UNCLASSIFIED [redacted]

1364

SANDIA SYSTEMATIC DECLASSIFICATION REVIEW
1st Review Date: 7/28/98
Authority: ☐ADC ☒ADD
Name: W Payne
2nd Review Date: 7/28/98
Authority: ADD
Name: R B Craner
Determination (Circle Numbers)
1. Classification Retained
2. Classification Changed to U
3. Contains No DOE Classified Information
4. Coordinate With:
5. Contains UCAI? no
6. Comments: ok for Opened

JUL 8 1955
M-7, 3-2
Case No. 627.00
Ref. Sym: 1612 (220)
Project No. TM-295

RECEIVED
JUL 14 1955
R & D FILES

MR. J. P. CODY - 1320

Attn: S. A. Moore - 1326

Re: Douglas Ejector Rack Test of the Mk 7

CDL No. 1004/81 D.L.
ACCOUNTABILITY CARD G.L.
FILE No. M-7
3-2

Summary of Results

A Douglas ejector rack test of the Mk 7 was conducted to subject a Mk 7 weapon to ejection loads applied by a Douglas Aircraft Company four hook ejector rack and to determine if the weapon would withstand the applied shock loads.

The maximum measured stress in the load beam was 97,500 psi tension.

During the first test run the MC-73 mounts (old style rubber lined - spring type, Dwg. Nos. 113739 and 113735) were damaged. The MC-73 had bottomed several times and was jammed tight down against the mounting plate. The jamming was caused by bent spindles inside the MC-73 mounts. After the first test run the MC-3 radar was found to be inoperative. The bottom of the MC-3 had struck a structural member of the cartridge.

A new set of MC-73 mounts (old style rubber lined - spring type) were used for the second test run and were damaged in a similar manner as the mounts used for the first run.

INVENTORIED
MAR 2 1959
BY ORG. ...

INVENTORIED
AUG 6 1964

After the second test run MC-73 mounts of the steel wool packed and spring type (Robinson mount, Dwg. No. 350373) were used and found to be satisfactory.

3427-1

At the conclusion of the test it was found that both the MC-1A and MC-3 radars had been striking structural members of the cartridge and the bottoms of the cans were bent. The air valve on top of the MC-3 was also damaged.

INVENTORIED
SEP 14 1965

The maximum faired value of the accelerations measured during the tests were: 38.5 g vertical on the MC-73, 16.8 g vertical on the MC-73 base plate and 12.2 g vertical at the CG of the weapon.

3428-3

CENTRAL M & R
CONTROL NO. Q 50110

SANDIA SYSTEMATIC DECLASSIFICATION REVIEW
DOWNGRADING OR DECLASSIFICATION STAMP
CLASSIFICATION CHANGED TO: U
AUTHORITY: R. B. Craner
Emelda Selph 7/29/98
PERSON CHANGING MARKING & DATE
RECORD ID: 98SW3186
W.C. Payne 7/30/98
PERSON VERIFYING MARKING & DATE
DATED: 7/29/98

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Object of Test

The object of this test was to subject a Mk 7 weapon to ejection loads applied by a Douglas Aircraft Company four hook ejector rack, Contract No. 52-1011C, using one small and one large cartridge. The ejection loads were applied to determine if the weapon would withstand the applied shock loads.

Reason for Test

This test was requested in a Work Order Authorization from J. P. Cody, 1320, to P. H. Adams, 1612, dated May 7, 1955.

Summary of Past Tests

A previous dynamic ejector test was conducted using a TX-7 weapon. The results of this test were published in a memorandum, Dynamic Ejector Performance Test of the TX-7 (Concrete-Filled Space Chamber), by J. H. Atkinson, R. C. Dove, and B. W. Duggin, dated July 16, 1952, Project No. TM-59, Ref. Sym: 1532 (31).

For this previous test the following ejectors were used: (1) Douglas cartridge type, (2) Republic air piston type, (3) McLean air piston type, (4) McLean cartridge type.

On the basis of maximum vertical acceleration (with respect to the longitudinal axis of the TX-7) at the center of gravity, the various ejectors may be listed in the following order: McLean cartridge type, 3.7 g (orifice size has little effect on maximum vertical acceleration at the center of gravity); Republic air piston type, 6.6 g; McLean air piston type 8.2 g; and Douglas cartridge type 8.8 g.

For all the ejectors tested, the stresses measured on the weapon were below the yield point stress of the material.

Another previous dynamic ejector test was conducted using an XW-7 BoAR. The results of this test were published in a memorandum, Dynamic Ejector Test of the XW-7 BoAR, By W. H. Cross, B. W. Duggin, and L. P. Navoda, dated August 23, 1954, Project No. TM-216, Ref. Sym: 1612 (132).

For this test the following three types of ejectors were used: Douglas powder actuated, Republic pneumatic and McLean powder actuated. Full powder charges were used with the powder actuated ejectors and air pressures of 1850 and 2400 psi were used with the pneumatic ejector.

The maximum measured stress in the load beam was 15,700 psi tension when using the Douglas ejector, 5,000 psi tension when using the Republic ejector with 2400 psi air and 10,800 psi tension when using the McLean ejector.

Some rivets in the ejector area of the case center section popped out slightly after the weapon was ejected with the Douglas ejector. No electrical failures occurred.

The maximum accelerations measured during the tests were: 29.9 g vertical (with respect to the longitudinal axis of the BoAR) at the CG of the weapon when using the Douglas ejector, 28.1 g vertical at the nose of the weapon when using the Republic ejector with 2,400 psi air and 65.7 g vertical at the CG of the weapon when using the McLean ejector.

Setup for Test

The dynamic jig was modified with a pendulum suspended from the main top beam. The Mk 7 was suspended in the test jig as shown in Fig. 1. The Douglas ejector was attached to the ejector mount as shown in Fig. 2. Figure 3 shows the Mk 7 weapon attached to the Douglas ejector rack.

The ejector fixture and pendulum were made adjustable to allow for proper alignment. An arresting device, consisting of two overriding clutches mounted on the pendulum rods and riding on cables, was used to prevent back swings. To insure engagement of the overriding clutches, two elastic shock cords were attached to each override clutch and to the frame of the ejector mount. The elastic shock cords also prevented the weapon from swinging high enough to strike the A frame to which the arresting cables were attached.

A Mk 7 weapon consisting of the components as tabulated in Table I was used as the test weapon.

The following equipment was used to perform the test:

Douglas Aircraft Co. four hook ejector rack, Contract No. 6341, Serial No. 6-95 as shown in Fig. 2.
Dynamic jig No. 1 (drop tower)
Miller amplifiers, Type C-3, Model CA12, Serial No. 7
Miller oscillograph, Model J, Serial No. 99

The Mk 7 weapon was instrumented as follows:

Four Baldwin SR-4 strain gages, Type A5-1, resistance 120 ± 0.2 ohms, gage factor 1.96 ± 1%, lot No. 232-11, were mounted on the load beam as

shown in Fig. 4.

Two 10,000 pound Baldwin load cells, Serial Nos. 6049 and 658 as shown in Figs. 2 and 3.

Vertical accelerometers were mounted on the MC-73 and on the MC-73 base plate as shown in Figs. 1 and 5. Longitudinal, vertical, and lateral accelerations were measured at the center-of-gravity of the Mk 7 as shown in Fig. 1. The directions of the acceleration measurements as stated are relative to the axes of the weapon in normal flight orientation. The Statham accelerometers used are as tabulated in Table II.

Procedure

Six test runs were made with the Douglas ejector rack using one large and one small cartridge.

The load cells were used to measure the load (force vertical with respect to the weapon) being applied to the Mk 7.

A FAT test was conducted after each of the first three test runs. After the fourth and fifth test runs the MC-73, MC-3, and MC-1A were checked electrically; however, the MC-3 and MC-1A were not rung out. A FAT test was again conducted after the sixth and final test run.

To determine the amount of permanent set or movement of the load beam the distance between the bottom edge of the load beam and the sphere case was measured after each ejection.

To measure the displacement of the load beam with respect to the sphere case, the surface of the sphere case under the load beam was oiled and putty was packed between the load beam and the sphere. The putty would not stick to the oiled sphere case; therefore, displacement measurements could be made between the putty and sphere case. Displacement measurements were made on both sides of the load beam at the center, 1-1/2 inches aft of center, 3 inches forward of center on the right side of the beam and 2-1/2 inches forward of center on the left side of the beam.

Results

The maximum measured stress in the load beam was 97,500 psi tension. The maximum stresses and strains measured on the load beam during the tests are as given in Table III.

After the first test run it was found that the MC-73 mounts (Dwg. Nos. 113739 and 113735) had been damaged as shown in Figs. 5 and 6. The shock of the first ejection caused the MC-73 to bottom several times and

the MC-73 was jammed tight down against the mounting plate. The jamming was caused by bent spindles inside the MC-73 mounts. A new set of MC-73 mounts (Dwg. Nos. 113739 and 113735) were used for the second test run and were damaged in a similar manner as the mounts used for the first run. After run 1 it was also found that the MC-3 radar, Serial No. AA-1961J3, was inoperative. The bottom of the MC-3 had struck a structural member of the cartridge as shown in Fig. 7. The bottom of the MC-3 was bent as shown in Fig. 8. The MC-3 radar, serial No. AA1961J3, was sent to Electronics Division 5421 where the radar was checked and was found to operate satisfactory.

At the conclusion of the test the MC-73 Robinson mounts (Dwg. No. 350373) that were installed after the second ejection were found to be satisfactory. The MC-73 did not bottom during the last four ejections and the timing was electrically within all tolerances. It was found that the coaxial cable connector on the MC-3 is located extremely close to the MC-73 cover as shown in Fig. 9.

The MC-3 radar that was installed after the first ejection was in satisfactory operating condition at the conclusion of the test; however, both the MC-1A and the MC-3 had been striking structural members of the cartridge and had bent the bottoms of the cans as shown in Fig. 8. The air value on the top of MC-3, serial No. AA1899J3, used during the last five test runs, was damaged as shown in Fig. 10.

The load beam was not damaged during the test other than a slight indention where the ejector plunger struck; however, the load beam was permanently displaced down approximately 1/16 inch due to permanent deformation of the box ring as shown in Fig. 11.

The maximum accelerations and their associated frequencies, measured during the test are as given in Table IV. Figure 12 is a typical record of the acceleration and strain measured during the test. Table V gives the displacement of the center of the load beam with respect to the sphere case.

Figures 13 through 18 are plots of the total force (vertical with respect to the weapon) applied to the weapon by the ejector vs. time, for each of the six ejections.

Conclusions

The MC-73 mounts (Dwg. Nos. 113735 and 113739) will not withstand the shock load applied by the Douglas ejector during this test.

It is possible that the cable connector, that is located extremely

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close to the MC-73 cover, could be damaged by movement of the MC-73.

William H. Cross
WILLIAM H. CROSS - 1612-1

JAMES H. STOEVER - 1612-1

FRANK C. LOW - 1612-1

Original Signed By
P. H. ADAMS

PAUL H. ADAMS - 1612

WHC/JHS/FCL:1612-1:as

DISTRIBUTION:
1/8A - J. P. Cody, 1320, Attn: S. A. Moore, 1326
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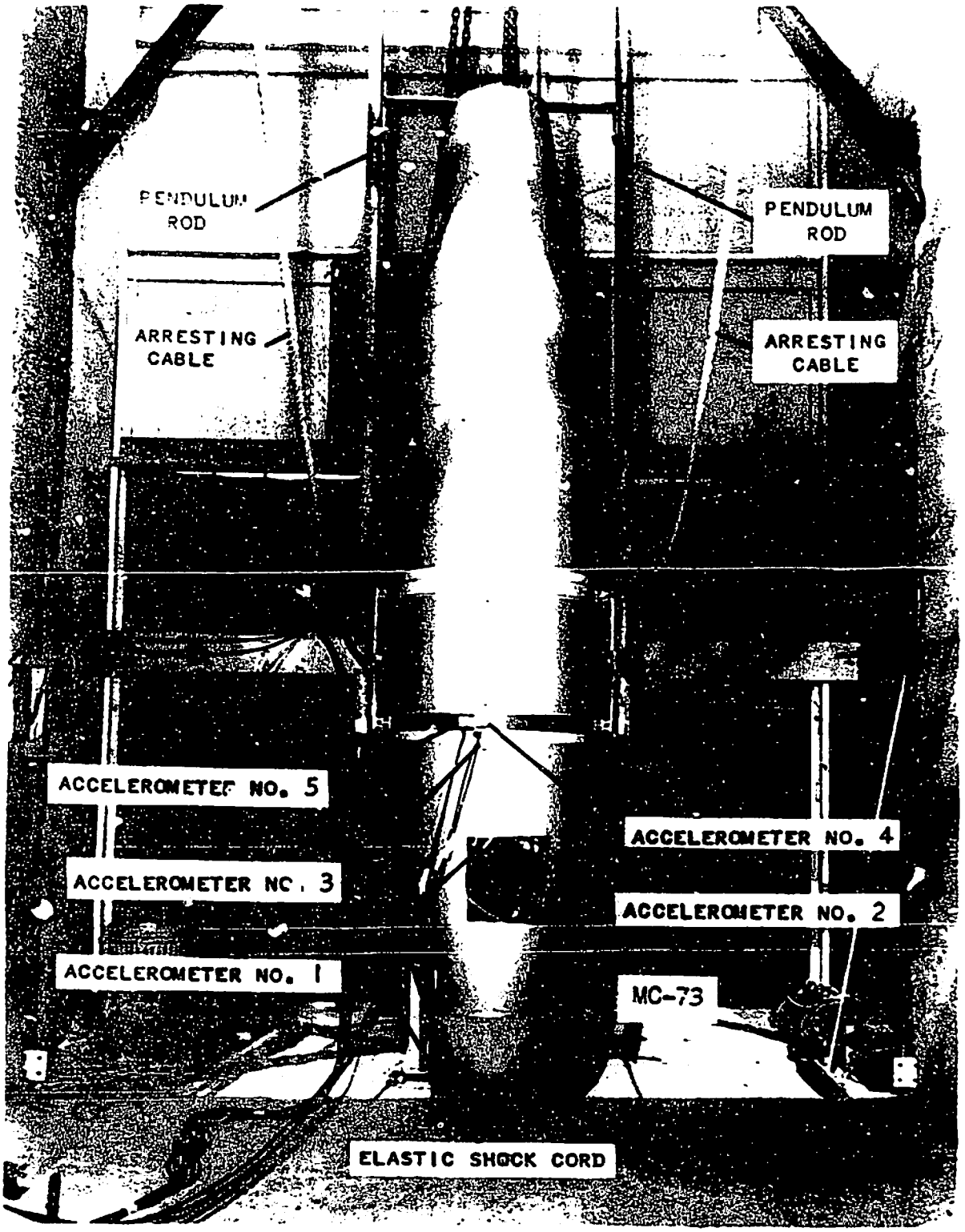

FIG - 1 ACCELEROMETER LOCATIONS ON THE Mk 7 SUSPENDED IN THE EJECTION TEST FIXTURE - DOUGLAS EJECTOR RACK TEST OF THE Mk 7.

D#62632

REF. SYM. 1612(220) TM-295

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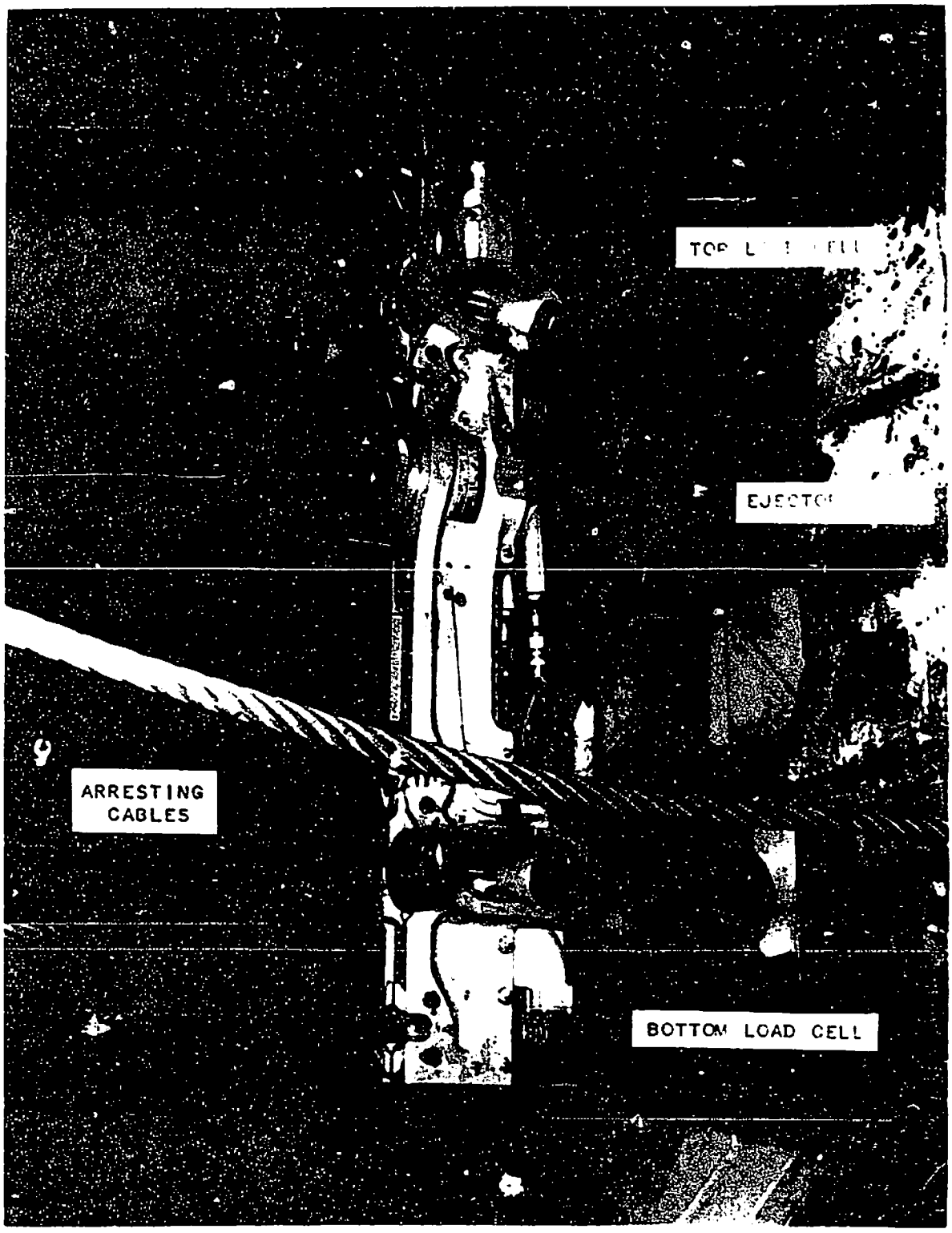
[redacted]



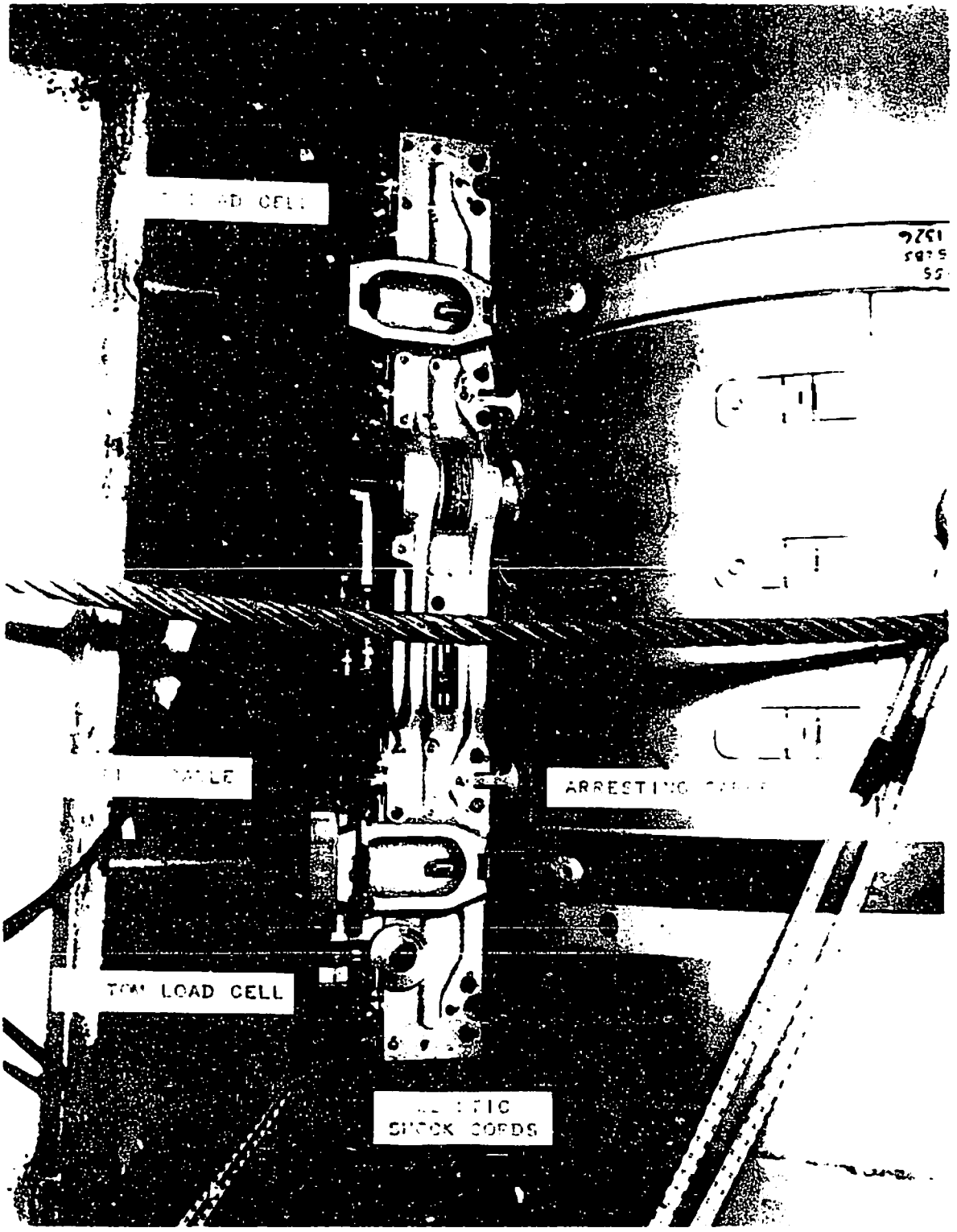
- DOUGLAS EJECTOR ATTACHED TO THE EJECTOR [illegible] -
DOUGLAS EJECTOR RACK TEST OF THE MK 7.

D#62633

UNCLASSIFIED

UNCLASSIFIED [redacted]

#1372



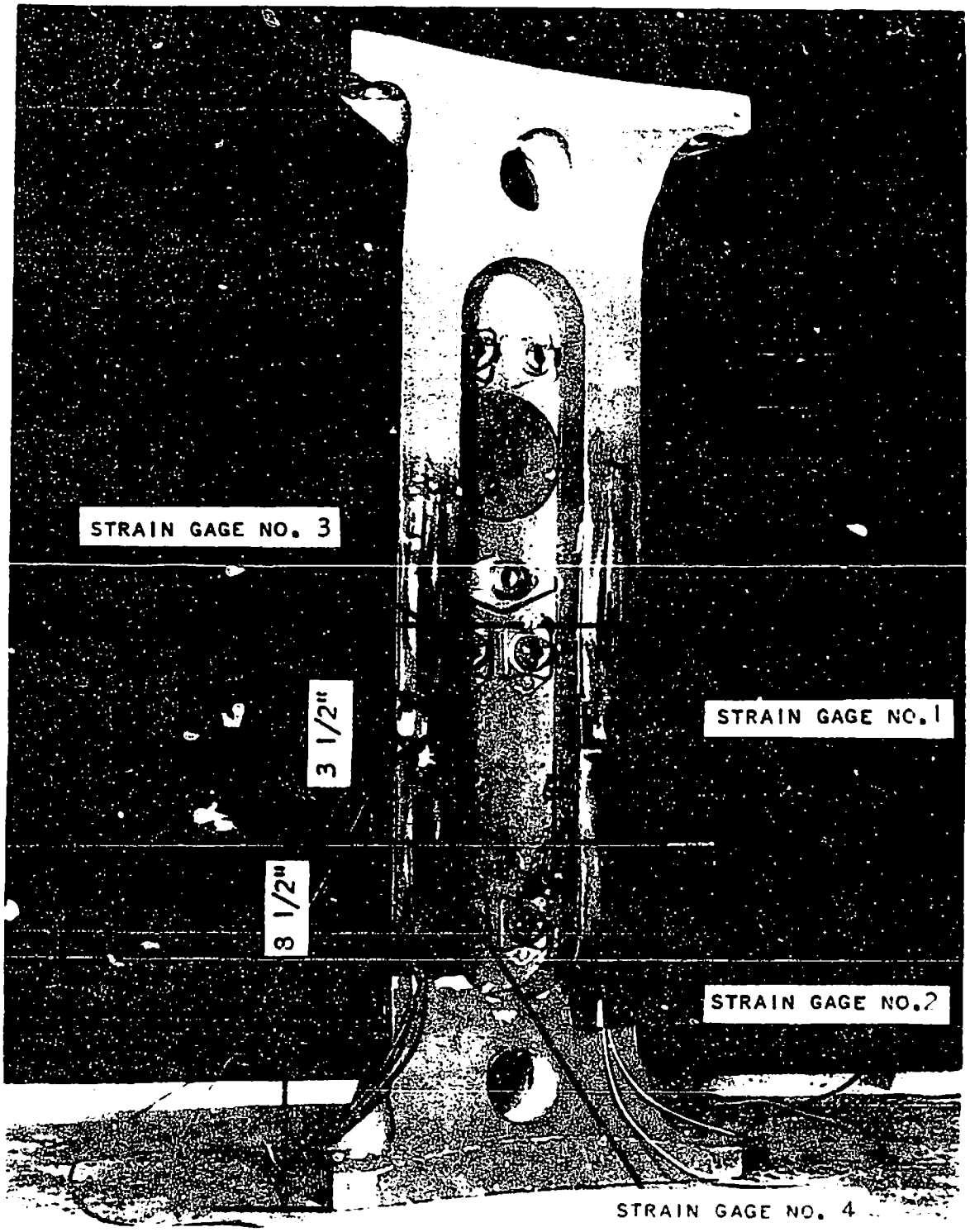
ATTACHED TO THE DOUGLAS EJECTOR
TEST OF THE

D# 62634

UNCLASSIFIED

#1373

[redacted]



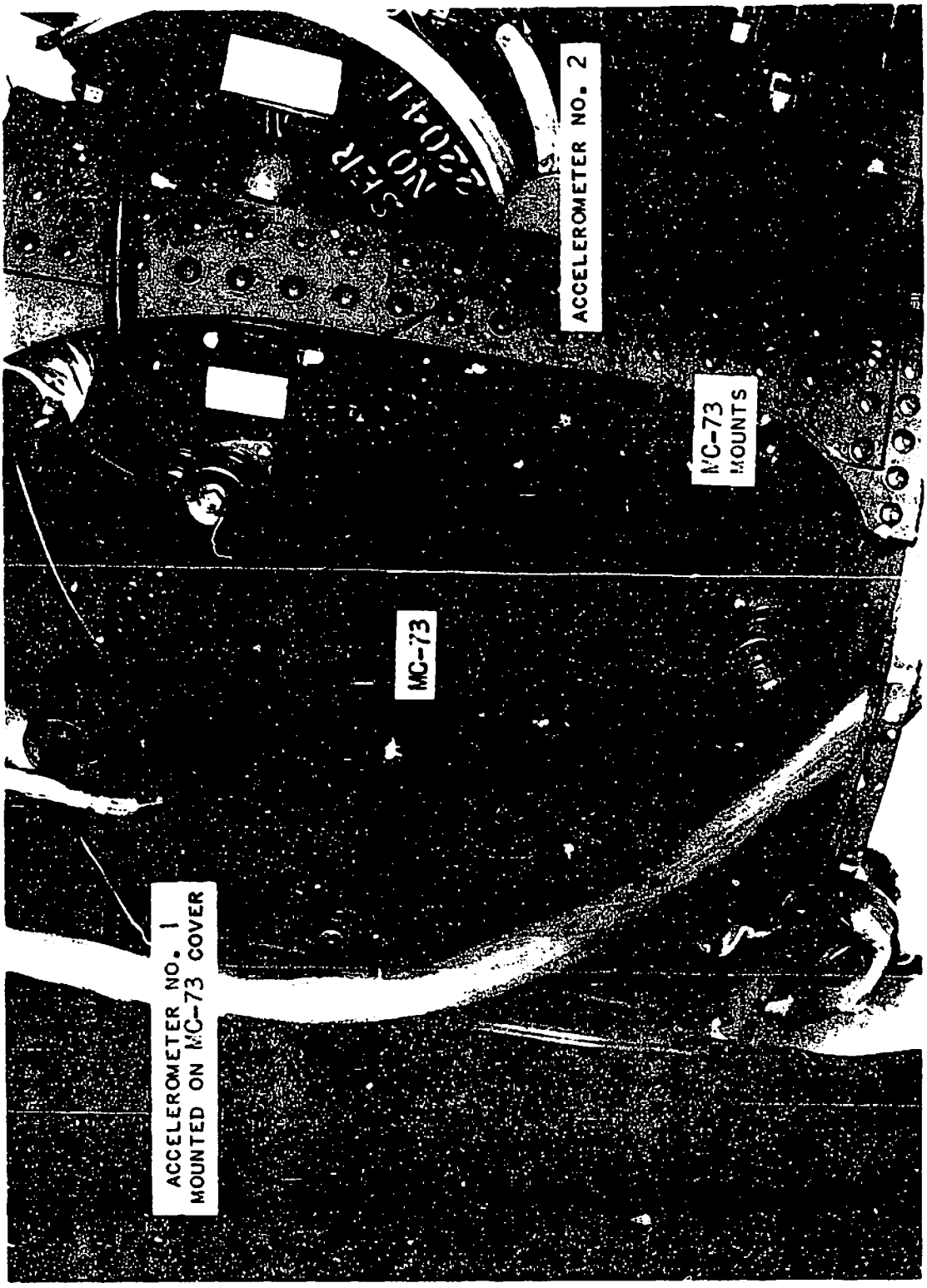
- STRAIN GAGES LOCATED ON LOAD BEAM - DOUGLAS EJECTOR RACK TEST OF THE Mk 7.

D#62635

REF. SY . [illegible]
T-[illegible]

#1374

[redacted]



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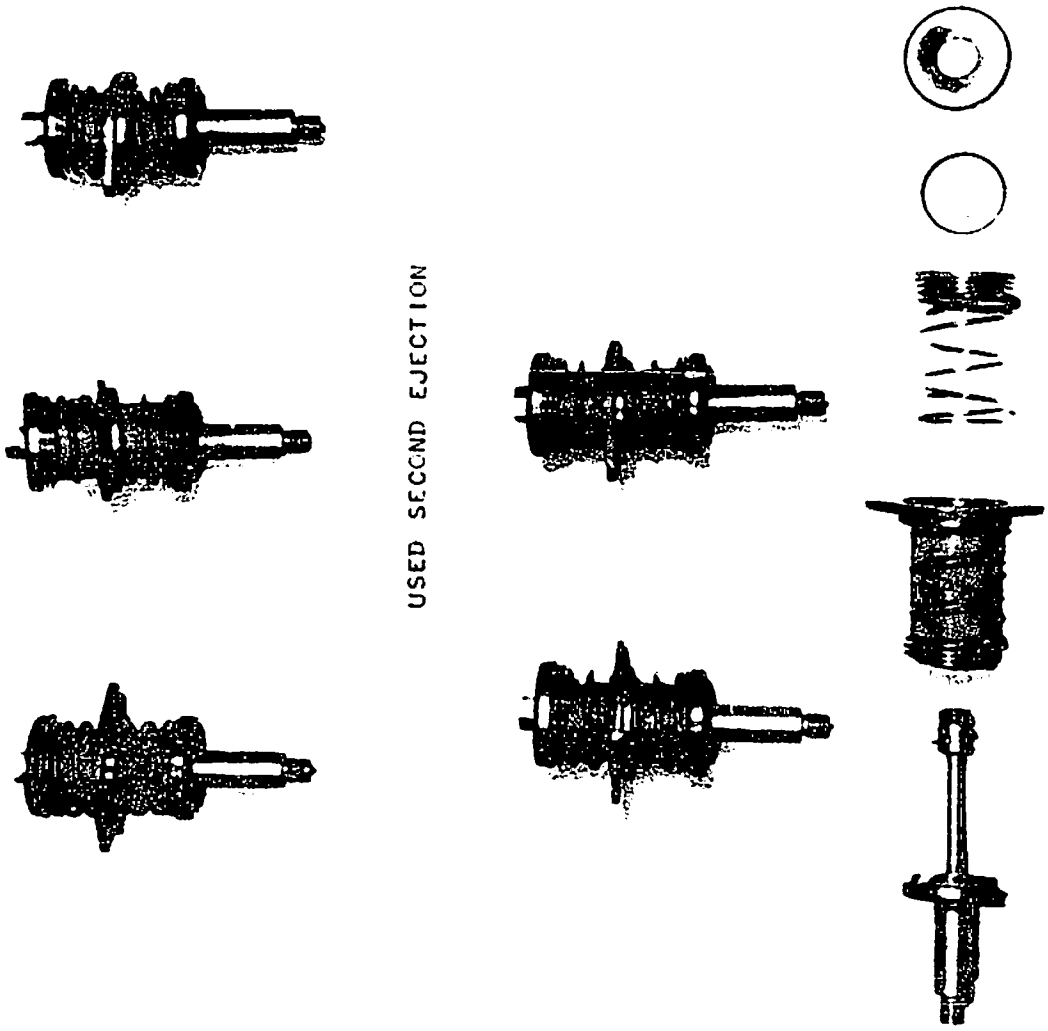

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UNCLASSIFIED

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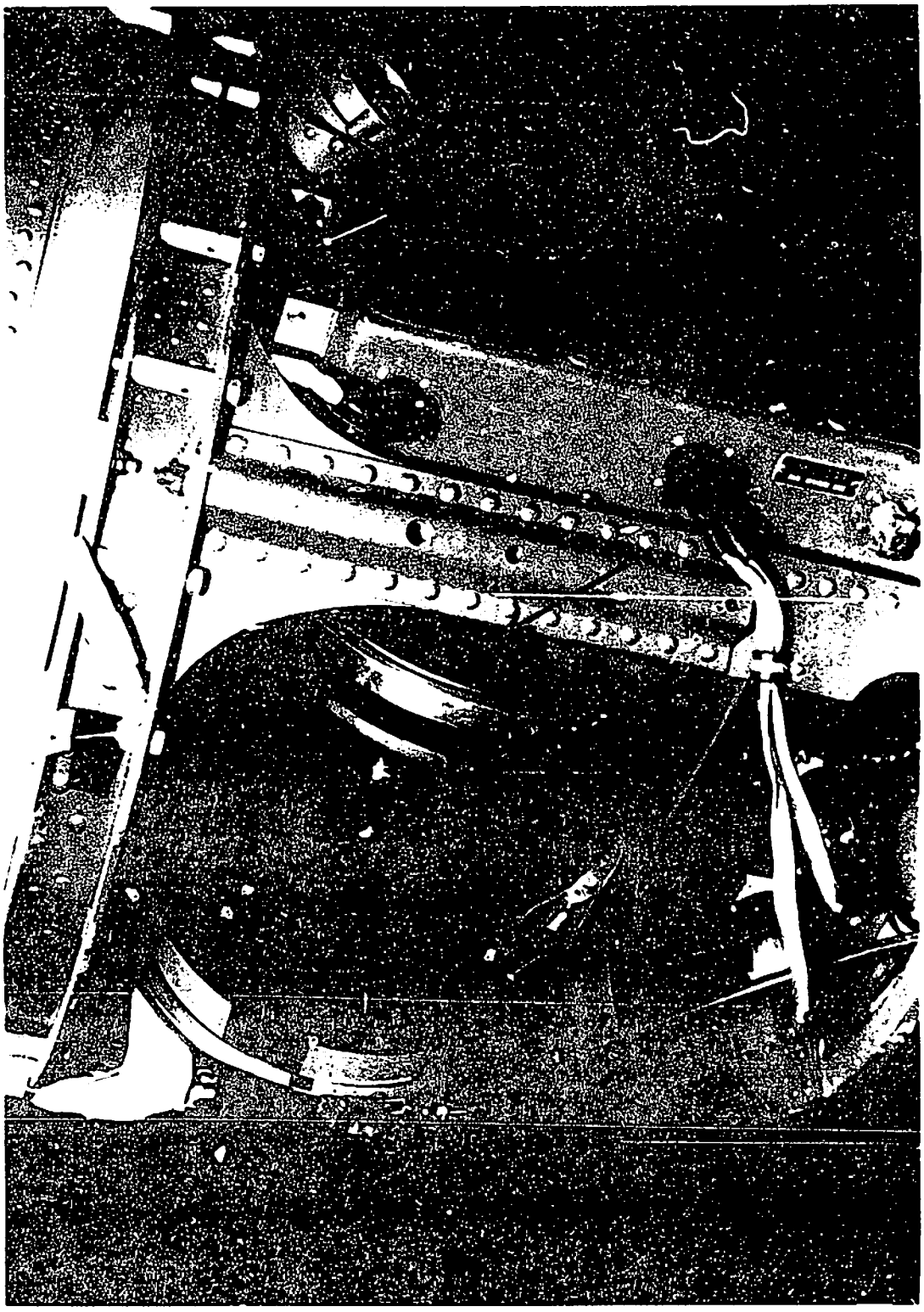

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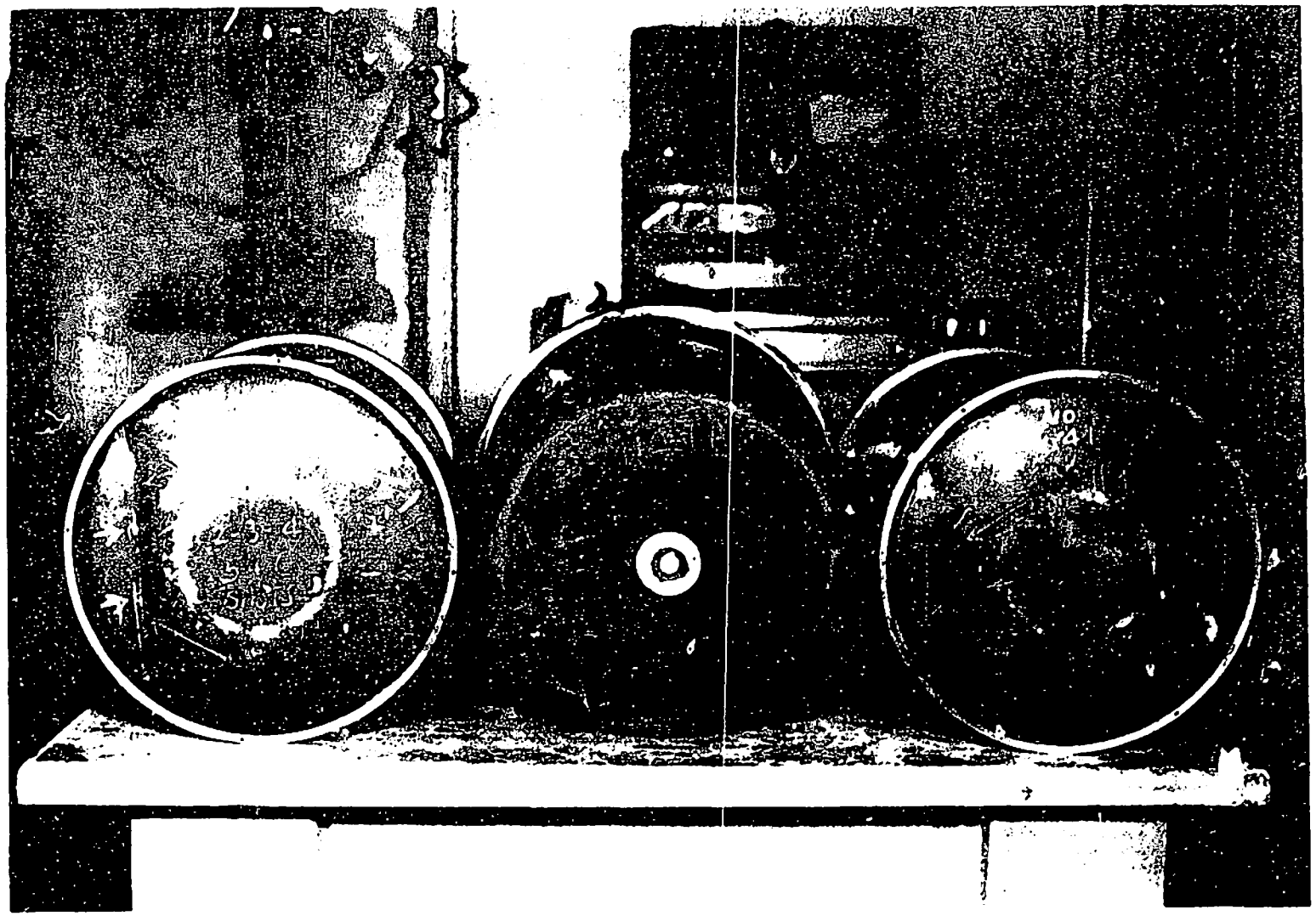

FIG. 8 - BENT MC-1A AND MC-3 RADARS -
DOUGLAS EJECTOR RACK TEST OF THE MK 7.

D#62639

REF. [illegible]

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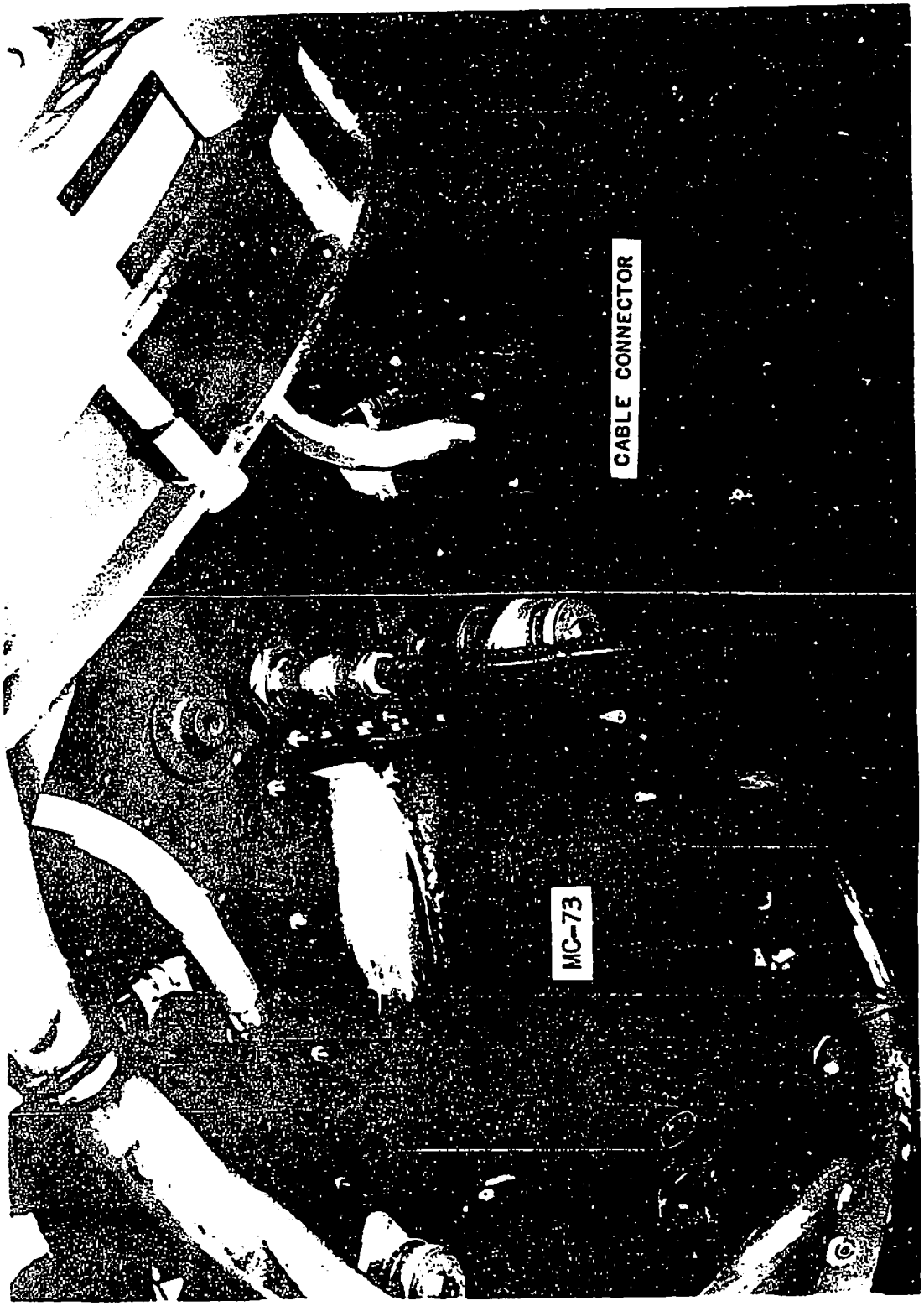
[redacted]



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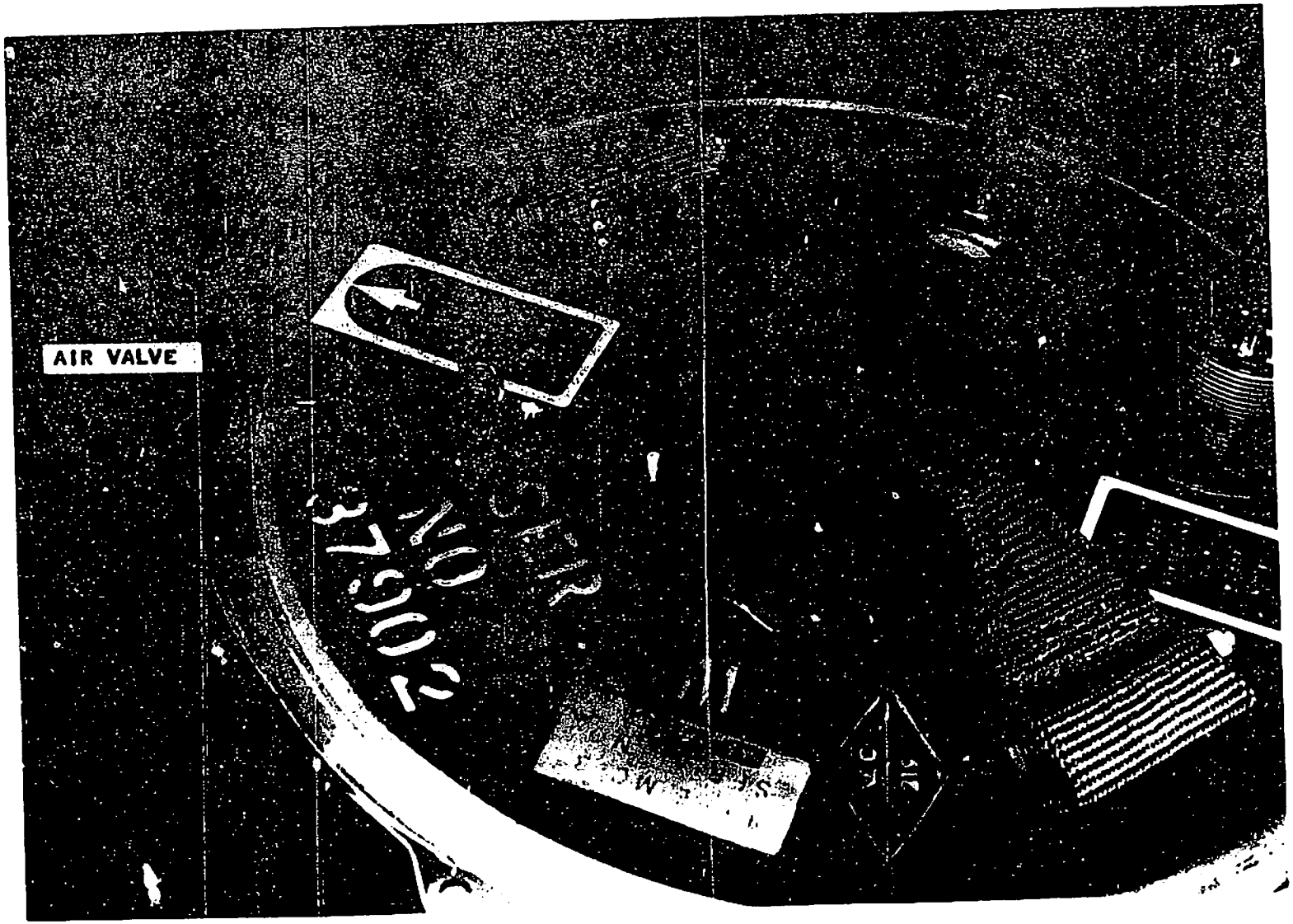

FIG. 10 - DAMAGED AIR VALVE ON TOP OF THE MC-3 - DOUBLES EJECTOR [illegible]

REF. S[illegible]. 1612(220)
[illegible]

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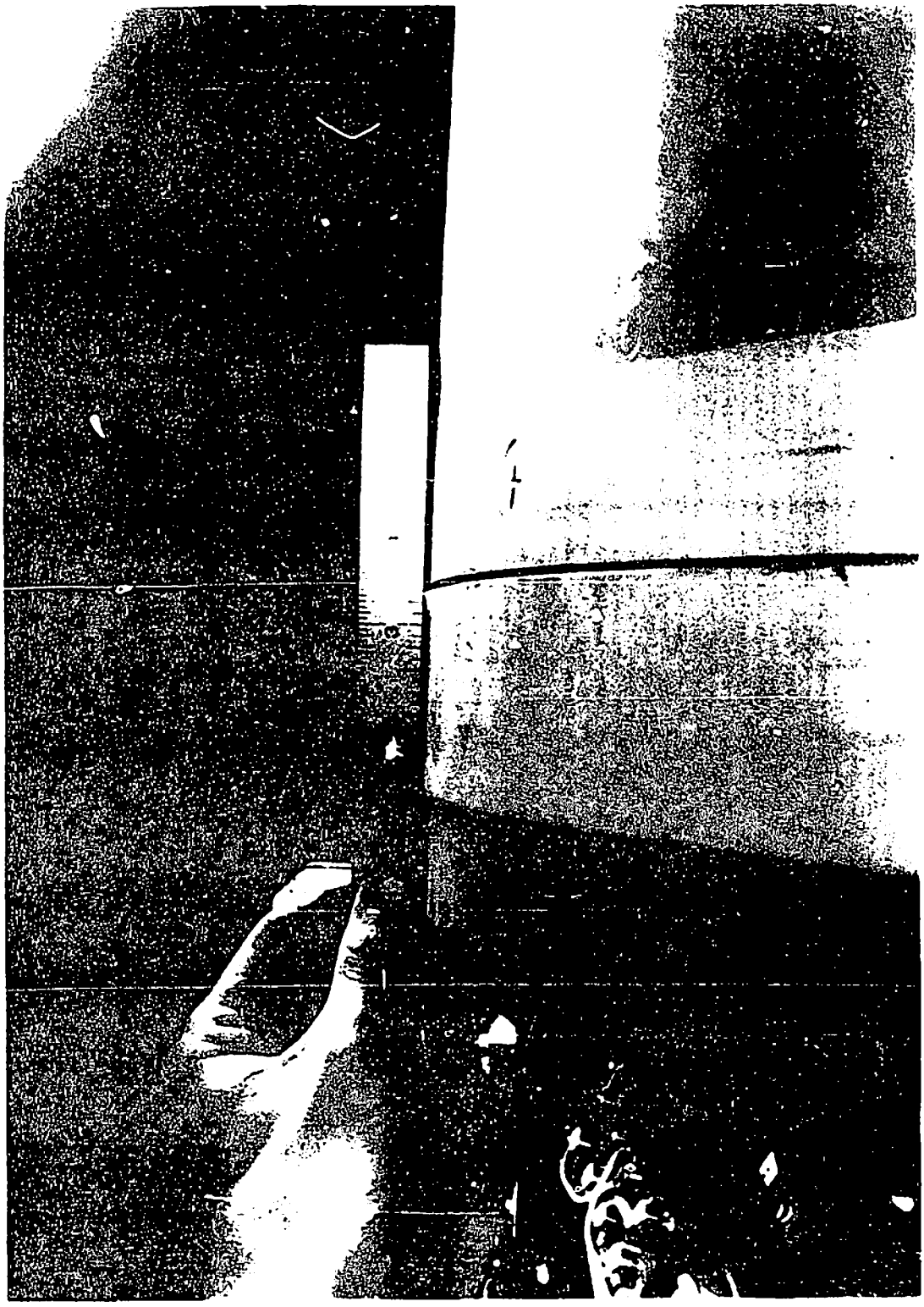

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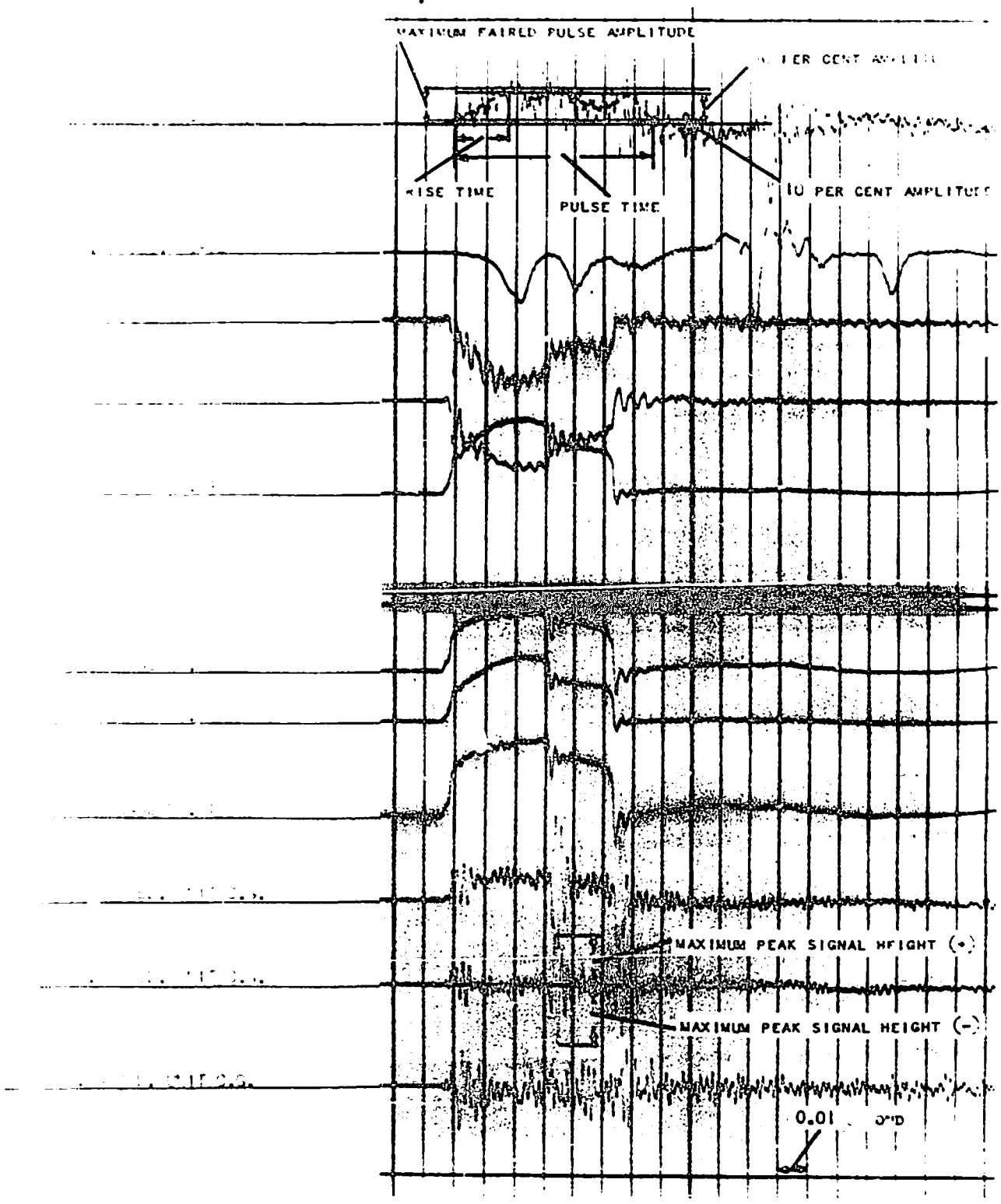

FIG. 1 - TYPICAL RECORD OF THE SHOCK SIGNALS MEASURED DURING DOUGLAS EJECTOR RACK TEST OF THE Mk 7.

REF. SYM. 1612(220)
DM-295

D#62642

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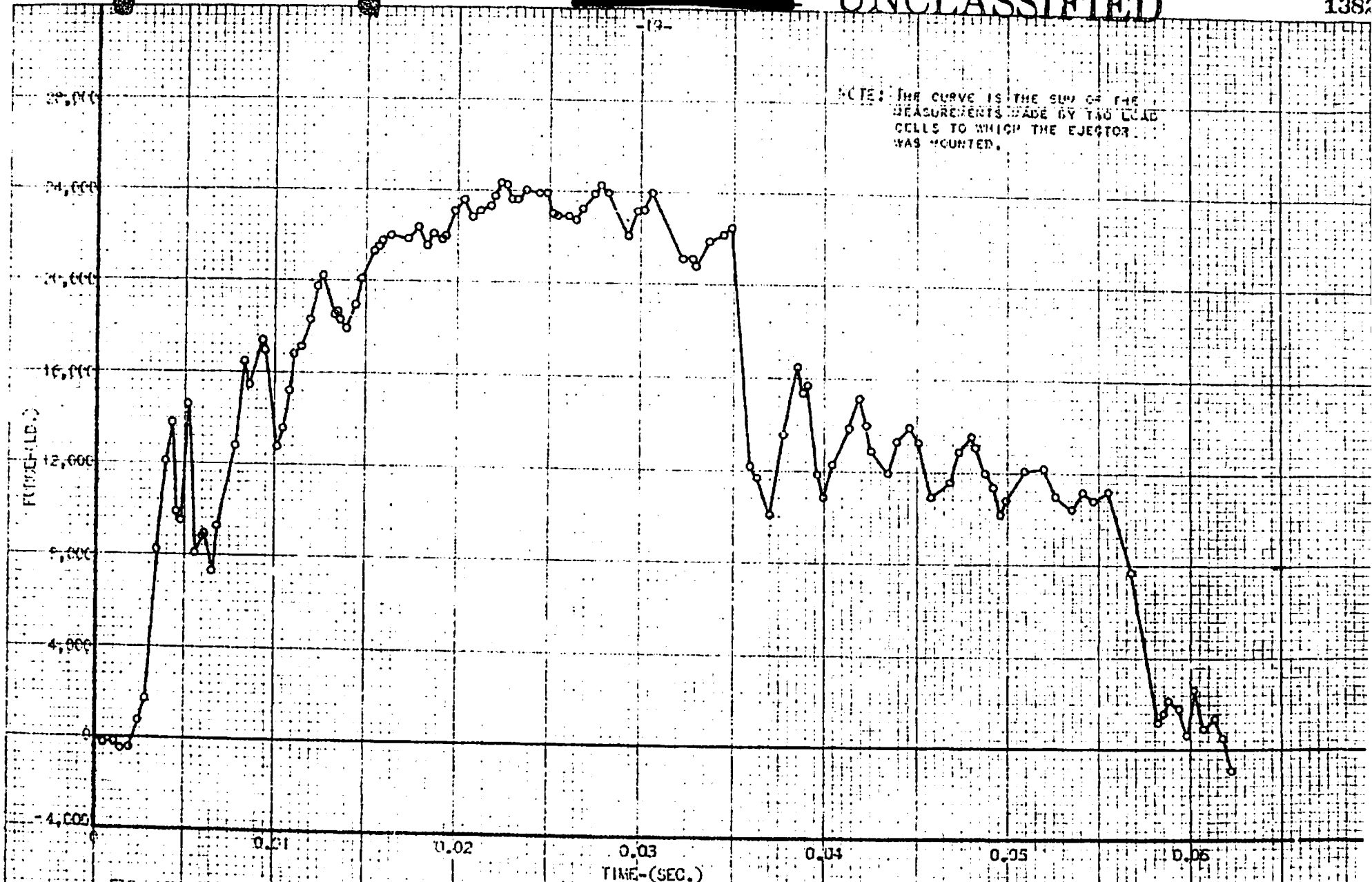

FIG. 13 - FORCE-TIME CURVE FOR RUN 1 - DOUGLAS EJECTOR RACK TEST OF THE Mk 7.

REF. SYM 1612(220)
TM-295

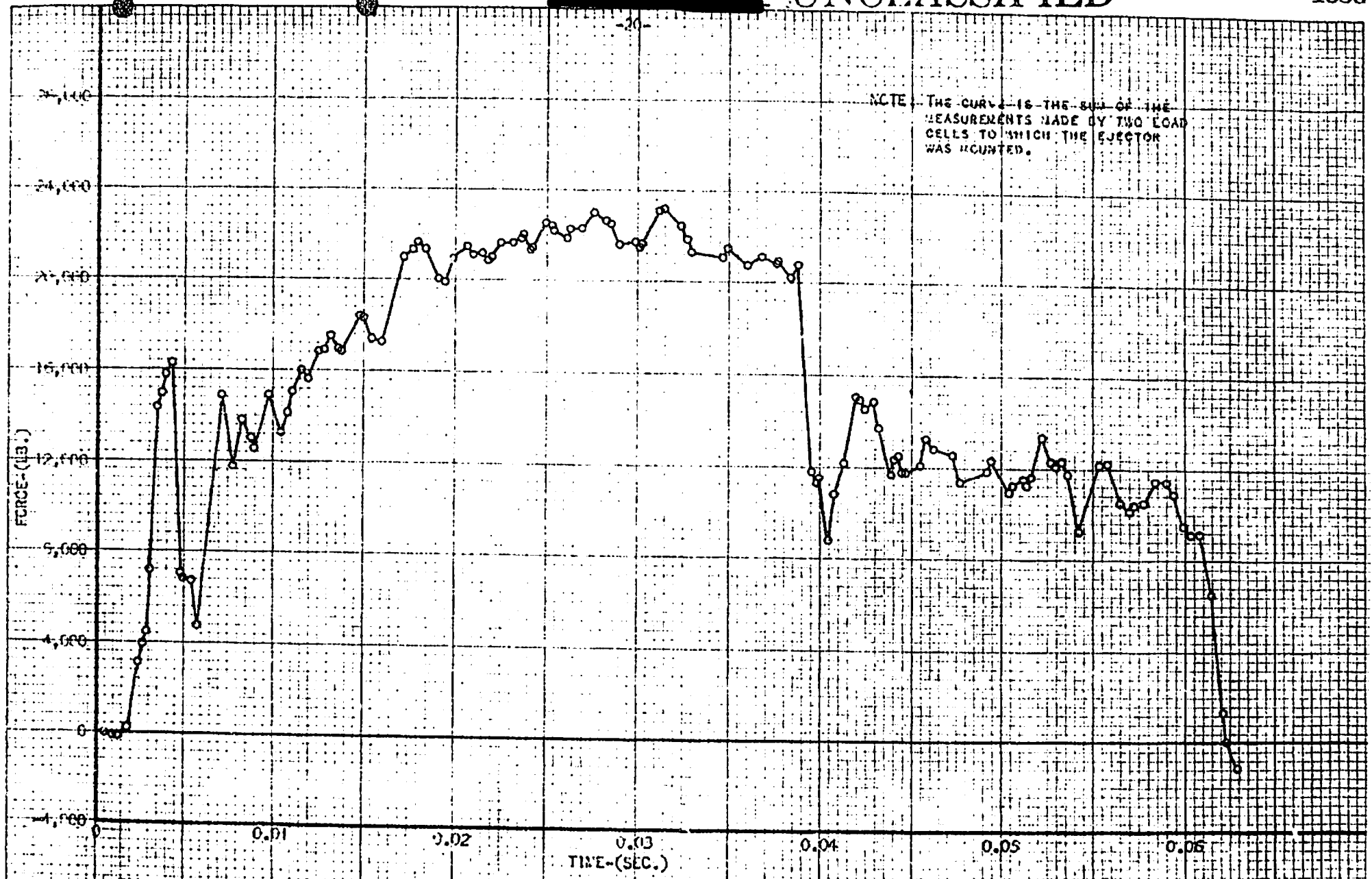

FIG. 14 - FORCE-TIME CURVE FOR RUN 2 - DOUGLAS EJECTOR RACK TEST OF TYPE MK 7.

REF. SYM. 1612(220)
TM-295

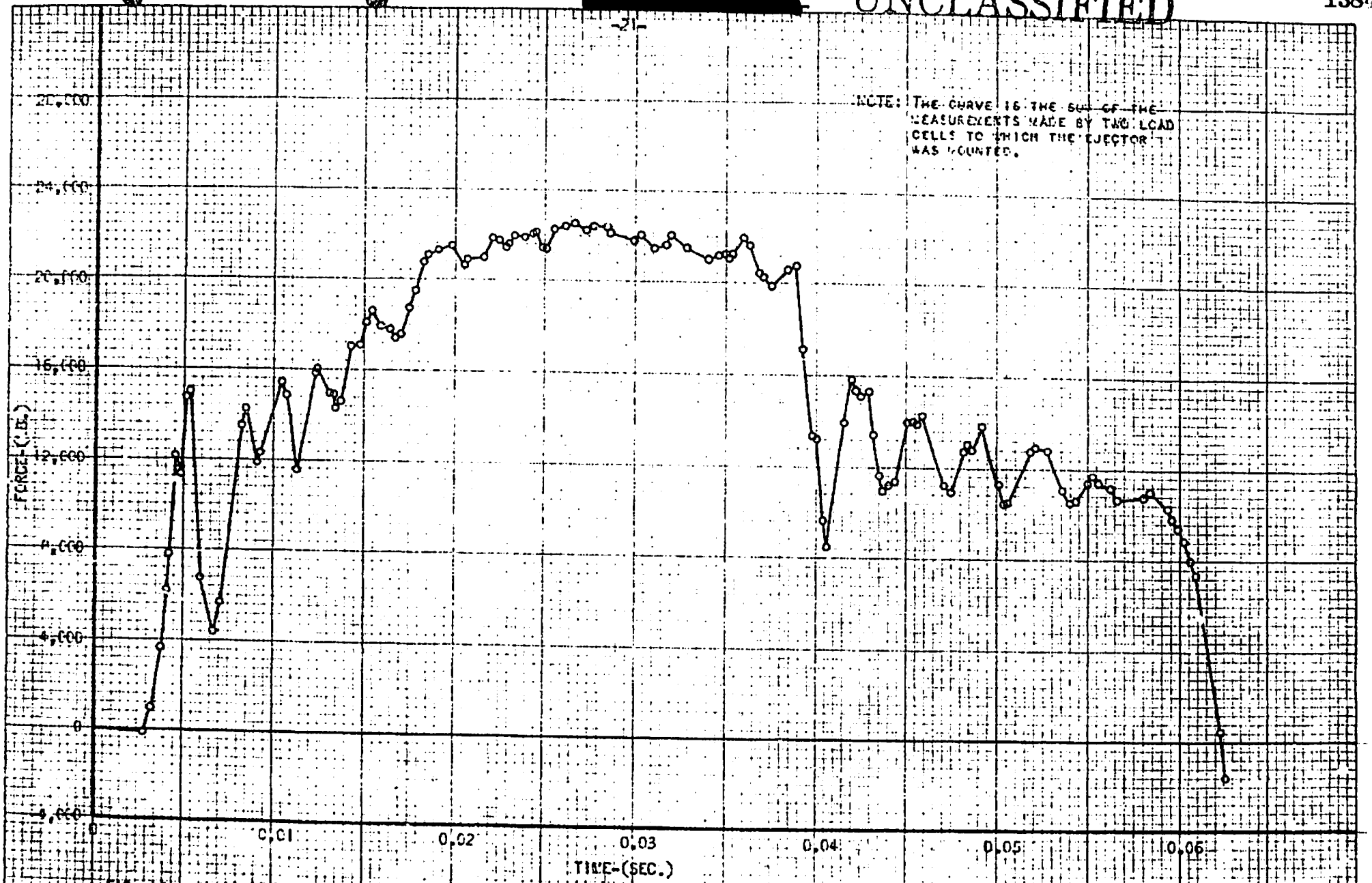

FIG. 15 - FORCE-TIME CURVE FOR RUN 3 - DOUGLAS EJECTOR RACK TEST OF THE MK 7.

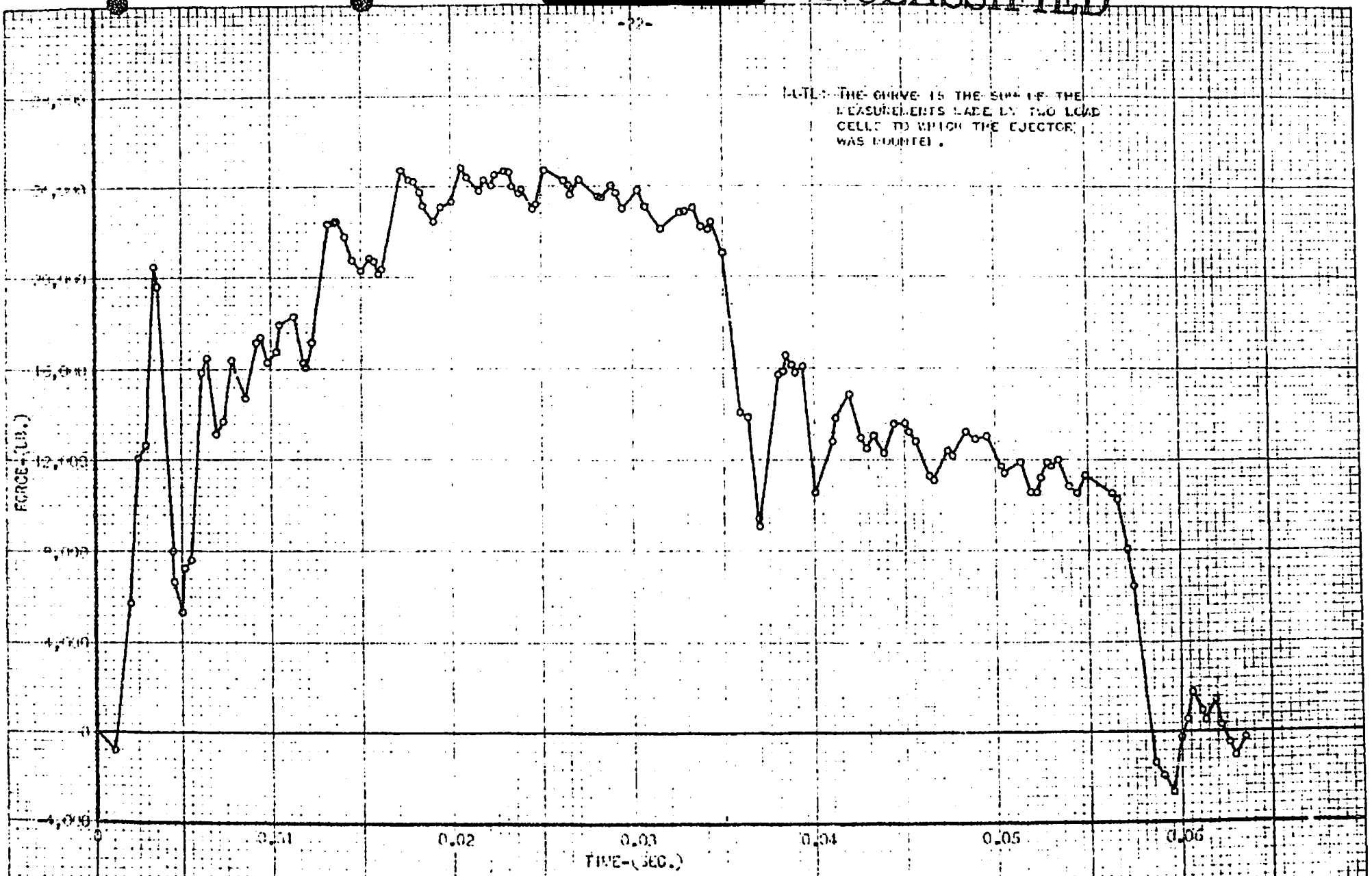

FIG. 16 - FORCE-TIME CURVE FOR RUN 6 - DOUGLAS EJECTOR RACK TEST OF [illegible] Mk 7.

REF. SYM. 1613(320)
TP-295

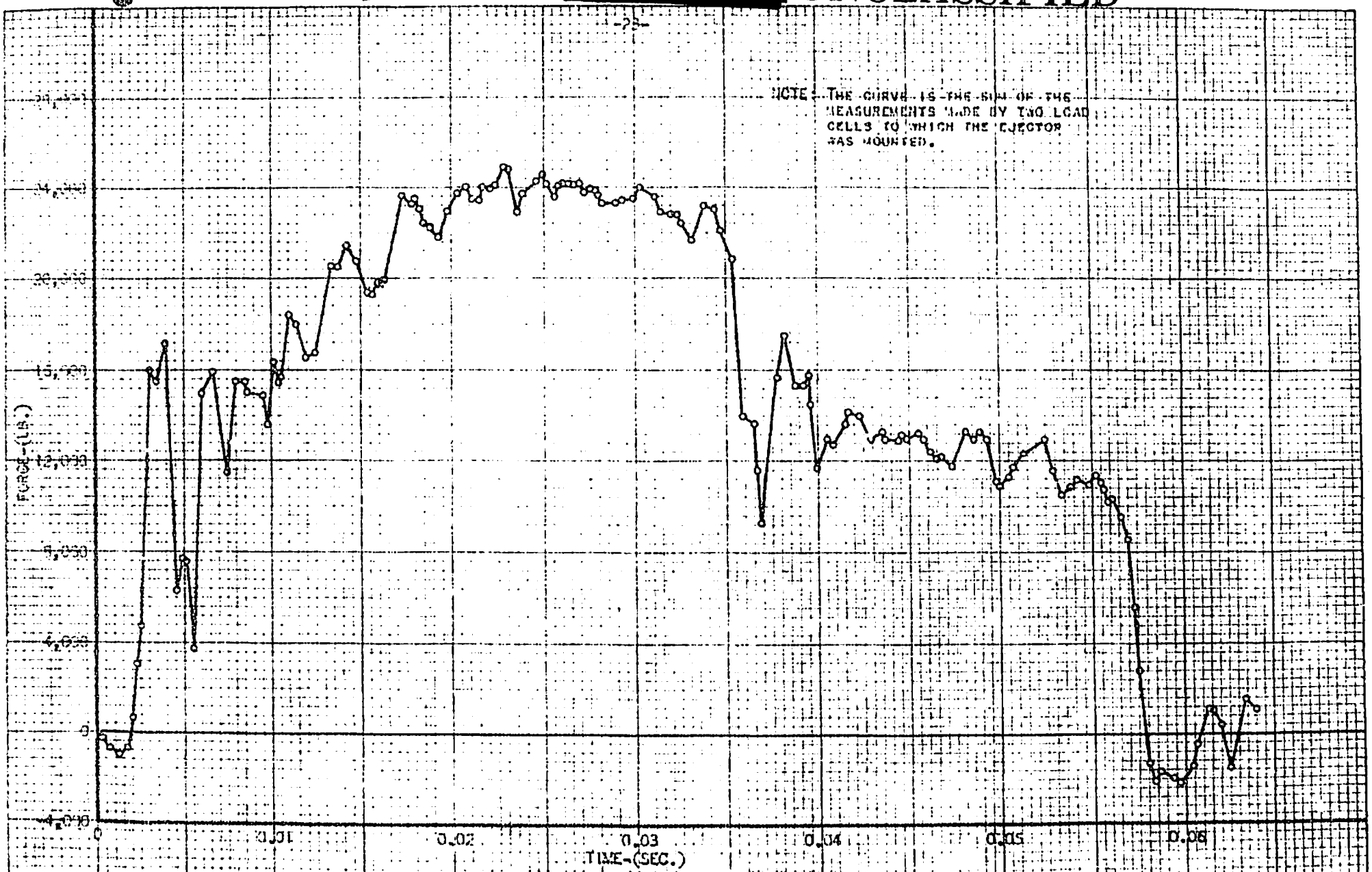

FIG. 17 - FORCE-TIME CURVE FOR RUN 5 - DOUGLAS EJECTOR TRACK TEST OF THE Mk 7.

REF. SYM. 1612(220)
TM-295

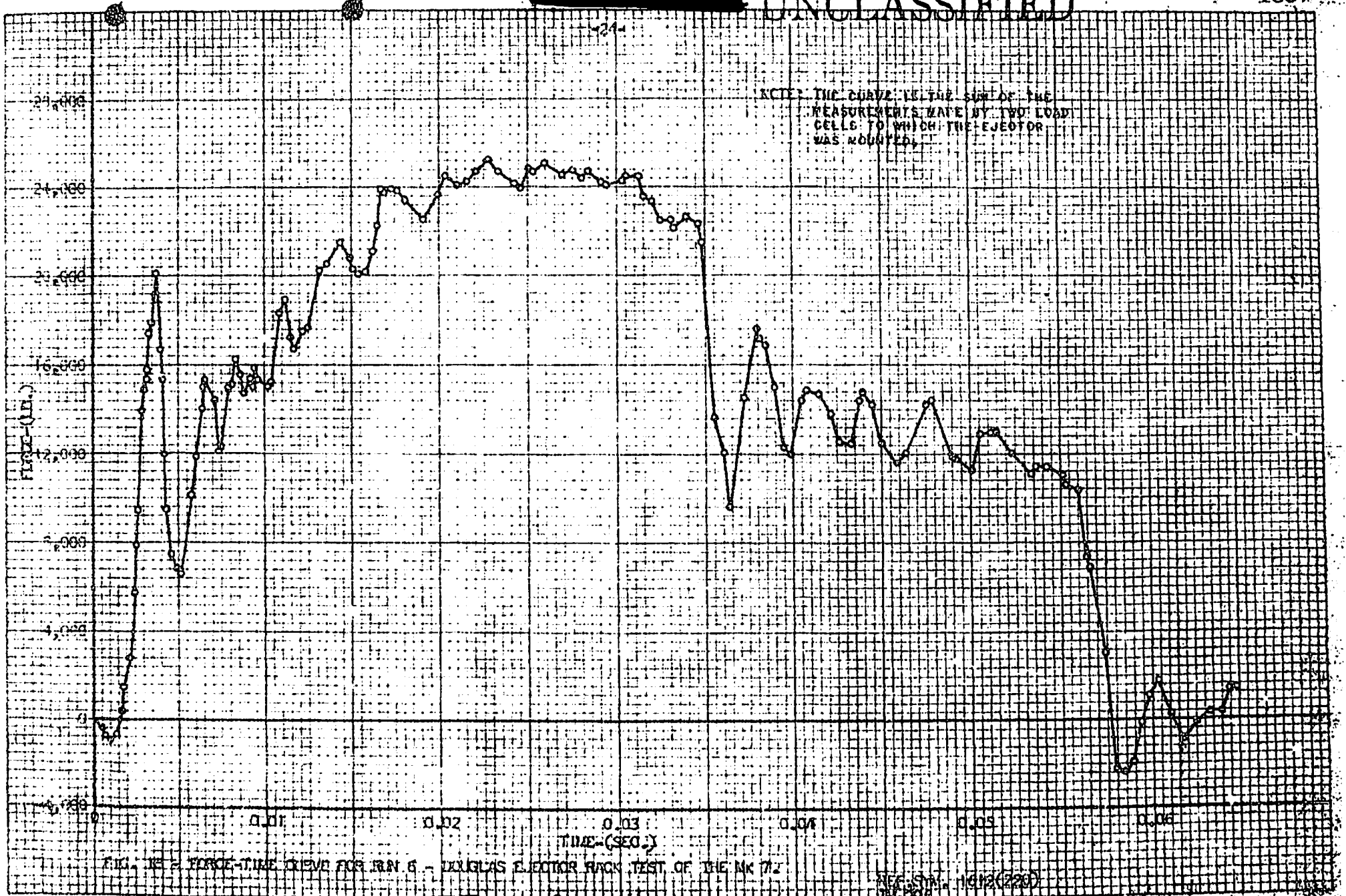

FIG. 18 - FORCE-TIME CURVE FOR RUN 6 - DOUGLAS EJECTOR RACK TEST OF THE MK 72

REF. SYM. 6H2(220)

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Project No. TM-295

TABLE I

COMPONENTS USED ON MK 7 - DOUGLAS EJECTOR RACK TEST OF THE MK 7

Component	Component No.	Drawing No.	Serial No.	Test Runs* Used
Battery	MC-193	112740	DG 7749 D3	1-6
Battery	MC-193	112740	DG 7656 D3	1-6
Battery Box	MC-291	114311	AK 4510 G3	1-6
Battery Box	MC-291	114311	AK 0933 D3	1-6
Junction Box	MC-131	579173	AA 2101 F3	1-6
Radar	MC-3	577000	AA 1961 J3	1
Radar	MC-3	577000	AA 1899 J3	2-6
Radar	MC-1A	—	BJ 6139 K1	1-6
Timer	MC-73	113800	CC 1641 F3	1-6
Mounts	3 for MC-73	113739 and 113735	None	1
Mounts	3 for MC-73	113739 and 113735	None	2
Mounts	3 for MC-73	350373	None	3-6
X-Unit	MC-134	100023	XAE 553 A3	1-6
Sphere (Concrete Filled)	MC-43	102293	C1 604 C3	1-6
Inverter	MC-251	117720	AF 0337 I5	1-6
Inverter	MC-251	117720	AF 0291 I3	1-6
Dynamotor	MC-84B	112822	BJ 6139 K1	1-6
Cartridge	—	--	84	1-6
Radar Support	MC-77	577865	—	1-6

* Runs listed are inclusive.

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Project No. TM-295

TABLE II

ACCELEROMETERS USED IN DOUGLAS EJECTOR RACK TEST OF THE MK 7

No.	Location	Serial No.	Range (g)	Statham Model No.	Nateral Frequency (cps)
1	Vertical, MC-73	1297	±50	F-50-300	530
2	Vertical, MC-73 Base Plate	520	±50	A5A-50-240	640
3	Longitudinal-Unit C.G.	515	±50	A5A-50-240	670
4	Vertical-Unit C.G.	654	±50	A5A-50-300	490
5	Lateral-Unit C.G.	514	±50	A5A-50-240	730

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TABLE III

MAXIMUM STRESSES AND STRAINS MEASURED ON THE LOAD BEAM
DOUGLAS EJECTOR RACK TEST OF THE MK 7

Strain Gage No.	Run 1 Max. Strain Tension μ in/in	Run 1 Max. Strain Comp. μ in/in	Run 1 Max. Stress Tension psi	Run 1 Max. Stress Comp. psi	Run 2 Max. Strain Tension μ in/in	Run 2 Max. Strain Comp. μ in/in	Run 2 Max. Stress Tension psi	Run 2 Max. Stress Comp. psi
1	1,740	720	52,200	21,600	1,820	570	54,600	17,100
2	2,650	380	79,500	11,400	2,770	290	83,100	8,700
3	1,800	730	54,000	21,900	1,850	560	55,500	16,800
4	2,510	370	75,300	11,000	2,900	290	87,000	8,700

Strain Gage No.	Run 3 Max. Strain Tension μ in/in	Run 3 Max. Strain Comp. μ in/in	Run 3 Max. Stress Tension psi	Run 3 Max. Stress Comp. psi	Run 4 Max. Strain Tension μ in/in	Run 4 Max. Strain Comp. μ in/in	Run 4 Max. Stress Tension psi	Run 4 Max. Stress Comp. psi
1	1,960	559	58,800	16,770	1,970	730	59,100	21,900
2	2,890	250	86,700	7,500	2,970	340	89,100	10,200
3	1,920	570	57,600	17,100	1,900	750	57,000	22,500
4	3,030	270	90,900	8,100	3,040	400	91,200	12,000

Strain Gage No.	Run 5 Max. Strain Tension μ in/in	Run 5 Max. Strain Comp. μ in/in	Run 5 Max. Stress Tension psi	Run 5 Max. Stress Comp. psi	Run 6 Max. Strain Tension μ in/in	Run 6 Max. Strain Comp. μ in/in	Run 6 Max. Stress Tension psi	Run 6 Max. Stress Comp. psi
1	1,970	680	59,100	20,400	1,980	730	59,400	21,900
2	3,120	320	93,600	9,600	3,140	430	94,200	12,900
3	1,940	710	58,200	21,300	1,990	780	59,700	23,400
4	3,250	270	97,500	8,100	3,240	350	97,200	10,500

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TABLE IV

MAXIMUM ACCELERATIONS* MEASURED DURING DOUGLAS EJECTOR TEST OF THE MK 7

No. and Location	Max. Accel. +(g)**	Max. Accel. -(g)**	Assoc. Freq. (cps)	Max. Faired (g)**	Rise Time (sec)	Pulse Time (sec)	Max. Accel. +(g)**	Max. Accel. -(g)**	Assoc. Freq. (cps)	Max. Faired (g)**	Rise Time (sec)	Pulse Time (sec)
	Run 1						Run 2					
1. Vertical, MC-73	57.4	59.8	--	+21.3	0.007	0.013	53.5	30.6	--	+38.5	0.004	0.012
2. Vertical, MC-73 Base Plate	32.1+	42.7	375	+14.5	0.021	0.063	33.0	27.8	--	+14.5	0.019	0.063
3. Longitudinal, Unit C.G.	49.2	44.2	417	--	--	--	49.2	52.2	500	--	--	--
4. Vertical, Unit C.G.	33.5	16.5	445	+11.6	0.100	0.157	36.9	18.1	460	+11.1	0.017	0.061
5. Lateral, Unit C.G.	9.2	8.2	500	--	--	--	8.8	8.0	500	--	--	--
	Run 3						Run 4					
1. Vertical, MC-73	25.0	8.9	--	+24.0	0.017	0.028	45.6	34.4	--	+29.5	0.014	0.023
2. Vertical, MC-73 Base Plate	24.1	21.4	--	+12.5	0.015	0.064	28.3	32.8	625	+14.0	0.017	0.064
3. Longitudinal, Unit C.G.	46.4	52.0	500	--	--	--	53.7	62.0	400	--	--	--
4. Vertical, Unit C.G.	35.4	17.2	445	+11.4	0.014	0.059	40.9	21.3	400	+11.5	0.014	0.061
5. Lateral, Unit C.G.	11.9	12.7	600	--	--	--	16.4	14.2	500	--	--	--
	Run 5						Run 6					
1. Vertical, MC-73	47.0	31.8	--	+32.7	0.011	0.021	46.8	37.3	--	+33.5	0.012	[illegible]
2. Vertical, MC-73 Base Plate	28.3	30.0	750	+13.5	0.015	0.067	29.3	30.1	750	+16.3	0.017	0.068
3. Longitudinal, Unit C.G.	56.8	64.5	360	--	--	--	53.1	64.9	400	--	--	--
4. Vertical, Unit C.G.	44.1	23.6	400	+11.2	0.013	0.064	41.3	22.7	400	+12.2	0.015	0.065
5. Lateral, Unit C.G.	10.7	11.1	670	--	--	--	13.7	12.0	570	--	--	--

* The accelerations are measured with a Seismic mass type accelerometer with a damping coefficient of 0.7; therefore, accelerations occurring at frequencies greater than 0.6 of the natural frequency of the accelerometer will be attenuated.

** Records read as per SCS-10 dated December 1954.

Directions for (+) accelerations (with respect to the weapon):

Longitudinal - Toward nose
Vertical - Toward bottom
Lateral - To right when looking in direction of nose.

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Ref. Sym: 1612 (220)
Project No. TN-295

TABLE V

DISPLACEMENT OF THE CENTER OF THE LOAD BEAM WITH RESPECT TO THE SPHERE CASE

Run No.	Displacement - Inches Right Side	Left Side
1	0.12	0.16
2	0.09	0.12
3	0.09	0.09
4	0.09	0.09
5	0.09	0.09
6	0.14	0.09

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