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SANDIA SYSTEMATIC DECLASSIFICATION REVIEW
1st Review Date: 8/18/98
Authority: ADD
Name: R B Cranin
2nd Review Date: 9-10-98
Authority: ADD
Name: W Layne
Determination (Circle Numbers):
1. Classification Retained
2. Classification Changed to: U
3. Contains No DOE Classified Information
4. Conditions With:
5. Contains UCAI? NO
6. Comments: OK for Open net

OCT 2 3 1958

Case No. 771.00
Ref. Sym: 1612 (809)
Project No. TM-853
File: TX-28, 3-2

MR. W. J. DENISON - 1224

Attn: Mr. H. M. Jones - 1224-2

Re: Static Tests of TX-28-X1 Rear Subassembly

Summary of Results

Static tests on the TX-28-X1 Rear Subassembly yielded the following results:

1. Pin joint separation in the final design cases occurred at less than 2,000 pounds axial pull on the small parachute lugs.

2. The rear lug and lug stop withstood a proof load of 8,000 pounds (240 per cent design limit) with no indication of yielding or failure.

3. A vertical load of 425 pounds (180 per cent design limit) applied to the small parachute cone resulted in negligible permanent displacement.

4. A vertical load of 2210 pounds (150 per cent design limit) applied to the MC-926 case resulted in 0.088 inch maximum permanent displacement.

5. Fin failure occurred at a simulated air load of 1860 pounds (262 per cent design limit) applied evenly over the fin surface.

6. Pin joint separation occurred at 2,170 pounds pull at an angle of 12 degrees with the case axis.

7. Each small parachute lug withstood 12,000 pounds load (240 per cent design limit) with no indication of yielding or failure.

8. When loaded by the rear lugs, the rear case section failed at 27,300 pounds (137 per cent design limit). The lugs and lug stops remained undamaged.

9. A simulated main parachute load of 80,000 pounds at an angle of 20 degrees to the case axis produced a maximum principal stress of 52,030 psi in the rear ring of the forward case section. The case section failed at 82,580 pounds pull applied at a 20-degree angle.

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AUTHORITY: W. C. Layne
Emilda Seeph 9/28/98
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9/23/98
PERSON VERIFYING MARKING & DATE
DATED: 8/27/98

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TX-28-X1
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Object of Test

The object of the tests was to determine the structural adequacy of the TX-28-X1 Rear Subassembly. The following tests were performed:

No. 1 - Pin joint separation by axial load.
No. 2 - Proof test of rear lug and lug stop to 8,000 pounds (240 per cent design limit).
No. 3 - Vertical load of 425 pounds (180 per cent design limit) on small parachute cone.
No. 4 - Vertical load of 2210 pounds (150 per cent design limit) on main parachute case.
No. 5 - Simulated air load on fins to failure.
No. 6 - Pin joint separation by a load applied at an angle of 12 degrees to the case axis.
No. 7 - Test to failure of small parachute lugs.
No. 8 - Test to failure of rear lug and lug stop installed in MC-926 case.
No. 9 - Simulated main parachute load of 80,000 pounds applied at 15-degree and 20-degree angles, followed by testing to failure with a load at an angle of 20 degrees.

Test No. 1 was performed on three different cases. The other tests were all performed on the same case or on various parts of it.

Reason for Test

The test was performed in accordance with a Work Order Authorization from Division 1224 to Division 1612, dated May 29, 1958. Mr. H. M. Jones, 1224-2, and Mr. D. F. Lange, 1282-2, were the consultants.

Function of Object Tested

The TX-28-X1 Rear Subassembly contains the pilot and main parachutes for the TX-28-X1 weapon.

Summary of Past Tests

Numerous tests have been performed on the TX-28-X1 and its components. Two of these involved load conditions similar to loads in this test.

Results of a static test simulating main parachute loads on the rear case are given in the report, Static Test of TX-28/X1 Aft Case Parachute Lug Ring, dated March 6, 1958, TM-548, Ref. Sym: 1612 (486). One TX-28/X1 parachute lug ring and aft case, DS(1224)79328, was loaded to 145,000 pounds simulated chute load at an angle of 15 degrees with the longitudinal

axis of the case. No damage occurred. Another TX-28/X1 aft case, Dwg. No. DL-10021, was loaded to 110,000 pounds at 15 degrees without failure. Failure occurred at a pull of 106,000 pounds making an angle of 20 degrees with the longitudinal axis.

Static tests to determine the load required to separate the MC-926 case sections are reported in Static Test of Release Joint of Ogive Section from MC-926 Aft Case (TX-28), dated March 31, 1958, TM-760, Ref. Sym: 1612 (711). The MC-926 tail case sections separated at a simulated pilot chute load of 3,000 pounds. A vertical load of 1,960 pounds was applied to the same case without causing failure.

Setup for Test

Figures 1 thru 10 illustrate the setups used in the different tests.

The object tested was the TX-28-X1 Rear Subassembly which consisted of the MC-923 parachute deploying ejector assembly, the MC-924 fins, the MC-926 case, main parachute lug assemblies, rear lug assemblies, and the small parachute cone. The design layout is given in Drawing No. DL-10269.

The following equipment was used:

1 - Simplex hydraulic jack, 30-ton capacity.
2 - Simplex hydraulic jacks, 60-ton capacity.
2 - Blackhawk hydraulic pumps.
5 - Baldwin strain indicators, Serial Nos. 199392, S-46593, 391903, J-92498, and J-92499.
2 - Load cells, 2,000-pound capacity, Serial Nos. 3813 and 20871.
2 - Load cells, 5,000-pound capacity, Serial Nos. 4898 and 2127.
1 - Load cell, 10,000-pound capacity, Serial No. 655.
8 - Calibrated pull bars, Serial Nos. 1, 2, 3, 4, 5, 6, 7, and 10.
1 - Two-inch pull bar, Serial No. 7.
1 - Fairchild strain indicator, Model 101-C-2.
1 - Patheon hydraulic ram, 400,000-pounds capacity.
1 - Hydraulic pump console.
1 - Sadic automatic data processing system, Model 34-112 ML.

The following instrumentation was used:

6 - Starrett dial indicators, maximum range 1.00 inch, least graduation 0.001 inch.
11 - Type AX-7 biaxial strain gages, G.F. = 1.88 ± 2%, resistance = 120 ohms.
5 - Rectangular rosette strain gages made up of Type A-7 gages, G.F. = 1.98 ± 2%, resistance = 120 ohms.

Procedure

For Test No. 1 the MC-926 case was mounted as shown in Fig. 1. A threaded ring on the forward end of the case served as a means of attachment to the jig. Load was applied through nylon straps over lugs in the rear of the case, with the resultant acting along the longitudinal case axis. The load was increased gradually until five 1/8-inch aluminum pins sheared at Station 146.88, permitting separation of the outer skin at Station 130.625. The slack was then taken up, and load again applied gradually until separation of the entire case section took place. This test was performed on three different cases.

In Test No. 2, a rear lug and lug stop were mounted as shown in Fig. 2. Load was applied through a nylon strap in increments up to 8000 pounds.

For Test No. 3, the complete TX-28-X1 Rear Subassembly was mounted as shown in Fig. 3. Load was applied through a 10-inch nylon strap to the small parachute cone. The load was increased in increments up to 425 pounds with deflection readings taken at each increment.

Test No. 4 was quite similar to Test No. 3 except that the load was applied at Station 153.5, and a 3-inch steel strap padded with rubber was used instead of the nylon strap. The test setup is shown in Fig. 4. Load was applied in increments up to 2210 pounds with deflection readings taken at each increment.

For Test No. 5, the Rear Subassembly was mounted as shown in Fig. 5. Loads were applied to two fins simultaneously (for the sake of clarity, only one fin is shown in Fig. 5). Rubber and wood pads distributed the load evenly over the fin surface. The resultant force passed through the centroid of the fin, normal to the surface. Load was applied in increments until fin failure, with deflection readings taken at each increment.

Test No. 6 was identical to Test No. 1 except that the resultant of the load made an angle of 12 degrees with the longitudinal axis of the case. The test setup is shown in Fig. 6. Loads were applied as in Test No. 1.

Test Nos. 7 and 8 were combined into one test. Only the rear section of the MC-926 case was used. Nylon shroud lines were placed over three of the six rear lugs and were used to attach the case section to the jig. The load was applied through four steel cable loops placed over the four small parachute lugs. This test setup is shown in Fig. 7. Load was applied gradually until case failure occurred.

For Test No. 9, the forward section of the MC-926 case, was mounted to the jig by the threaded ring in the forward end. Nylon shroud lines were placed over each of the eight main parachute lugs and were brought out through the

rear of the section to an intermediate jig fixture. This fixture was attached to a calibrated pull bar and hydraulic ram in such a way that the resultant pull on the lines was at an angle of 15 degrees to the case axis. Individual pull bar and turnbuckle arrangements were used on each shroud line as a means of monitoring and adjusting line tension. The test setup is shown in Fig. 8. The rear ring of the case section was instrumented with strain gages. Eleven biaxial gages and five rectangular rosettes were mounted as shown in Figs. 11 and 12.

Load was applied in increments of 10,000 pounds up to 80,000 pounds maximum. Strain gage readings were taken at each increment. During this and the following test, approximately equal tension was maintained in all shroud lines.

A shim was inserted behind the jig mounting plate so that the case section was tilted downward five degrees from its position in the previous test. The other parts of the setup remained the same so that the direction of the resultant load made an angle of 20 degrees with the case axis. As before, load was applied in increments up to 80,000 pounds, with strain gage readings taken at each increment. After readings were obtained for 80,000 pounds, the load was gradually increased until failure occurred.

Following the case tests, the main parachute lugs were individually tested to failure. A straight pull was applied to four of the lugs, and a 25-degree pull to the other four. Figures 9 and 10 show the setups for these pulls.

Results

The results of Test No. 1 are given in Table I. The final design cases (Case Nos. 2 and 3) separated at loads less than 2,000 pounds. Case No. 1 had sealing compound around the separation joint, and withstood 3,300 pounds before separating. Figures 13 and 14 are views of case Nos. 1 and 2, respectively, after pin joint separations, and Fig. 15 shows Case No. 2 with the outer skin removed. Figure 16 is a close-up of the roll-pin socket, showing deformation incurred during separation.

In Test No. 2, the rear lug and lug stop were loaded to 8,000 pounds (240 per cent design limit) with no indication of yielding or failure.

In Test No. 3, a vertical load of 425 pounds (180 per cent design limit) applied to the small parachute cone resulted in negligible permanent set. Complete load vs. deflection data is given in Table II.

In Test No. 4, a vertical load of 2,210 pounds (150 per cent design limit) applied at Station 153.5 on the MC-926 case resulted in 0.088 inch permanent

set at Station 165.0, the location of greatest deflection. Complete load vs. deflection data is given in Table III.

In Test No. 5, failure of a fin occurred at a load of 1,860 pounds (262 per cent design limit). Failure was not in the fin itself, but in the threaded inserts in the MC-926 case holding the fin mounting bolts. Load vs. deflection data for loads up to 1,200 pounds is given in Table IV. Tensile test specimens taken after the test indicated an average yield strength of 43,750 psi and an ultimate strength of 48,000 psi for the fin material.

In Test No. 6, outer skin separation occurred at a load of 2,170 pounds and case separation at 1,770 pounds applied at a 12-degree angle with the case axis.

In the combined running of Test Nos. 7 and 8, case failure occurred at an axial pull of 27,300 pounds (137 per cent design limit). Rivets holding the rear lug stop ring to the outer skin either sheared or pulled through, and the ring itself fractured into three pieces. The rear lugs and lug stops remained undamaged. Figures 17 and 18 show the case and ring after failure. At the time of failure, the average load was 9,100 pounds on each rear lug and 6,825 pounds on each small parachute lug. The small lugs had been previously loaded to 12,000 pounds each (240 per cent design limit) with no indications of yielding or failure.

Strain gage readings and calculated principle stresses for Test No. 9 are given in Tables V and VI. As noted, the principle stress calculations for the biaxial gages (Gage Nos. 1 thru 22) were based on the assumption that the biaxial gages were actually mounted along the directions of principle stress; i.e., the principle stresses were assumed to be longitudinal and circumferential.

A simulated main parachute load of 80,000 pounds at an angle of 15 degrees with the case axis produced a maximum principle stress of 32,730 psi at strain gage No. 30. The same load at an angle of 20 degrees produced a stress of 52,030 psi at strain gage No. 30. Case failure occurred at 82,580 pounds pull at an angle of 20 degrees. Figures 19 and 20 show the case after failure.

Results of pull tests on the individual main lugs are given in Table VII. Figure 21 shows the lugs after failure.

Tensile specimens were cut from the case section following Test No. 9, and were tested to failure. Results are given in Table VIII.

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Conclusions

It is concluded that the TX-28-X1 Rear Subassembly and its component parts adequately meet the design requirements for structural strength under the conditions tested.

W. M. SIGMON - 1612-2

Approved by: PAUL H. ADAMS - 1612

WMS:1612-2:as

Copy to:
W. A. Gardner, 1610
D. M. Bruce, 1282
C. L. Gomel, 5523
R. K. Smeltzer, 7221-3

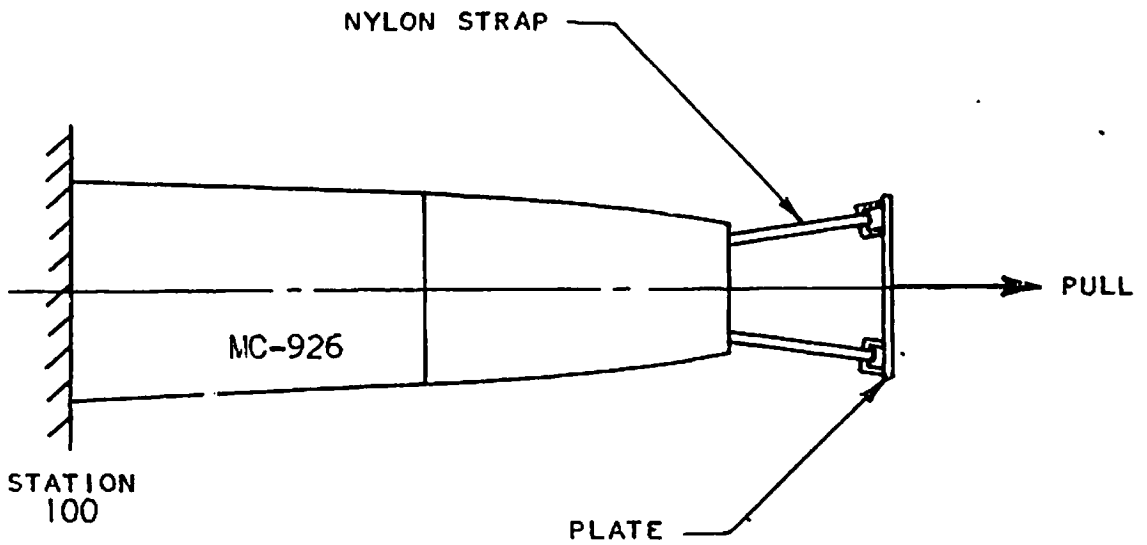

FIG. 1 -- SKETCH OF SETUP FOR TEST NO. 1 -- STATIC TEST OF TX-28-X1 REAR SUBASSEMBLY.

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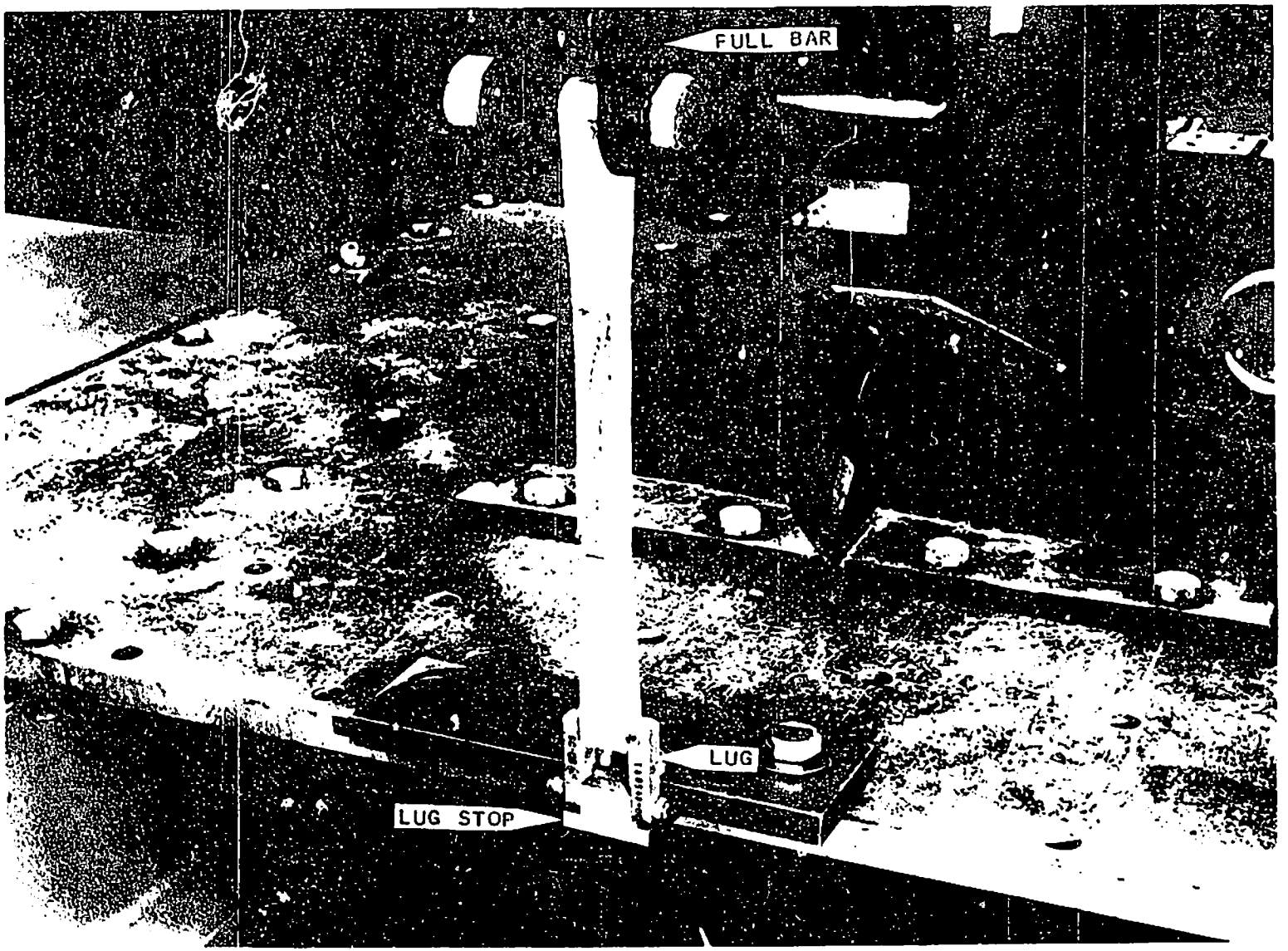

FIG. 2 -- SETUP FOR TEST NO. 2 -- STATIC TEST OF TX-28-X1 REAR SUBASSEMBLY.

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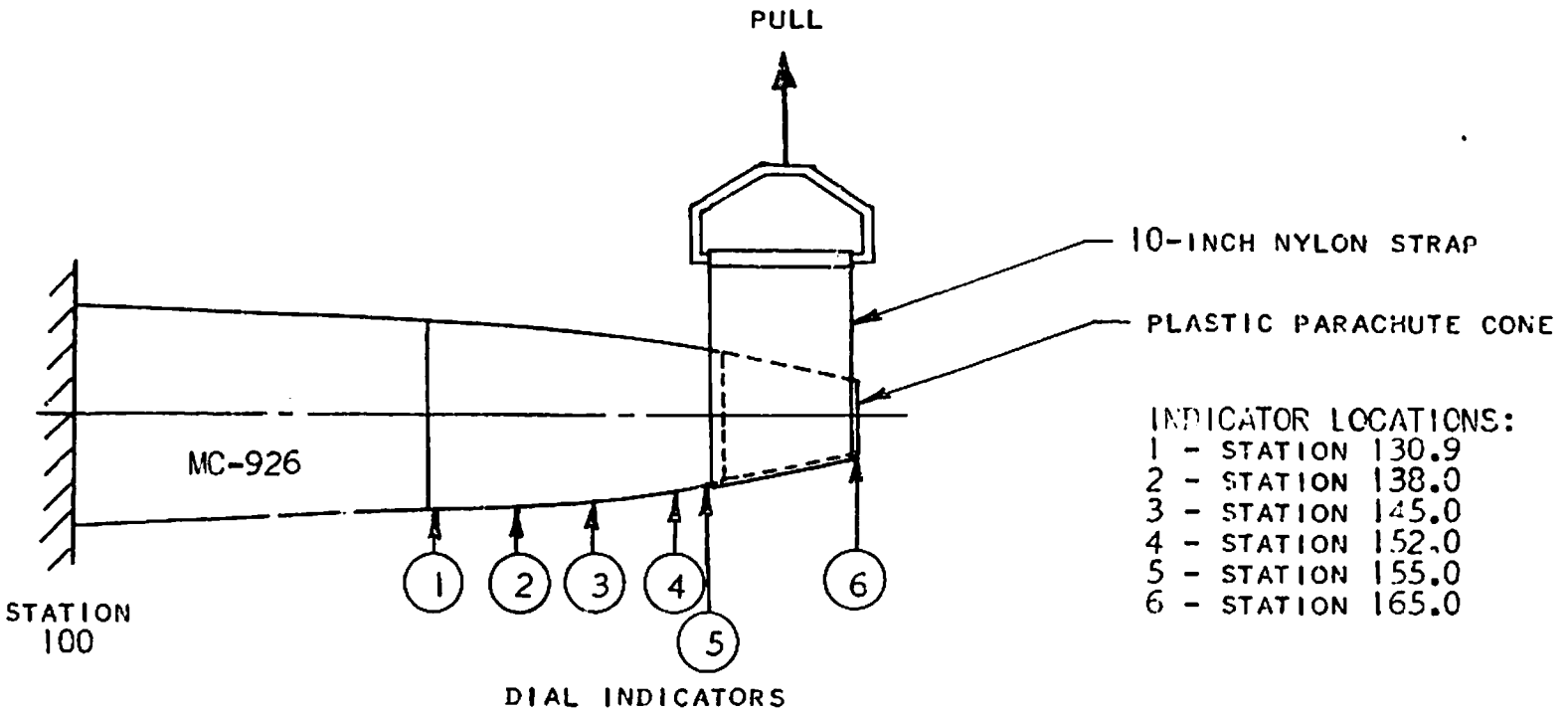

FIG. 3 -- SKETCH OF SETUP FOR TEST NO. 3 -- STATIC TEST OF TX-28-XI REAR SUBASSEMBLY.

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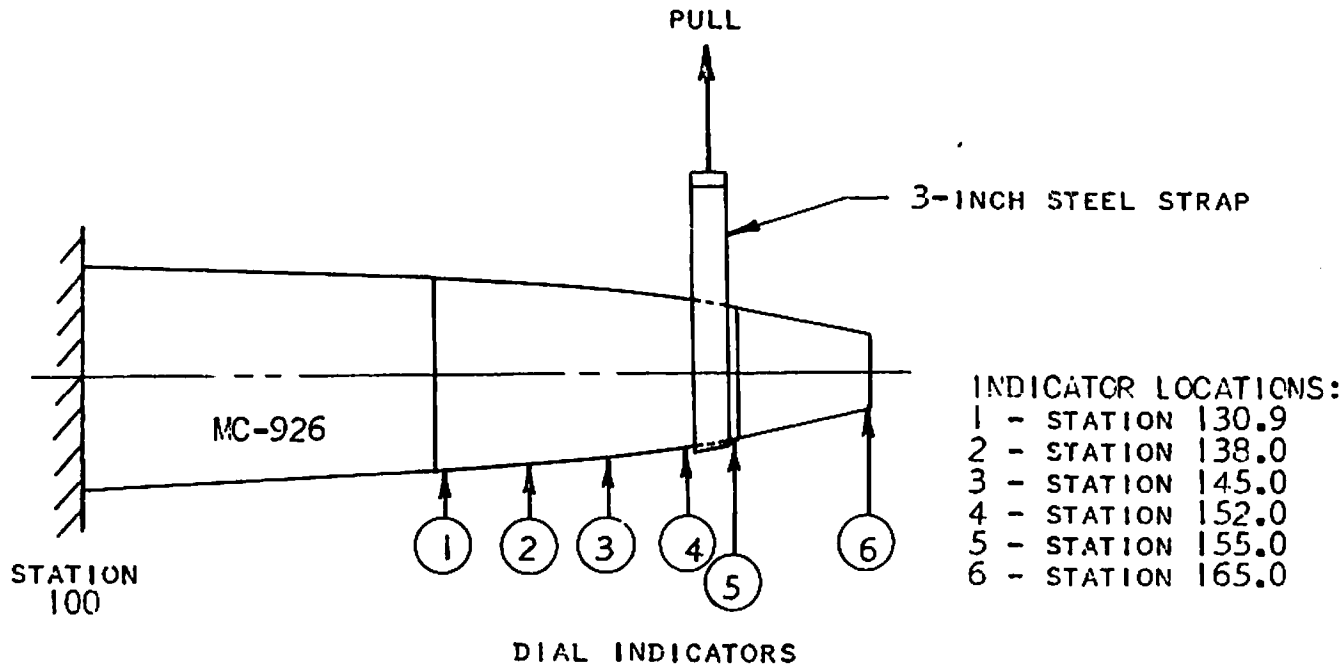

FIG. 4 -- SKETCH OF SETUP FOR TEST NO. 4 -- STATIC TEST OF TX-28-XI REAR SUBASSEMBLY.

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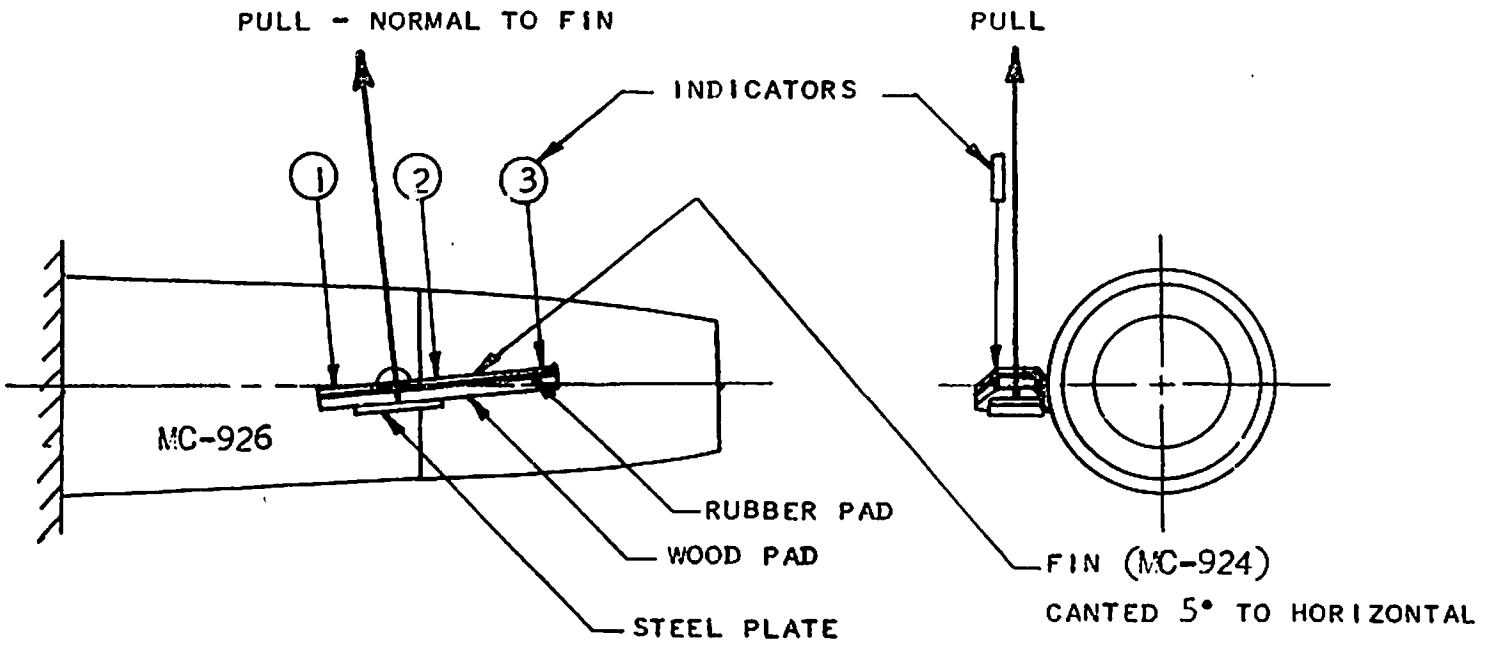
NOTE: LOAD WAS APPLIED SIMULTANEOUSLY TO TWO FINS; ONLY ONE IS SHOWN FOR THE SAKE OF CLARITY.



OTHER FINS OMITTED FOR CLARITY

FIG. 5 -- SKETCH OF SETUP FOR TEST NO. 5 -- STATIC TEST OF TX-28-X1 REAR SUBASSEMBLY.

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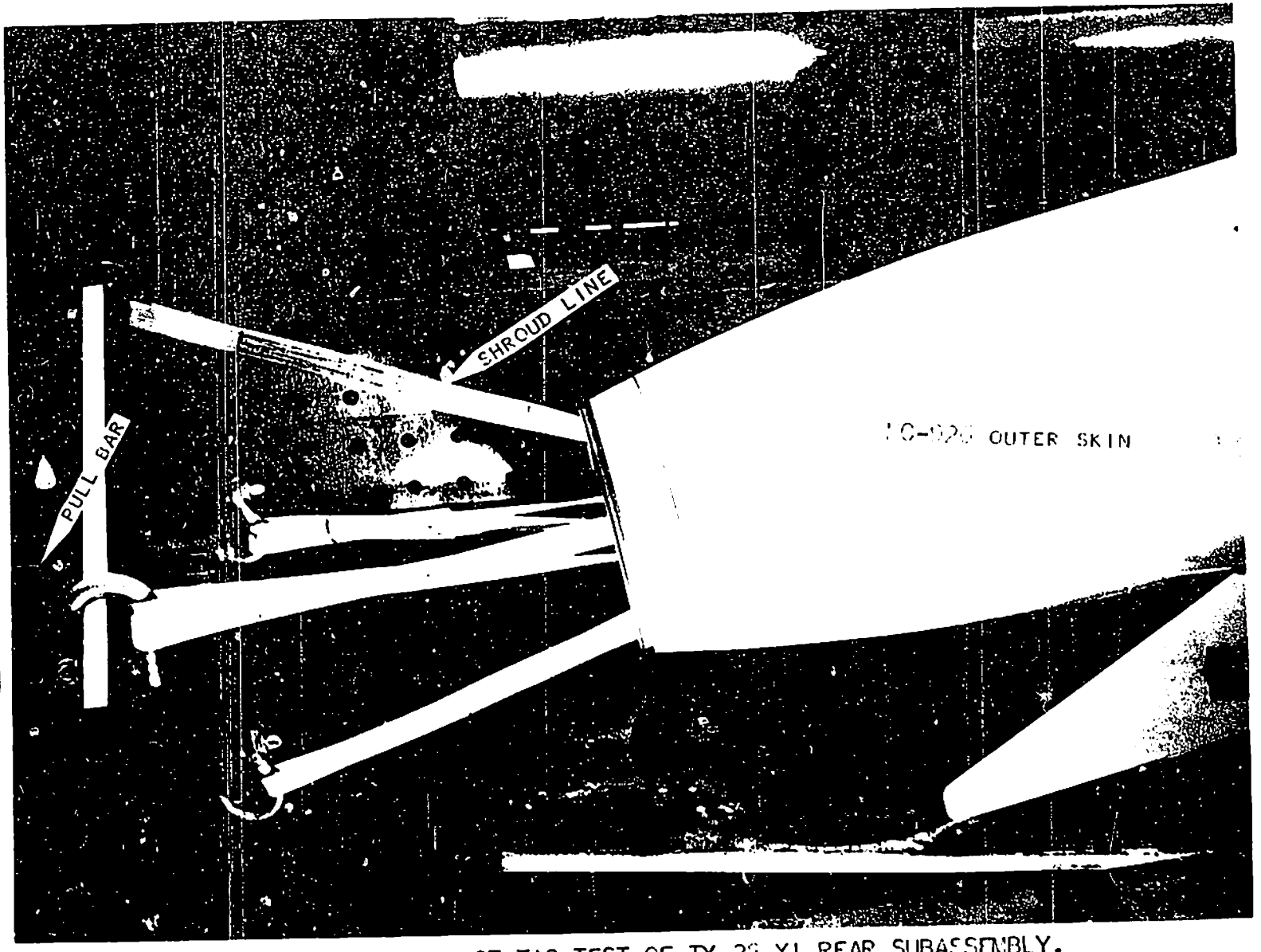

FIG. 6 -- SETUP FOR TEST NO. 6 -- STATIC TEST OF TX-2[illegible]-X1 REAR SUBASSEMBLY.

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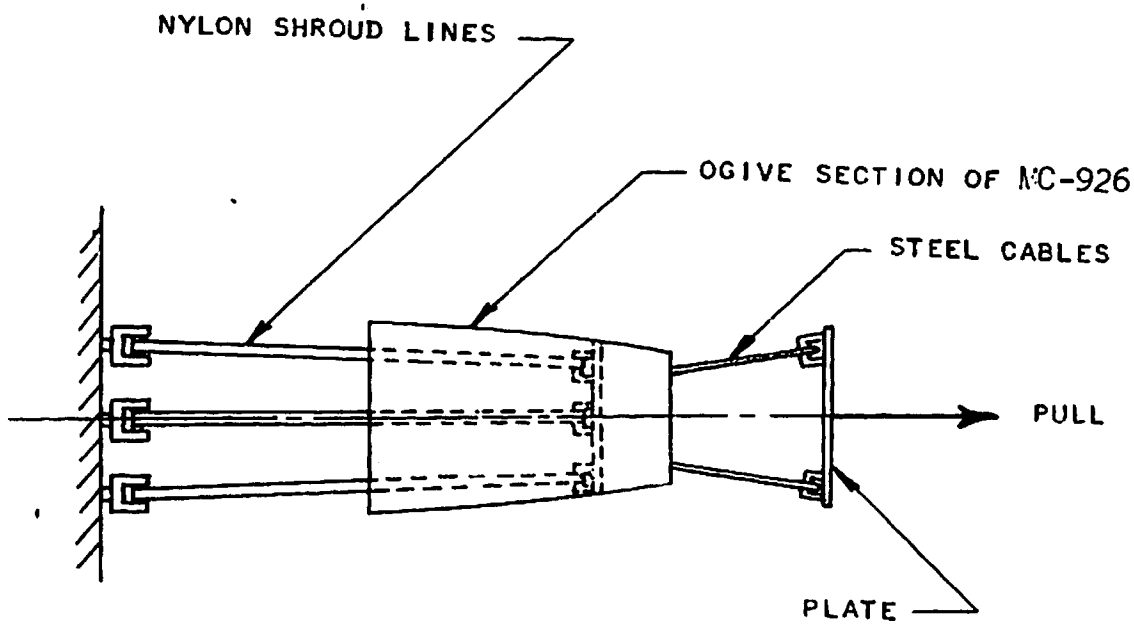

FIG. 7 -- SKETCH OF SETUP FOR COMBINED TESTS NO. 7 AND 8 -- STATIC TEST OF TX-28-X1 REAR SUBASSEMBLY.

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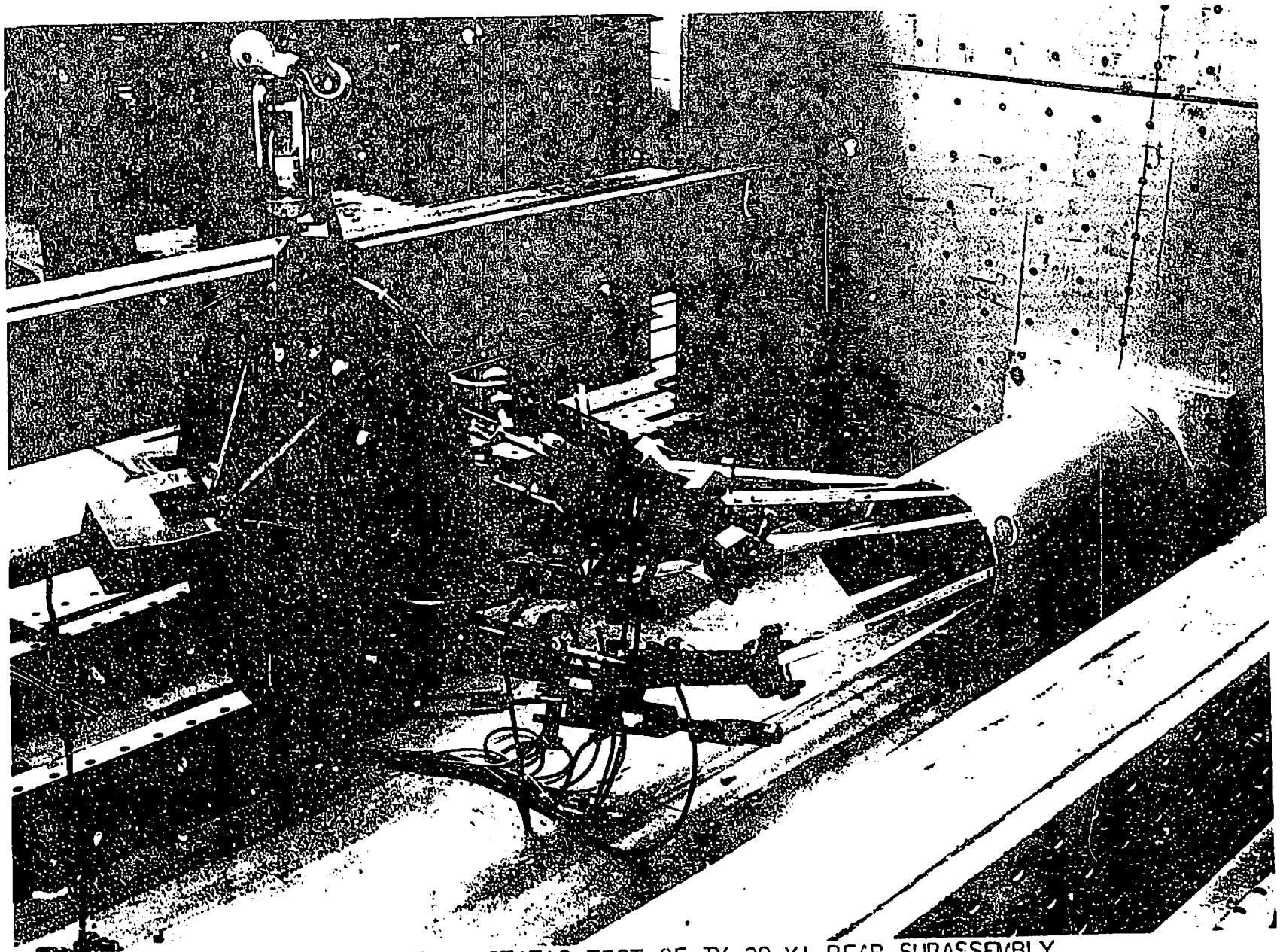

FIG. 8 -- SETUP FOR TEST NO. 9 -- STATIC TEST OF TX-28-X1 REAR SUBASSEMBLY.

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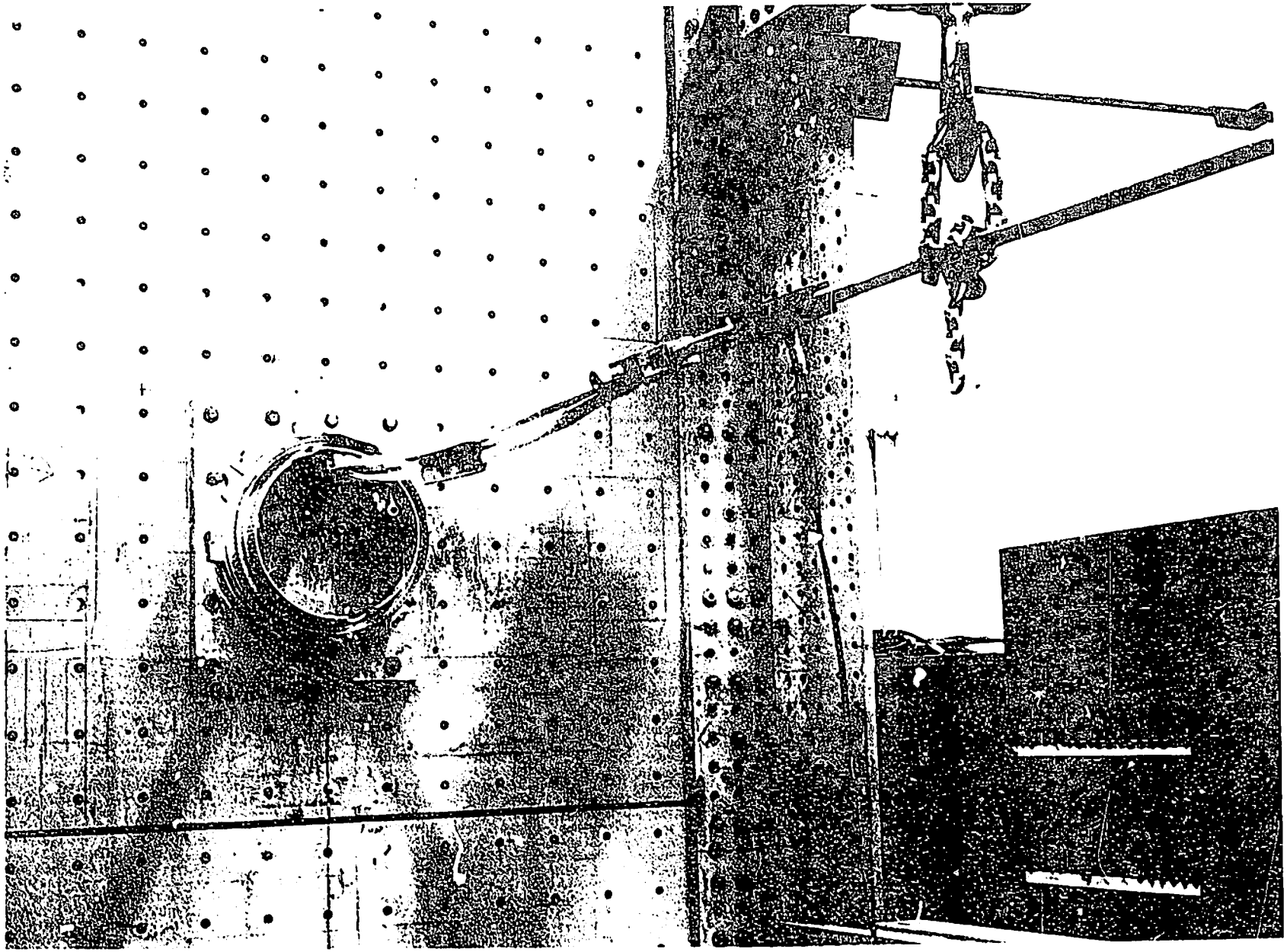

FIG. 9 -- SETUP FOR STRAIGHT PULL ON MAIN LUG IN TEST NO. 9 -- STATIC TEST OF TX-28-X1 REAR SUBASSEMBLY.

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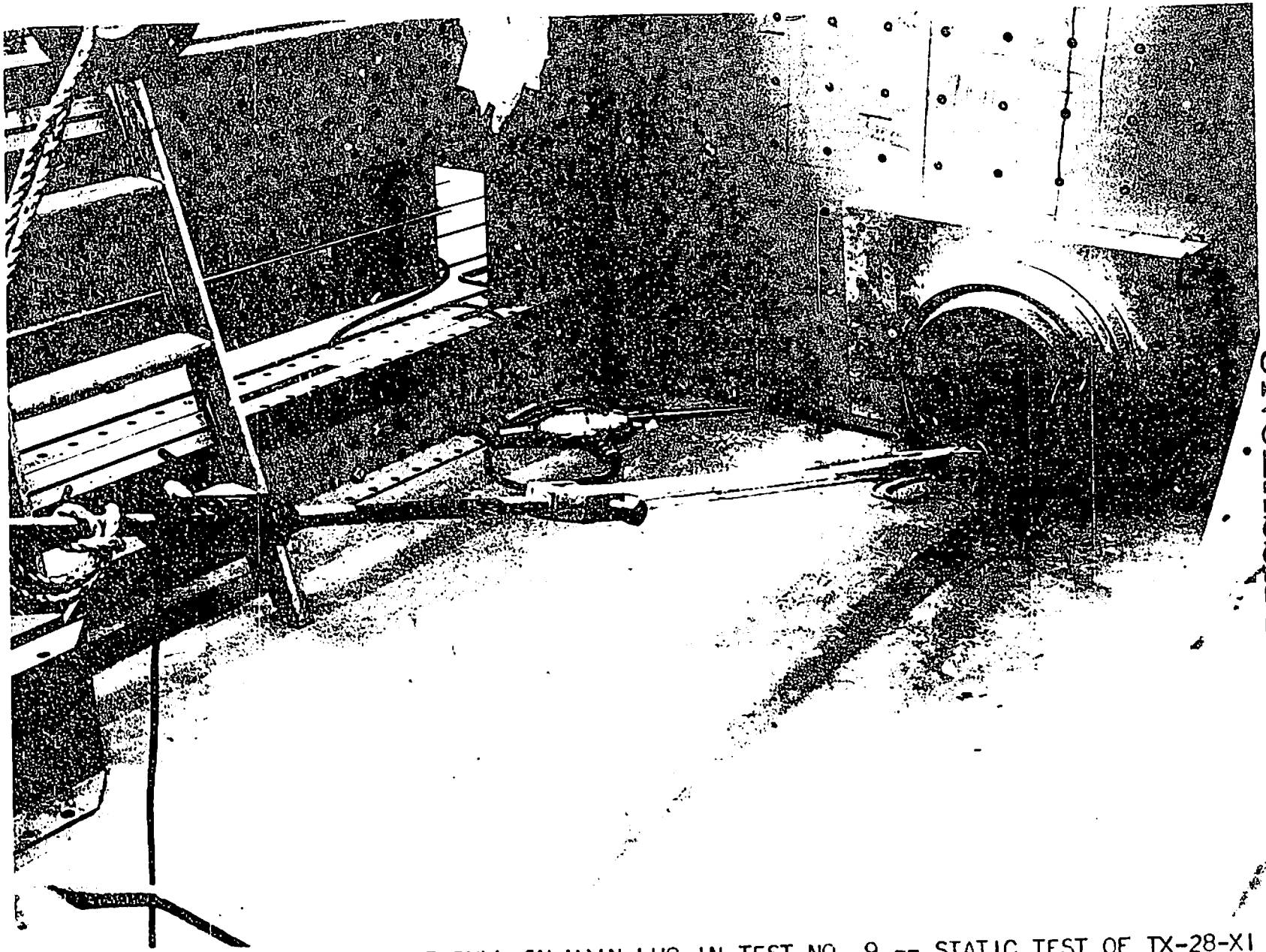

FIG. 10 -- SETUP FOR 25-DEGREE PULL ON MAIN LUG IN TEST NO. 9 -- STATIC TEST OF TX-28-X1 REAR SUBASSEMBLY.

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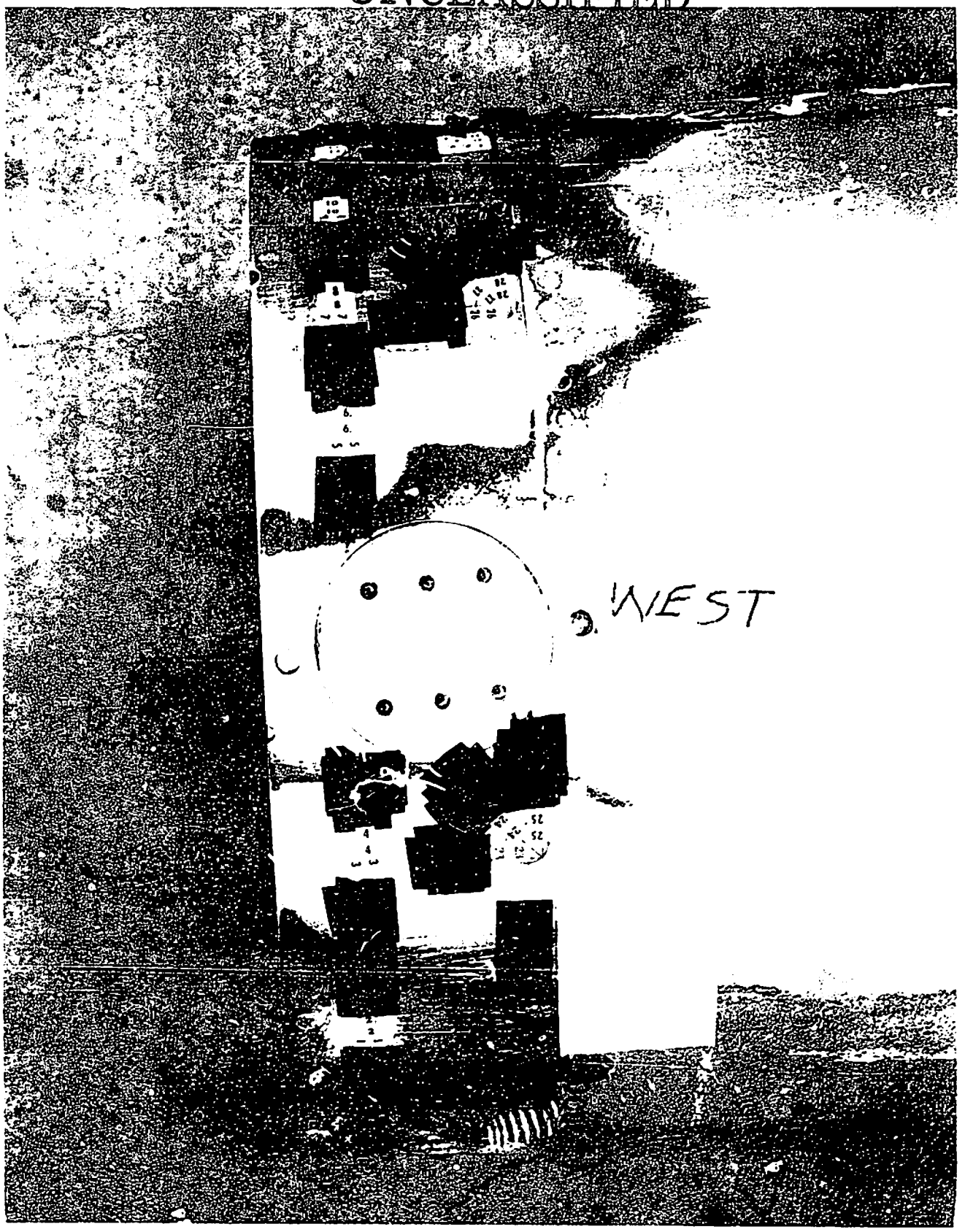

FIG. 11 -- STRAIN GAGE LOCATIONS ON FORWARD CASE SECTION IN TEST NO. 9 -- STATIC TEST OF TX-28-X1 REAR SUBASSEMBLY.

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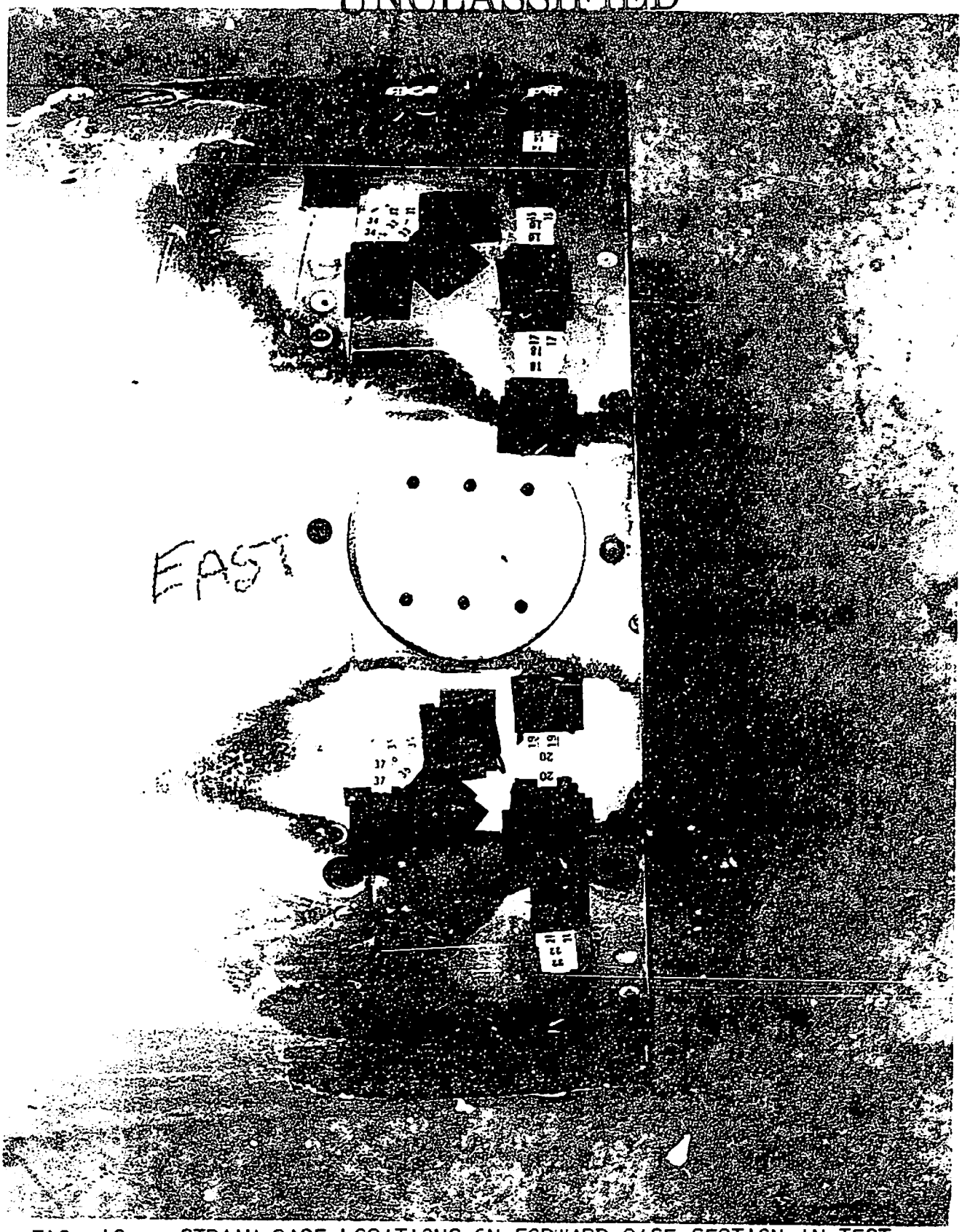

FIG. 12 -- STRAIN GAGE LOCATIONS ON FORWARD CASE SECTION IN TEST NO. 9 -- STATIC TEST OF TX-28-X1 REAR SUBASSEMBLY.

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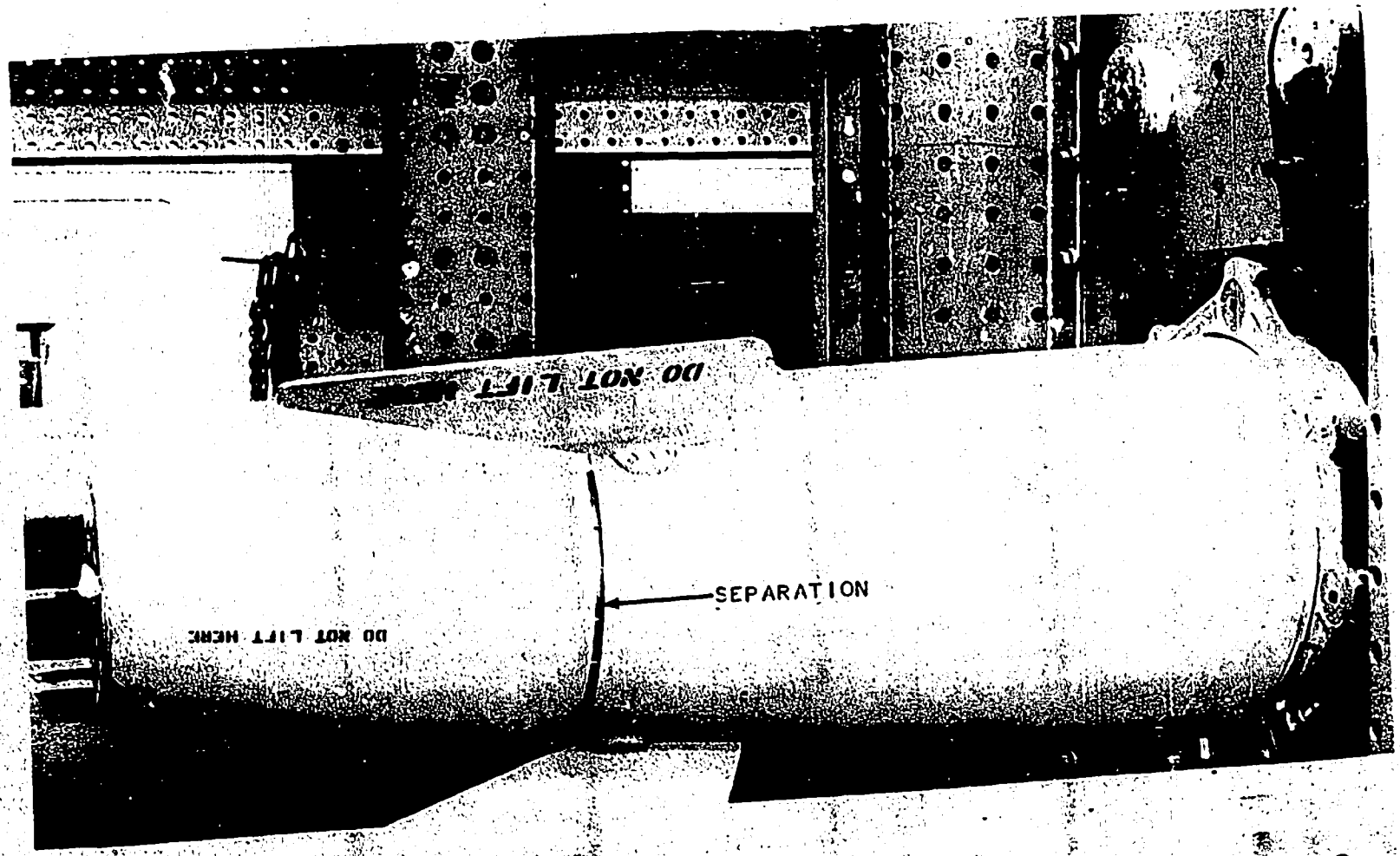

FIG. 13 -- TX-28-X1 REAR SUBASSEMBLY, CASE NO. 1, AFTER PIN JOINT SEPARATION IN TEST NO. 1 -- STATIC TEST OF TX-28-X1 REAR SUBASSEMBLY.

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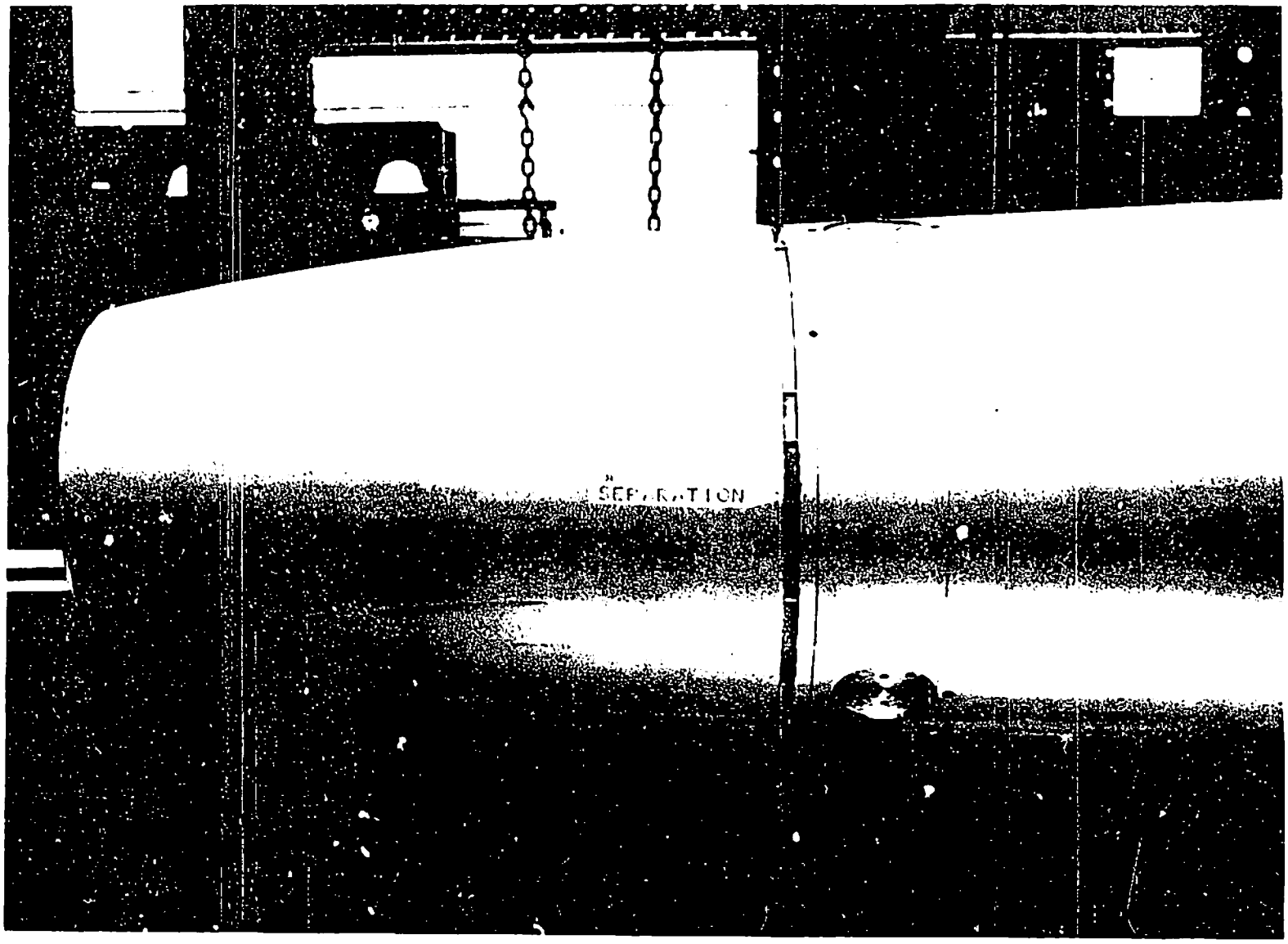

FIG. 14 -- MC-926, CASE NO. 2, AFTER PIN JOINT SEPARATION IN TEST NO. 1 -- STATIC TEST OF TX-28-X1 REAR SUBASSEMBLY.

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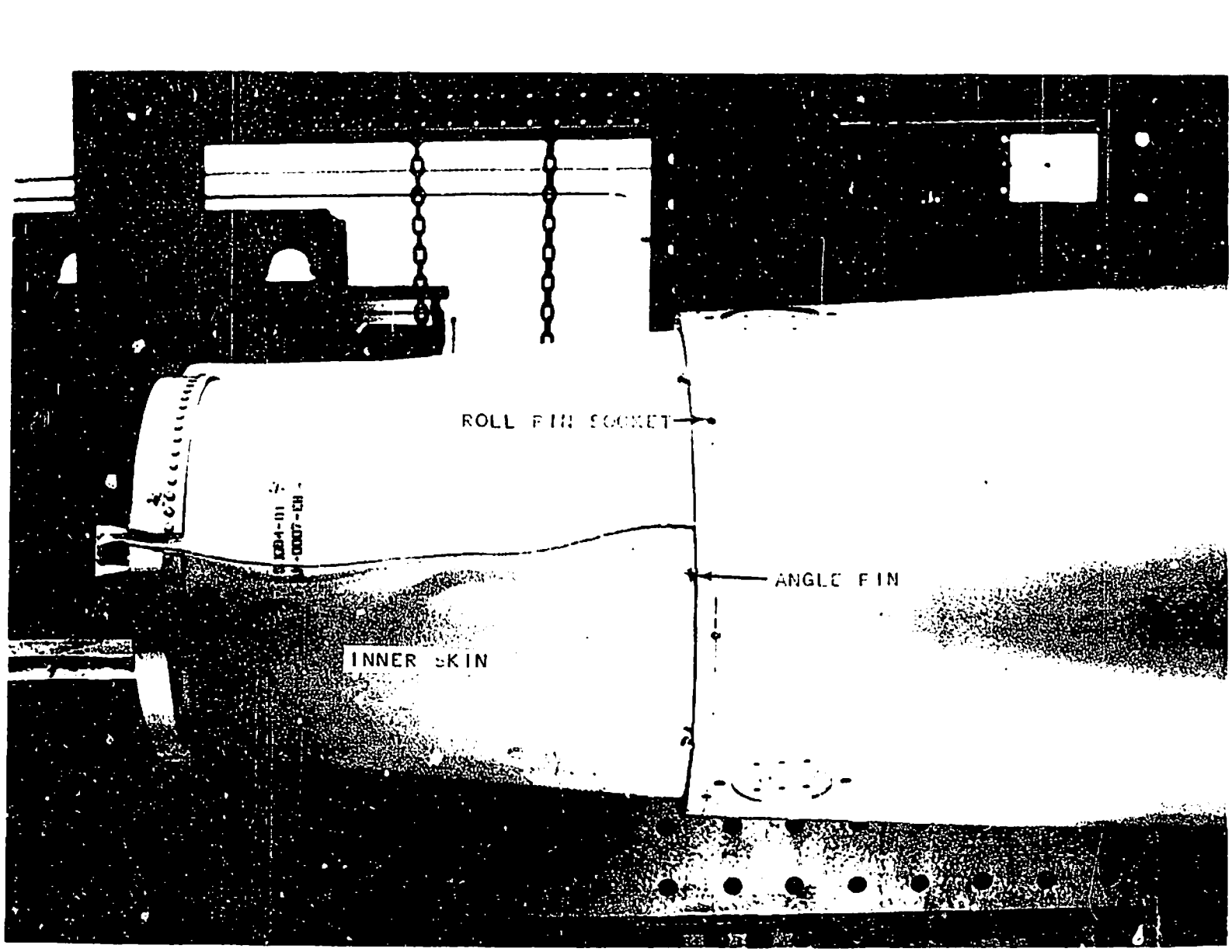

FIG. 15 -- MC-926, CASE NO. 2, WITH OUTER SKIN REMOVED FOLLOWING TEST NO. 1 -- STATIC TEST OF TX-28-X1 REAR SUBASSEMBLY.

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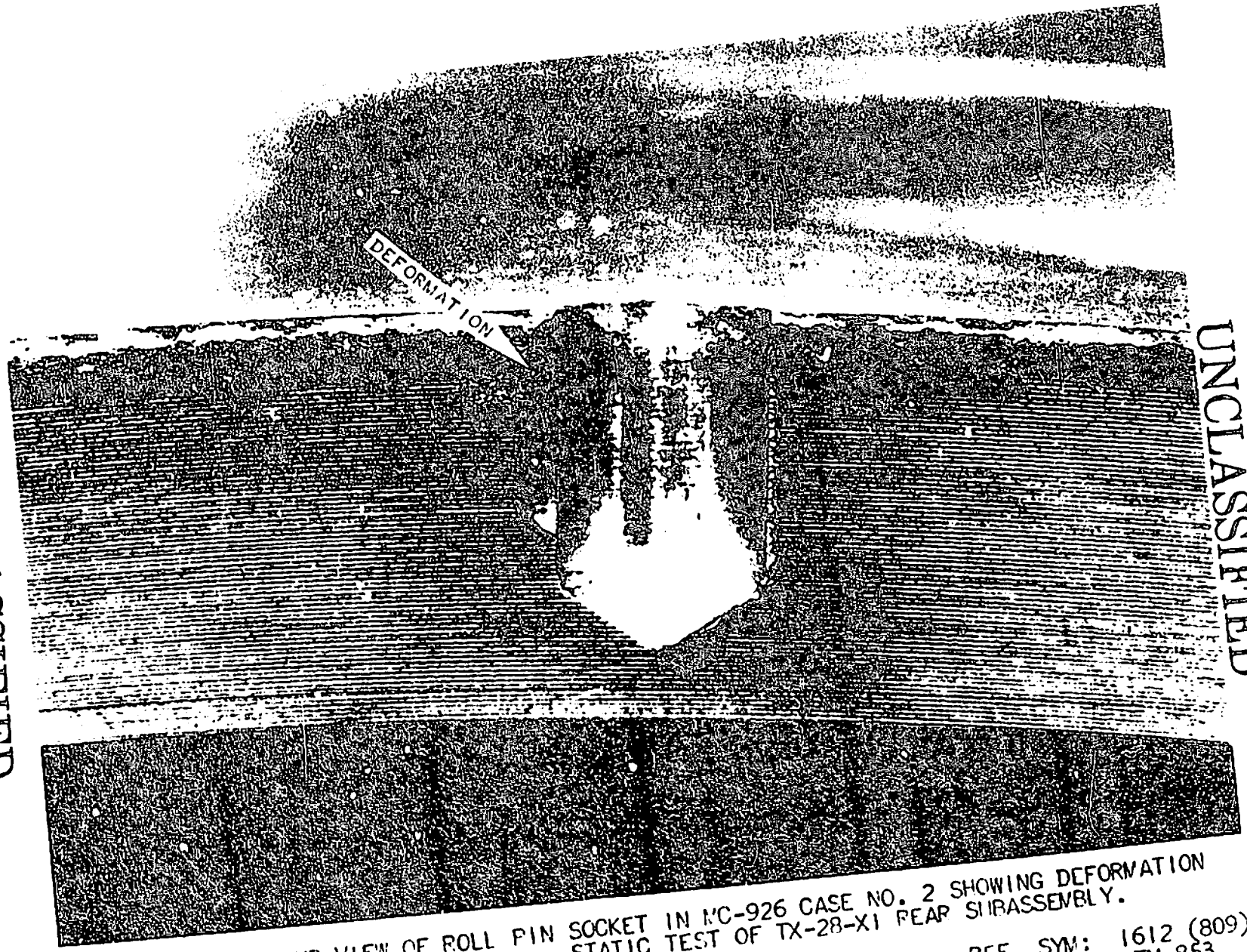

FIG. 16 -- CLOSE-UP VIEW OF ROLL PIN SOCKET IN MC-926 CASE NO. 2 SHOWING DEFORMATION INCURRED IN TEST NO. 1 -- STATIC TEST OF TX-28-X1 REAR SUBASSEMBLY.

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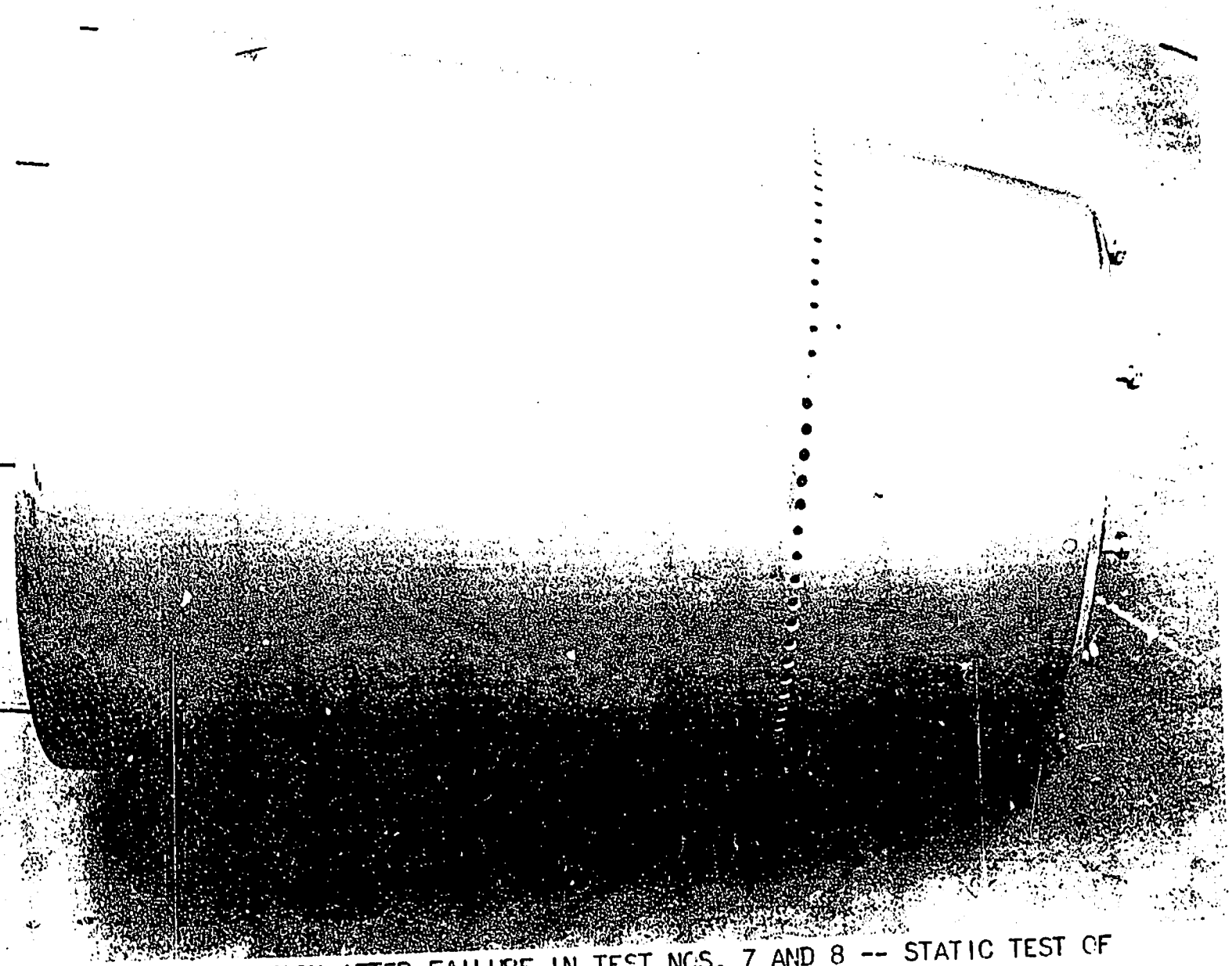

FIG. 17 -- REAR CASE SECTION AFTER FAILURE IN TEST NOS. 7 AND 8 -- STATIC TEST OF TX-28-X1 REAR SUBASSEMBLY.

REF. SYM: 1612 (809)
PROJECT NO. TM-853

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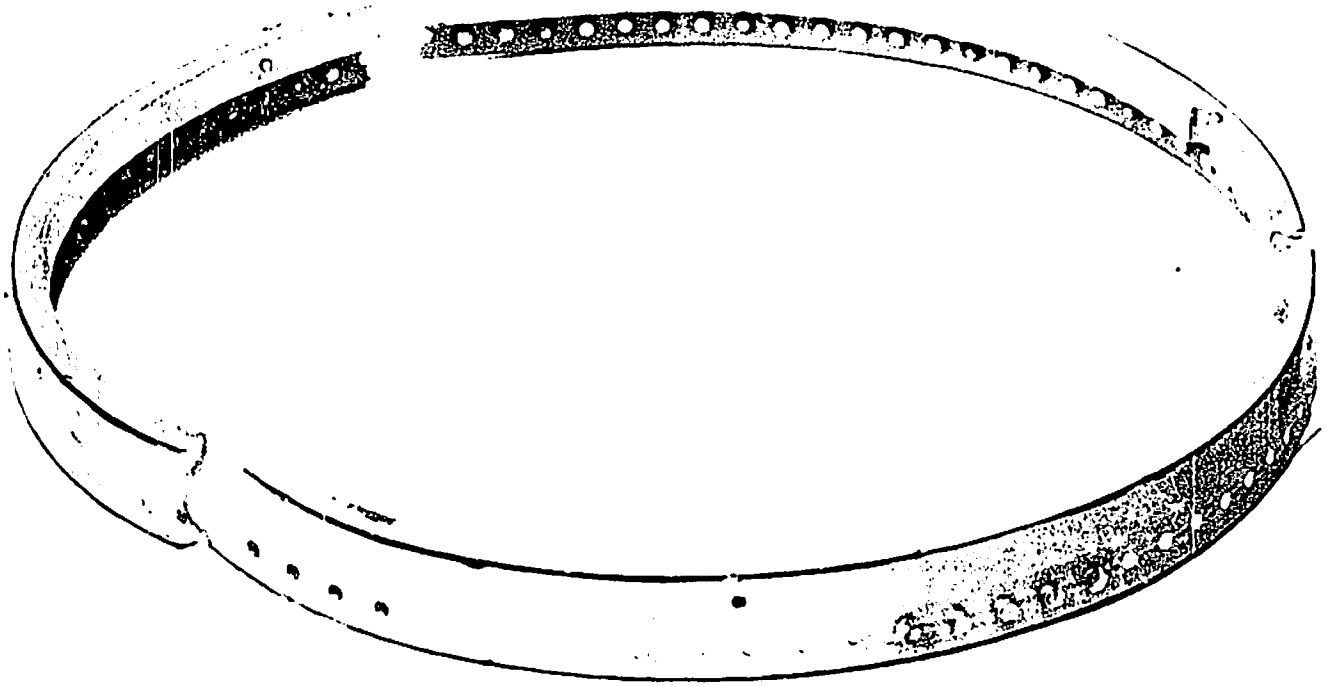

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FIG. 18 -- LUG STOP RING AFTER FAILURE IN TEST NOS. 7 AND 8 -- STATIC TEST OF TX-28-X1 REAR SUBASSEMBLY.

REF. SYM: 1612 (809)
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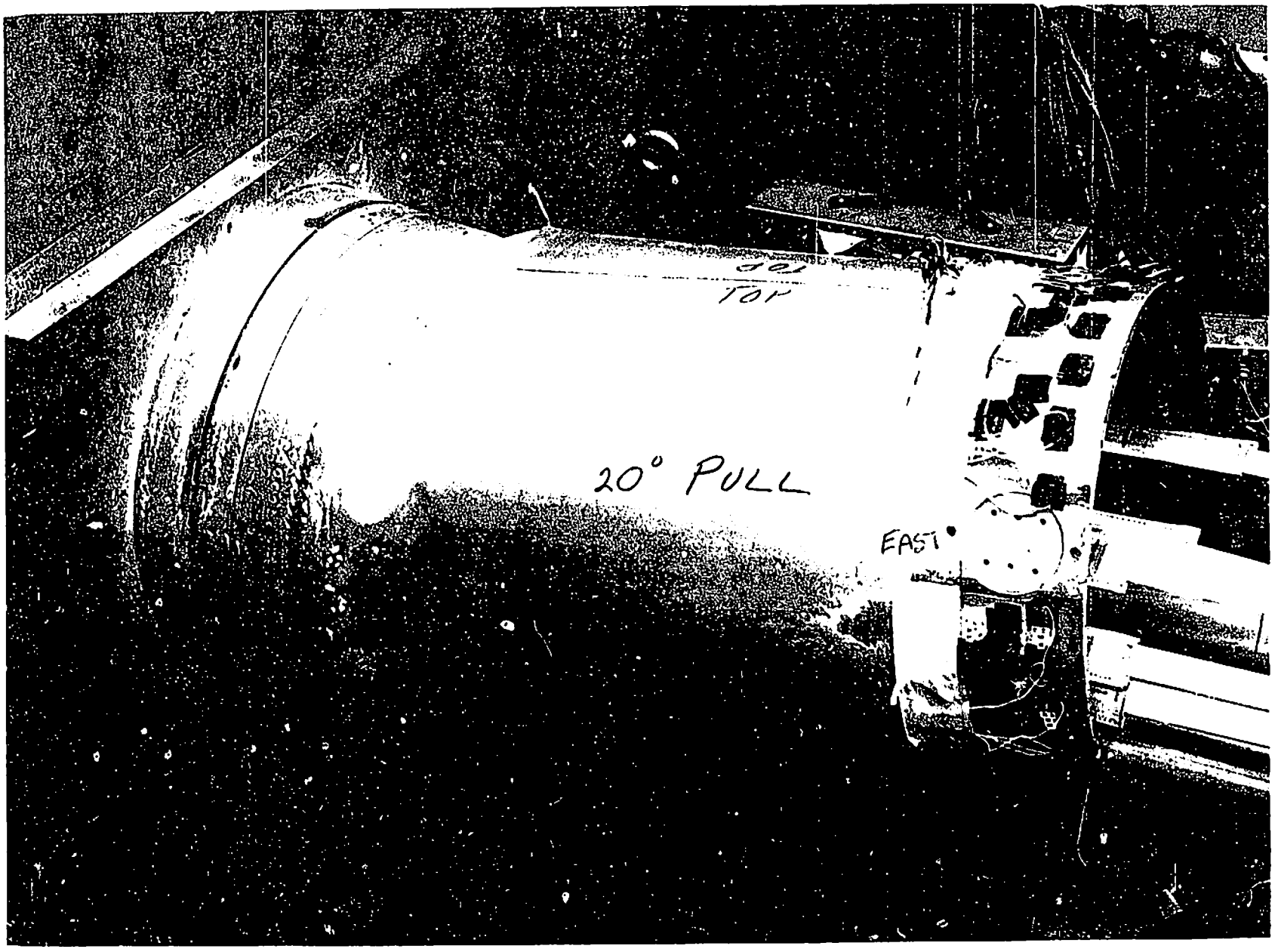

FIG. 19 -- FAILURE OF MC-926 FORWARD SECTION IN TEST NO. 9 -- STATIC TEST OF TX-28-XI REAR SUBASSEMBLY.

REF. SYM: 1612 (809)
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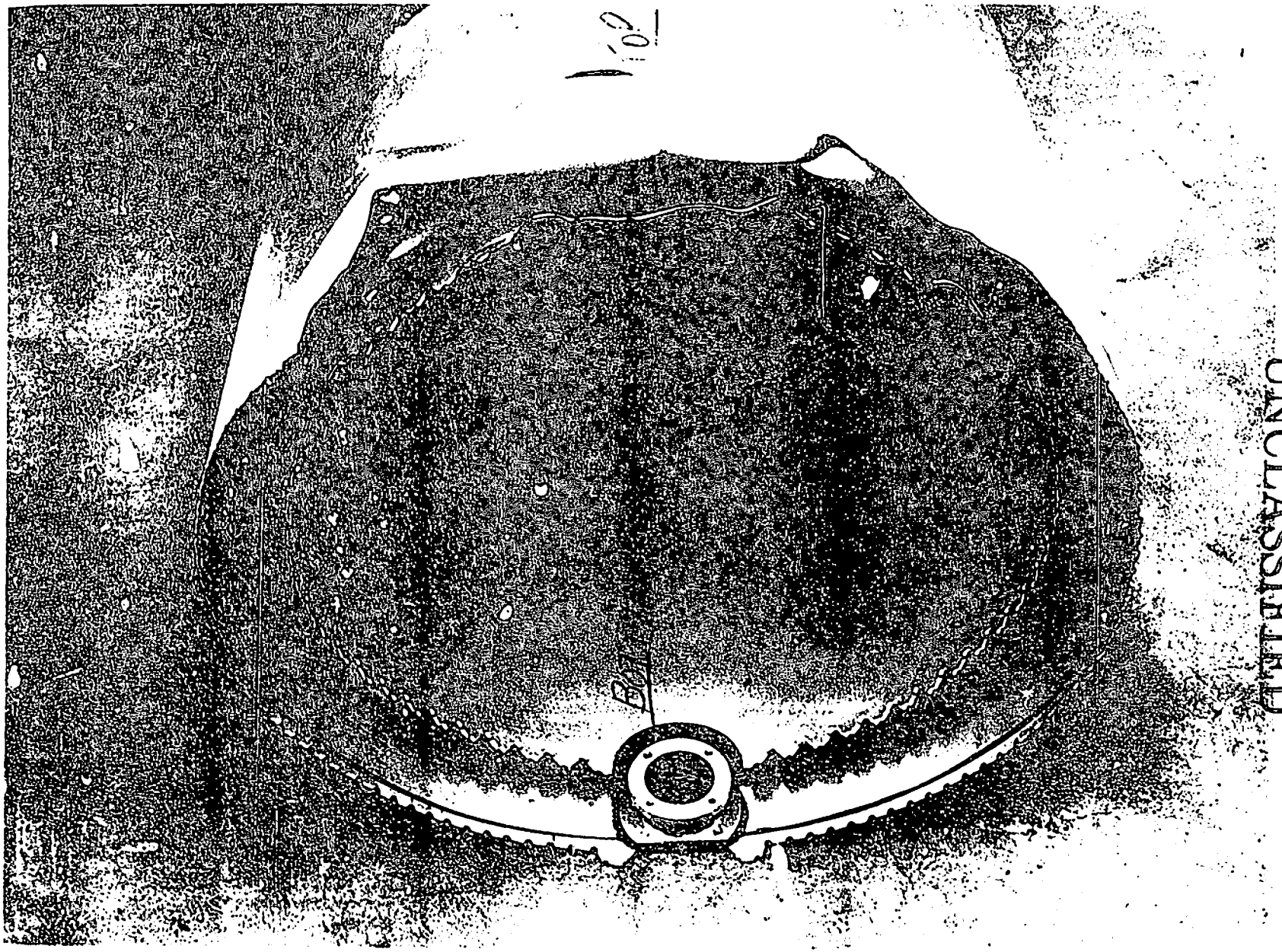

FIG. 20 -- VIEW OF NC-926 FORWARD SECTION FOLLOWING FAILURE IN TEST NO. 9 -- STATIC TEST OF TX-28-XI REAR SUBASSEMBLY.

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PROJECT NO. TM-853

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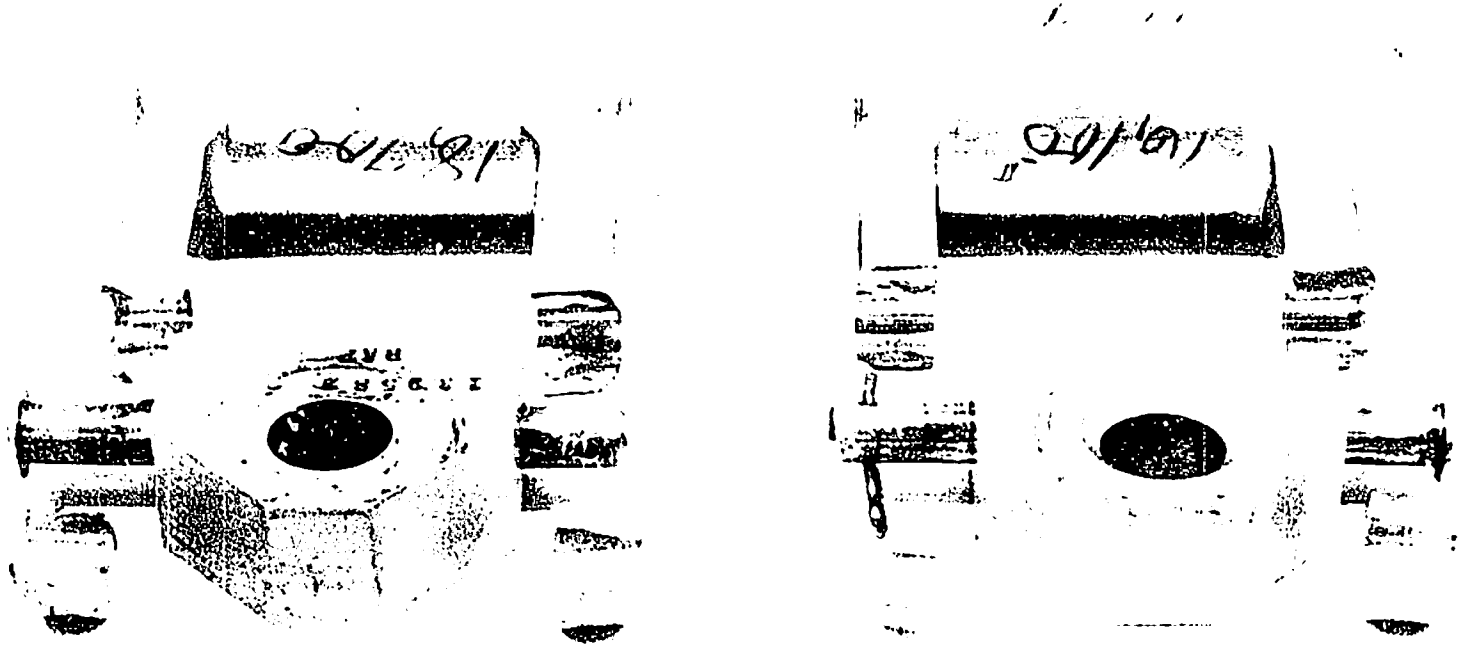

FIG. 21 -- MAIN PARACHUTE LUGS AFTER FAILURE IN TEST NO. 9 -- STATIC TEST OF TX-28-XI REAR SUBASSEMBLY.

D# 109700

REF. SYM: 1612 (80B)
PROJECT NO. TM-853

#1063

TABLE I

TEST NO. 1 - CASE SEPARATION LOADS
STATIC TEST OF TX-28-X1 REAR SUBASSEMBLY

Case	Load to Separate Outer Skin (Pounds)	Load to Separate Case Section (Pounds)	Remarks
1 (Drop Case)	3300	Did Not Test	
2 (TMS Case)	1915	3200	Section could not rotate.
		1390	Section could rotate.
		1240	Without roll pins.
3 (Case with Offset Roll Pins)	1950	--	Separation of outer skin and case section occurred simultaneously.

TABLE II

TEST NO. 3 - VERTICAL LOAD ON SMALL PARACHUTE CONE
STATIC TEST OF TX-28-X1 REAR SUBASSEMBLY

Load Pounds	Deflection Readings - 0.001 Inch Dial Indicator No. 1	2	3	4	5	6
0	0	0	0	0	0	0
75	5	7	6	10	12	32
150	15	19	21	27	32	66
*236	29	37	42	53	59	107
300	40	49	58	69	77	134
**354	47	59	70	82	91	154
0	7	9	8	12	14	23
425	57	67	86	101	109	189
0	7	10	10	14	16	31

* 100 per cent design load.
** 150 per cent design load.

TABLE III

TEST NO. 4 - VERTICAL LOAD ON MC-926 CASE AT STATION 153.5
STATIC TEST OF TX-28-X1 REAR SUBASSEMBLY

Load Pounds	Deflection Readings - 0.001 Inch Dial Indicator No. 1	2	3	4	5	6
0	0	0	0	0	0	0
200	26	34	42	49	53	62
400	50	62	75	87	97	113
600	76	90	110	129	142	165
800	99	123	150	173	193	226
1000	123	157	196	230	255	303
1200	144	186	236	275	310	368
1350	159	207	264	310	347	413
*1475	169	225	285	337	377	452
0	5	13	23	29	34	45
1600	181	241	312	365	420	504
1800	198	268	350	411	472	570
2000	210	290	382	454	524	--
**2210	220	315	422	504	584	719
0	5	22	41	52	66	88

* 100 per cent design load.
** 150 per cent design load.

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TABLE IV

TEST NO. 5 - FIN TEST
STATIC TEST OF TX-28-X1 REAR SUBASSEMBLY

Deflection Readings - 0.001 Inch
Dial Indicator Location

Loads Pounds	Fin No. 1 Front	Fin No. 1 Center	Fin No. 1 Rear	Fin No. 2 Front	Fin No. 2 Center	Fin No. 2 Rear
0	0	0	0	0	0	0
100	10	29	53	16	29	39
200	16	39	98	25	57	78
300	25	69	142	39	87	121
400	34	101	175	55	121	167
0	1	2	5	-11	-21	-33
400	36	100	182	42	96	131
500	45	120	242	56	127	178
550	50	138	277	65	146	201
600	54	149	296	73	161	221
0	-3	1	7	-4	-5	-20
600	51	140	277	75	165	231
650	58	160	306	83	182	250
*711	63	180	330	94	204	280
0	-6	2	14	0	1	-9
800	69	209	362	112	242	340
0	-9	7	26	2	9	0
1000	85	290	437	143	322	457
0	-20	24	68	10	35	144
1200	103	363	539	179	406	582
0	-25	28	76	24	67	92
1860	- - - - - Failed - - - - -			--	--	--

* 100 per cent design load.

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TABLE V

TEST NO. 9 - SIMULATED MAIN PARACHUTE LOAD (15-DEGREE FULL)
STATIC TEST OF TX-29-X1 REAR SUBASSEMBLY

Strain - Microinches per Inch
Strain Gage Element No.

Load in Pounds	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10,000	30	-200	40	-240	-90	-220	-150	210	40	370	-180	330	-160	310	-180	230	-70	70
20,000	60	-330	80	-410	-170	-400	-280	400	80	680	-340	620	-280	600	-360	460	-120	120
30,000	90	-460	110	-580	-240	-570	-420	570	120	970	-500	910	-420	870	-530	620	-180	170
40,000	120	-570	150	-740	-300	-730	-540	760	150	1,270	-650	1,200	-530	1,190	-670	810	-220	210
50,000	140	-670	180	-870	-350	-880	-650	910	170	1,530	-790	1,440	-640	1,450	-830	990	-260	260
60,000	160	-760	210	-990	-400	-1,040	-750	1,060	200	1,770	-920	1,660	-740	1,690	-960	1,150	-300	310
70,000	170	-840	220	-1,100	-450	-1,140	-840	1,190	210	2,000	-1,040	1,870	-850	1,920	-1,100	1,310	-340	360
80,000	190	-880	240	-1,180	-480	-1,240	-910	1,280	220	2,180	-1,120	2,040	-930	2,100	-1,200	1,430	-360	410
0	-40	-10	-20	-10	-20	0	-10	-20	-10	-40	-10	-40	-10	-20	-10	-30	-20	-20

Principle Stresses - psi
Strain Gage Element No.

Load in Pounds	1 and 2		3 and 4		5 and 6		7 and 8		9 and 10		11 and 12		13 and 14		15 and 16		17 and 18	
	Su	Sv	Su	Sv	Su	Sv	Su	Sv	Su	Sv	Su	Sv	Su	Sv	Su	Sv	Su	Sv
10,000	-2,250	-460	-2,680	-500	-2,070	-1,960	1,880	-930	4,550	1,980	3,180	-800	-650	-1,900	2,000	-1,200	550	-550
20,000	-3,670	-630	-4,540	-720	-5,430	-3,640	3,600	-1,700	8,380	3,710	5,970	-1,520	5,980	-890	3,520	-2,560	940	-940
30,000	-5,130	-920	-6,430	-1,050	-7,730	-5,160	5,050	-2,670	11,980	5,360	8,760	-2,240	8,490	-1,490	5,200	-3,770	1,290	-1,440
40,000	-6,270	-890	-8,160	-1,020	-9,370	-6,520	6,820	-3,320	15,660	6,930	11,590	-2,840	11,050	-1,460	6,880	-4,660	1,600	-1,760
50,000	-7,370	-1,060	-9,530	-1,400	-11,850	-7,720	8,150	-4,010	18,820	8,220	13,860	-3,520	14,500	-1,710	8,370	-5,820	2,030	-2,030
60,000	-8,360	-1,190	-10,830	-1,530	-13,710	-8,830	9,520	-4,590	21,790	9,550	15,940	-4,170	17,030	-1,920	9,740	-6,710	2,460	-2,300
70,000	-9,270	-1,330	-12,150	-1,850	-15,340	-9,960	10,580	-5,170	24,560	10,600	17,940	-4,740	19,310	-2,290	11,060	-7,720	2,890	-2,570
80,000	-9,660	-1,320	-13,010	-1,940	-16,640	-10,720	11,480	-5,590	26,730	11,450	19,640	-5,000	21,120	-2,500	12,080	-8,420	3,400	-2,600

NOTES: 1 - (+) indicates tensile strain or stress.
(-) indicates compressive strain or stress.

2 - Su is the numerically larger principle stress.
Sv is the numerically smaller principle stress.

3 - Calculation of principle stresses at biaxial gage locations (Gages 1 thru 22) is based on the assumption that the gages were mounted in the directions of principle stress.

TABLE V (Continued)

TEST NO. 9 - SIMULATED MAIN PARACHUTE LOAD (15-DEGREE PULL)
STATIC TEST OF TX-28-X1 REAR SUBASSEMBLY

Strain - Microinches per Inch
Strain Gage Element No.

Load in Pounds	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10,000	30	-220	40	-210	100	-40	-250	-60	-10	170	80	-110	320	-80	80	190	90	-90	-230
20,000	70	-380	90	-390	180	-60	-440	-130	-20	300	140	-210	580	-160	150	320	180	-160	-420
30,000	100	-550	110	-470	260	-90	-620	-180	-40	410	200	-310	800	-230	230	480	260	-240	-620
40,000	140	-700	150	-590	340	-110	-790	-240	-50	530	270	-400	1,080	-290	300	620	340	-310	-790
50,000	170	-830	170	-710	410	-140	-940	-280	-70	620	320	-490	1,280	-350	360	740	400	-370	-940
60,000	190	-950	200	-830	470	-160	-1,080	-320	-80	700	370	-570	1,480	-400	420	860	470	-430	-1,080
70,000	210	-1,060	230	-890	520	-180	-1,200	-350	-110	780	400	-650	1,660	-450	480	960	520	-480	-1,210
80,000	230	-1,130	240	-950	560	-190	-1,290	-380	-130	830	430	-700	1,790	-500	520	1,040	570	-520	-1,300
0	-20	-10	-20	0	-10	-10	20	0	0	0	0	20	-20	10	10	-10	0	10	10

Principal Stresses - psi
Strain Gage Element No.

Load in Pounds	19 and 20		21 and 22		23, 24, and 25			26, 27, and 28			29, 30, and 31			32, 33, and 34			35, 36, and 37		
	Su	Sv	Su	Sv		Su	Sv		Su	Sv		Su	Sv		Su	Sv		Su	Sv
10,000	-2,490	-540	-2,330	-330		-2,580	200		1,910	-160		5,850	520		1,940	-200		-2,370	140
20,000	-4,220	-710	-3,700	-430		-4,550	410		3,220	-510		10,490	960		3,330	-620		-4,270	450
30,000	-6,110	-1,040	-5,140	-600		-6,360	640		4,430	-770		14,690	1,420		4,880	-900		-6,020	600
40,000	-7,730	-1,180	-6,390	-620		-8,070	900		5,670	-1,060		19,690	1,780		6,340	-1,080		-8,030	880
50,000	-9,150	-1,350	-7,740	-860		-9,570	1,140		6,680	-1,270		23,460	2,000		7,540	-1,340		-9,580	990
60,000	-10,430	-1,600	-8,670	-870		-11,000	1,300		7,520	-1,480		27,150	2,280		8,790	-1,470		-10,970	1,270
70,000	-11,710	-1,810	-9,620	-880		-12,230	1,410		8,500	-1,660		30,370	2,400		9,830	-1,710		-12,010	1,340
80,000	-12,960	-1,860	-10,290	-1,010		-13,150	1,530		9,050	-1,890		32,730	2,580		10,610	-2,020		-13,200	1,580

NOTES: 1 - (+) indicates tensile strain or stress.
(-) indicates compressive strain or stress.

2 - Su is the numerically larger principal stress.
Sv is the numerically smaller principal stress.

- Calculation of principal stresses at biaxial gage locations (Gages 1 thru 22) is based on the assumption that the gages were mounted in the directions of principal stress.

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Ref. Sym: 1612 (809)
Project No. TM-853

TABLE VI

TEST NO. 9 - SIMULATED MAIN PARACHUTE LOAD (20-DEGREE PULL)
STATIC TEST OF TX-23-X1 REAR SUBASSEMBLY

Strain - Microinches per Inch
Strain Gage Element No.

Load in Pounds	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10,000	70	-300	80	-340	-110	-290	-210	320	60	520	-260	520	-230	510	-280	380	-100	130
20,000	120	-520	150	-660	-200	-550	-410	600	100	1,000	-500	990	-420	960	-530	690	-180	230
30,000	160	-690	220	-920	-280	-800	-590	870	150	1,450	-730	1,430	-600	1,400	-760	990	-240	310
40,000	220	-880	270	-1,160	-360	-1,040	-760	1,140	170	1,910	-950	1,860	-770	1,810	-990	1,270	-290	350
50,000	260	-1,040	330	-1,370	-420	-1,240	-930	1,370	200	2,200	-1,140	2,230	-920	2,180	-1,190	1,520	-350	410
60,000	290	-1,180	370	-1,570	-500	-1,440	-1,080	1,580	220	2,660	-1,330	2,590	-1,070	2,350	-1,330	1,770	-390	440
70,000	320	-1,320	420	-1,760	-550	-1,640	-1,240	1,790	250	3,040	-1,500	2,970	-1,230	2,370	-1,580	2,010	-430	470
80,000	350	-1,410	450	-1,900	-600	-1,820	-1,360	1,950	250	3,340	-1,650	3,300	-1,360	3,160	-1,750	2,170	-450	490

Principal Stresses - psi
Strain Gage Element No.

Load in Pounds	1 and 2		3 and 4		5 and 6		7 and 8		9 and 10		11 and 12		13 and 14		15 and 16		17 and 18	
	Su	Sv	Su	Sv	Su	Sv	Su	Sv	Su	Sv	Su	Sv	Su	Sv	Su	Sv	Su	Sv
10,000	-3,270	-390	-3,700	-430	-3,880	-2,480	2,940	-1,190	6,410	2,820	5,110	-970	5,110	-660	3,370	-1,780	1,140	-660
20,000	-5,680	-690	-7,210	-900	-7,330	-4,600	5,450	-2,430	12,260	5,240	9,710	-1,910	9,670	-1,080	6,030	-3,480	2,000	-1,200
30,000	-7,530	-900	-10,010	-1,120	-10,620	-6,560	7,920	-3,460	17,790	7,660	13,990	-2,850	14,160	-1,430	8,650	-4,990	2,700	-1,590
40,000	-9,540	-960	-12,650	-1,500	-13,790	-8,480	10,430	-4,380	23,330	9,760	18,190	-3,720	18,330	-1,780	11,040	-6,580	2,970	-2,020
50,000	-11,270	-1,140	-14,900	-1,640	-16,400	-10,010	12,460	-5,470	27,950	11,660	21,810	-4,470	22,110	-2,060	13,190	-7,940	3,440	-2,480
60,000	-12,810	-1,350	-17,110	-1,980	-19,100	-11,770	14,350	-6,390	32,420	13,400	25,300	-5,260	25,650	-2,420	15,380	-9,180	3,630	-2,840
70,000	-14,350	-1,560	-19,160	-2,160	-21,670	-13,170	16,190	-7,440	37,040	15,200	29,120	-5,730	29,030	-2,940	17,410	-10,570	3,830	-3,190
80,000	-15,290	-1,570	-20,690	-2,370	-24,000	-14,490	17,600	-8,210	40,600	16,510	32,420	-6,170	31,940	-3,300	18,620	-11,940	3,980	-3,350

NOTES: 1 - (+) indicates tensile strain or stress.
(-) indicates compressive strain or stress.

2 - Su is the numerically larger principal stress.
Sv is the numerically smaller principal stress.

3 - Calculation of principal stresses at biaxial gage locations (Gages 1 thru 22) is based on the assumption that the gages were mounted in the directions of principal stress.

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Ref. Symb 1612 (809)
Project No. TM-853

TABLE VI (Continued)

TEST NO. 9 - SIMULATED MAIN PARACHUTE LOAD (20-DEGREE PULL)
STATIC TEST OF TX-28-X1 REAR SUBASSEMBLY

Strain - Microinches per Inch
Strain Gage Element No.

Load in Pounds	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10,000	80	-350	80	-320	130	-70	-390	-100	-10	240	120	-180	510	-140	130	320	150	-160	-390
20,000	140	-630	140	-550	290	-120	-710	-200	-30	440	230	-340	920	-260	250	570	280	-280	-690
30,000	210	-870	200	-750	410	-150	-980	-270	-40	620	330	-480	1,300	-350	350	790	410	-390	-970
40,000	260	-1,200	250	-940	530	-190	-1,250	-360	-70	790	430	-630	1,680	-450	460	990	520	-510	-1,240
50,000	310	-1,310	300	-1,120	620	-220	-1,480	-420	-100	940	500	-760	2,010	-540	570	1,190	630	-620	-1,480
60,000	360	-1,320	340	-1,260	710	-260	-1,700	-480	-130	1,090	570	-880	2,310	-620	660	1,350	710	-720	-1,700
70,000	400	-1,700	380	-1,410	800	-290	-1,910	-550	-170	1,230	650	-1,000	2,610	-700	760	1,510	810	-810	-1,920
80,000	440	-1,830	420	-1,530	860	-310	-2,050	-580	-210	1,310	710	-1,100	2,830	-760	840	1,630	870	-880	-2,080

Principal Stresses - psi
Strain Gage Element No.

Load in Pounds	19 and 20		21 and 22		23, 24, and 25		26, 27, and 28		29, 30, and 31		32, 33, and 34		35, 36, and 37	
	Su	Sv	Su	Sv	Su	Sv	Su	Sv	Su	Sv	Su	Sv	Su	Sv
10,000	-3,820	-470	-3,470	-350	-4,150	10	2,580	-350	9,160	860	3,250	-390	-4,040	220
20,000	-6,900	-900	-5,950	-570	-7,300	620	4,660	-850	16,770	1,520	5,780	-850	-7,090	560
30,000	-9,460	-1,040	-8,080	-670	-10,050	990	6,640	-1,070	23,750	2,180	8,060	-1,060	-9,900	990
40,000	-13,170	-1,780	-10,130	-850	-12,790	1,340	8,420	-1,580	30,790	2,770	10,100	-1,510	-12,690	1,230
50,000	-14,270	-1,640	-12,060	-990	-15,190	1,510	10,140	-1,860	36,740	3,190	12,180	-1,840	-15,120	1,600
60,000	-14,180	-1,090	-13,550	-1,080	-17,450	1,700	11,850	-2,140	42,220	3,590	13,820	-2,210	-17,430	1,680
70,000	-18,530	-2,150	-15,170	-1,220	-19,590	1,940	13,740	-2,120	47,810	4,050	15,490	-2,610	-19,660	2,000
80,000	-19,900	-2,210	-16,430	-1,230	-21,020	2,090	14,430	-2,820	52,030	4,280	16,760	-2,920	-21,320	2,070

NOTES: 1 - (+) indicates tensile strain or stress.
(-) indicates compressive strain or stress.

2 - Su is the numerically larger principal stress.
Sv is the numerically smaller principal stress.

3 - Calculation of principal stresses at biaxial gage locations (Gages 1 thru 22) is based on the assumption that the gages were mounted in the directions of principal stress.

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TABLE VII

FAILURE TEST OF MAIN PARACHUTE LUGS
TEST NO. 9 — STATIC TEST OF TX-28-X1 REAR SUBASSEMBLY

Lug No.	Attitude of Pull	Failure Load (Pounds)
1	Straight	17,200
2	Straight	19,200
3	Straight	18,900
4	Straight	16,100
5	25° Angle	18,700
6	25° Angle	19,100
7	25° Angle	19,100
8	25° Angle	18,900

Average failure load for straight pull = 17,850 pounds.
Average failure load for 25° angle pull = 18,950 pounds.

Ref. Sym: 1612 (809)
Project No. TM-853

TABLE VIII

RESULTS OF TENSILE SPECIMEN FAILURE TESTS
STATIC TEST OF TX-28-X1 REAR SUBASSEMBLY

Specimen No.	Cross Section Area (Sq. In.)	Ultimate Load (Lbs.)	Ultimate Stress (psi)	Yield Load (Lbs.)	Yield Stress (psi)
Interior Case Skin					
1	0.026	1,085	41,700	975	37,500
2	0.026	1,105	42,500	975	37,500
3	0.026	1,095	42,100	1,000	38,500
Exterior Case Skin					
1	0.025	1,090	43,500	975	39,000
2	0.025	1,080	43,200	1,000	40,000
3	0.025	1,090	43,500	975	39,000
Rear Case Ring					
1	0.050	2,500	50,000	2,150	40,300
2	0.050	2,510	50,020	2,150	40,300
3	0.050	2,505	50,010	2,150	40,300