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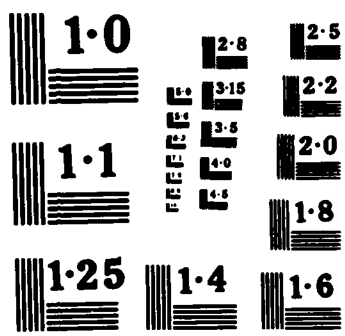
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M577 FUZE PRODUCT IMPROVEMENT PROGRAM: REDESIGNED BARREL HOUSING

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AUGUST 1984

U.S. ARMY ARMAMENT RESEARCH AND DEVELOPMENT CENTER

LARGE CALIBER WEAPON SYSTEMS LABORATORY

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The objective of this task was to redesign the barrel housing for the M577 fuze using an alternate material and process in an effort to lower the cost of producing the barrel housing. The proposed design replaces the machined stainless steel barrel housing with a ZA 12 die cast barrel housing.

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FIGURES

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INTRODUCTION

The objective of this task was to design and develop a new barrel housing for the M577 MTSQ Fuze using an alternate material and/or process in an effort to lower the cost of producing the barrel housing.

This task investigated aluminum and zinc barrel housings to replace the present machined stainless steel barrel housing. Static testing was used to determine which materials are of sufficient strength to withstand 30,000g setback.

TECHNICAL DISCUSSION

The primary concern of this task was the use of a material which was more economical and of sufficient strength to withstand the required design criteria. The load of the timer is supported by the barrel housing, sleeve, and timing scroll assembly. Since the barrel housing is not a primary structural member, the strength of a material such as stainless steel is not required. Calculations and various static tests of different designs and materials were conducted to determine the strength of these materials under simulated setback loads. The areas of concern in the barrel housing are the top-to-shoulder joint and the cylindrical portion. (Figure 1).

Figure 1 Loads on barrel housing during setback

The top of the barrel housing is loaded in compression during setback by the timer assembly less the timing scroll assembly and the tumblers. This load is calculated to be 2,307 lbs. under 30,000-g setback (see Appendix A). The shoulder of the barrel housing is loaded in compression during setback by the setting mechanism and tumblers. This load is 7,014 lbs. under 30,000-g setback (see Appendix A). In addition, the load on the top of the barrel housing is transmitted to the cylindrical portion of the barrel housing. Static tests were performed on the two loading areas of barrel housings made from the current stainless steel, aluminum, and several die cast zinc alloys. From the results of these static tests, it was decided that two of the die cast zinc alloys, ZA12 and zinc alloy 3, should be pursued.

Additional laboratory and ballistic tests were done on both ZA12 and zinc alloy 3 barrel housings. Ballistic testing was first performed on fuzes built with zinc alloy 3 barrel housings. This material was tested first because the manufacturing cost is cheaper than with ZA12. The results of these tests were not conclusive. Fuzes with ZA12 barrel housings were air-gunned and ballistically tested with excellent results. It was decided to use ZA12 for the final design of the barrel housing because of its higher strength and the test results. Since ZA12 is a higher strength material than zinc alloy 3, the environmental tests were not repeated with ZA12.

Stress Analysis

The stressed areas of concern in the Barrel Housing are the top-to-shoulder joint and the cylindrical portion (see Figure 2).

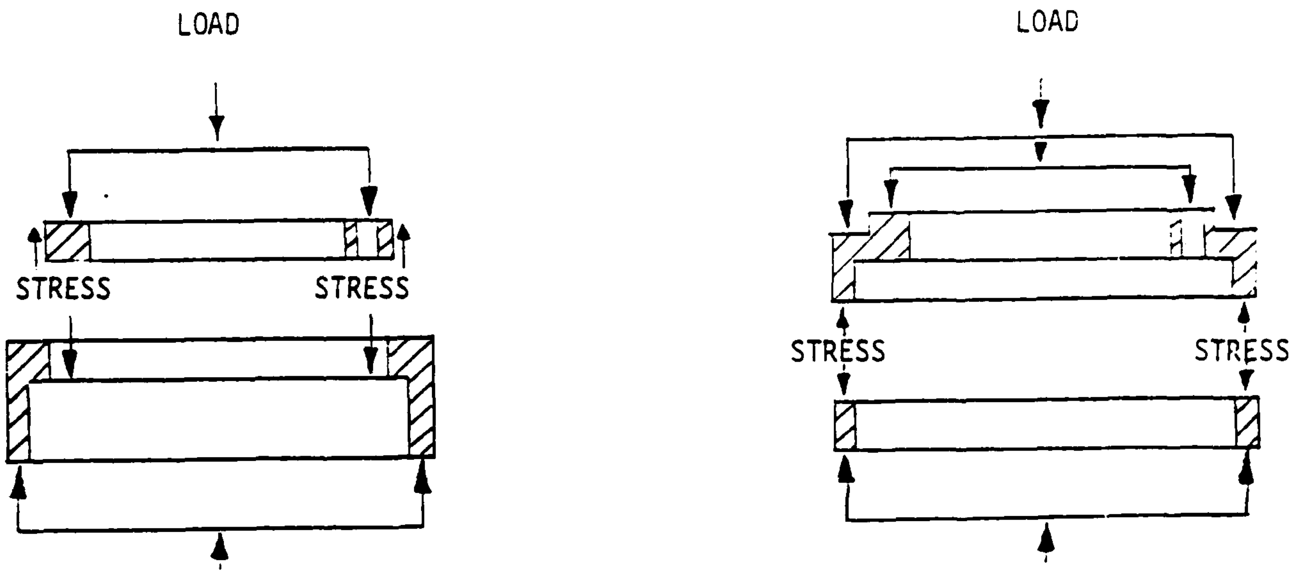


Figure 2 Stress areas of barrel housing

The compressive load applied on the top of the barrel housing during setback induces a shear stress at the top-to-shoulder joint. The combined load applied to the top and shoulder of the barrel housing during setback induces a stress on the cylindrical portion of the barrel housing.

The stress in the barrel housing is difficult to calculate because of the variation of thickness and the various cutout areas. Therefore, the stress in the two areas of concern was calculated without considering the stress concentration caused by the cutout areas (see Appendix B). In the stainless steel barrel housing, the shear stress at the top-to-shoulder joint is 7,406 psi, and the stress in the cylindrical portion is 41,060 psi. Since these calculated stresses do not include the stress concentration factor, these calculated stresses were used only as a guide in choosing the zinc alloy to be used.

The strength of the current material and the alloys considered for a die cast barrel housing are shown in Table 1.

Table 1. Strength of barrel housing materials

Material	Tensile (ksi)	Shear (ksi)	Yield (ksi)
416 Stainless heat treated	114	68-80**	95
AG 40-A (Zinc 3)	41	31-38	Not used
ZA12	52	37*	38
ZA27	61	42*	52
SG 100A (die cast alum.)	46	26	24

* Strengths of die cast materials given are as die cast, except the shear strengths of ZA12 and ZA27 are as sand cast. The shear strengths as die cast for ZA12 and ZA27 are not available, but die cast strength is normally higher than sand cast strength.

** As for most steels, the shear strength is assumed to be in the vicinity of 0.6 to 0.7 of the tensile strength.

As can be seen from Table 1, the calculated shear stress of 7,084 psi at the top-to-shoulder joint of the ZA12 barrel housing is well within the shear estimated strength of 37,000 psi for ZA12. The calculated stress in the cylindrical portion of the ZA12 barrel housing is 39,303 psi, which is within the published tensile strength of 52,000 psi for ZA12.

Fabrication

A barrel housing blank was made as a die casting (see Appendix C). The two dowel pin holes and the four radial holes in the completed part are not in the die cast blank. The top surfaces, outside diameters, and slot for the setback pin are not to the final dimensions in the die cast blank. The die cast barrel housings were assembled in the timer assembly using the current production processes. The zinc die cast barrel housing will have a protective finish and salt spray requirment exactly the same as is specified on the SSD zinc die cast spacer. Both parts are chromated to Finish No. 6.1.2 of MIL-STD-171. Both parts are also in contact with similar metals, namely aluminum and stainless steel. No problems have ever surfaced to date with the SSD spacer, therefore, the finish requirement is satisfactory.

Static Tests

Preliminary static compression tests were performed on the current and various die cast barrel housings in a Tinius Olsen Electmatic Universal Testing Machine with a recorder and deflectometer. The load was applied on the top and shoulder of barrel housings independently, with a deflection rate of less than 0.100 inches per minute. The test setup is shown in Figures 3 and 4.

The tests were first done at room temperature on barrel housings made of aluminum SG100A, zinc alloy 3, ZA12, ZA27, and the current stainless steel material. Typical load versus deformation curves obtained from these tests are given in Figures 5 and 6. The compressive failure load of the barrel housings for all materials except the current stainless steel was obtained from these tests. These loads are given in Table 2. The current barrel housing did not fail when it was loaded on the shoulder with the maximum capability (12,000 lbs.) of the machine. This indicates that the current stainless steel barrel housing is over designed for the fuze application.

Table 2. Compressive failure load

		Current Housing	Die Cast Housing			
			SG 100-A	AG 40-A	ZA12	ZA27
Failure Load, Klbs	Top	11.5	4.0	3.7	4.7	5.2
	Shoulder	No failure	7.2	7.2	9.4	10.4

Additional static tests were performed on ZA12 barrel housings with the mainspring barrel installed in the barrel housing and the barrel housing in the sleeve. A compressive static load was applied on the shoulder of the barrel housing with the same test setup used for the previous tests. The load versus deformation curve, obtained from this test, and the curve from the previous test is shown in Figure 7. As shown in Figure 7, the assembled ZA12 barrel housing failed at 11,700 lbs. versus 9,400 lbs. in the unassembled condition.

A static test was then performed on the top of ZA12 barrel housings, which were conditioned to -40°F. The test was peformed with the same test setup as previously used. The load versus deformation curve, along with the curve from the room temperature tests, is shown in Figure 8. As expected, the cold samples exhibited higher strength but were brittle. The room temperature samples showed a high level of malleability during loading, but the cold samples showed reduced malleability.

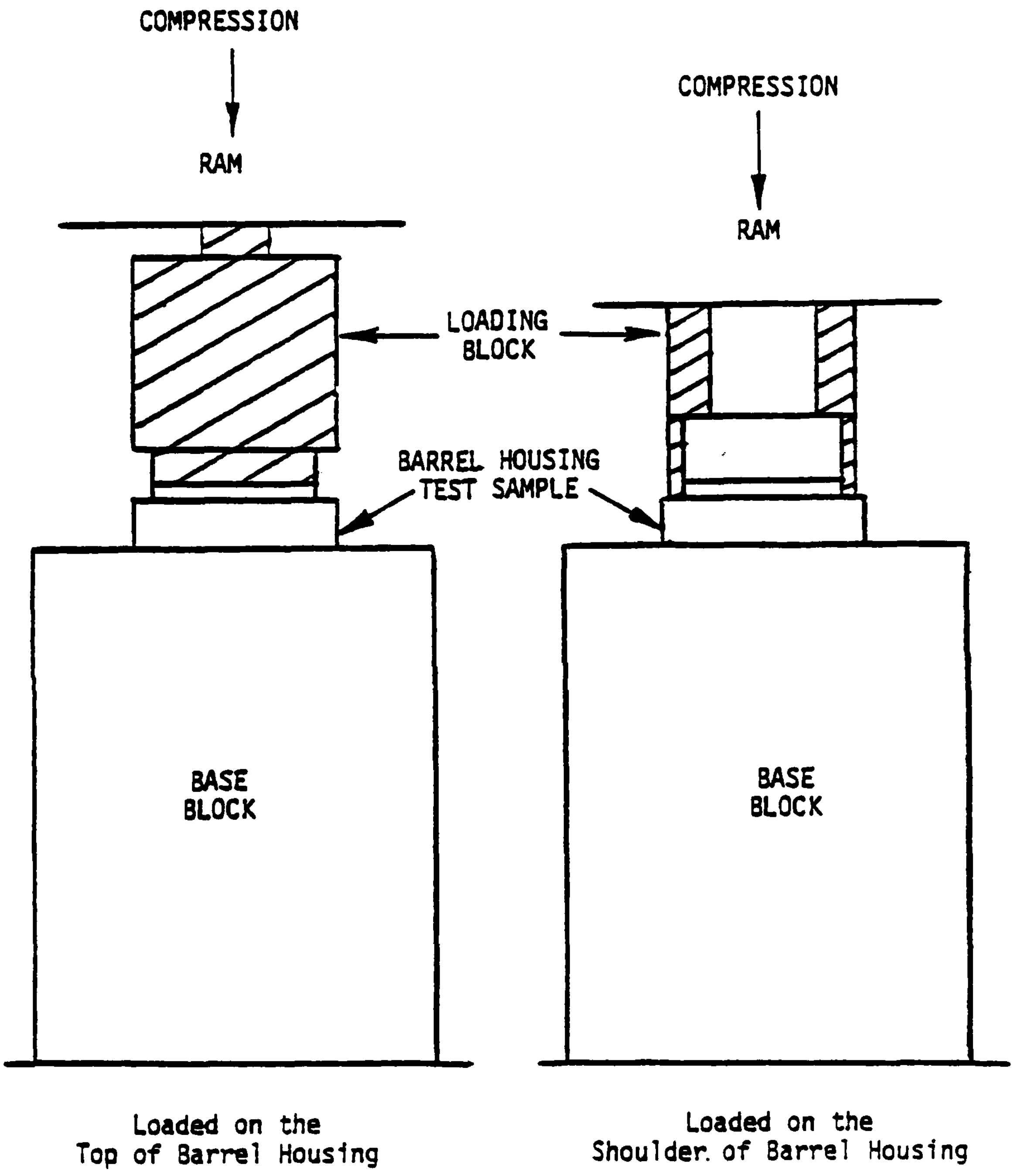
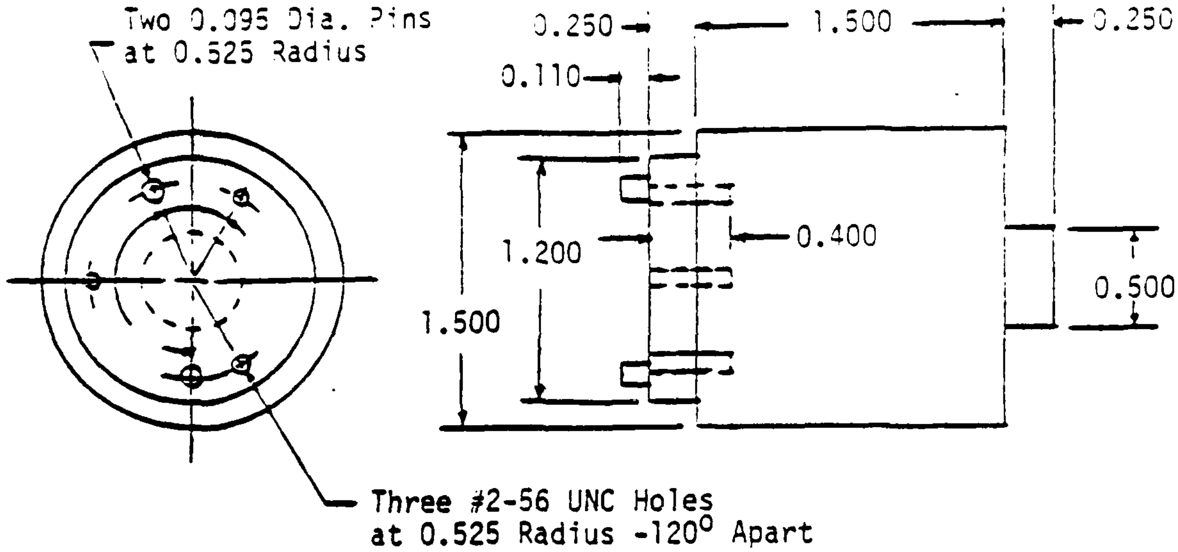
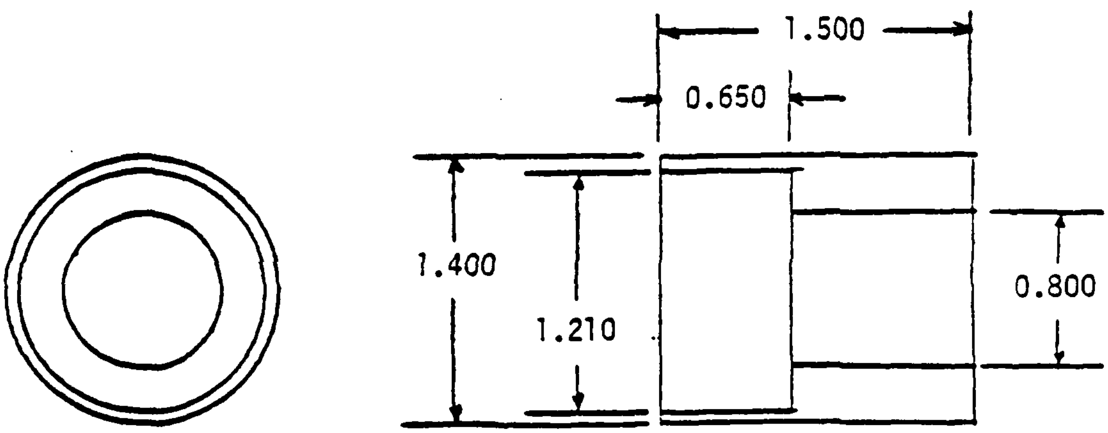


Figure 3 Static test fixture



Loading Block for Top of Barrel Housing



Loading Block for Shoulder of Barrel Housing

Figure 4 Static test loading blocks

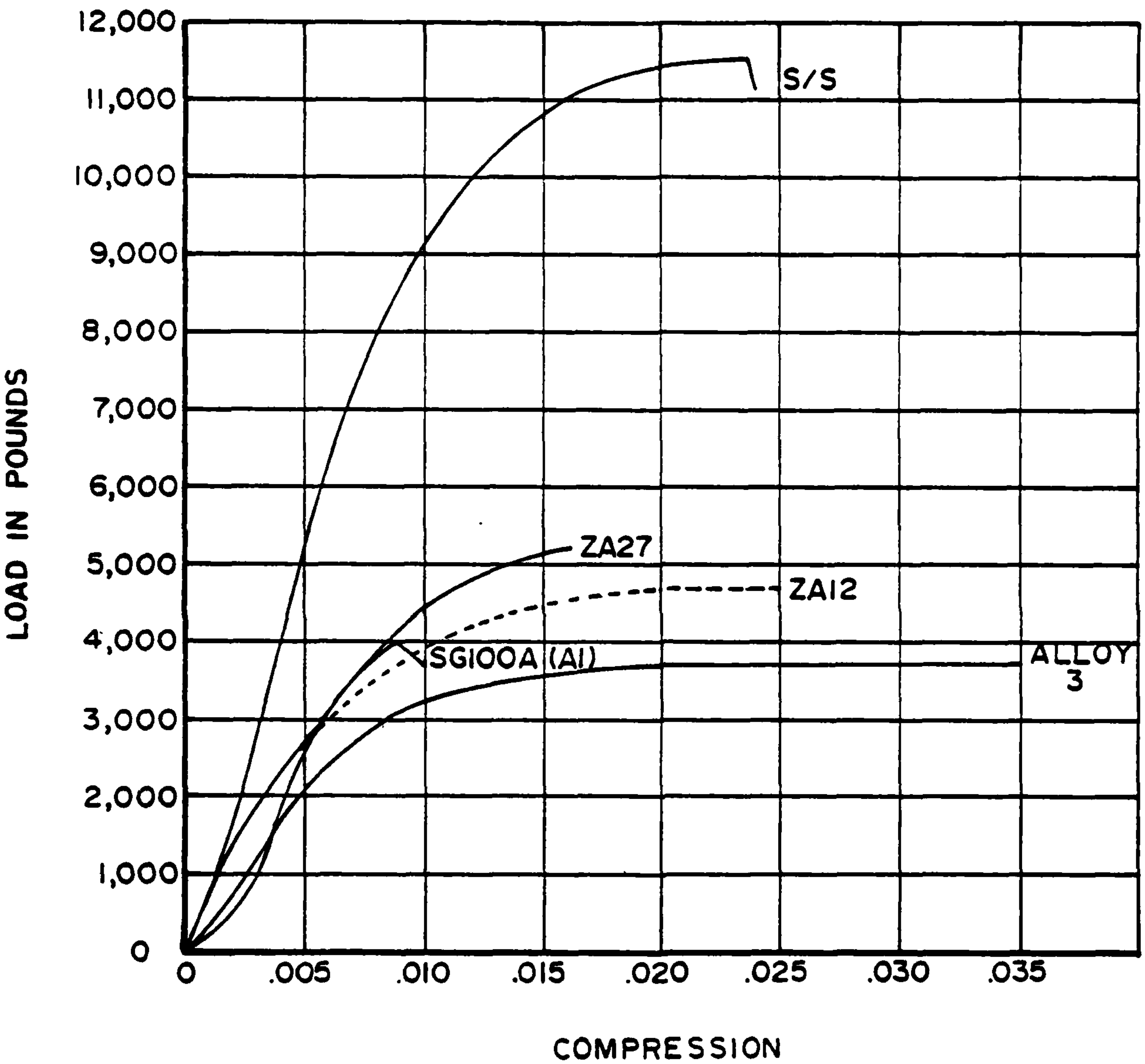


Figure 5. Static tests on top at room temperature

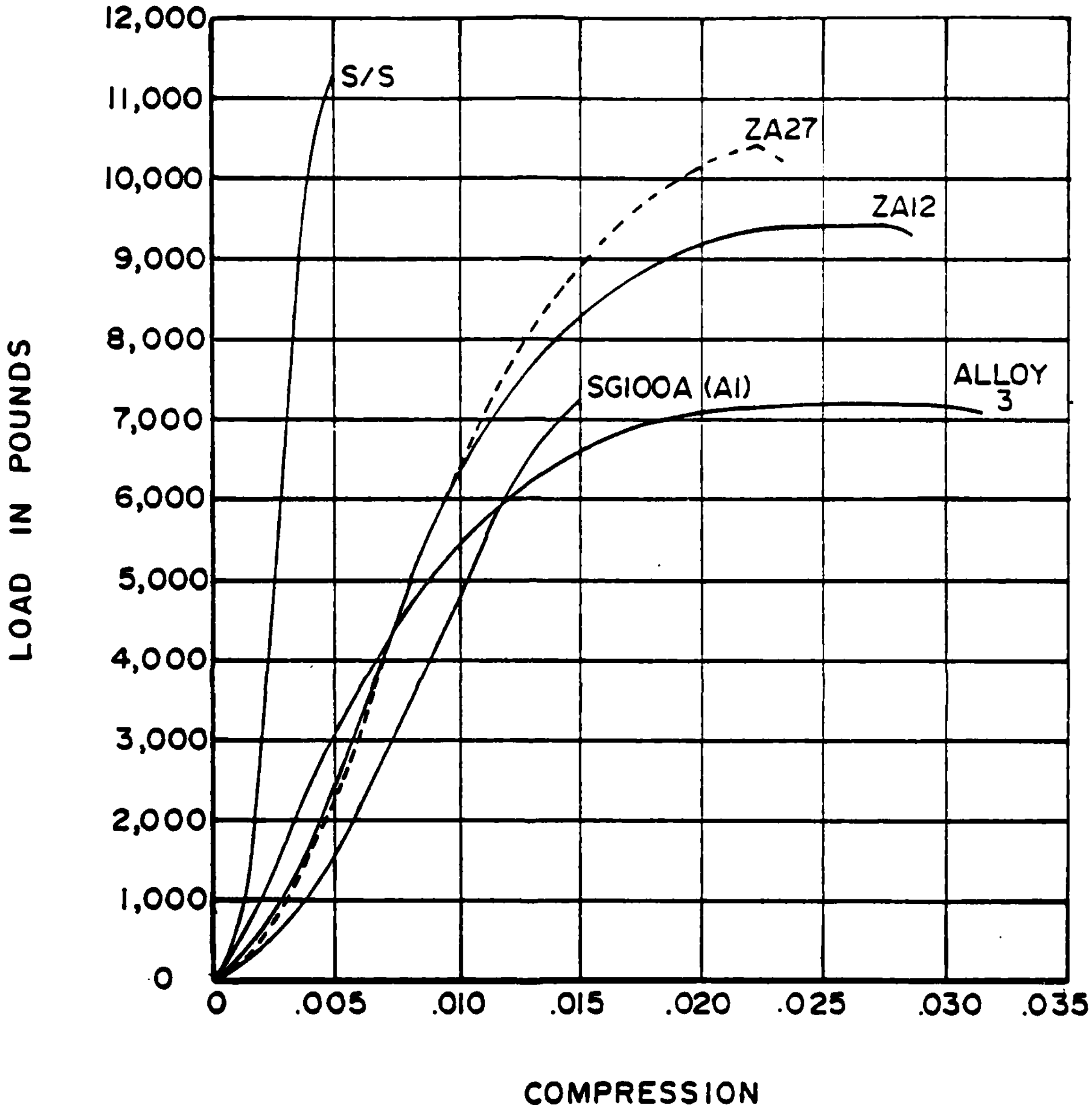


Figure 6. Static tests on shoulder at room temperature

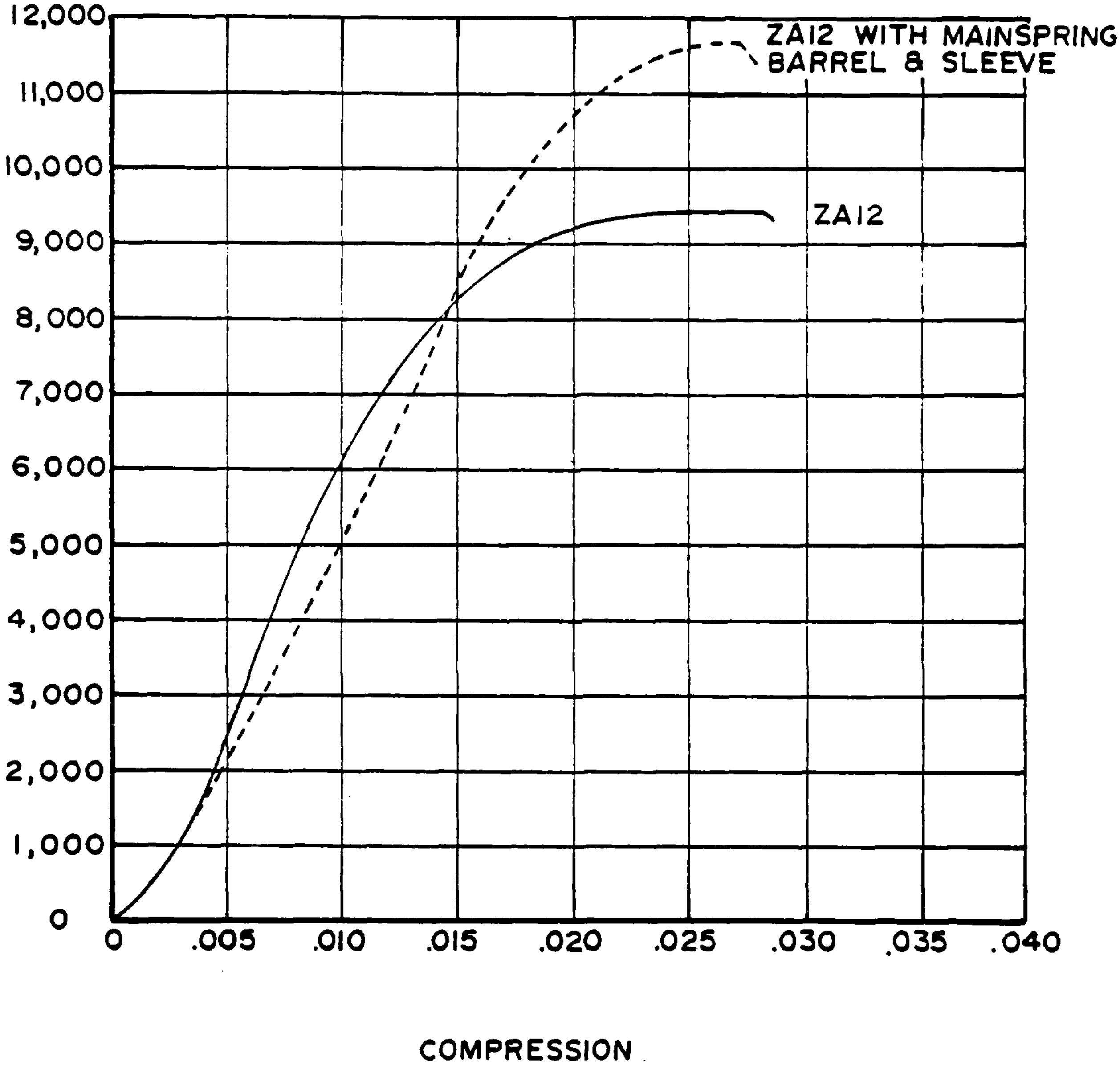


Figure 7. Static test on shoulder when assembled

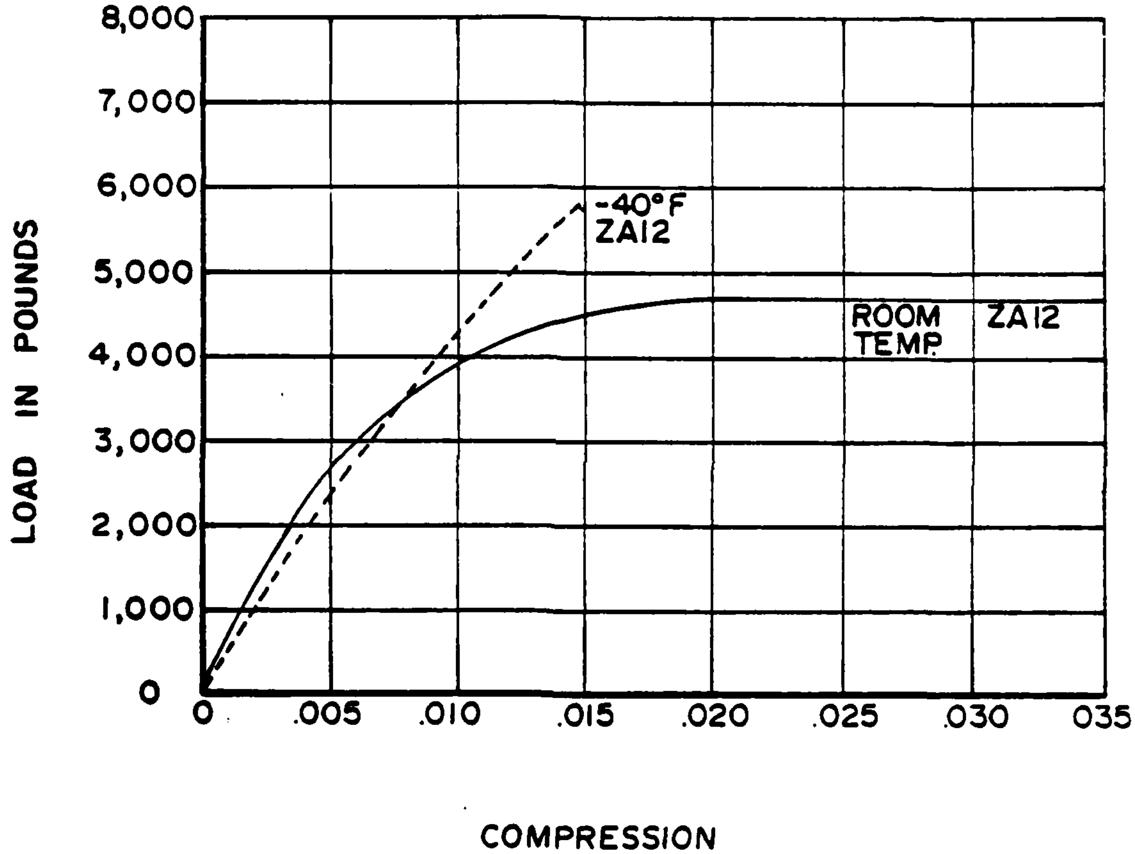


Figure 8. Static tests on top at cold temperature

These static test results on ZA12 barrel housings show the failure load of a ZA12 barrel housing is greater than the calculated compressive load during 30,000-g setback. Table 3 shows a comparison of failure load with calculated load during 30,000-g setback for a ZA12 barrel housing (see Appendix A).

Table 3. ZA12 Barrel Housing strength comparison

	Load Applied To:			
	Top Room Temp.	Top -40°F.	Shoulder Room Temp.	Shoulder Room Temp in Sleeve
Failure Load (Klb)	4.7	5.8	9.4	11.7
Calculated Load at 30,000-g setback (Klb)	2.2	2.2	6.7	6.7

As can be seen from the data, the safety factor for the load applied at the top is over two. Since the barrel housing does not assume all the load of the timer, a more realistic test for loading the shoulder of the barrel housing is to assembly it with the mainspring barrel and the sleeve. Under these conditions, a safety factor of approximately 1.8 exists when a load equivalent to 30,000 g's is applied on the shoulder.

TESTING

Air-gun Test

Twenty fuzes with ZA12 die cast barrel housings were air-gun tested at 27,650 to 36,540 g's. Twelve units were tested in a cold environment, and eight units were tested at ambient temperature. There was no visual damage to any of the barrel housings in a functional area, including the sixteen units tested in excess of 30,000 g's. The barrel housing in unit 34 had a hairline fracture from the mainspring barrel staking notch to the radial hole above it, which is a non-functional area. The timers were functionally tested after the air-gun test. All timers that did not run after the air-gun test were analyzed, and in each case the failure was found to be unrelated to the barrel housing (see Table 4). Data for the air-gun test are shown in Table 4.

Table 4. Air-gun test data

Unit	Setback (g)	Temperature (F$^{\circ}$)	Observation
15	32,130	-40°	Timer ran after test.
16	34,450	-40°	"
17	34,450	70°	"
18	35,350	-40°	Timer did not run after test; after #1 Pinion replaced, timer ran.
19	35,208	-40°	Timer ran after test.
20	35,910	-40°	"
21	35,150	70°	"
22	34,450	70°	"
23	34,310	70°	Timer did not run after test; #1 Plate (Zinc Alloy 3) failure.*
24	33,480	70°	Timer did not run after test; after lever replaced Timer ran.
25	35,210	70°	Timer ran after test.
26	35,350	70°	"
27	34,230	70°	"
28	32,500	-40°	"
29	36,540	-40°	"
30	35,980	-40°	"
31	27,650	-40°	"
32	27,790	-40°	Timer did not run after test; #1 Plate (Zinc Alloy 3) failure.*
33	28,900	-40°	"
34	28,370	-40°	" Hairline fracture in Barrel Housing in non-functional area.

* Zinc alloy #1 Plates were prototypes; this material was changed to aluminum.

Jolt & Jumble Test

Twelve fuzes with zinc alloy 3 die cast barrel housings were built and tested per MIL-STD-331, Tests 102.1 and 101.2. Units were examined and found to be safe to handle and dispose of after testing. Since the MIL-STD test were met with the weaker alloy, no further testing was conducted with the stronger alloy, ZA12

Sequential Rough Handling Test

Thirty-two fuzes with zinc alloy 3 die cast barrel housings were built for the Sequential Rough Handling test. A flow chart of the test is shown in Figure 9 All units were inspected according to the flow chart and then subjected to ballistic testing. The sequential rough handling tests require 7 ft. packaged and 5 ft. unpackaged drops at -50°F and +145°F. They then must be safe to handle and able to be fired. Since no problems occurred in safety or ballistics, the zinc die cast barrel housing was of sufficient strength to survive this environment.

Ballistic Recovery Tests Using Zinc Alloy 3 Die Cast Barrel Housings

Twenty inert fuzes, containing Zinc Alloy 3 die cast barrel housings, were shipped to Yuma Proving Grounds and tested in 155mm recovery vehicles conditioned to -50°F. The recovery vehicles were fired using the 155mm, 198 System weapon with a Zone 8 charge. The recovery vehicles fell apart in flight; therefore, the test results of these units were not valid. Two of seven internal fuzes recovered functioned, and two of the two nose fuzes recovered functioned. There was no visible damage to the barrel housings.

Recovery testing was redone with 105mm recovery vehicles because of the failure of the 155mm recovery vehicles. Ten inert fuzes were tested in 105mm, M103 Tube, Zone 7, -35°F, 50 seconds at Yuma Proving Grounds. Eight of the ten units functioned properly. In one of the malfunction fuzes, the release lever in the trigger assembly did not release, thus preventing the SSD from arming. In the other one, the timer ran for only five seconds. After removing the timer from the fuze, the timer ran about forty seconds before stopping. After disassembling the timer, it was observed the barrel housing was broken. It was not clear whether the breakage occurred during setback or impact, but based on past experience, steel barrel housings are also found broken when hardware is recovered. This is assumed to be from impact.

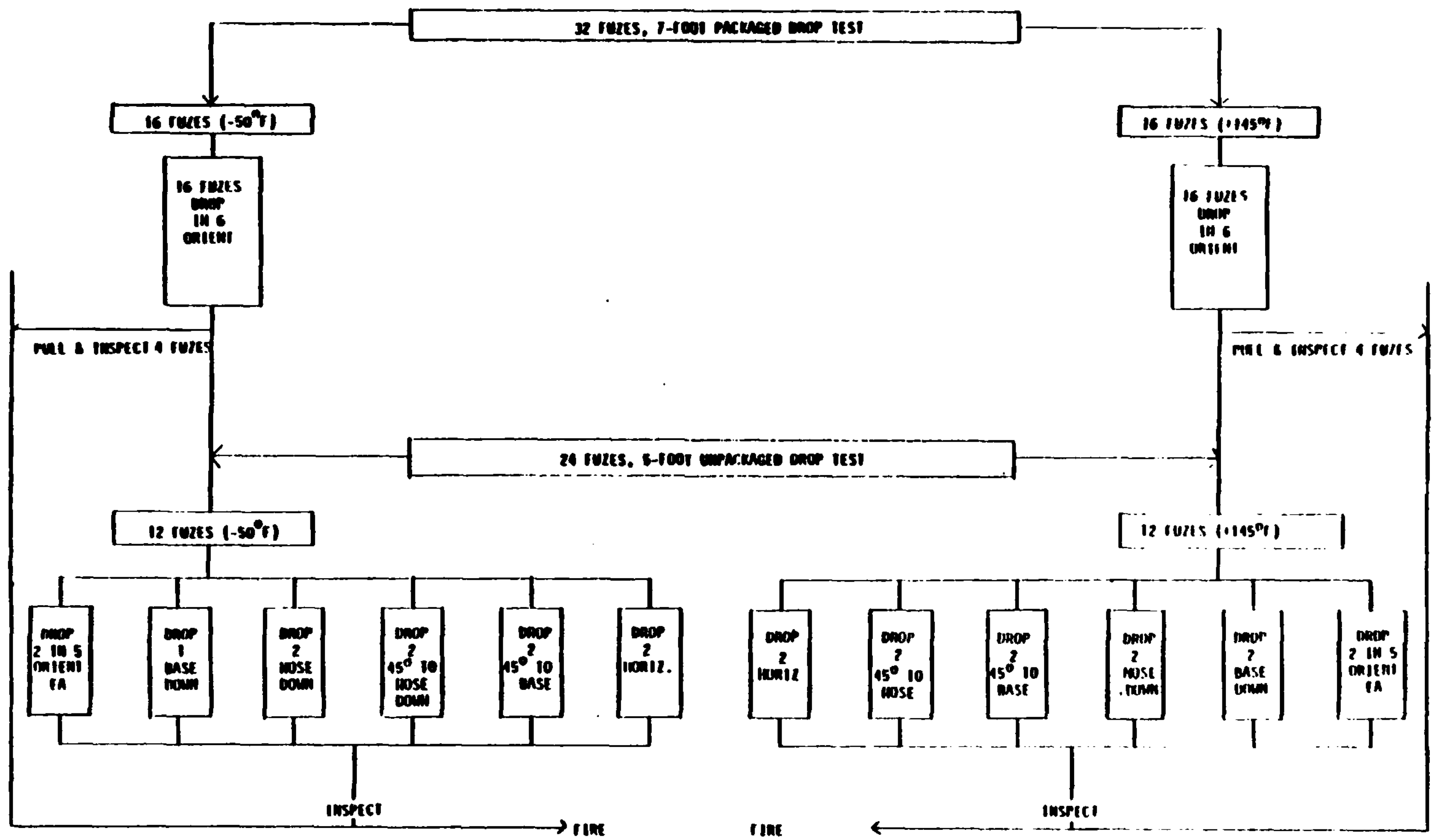


Figure 9 Sequential rough handling test flow chart

Ballistic Tests Using Zinc Alloy 3

Ninety-seven fuzes, containing zinc alloy 3 die cast barrel housings and fifteen control units were shipped to Yuma Proving Grounds and ballistically tested. Thirty-two of these fuzes had been subjected to the Sequential Rough Handling Test. Because of the use of a zinc die casting, all but the Sequential Rough Handling Test units were tested at -40°F. Table 5 shows a summary of the results.

Ballistic Recovery Tests Using ZA12

Ten inert fuzes built with ZA12 die cast were tested in 105mm recovery vehicles at Yuma Proving Grounds. The recovery vehicles were fired using the 105mm, M103 Tube weapon, Zone 7, -35°F, 50 seconds. Nine of the ten units functioned properly. The timer did not run in the tenth unit, but the barrel housing had no damage. Five of the ten barrel housings were cracked or broken at the screw holes after the test; however, all of these units functioned properly.

Because the fuzes with ZA12 die cast barrel housings did not crack in air-gun testing at much higher setbacks than are seen in the 105mm weapon, it was suspected the barrel housings were cracking on impact rather than setback. Therefore, ten barrel housings that had been subjected to air-gun testing were reassembled into inert fuzes for testing in 105mm recovery vehicles. All units functioned properly; however, six units had cracks or breaks on the top of the barrel housing in the area of the screw holes.

Ten inert fuzes containing ZA12 die cast barrel housings were built to be tested at Yuma Proving Grounds in 105mm vertical recovery. All units functioned properly, and no cracks in the barrel housings were observed. In vertical recovery, the projectiles land on the ground base down so the forces on the fuze from impact are in the same direction as the forces from setback.

These test results indicate the barrel housings are cracking from impact rather than setback. Test data for ZA12 barrel housing recovery testing are shown in Table 6.

Table 5. Ballistic results with zinc alloy 3 barrel housings

TPR 2594 SUPPLEMENTS 6 & 7

LOT # HAT81K000E054 TEST UNITS

GUN	ZONE	ENV	TIME (SEC.)	FUNCTION	MEAN	STD. DEV.
105mm, M103	7	70°, Seq. Rough Handling	50	30/32	50.104	.154

LOT # HAT81K000E062 TEST UNITS

GUN	ZONE	ENV(F)	TIME (SEC.)	FUNCTION	MEAN	STD. DEV.
155mm, M199E9	8(203 Charge)	-40°	105	18/20	105.278	.544
105mm, M103	7	-40°	50	12/15	49.972	.139
8", M2A2	1	-40°	25	15/15	24.896	.085
105mm, M205	8	-40°	75	1/8	74.361	0

LOT # HAT81H000E068

GUN	ZONE	ENV(F)	TIME (SEC.)	FUNCTION
105mm, M205	8	-40°	75	0/8

Table 6. ZA12 Recovery test data

GUN	ZONE	ENV.	TIME (SEC.)	FUNCTION
105mm, M103 (Recovery Vehicles)	7	-35°F	50	9/10
105mm, M103 (Recovery Vehicles)	7	-50°F	30	10/10*
105mm, M103 (Verticle Recovery)	7	-50°F	3	10/10

*Barrel Housings were previously used in air-gun test.

Ballistic Tests Using ZA12 Die Cast Barrel Housings

Sixty (60) fuzes containing ZA12 die cast barrel housings, and sixty (60) control fuzes were built for ballistic testing at Yuma Proving Grounds. All units were tested at -40°F with 100% reliability in both groups and tighter standard deviations in the test fuzes. Table 7 shows a summary of the results.

Table 7. Ballistic results with ZA12 barrel housings

TPR #2594, SUPPLEMENT #25

LOT # HAT82C000E085 TEST UNITS

GUN	ZONE	ENV(F)	TIME (SEC.)	FUNCTION	MEAN	STD. DEV.
8", M201	9	-40°	100	20/20	100.032*	.172
105mm, M103	7	-40°	50	20/20	49.978	.119
155mm, M199E9	8 (203 Charge)	-40°	105	20/20	104.894*	.426

LOT # HAT82C000E084 CONTROL UNITS

GUN	ZONE	ENV(F)	TIME (SEC.)	FUNCTION	MEAN	STD. DEV.
8", M201	9	-40°	100	20/20	99.963*	.194
105mm, M103	7	-40°	50	20/20	50.066	.148
155mm, M199E9	8(203 Charge)	-40°	105	20/20	105.217	.544

* Outlier excluded

COST & WEIGHT

Cost Comparison

A cost comparison of the current barrel housing and the proposed barrel housing is shown in Table 8. The cost of the proposed design is based on the lowest price obtained for a quantity of 300,000. These costs do not include tooling, general and administrative expenses, or profit. The projected cost of the tooling for the proposed design is $25,600. The projected cost savings for the die cast barrel housing design is $.7954 per fuze.

Table 8. Cost comparison

	Present Design ($)	Proposed Design ($)	Savings ($)
Make	1.4379	.715	.7229
Inspect	.0875	.015	.0725
Total	1.5254	.730	.7954

After the PIP program was completed and the design was incorporated into the Technical Data Package, the following changes occurred:

1) the vendor increased the price of the ZA12 barrel housing by $.33;

2) the stainless steel barrel housing blank cost decreased by $.22;

3) the cost to finish the stainless steel barrel housing blank significantly decreased.

With these changes the cost savings, based on 170,000 units, was estimated to be $.121 per fuze.

Weight

Replacing the current barrel housing with a ZA12 barrel housing decreases the weight of the fuze by .015 pounds. This is an insignificant change in weight.

CONCLUSIONS AND RECOMMENDATIONS

Several aluminum and zinc-aluminum die cast alloys were investigated for the barrel housing application. The use of die cast aluminum was eliminated from further consideration because the resulting weight change was not acceptable. Die cast barrel housings, utilizing zinc- aluminum alloys (3 and 12), were rigorously tested in the laboratory and ballistically. Although ZA3 testing was somewhat successful, it was decided to use ZA12 because it is a stronger material with increased safety factors.

All requirements, including air-gun and all standard ballistic tests, were completed successfully on fuzes built with ZA12 barrel housings. It is recommended that a ZA12 die cast barrel housing be incorporated into the M577 MTSQ Technical Data Package. Implementation of this new design provides a projected cost saving of $.795 per fuze, without general and administrative expenses, profit, and tooling.

APPENDIX A

CALCULATIONS OF LOADS ON BARREL HOUSING

There are two loaded areas on the barrel housing during setback. One is the top of the Barrel Housing, and the other is the shoulder of the barrel housing, as shown in Figure 10. Table 9 shows the weights needed to calculate the loads in the two areas.

The top of the barrel housing is loaded by the acceleration of the timer assembly less the timing scroll assembly, tumblers, spring washer, setback parts and cylindrical portion of the barrel housing.

The compressive load applied during setback is

$$P_t = Wg,$$

where

$$W = \text{weight in lbs.}$$
$$g = \text{acceleration in g's.}$$

The compressive load applied to the top of the present barrel housing during 30,000g setback is

$$\begin{aligned} P_t &= (.0769)(30{,}000) \\ &= 2{,}307 \text{ lbs.} \end{aligned}$$

The corresponding compressive load on the ZA12 barrel housing is

$$\begin{aligned} P_t &= (.0736)(30{,}000) \\ &= 2{,}207 \text{ lbs.} \end{aligned}$$

The shoulder of the barrel housing will be loaded during setback by the cylindrical portion setting mechanism and tumblers. The compressive load applied to the shoulder of the present barrel housing during 30,000g setback is

$$\begin{aligned} P_s &= (.2338)(30{,}000) \\ &= 7{,}014 \text{ lbs.} \end{aligned}$$

The corresponding compressive load on the ZA12 barrel housing is

$$\begin{aligned} P_s &= (.2238)(30{,}000) \\ &= 6{,}714 \text{ lbs.} \end{aligned}$$

The load on the cylindrical portion of the barrel housing is the combined load of P_t and P_s. This combined load is used in the comparison of the failure load to the load during 30,000g setback.

Figure 10. Two areas subjected to the 30,000 g load

Table 9. Weight of various assemblies used in load calculations

Assembly	Part No.	Weight (lbs.)
S/S Barrel Housing	9236688	0.0600
Center Portion		0.0150
Cylindrical Portion		0.0450
ZA12 Barrel Housing	SK5996	0.0467
Center Portion		0.0117
Cylindrical Portion		0.0350
Timer Assembly	9236634	0.2374
Timer Assembly with ZA12 Barrel Housing		0.2241
Timing Scroll Assembly	9236690	0.0859
Tumblers & Setback Parts	Note 1	0.0296
Setting Mechanism	Note 2	0.0244
Counter Assembly	9236573	0.0453
Timer Housing Assembly	9236588	0.0848
Retaining Parts	Note 3	0.0047

Notes:

1. Tumblers and setback parts include internal tab tumbler (9236682), four tumblers (one 9236683-1 and three 9236683-2), tumbler keeper (9236684), spring washer (9236707), setback pin (9236703), setback spring (9236705) and expansion plug (9236687).

2. Setting mechanism includes setting key ring (9236515), setting key (9236517), crush element (9236518), crush retainer (9236519), clutch drive sleeve (9236520), nine clutch grip rings (9236570), three clutch spacers (9236571), set clutch washer (9236551) and spacer (9236566).

3. Retaining parts include timer housing retaining ring (9236587), counter housing skirt (9236586) and spacer (9236596).

APPENDIX B

STRESS CALCULATIONS

The stress is calculated below in the two areas of concern for the ZA12 barrel housing (see Figure 11). In both cases, the calculations do not include the stress concentration caused by the cutout areas. The stress can be calculated using the formula (Mark's Handbook, p. 495)

$$\sigma = P/A + MC/I,$$

where

σ = stress in psi
P = applied load in lbs.
A = cross-sectional area in square inches
bending moment in inch-lbs.
I/C = section modulus.

Using the above formula, the shear stress (σ_s) in the top to shoulder joint during 30,000g setback is

$$\begin{aligned}\sigma_s &= P/A + MC/I \\ &= P_t/(\pi D_o t) + (P_t D_o/2)(t/2)/(\pi (D_o^4 - D_i^4)/64) \\ &= (2207)/(\pi (1.199)(.095) + (2207(1.199)/2)(.095/2)/ \\ &\quad (\pi (1.199^4 - .905^4)/64) \\ &= 7{,}084 \text{ psi}\end{aligned}$$

The compressive stress, σ_c, in the cylindrical portion of the barrel housing is induced by the sum of the load on the top and shoulder of the barrel housing.

Since there is no bending moment in this case, the stress is

$$\begin{aligned}\sigma_c &= P/A \\ &= (P_t + P_s)/(\pi (D_2^2 - D_1^2)/4) \\ &= (2207 + 6714)/(\pi (1.495^2 - 1.395^2)/4) \\ &= 39{,}303 \text{ psi}\end{aligned}$$

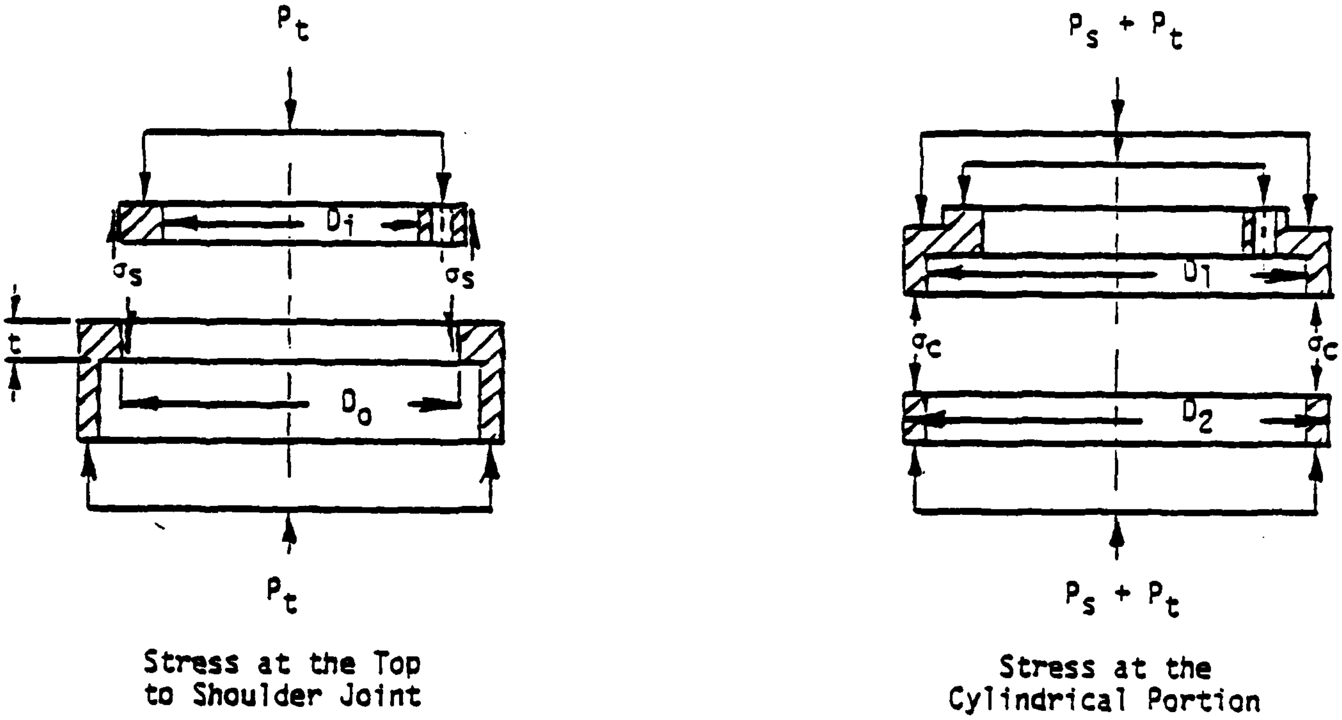
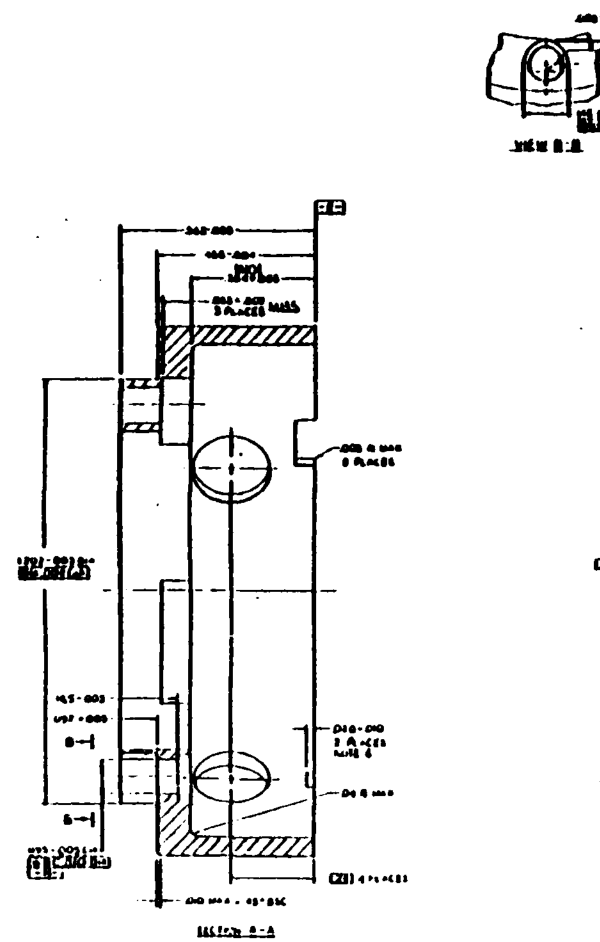
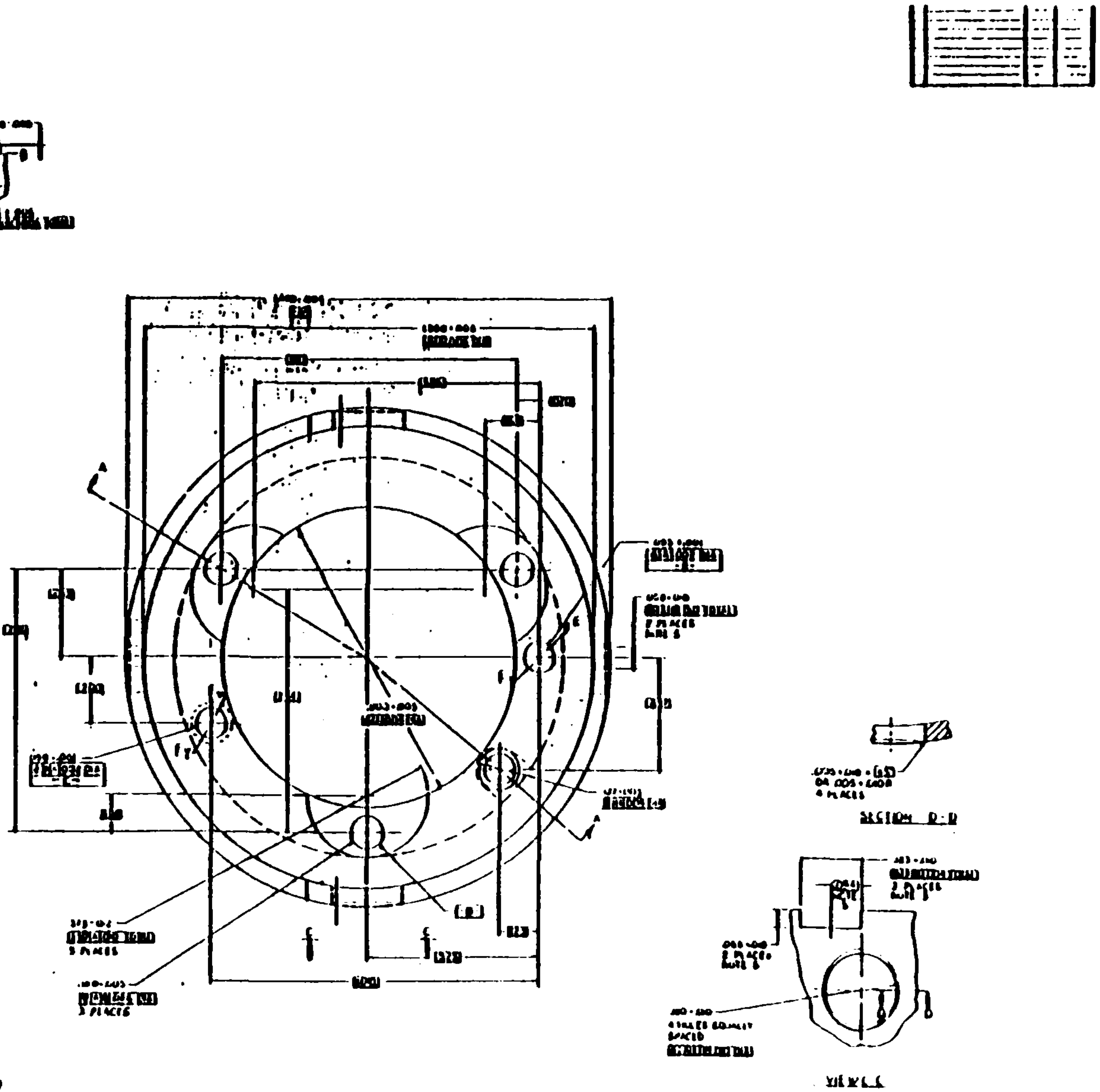


Figure 11   Stress areas of barrel housing

APPENDIX C

DRAWINGS





NOTES:-

1- SEE MR-A-2550 APPLIES

(B) 2 MATERIAL - ZINC ALLOYS IN INGOT FORM FOR FOUNDRY CASTINGS, ASTM B669-80 .

3- UNLESS OTHERWISE SPECIFIED, FILLETS ARE TO BE .005R MAX AND CORNERS ARE TO BE .005 R MAX OR .005 MAX × [45°].

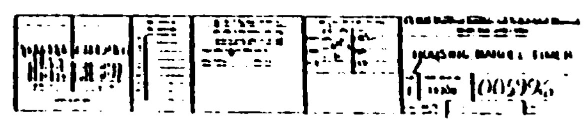
4- 125/ ALL OVER.

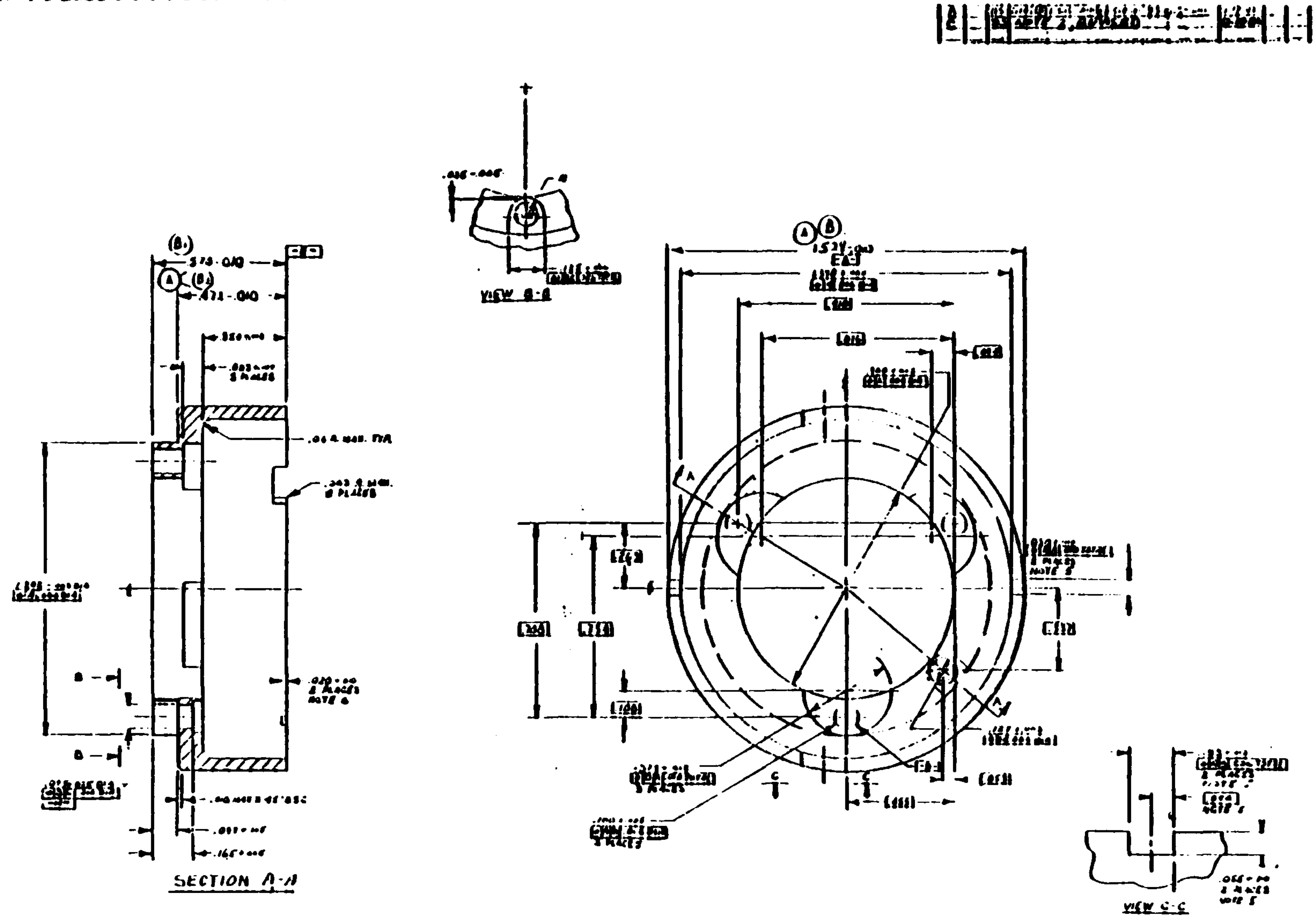
5- KEY AUTOMATIC ASSEMBLY DIMENSIONS.

6- .050±.010 × .020±.010 DEEP NOTCHES ARE OPTIONAL.

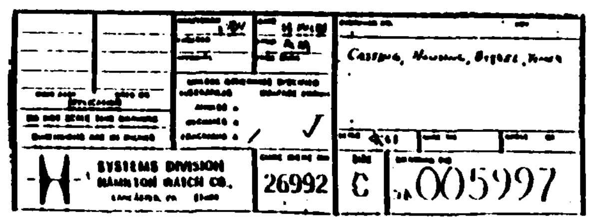
7- ALL DIMENSIONS GIVEN ARE TO INCLUDE TAPER & TOLERANCE.

8- PROTECTIVE FINISH: - FINISH 6.1.2 OF MIL-STD -171, EXCEPT PART SHALL BE EXPOSED TO A SALT SPRAY FOR A MINIMUM OF 24 HOURS IN LIEU OF 96 HOURS PER PARA 4.4.3 OF MIL-T-12879.





HOTES :-|
1 - SPEC MIL-A-2550 APPLIES.
©2 - MATERIAL : - ZINC ALLOYS IN INGOT FORM FOR FOUNDRY CASTINGS, ASTM B669-80.
3 - UNLESS OTHERWISE SPECIFIED, FILLETS ARE TO BE .008 R. MAX AND CORNERS ARE TO BE .005 R. MAX. OR .005 MAX. X 45°.
4 - 125/ ALL OVER.
5 - KEY AUTOMATIC ASSEMBLY DIMENSIONS.
6 - .058 +.010 X .020 +.010 DEEP NOTCHES ARE OPTIONAL.
7 - ALL DIMENSIONS GIVEN ARE TO INCLUDE TAPER & TOLERANCE.



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