R. Lawson, Mechanical Engineer and R. L. Rosenblum, Mechanical Engineer.		Howitzers
Cannon, 155mm T255E3	Report No. WVT-II-6412, August 1964, 60 pages, 4 tables and 36 figures. OOMS Code No. 4020.24.2223.2.10.04		Cannon, 155mm T255E3	Report No. WVT-II-6412, August 1964, 60 pages, 4 tables and 36 figures. OOMS Code No. 4020.24.2223.2.10.04		Cannon, 155mm T255E3
Cannon, 155mm How. M126	Unclassified Report		Cannon, 155mm How. M126	Unclassified Report		Cannon, 155mm How. M126
Bore Evacuation	The limited life of Bore Evacuator Valve Assembly 8769384 during firing tests led to the authorization of a test program to find a valve assembly with a longer life. The cost of testing in the gun (155mm How. M126) made it economical to build a test apparatus which simulated the weapon. The test program was the basis for the incorporation of valve assembly 8769531 into the weapon system. A comparison of the strain level of the modification is presented. The life of the then current production valve assembly and the new production valve assembly under different charges is also given.		Bore Evacuation	The limited life of Bore Evacuator Valve Assembly 8769384 during firing tests led to the authorization of a test program to find a valve assembly with a longer life. The cost of testing in the gun (155mm How. M126) made it economical to build a test apparatus which simulated the weapon. The test program was the basis for the incorporation of valve assembly 8769531 into the weapon system. A comparison of the strain level of the modification is presented. The life of the then current production valve assembly and the new production valve assembly under different charges is also given.		Bore Evacuation
Valves			Valves			Valves
Bore Scavenging			Bore Scavenging			Bore Scavenging
Distribution Unlimited			Distribution Unlimited			Distribution Unlimited

UNCLASSIFIED	AD	Accession No.	UNCLASSIFIED	AD	Accession No.	UNCLASSIFIED
Artillery	Watervliet Arsenal, Watervliet, N. Y.		Artillery	Watervliet Arsenal, Watervliet, N. Y.		Artillery
Howitzers	BORE EVACUATOR VALVE TEST, CANNON 155MM HOWITZER, M126, by J. M. Giesey, Mechanical Engineer; E. R. Lawson, Mechanical Engineer and R. L. Rosenblum, Mechanical Engineer.		Howitzers	BORE EVACUATOR VALVE TEST, CANNON 155MM HOWITZER, M126, by J. M. Giesey, Mechanical Engineer; E. R. Lawson, Mechanical Engineer and R. L. Rosenblum, Mechanical Engineer.		Howitzers
Cannon, 155mm T255E3	Report No. WVT-II-6412, August 1964, 60 pages, 4 tables and 36 figures. OOMS Code No. 4020.24.2223.2.10.04		Cannon, 155mm T255E3	Report No. WVT-II-6412, August 1964, 60 pages, 4 tables and 36 figures. OOMS Code No. 4020.24.2223.2.10.04		Cannon, 155mm T255E3
Cannon, 155mm How. M126	Unclassified Report		Cannon, 155mm How. M126	Unclassified Report		Cannon, 155mm How. M126
Bore Evacuation	The limited life of Bore Evacuator Valve Assembly 8769384 during firing tests led to the authorization of a test program to find a valve assembly with a longer life. The cost of testing in the gun (155mm How. M126) made it economical to build a test apparatus which simulated the weapon. The test program was the basis for the incorporation of valve assembly 8769531 into the weapon system. A comparison of the strain level of the modification is presented. The life of the then current production valve assembly and the new production valve assembly under different charges is also given.		Bore Evacuation	The limited life of Bore Evacuator Valve Assembly 8769384 during firing tests led to the authorization of a test program to find a valve assembly with a longer life. The cost of testing in the gun (155mm How. M126) made it economical to build a test apparatus which simulated the weapon. The test program was the basis for the incorporation of valve assembly 8769531 into the weapon system. A comparison of the strain level of the modification is presented. The life of the then current production valve assembly and the new production valve assembly under different charges is also given.		Bore Evacuation
Valves			Valves			Valves
Bore Scavenging			Bore Scavenging			Bore Scavenging
Distribution Unlimited			Distribution Unlimited			Distribution Unlimited