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CDL No.
ACCOUNTABILITY CARD
FILE No. H-490 3-2

AUG 21 1956
Case No. 433.00
Ref. Sym: 1612 (365)
Project No. TM-431
File: H-490, 3-2

INVENTORIED
AUG 6 1964
3427-1

MR. L. A. DUNN - 1284

Re: Ramp Test of H-490 with Polyurethane Cushioning (X-9030)

Summary of Results

Ramp tests were conducted at 7 and 9-1/2 mph to determine the cushioning properties of polyurethane (American Latex X-9030) as used in an H-490 container. Two sets of tests were conducted to compare different shields used to transmit the decelerating force between the polyurethane and the contained dummy XW-25.

Using the plywood type shield, maximum measured faired accelerations (with respect to the ramp dolly axes) were: longitudinal on the container, +74 g; longitudinal on the dummy XW-25 warhead, -31 g; vertical on the dummy XW-25 warhead, -3.1 g; longitudinal on the ramp dolly, -37 g.

INVENTORIED
SEP 14 '65
3428-3

Using the plywood-and-steel type shield, maximum measured faired accelerations were: longitudinal on the container, +42 g; longitudinal on the dummy XW-25 warhead, -22 g; vertical on the dummy XW-25, -3.8 g; longitudinal on the ramp dolly, -39 g.

The wood on both the plywood shield and the plywood-and-steel type shield was chipped adjacent to the bolt holes.

The container legs were bent considerably from the 9-1/2 mph impact. No other container damage resulted.

No damage resulted to the dummy XW-25 warhead.

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BY ORG. 2743

Object of Test

The test was performed to determine the cushioning properties of a new material developed by American Latex and labeled X-9030. Performance was compared between two different type shields on the dummy XW-25 warhead; a plywood shield and a plywood-and-steel type shield.

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MAR 2 1965
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Reason for Test

The test was requested in a Request for Materials Laboratory Investigation from L. A. Dunn, 1284, dated June 28, 1956.

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Summary of Past Tests

Ramp and drop tests have been performed on the H-490 prototype No. 5 container (similar to the containers used in this test) which contained stafoam cushioning material. This test, entitled Ramp and Drop Test of the H-490 Prototypes 4 and 5, Ref. Sym: 1612 (286), was reported in a memorandum from R. L. Ault, 1612, to L. A. Dunn, 1284, dated January 30, 1956.

The maximum measured faired accelerations (with respect to the warhead axes) during the ramp test of prototype No. 5 were: longitudinal on the dummy XW-25, 2.8 g; vertical, 24 g.

Maximum measured faired accelerations during the drop test of prototype No. 5 were: longitudinal on the dummy XW-25, 20 g; vertical, 3.7 g.

No mechanical or electrical damage resulted to the H-490 prototype No. 5 container or to the dummy XW-25 warhead contained therein from the ramp and drop tests, which were performed in accordance with SCS-5.

Another test was reported in a memorandum entitled Material Cushioning Properties Test for XH-490, Ref. Sym: 1612 (350), from R. L. Ault, 1612, to L. A. Dunn, 1284, dated July 25, 1956.

The XH-490, using four different mounting systems for the dummy XW-25 warhead contained, was subjected to drop and ramp tests.

Maximum measured faired longitudinal accelerations (with respect to the warhead axes) on the dummy XW-25 warhead during the 12-inch drops ranged from 15 g to 39 g.

During the 7.0 mph ramp test, maximum measured faired vertical accelerations (with respect to the warhead axes) on the dummy XW-25 warhead ranged from 15 g to 22 g, with maximum measured faired longitudinal accelerations from 5.0 g to 15 g.

During the 9-1/2 mph ramp test, the maximum measured faired accelerations on the dummy XW-25 warhead ranged as follows: vertical, 26 g to 74 g; longitudinal, 2.6 g to 142 g. No comparisons of the cushioning materials could be made from the 9-1/2 mph ramp tests, since the dummy XW-25 warhead was hitting the sides of two containers.

For the drop tests the Polyurethane had the best cushioning characteristics.

Setup for Test

Figure 1 shows the H-490 mounted on the ramp dolly.

Figures 2 and 3 show the two types of shields used on the dummy XW-25 warhead. Container 1 had the plywood-and-steel type shield; container 2 had the plywood shield.

Components tested are listed in Table I.

Test equipment used by Division 1612 for the ramp test was:

Consolidated Amplifiers, Type 1-113B.
Consolidated Oscillographs, Type S-114-P3, Serial No. 508AM13.
Statham accelerometers as listed in Table II and shown in Figs. 1, 3, and 4.

Procedure

Accelerometers number 2 and 3 were fastened to the XW-25 warhead (Fig. 3) to record, respectively, the longitudinal and vertical accelerations (with respect to the ramp dolly). The dummy XW-25 was then placed in the container padded with extra firm polyurethane material (Fig. 4). Accelerometer No. 1 was mounted on the outside of the container (Fig. 1) to measure longitudinal accelerations.

The container was fastened to the ramp dolly by means of four chains and turnbuckles attached to holdown lugs at the top. Planks were spiked against the legs to prevent sliding, (Fig. 1).

Accelerometer No. 4 was mounted to record longitudinal acceleration on the ramp dolly (Fig. 1).

Velocity was measured by means of a make-and-break circuit using a microswitch attached to the dolly (Fig. 1) and triggered by two actuating arms fastened four feet apart on the track of the ramp. Velocities of 7.0 mph and 9.5 mph were obtained.

Two different types of shields (Figs. 2 and 3) were tested on the dummy XW-25 warhead, with the same velocities (7 mph and 9-1/2 mph) being used for each test.

Results

The accelerations on the ramp test were read in accordance with SCS-10 and are given in Table III. All accelerations are with respect to the ramp dolly axes.

Using the plywood type shield (container 2), maximum measured faired accelerations were: longitudinal on the container, +74 g; longitudinal on

the dummy XW-25 warhead, -31 g; vertical on the dummy XW-25, -3.1 g. The maximum measured faired acceleration on the ramp dolly was -37 g.

Using the plywood-and-steel type shield (container 1), maximum measured faired accelerations were: longitudinal on the container, +42 g; longitudinal on the dummy XW-25 warhead, -22 g; vertical on the dummy XW-25 warhead, -3.8 g. The maximum measured faired longitudinal acceleration on the ramp dolly was -39 g.

Typical oscillograph records are shown in Figs. 6 and 7.

The plywood adjacent to the bolt holes on both types of shields (containers 1 and 2) was cracked and chipped from the impacts received.

The legs of the container were bent by the 9-1/2 mph impact (Fig. 5). No other damage resulted to the container.

No damage resulted to the dummy XW-25 warhead from either test.

Conclusions

The plywood-and-steel type shield is considerably more effective than the plywood shield in reducing shock to both the warhead and the container.

The warhead apparently hit the side of container 2 when tested at 9.5 mph, producing much greater longitudinal accelerations on both the container and the dummy XW-25.

It is felt that damage to the plywood around the bolts, which fasten the shields to the dummy XW-25 warhead, could be reduced by the use of larger washers pressed integrally into the wood.

The container legs are not made of sufficiently heavy material.

Guy M. Willson
G. M. WILLSON - 1612-1

GMW:1612-1:as

Approved by: Paul H. Adams
P. H. ADAMS - 1612

DISTRIBUTION:
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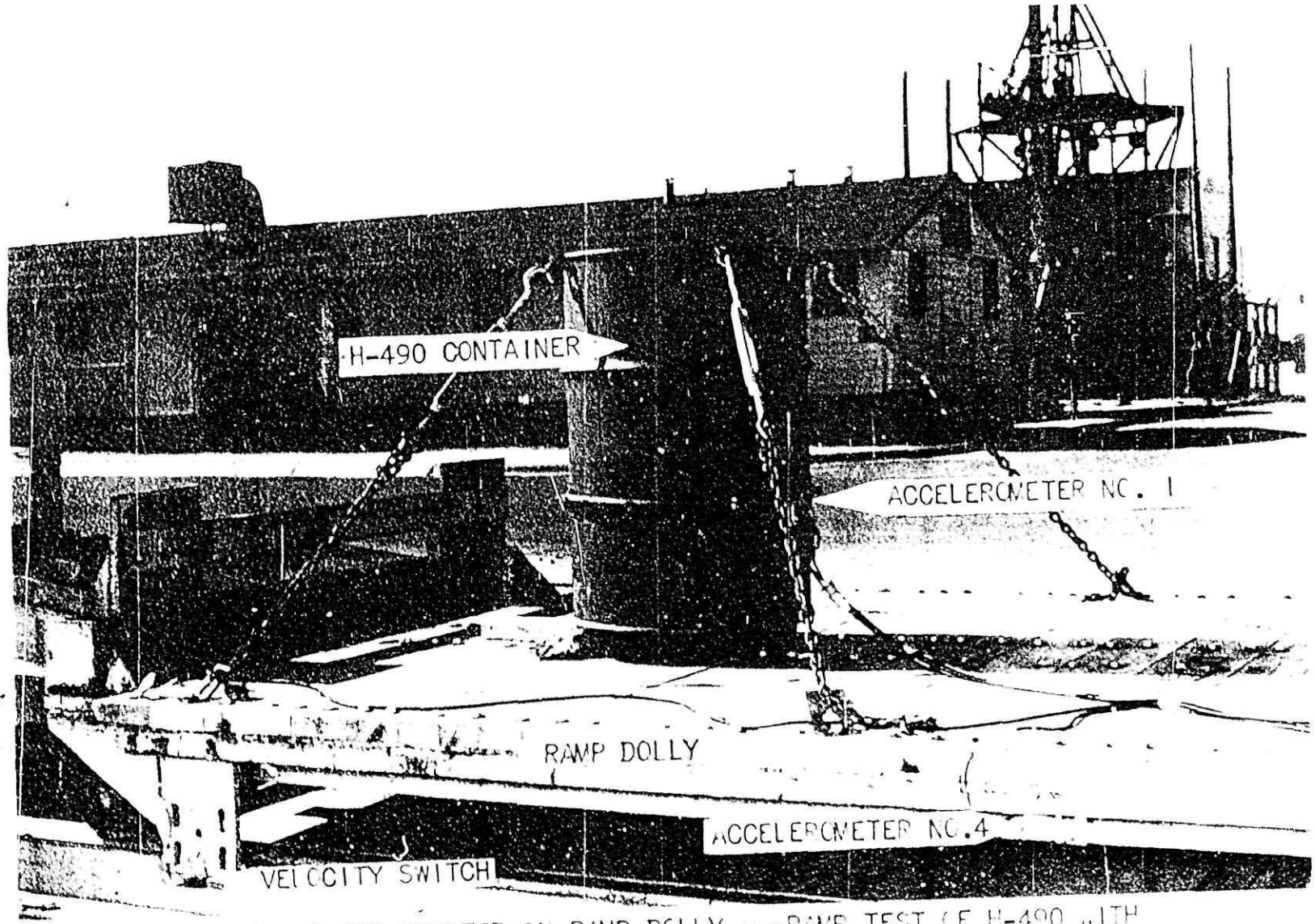

FIG.1 H-490 MOUNTED ON RAMP DOLLY ---RAMP TEST OF H-490 WITH POLYURETHANE CUSHIONING (X-9030)

REF. SYM. 1612(36)
TM-431

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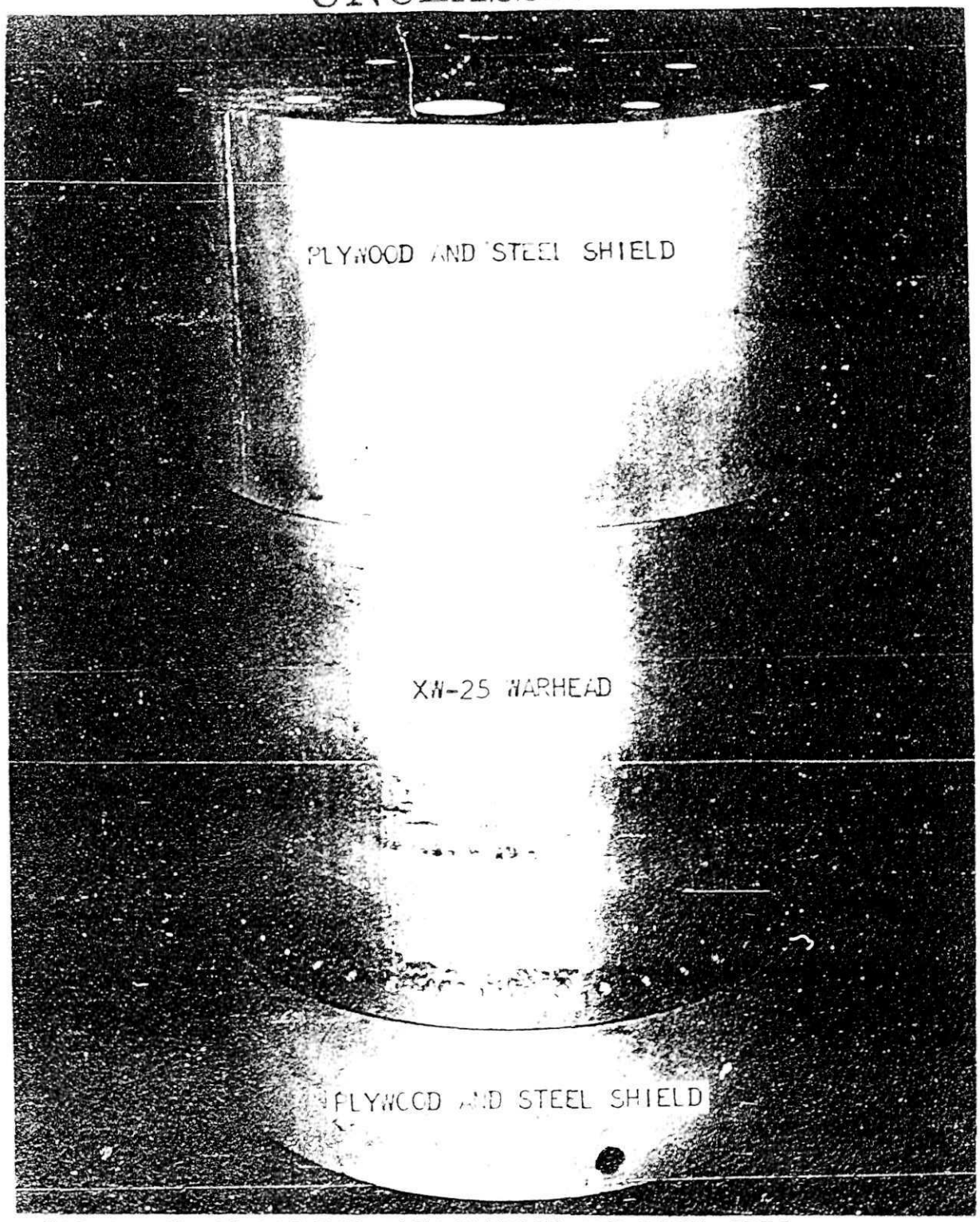

FIG.2 XW-25 WARHEAD WITH PLYWOOD AND STEEL TYPE SHIELDS---RAMP TEST OF H-490 WITH POLYURETHANE CUSHIONING (X-9030)

REF. SYM. 1612(365)
TM-431

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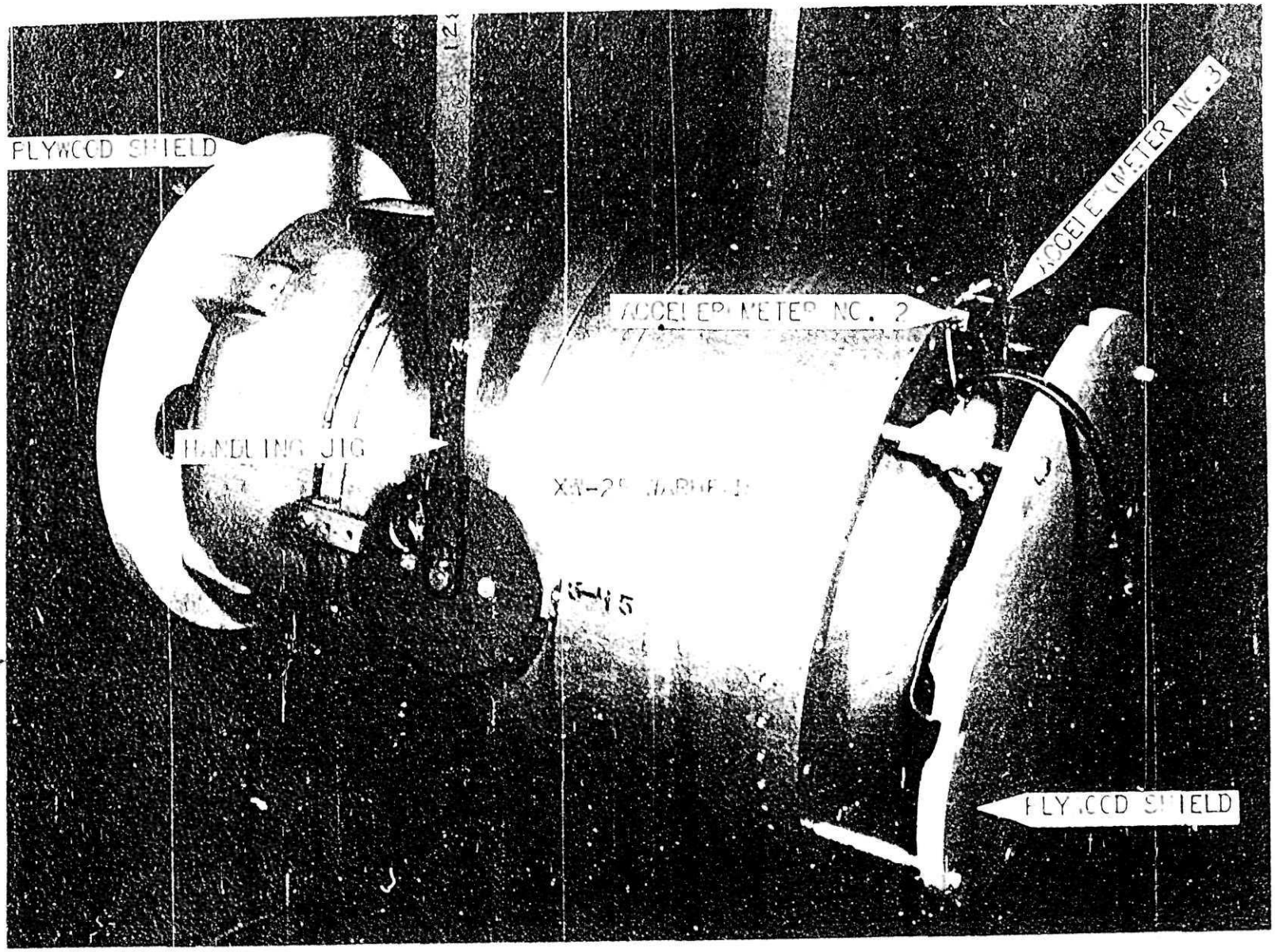

FIG. 3 XW-25 WARHEAD SAFING INSTRUMENTATION AND FLYWOOD TYPE SHIELDS--PRIOR TO [illegible]

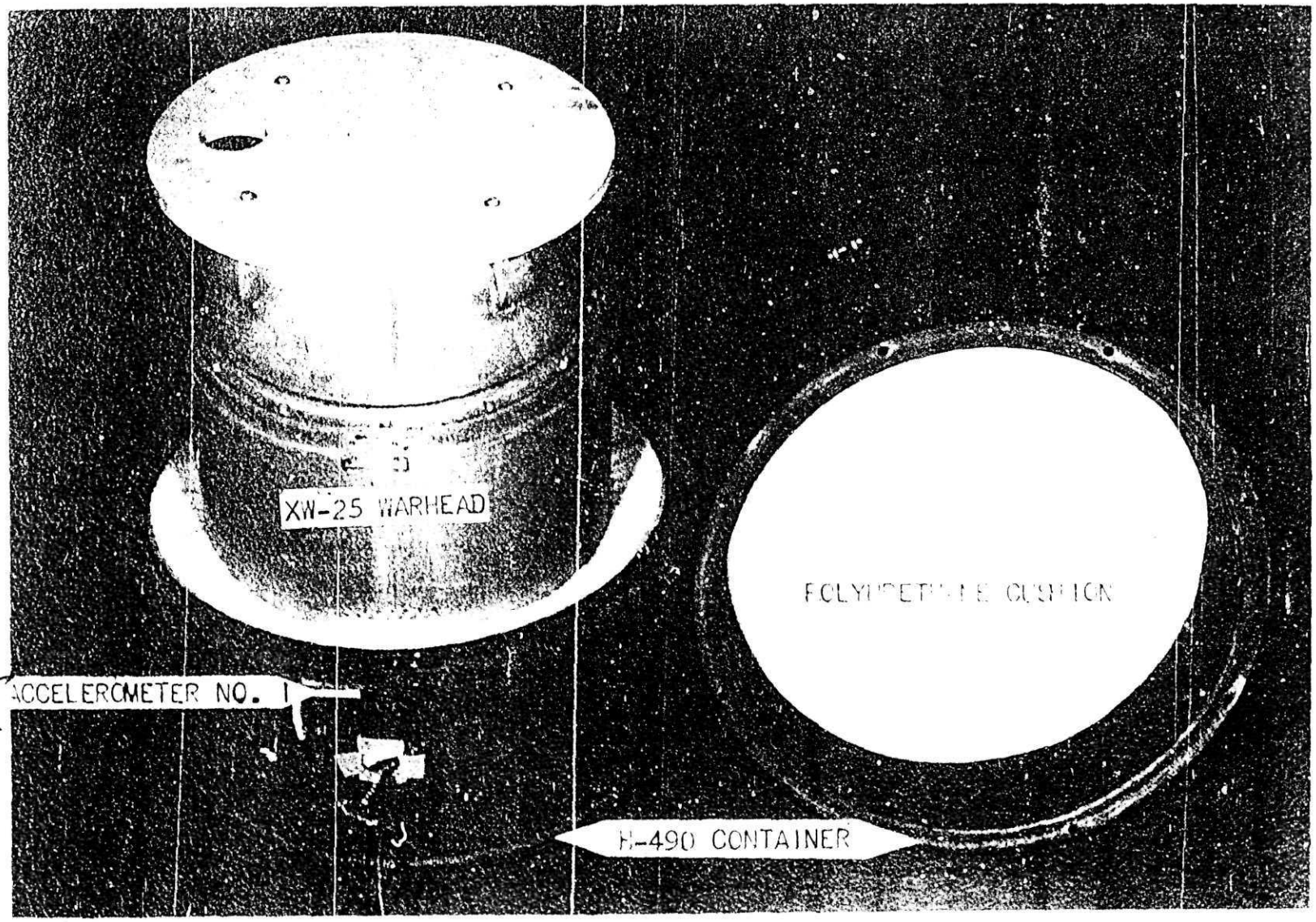

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FIG 4 XW-25 WARHEAD IN CONTAINER WITH POLYURETHANE CUSHIONING MATERIAL--
RAMP TEST OF H-490 WITH POLYURETHANE CUSHIONING (X-9030)

EP. SYM. 1612(3)
TM-431

#1109

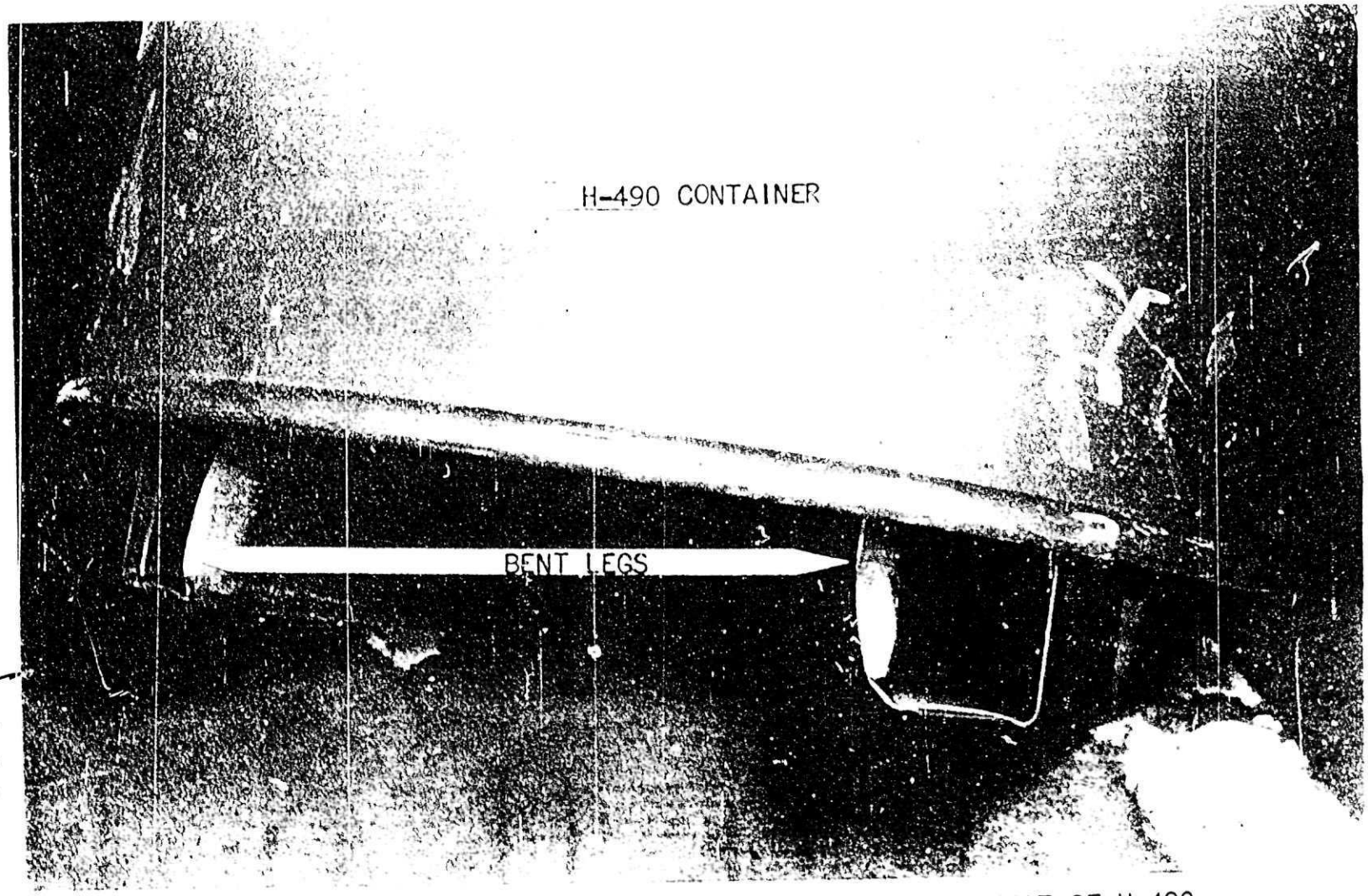

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FIG. 5 DAMAGED LEGS ON H-490 CONTAINER -- RAMP TEST OF H-490 WITH POLYURETHANE CUSHIONING (X-9030)

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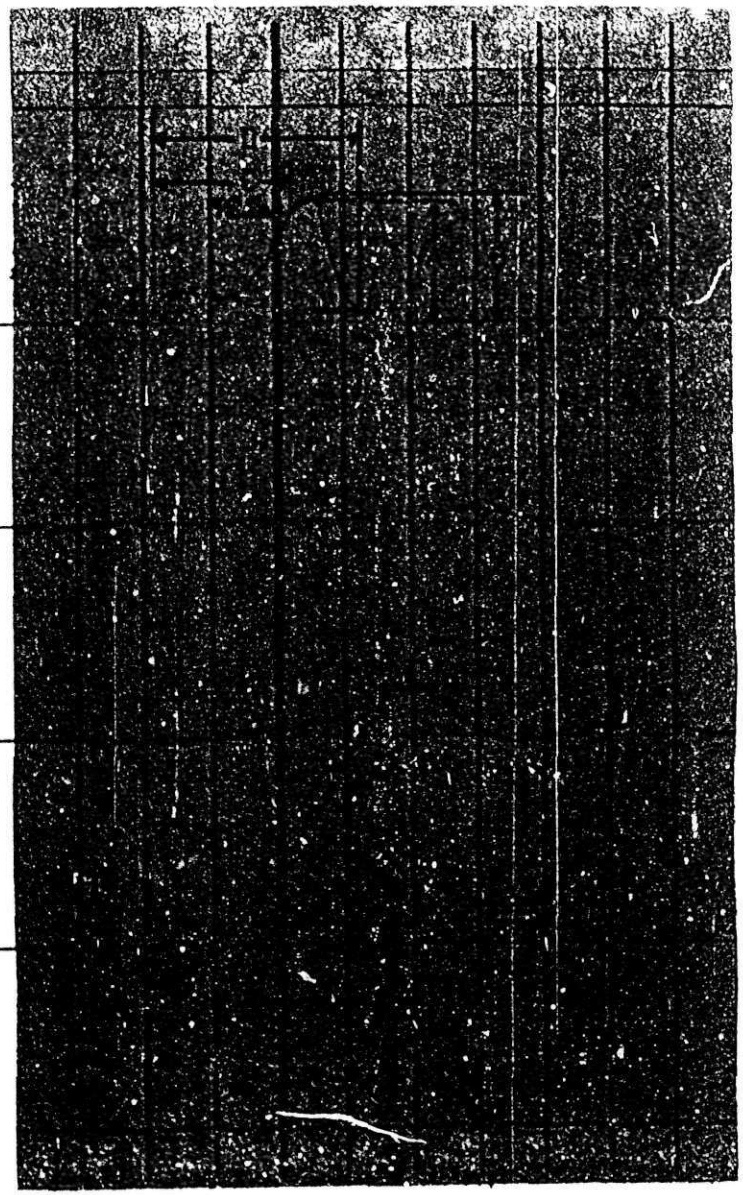

ACCEL. NO. 4 RAMP DOLLY - LONG.* — 40G

ACCEL. NO. 3 XN-25 WARHEAD- VERT.* — 20G

ACCEL. NO. 2 XN-25 WARHEAD- LONG.* — 40G

ACCEL. NO. 1 H-490 CONTAINER- LONG.* — 40G

A- MAXIMUM FAIRED VALUE(100%)
B- MAXIMUM AMPLITUDE
C- RISE TIME
D- PULSE TIME
E- 0.01 SECOND

* ACCELER. TIMES WITH RESPECT TO RAMP DOLLY

FIG. 6 REPRESENTATIVE OSCILLOGRAPH RECORD FOR H-490 RAMP TEST, CONTAINER NO. 1--RAMP TEST OF H-490 WITH POLYURETHANE CUSHIONING

REF. SYM. 1612 (365)
TM-431

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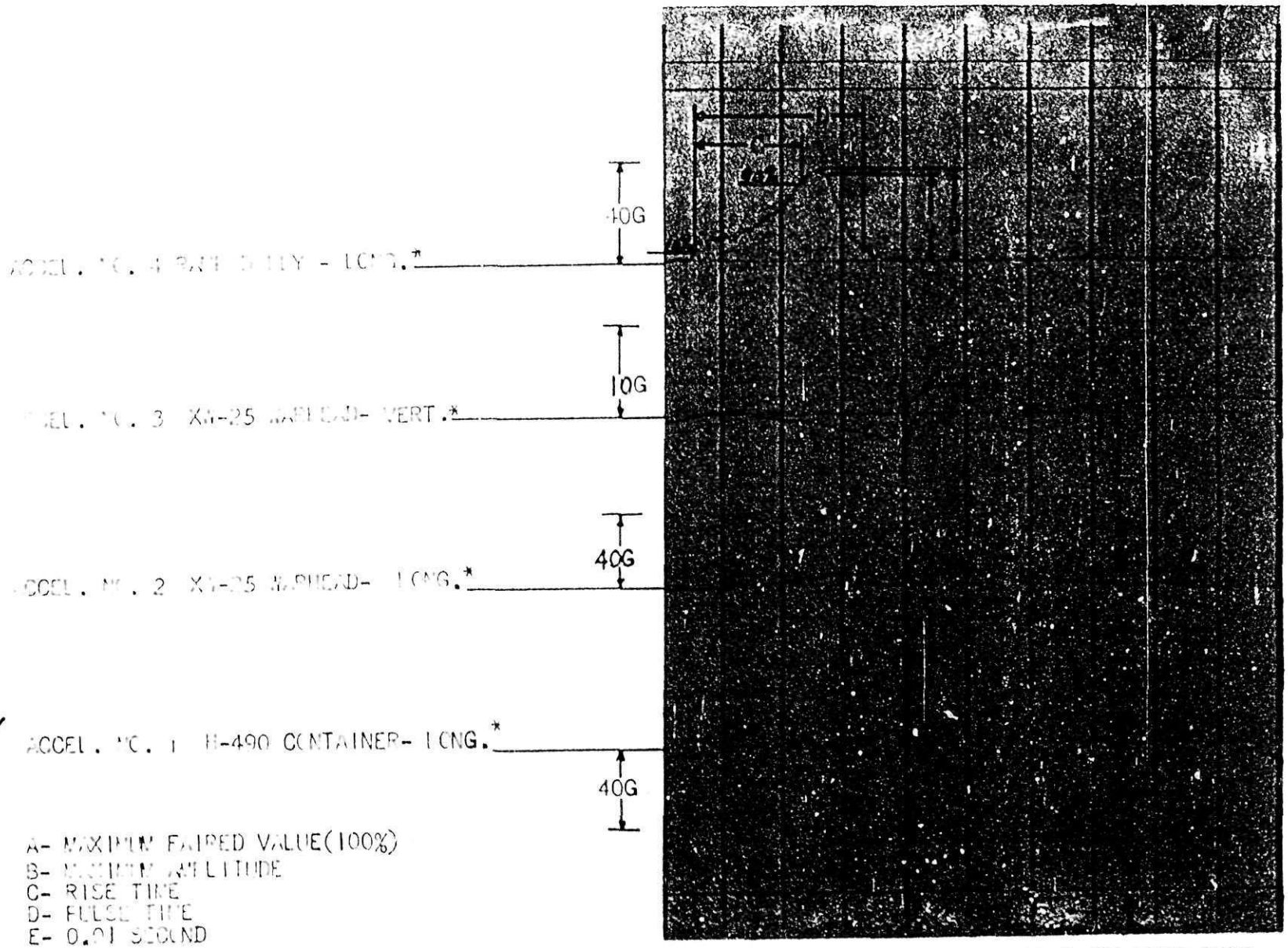

A- MAXIMUM FAIRED VALUE(100%)
B- MAXIMUM AMPLITUDE
C- RISE TIME
D- PULSE TIME
E- 0.01 SECOND

* ACCELERATIONS WITH RESPECT TO RAMP DOLLY

FIG. 7 REPRESENTATIVE OSCILLOGRAPH RECORD FOR H-490 RAMP TEST, CONTAINER NO. 2 --RAMP TEST OF H-490 WITH POLYURETHANE CUSHIONING

REF. SYM. 1612 (365)
TM-431

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TABLE I

COMPONENTS TESTED

RAMP TEST OF H-490 WITH POLYURETHANE CUSHIONING (X-9030)

	Component	Dwg. No.	Serial No.
	Sphere, Concrete	None	None
MC-672	Case, HE Sphere	310236	AA-1005-H5
	Cover and Mount, X-Unit	126662	None
H-490	Container	DS(1284)56206	None
	Packing, Polyurethane (X-9030)	None	None
	Shield, Top	DS(1284)56414	None
	Shield, Bottom	DS(1284)56413	None
Insert, Metal Drum, Bottom		SK(1284)60485	None
Insert, Metal Drum, Top		SK(1284)60486	None

TABLE II

ACCELEROMETERS

RAMP TEST OF H-490 WITH POLYURETHANE CUSHIONING (X-9030)

Accel. No.	Location*	Serial No.	Range	Statham Model No.	Nat. Freq. (cps)
1	Container, Long.	681	±50 g	Fa-50-300	470
2	Dummy XW-25 Warhead, Long.	1298	±50 g	Fa-50-300	565
3	Dummy XW-25 Warhead, Vert.	1297	±50 g	Fa-50-300	530
4	Ramp Dolly, Long.	654	±50 g	A5A-50-300	490

* All directions are with respect to the ramp dolly axes.

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Ref. Sym: 1612 (365)
Project No. TM-431

TABLE III

ACCELERATIONS AND TIMES — RAMP TEST OF H-490 WITH POLYURETHANE CUSHIONING (X-9030)

		7.0 mph Impact Velocity							
		Plywood Shield Container 2				Plywood-and-Steel Shield Container 1			
		Acceleration, g*		Time (sec.)		Acceleration, g*		Time (sec.)	
Accel. No.	Location[1]	Max. Faired	Max. Amp.	Rise	Pulse	Max. Faired	Max. Amp.	Rise	Pulse
1	Container, Long.	-14	-27	.017	.032	-12	-18	.010	.019
2	Dummy XW-25 Warhead, Long.	-19	-19	.028	.054	-13	-14	.031	.060
3	Dummy XW-25 Warhead, Vert.	-3.9	-4.1	.014	.028	-2.6	-3.1	.012	.046
4	Ramp Dolly, Long.	-15	-20	.013	.032	-14	-18	.021	.039

		9-1/2 mph Impact Velocity							
		Plywood Shield Container 2				Plywood-and-Steel Shield Container 1			
		Acceleration, g*		Time (sec.)		Acceleration, g*		Time (sec.)	
Accel. No.	Location[1]	Max. Faired	Max. Amp.	Rise	Pulse	Max. Faired	Max. Amp.	Rise	Pulse
1	Container, Long.	+74	+75	.002	.006	+30	+42	.004	.011
2	Dummy XW-25 Warhead, Long.	-31	-35	.015	.037	-20	-22	.023	.037
3	Dummy XW-25 Warhead, Vert.	-3.1	-5.2	.004	.022	-3.1	-3.8	.012	.030
4	Ramp Dolly, Long.	-34	-35	.017	.027	-38	-39	.021	.030

[1] All directions are given with respect to the ramp dolly axes.

* Plus accelerations are: Vertical - toward nose end of weapon;
Longitudinal - toward bottom of warhead.

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