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NSWC/DL TECHNICAL REPORT TR-3141

October 1974

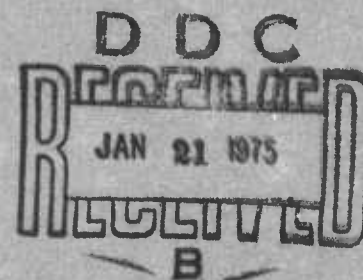
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TEMPERATURE AND PRESSURE PROFILES OBTAINED DURING BURN OF A SPARROW MARK 38 MOD 0 OR MOD 1 MOTOR IN A 15,300 CUBIC-FOOT MAGAZINE, PART II

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NSWC/DL Technical Report No. TR-3141
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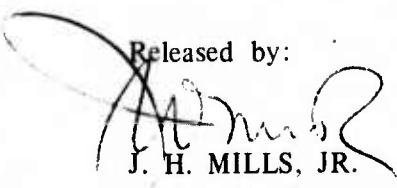
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FOREWORD

The missile motor ignition tests reported herein were conducted in response to NAVSHIP Project S4643, Task 15925. This task requested that the Naval Weapons Laboratory (NWL), Dahlgren, Virginia review the need for a wet sprinkler system as opposed to a dry sprinkler system for missile and rocket motor stowage magazines aboard various classes of ships in view of current missile stowage and handling procedures. These tests are the last two of a series of seven magazine tests conducted at NWL. NSWC/DL Technical Report TR-3139 reported the first two, and NSWC/DL TR-3140 reported Tests Nos. 3 through 5 of the seven tests.

Data from these tests were evaluated to determine the effects of ignition of SIDEWINDER MK 17 MOD 5 and SPARROW MK 38 MOD 0 or MOD 1 motors in a large volume magazine. Conclusions based on the evaluation of these tests are discussed.

Released by:



J. H. MILLS, JR.

Engineering Department

ABSTRACT

SPARROW MK 38 MOD 0 or MOD 1 motors were ignited in two tests in an instrumented 15,300 cubic-foot magazine under conditions simulating accidental ignition of these motors in shipboard service using the wet or dry sprinkler system as the damage control mechanism. The results provided a detailed temperature and pressure profile in the magazine; and thermal characteristics for bare, inert, instrumented ZUNI motors, bare, inert, instrumented, all-up configuration of SIDEWINDER and ZUNI missiles, and inert, instrumented, containerized, all-up SIDEWINDER and ZUNI missiles located in the magazine.

Temperatures and pressures within the magazine reached a peak of 1185°F and 19.3 psig. External and internal temperatures for the instrumented, inert ordnance peaked at 1200°F and 455°F, respectively. Data from these tests will assist in evaluating the relative effectiveness of the wet vs. dry sprinkler system in preventing chain reaction of ordnance in deep stowage magazines during motor burn, and in evaluating thermal systems designed for explosive ordnance.

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I. INTRODUCTION

The Navy's Improved Rearming Rates Program/Assembled Air Launched Weapons (IRRP/AALW) concept has resulted in major changes to the logistic flow of weapons systems. This concept provides for missiles to be brought aboard and stowed in aircraft carrier deep stowage magazines in their respective containers. A detailed description of the IRRP/AALW concept is presented in Reference (1).

Because the containers used with the IRRP/AALW concept may delay AALW systems cook-off in deep stowage magazines, Reference (2) assigned NWL the task of obtaining data during a motor burning in a magazine to ascertain if the containers delay cook-off of AALW systems. Under this task, a series of seven tests were conducted at NWL in an instrumented magazine which simulated a CVA deep stowage magazine. These tests were conducted to:

- (1) Provide thermal information to determine the cook-off parameters of AALW systems;
- (2) Reevaluate the need for a wet (as opposed to the lighter-weight, less expensive, less complicated dry) sprinkler system in a deep stowage missile magazine;
- (3) Assist in the design of more effective damage control equipment; and
- (4) Provide thermal information to assist in evaluation of thermal protection systems designed for explosive ordnance.

In past magazine missile motor tests, insufficient data were documented and therefore could not be referenced when needed at a later date. It is the intent of this report to document the vast amount of data obtained during Tests Nos. 6 and 7 of this series.

In the first two tests, SIDEWINDER MK 17 MOD 5 motors, secured on a static thrust stand, were fired to obtain detailed temperature and pressure profiles of the simulated magazine, plus the thermal characteristics of inert, instrumented ZUNI motors located in this magazine. These data are reported in NSWC/DL Technical Report TR-3139 and were used to:

- (1) Determine the size of the active motor to be used in subsequent tests; and
- (2) Determine the optimum location of inert, instrumented, bare, and containerized AALW systems in the magazine for subsequent tests.

In tests Nos. 3 through 5, SPARROW MK 38 MOD 0 or MOD 1 motors, secured on a static thrust stand, were fired to obtain detailed temperature and pressure profiles of the simulated magazine, plus the thermal characteristics of bare, inert, instrumented ZUNI motors, bare, inert, instrumented, all-up configuration of SIDEWINDER and ZUNI missiles, and inert, instrumented, containerized, all-up SIDEWINDER and ZUNI missiles located in the magazine. A wet or dry sprinkler system was used as the damage control mechanism during each test. These data are reported in DL TR-3140 and were used to determine the effects of:

- (1) Using a super-fast¹ activated sprinkler system;
- (2) Rupture of a burning missile motor followed by deflagration; and
- (3) Massive venting of the magazine.

In tests Nos. 6 and 7, SPARROW MK 38 MOD 0 or MOD 1 motors, secured on a static thrust stand, were fired to obtain detailed temperature and pressure profiles of the simulated magazine, plus the thermal characteristics of bare, inert, instrumented ZUNI motors, bare, inert, instrumented, all-up configuration of SIDEWINDER and ZUNI missiles, and inert, instrumented, containerized, all-up SIDEWINDER and ZUNI missiles located in the magazine. A wet or dry sprinkler system was used as the damage control mechanism during each test. These data were used to determine the effects of:

- (1) Using the wet sprinkler system; and
- (2) Using the dry sprinkler system.

A fourth technical report will include an analysis of the collated data obtained during the overall test program with respect to the need for a wet-type sprinkler system in the IRRP/AALW magazine.

¹ Activated before motor burn.

II. APPROACH

Because of the high cost of hardware, materials, labor, etc., necessary to conduct magazine tests, a preliminary study was made prior to conducting any tests to:

1. Determine if some of the tests could be combined or eliminated to reduce cost and save materials; and
2. Insure that test sequence, instrumentation, and use of correct explosive ordnance would provide the necessary data. The test plan resulting from this study was reported by Reference (3), and served as the basis for the two tests covered in this report.

III. TEST PROCEDURES

A. Test No. 6

1. Motor: SPARROW MK 38 MOD 1

a. In Test No. 6, a SPARROW MK 38 MOD 1 motor was electrically ignited using the igniter installed in the motor. This test was conducted on 14 November 1973. Ambient temperature was 59°F. Prior to firing the motor, it was X-rayed to insure that no cracks or other irregularities were present that would preclude normal motor burn. The motor was provided with a pressure tap so that chamber pressure could be measured during burning.

2. Magazine Configuration

a. An NWL missile magazine was modified to simulate a large CVA-type magazine (of the AALW concept). The magazine had a volume of 15,300 cubic feet.

b. The static thrust stand was secured on the center line of the test magazine.

c. The magazine was equipped with a blow-out patch set to release at 20 psig. The magazine's access door assembly was reinforced to withstand an internal magazine pressure of 40 psig. A 20-inch X 20-inch baffle was mounted in front of the blow-out patch to prevent the dynamic pressure of the burning active motor exhaust stream from impinging on the vent.

d. The wet sprinkler system was used as the damage control mechanism. It was programmed to open the hydraulic control valve at 0.5 second after the firing pulse was applied to the active motor.

e. Four instrumented, inert ZUNI motors loaded with Filler E were located in a magazine as shown in Figure 1 of Appendix A. Temperature data similar to that resulting from short-term impingement simulating a ballistic (fly-away) rocket in the magazine was to be obtained from this configuration.

f. The location of the bare, inert, instrumented ZUNI motors, bare, inert, instrumented, all-up configuration of SIDEWINDER and ZUNI missiles, and inert, instrumented, containerized, all-up SIDEWINDER and ZUNI missiles are shown in Figures 1 and 2 of Appendix D. The location of the latter missiles was determined from an analysis made of the magazine temperature and pressure profile data reported in DL TR 3139.

3. Instrumentation

a. Fifty-two Chromel-Alumel thermocouples (illustrated in Figure 2 of Appendix A) and four strain-gage type pressure transducers were located at selected points (as shown in Figure 3 of Appendix A) in the magazine to measure free air temperature and pressure in the magazine. A detailed sketch (Figure 4 of Appendix A) shows the thermocouple installation array for the test. All exterior mounted ordnance thermocouples (shown in Figure 5 of Appendix A) were peened to the surface of the item. The external thermocouples on the LAU 10A launcher and MK 14 MOD 0 SIDEWINDER cradle were pressed against the surface and held in place with tape. All interior mounted thermocouples were mechanically pressed to bear on the inner surface wall of the ordnance items before loading the test specimen with Filler E.

b. Chamber pressure was measured on the active motor during motor burn.

c. A break wire was installed on the blow-out patch to determine time of release if it should occur.

d. Close of firing key (CFK) and 10 KC timing was provided for time correlation.

e. Photographic coverage of the magazine instrumentation and ordnance configuration was provided for this test.

f. A micro-switch was mounted on each of two Sylphon detectors to measure the time at which the fixed temperature metal slugs melted. The Sylphon detectors were mounted in the ceiling of the magazine (as shown in Figure 3 of Appendix A).

g. Instrumentation to detect sprinkler flow was provided.

h. Instrumentation to indicate time of pneumatically released pilot (PRP) valve function and pressure was provided.

i. Instrumentation on the sprinkler manifold to record activation time was provided.

4. General

a. Figure 6 of Appendix A shows a block diagram of the Sprinkler Control Circuitry used in Test No. 6.

b. Figure 7 of Appendix A shows a block diagram of the Instrumentation Recording System used in Test No. 6.

c. Figure 8 of Appendix A shows a block diagram of the Pressure Data Reduction System used in Test No. 6.

B. Test No. 7

1. Motor: SPARROW MK 38 MOD 0

a. In Test No. 7, a SPARROW MK 38 MOD 0 motor was electrically ignited using the igniter installed in the motor. This test was conducted on 9 January 1974. Ambient temperature was 26°F. Prior to firing the motor, it was X-rayed to insure that no cracks or other irregularities were present that would preclude normal motor burn. The motor was provided with a pressure tap so that chamber pressure could be measured during burning.

2. Magazine Configuration

a. The magazine configuration for this test was the same as for Test No. 6 except that a dry sprinkler system was used as the damage control mechanism. The sprinkler system was programmed to open the hydraulic control valve at 15 seconds after the active motor pressure had reached 300 psig.

3. Instrumentation

a. The instrumentation for this test was the same as for Test No. 6.

4. General

a. Figure 9 of Appendix A shows a block diagram of the Sprinkler Control Circuitry used in Test No. 7.

b. The Instrument Recording System, and Pressure Data Reduction System techniques (Figures 7 and 8, respectively, of Appendix A) used in Test No. 7 were the same as those used in Test No. 6.

IV. TEST RESULTS

The detailed temperature/time, pressure/time and related instrumentation data including photographs obtained during Tests Nos. 6 and 7 are presented in Appendices B through D, respectively. The temperature curve 2-A, (shown in Figure 27 of Appendix B) recorded during Test No. 6 shows an erratic drop, then rise in temperature pattern for this thermocouple. This unusual temperature pattern may be due in part to erratic behavior of and/or failure of the thermocouple. The results of these tests are given below.

A. Test No. 6

1. Figure 1 of Appendix B indicates normal motor chamber pressure and motor burn during Test No. 6.
2. The pressure profile measured inside the test magazine ranged between 18.6 and 19.4 psig, as shown in Figures 2 through 5 of Appendix B.
3. The detailed temperature profile of the test magazine (interior) was as shown in Figures 6 through 25 of Appendix B.
4. Exterior and interior temperature measurements were obtained on the bare, inert, instrumented ZUNI motors, bare, inert, instrumented, all-up configuration of SIDEWINDER and ZUNI missiles, and inert, instrumented, containerized, all-up SIDEWINDER and ZUNI missiles located in the magazine. These temperature curves are shown in Figures 26 through 33 of Appendix B.
5. Magazine venting during Test No. 6 occurred 1.7 seconds after CFK. Venting occurred through a 1.23 square-foot opening.
6. The metal slug in the Sylphon detector did not melt during Test No. 6.
7. Full water flow at the sprinkler heads occurred between 3 and 4 seconds after CFK.
8. PRP valve activation occurred 1.45 seconds after CFK.
9. A maximum of 2.4 psig was recorded on the detector PRP manifold. The manifold pressure was 0.35 psig at the time of PRP activation.

B. Test No. 7

1. Figure 1 of Appendix C indicates that normal motor chamber pressure and motor burn occurred during Test No. 7.
2. The pressure profile measured inside the test magazine ranged between 11.6 and 16.0 psig, as shown in Figures 2 through 5 of Appendix C.
3. The detailed temperature profile of the magazine interior was as shown in Figures 6 through 25 of Appendix C.
4. Exterior and interior temperature measurements were obtained on the bare, inert, instrumented ZUNI motors, bare, inert, instrumented, all-up configuration of SIDEWINDER and ZUNI missiles, and inert, instrumented, containerized, all-up SIDEWINDER and ZUNI missiles located in the magazine. These temperature curves are shown in Figures 26 through 33 of Appendix C.
5. The magazine did not vent during this test.
6. The metal slug in the Sylphon detector did not melt during test No. 7.
7. The PRP valve activated 1.45 seconds after CFK.
8. The PRP manifold instrumentation for this test failed.

V. DISCUSSION

1. Magazine temperature and pressure profile data, and external and internal temperature characteristics of bare, inert, instrumented ZUNI motors, bare, inert, instrumented, all-up configuration of SIDEWINDER and ZUNI missiles, and inert, instrumented, containerized, all-up SIDEWINDER and ZUNI missiles were obtained during Tests Nos. 6 and 7. These profiles provided thermal/time and pressure/time data for the ordnance items. These data will be used in a computerized simulation study to determine cook-off parameters for explosive ordnance items while using the wet or dry sprinkler system as the damage control mechanism.
2. During Test No. 6, temperature and pressure in the magazine reached a peak of 1180°F and 19.2 psig. One of the external thermocouples peened to the surface of the inert, No. 1 ZUNI motor (located in the active motor exhaust plume) peaked at 395°F, then failed. The other thermocouple peaked at 1200°F. The corresponding internal thermocouples recorded peak temperatures of 475°F and 300°F, respectively. The No. 2 inert, ZUNI motor external thermocouples peaked at 325°F and 200°F. The corresponding internal thermocouples for this motor peaked under 100°F. The No. 3 inert, ZUNI motor external thermocouples peaked at 250°F, while the corresponding internal thermocouples peaked under 150°F. The No. 4 inert, ZUNI motor external thermocouples peaked at 380°F and 325°F, while the corresponding internal thermocouples peaked under 100°F. All of the remaining thermocouples attached to the inert IRRP/AALW configured systems located in the magazine peaked under 275°F.
3. During Test No. 7, temperature and pressure in the magazine reached a peak of 890°F and 16.1 psig. The two external thermocouples peened to the surface of the inert, No. 1 ZUNI motor peaked at 850°F and 25°F, then failed. The corresponding internal thermocouples for this motor peaked at 400°F and 200°F, respectively. The No. 2 inert, ZUNI motor external thermocouples peaked at 1080°F and 225°F, while the corresponding internal thermocouples peaked below 120°F. The No. 3 inert, ZUNI motor external and internal thermocouples peaked under 175°F. The No. 4 inert, ZUNI motor external thermocouples peaked at 230°F and 175°F, while the corresponding internal thermocouples peaked under 100°F. All remaining thermocouples attached to the inert IRRP/AALW configured systems located in the magazine peaked under 175°F.

VI. CONCLUSIONS

The temperature/time and pressure/time profile data obtained during Tests Nos. 6 and 7 are vitally important because they include the effects of:

1. The wet sprinkler system during motor burn in a magazine; and
2. The dry sprinkler system during motor burn in a magazine.

Knowledge of these effects is now available for use in computerized simulation programs to determine the cook-off parameters of IRRP/AALW configured systems, in reevaluating the need for a wet vs. dry sprinkler system in deep stowage magazines, and in evaluating thermal systems designed for ordnance.

REFERENCES

1. NAVAIR 11-120-27; Guidance Pamphlet, Assembled Air Launched Weapons Implementation, Improved Rearming Rates Project, 1 June 1969.
2. NAVSHIP Project S4643, Task 15925.
3. NWL ltr EST:FJH:ddw 8000 dtd 8 March 1973.

APPENDIX A

**TEST MAGAZINE CONFIGURATION AND INSTRUMENTATION FOR
TESTS NO.'S 6 AND 7**

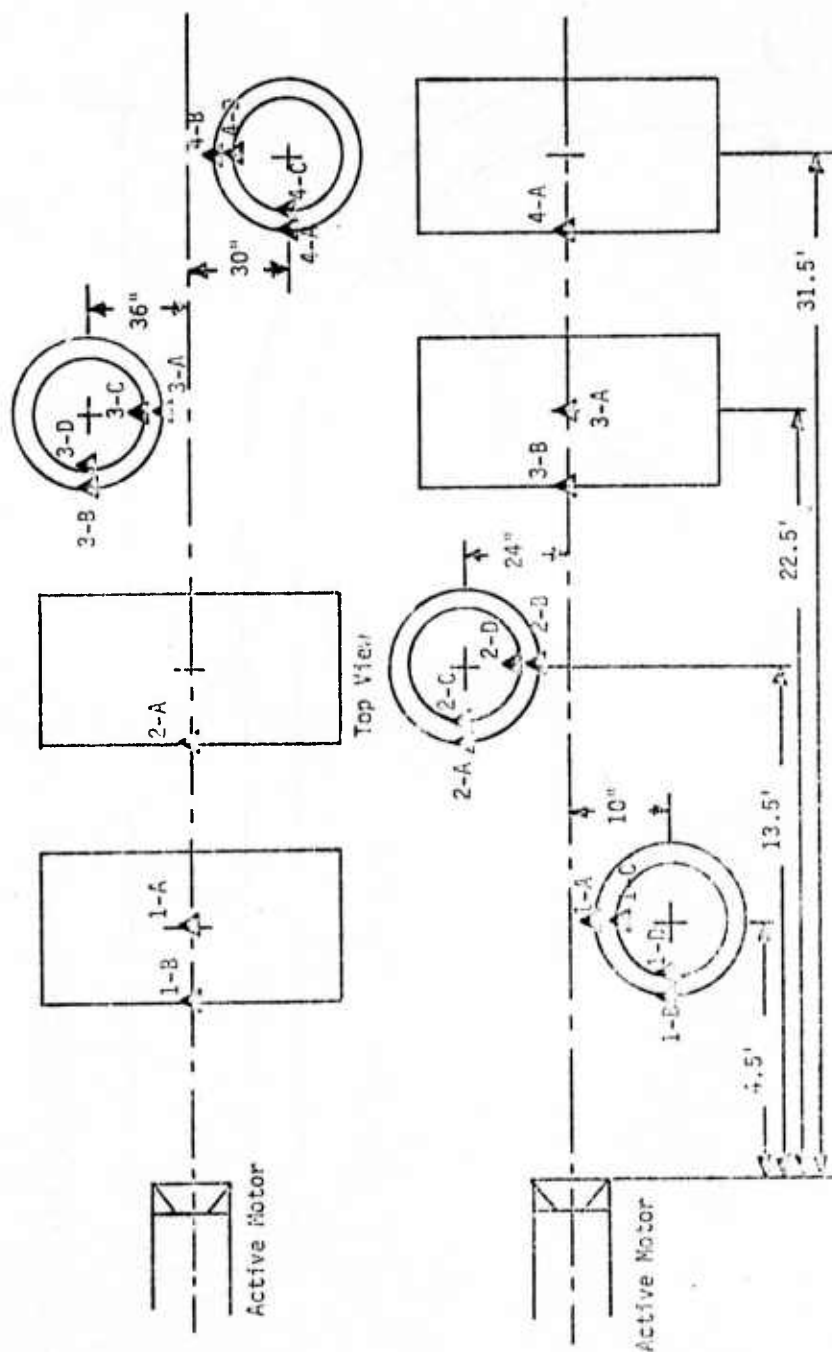
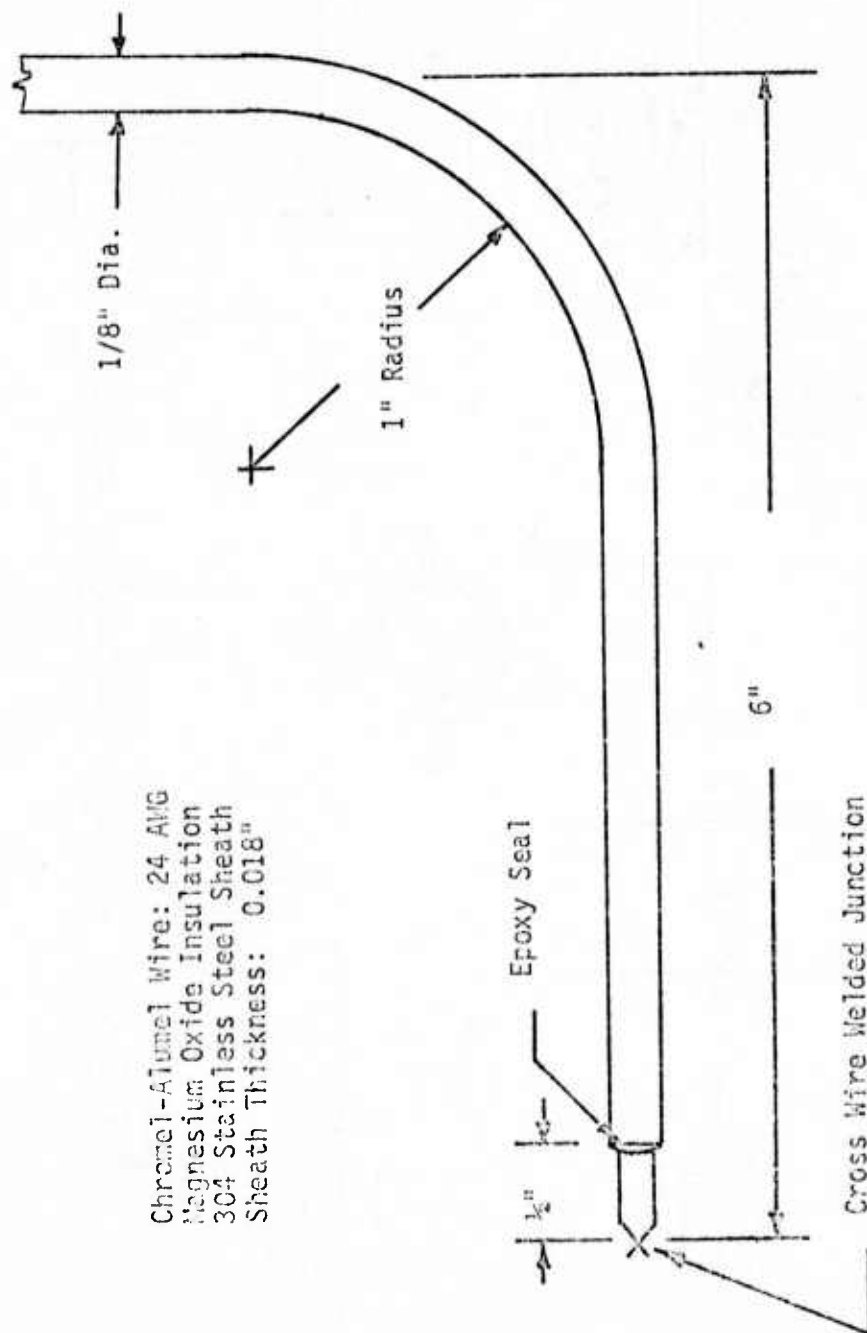


FIGURE A-1
ZUNI Motors in Exhaust Plume



Chromel-Alumel Wire: 24 AWG
 Magnesium Oxide Insulation
 304 Stainless Steel Sheath
 Sheath Thickness: 0.018"

FIGURE A-2
Thermocouple Detail

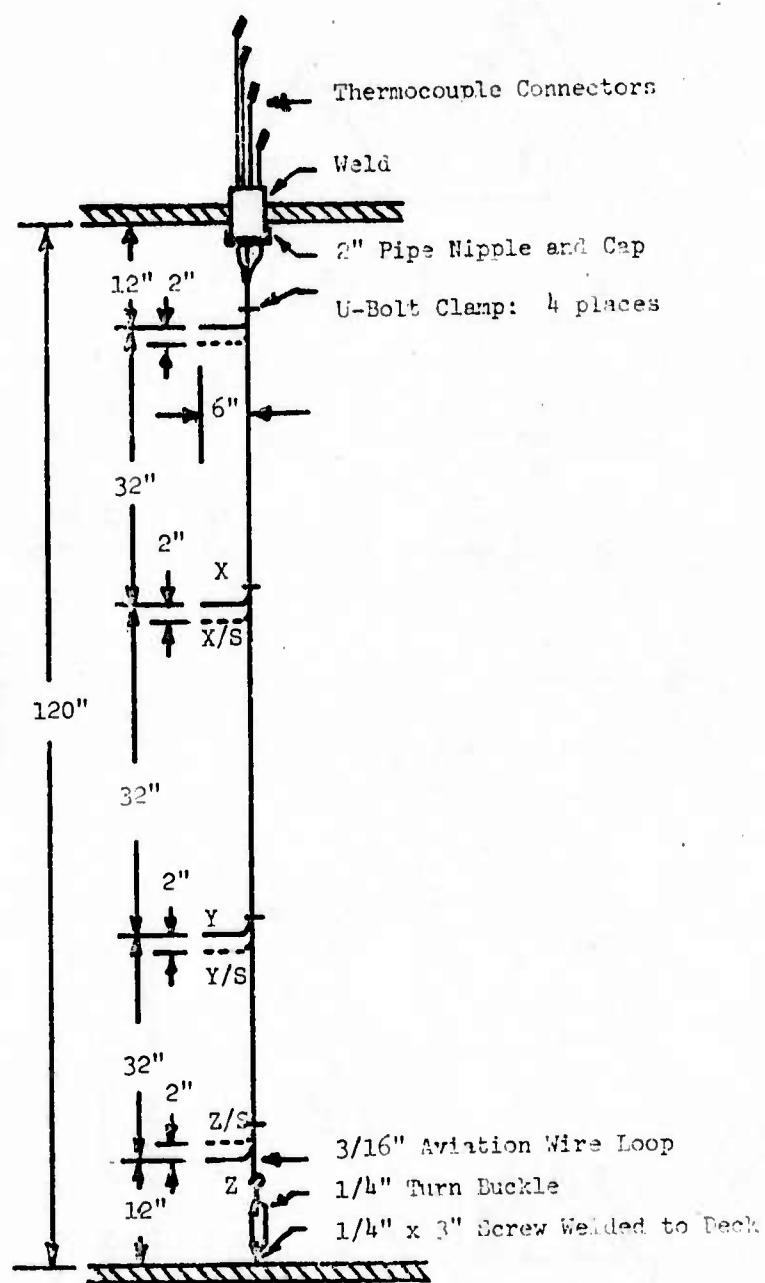


FIGURE A-4

Thermocouple Array

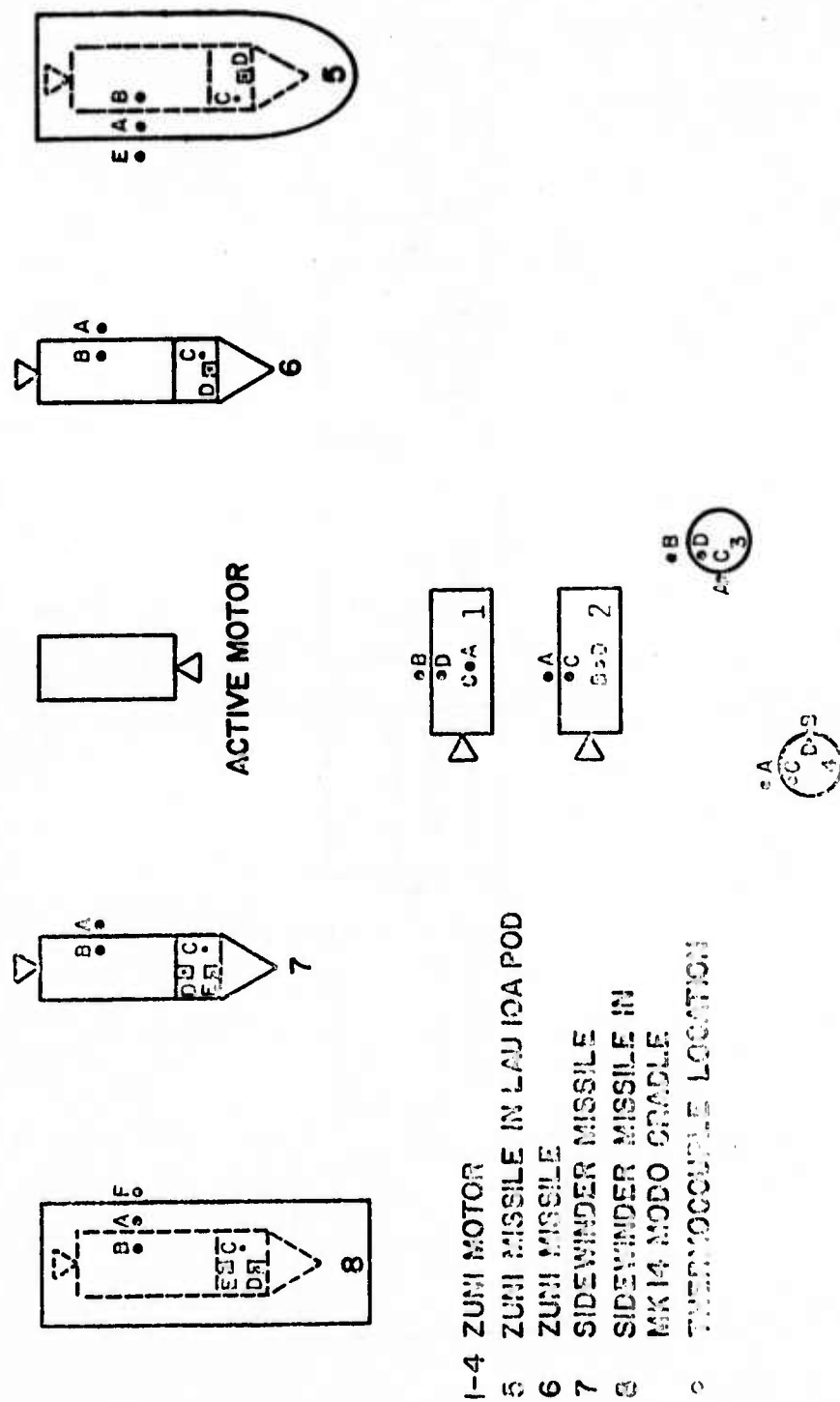


FIGURE A-5

ZUNI Motors and IRRP/AALW Configured Systems Location in Magazine

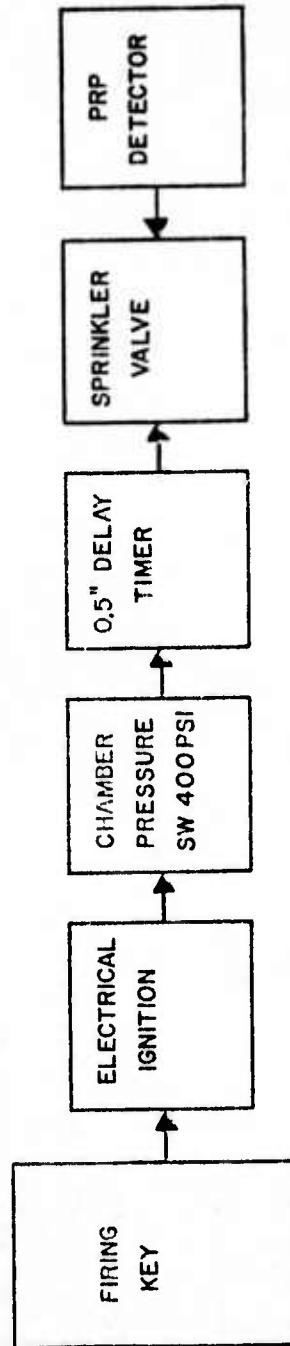


FIGURE A-6
Block Diagram of Sprinkler Control Circuitry
Test No. 6 14 November 1973

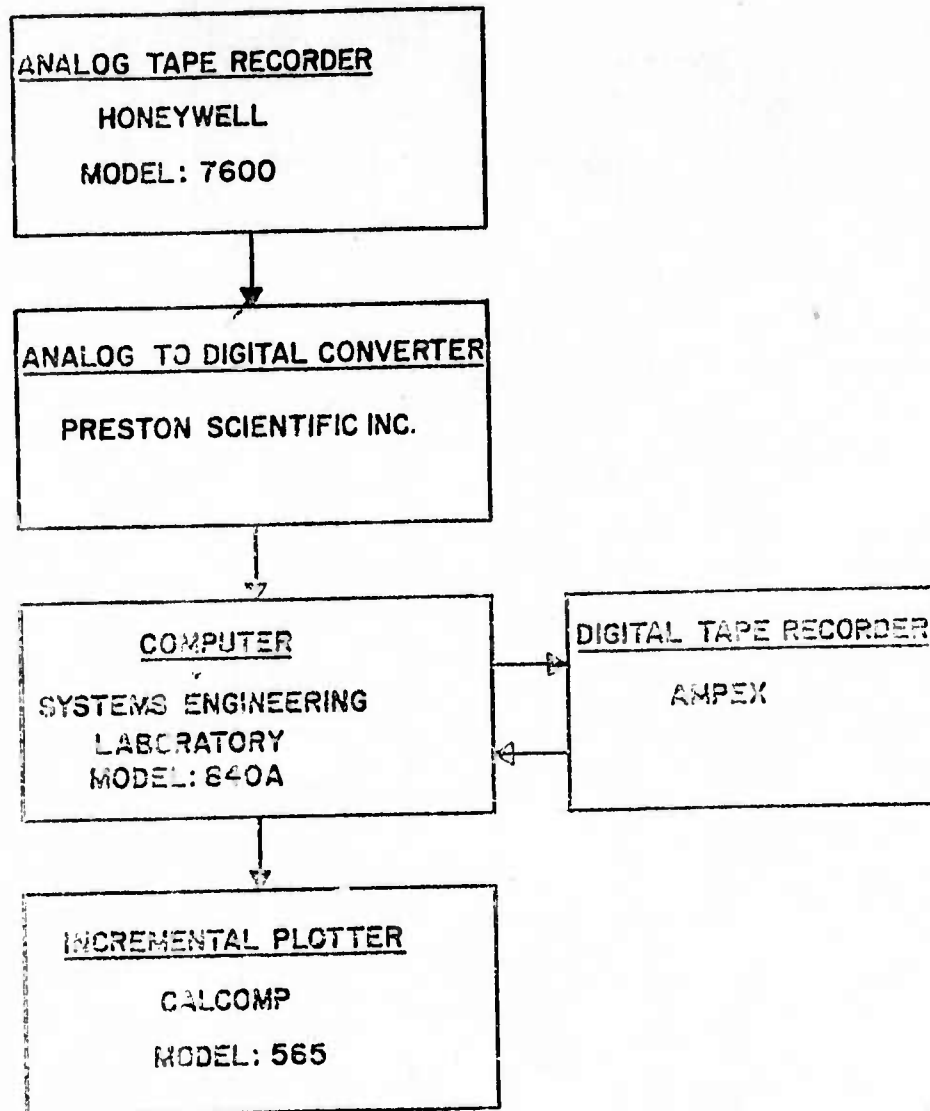


FIGURE A-8
Pressure Data Reduction System

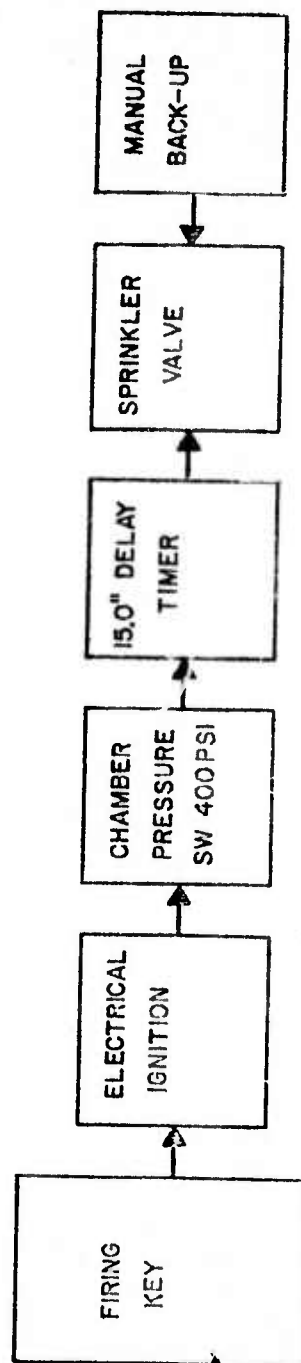


FIGURE A-9
Block Diagram of Sprinkler Control Circuitry

APPENDIX B

TEST DATA OBTAINED DURING TEST NO. 6

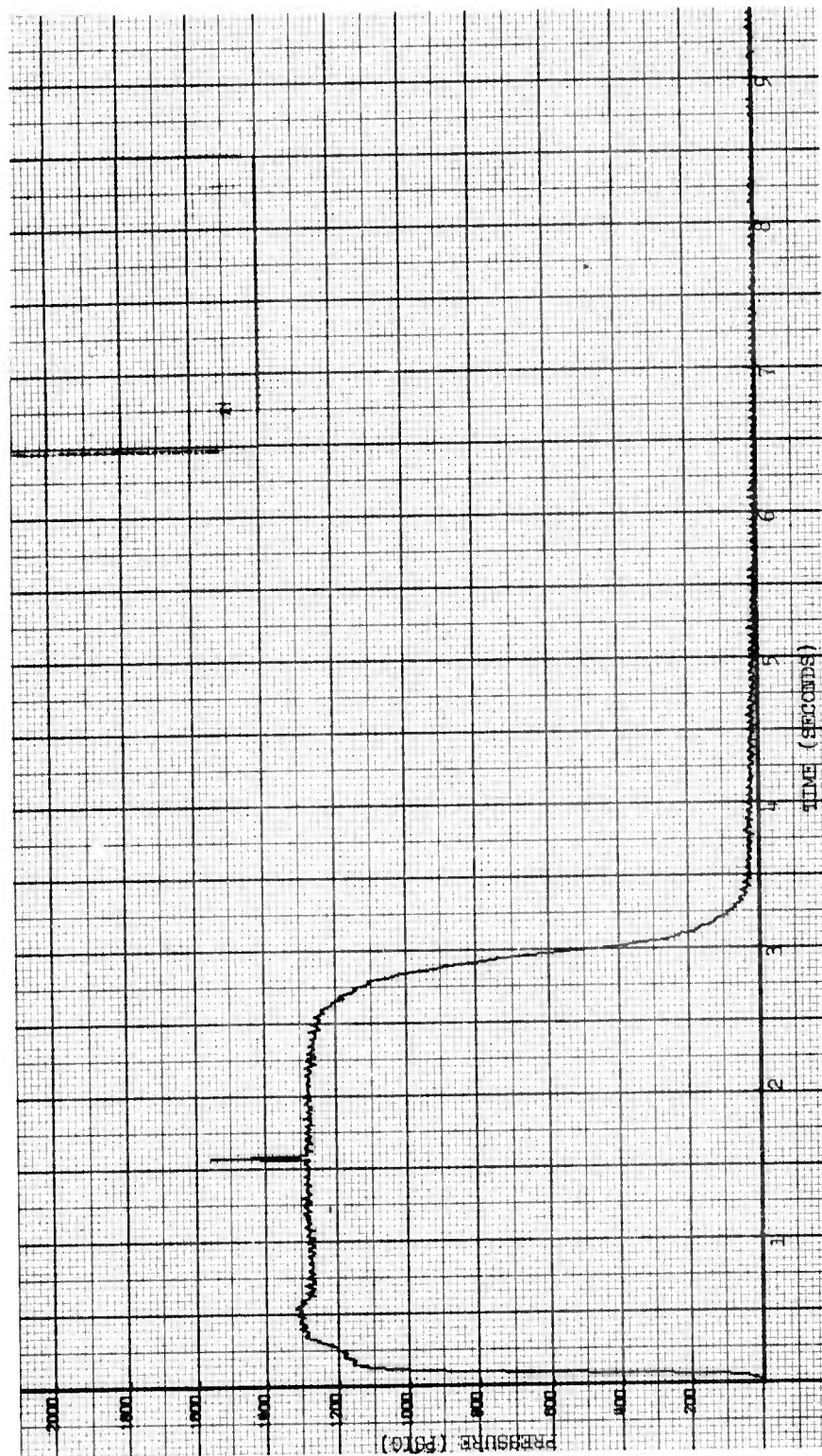


FIGURE B-1

SPARROW MK 38 MOD 1 Motor Pressure
Test No. 6

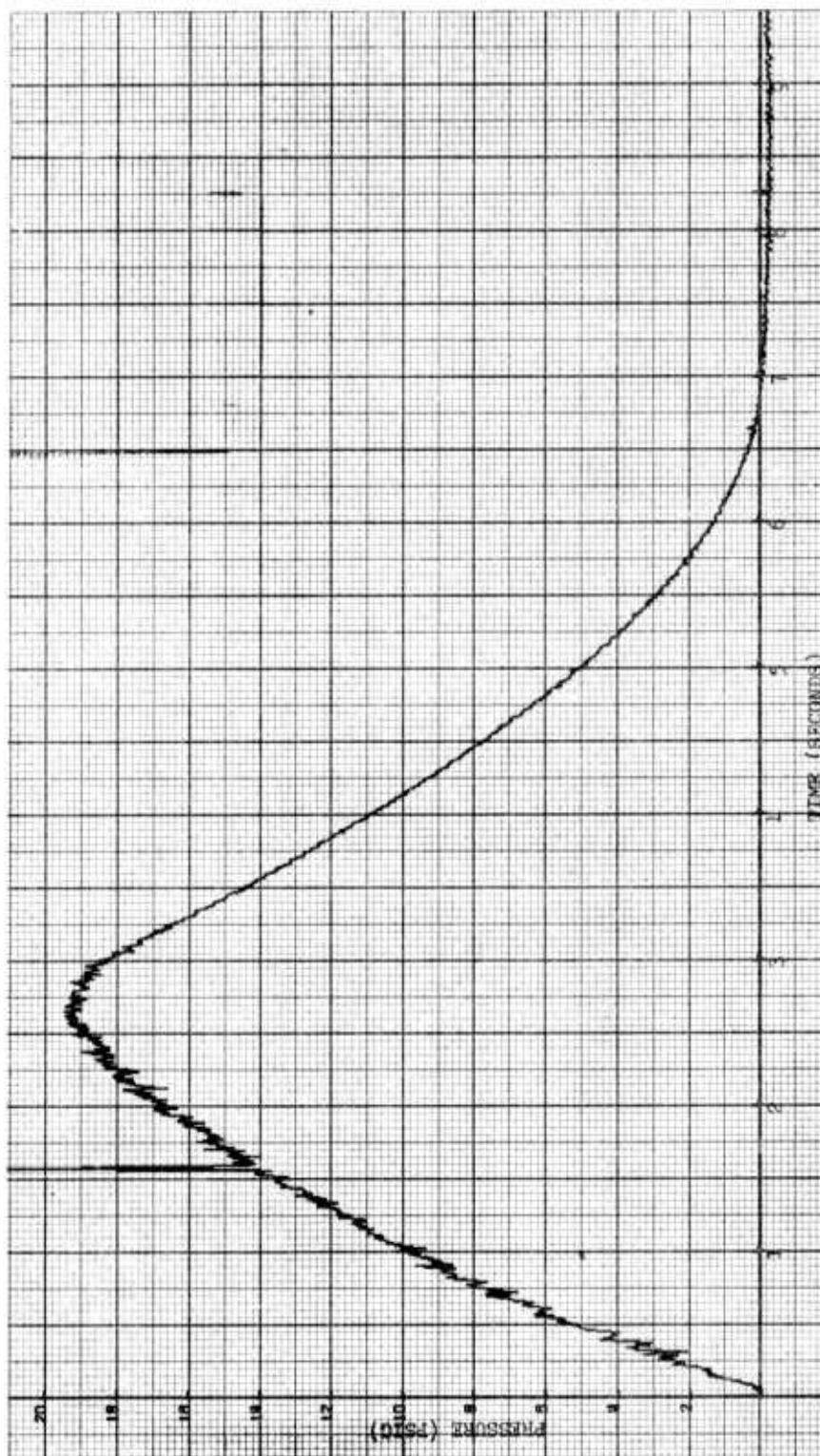


FIGURE B-2

Pressure Transducer No. 1
Test No. 6

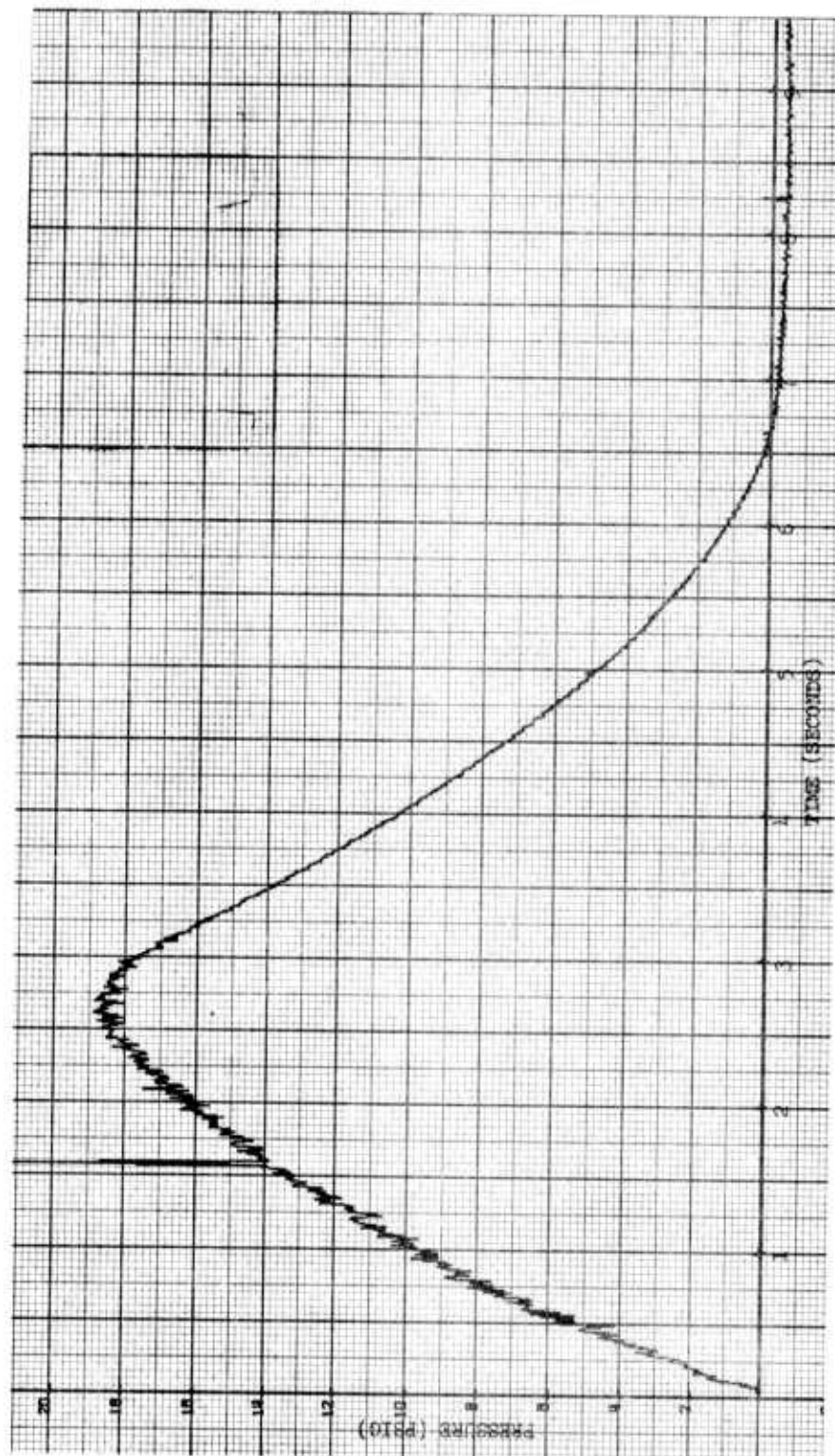


FIGURE B-3
Pressure Transducer No. 2
Test No. 6

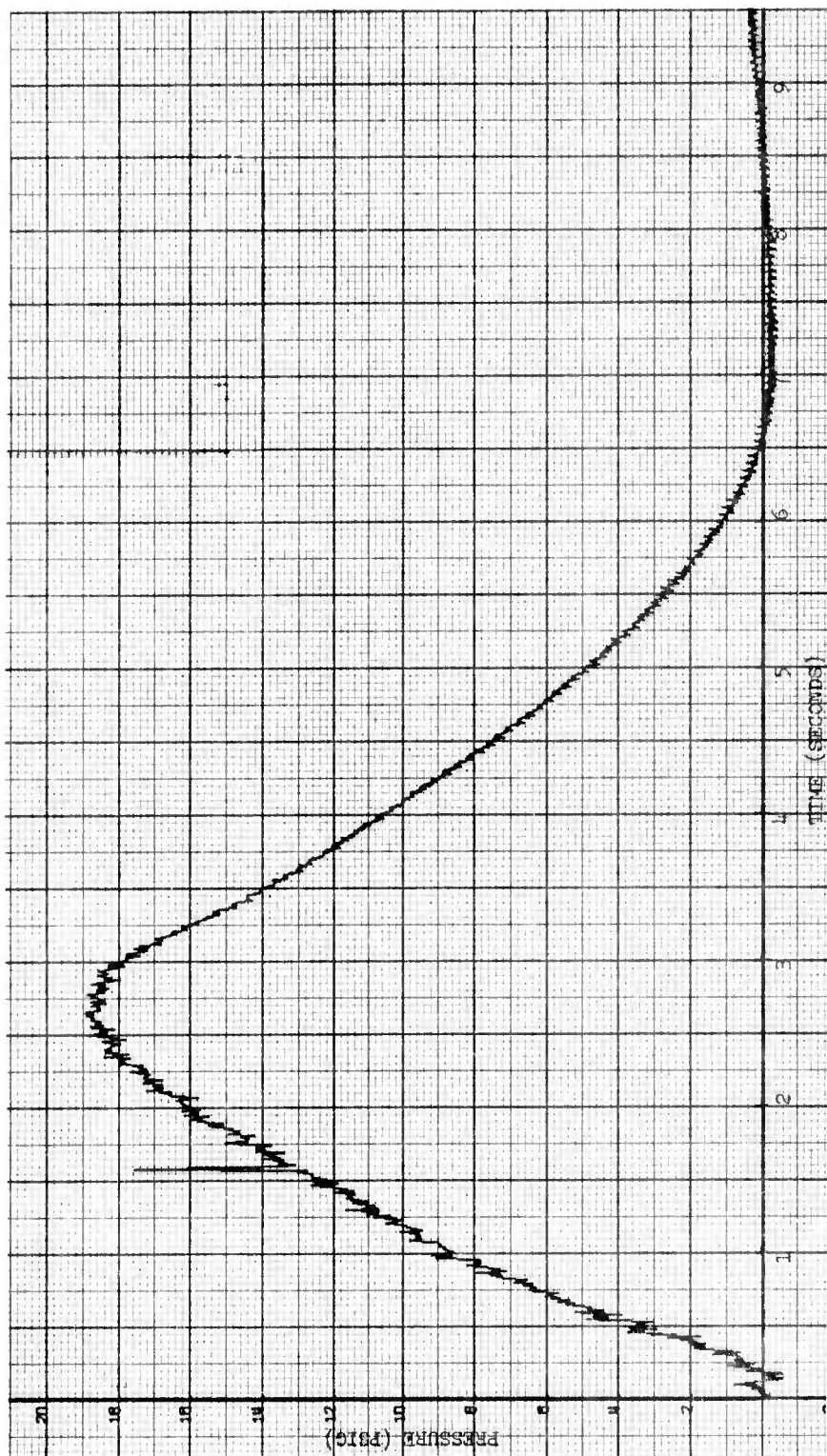


FIGURE B-4
Pressure Transducer No. 3
Test No. 6

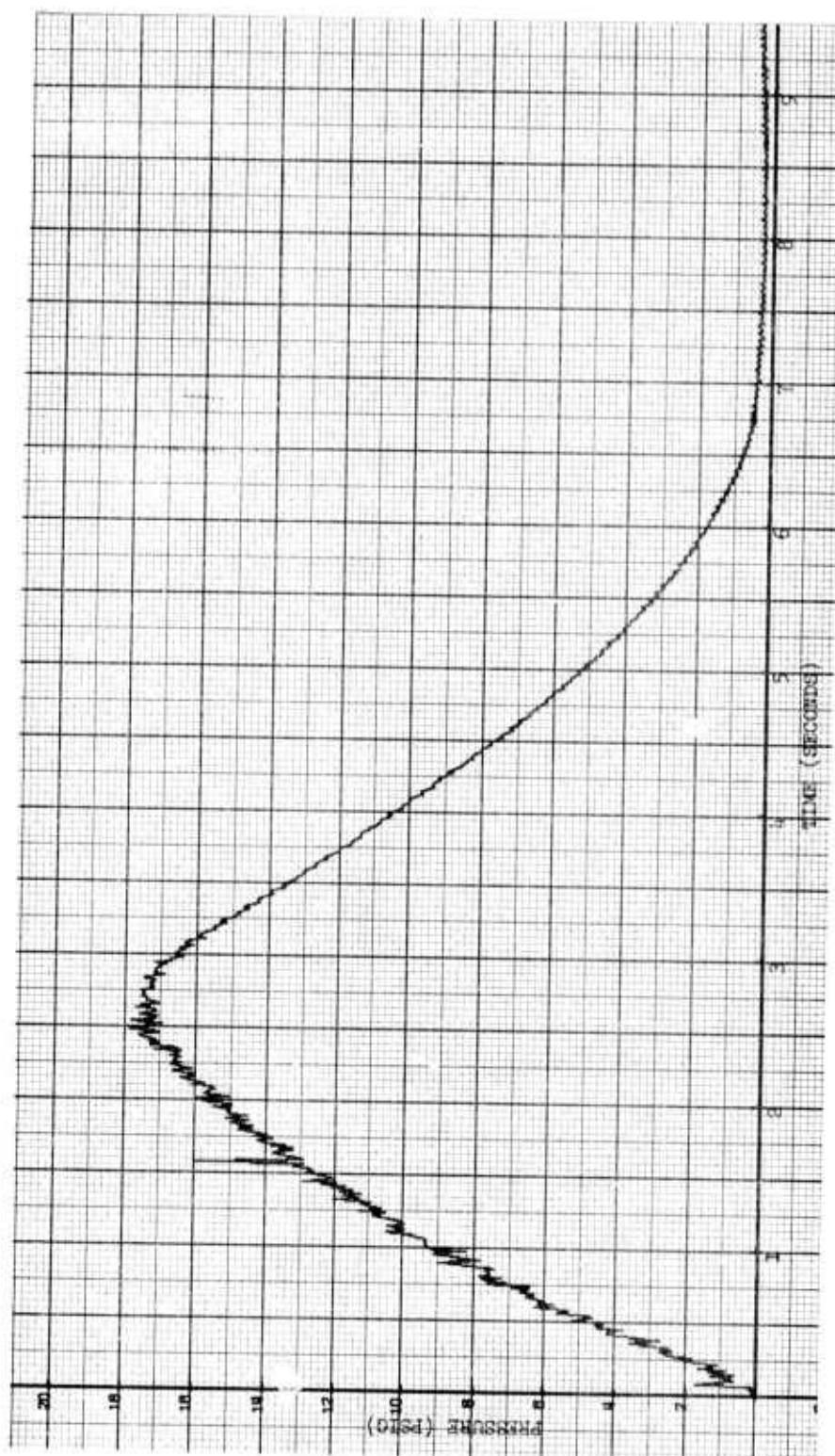


FIGURE B-5
Pressure Transducer No. 4
Test No. 6

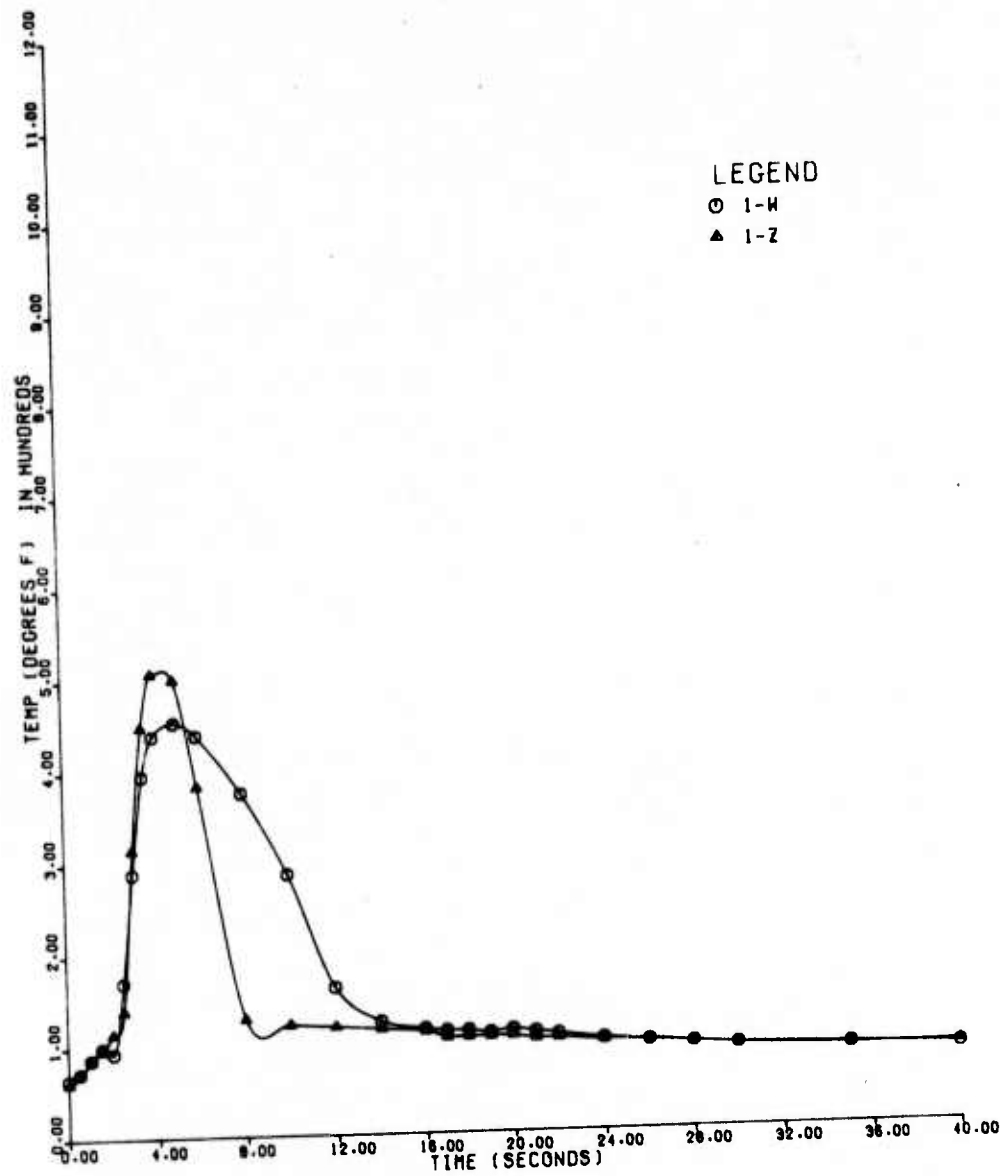


FIGURE B-6
CVA Magazine Test
No. 6 14 November 1973

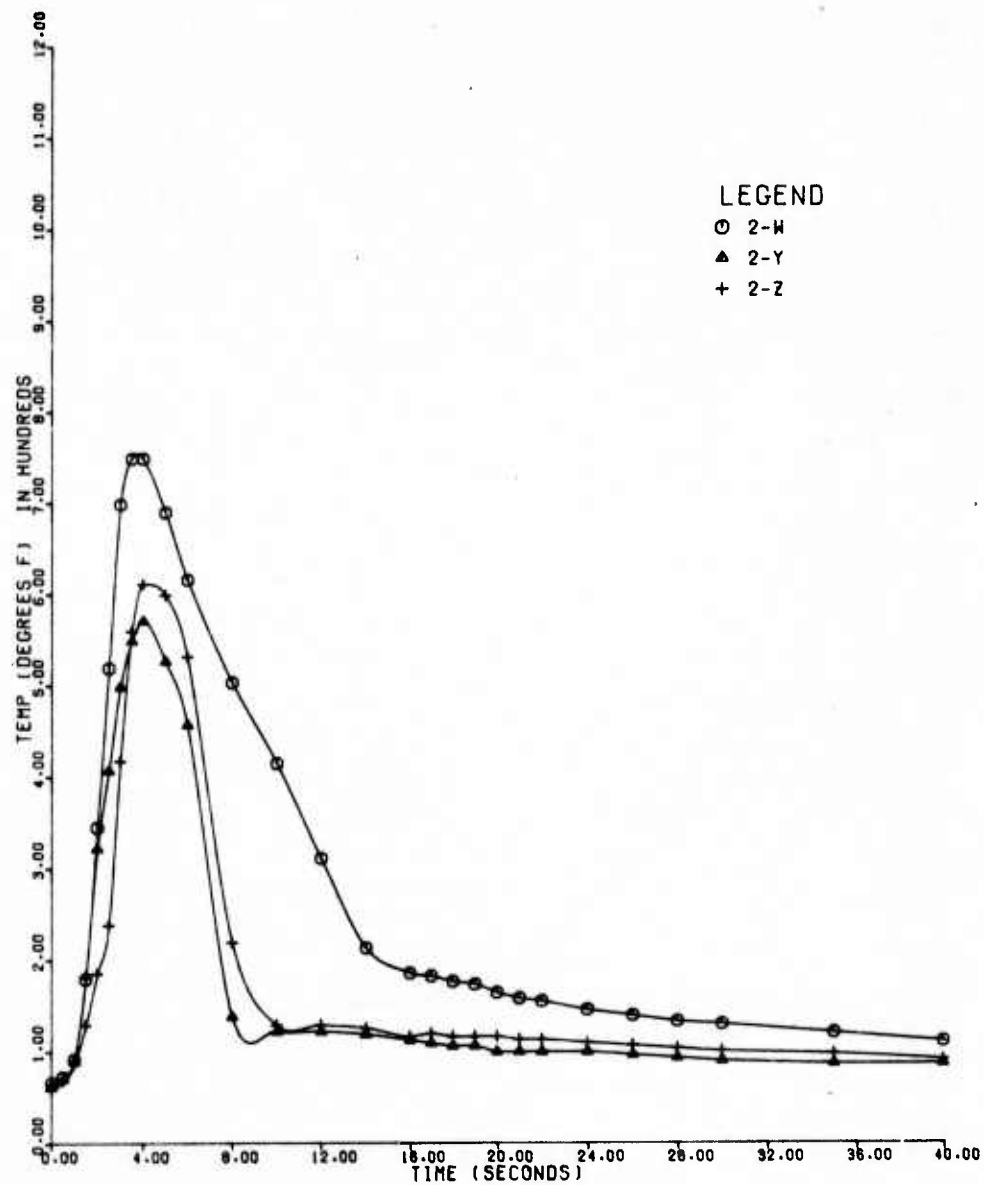


FIGURE B-7

CVA Magazine Test
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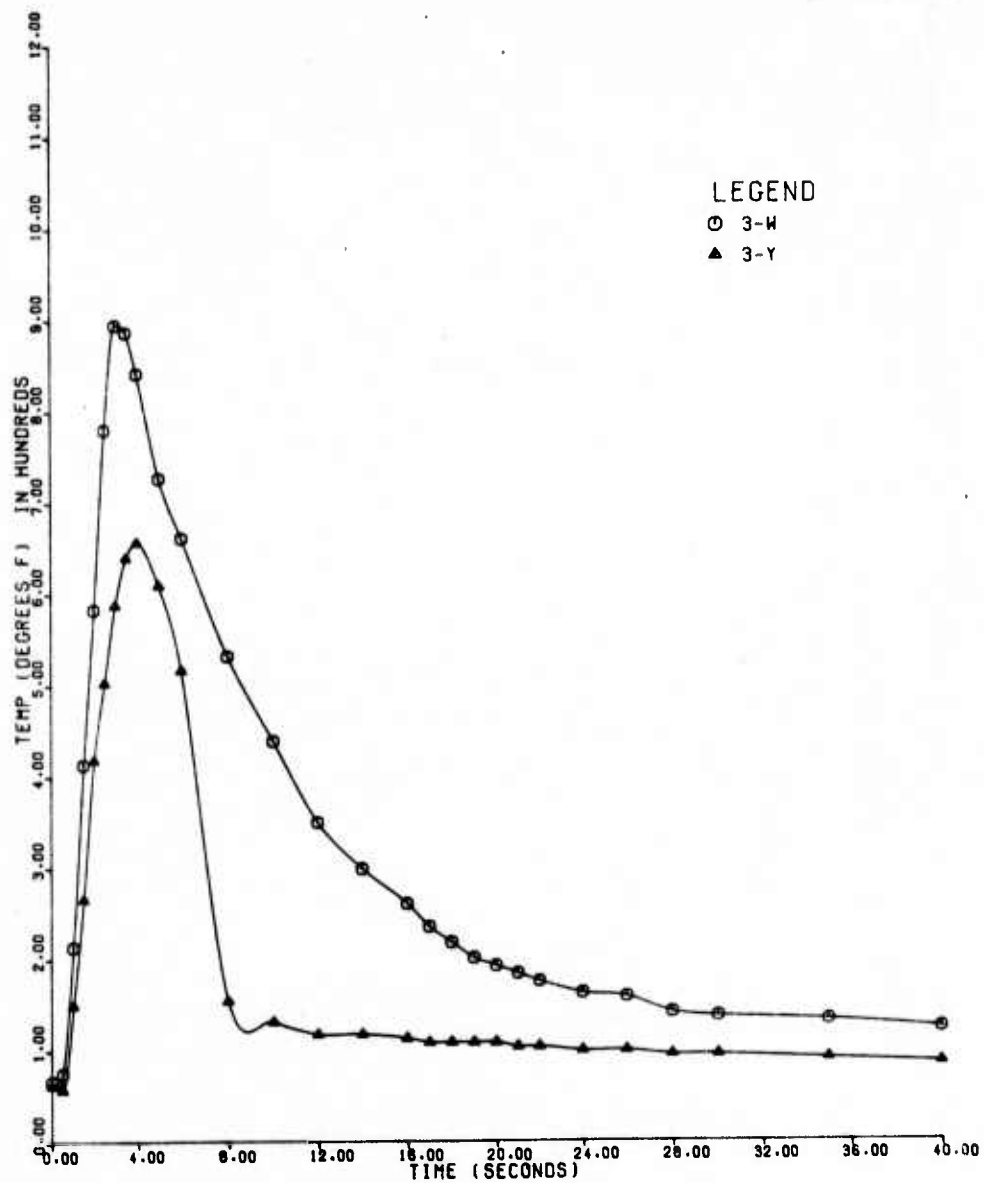


FIGURE B-8

CVA Magazine Test
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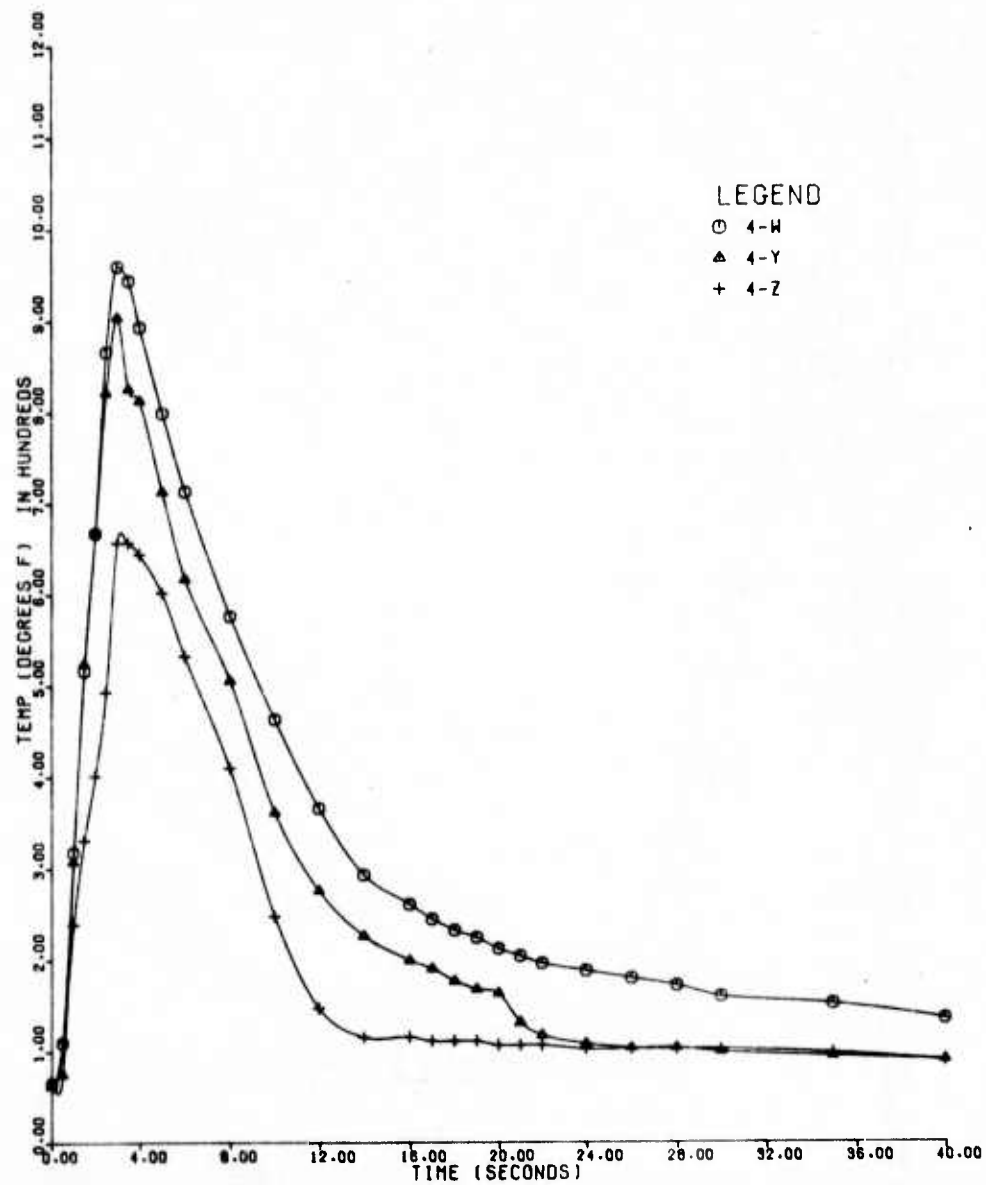


FIGURE B-9

CVA Magazine Test
No. 6 14 November 1973

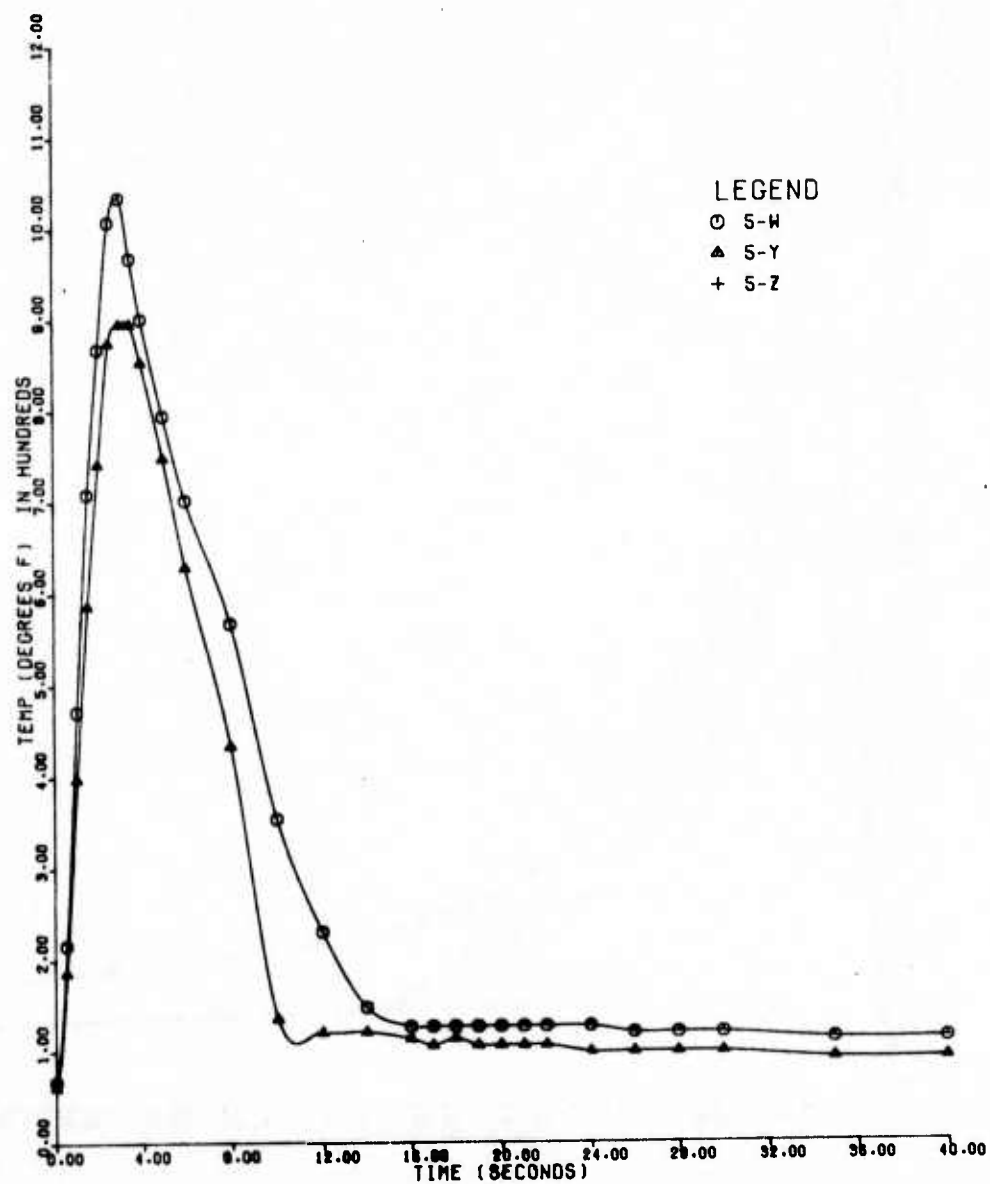


FIGURE B-10

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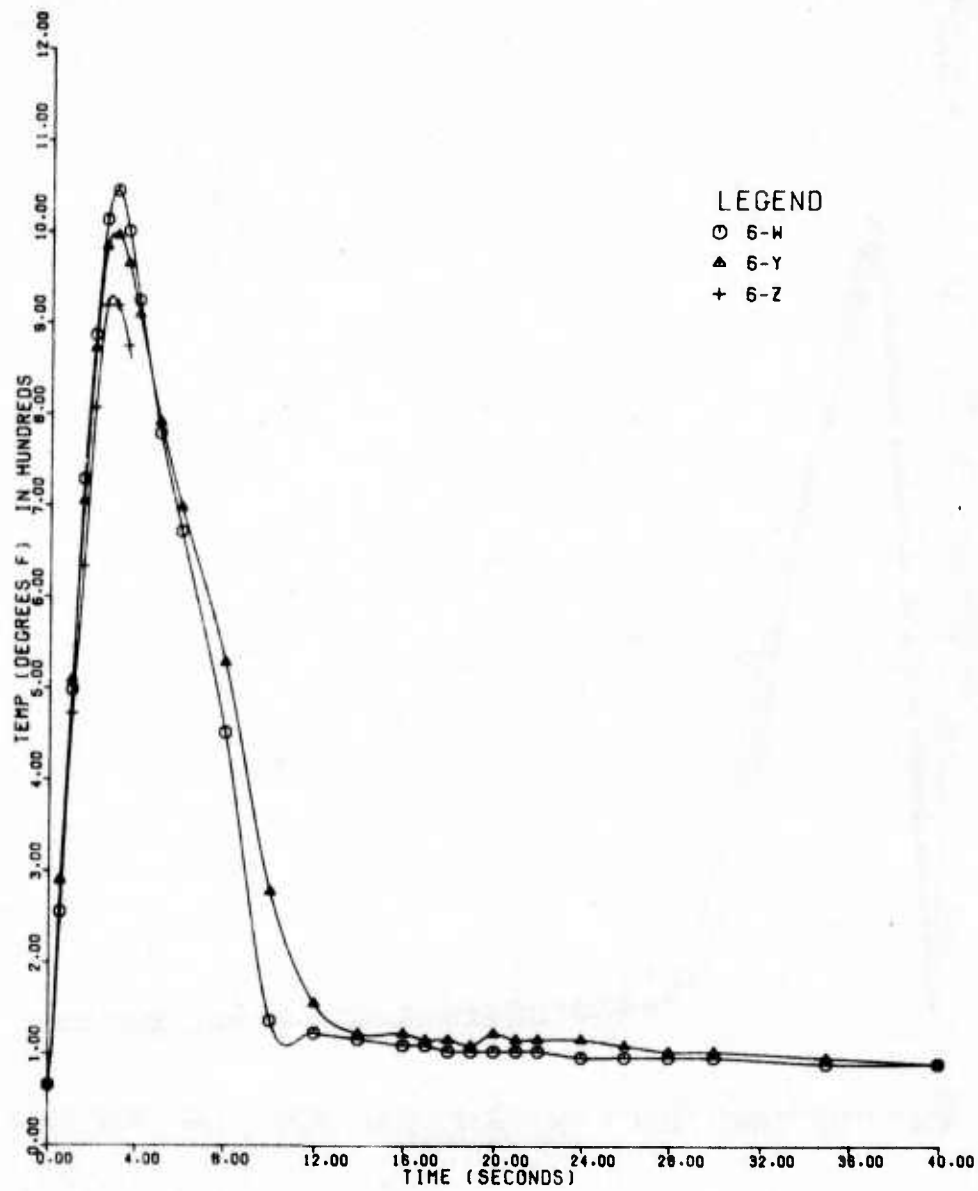


FIGURE B-11

CVA Magazine Test
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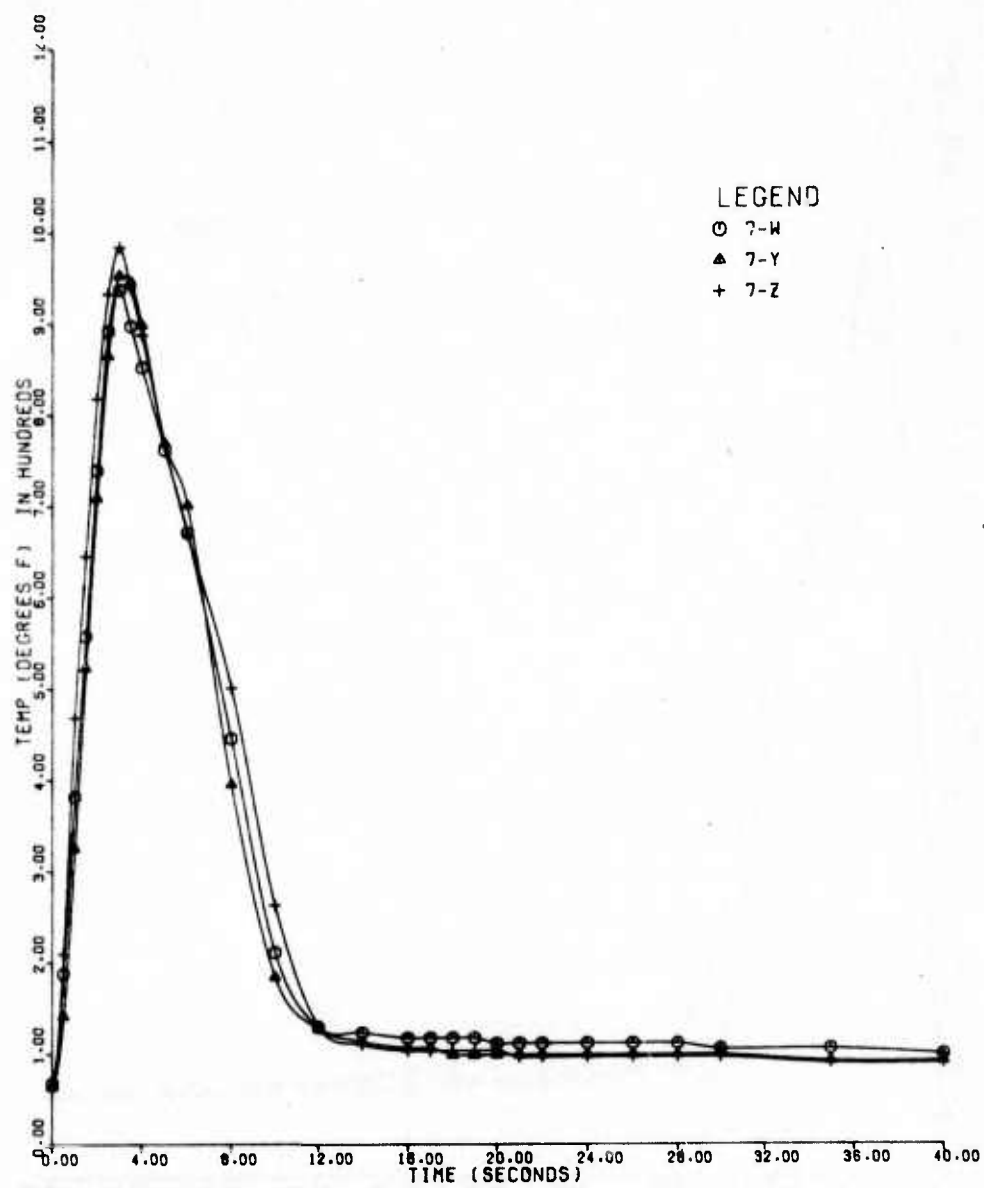


FIGURE B-12

CVA Magazine Test
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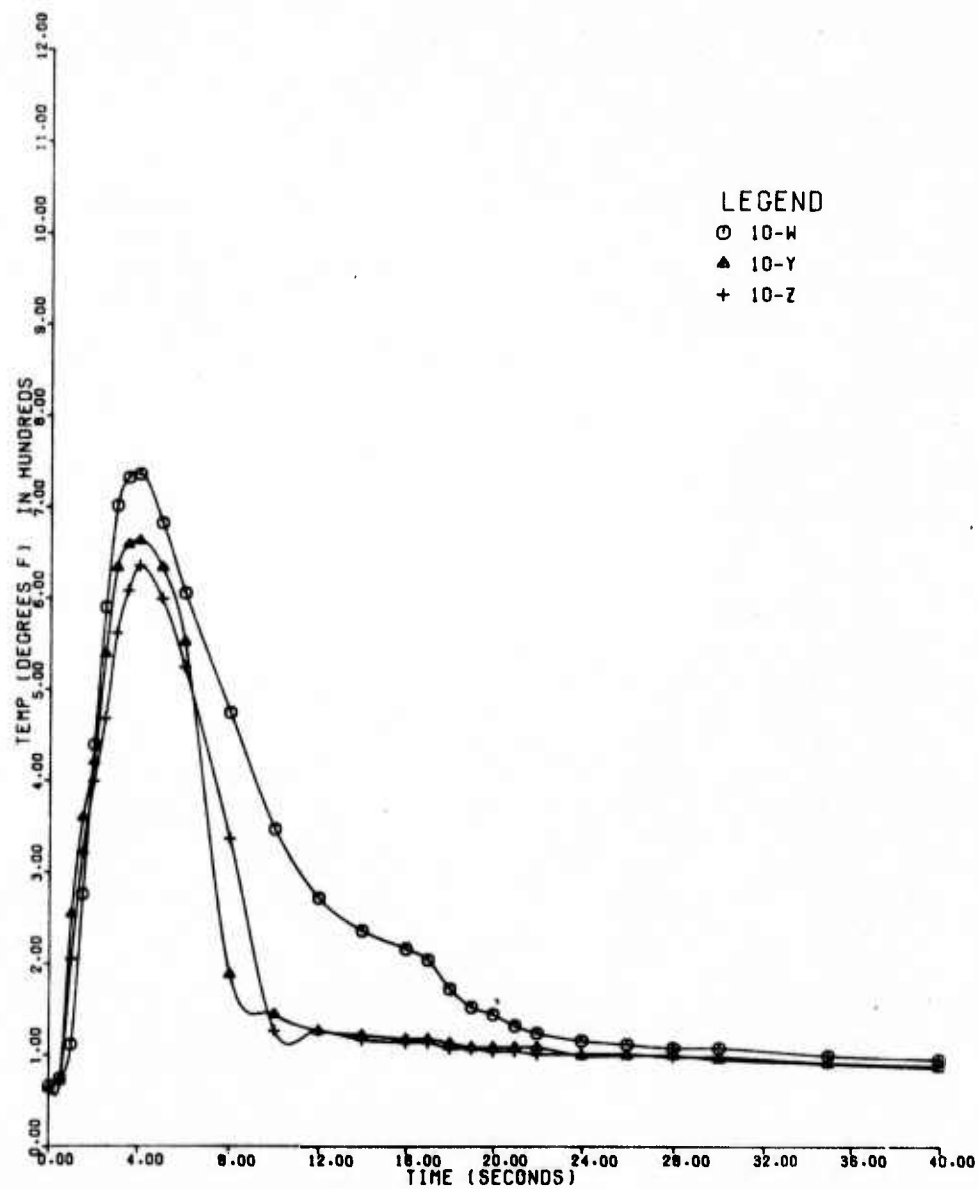


FIGURE B-13

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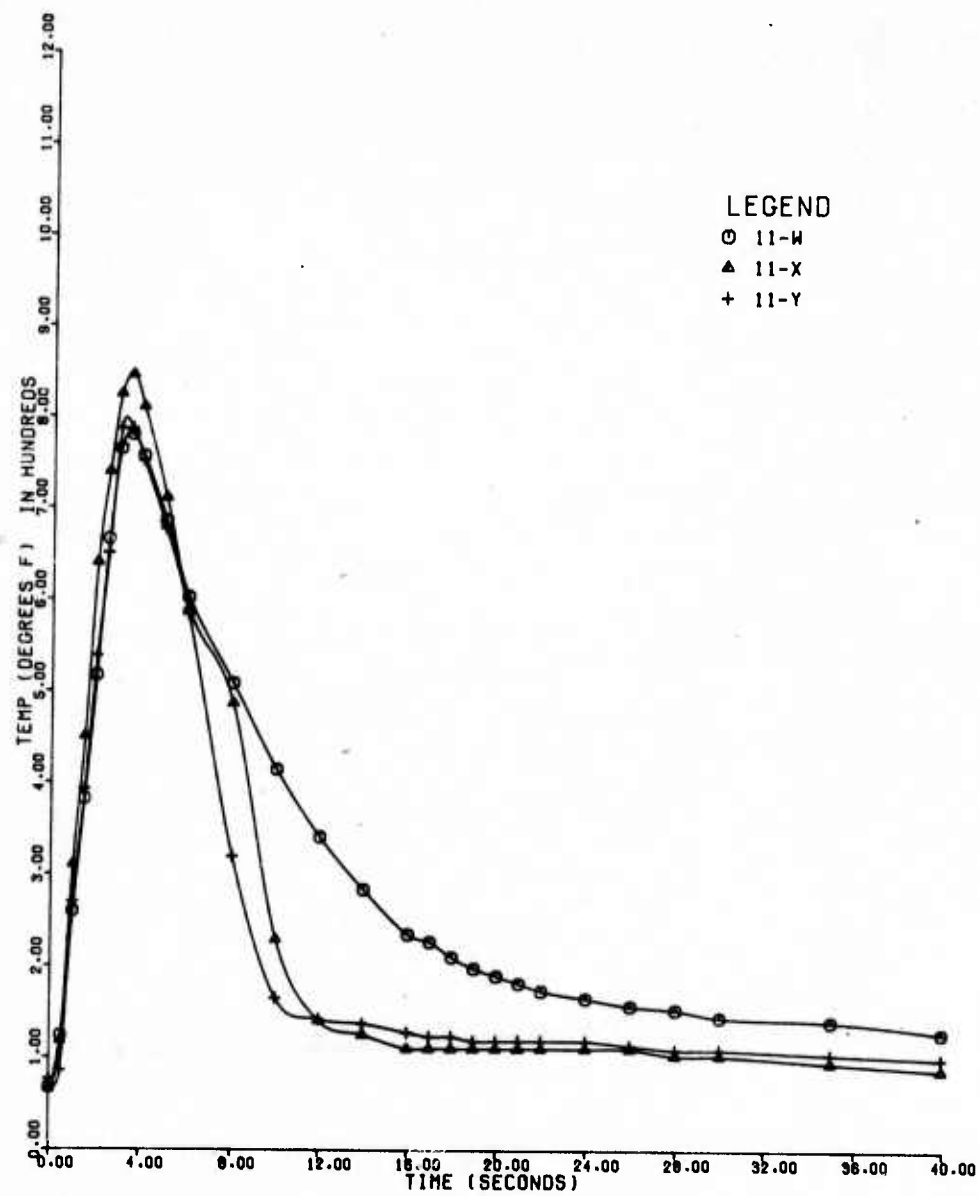


FIGURE B-14

CVA Magazine Test
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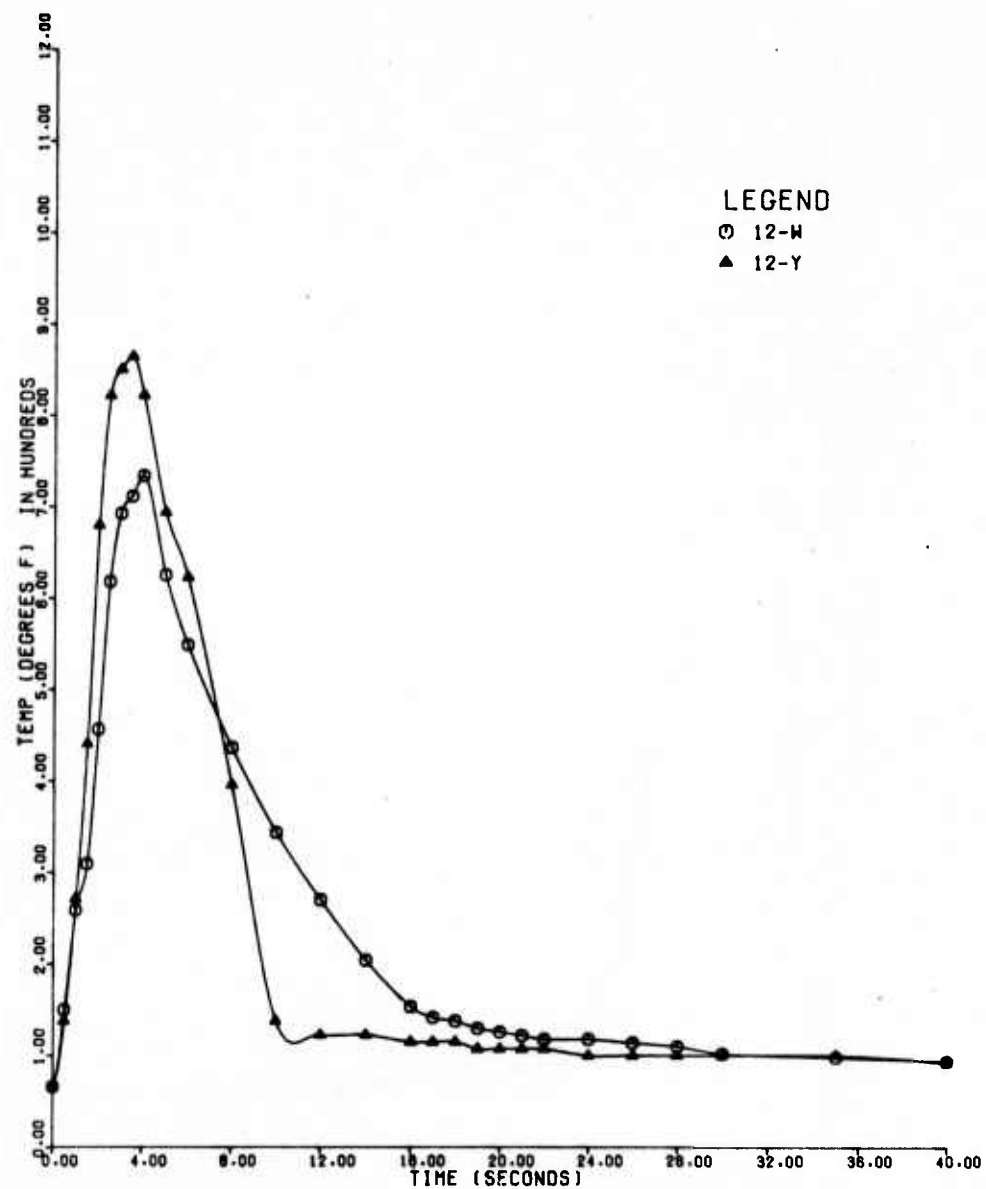


FIGURE B-15

CVA Magazine Test
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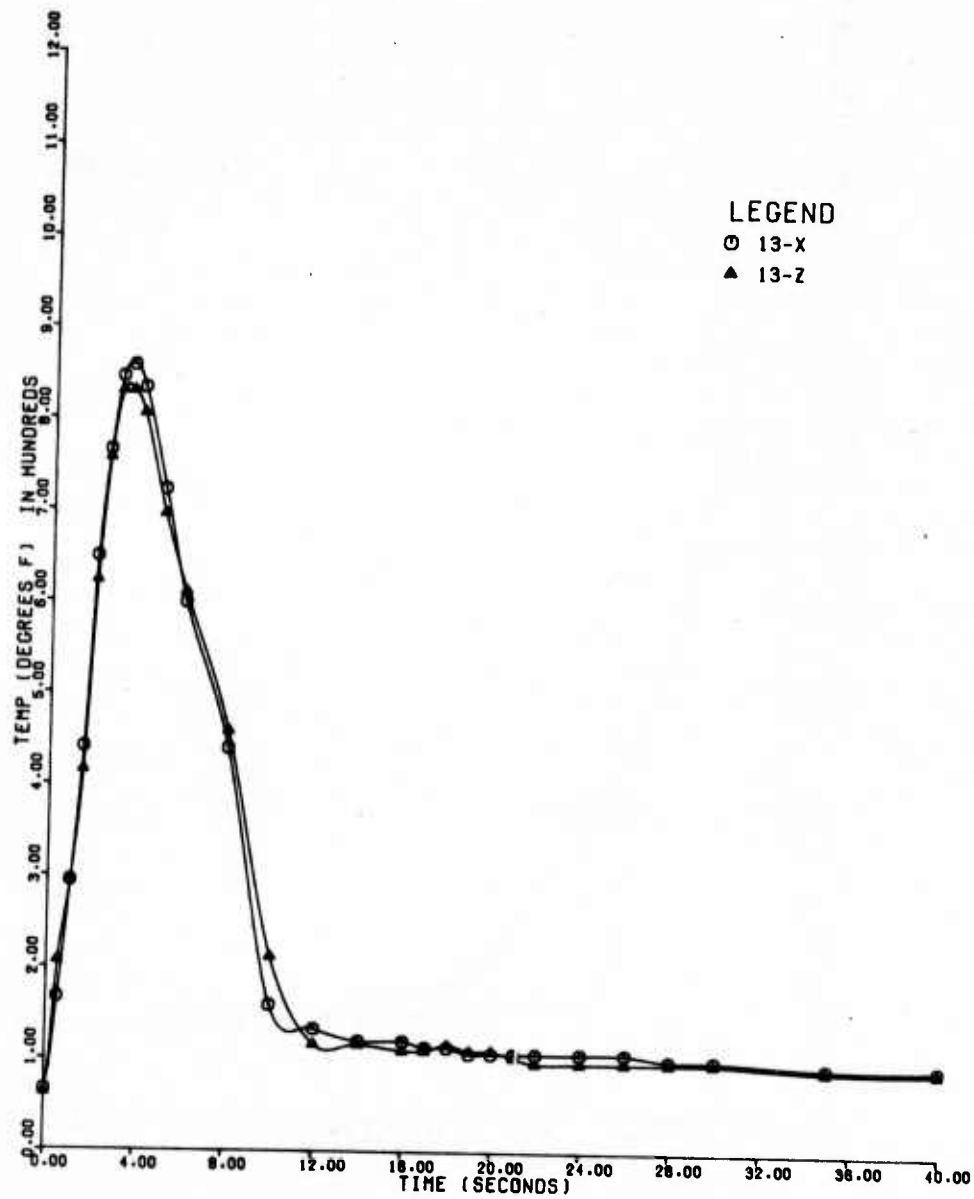


FIGURE B-16

CVA Magazine Test
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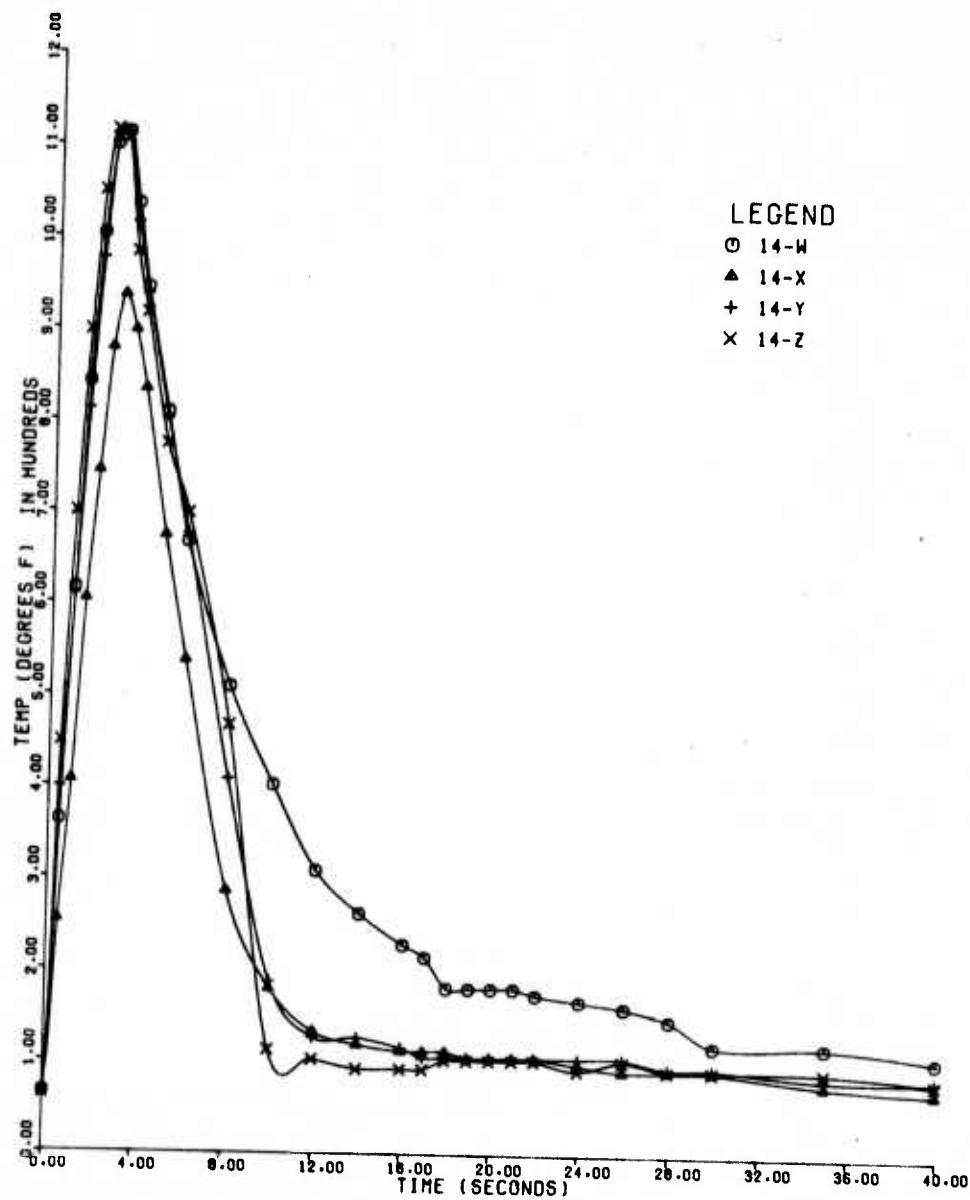


FIGURE B-17

CVA Magazine Test
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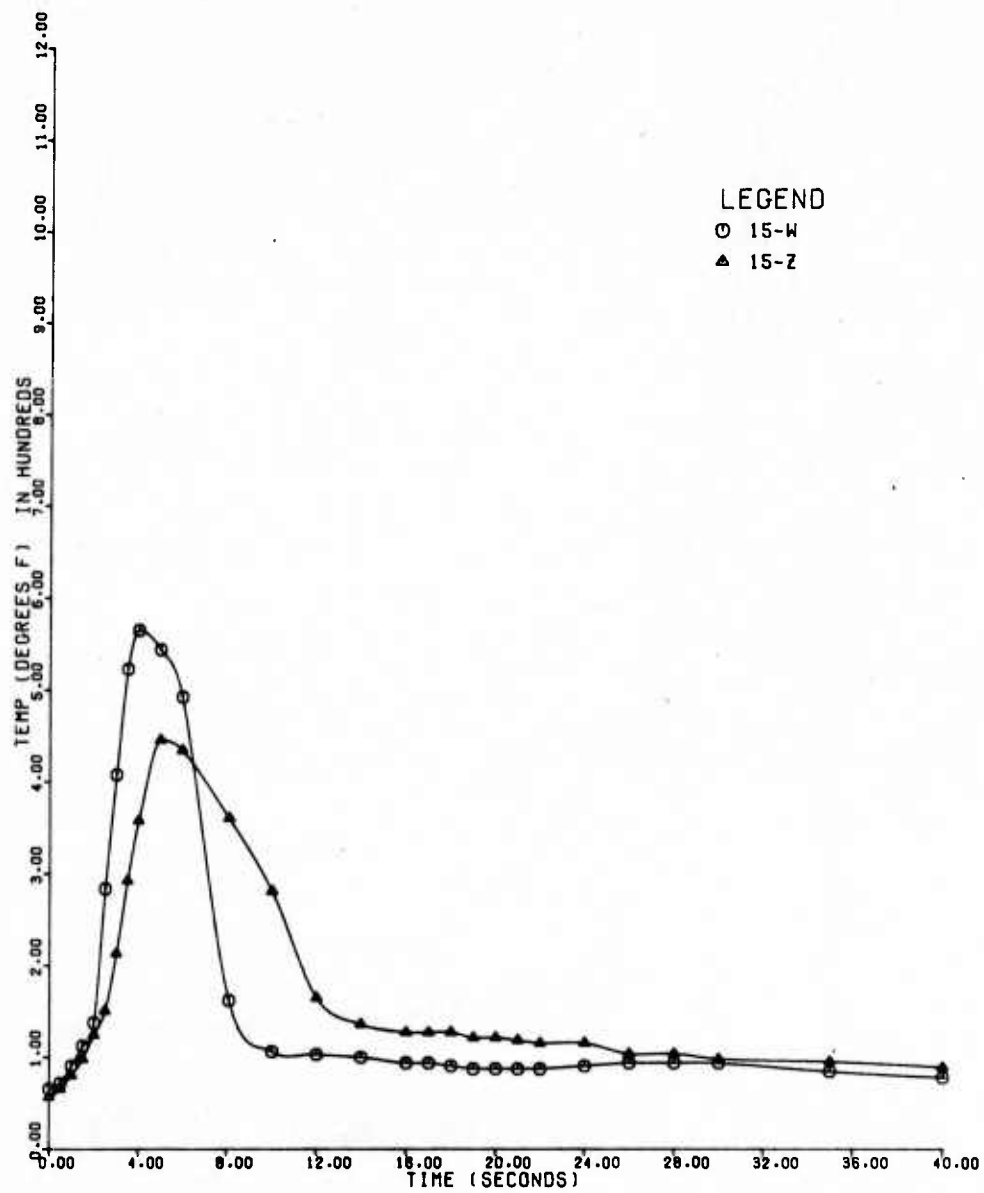


FIGURE B-18

CVA Magazine Test
No. 6 14 November 1973

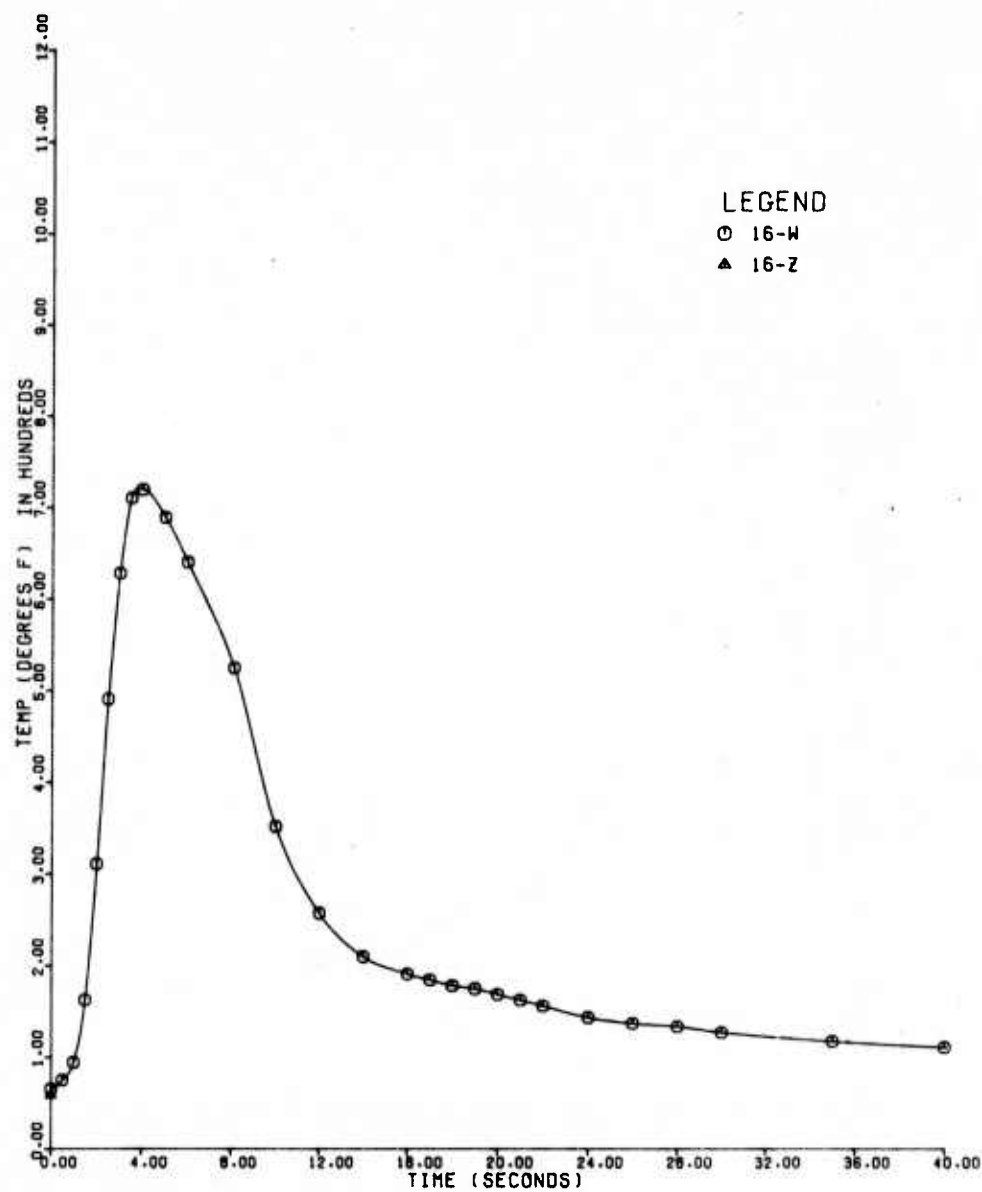


FIGURE B-19

CVA Magazine Test
No. 6 14 November 1973

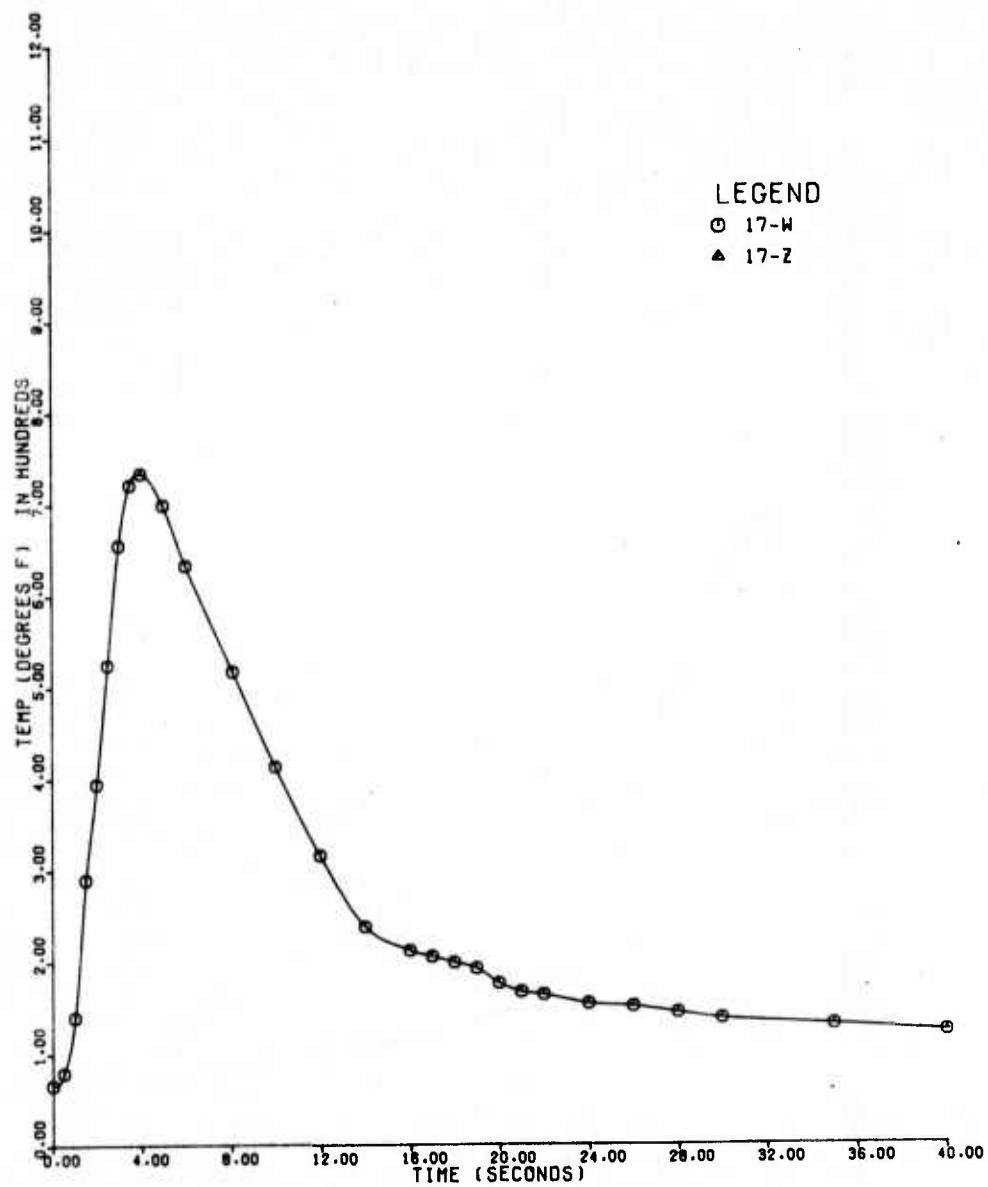


FIGURE B-20

CVA Magazine Test
No. 6 14 November 1973

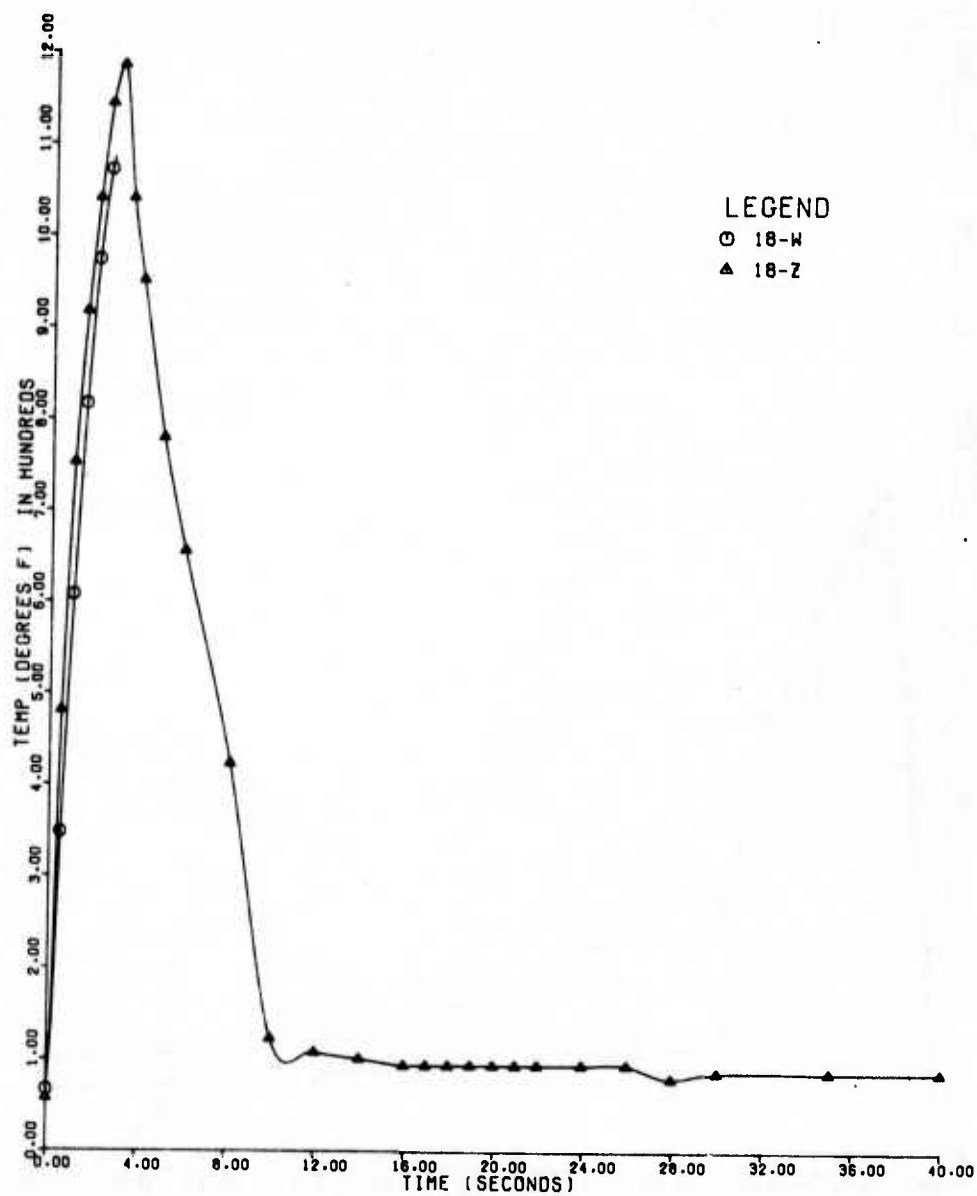


FIGURE B-21

CVA Magazine Test
No. 6 14 November 1973

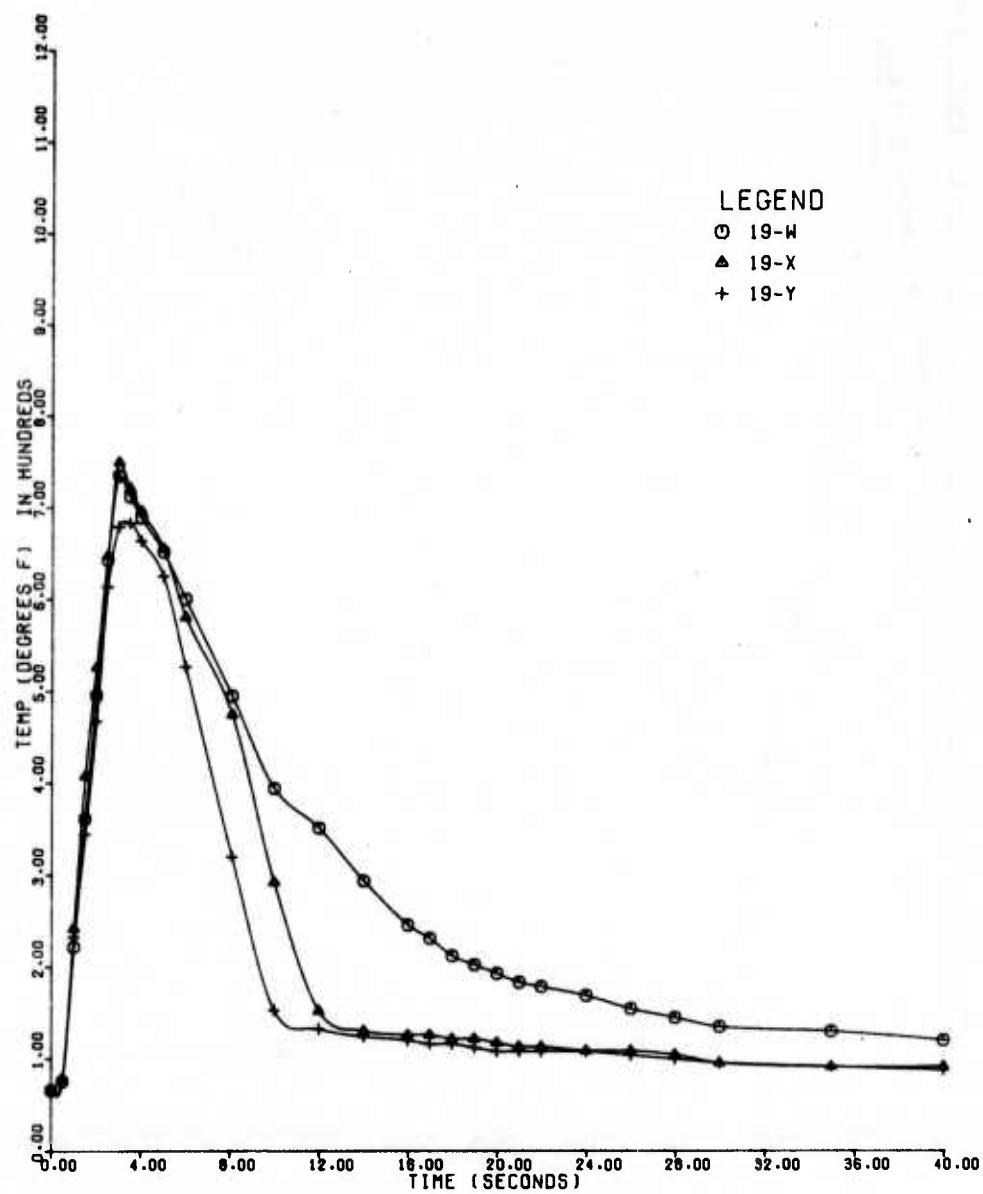


FIGURE B-22

CVA Magazine Test
No. 6 14 November 1973

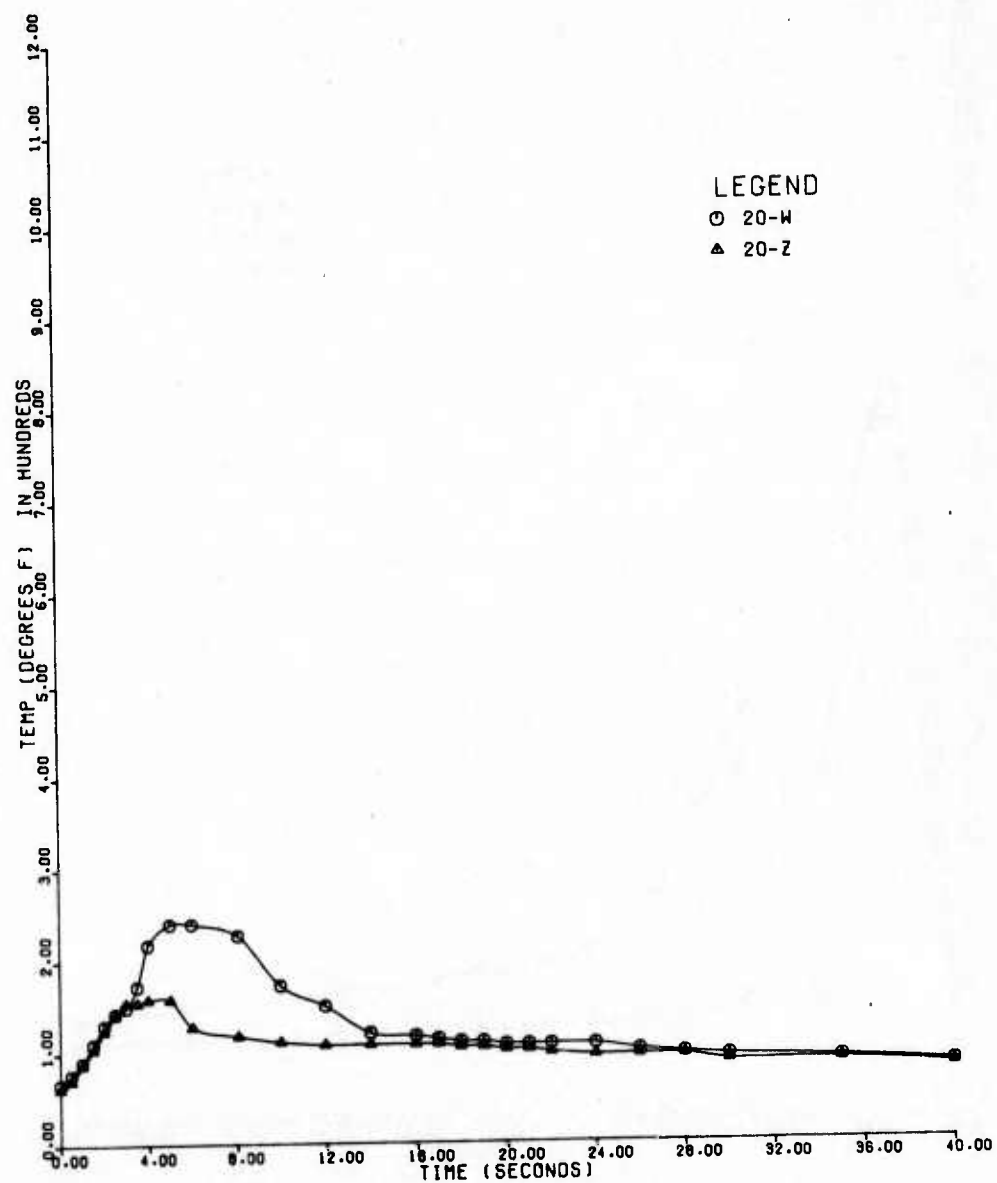


FIGURE B-23
CVA Magazine Test
No. 6 14 November 1973

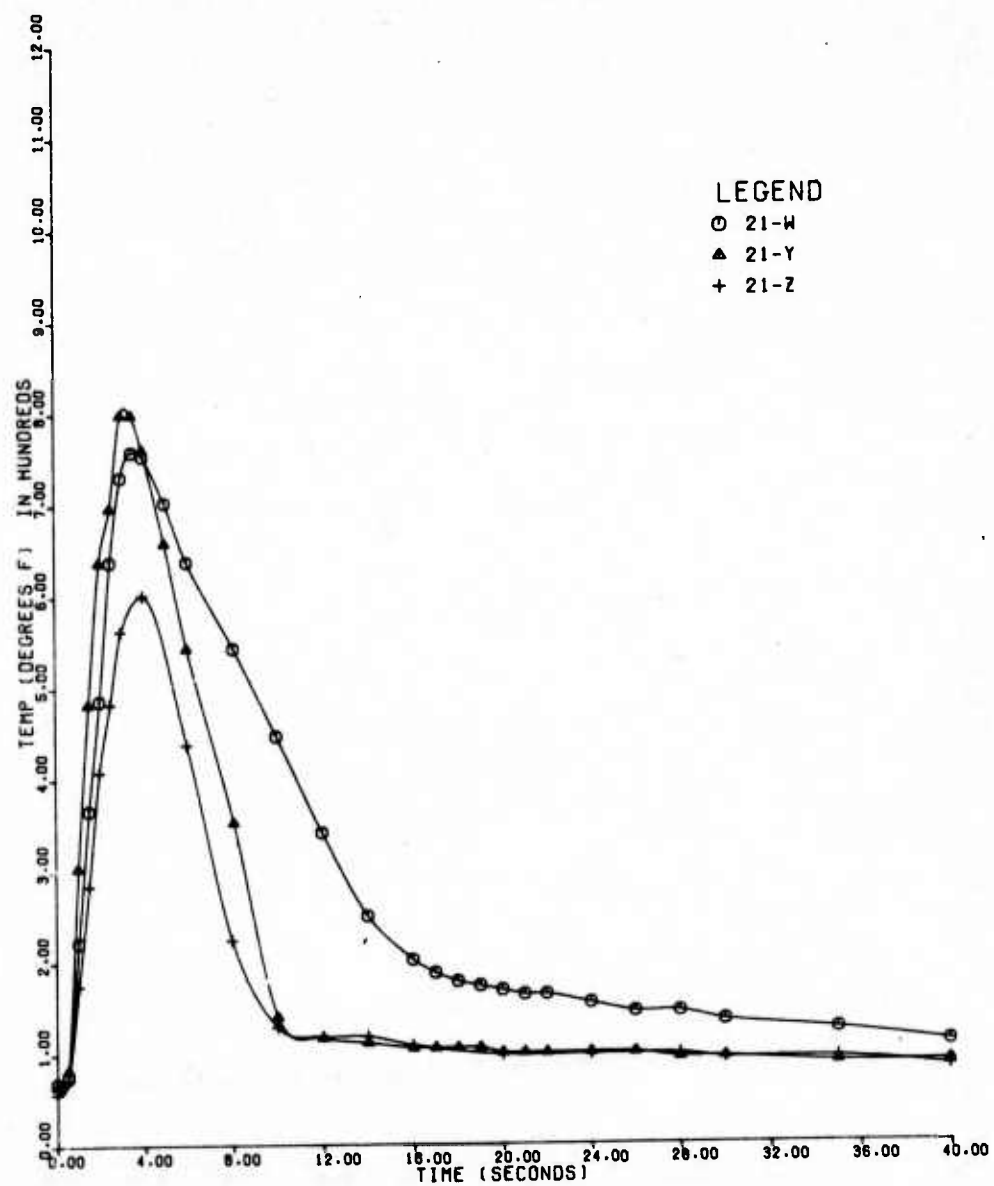


FIGURE B-24

CVA Magazine Test
No. 6 14 November 1973

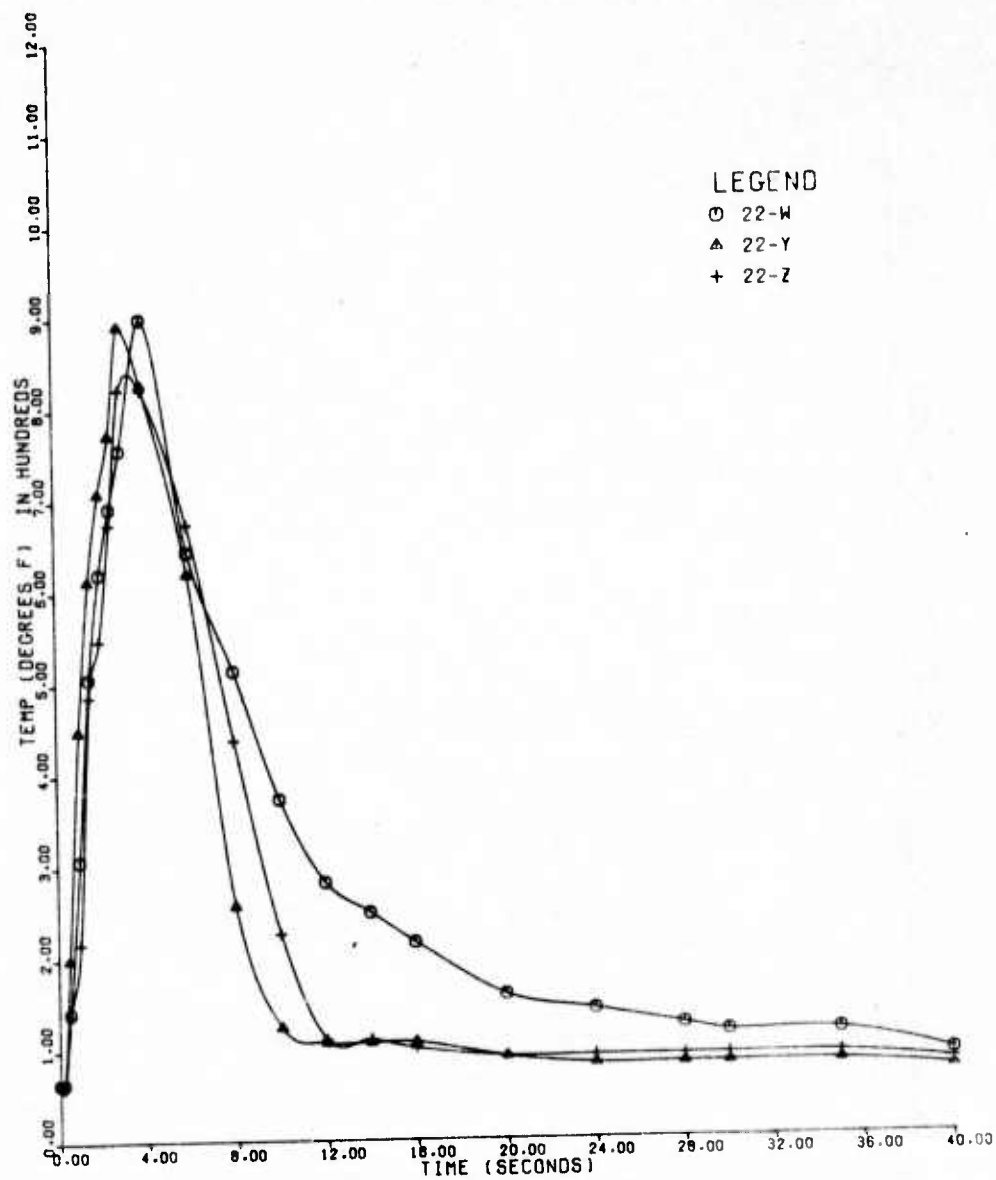


FIGURE B-25

CVA Magazine Test
No. 6 14 November 1973

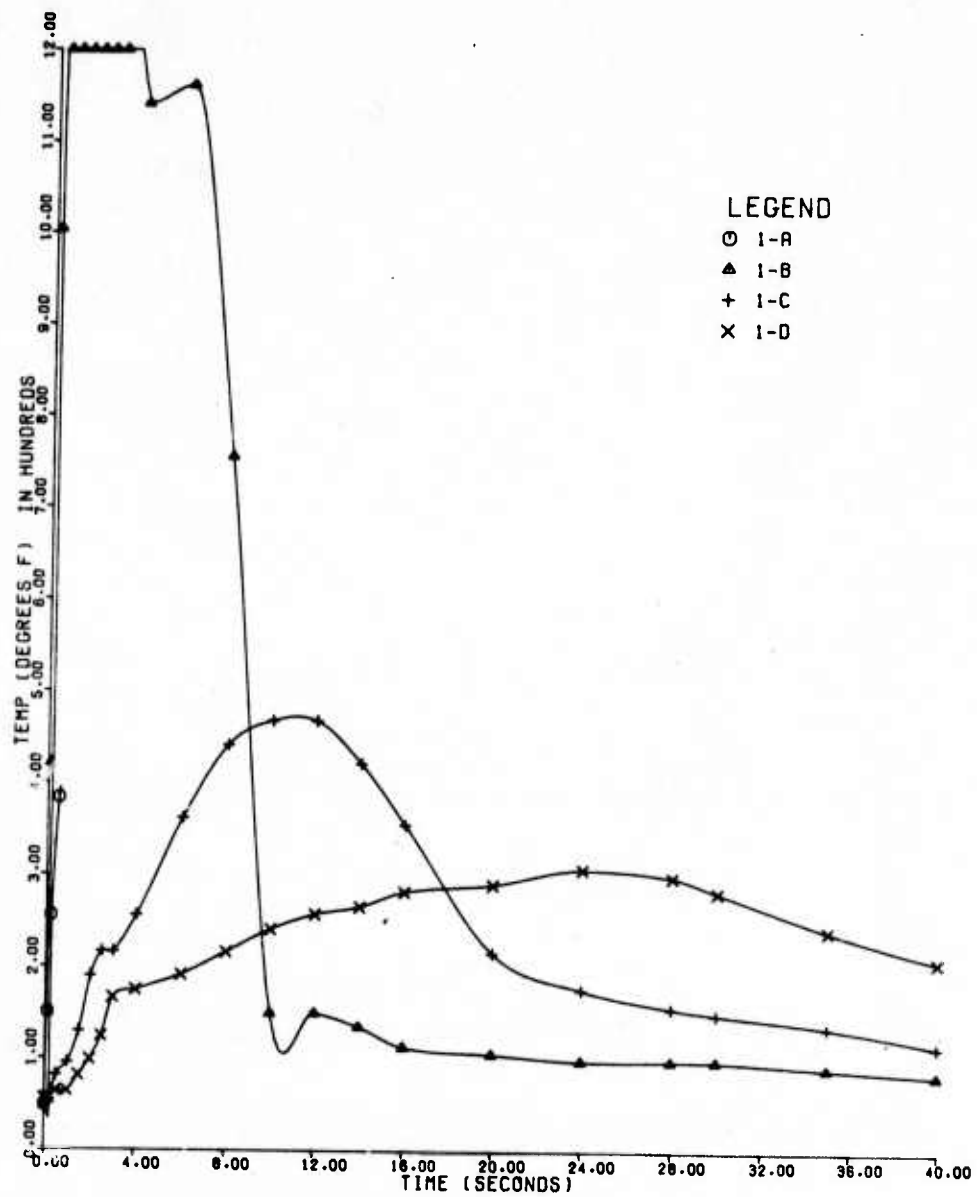


FIGURE B-26

CVA Magazine Test
No. 6 14 November 1973

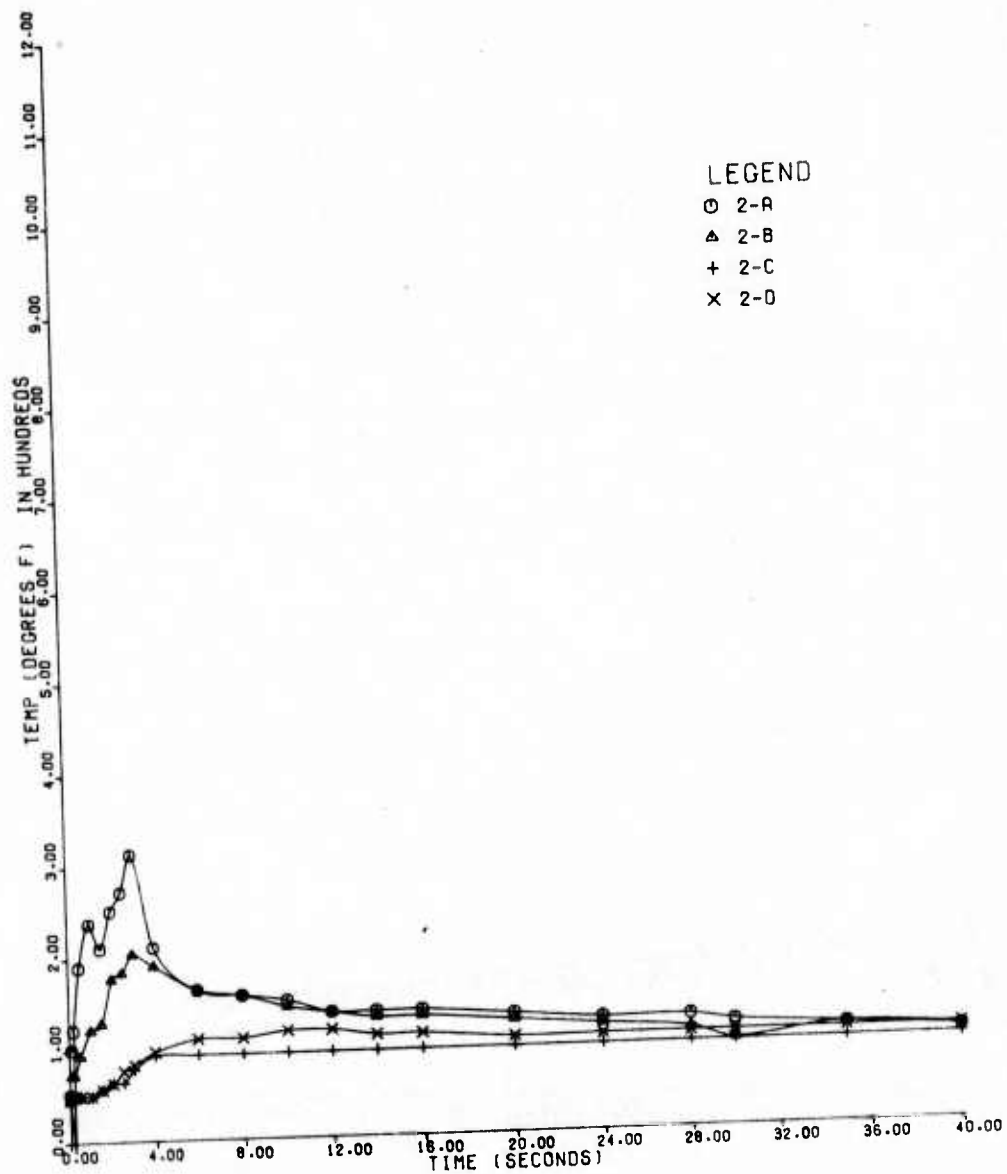


FIGURE B-27

CVA Magazine Test
No. 6 14 November 1973

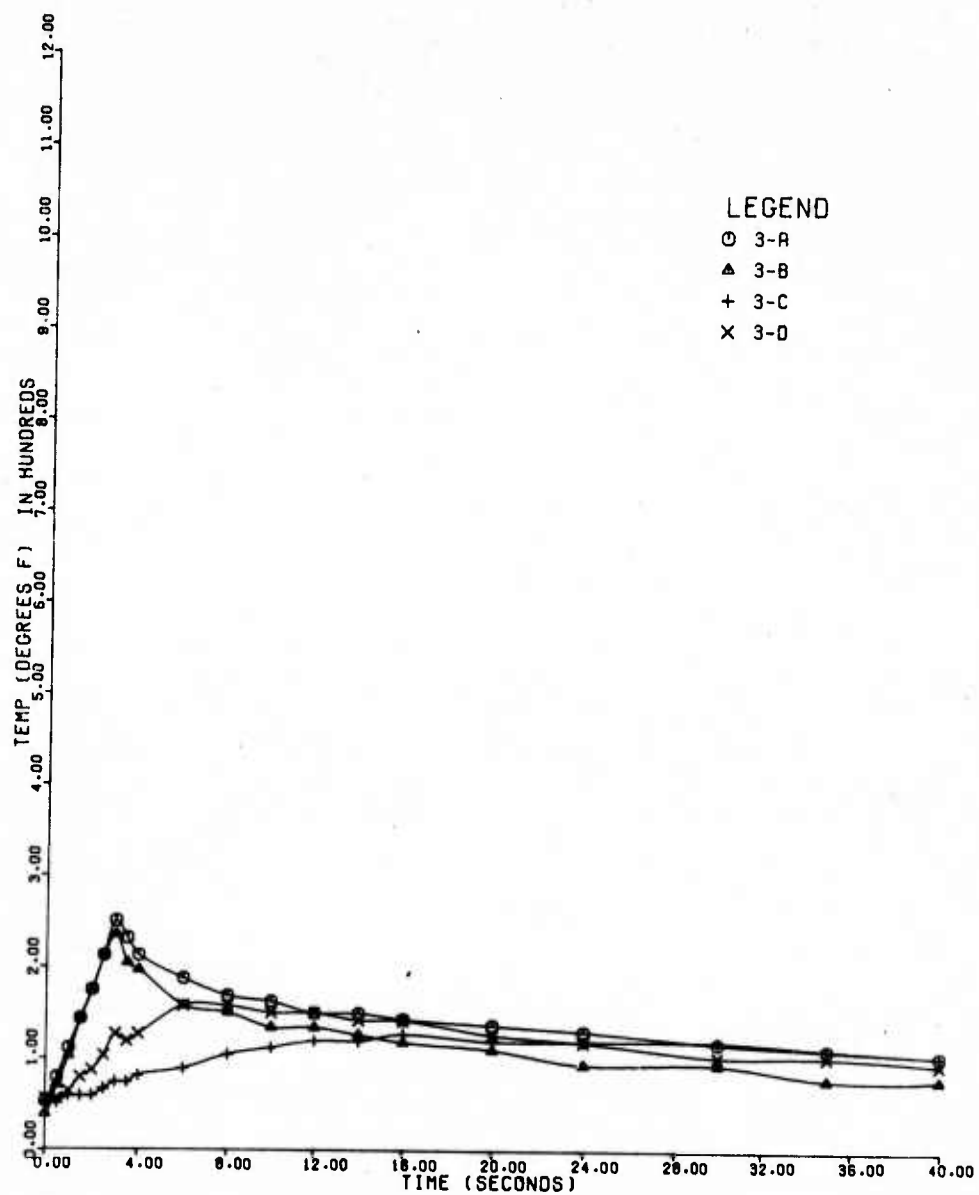


FIGURE B-28

CVA Magazine Test
No. 6 14 November 1973

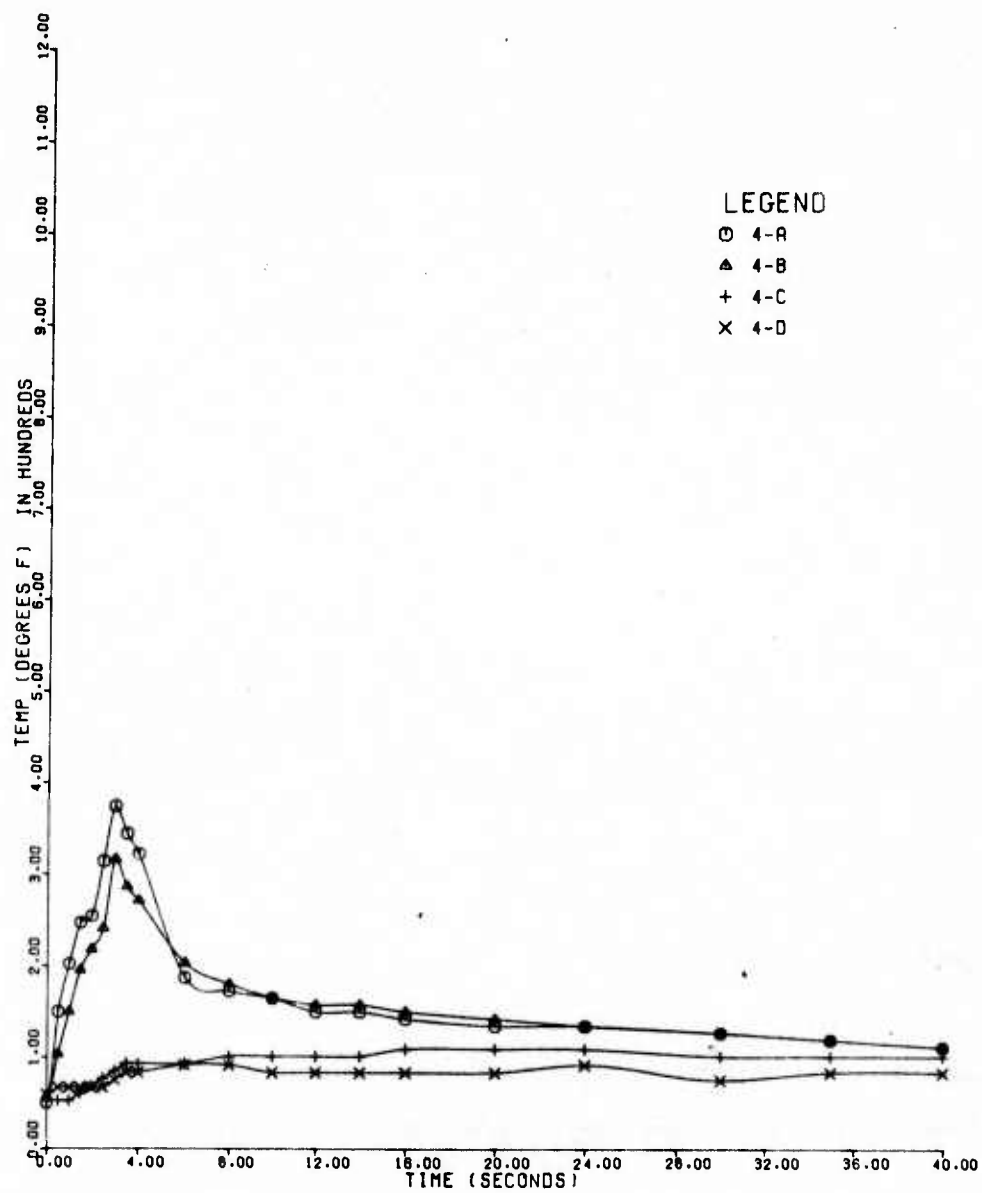


FIGURE B-29

CVA Magazine Test
No. 6 14 November 1973

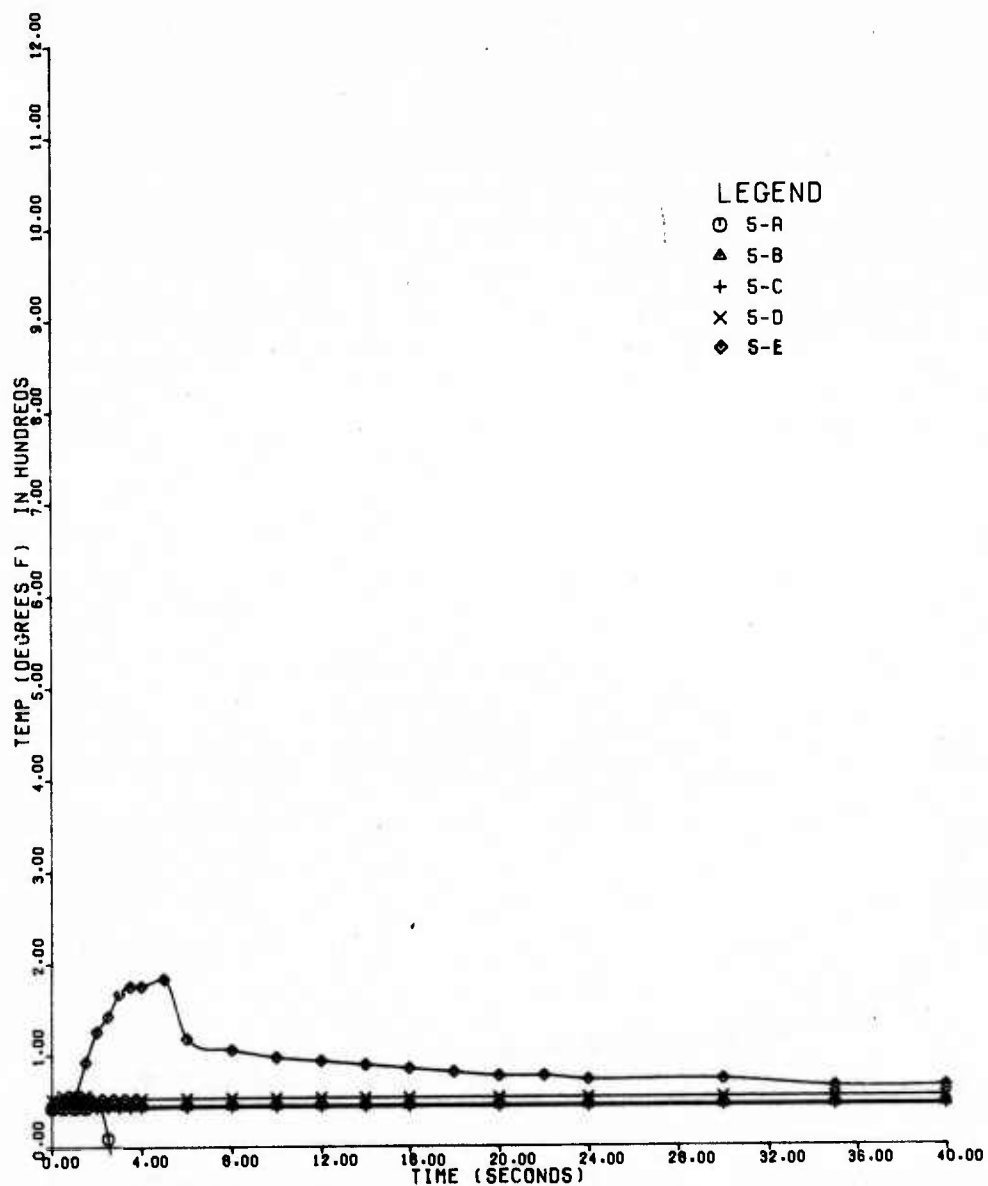


FIGURE B-30

CVA Magazine Test
No. 6 14 November 1973

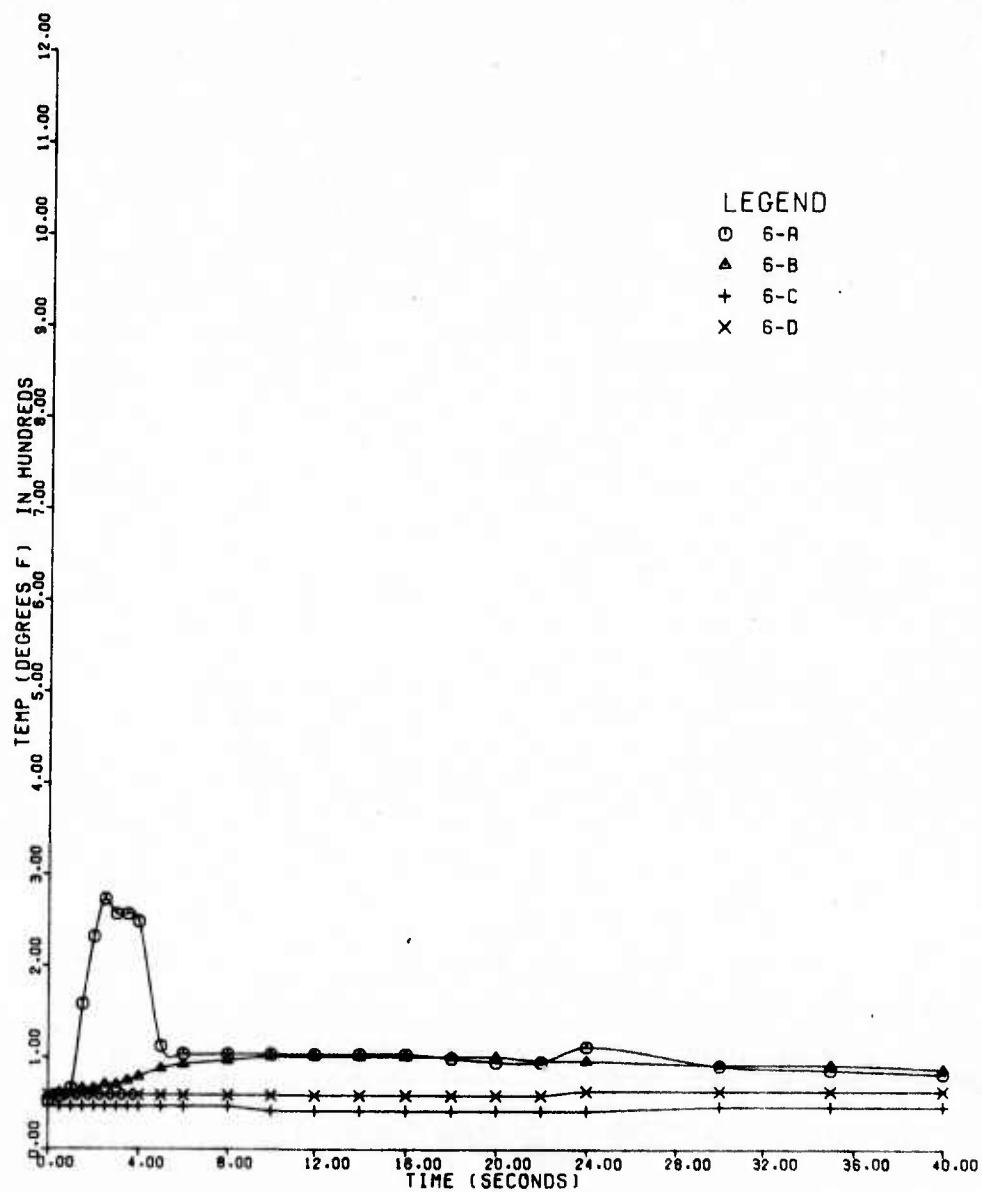


FIGURE B-31

CVA Magazine Test
No. 6 14 November 1973

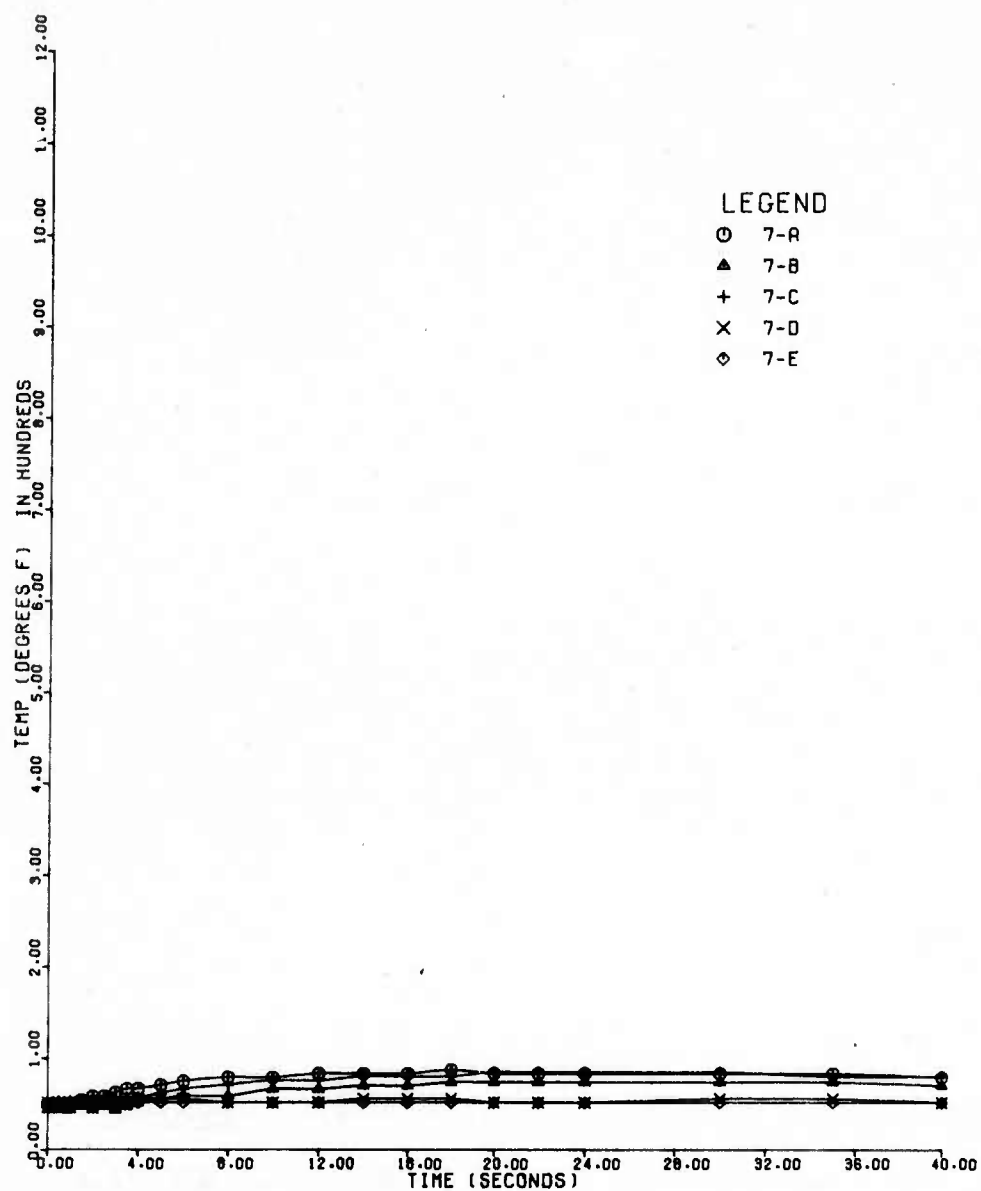


FIGURE B-32

CVA Magazine Test
No. 6 14 November 1973

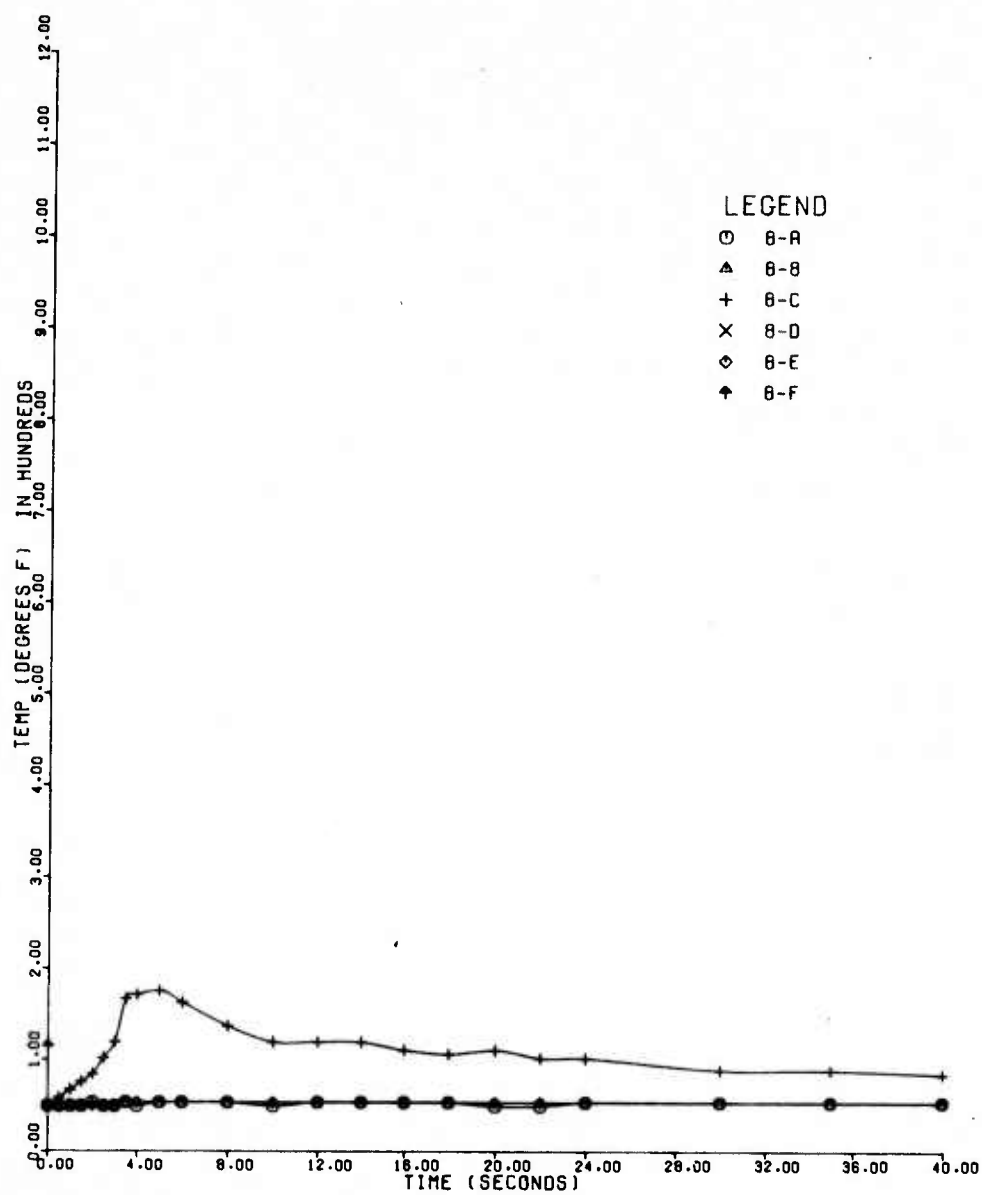


FIGURE B-33

CVA Magazine Test
No. 6 14 November 1973

APPENDIX C

TEST DATA OBTAINED DURING TEST NO. 7

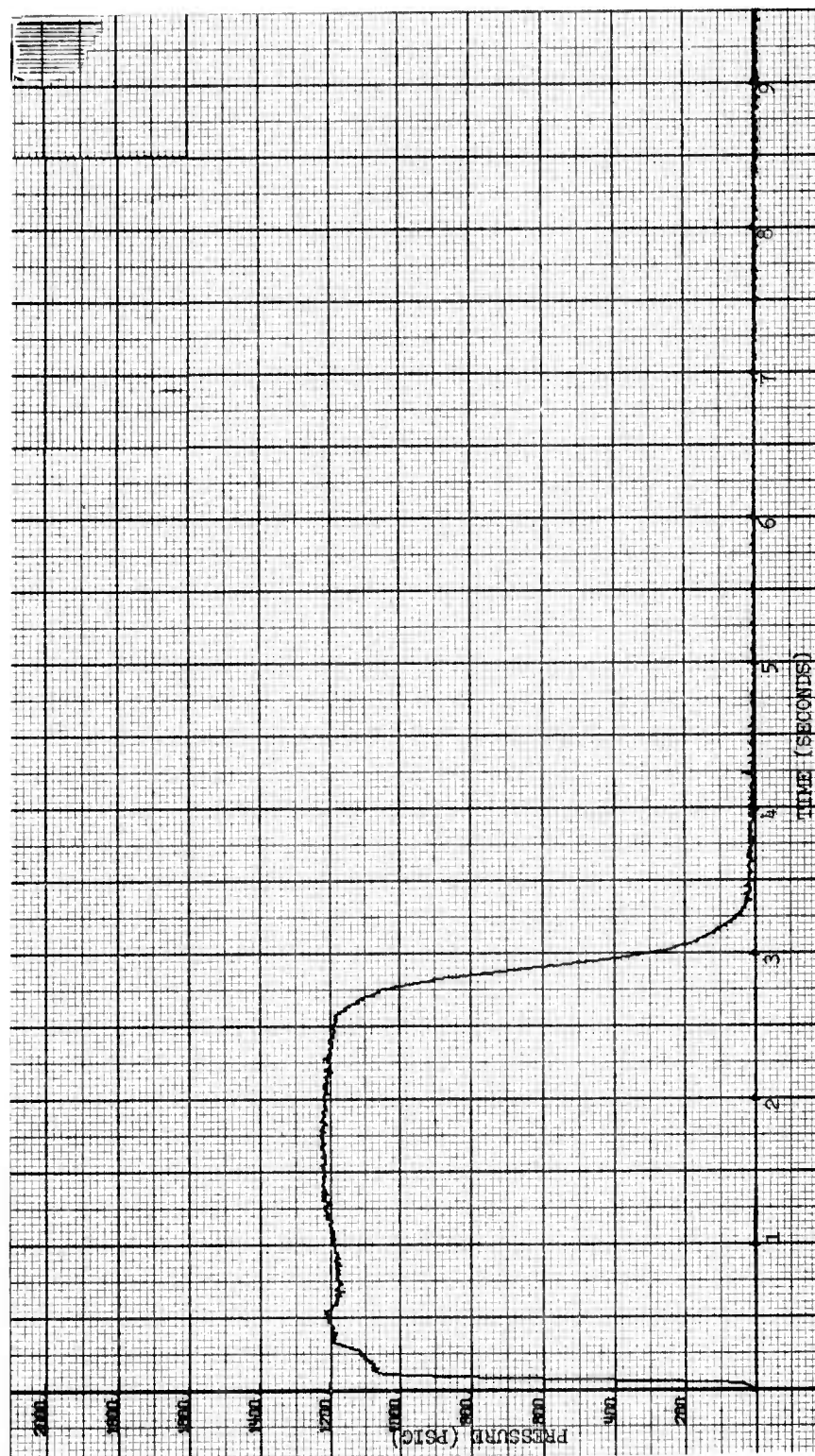


FIGURE C-1

SIDEWINDER MK 38 MOD 0 Motor Pressure
Test No. 7

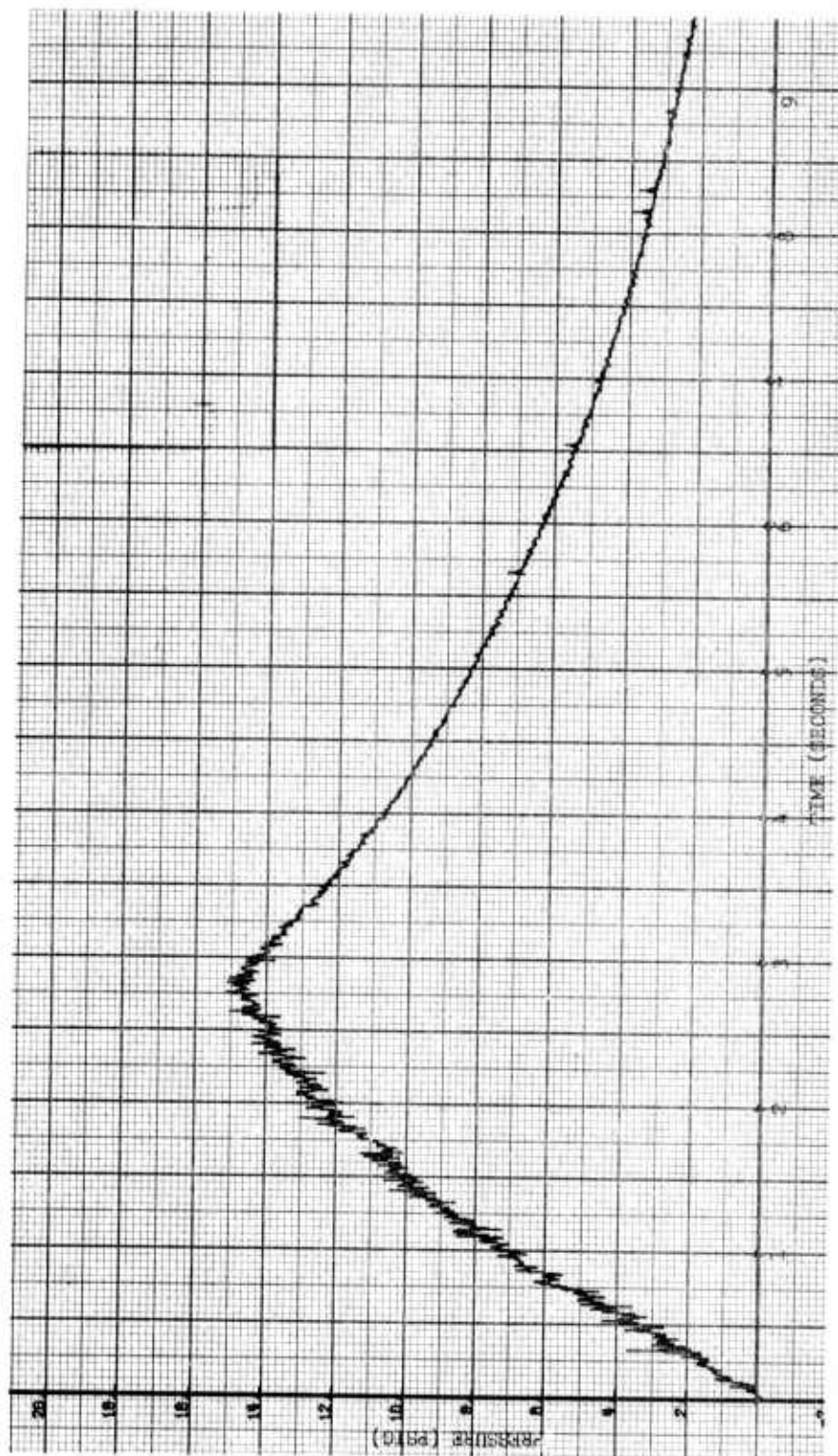


FIGURE C-2
Pressure Transducer No. 1
Test No. 7

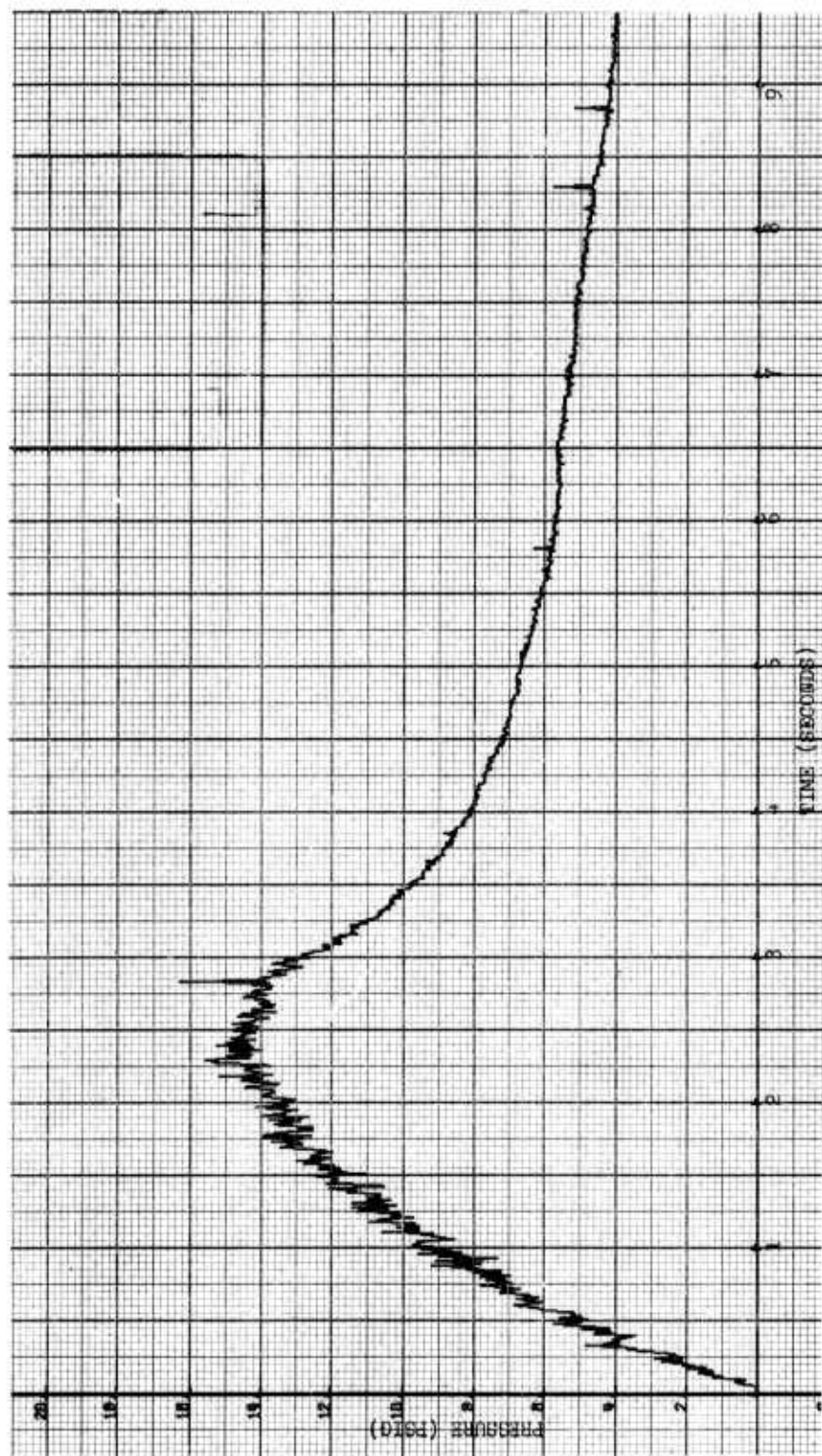


FIGURE C-3
Pressure Transducer No. 2
Test No. 7

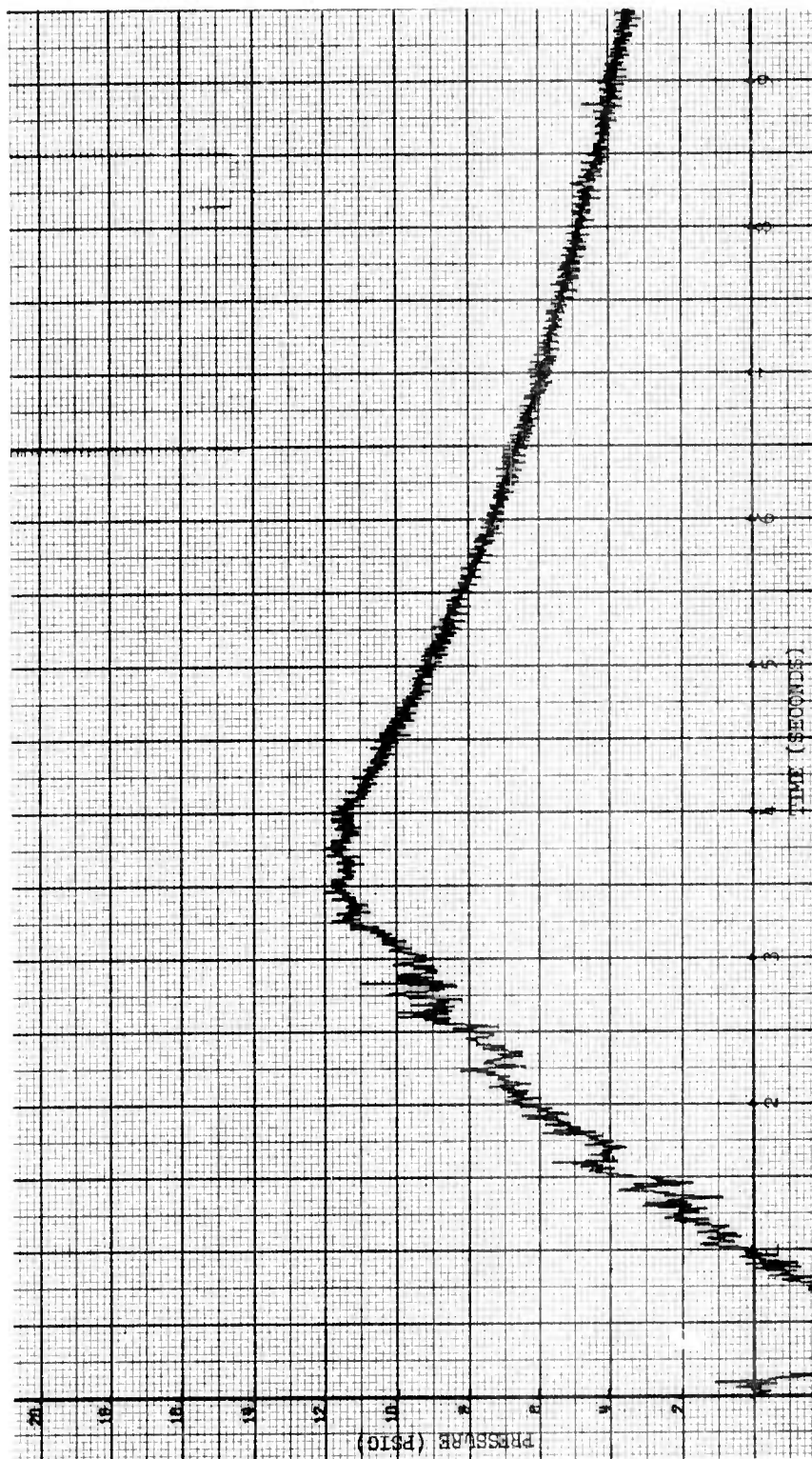


FIGURE C-4
Pressure Transducer No. 3
Test No. 7

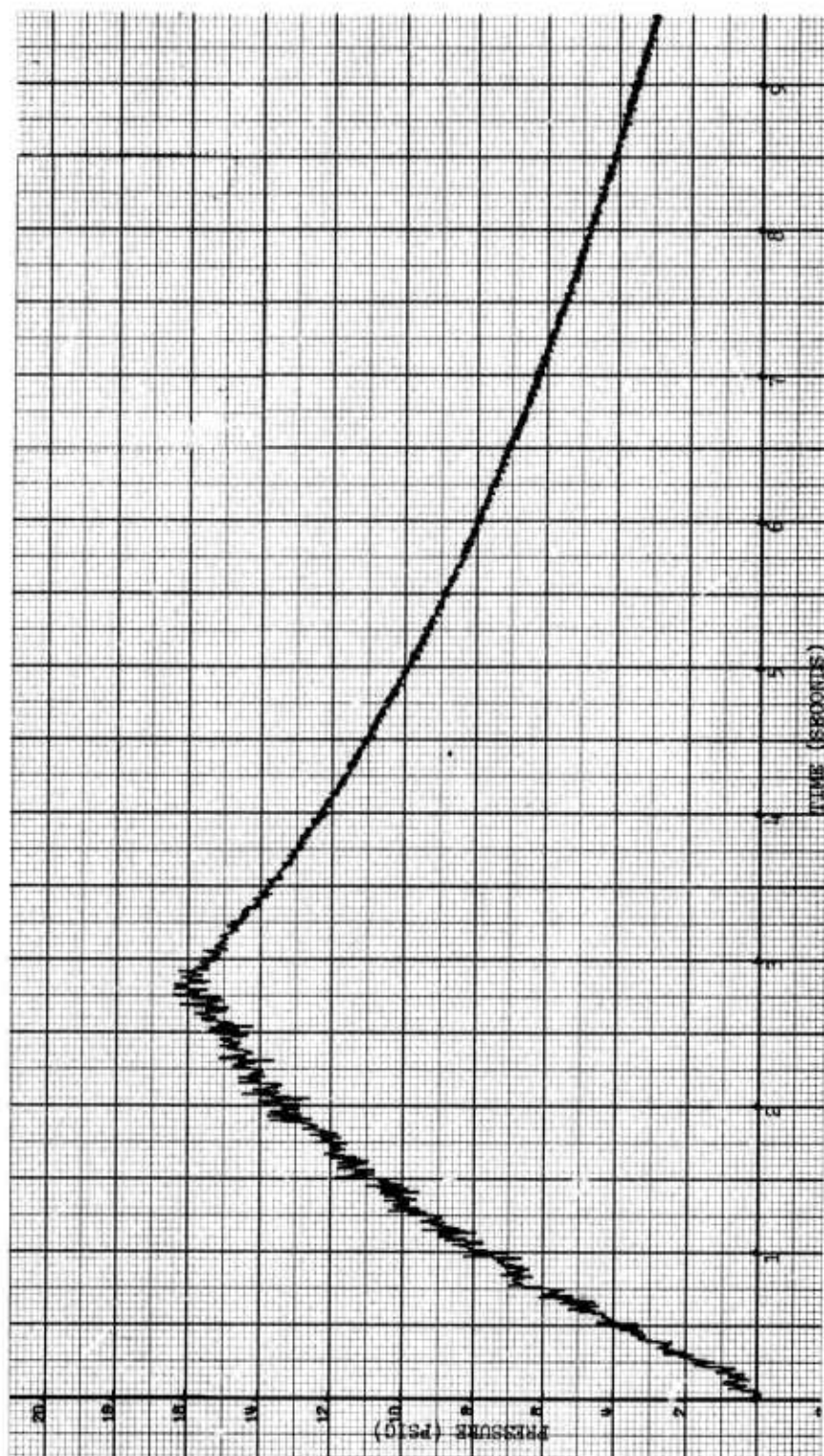


FIGURE C-5
Pressure Transducer No. 4
Test No. 7

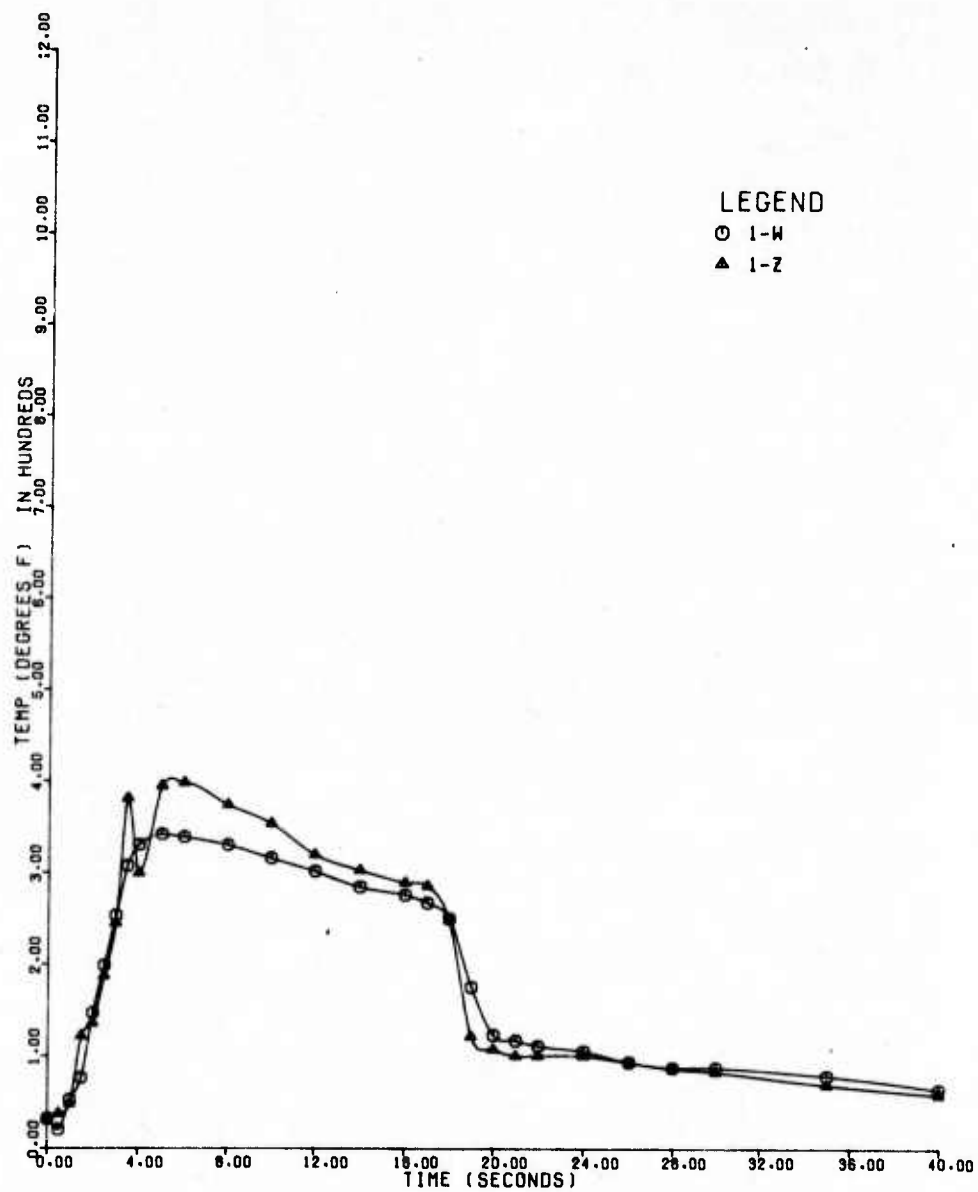


FIGURE C-6

CVA Magazine Test
No. 7 9 January 1974

C-6

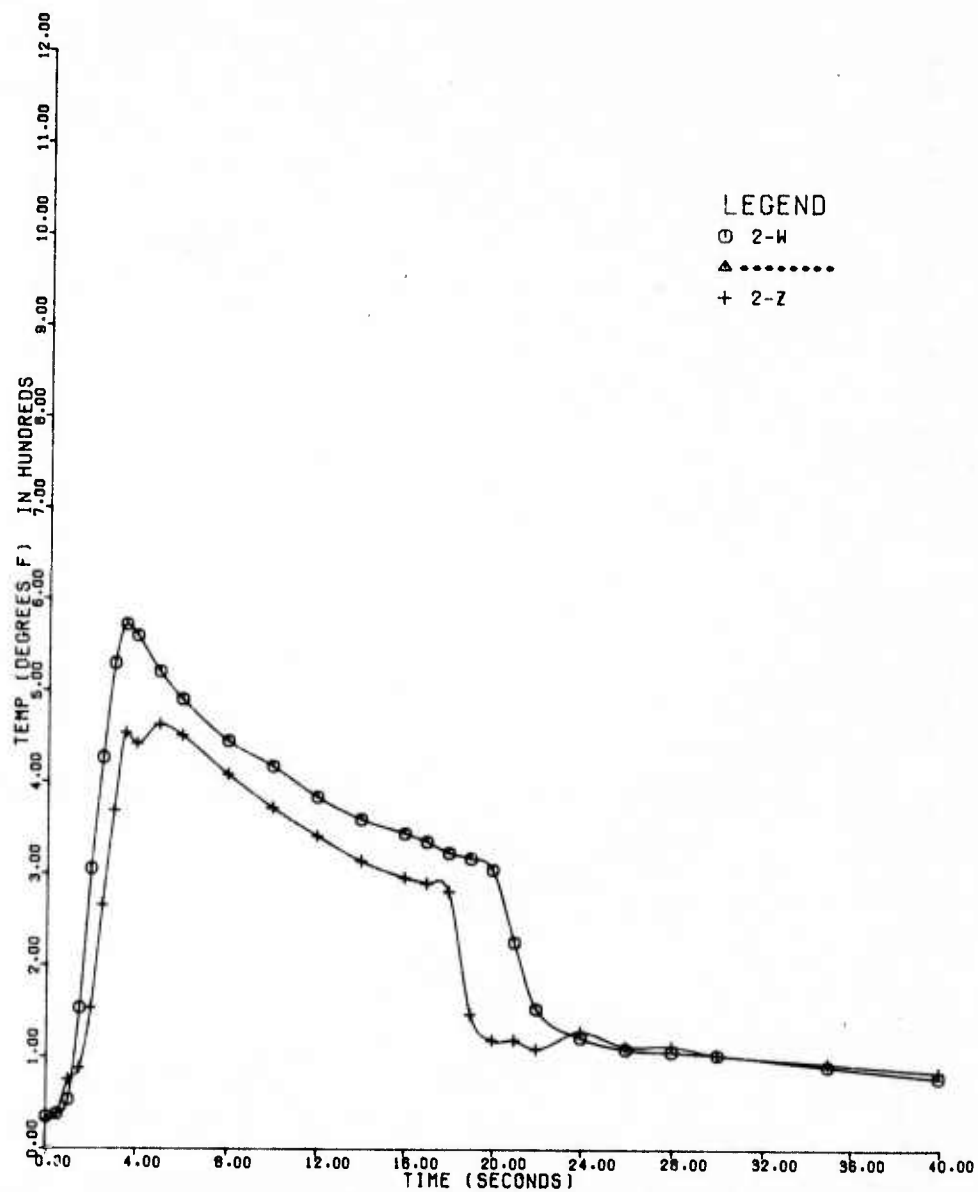


FIGURE C-7

CVA Magazine Test
No. 7 9 January 1974

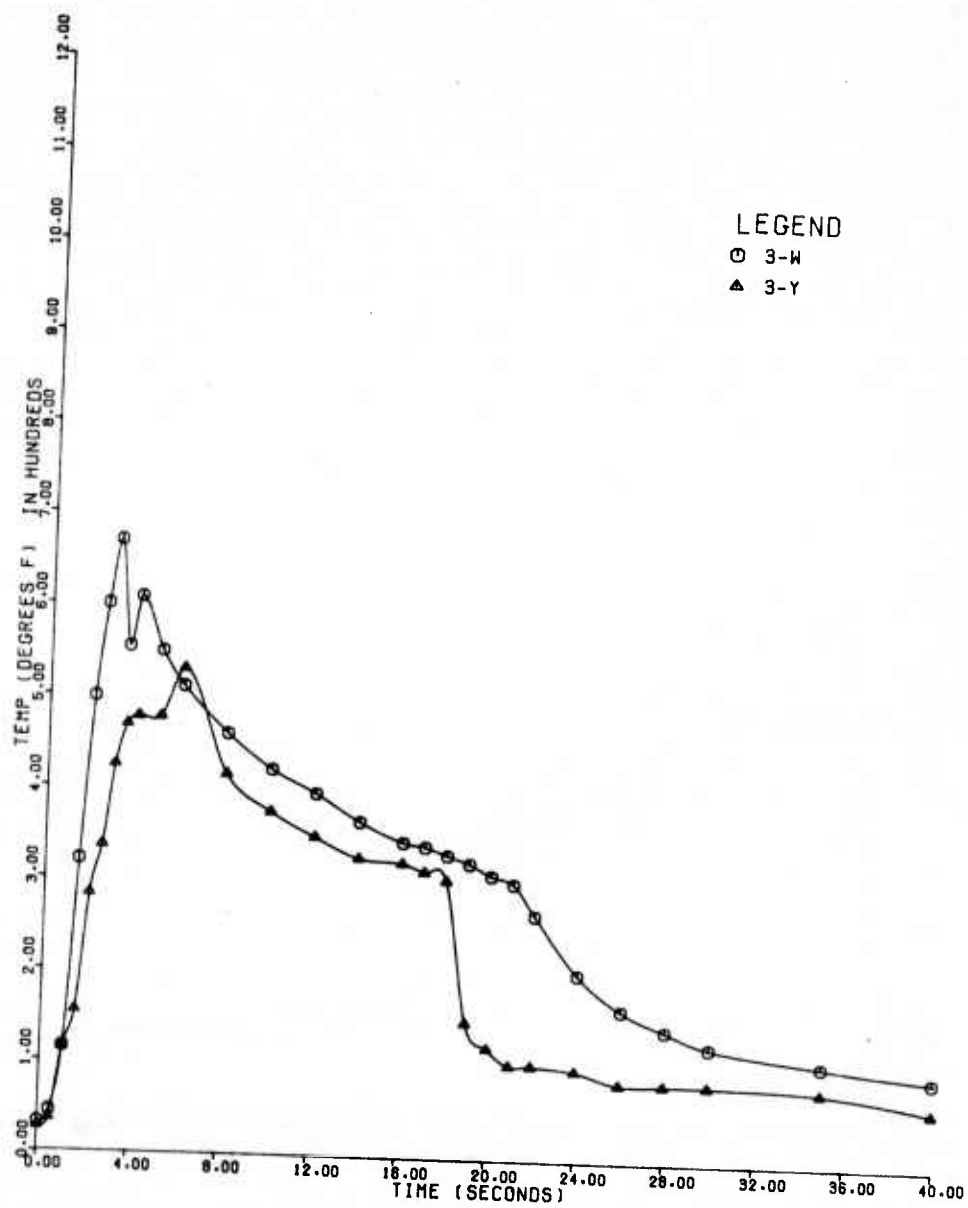


FIGURE C-8

CVA Magazine Test
No. 7 9 January 1974

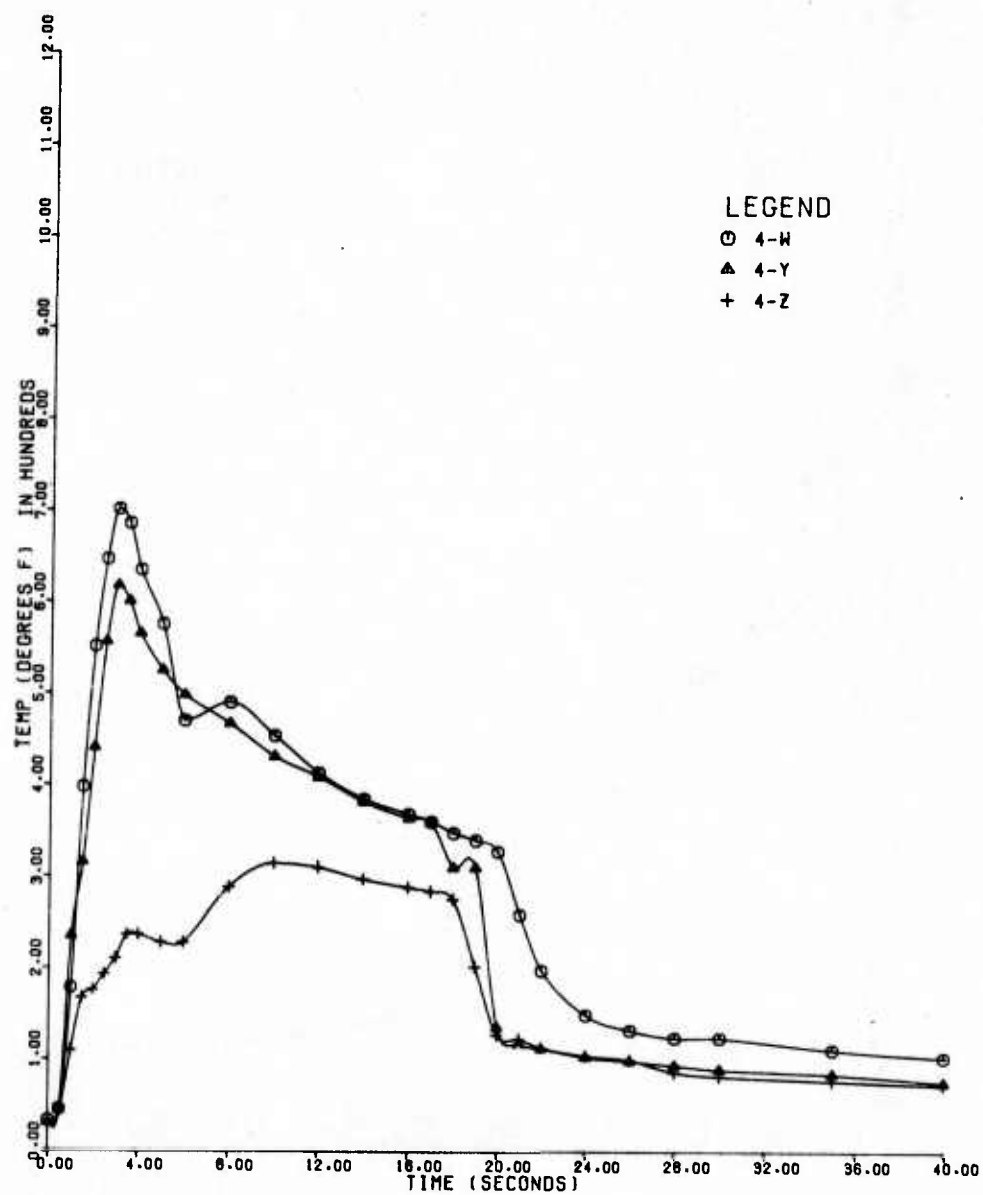


FIGURE C-9

CVA Magazine Test
No. 7 9 January 1974

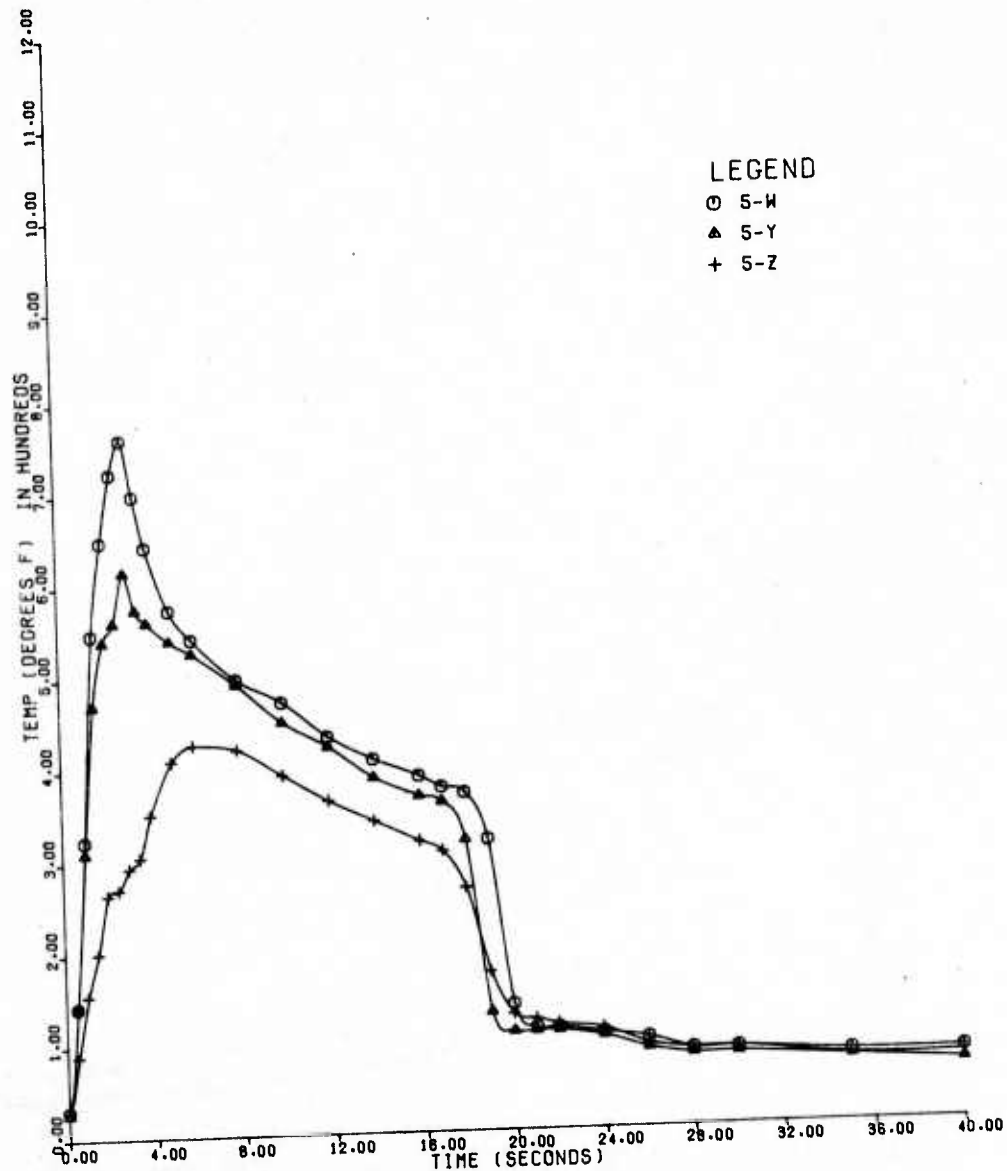


FIGURE C-10

CVA Magazine Test
No. 7 9 January 1974

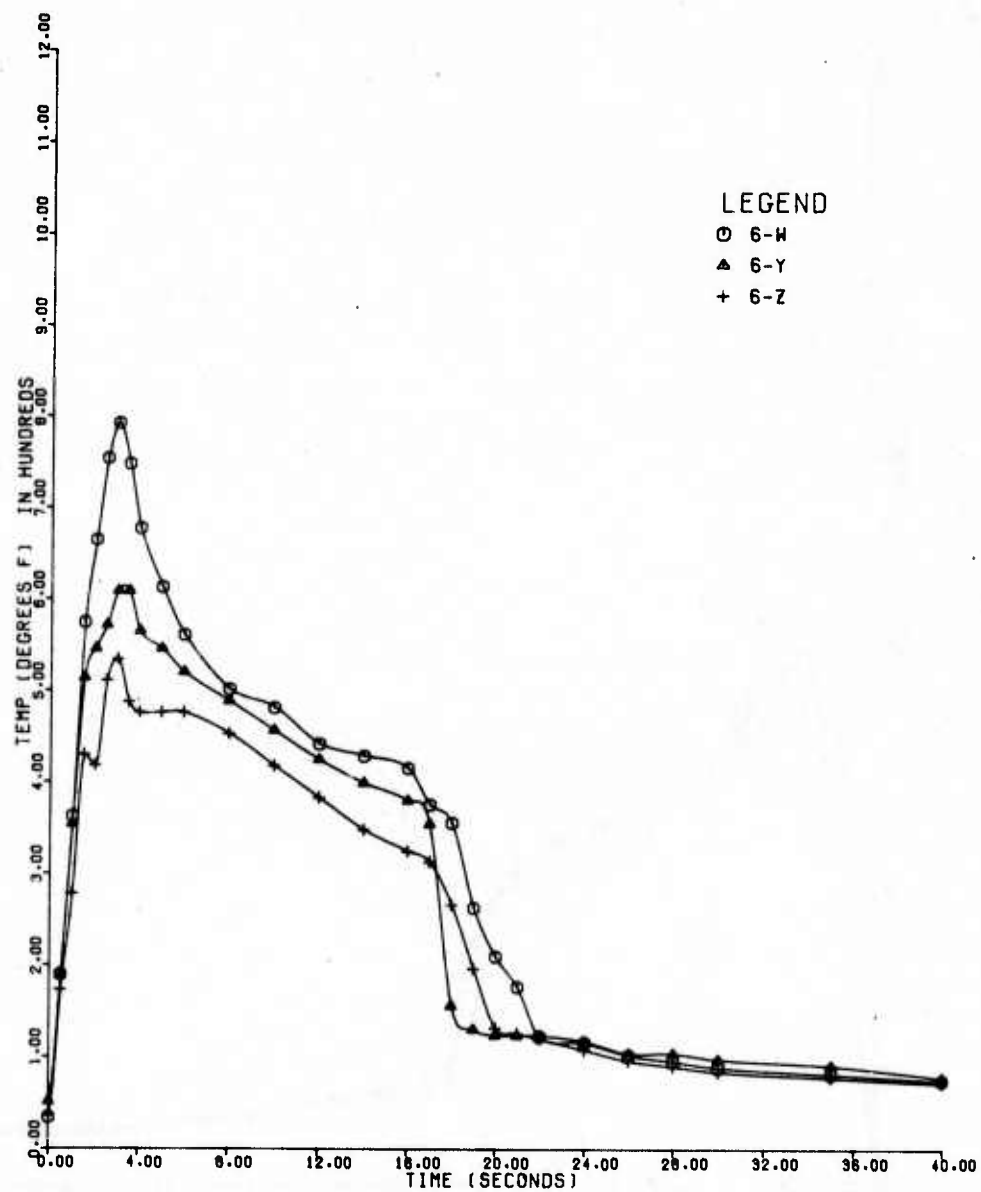


FIGURE C-11

CVA Magazine Test
No. 7 9 January 1974

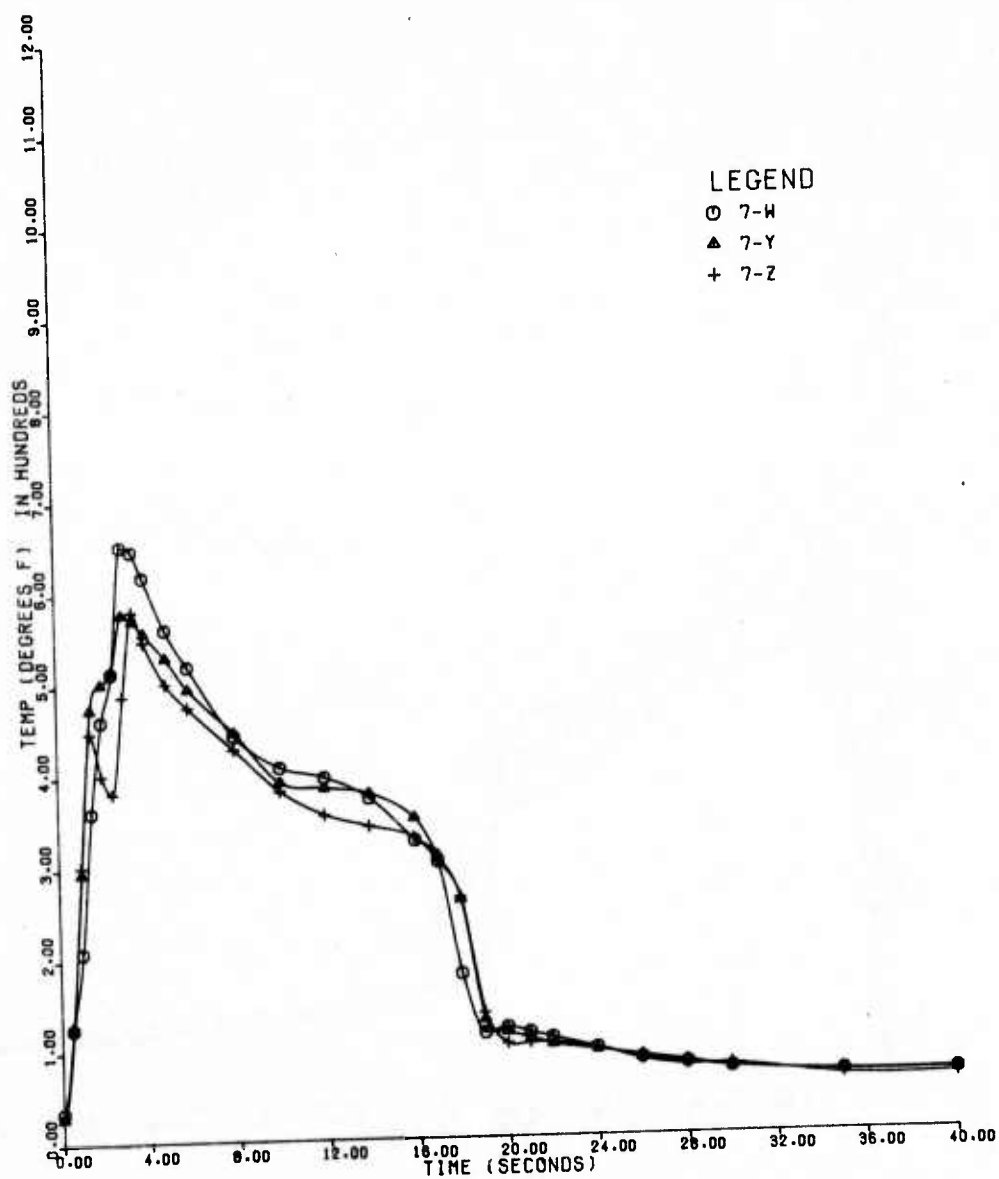


FIGURE C-12

CVA Magazine Test
No. 7 9 January 1974

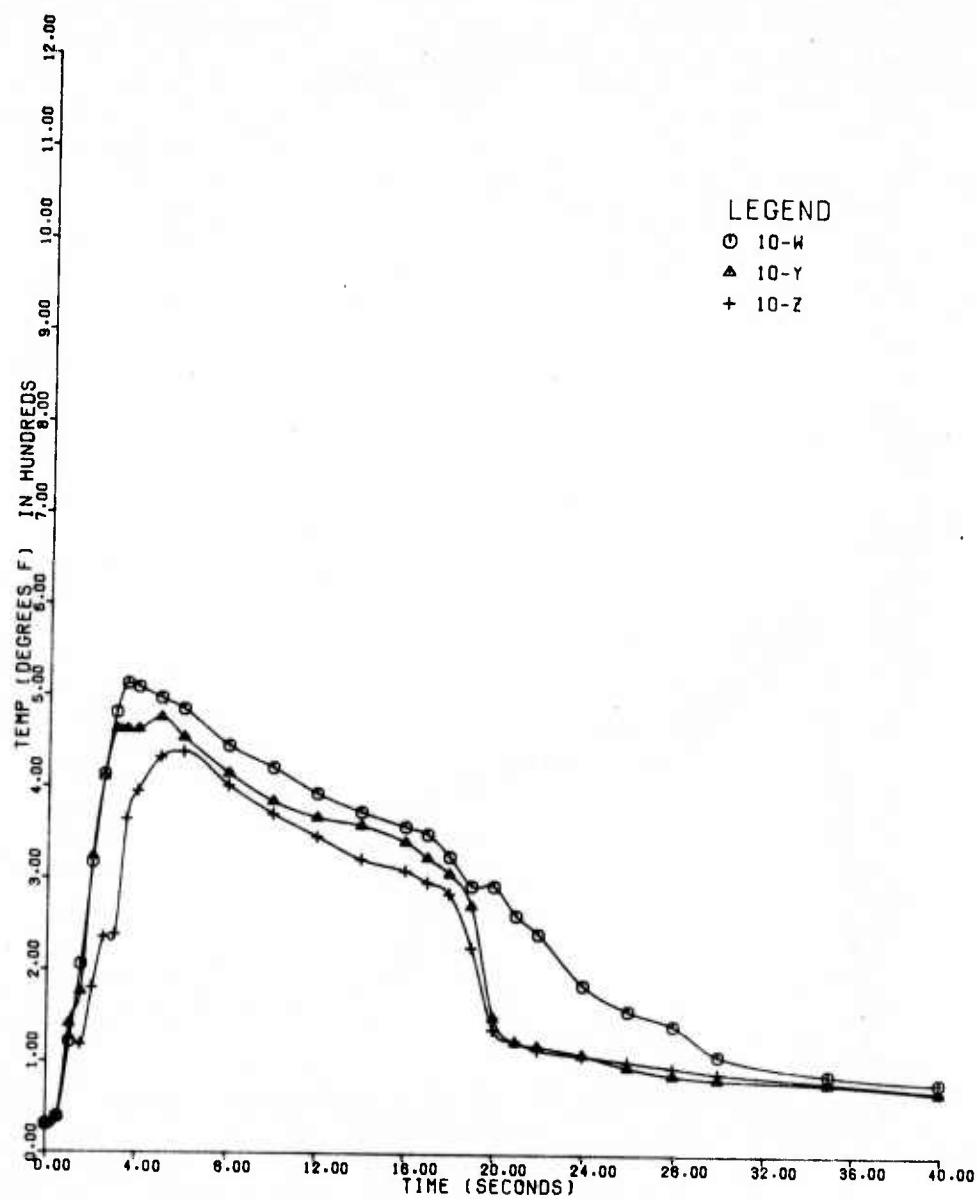


FIGURE C-13

CVA Magazine Test
No. 7 9 January 1974

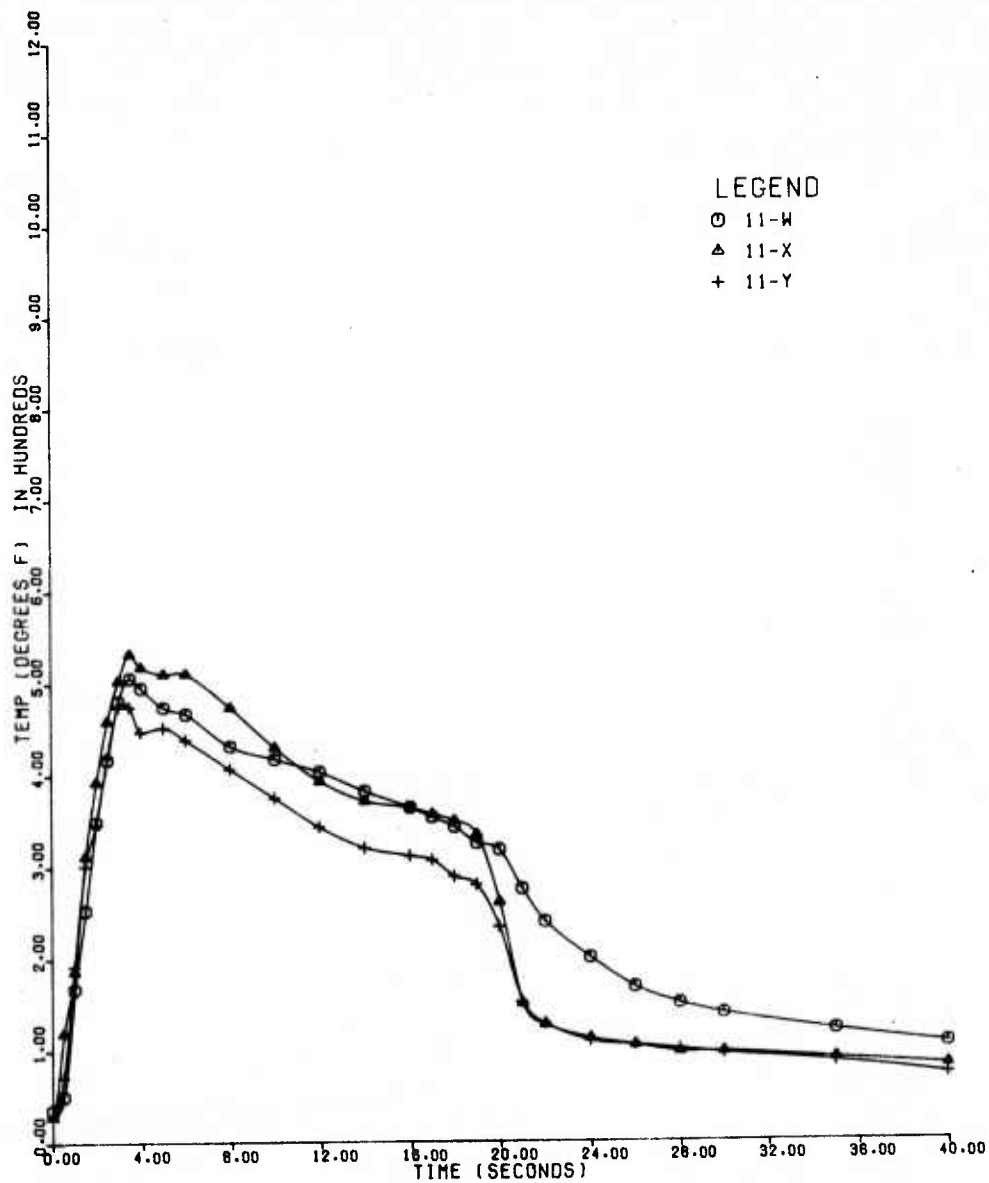


FIGURE C-14

CVA Magazine Test
No. 7 9 January 1974

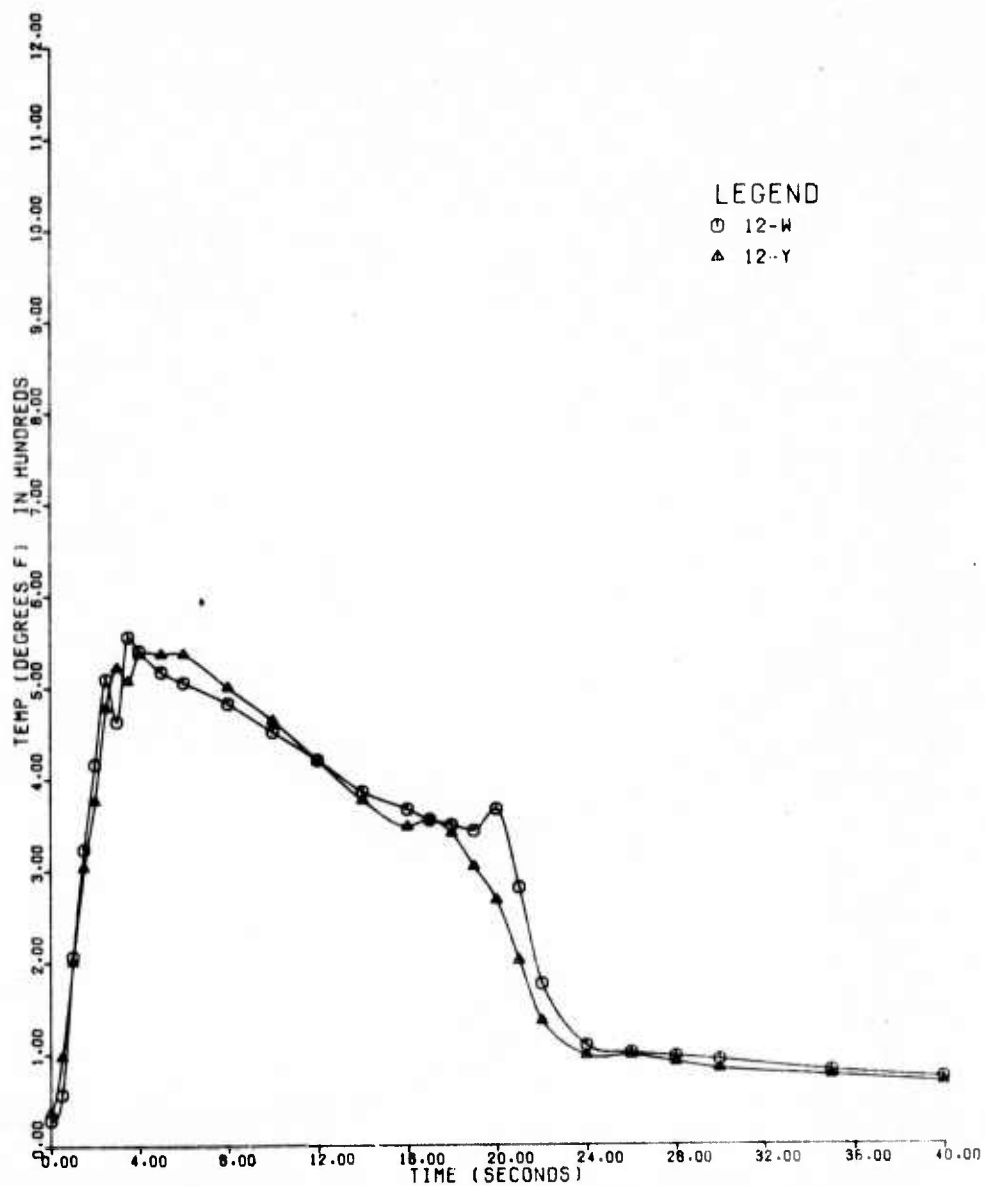


FIGURE C-15
CVA Magazine Test
No. 7 9 January 1974

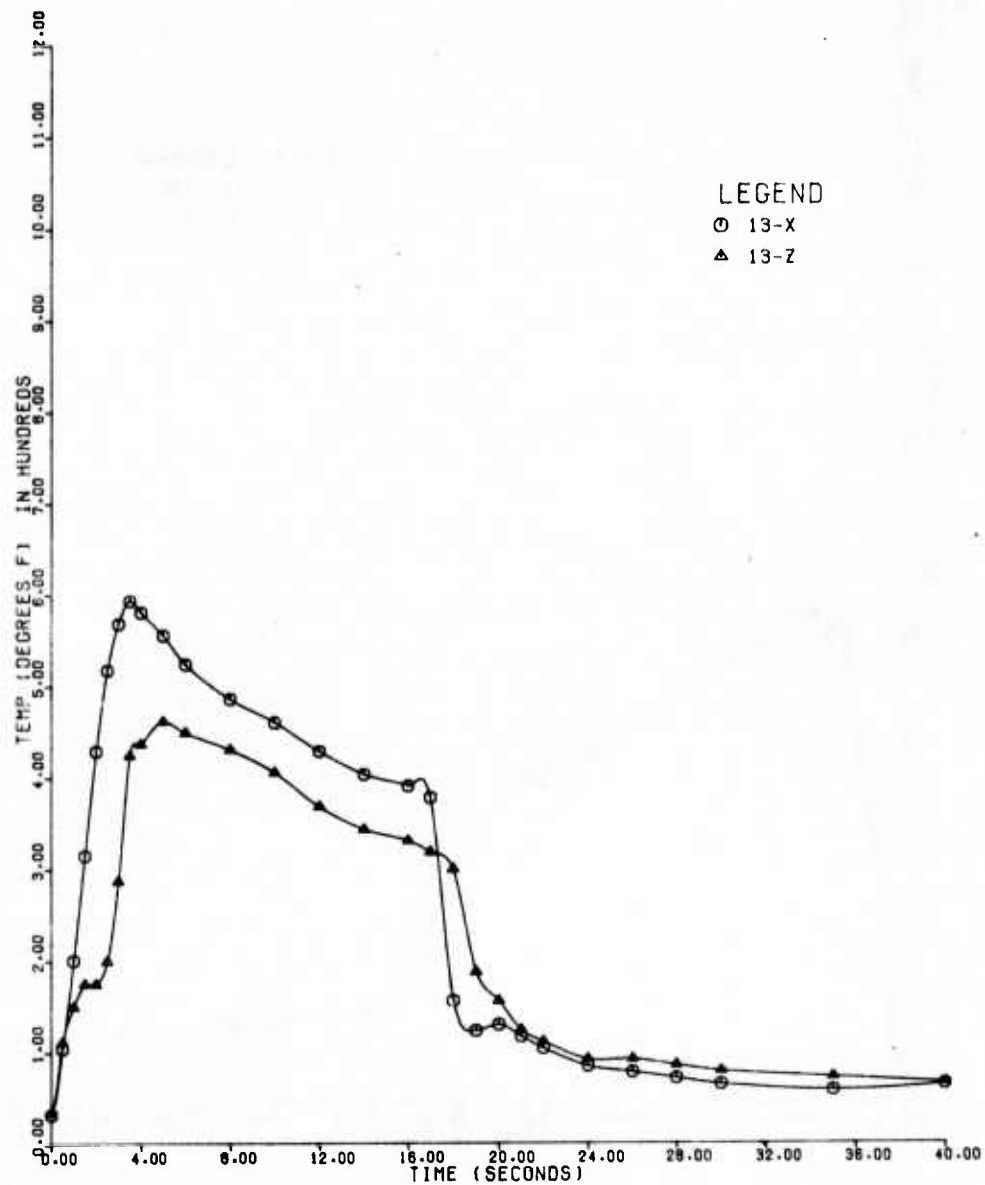


FIGURE C-16

CVA Magazine Test
No. 7 9 January 1974

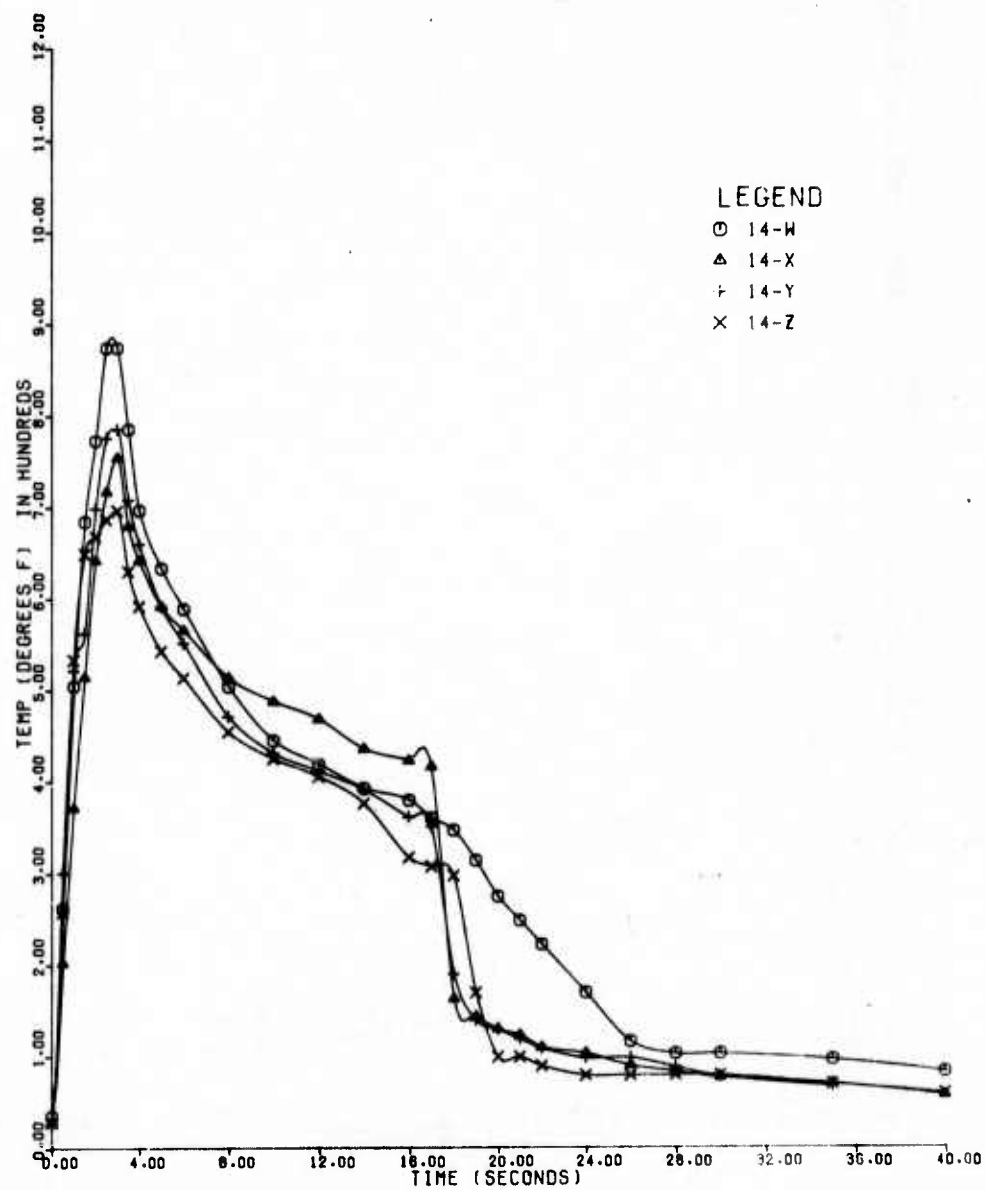


FIGURE C-17

CVA Magazine Test
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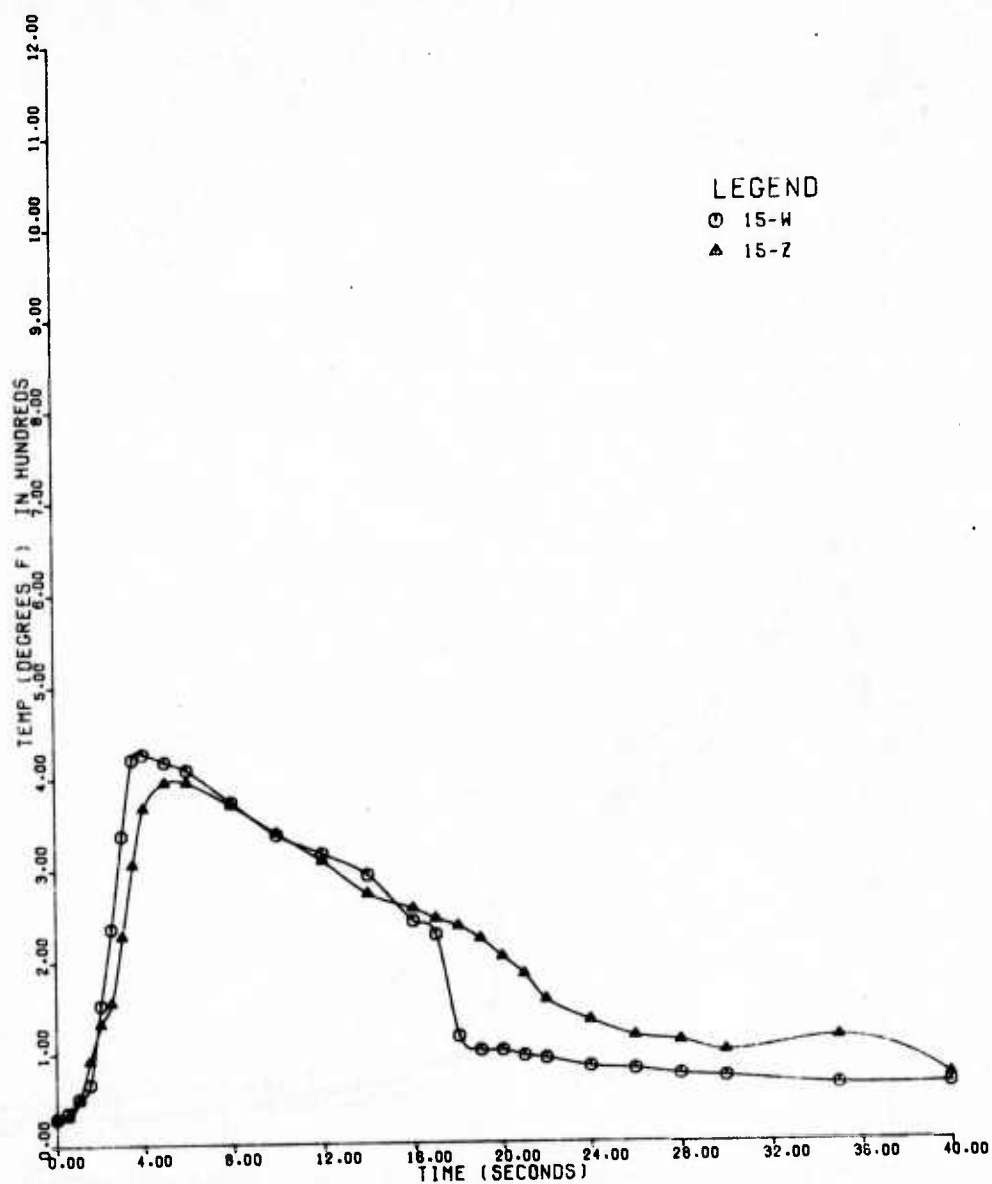


FIGURE C-18

CVA Magazine Test
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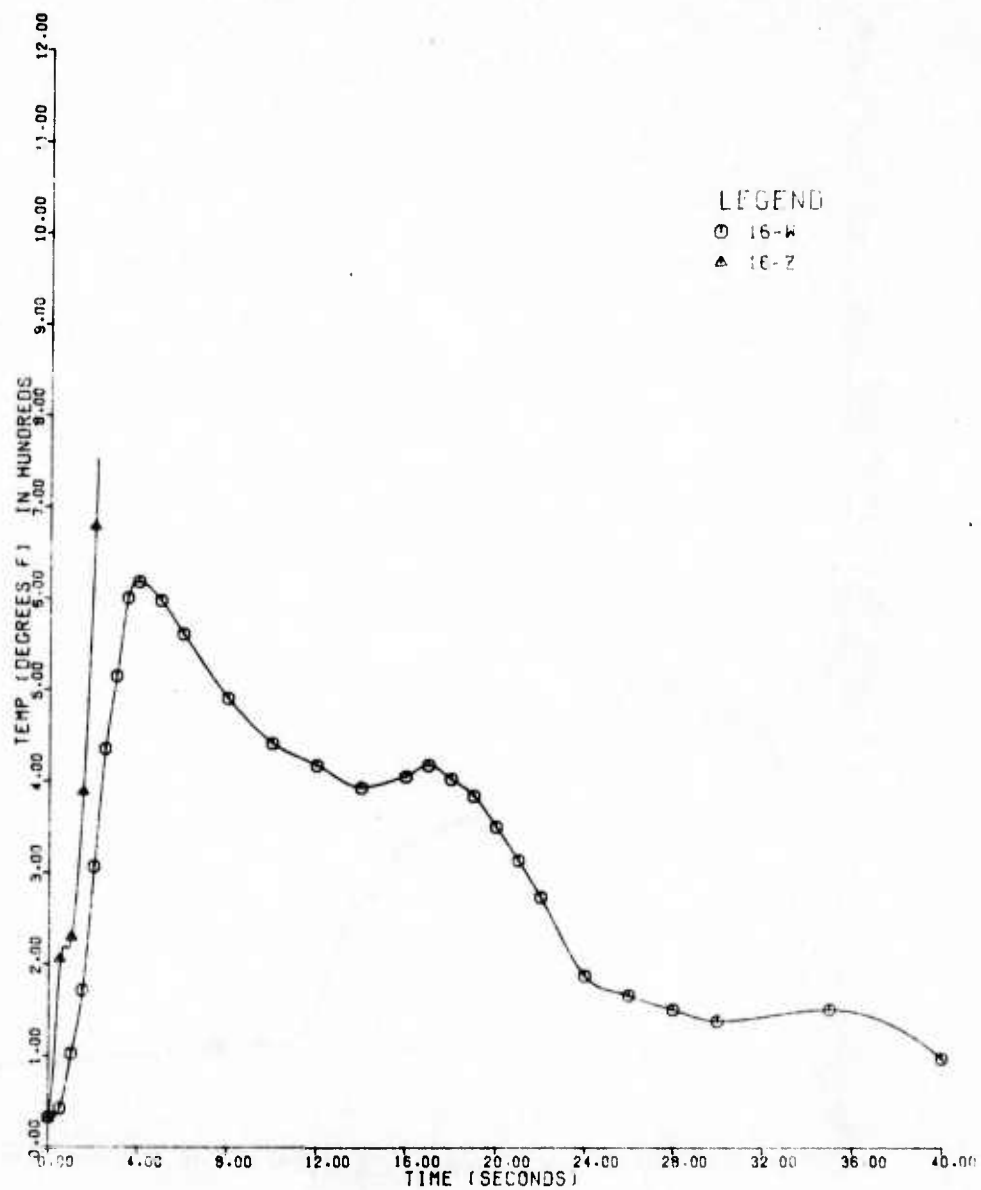


FIGURE C-19

CVA Magazine Test
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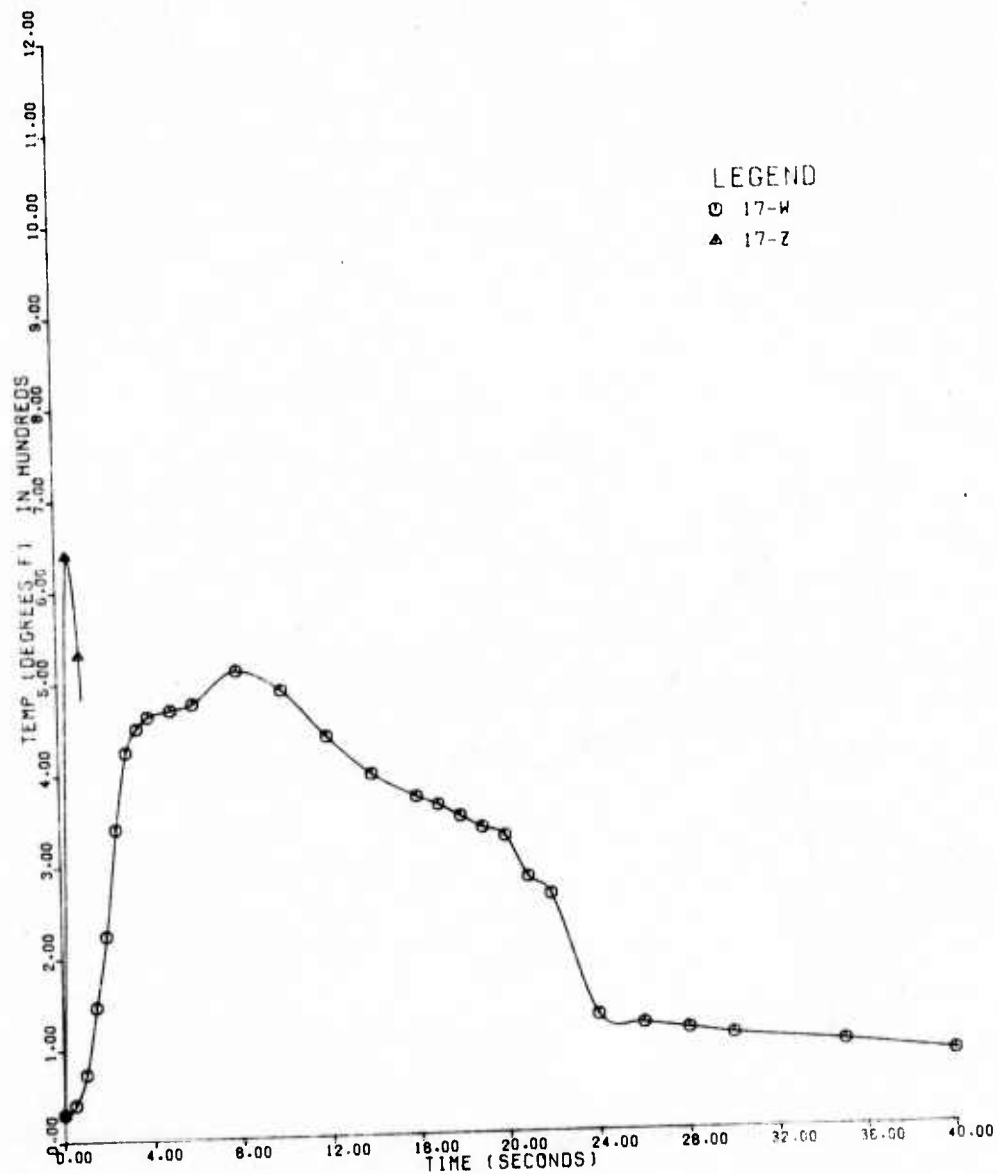


FIGURE C-20

CVA Magazine Test
No. 7 9 January 1974

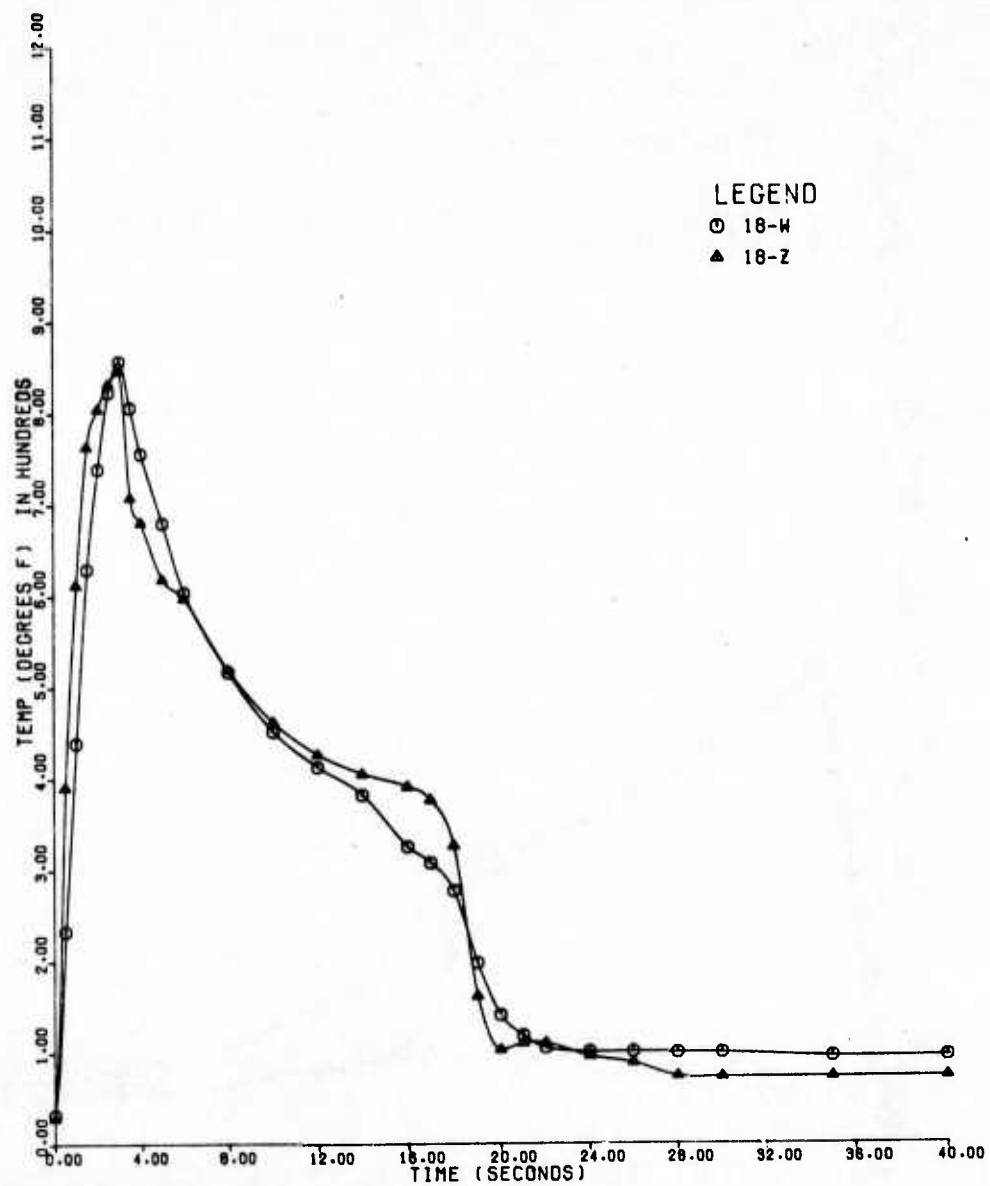


FIGURE C-21

CVA Magazine Test
No. 7 9 January 1974

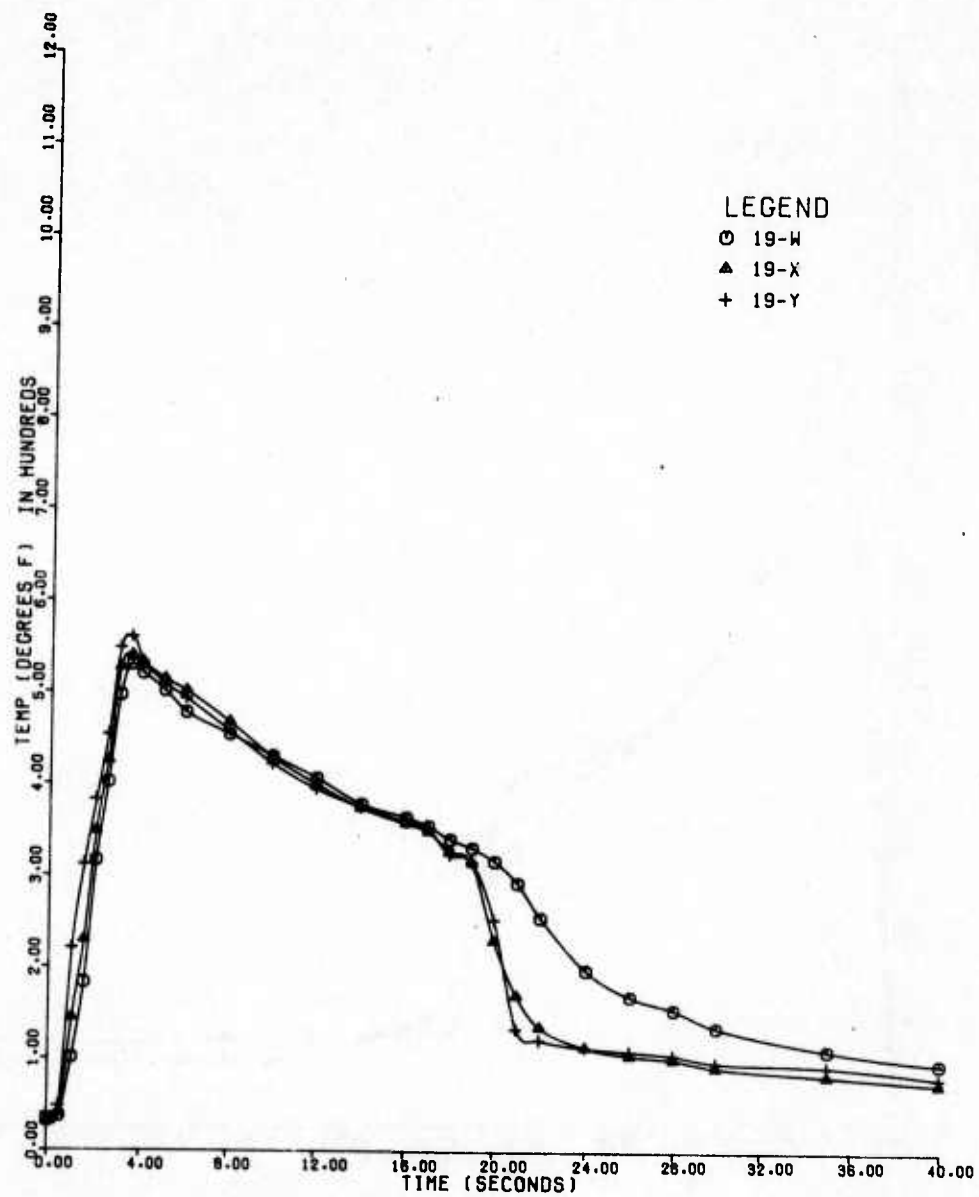


FIGURE C-22

CVA Magazine Test
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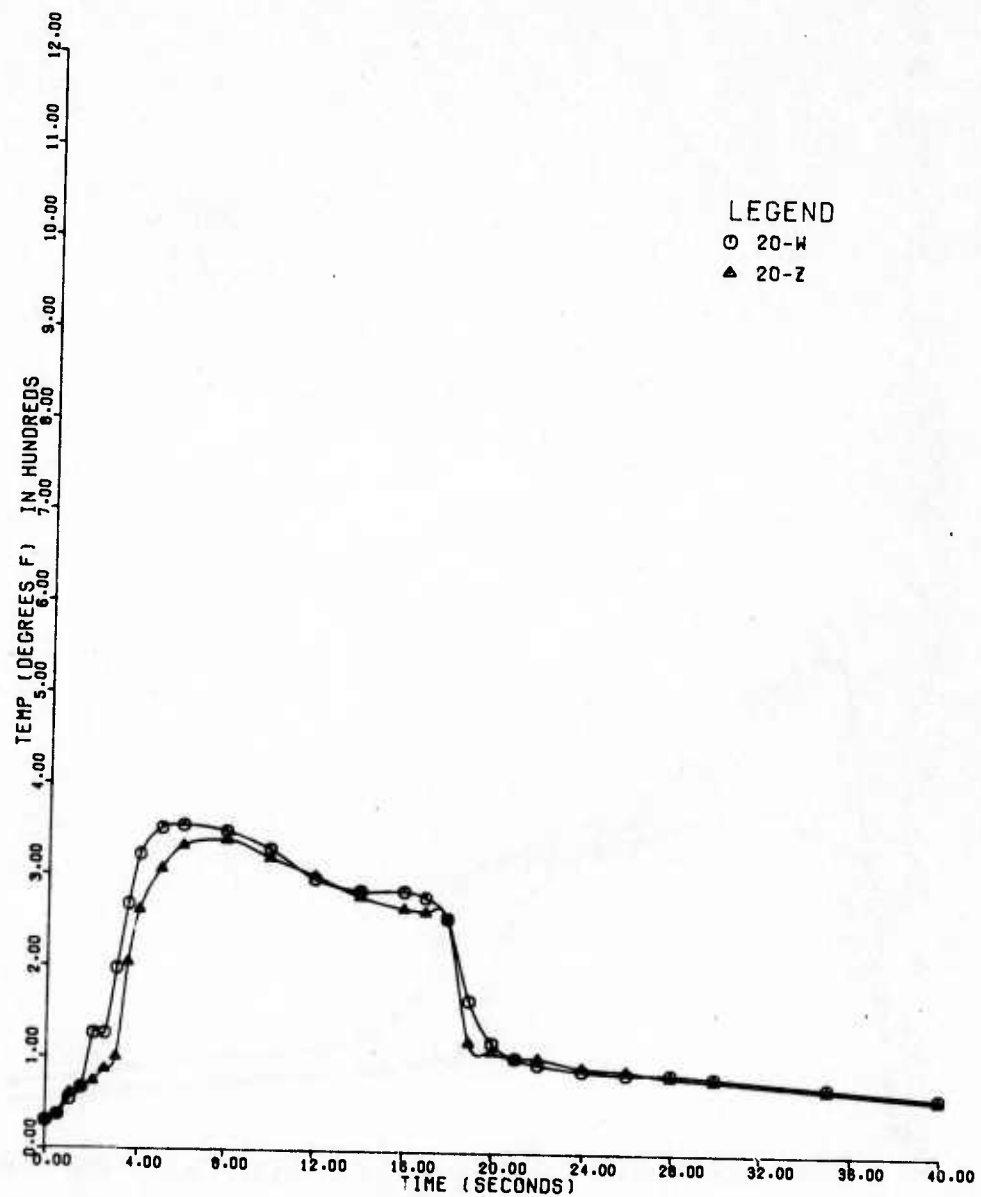


FIGURE C-23

CVA Magazine Test
No. 7 9 January 1974

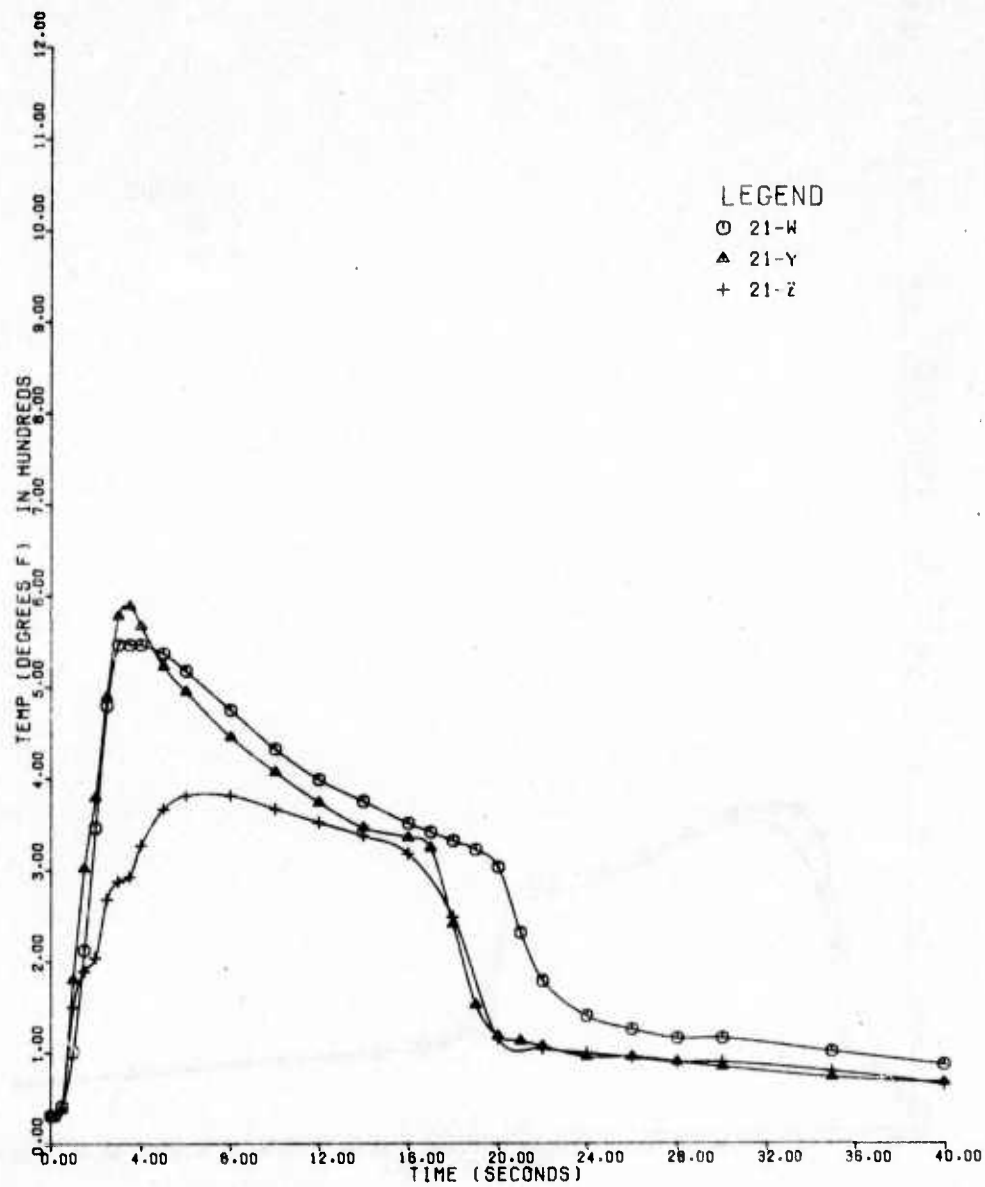


FIGURE C-24

CVA Magazine Test
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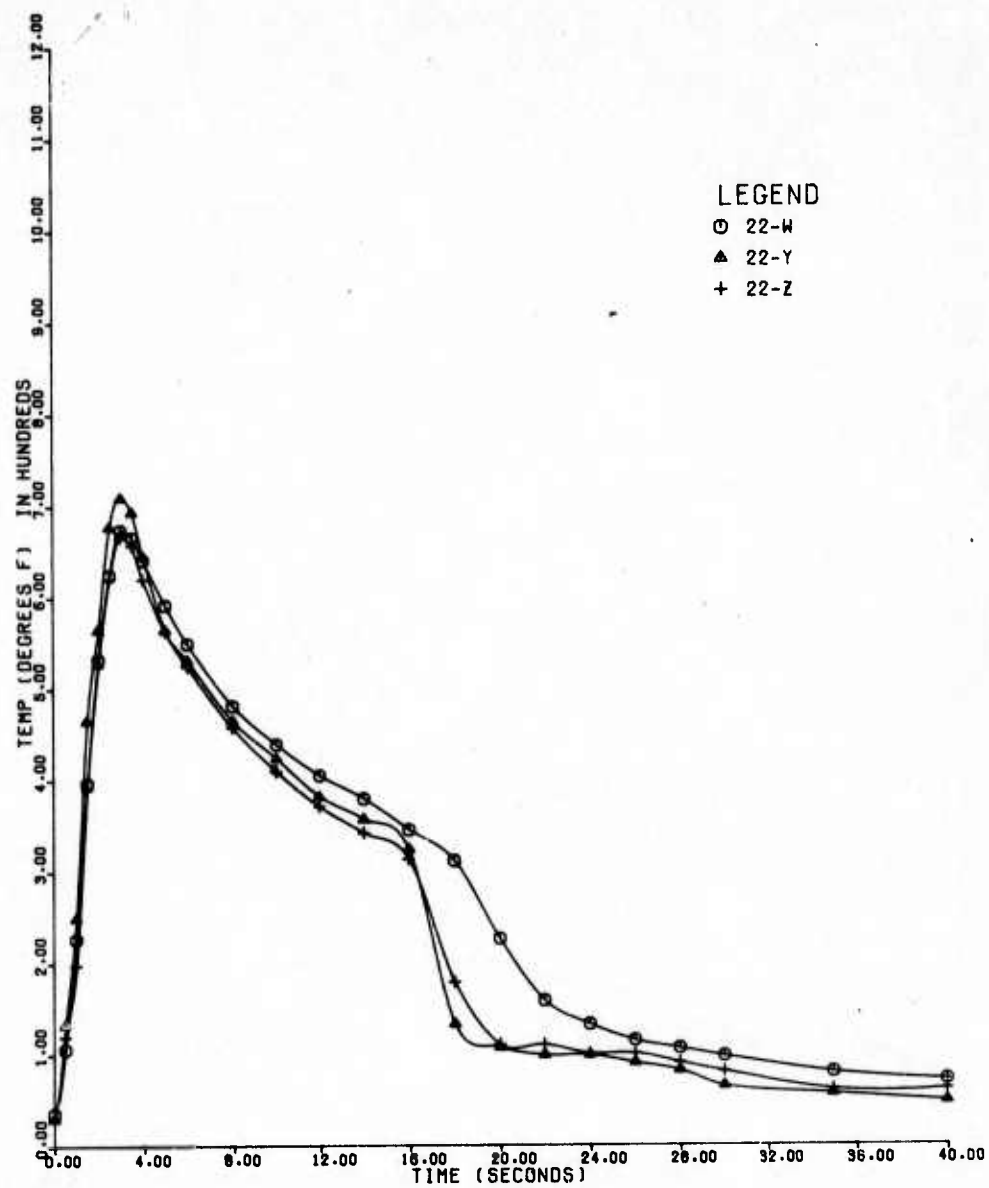


FIGURE C-25

CVA Magazine Test
No. 7 9 January 1974

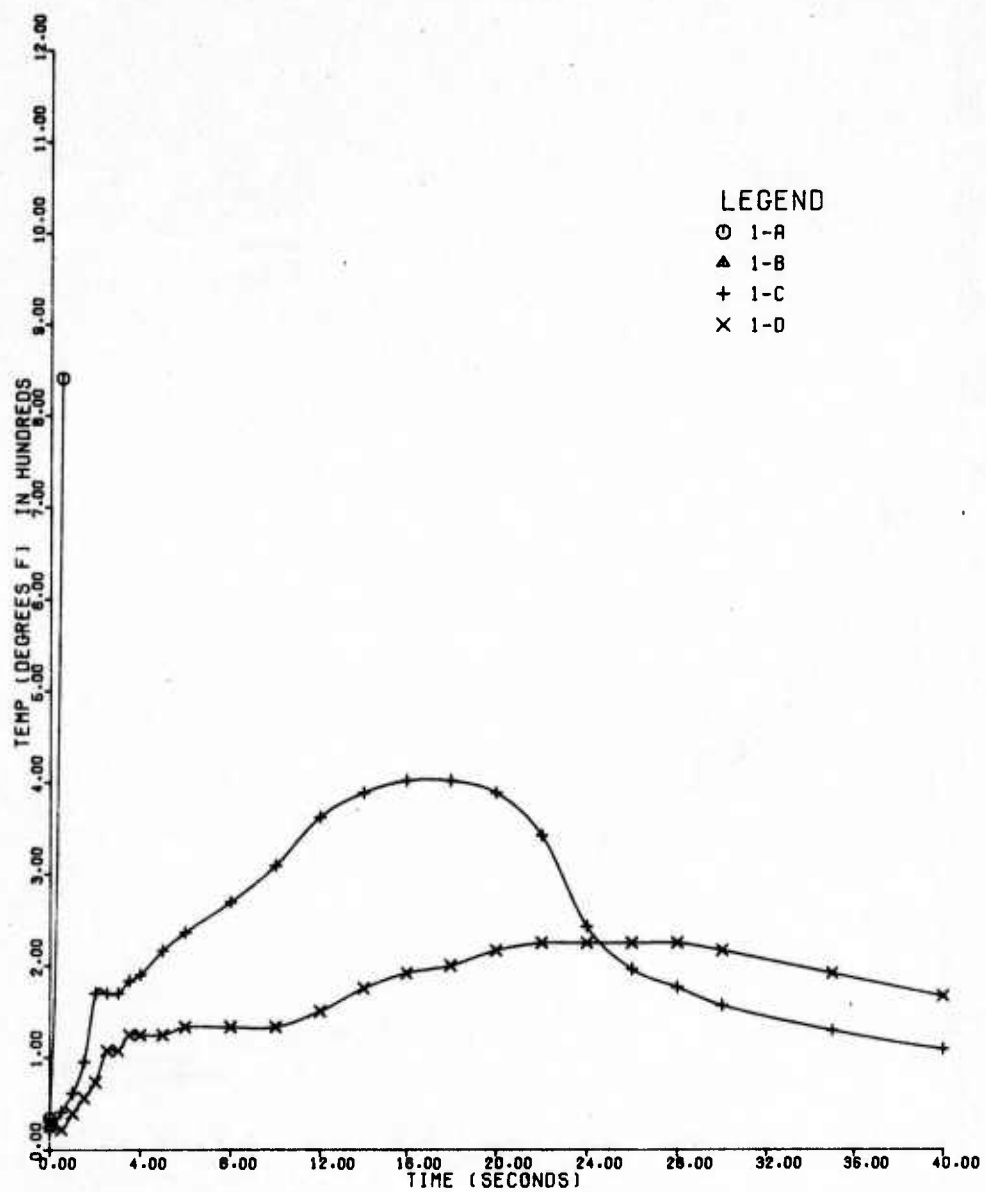


FIGURE C-26

CVA Magazine Test
No. 7 9 January 1974

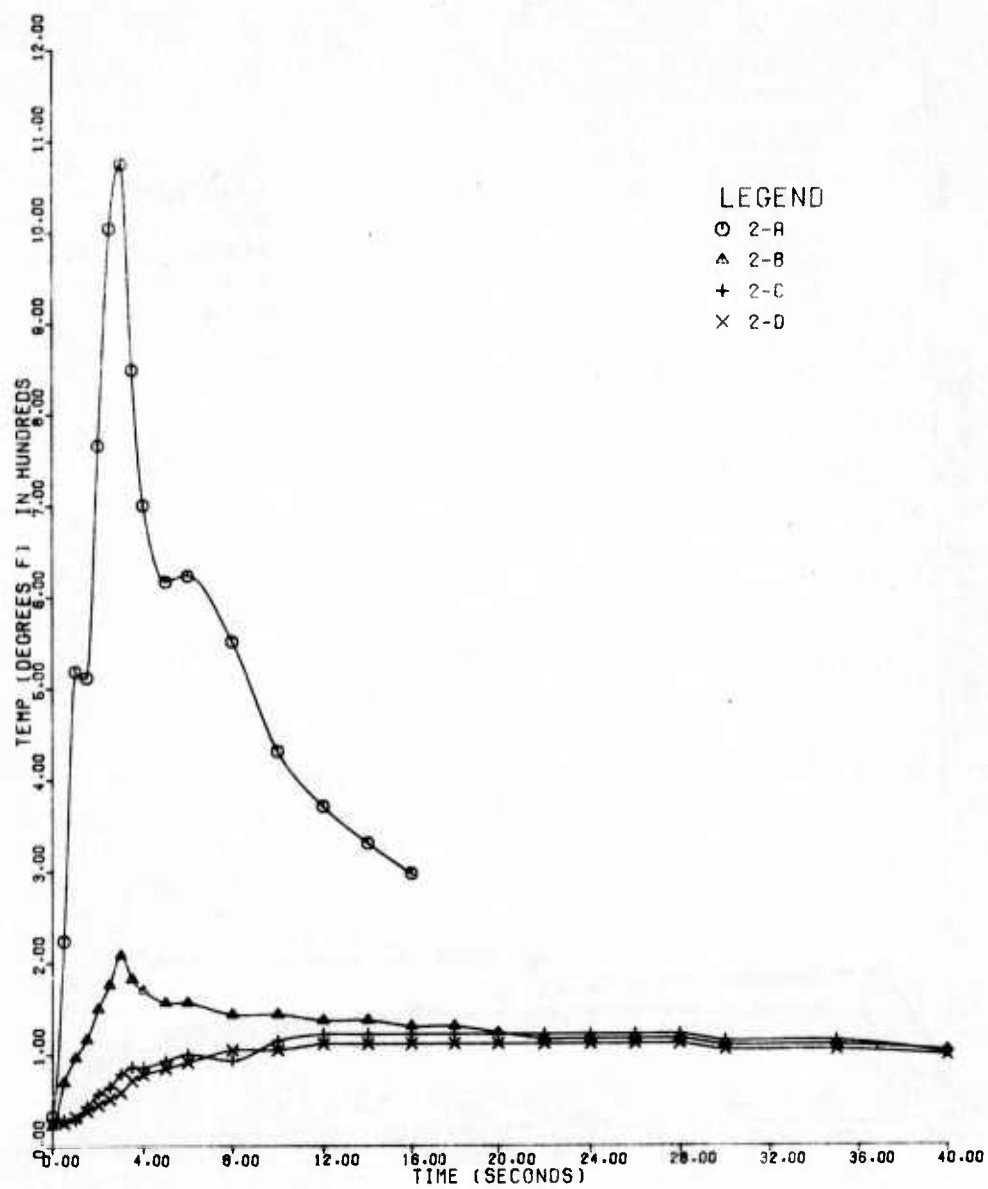


FIGURE C-27

CVA Magazine Test
No. 7 9 January 1974

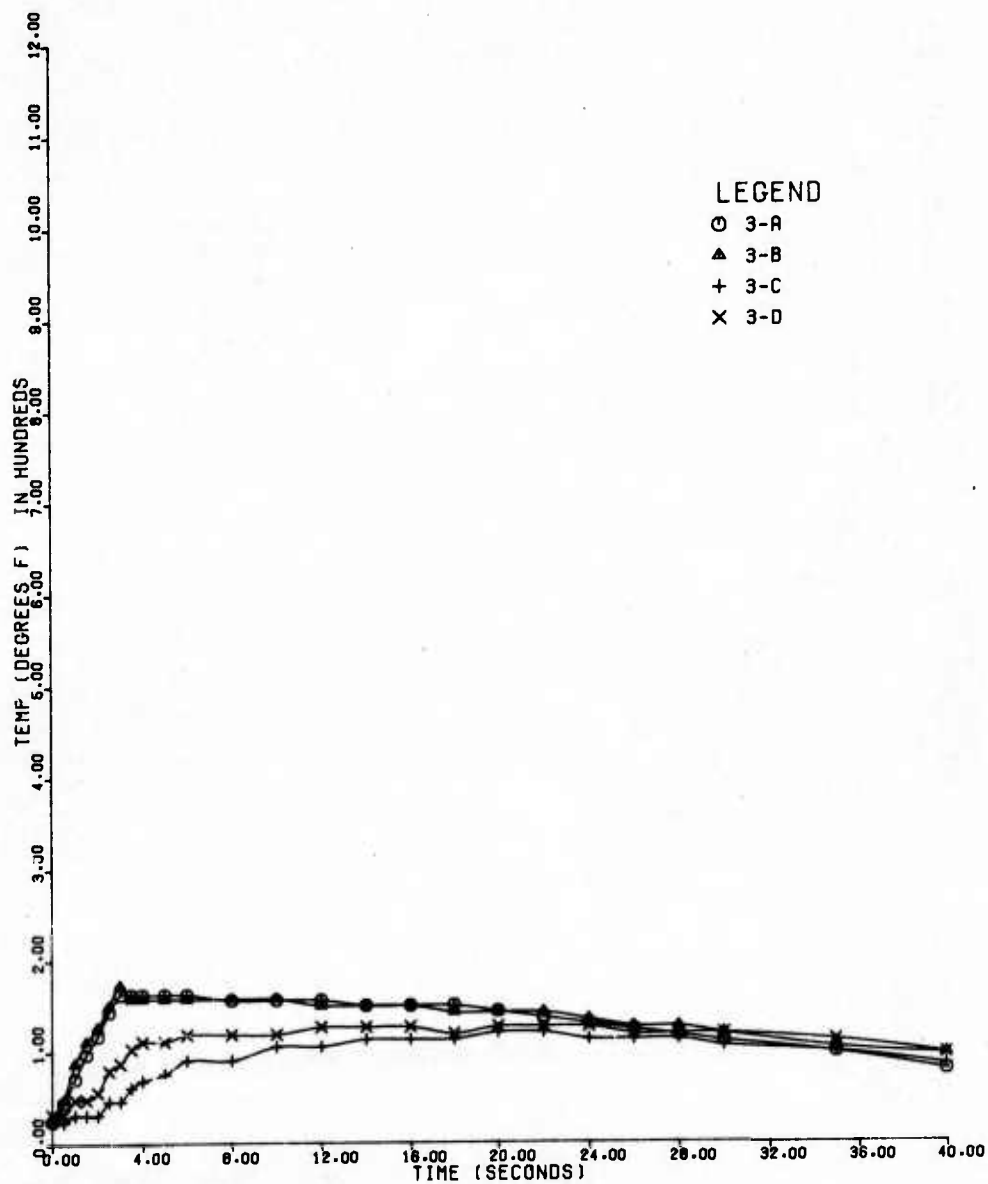


FIGURE C-28

CVA Magazine Test
No. 7 9 January 1974

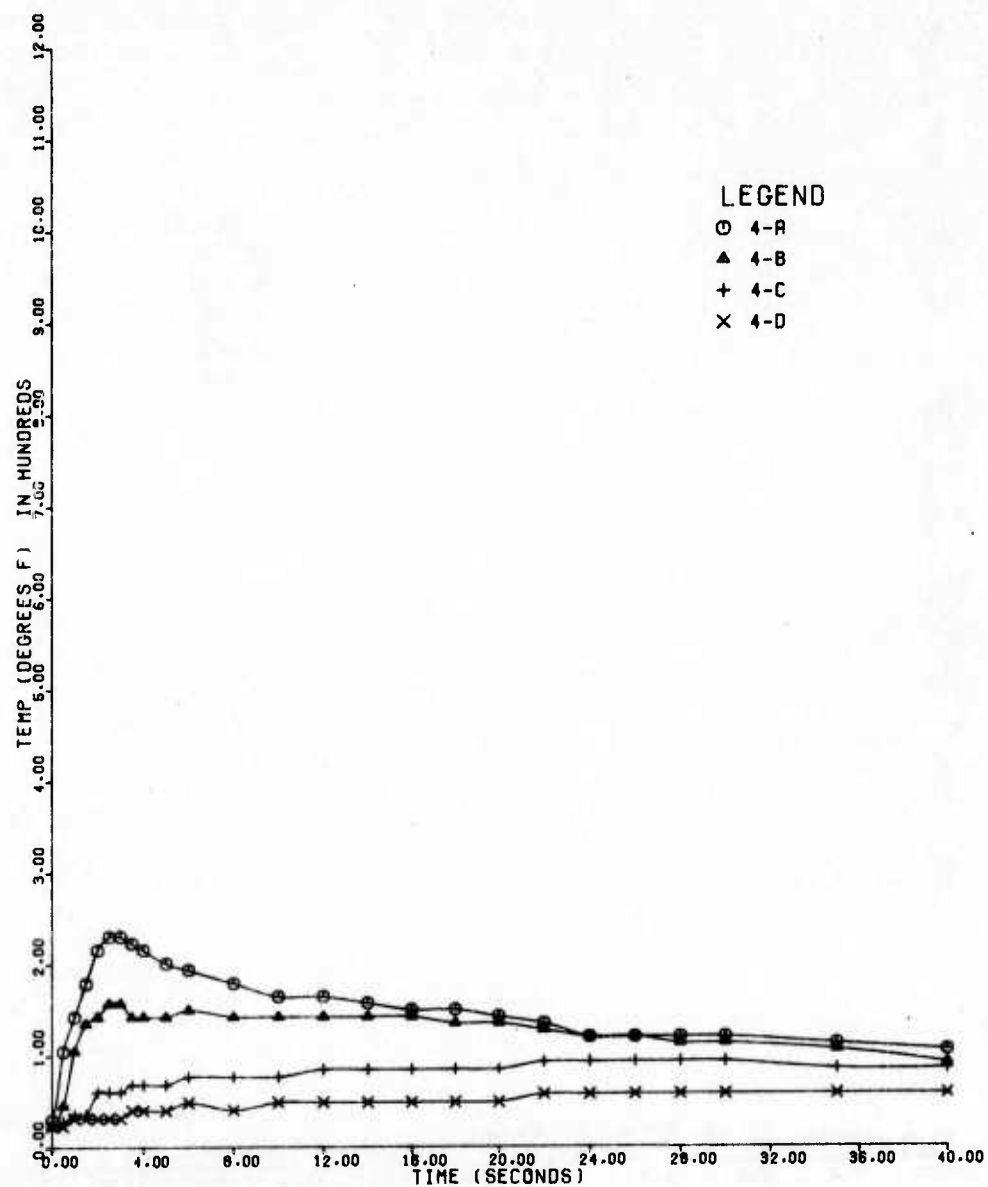


FIGURE C-29

CVA Magazine Test
No. 7 9 January 1974

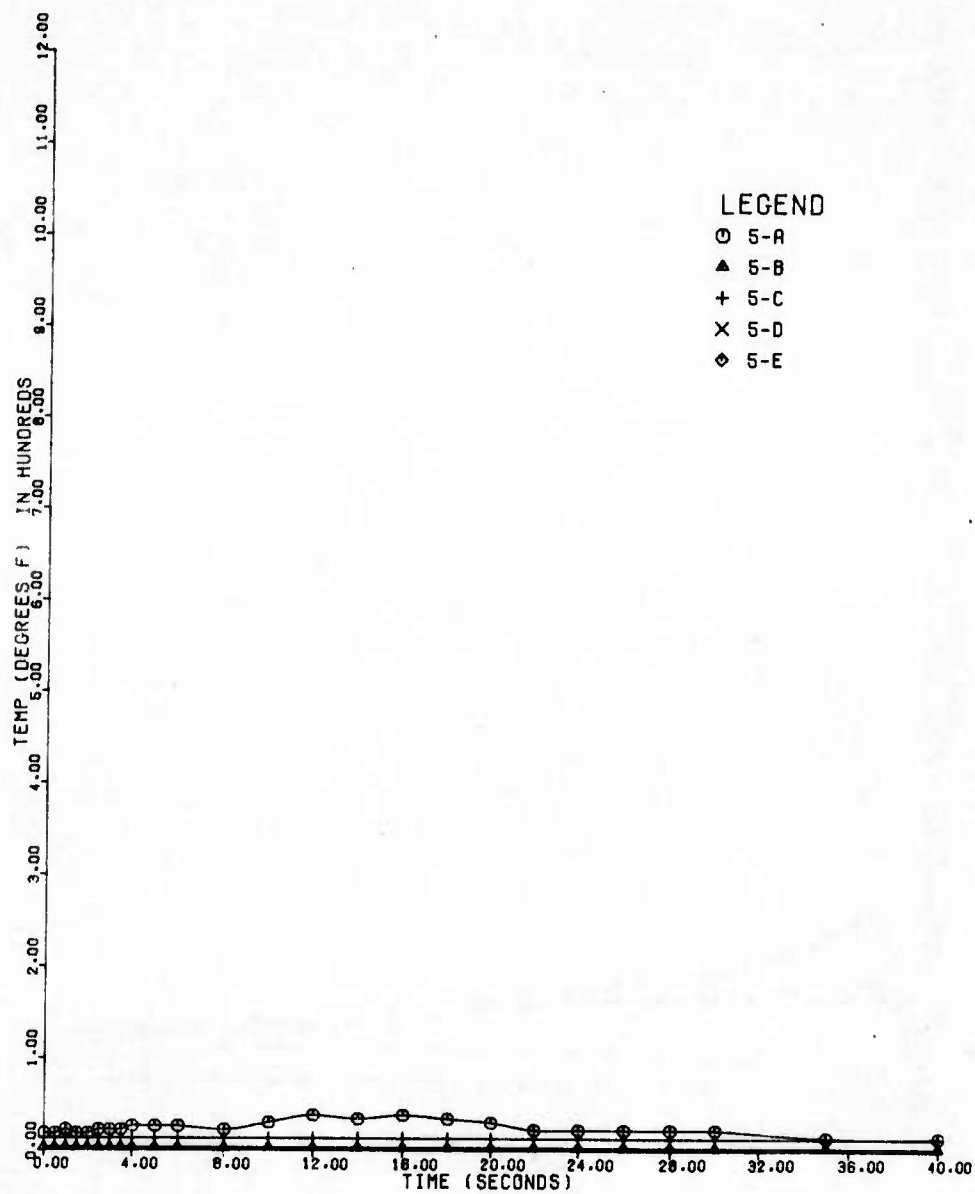


FIGURE C-30

CVA Magazine Test
No. 7 9 January 1974

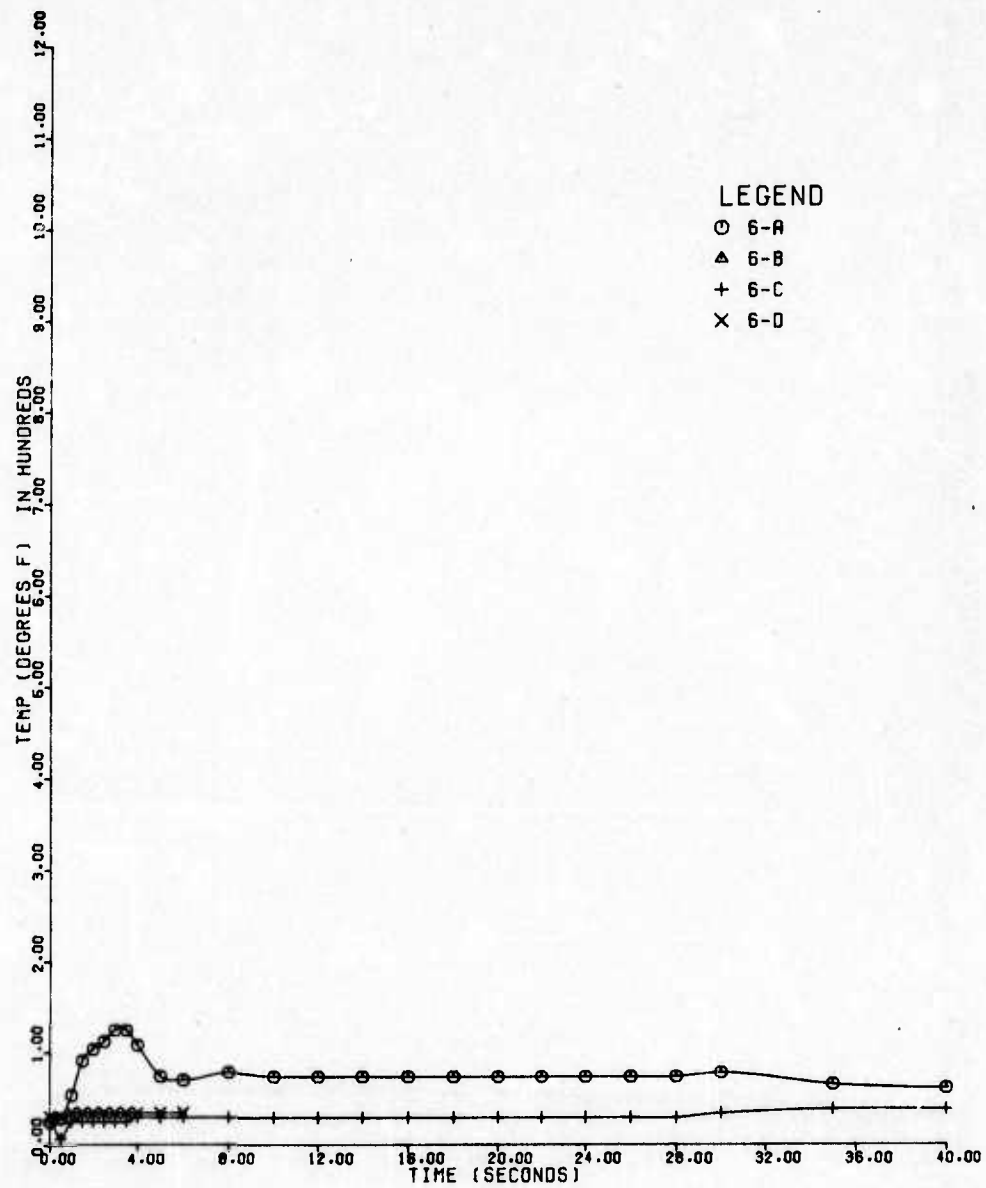


FIGURE C-31

CVA Magazine Test
No. 7 9 January 1974

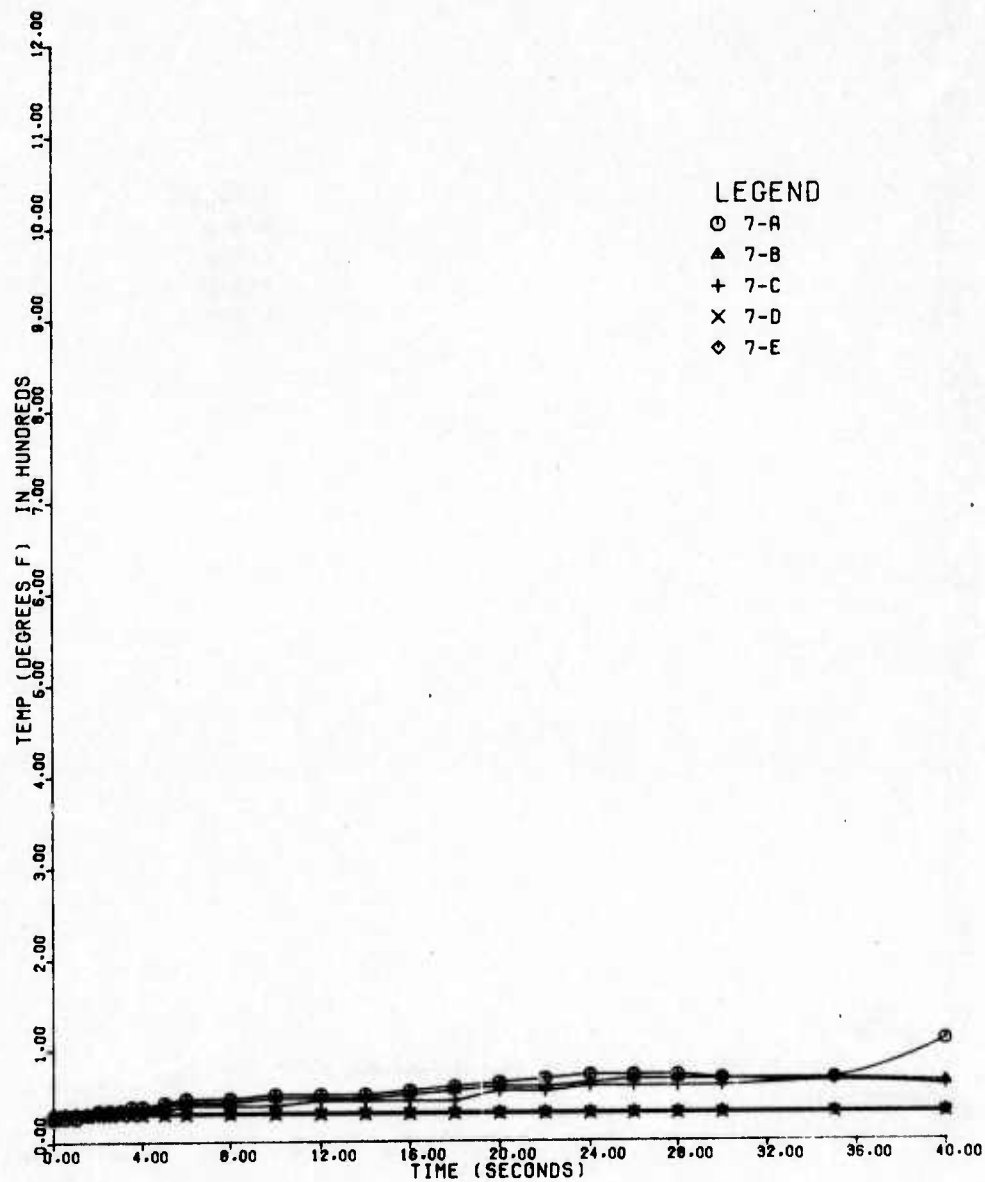


FIGURE C-32

CVA Magazine Test
No. 7 9 January 1974

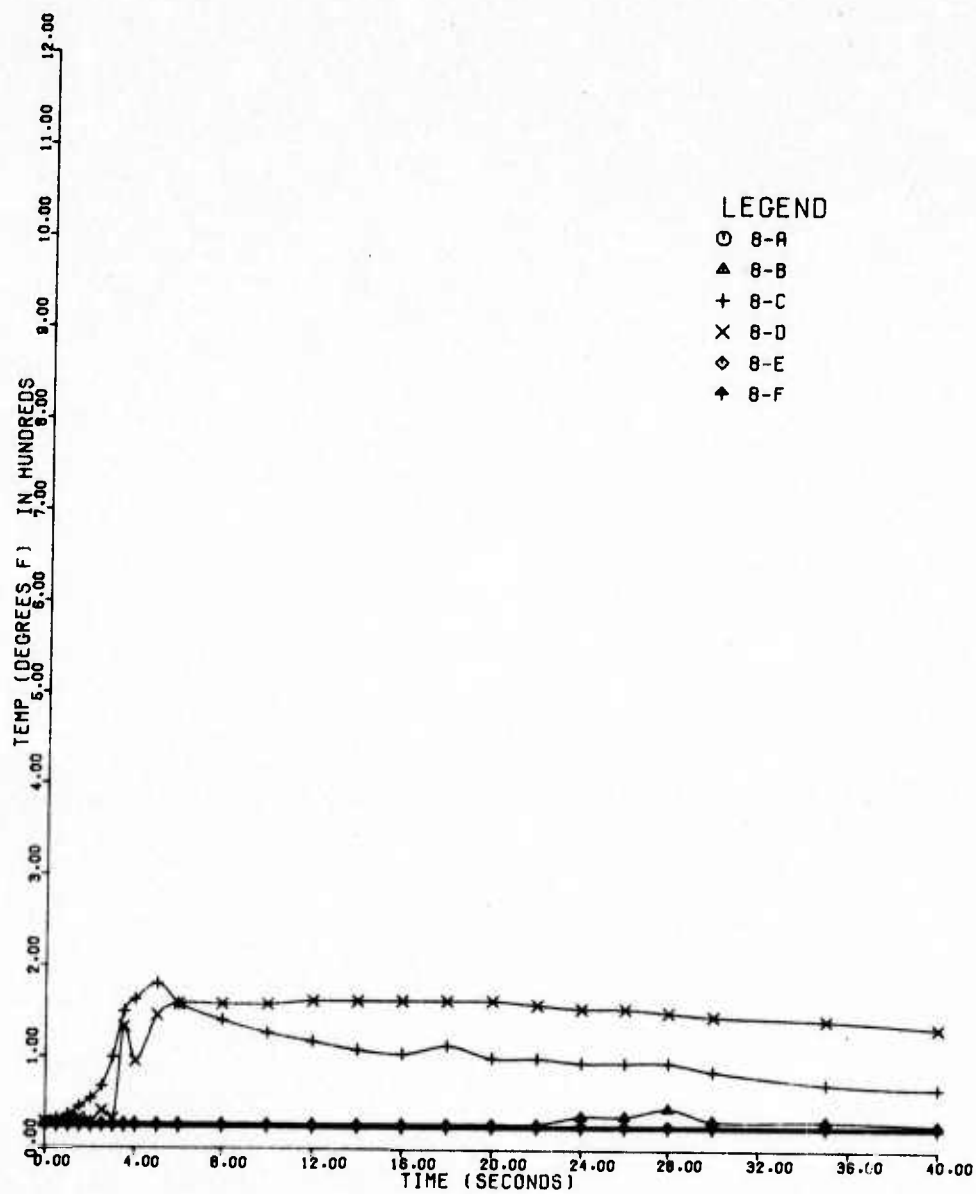


FIGURE C-33

CVA Magazine Test
No. 7 9 January 1974

APPENDIX D

**PHOTOGRAPHS OF MAGAZINE INSTRUMENTATION AND
ORDNANCE CONFIGURATIONS**

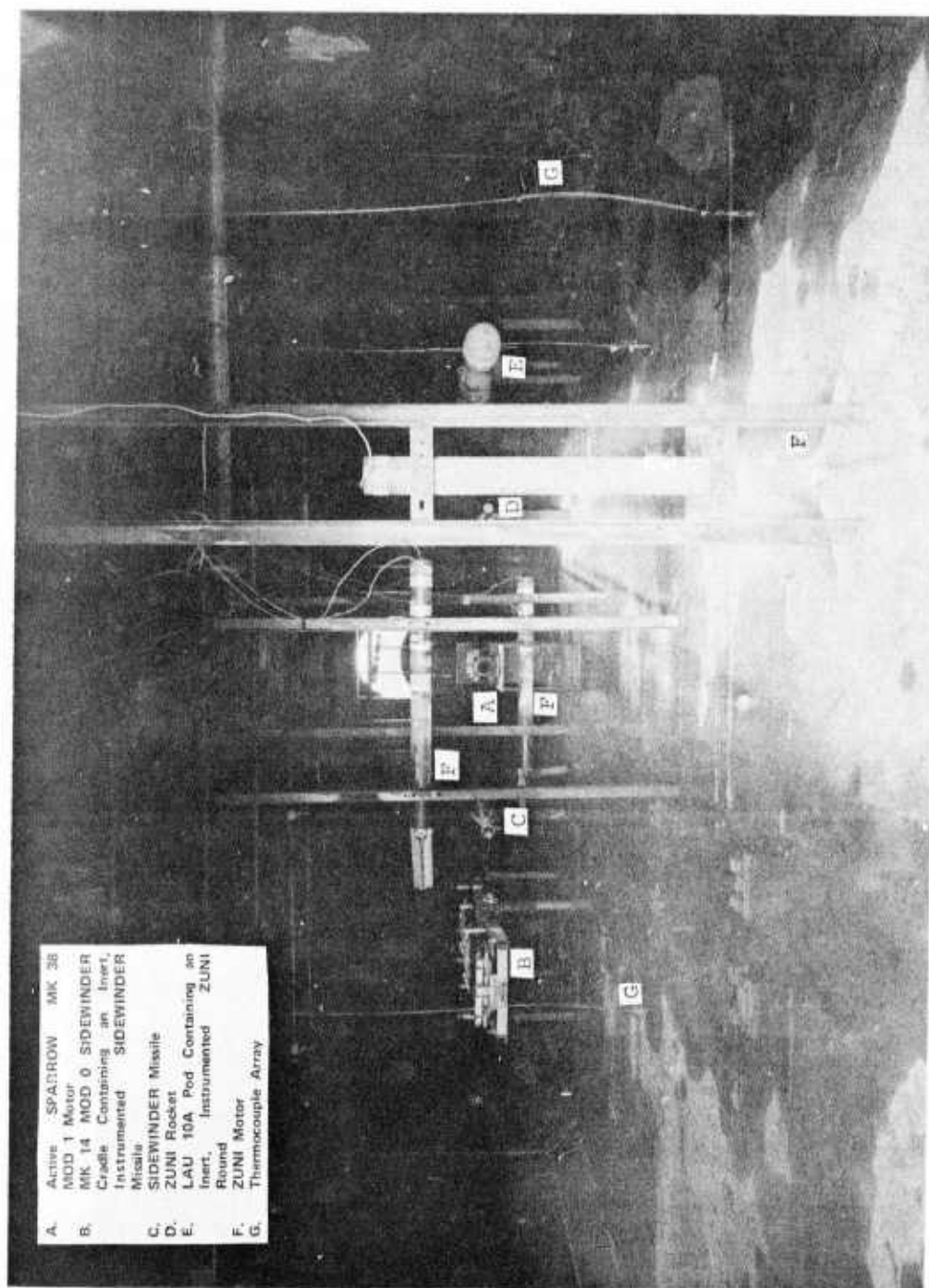


FIGURE D-1

Magazine Instrumentation and Ordnance Configuration
Test No. 6 14 November 1973

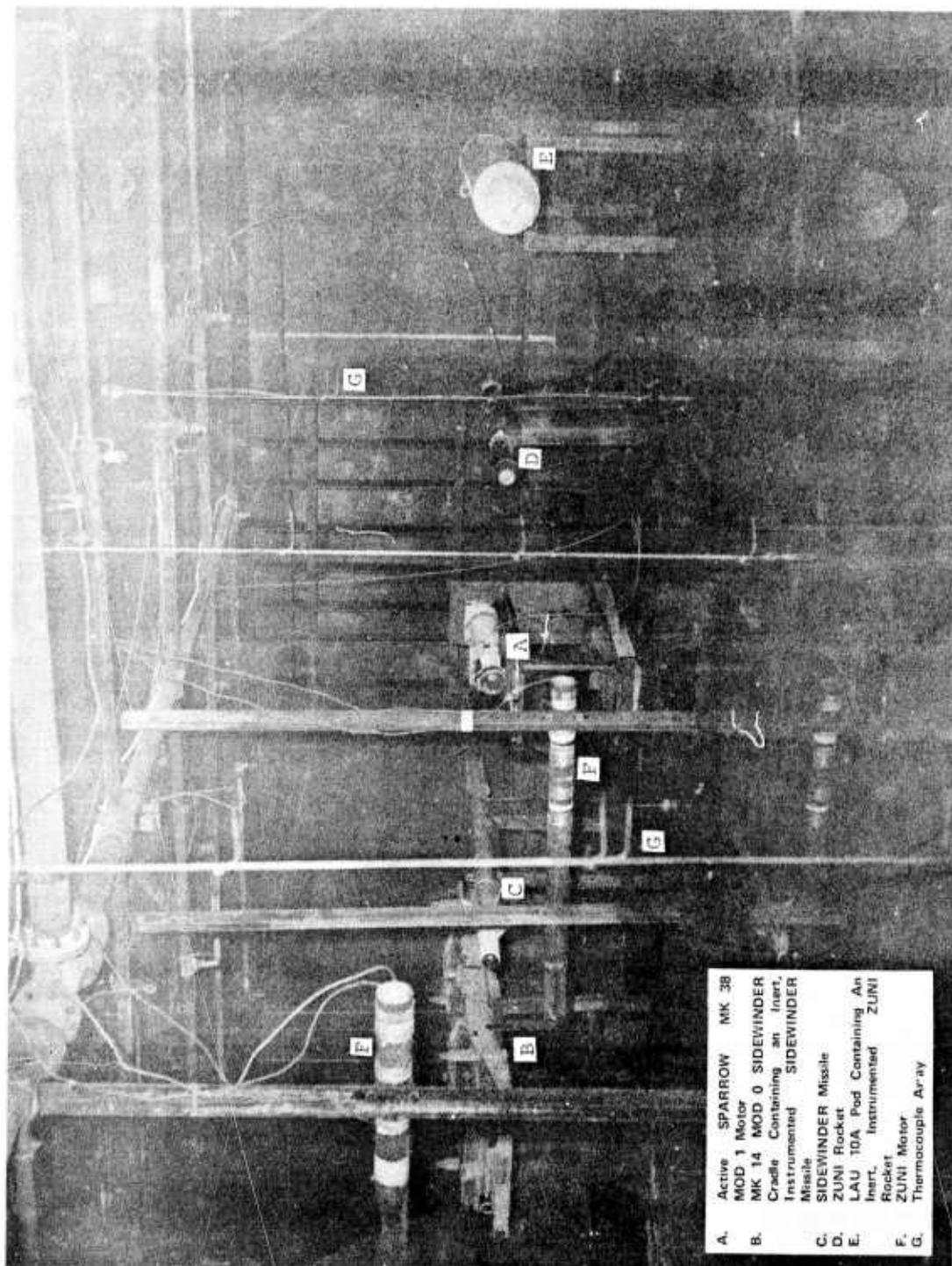


FIGURE D-2

Magazine Instrumentation and Ordnance Configuration
Test No. 6 14 November 1973

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		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Frank J. Hanzel Charles L. Berkey Richard E. Miller, Jr.		8. CONTRACT OR GRANT NUMBER(s)
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) SPARROW MK 38 MOD 0 or MOD 1 motors were ignited in two tests in an instrumented 15,300 cubic-foot magazine under conditions simulating accidental ignition of these motors in shipboard service using the wet or dry sprinkler system as the damage control mechanism. The results provided a detailed temperature and pressure profile in the magazine; and thermal characteristics for bare, inert, instrumented ZUNI motors, bare, inert, instrumented, all-up configuration of SIDEWINDER and ZUNI missiles, and inert, instrumented,		

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containerized, all-up SIDEWINDER and ZUNI missiles located in the magazine.

Temperatures and pressures within the magazine reached a peak of 1185°F and 19.3 psig. External and internal temperatures for the instrumented, inert ordnance peaked at 1200°F and 455°F, respectively. Data from these tests will assist in evaluating the relative effectiveness of the wet vs. dry sprinkler system in preventing chain reaction of ordnance in deep stowage magazines during motor burn, and in evaluating thermal systems designed for explosive ordnance.

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