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SANDIA SYSTEMATIC DECLASSIFICATION REVIEW
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MAR 6 1958
Case No. 771.00
Ref. Sym: 1612 (486)
Project No. TM-548
File: TX-28, 3-2

MR. W. J. DENISON - 1224

Attn: Mr. H. A. Mullin - 1224-2

Re: Static Test of TX-28/X1 Aft Case Parachute Lug Ring

COL No
ACCOUNTABILITY CARD BM
FILE No TX-28 3-2

Summary of Results

One TX-28/X1 parachute lug ring and aft case, DS(1224)79328, was loaded to about 145,000 pounds with the simulated chute load pulling at 15 degrees with respect to the longitudinal axis of the case. No damage resulted to the unit from this load. The limit load at the time of this portion of the test was 107,500 pounds.

The second TX-28/X1 parachute lug ring and aft case, Dwg. No. DL-10021, was loaded to 110,000 pounds with the load pulling at 15 degrees with respect to the longitudinal axis of the case without failure. When the angle of the load was increased to 20 degrees, failure occurred at 106,000 pounds by buckling of the case which in turn was followed by rivet failure near the mounted end of the case. The limit load at the time this portion of the test was run was 80,000 pounds.

Object of Test

The test was performed to determine the structural adequacy of the TX-28/X1 parachute lug ring and aft case unit for a 15 degree pull (15 degree angle of attach) when loaded to 137.5 per cent of design limit load. Also, the unit was to be tested to failure by increasing the angle of pull by 5 degree increments beyond 15 degrees. The design limit load at the time of testing the first unit was 107,500 pounds. However, when the second unit was tested, the design limit load had decreased to 80,000 pounds due to reconsideration of aerodynamic forces.

Reason for Test

The test was performed as a result of the Work Order Authorization dated March 7, 1957 from Division 1224 to Division 1612.

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Function of Object Tested

The aft case of the TX-28 contains the parachute and transmits to the weapon the loads induced by the parachute when it is deployed.

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Summary of Past Tests

Numerous tests have been run on the TX-28 and its components. However, no previous static tests have been run in which the parachute loads were applied to the aft case. A previous static test was performed on a couple of parachute lugs, the results of which are given in the report, Static Test of TX-28 Parachute Lug, dated June 13, 1957, TM-577, Ref. Sym: 1612 (519), from Division 1612 to Division 1224. Following is the "Summary of Results" from that test:

> "Two TX-28 lug and clevis assemblies were tested to destruction. In the first test the clevis failed in tension at the pin hole when subjected to a load of 137.5 per cent limit load (13,750 pounds). A heavier clevis was substituted for the second test and the lug failed in tension at the pin hole at a load of 159 per cent limit load (15,900 pounds)".

The lugs used in the current tests are very similar but not identical to the second clevis or lug tested in the above "Summary of Results".

Setup for Test

The setup for the test is shown in Figs. 1 and 2.

The drawing number for the first case was DS(1224)79328 and the drawing number for the second case was DL-10021.

Following is a description of the materials in the two cases: The first case had a 1/8-inch outer skin and 1/16-inch inner skin of 24S-T36 aluminum. The aluminum rings at both the mounted end and open end of the case was 14S-T6. The steel ring at the mounted end was 4130 steel (H.T. 125,000 - 145,000 psi). In the second case the inner and outer skins were 1/16-inch aluminum (61S-T6). The aluminum rings at each end of the case was also 61S-T6. The steel ring at the mounted end was 4130 steel (H.T. 125,000 - 145,000 psi).

The following equipment was used:

1 - Paytheon hydraulic cylinder, 400,000 pounds capacity
1 - Two-inch calibrated pull bar No. 7
8 - One-inch calibrated pull bars, Serial Nos. 2, 3, 4, 5, 6, 8, 9, and 10.
1 - Fairchild strain indicator, Model 101-C-2.
1 - Sadic automatic data processing system, Model 34-112 M1
Baldwin Southwark testing machine, 5000-pounds capacity.

The following instrumentation was used:

5 - Starrett dial indicators, graduated to .001 inch with a maximum range of 1.0 inch
28 - Type A-7 strain gages, six of which were used in two rosettes, Res. 120 ohms
10 - Type AX-7 strain gages, G.F. = 1.86 ± 2%, Res. = 120 ohms
Stresscoat No. 1206, sensitivity at time of test was 800 to 850 microinches per inch.

Procedure

The first TX-28/X1 aft case, DS(1224)79328, was Stresscoated with Stresscoat No. 1206 and mounted in the static jig as shown in Figs. 1 and 2. The load was applied in a direction making an angle of 15 degrees with the longitudinal axis of the case. The load was applied in increments from 20,000 pounds to 125,000 pounds with each load being 1.2 times the preceding load. After each increment, the load was released to zero and the areas of Stresscoat cracks were marked. The eight shroud lines between the unit and the intermediate jig fixture were kept approximately equally loaded during this test and all subsequent tests of the unit by adjusting the tension in each shroud line as required before loading to the next increment.

After the Stresscoat test was completed, 25 strain gages were mounted, consisting of 19 uniaxial gages and 2 rosettes. The unit was again mounted in the static jig as shown in Fig. 1 and loaded in increments of 10,000 pounds to a load of about 145,000 pounds.

Strain readings were taken at each increment of load. At a load of 145,000 pounds, jig failure prohibited additional loading.

The second TX-28/X1 aft case, DL-10021, was Stresscoated with Stresscoat No. 1206 and mounted in the static jig as shown in Figs. 1 and 2. The load was applied in a direction making an angle of 15 degrees with the longitudinal axis of the case. The load was applied in increments from 20,000 pounds to 41,500 pounds with each load being 1.2 times the preceding load. After each increment, the load was released to zero and the areas of Stresscoat cracks were marked.

Ten biaxial strain gages and three uniaxial strain gages were mounted to this second case and the unit was again setup in the static jig as shown in Figs. 1 and 2. The unit was loaded in increments to a load of 110,000 pounds, pulling at an angle of 15 degrees from the longitudinal axis of the test unit. Strain readings were taken at the 23 strain gages and deflection readings were taken at the two dial indicators after each increment of load. In addition, as the test progressed, the load was dropped

to 10 per cent of limit load after each increment of load and deflection readings were taken at this 10 per cent load. The tension on shroud lines was equalized each time when the load was released to 10 per cent of limit load.

A five-degree shim was inserted on the static jig mounting plate so that the outer end of the test unit was tilted downward five degrees from the preceding test. With the same setup for the hydraulic ram and pull rods as used previously, the direction of the load made an angle of 20 degrees with the longitudinal axis of the unit. The unit was then loaded in increments to about 106,000 pounds at which load failure prohibited additional loading. Strain readings at 23 strain gages and deflection readings at five dial indicators were taken at the increments of load. As in the previous test, the load was dropped to 10 per cent of limit load after each increment of load for equalizing the tension in the eight shroud lines. At this 10 per cent load, deflection readings were taken at the dial indicators for a portion of the test.

Results

The Stresscoat test on the first TX-28/X1 aft case, DS(1224)79328, produced the areas of Stresscoat cracks shown on Figs. 3 thru 6 when loaded to a maximum of 125,000 pounds. Table I shows the loads producing the Stresscoat cracks on the above figures and the sensitivity of the Stresscoat.

The first unit when loaded to about 145,000 pounds at a 15-degree pull failed the adapter plate between the test unit and the static jig. However, the TX-28/X1 case did not fail from this test. This load corresponds to 135 per cent of limit load based on the limit load of 107,500 pounds applicable at the time of this test. However, based on the limit load of 80,000 pounds used and the second case, the load of 145,000 pounds would be 182 per cent of the design limit load. The strain readings from the 25 strain gages and the computed stresses for the two rosettes are shown on Table II. The maximum computed stress was 8,200 psi (compression) at rosette (20, 21, 22) on 24S-T36 aluminum. The locations of the strain gages are shown on Figs. 7 thru 12.

The Stresscoat test on the second TX-28/X1 case (DL-10021) produced the areas of Stresscoat cracks shown on Figs. 13 thru 15 when loaded to a maximum of 41,500 pounds at an angle of 15 degrees with the longitudinal axis of case. Table III shows the loads producing the Stresscoat cracks on the preceding three figures.

The second unit when loaded to 110,000 pounds (137.5 per cent of a limit load of 80,000 pounds) with the load making an angle of 15 degrees with the longitudinal axis did not result in any damage to the unit. The

strain readings and the computed principal stresses are shown on Table IV. The stresses at gages (3, 4) reached the yield stress of 61S-T6 aluminum (35,000 psi) at a load of 64,000 pounds (80 per cent limit load). The maximum stress on the steel ring was about 78,000 psi at gages (20, 21) at a load of 110,000 pounds. The stresses are computed on the assumption that the biaxial gages are oriented in the direction of the principal stresses. The location of the 23 strain gages are shown on Figs. 16 thru 19. The deflection readings at the two dial indicators are shown on Table V. Dial indicators 1 and 2 measure the vertical movement of the bottom of the case with respect to the floor at the mounted end and open end, respectively. The location of these two dial indicators is shown on a subsequent photograph.

When loaded with a 20-degree pull, the unit failed at a load of 106,000 pounds which is about 133 per cent of limit load based on a limit load of 80,000 pounds. The initial failure was the buckling of the skin of the case which was followed by the shearing of the rivets near the mounted end. The unit after failure is shown in Figs. 20 thru 23. Table VI shows the strain readings and the computed principal stresses. The computed stress on the aluminum ring (61S-T6) reached the yield point of 61S-T6 (35,000 psi) at about 50 per cent of limit load (gages 3, 4). The maximum computed stress in the steel ring (4130) was about 95,000 psi at 133 per cent of limit load (gages 20, 21). The strain gages are the same as used in the preceding test and are shown on Figs. 16 thru 19. The deflection readings for dial indicators 1 thru 5 is shown on Table V. The location of dial indicators 1 and 2 is the same for both the 15-degree and 20-degree pull.

After the test was completed, fourteen tensile specimens were cut from the unit at the locations shown in Figs. 16 and 17. These tensile specimens were pulled to failure in the Baldwin-Southwark testing machine with the results shown in Table VII.

The properties of the exterior and interior skins shown on Table VII indicate that this part of the structure is 61S-T6 which has an ultimate stress of 42,000 psi and a yield stress of 35,000 psi. The properties of the ring near the mounted end of the case shown on Table VII indicates that this part of the structure has a yield stress of about 43,000 psi and an ultimate stress of about 47,000 psi. This part is supposed to be 61S-T6. However, these values are somewhat above the minimum values of 61S-T6. The four tensile specimens from the ring at the open end of the case gave an average ultimate stress of 41,900 psi and an average yield stress of 39,100 psi. This corresponds to 61S-T6 aluminum except the yield stress is somewhat higher than the minimum yield stress for 61S-T6.

Conclusions

It is concluded that the second unit had adequate strength for the 15-degree pull based on 137.5 per cent of a design limit load of 80,000 pounds. The first case has sufficient strength for at least 132 per cent of a limit load of 80,000 pounds when pulling at 15 degrees.

H. P. WHEELER - 1612-2

Approved by:
PAUL H. ADAMS - 1612

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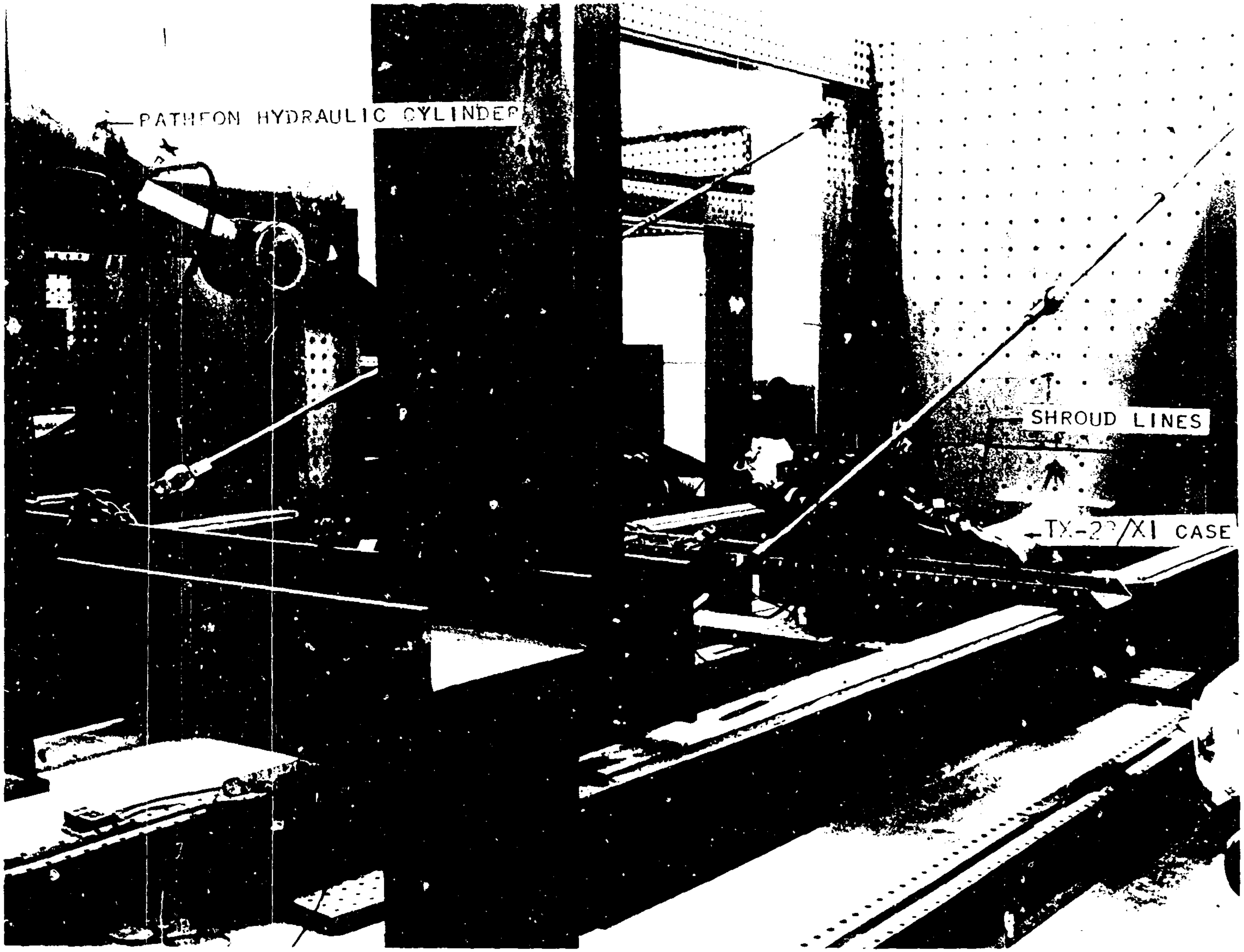

FIG. 1 -- TEST SETUP FOR STATIC TEST OF TX-28/XI AFT CASE PARACHUTE LUG RING.

REF. SYM: 1612 (486)
PROJECT NO. TM-54

D# 102610

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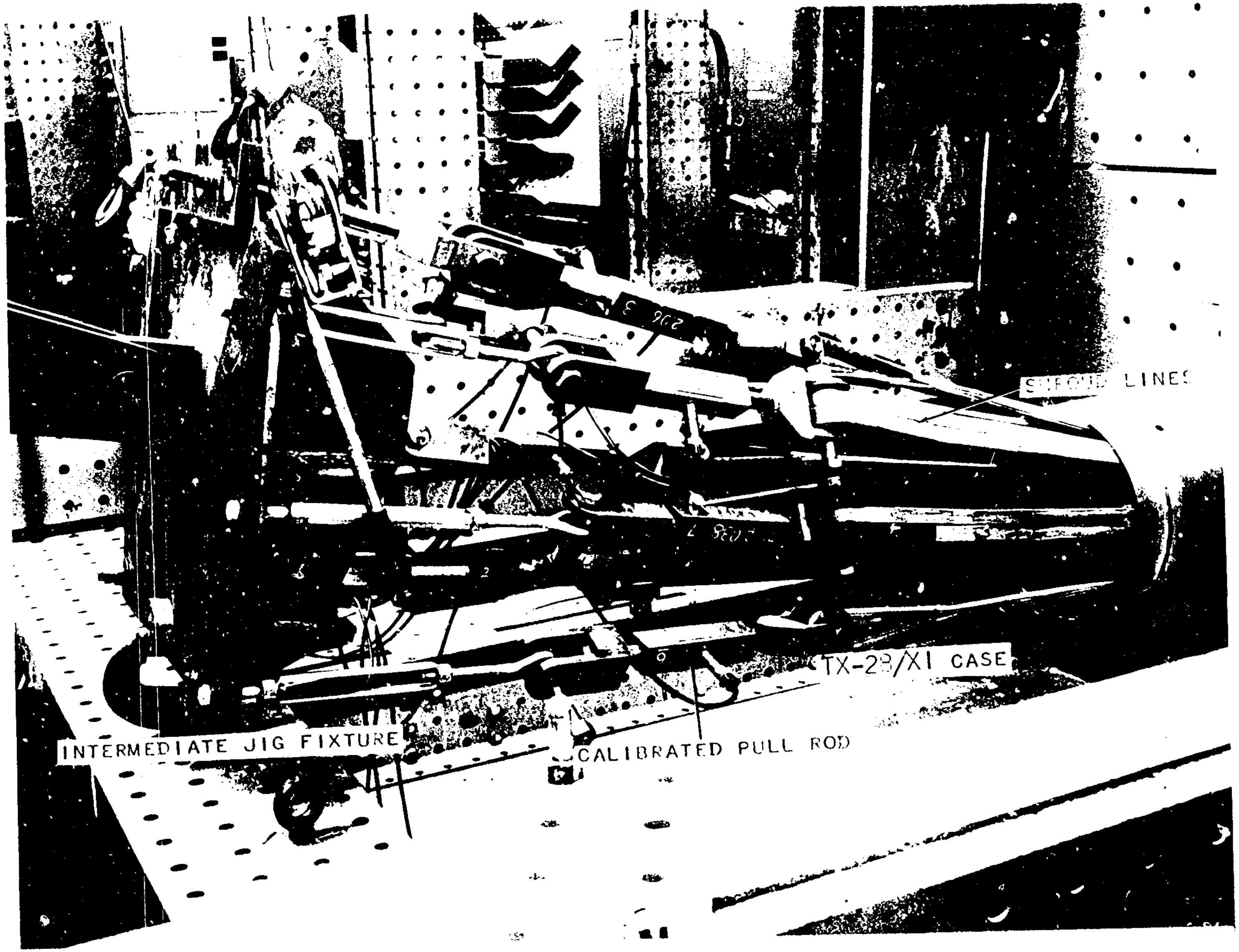

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FIG. 2 -- TEST SETUP FOR STATIC TEST OF TX-28/XI AFT CASE PARACHUTE LUG RING.

REF. SYM: 1612 (486)
PROJECT NO. TM-548

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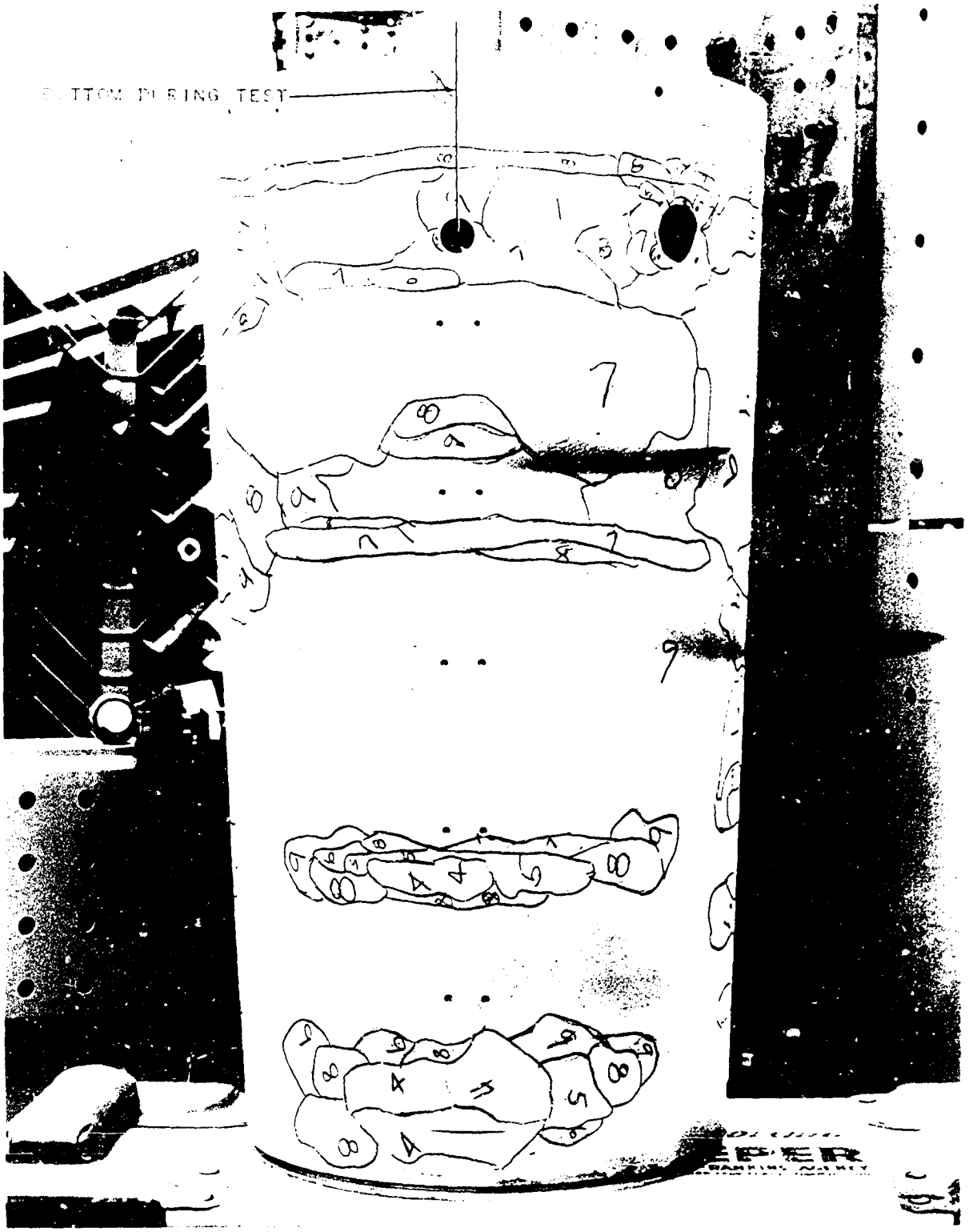

FIG. 3 -- AREAS OF STRESSCOAT CRACKS FOR 15° PULL (FIRST CASE) -- STATIC TEST OF TX-28/X1 AFT CASE PARACHUTE LUG RING.

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REF. SYM: 1612 (486)
PROJECT NO. TM-548

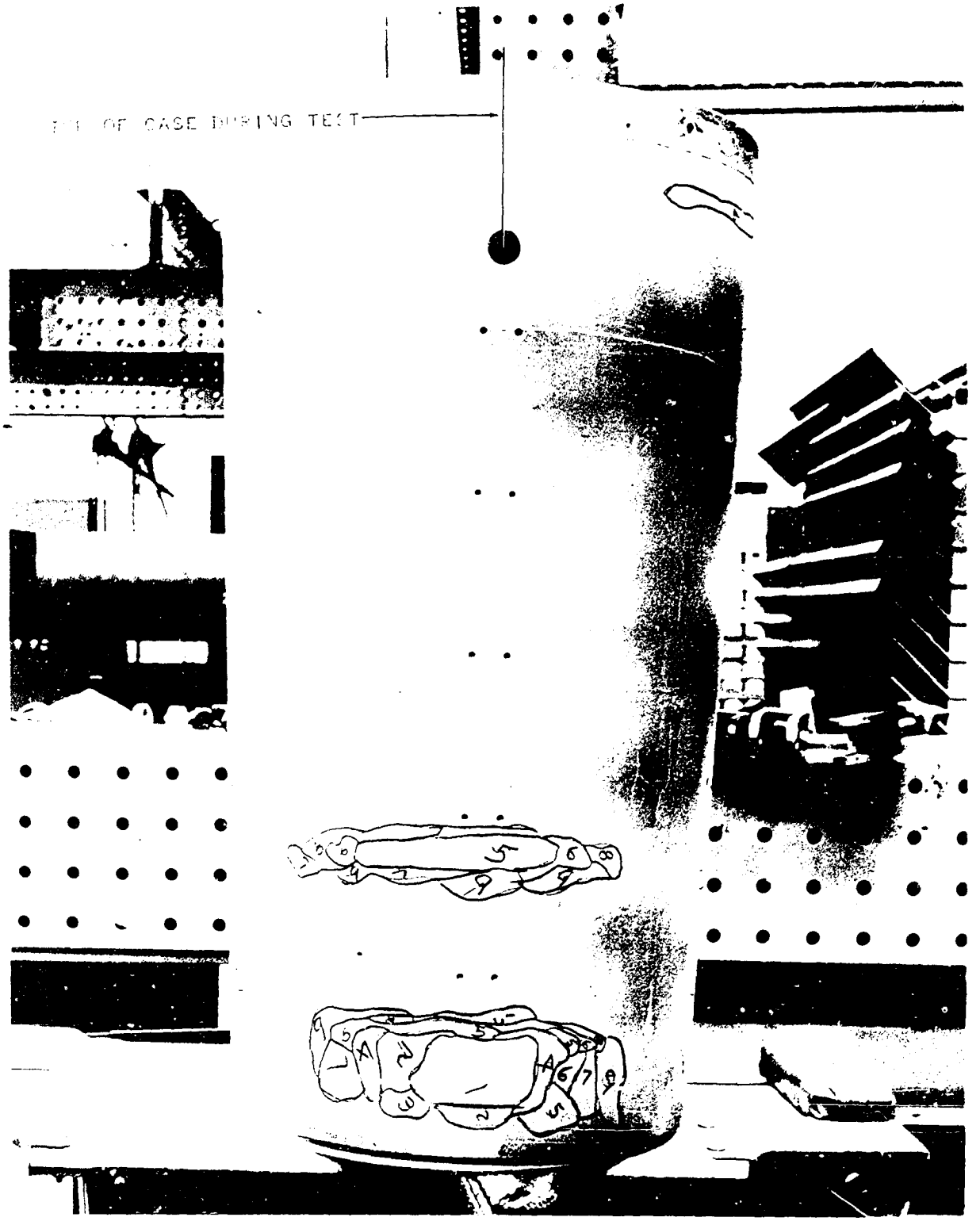

FIG. 4 -- AREAS OF STRESSCOAT CRACKS FOR 15° FULL (FIRST CASE) -- STATIC TEST OF TX-2P/X1 AFT CASE PARACHUTE LUG RING.

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REF. SYM: 1612 (486)
PROJECT NO. TM-548

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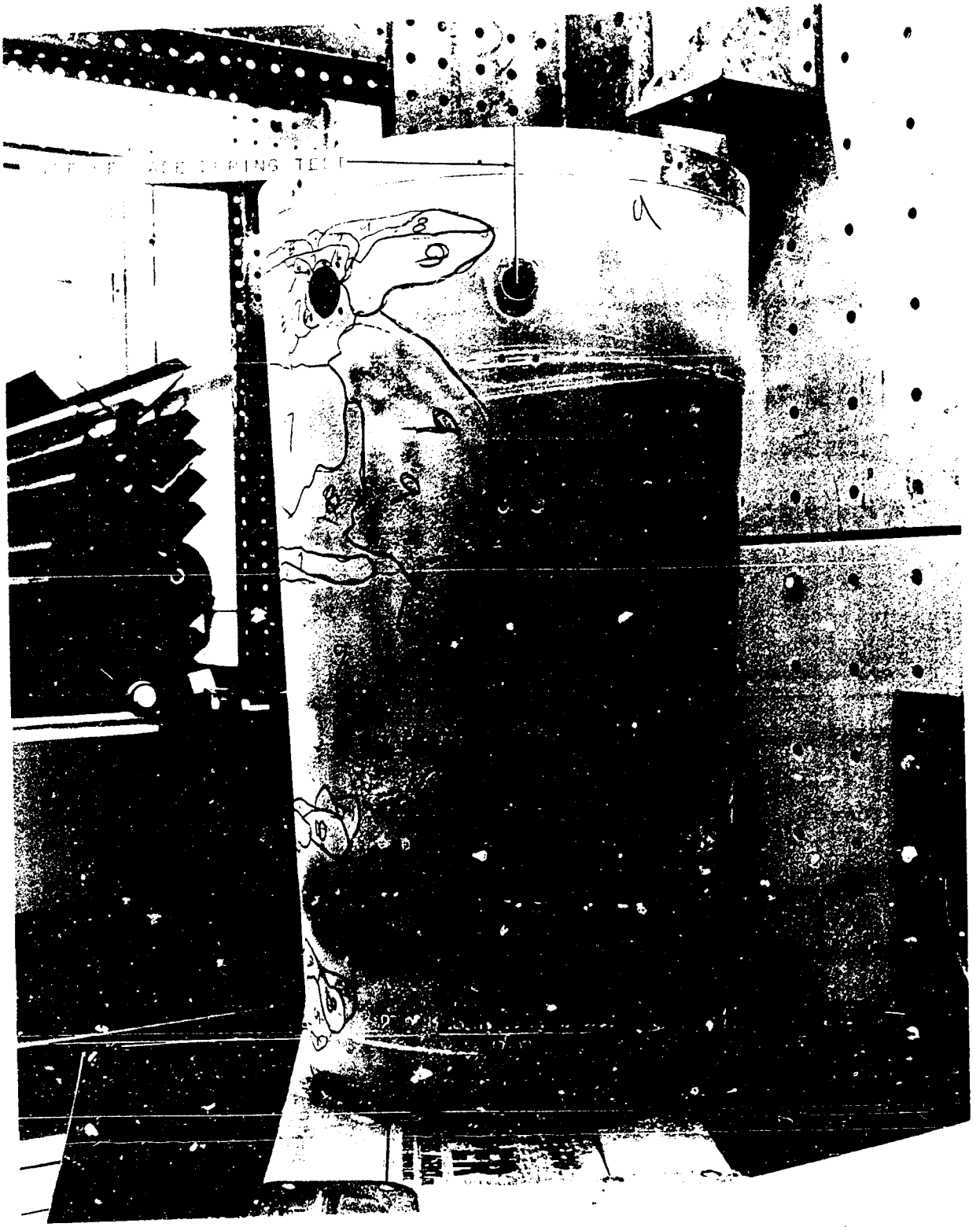

FIG. 5 -- AREAS OF STRESSCOAT CRACKS FOR 15° PULL (FIRST CASE) -- STATIC TEST OF TX-2 /A1 AFT CASE PARACHUTE LUG PINS.

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REF. SYM: 1G1C (4-6)
PROJECT NO. TX-4

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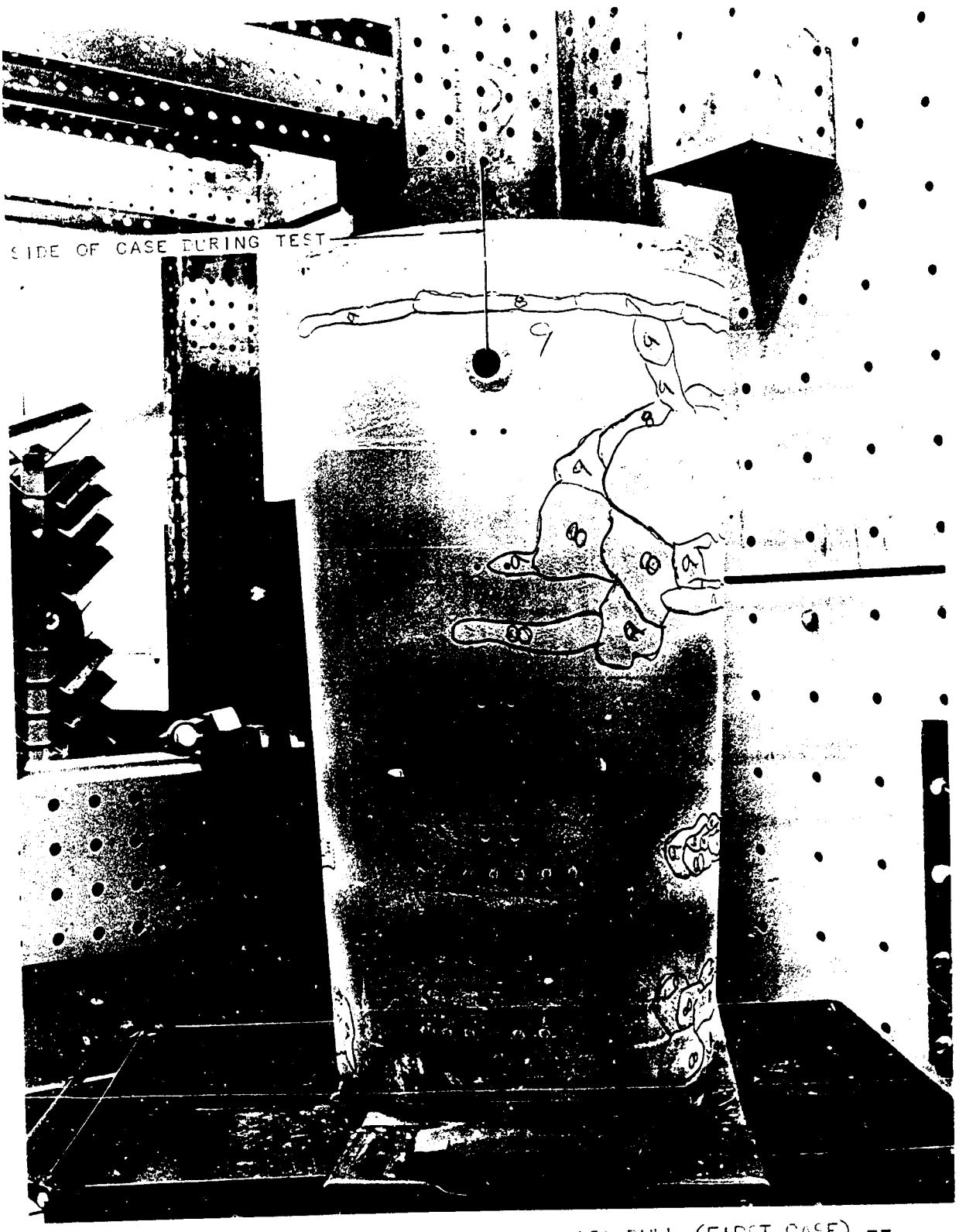

FIG. 6 -- AREAS OF STRESSCOAT CRACKS FOR 15° PULL (FIRST CASE) -- STATIC TEST OF TX-28/X1 AFT CASE PARACHUTE LUG RING.

REF. SYM: 1612 (486)
PROJECT NO. TM-548

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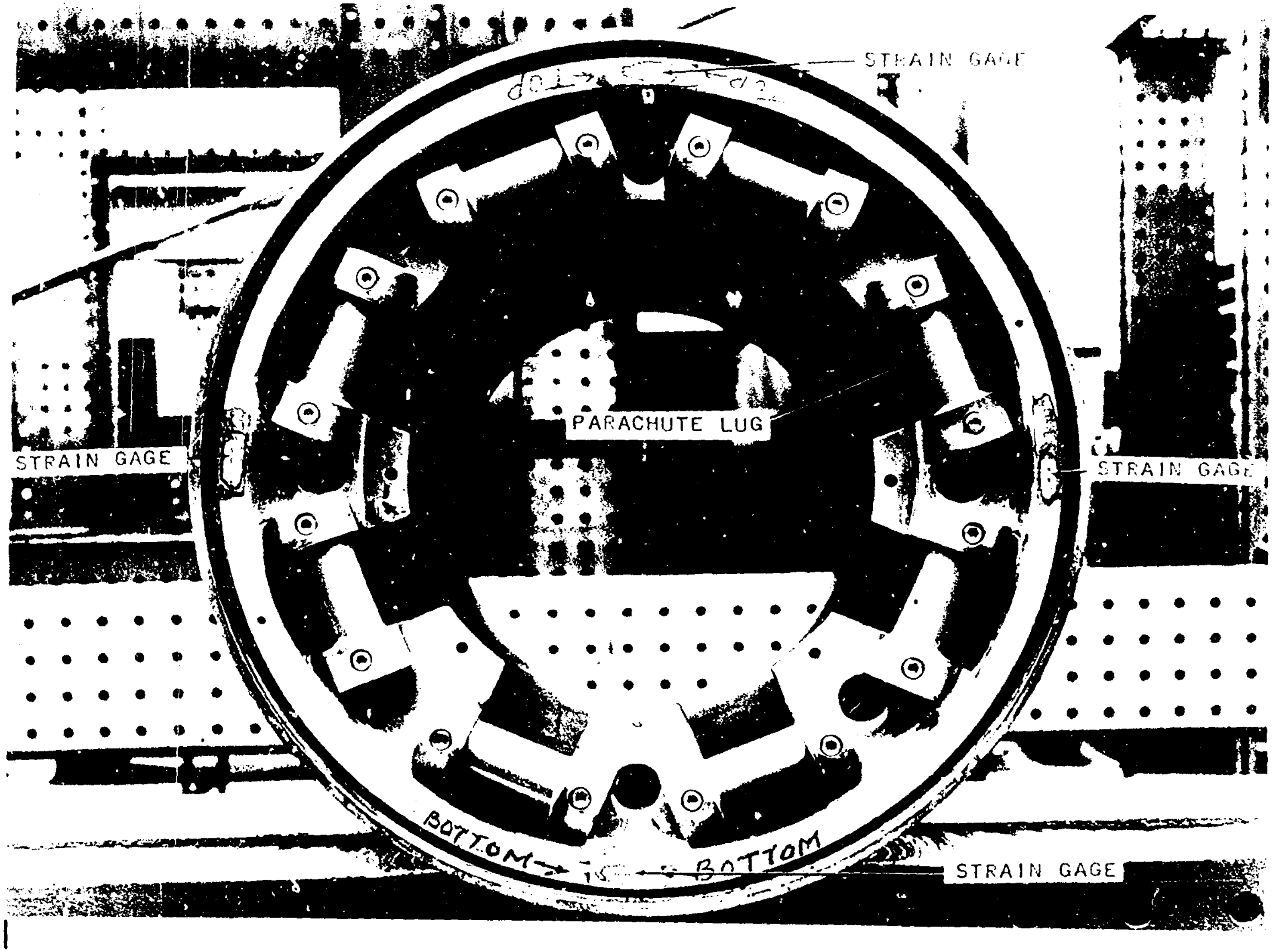

FIG. 7 -- LOCATION OF STRAIN GAGES (FIRST CASE) -- STATIC TEST OF TX-28/XI AFT CASE PARACHUTE LUG RING.

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REF. SYM: 1612 (4?6)
PROJECT NO. TM-54?

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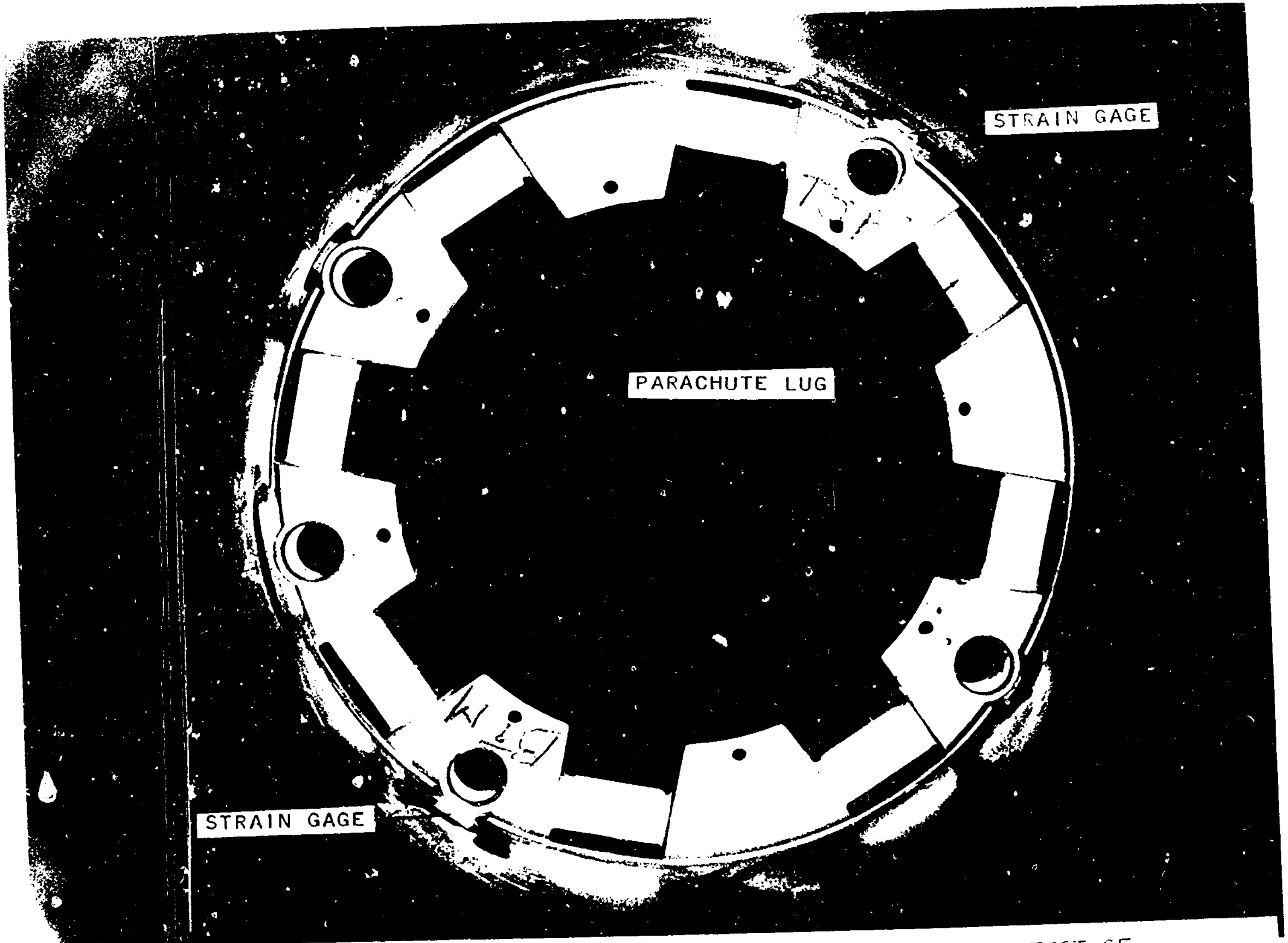

FIG. 8 -- LOCATION OF STRAIN GAGES (FIRST CASE) -- STATIC TEST OF TX-28/XI AFT CASE PARACHUTE LUG RING.

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PROJECT NO. TM-548

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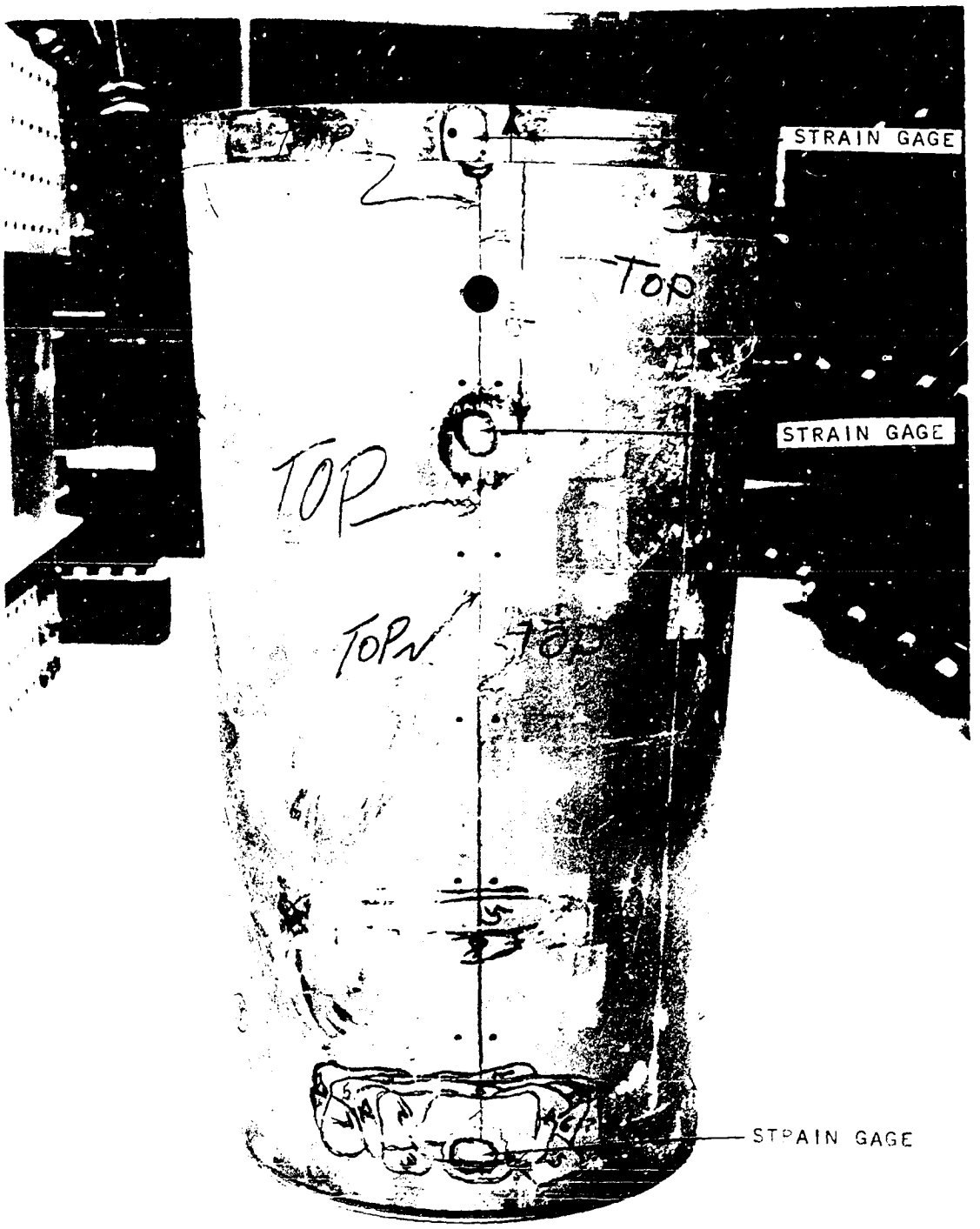

FIG. 9 -- LOCATION OF STRAIN GAGES (FIRST CASE) -- STATIC TEST OF TX-2P/X1 AFT CASE PARACHUTE LUG RING.

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REF. SYM: 1612 (486)
PROJECT NO. TX-548

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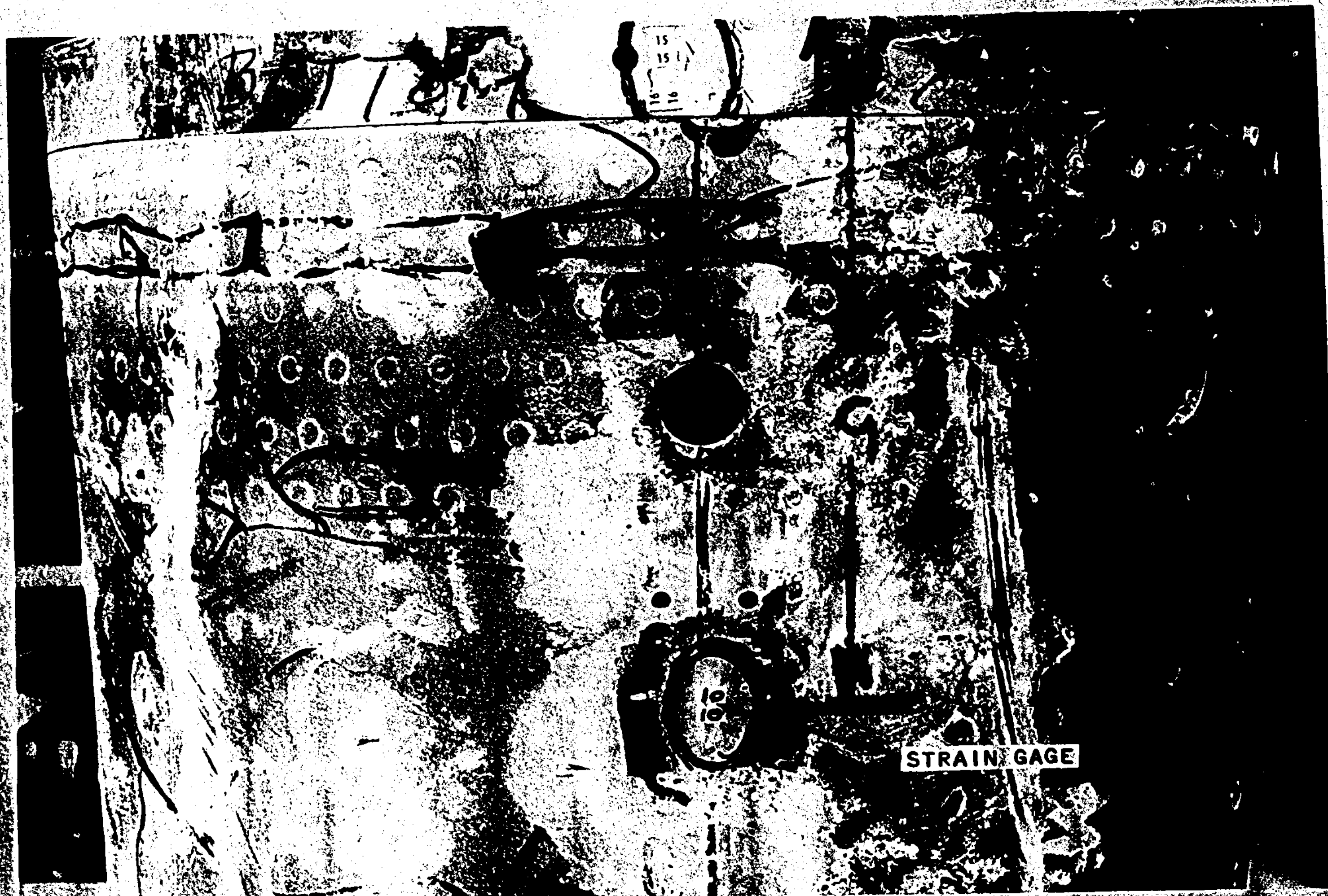

FIG. 10 -- LOCATION OF STRAIN GAGES (FIRST CASE) -- STATIC TEST OF TX-28/XI AFT CASE PARACHUTE LUG RING.

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REF. SYM: 1612 (486)
PROJECT NO. TM-548

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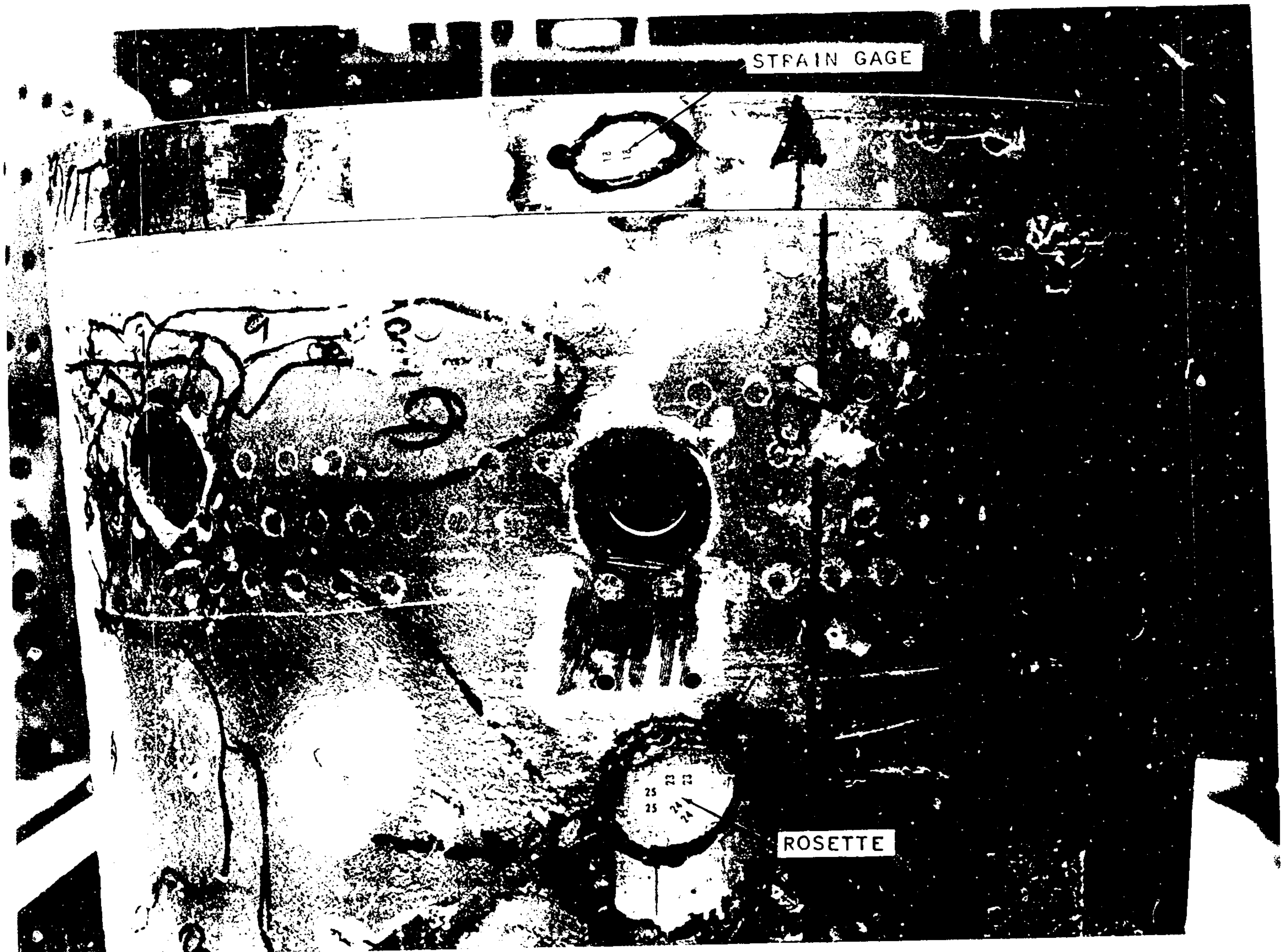

FIG. 11 -- LOCATION OF STRAIN GAGES (FIRST CASE) -- STATIC TEST OF TX-2[illegible]/X1 AFT CASE PARACHUTE LUG RING.

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REF. SYM: 1612 (4-6)
PROJECT NO. TM-54[illegible]

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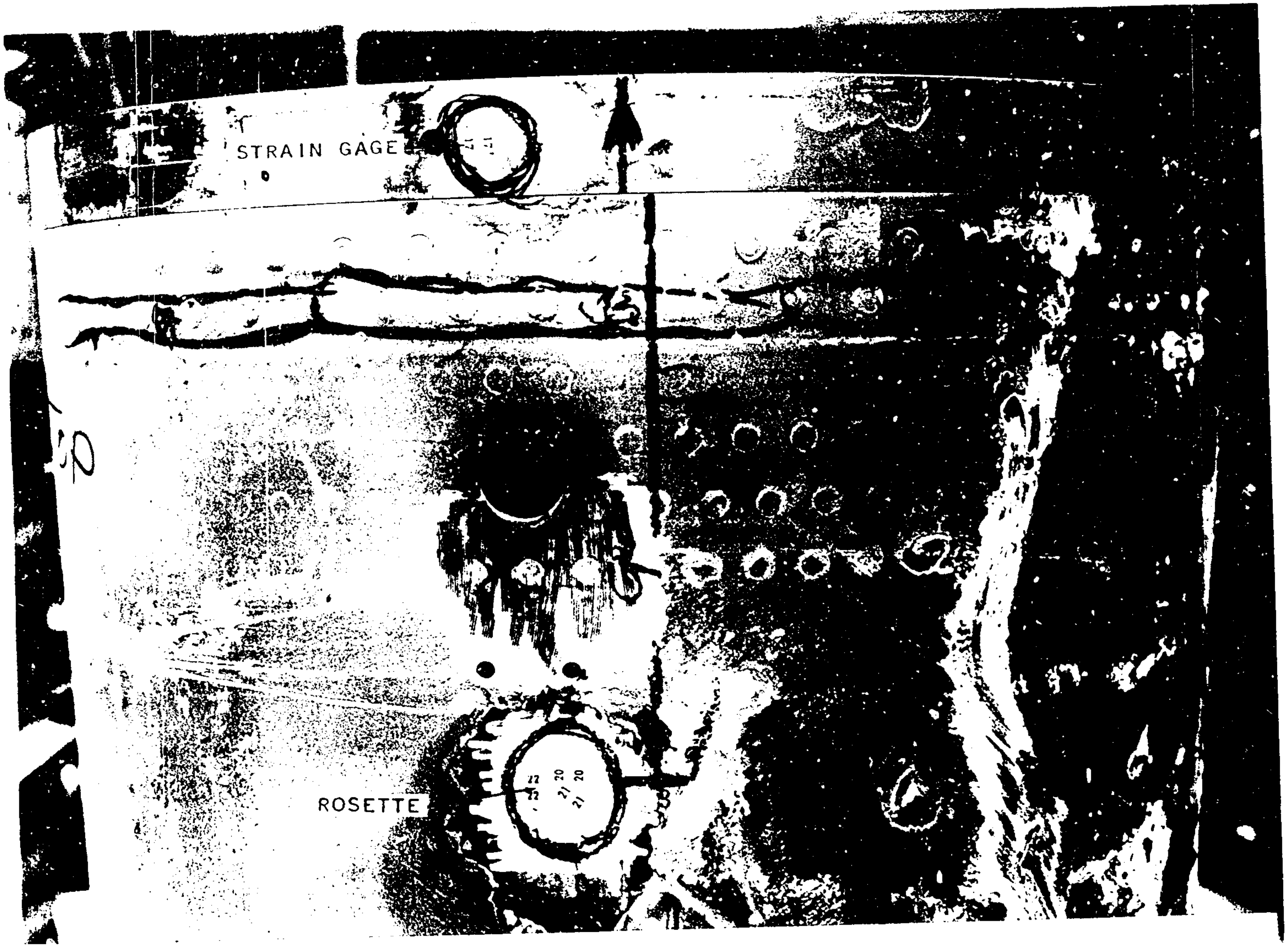

FIG. 12 -- LOCATION OF STRAIN GAGES (FIRST CASE) -- STATIC TEST OF TX-28/XI AFT CASE PARACHUTE LUG RING.

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REF. SYM: 1612 (486)
PROJECT NO. TM-548

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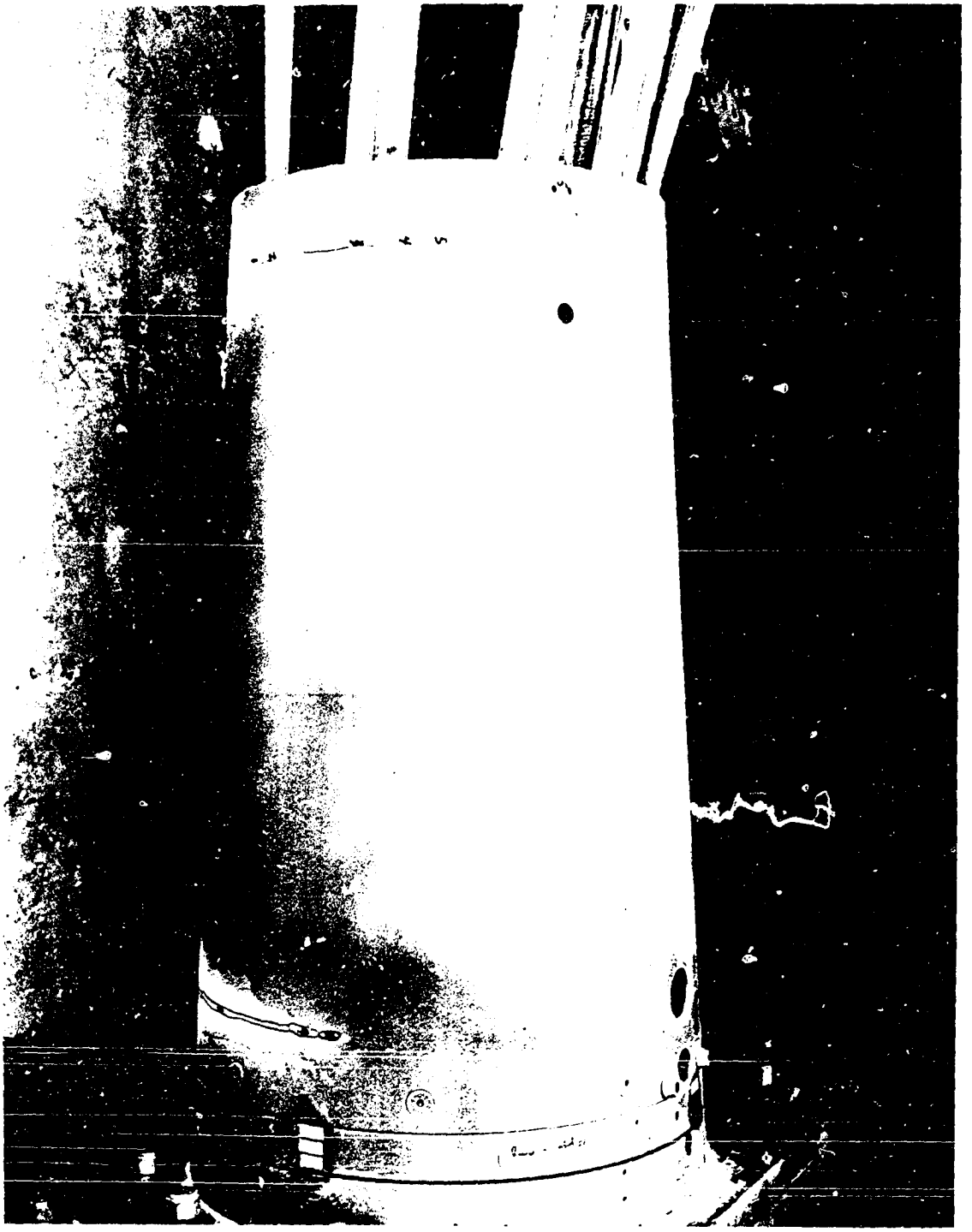

FIG. 13 -- AREAS OF STRESSCOAT CRACKS FOR 15° PULL (SECOND CASE) -- STATIC TEST OF TX-28/X1 AFT CASE PARACHUTE LUG RING.

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REF. SYM: 1612 (486)
PROJECT NO. TM-548

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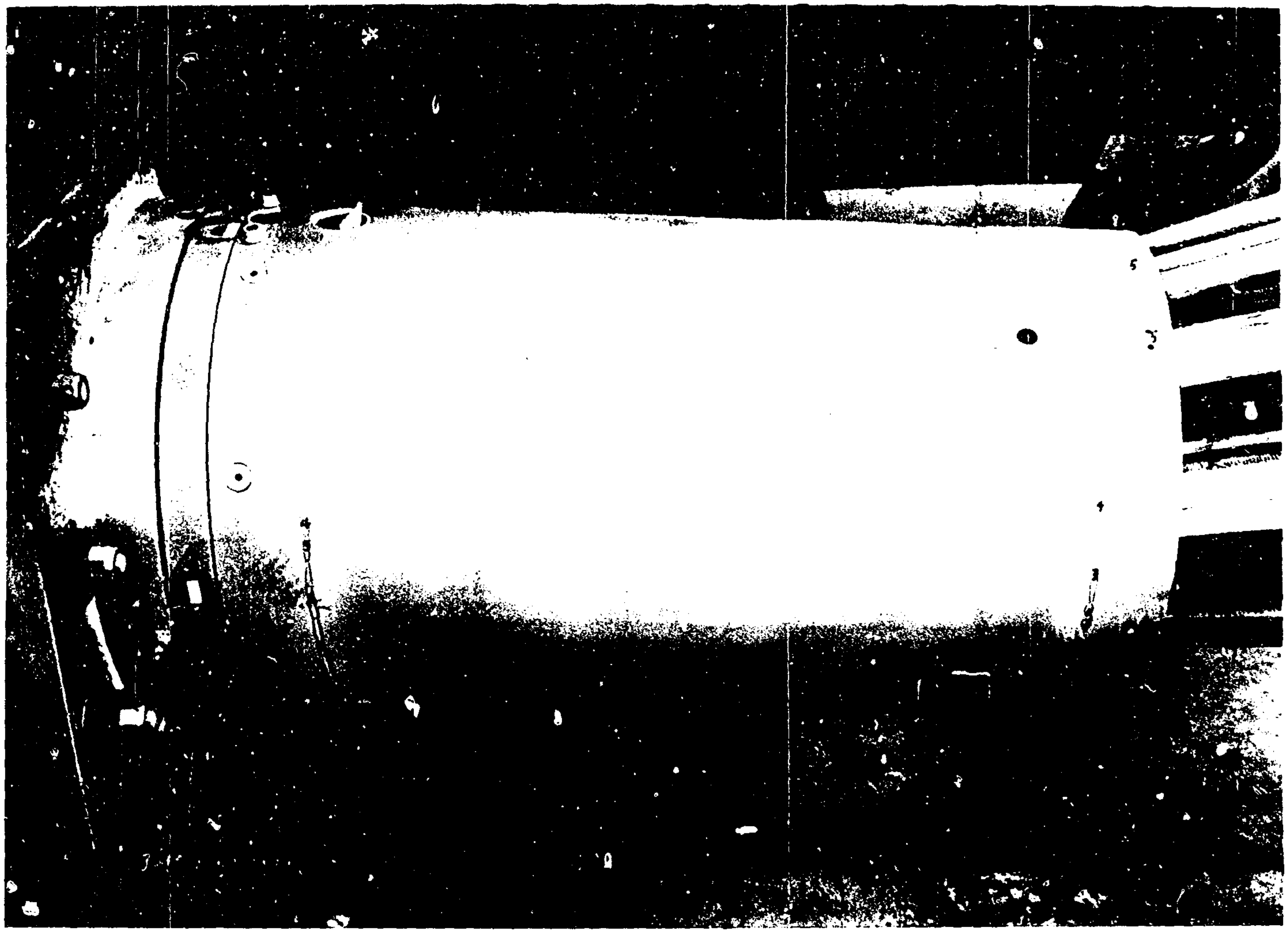

FIG. 14 -- AREAS OF STRESSCOAT CRACKS FOR 15° PULL (SECOND CASE) -- STATIC TEST OF TX-28/XI AFT CASE PARACHUTE LUG RING.

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REF. SYM: 1612 (486)
PROJECT NO. TM-548

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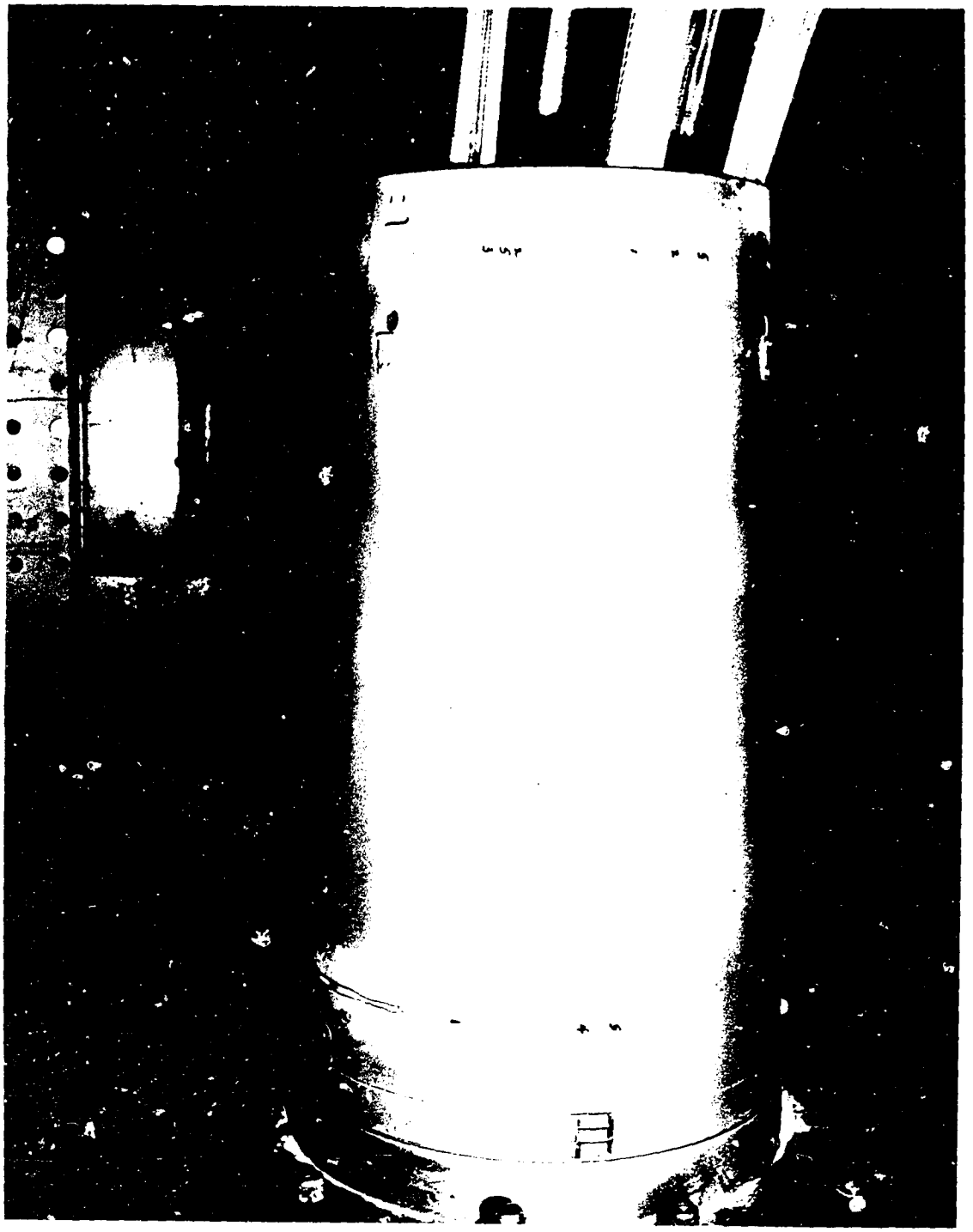

FIG. 15 -- AREAS OF STRESSCOAT CRACKS FOR 15° PULL (SECOND CASE) -- STATIC TEST OF TX-28/X1 AFT CASE PARACHUTE LUG PING.

REF. SYM: 1612 (486)
PROJECT NO. TM-548

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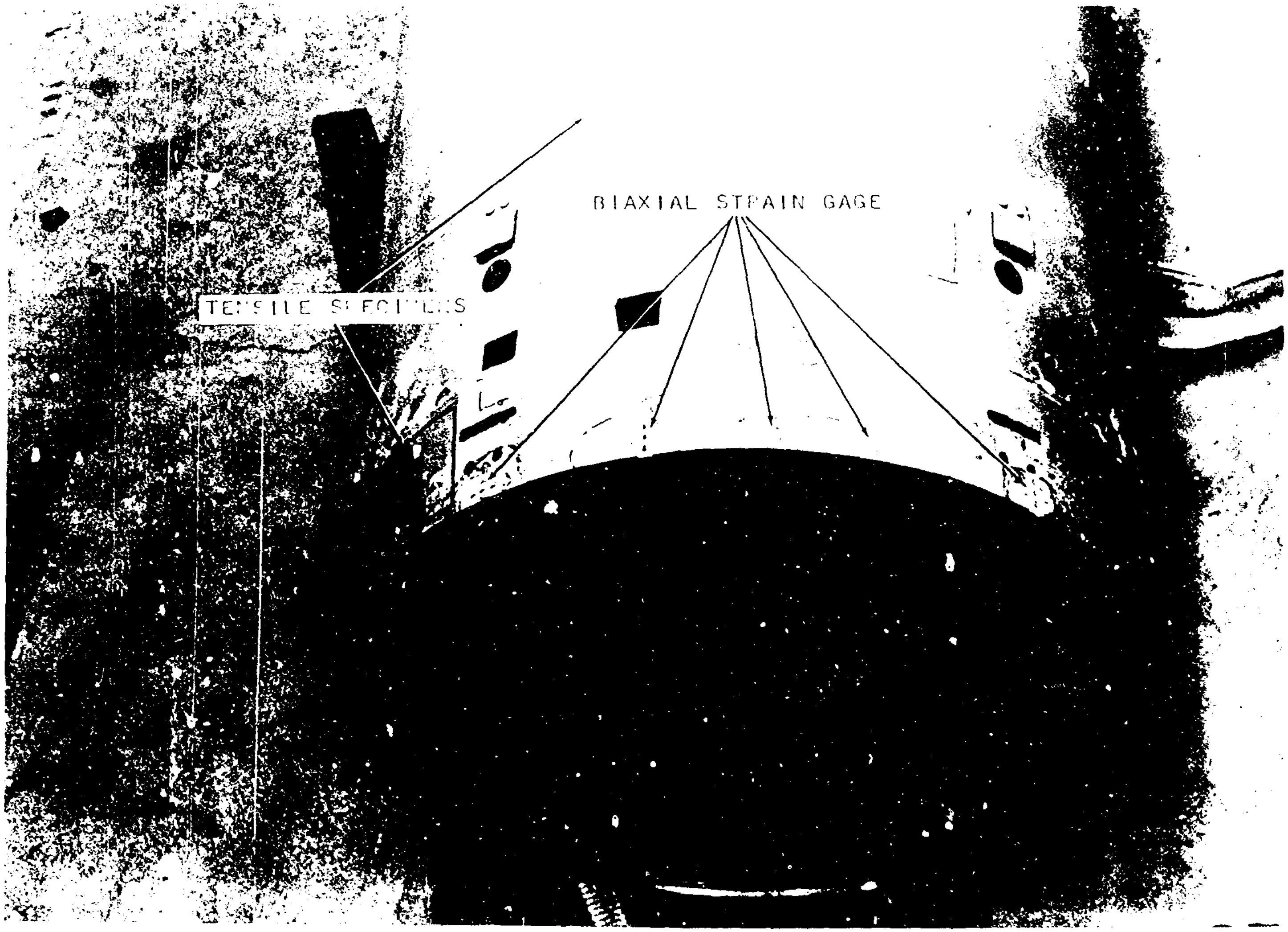

FIG. 16 -- LOCATION OF STRAIN GAGES (SECOND CASE) -- STATIC TEST OF TX-2[illegible]/X1 AFT CASE PARACHUTE LUG RING.

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REF. SYM: 1612 (4[illegible]6)
PROJECT NO. TM-5[illegible]

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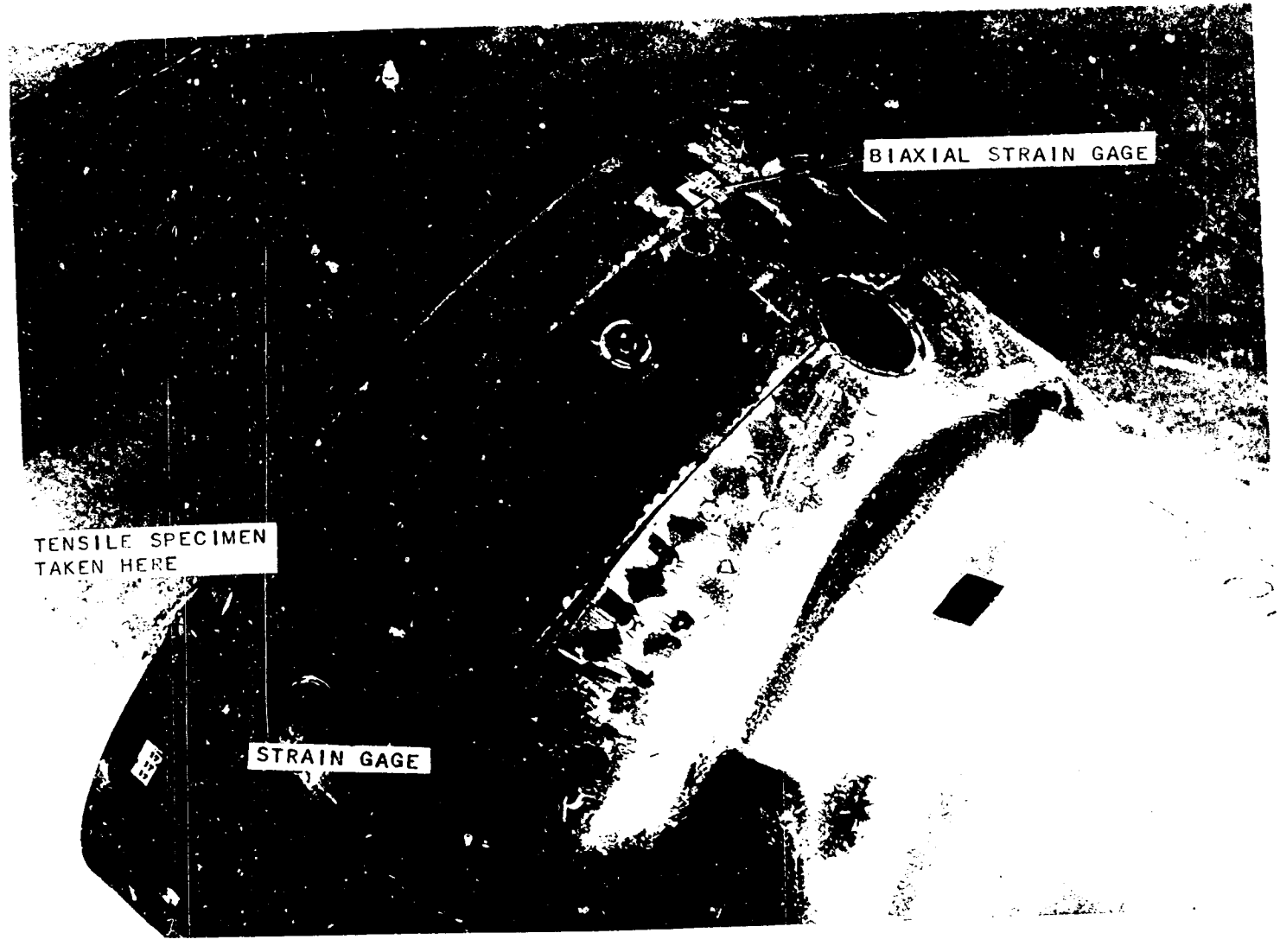

FIG. 17 -- LOCATION OF STRAIN GAGES (SECOND CASE) -- STATIC TEST OF TX-28/X1 AFT CASE PARACHUTE LUG RING.

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REF. SYM: 1612 (486)
PROJECT NO. TM-548

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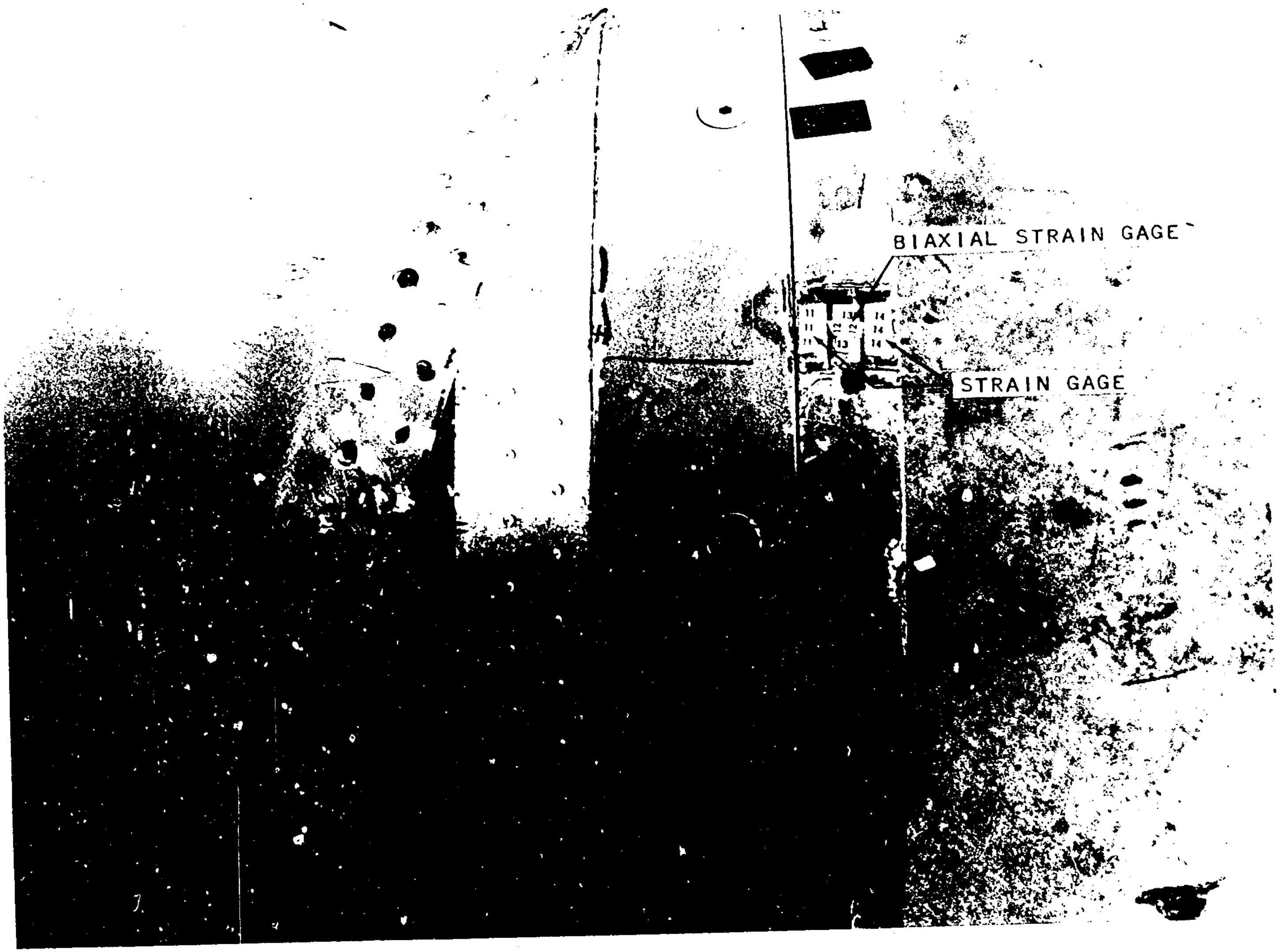

FIG. 18 -- LOCATION OF STRAIN GAGES (SECOND CASE) -- STATIC TEST OF TX-28/XI AFT CASE PARACHUTE LUG RING.

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REF. SYM: 1612 (486)
PROJECT NO. TM-548

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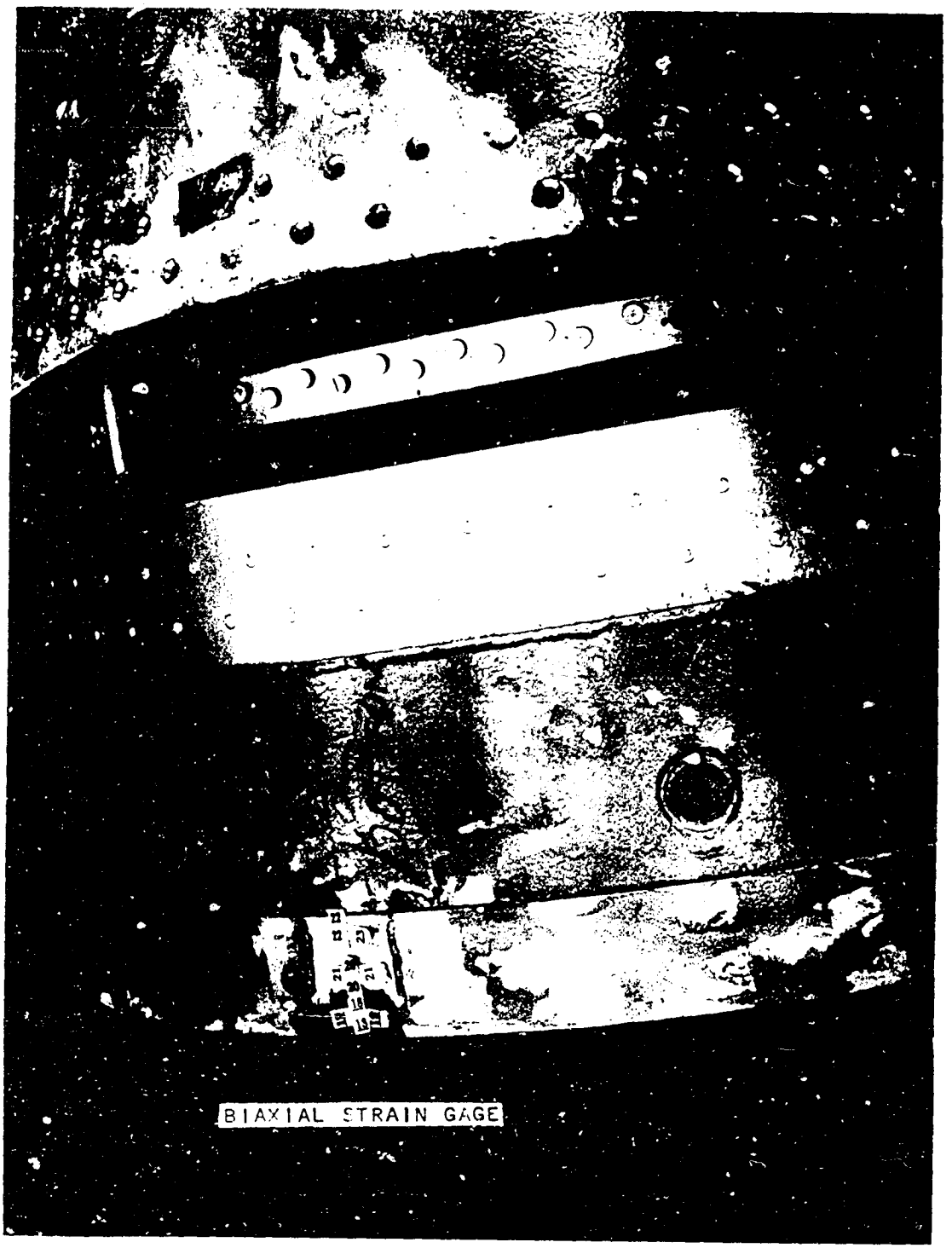

FIG. 19 -- LOCATION OF STRAIN GAGES (SECOND CASE) -- STATIC TEST OF TX-28/X1 AFT CASE PARACHUTE LUG RING.

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REF. SYM: 1612 (486)
PROJECT NO. TM-548

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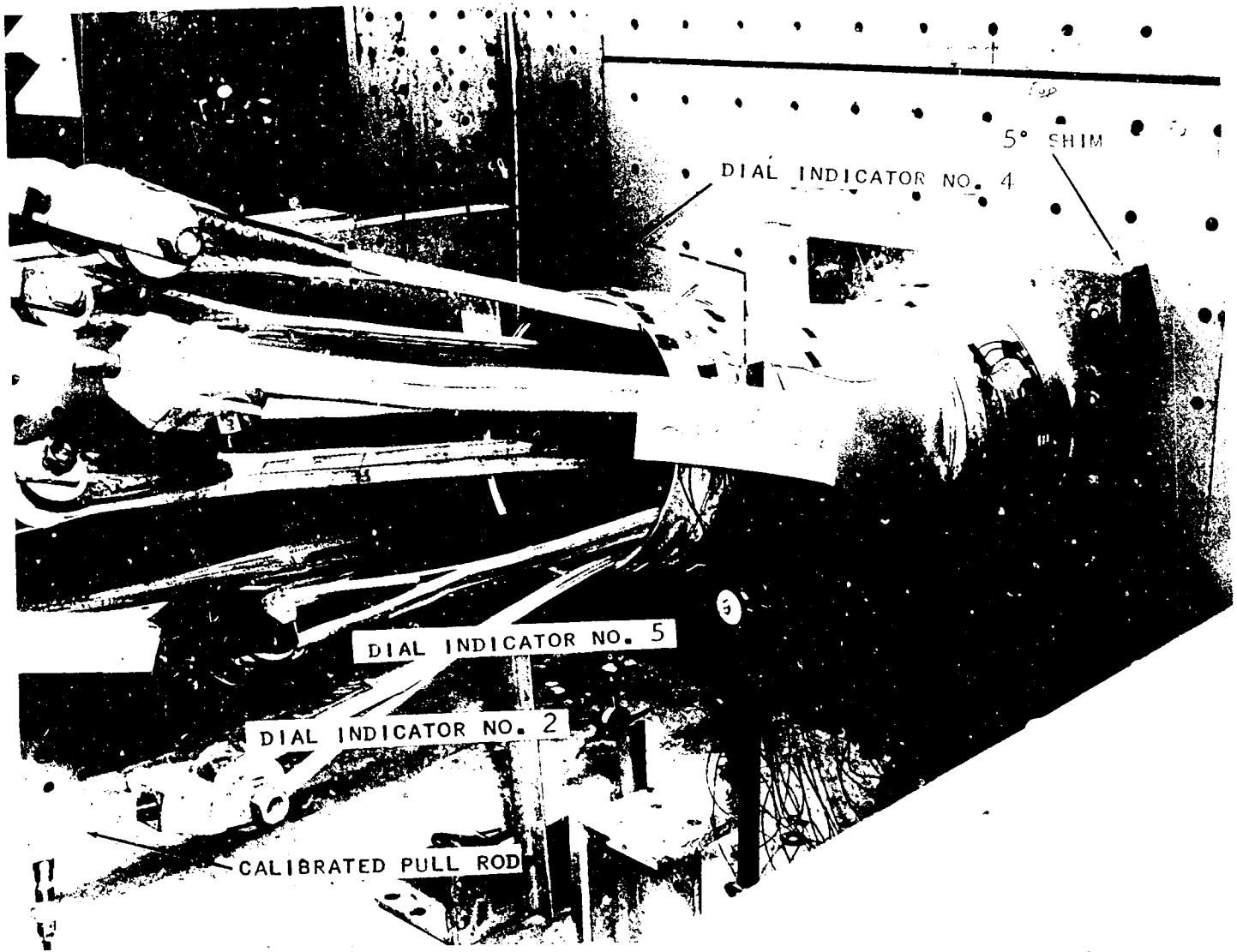

FIG. 20 -- FAILURE OF CASE RESULTING FROM 20° PULL (SECOND CASE) -- STATIC TEST OF TX-28/X1 AFT CASE PARACHUTE LUG RING.

D# 102629

REF. SYM: 1612 (486)
PROJECT NO. TM-548

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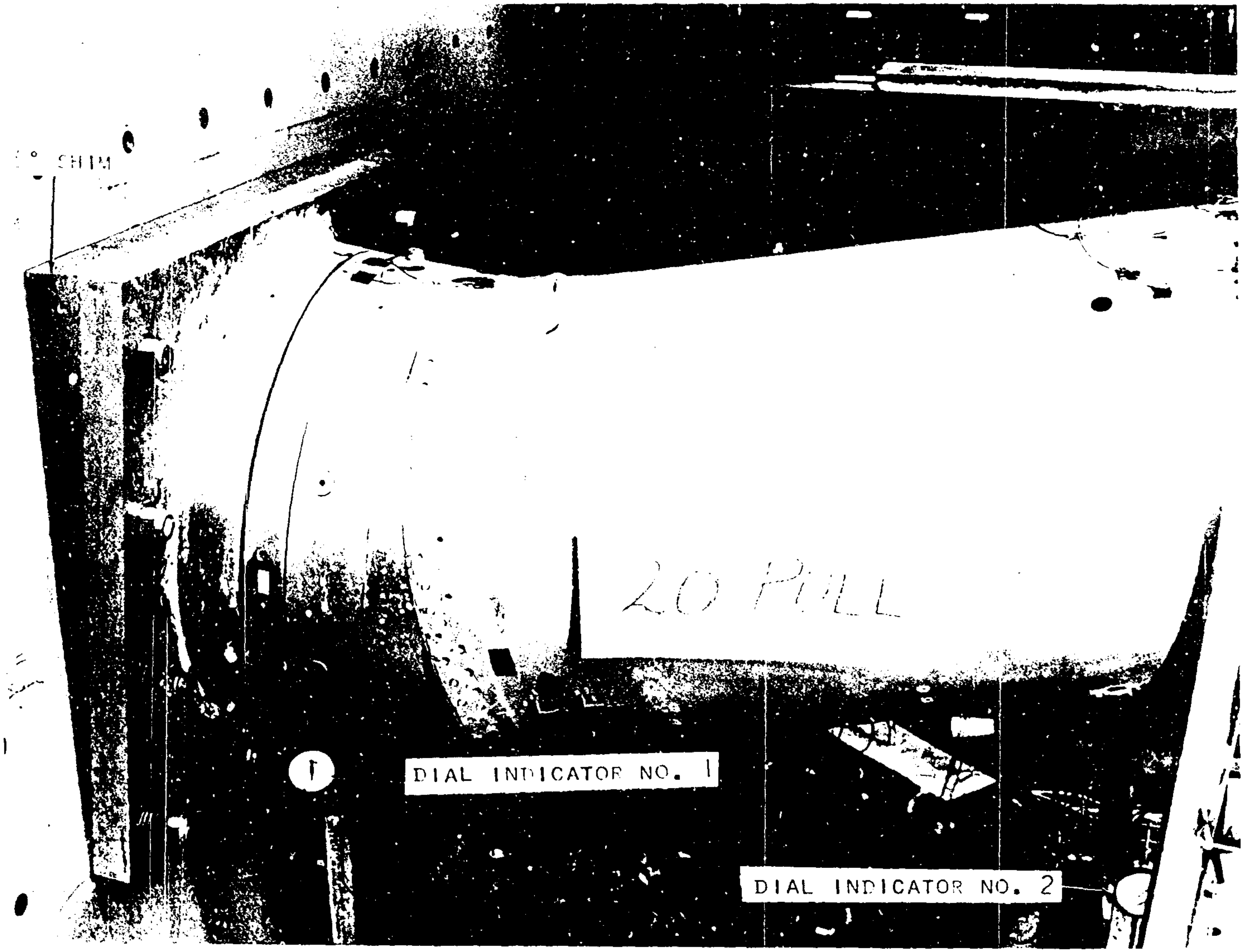

FIG. 21 -- FAILURE OF CASE RESULTING FROM 20° PULL (SECOND CASE) -- STATIC TEST OF TX-2?/X1 AFT CASE PARACHUTE LUG RING.

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REF. SYM: 1612 (4?6)
PROJECT NO. TX-?4

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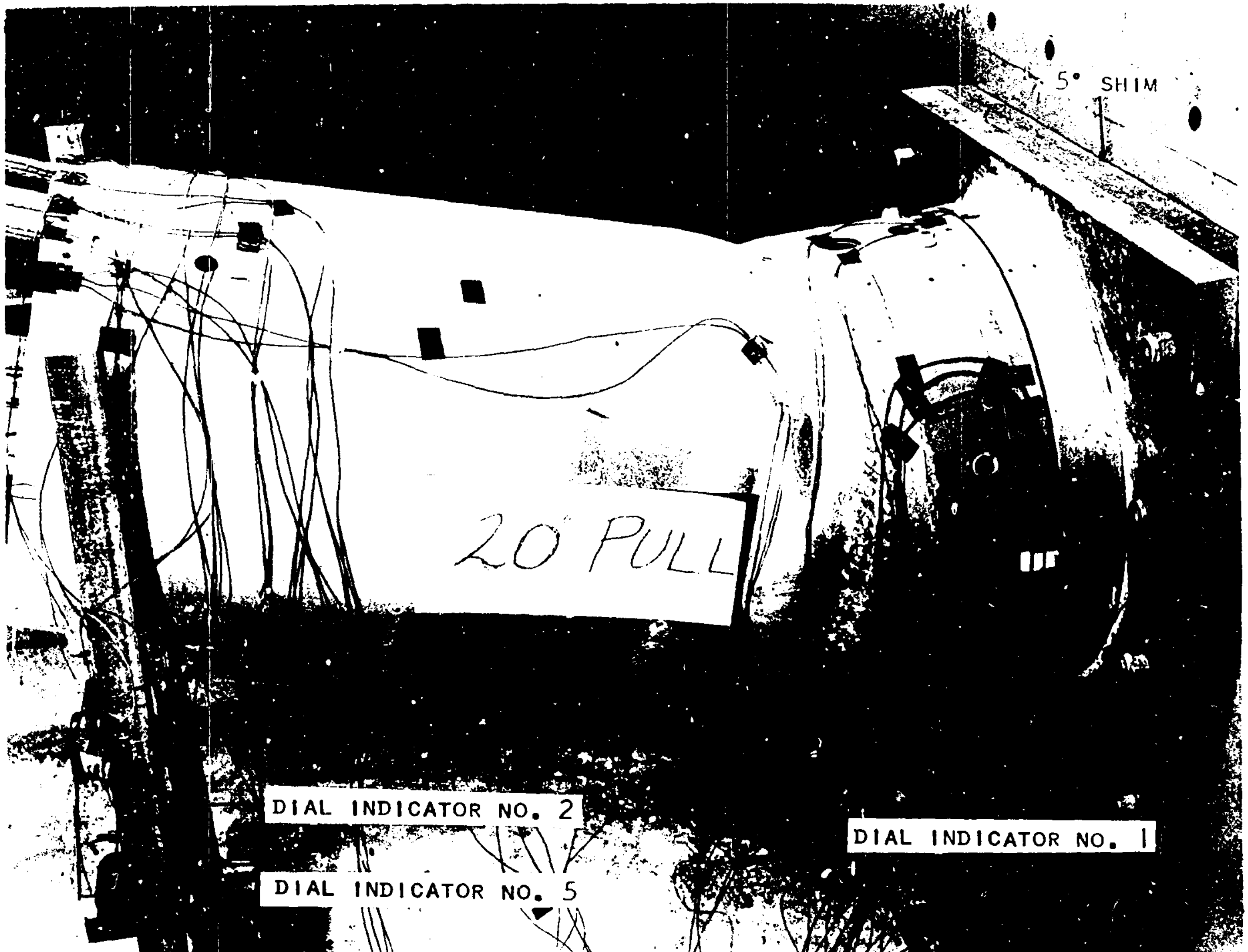

FIG. 22 -- FAILURE OF CASE RESULTING FROM 20° PULL (SECOND CASE) -- STATIC TEST OF TX-28/XI AFT CASE PARACHUTE LUG RING.

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D#: 102631

REF. SYM: 1612 (486)
PROJECT NO. TM-548

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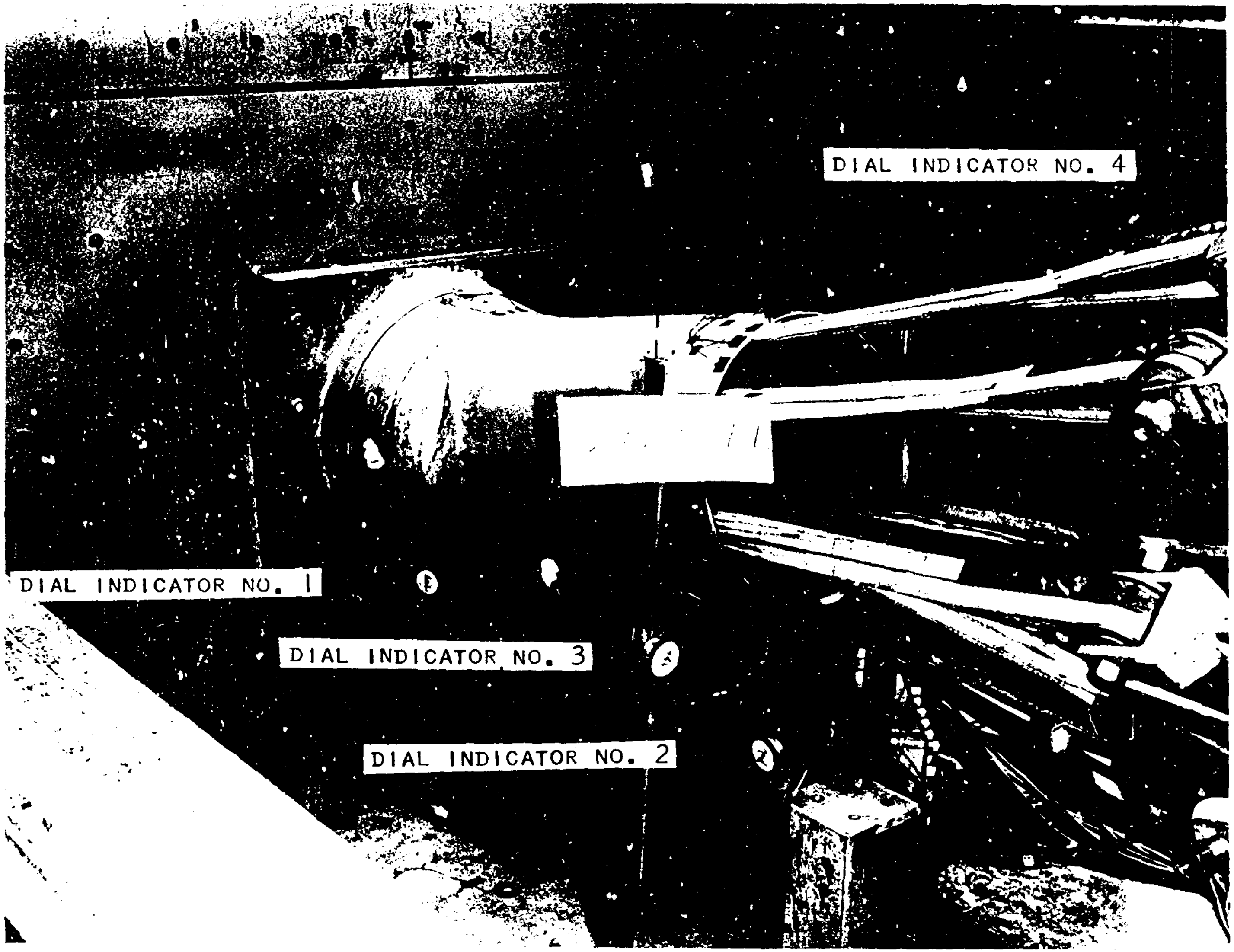

FIG. 23 -- FAILURE OF CASE RESULTING FROM 20° PULL (SECOND CASE) -- STATIC TEST OF TX-28/XI AFT CASE PARACHUTE LUG RING.

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Ref. Sym: 1612 (436)
Project No. TX-542

TABLE I

STRESSCOAT DATA (FIRST CASE) -- STATIC TEST OF TX-28/X1 AFT CASE PARACHUTE LUG RING

Load in Pounds	Stresscoat Sensitivity in Microinches per Inch	Stresscoat Designations (Figs. 2 through 5)
20,000	850	--
24,000	850	--
29,000	850	1
35,000	850	2
42,000	850	3
50,000	850	4
60,000	850	5
72,000	850	6
87,000	850	7
104,000	850	8
125,000	850	9

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[redacted]

TABLE II

STRAIN READINGS AND COMPUTED PRINCIPAL STRESSES (15° PULL) (PILOT CASE) -- STATIC TEST OF TX-18/X1 A/T CASE PARACHUTE LUG RING

Load in Pounds	Strain Readings at the Following Gages - Microinches per Inch																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20 - 21 - 22			23 - 24 - 25		
10,000	-177	-191	48	261	-239	-216	48	191	-148	41	7	-42	85	14	1	-78	34	-9	227	-26	54	-22	-32	57	53
20,000	-384	-393	98	366	-477	-455	228	434	-299	69	33	-99	188	136	87	-228	80	6	468	-51	108	-44	-67	109	104
30,000	-584	-583	145	423	-715	-692	369	624	-361	133	45	-128	251	253	126	-389	112	30	755	-66	144	-64	-76	151	143
40,000	-660	-695	159	453	-913	-837	446	785	-499	219	44	-140	295	310	116	-640	122	47	1110	-72	175	-88	-93	186	171
50,000	-750	-790	190	470	-1060	-1010	540	920	-540	280	40	-150	330	370	140	-860	130	60	1420	-80	200	-120	-120	230	210
60,000	-880	-920	270	500	-1230	-1170	620	1040	-620	320	40	-150	360	470	240	-1080	130	60	1680	-90	220	-130	-130	260	220
70,000	-1030	-980	250	550	-1420	-1310	750	1190	-700	430	30	-160	380	560	320	-1360	160	100	1980	-100	230	-180	-140	280	240
80,000	-1130	-1130	290	600	-1620	-1490	870	1340	-760	530	30	-180	440	660	420	-1550	190	130	2250	-120	230	-190	-150	280	250
90,000	-1280	-1240	330	650	-1810	-1660	980	1490	-820	590	40	-170	490	730	460	-1750	220	140	2520	-130	240	-240	-160	320	250
100,000	-1430	-1400	370	710	-1980	-1850	1100	1650	-850	680	40	-220	560	780	550	-1960	260	170	2730	-130	240	-260	-160	340	250
110,000	-1580	-1570	390	780	-2150	-2020	1240	1800	-900	780	40	-240	630	840	640	-2150	280	230	2960	-140	250	-270	-160	370	260
120,000	-1700	-1710	440	840	-2340	-2170	1370	1950	-950	790	30	-240	660	870	730	-2330	290	240	3140	-140	250	-290	-180	380	260
130,000	-1850	-1860	470	920	-2520	-2320	1540	2150	-1020	860	30	-240	730	900	780	-2450	330	250	3330	-150	270	-330	-170	390	300
140,000	-2000	-1950	530	960	-2620	-2440	1740	2400	-1070	930	-10	-260	760	960	840	-2420	330	270	3420	-170	320	-300	-190	440	440

Load in Pounds	Maximum and Minimum Principal Stresses - psi					
	20-21-22			23-24-25		
	Su	Sv		Su	Sv	
10,000	+200	-1000		+300	-600	
20,000	+500	-1900		+550	-1300	
30,000	+600	-2600		+700	-1700	
40,000	+700	-3350		+950	-2200	
50,000	+800	-3900		+1250	-2650	
60,000	+300	-4510		+1500	-2900	
70,000	+500	-5700		+1550	-3100	
80,000	+600	-5500		+1650	-3200	
90,000	+450	-6200		+2000	-3400	
100,000	+125	-6500		+2150	-3500	
110,000	+400	-6800		+2250	-3800	
120,000	+200	-7100		+2600	-3350	
130,000	+300	-7300		+2450	-4150	
140,000	+800	-8200		+1600	-5500	

Gages 1 thru 8 and No. 19 are mounted on 14S-T6 aluminum.
Gages 9, 10, and 20 thru 25 are mounted on 24S-T36
Gages 11 thru 18 are mounted on 4130 steel (H.T. 125,000 - 145,000 psi).

Su = Maximum principal stress (largest algebraic values).
Sv = Minimum principal stress (smallest algebraic values).

[redacted]

TABLE III

STRESSCOAT DATA (SECOND CASE, DWG. NO. DL-10021) — STATIC TEST OF TX-28/X1 AFT CASE PARACHUTE LUG RING

Load in Pounds	Stresscoat Sensitivity in Microinches per Inch	Stresscoat Designations (Figs. 13 through 15)
20,000	800	1
24,000	800	2
28,800	800	3
34,600	800	4
41,500	800	5

[redacted]

Ref. Sym: 1612 (486)
Project No. TX-548

TABLE IV

STRAIN READINGS AND COMPUTED PRINCIPAL STRESSES (15° PULL) (SECOND CASE) -- STATIC TEST OF TX-28/X1 AFT CASE PARACHUTE LUG RING

Load in Pounds	Strain Readings at the Following Gages - Microinches per Inch																						
	1 - 2		3 - 4		5 - 6		7 - 8		9 - 10		11	12 - 13		14	15 - 16		17	18 - 19		20 - 21		22 - 23	
8,000	156	-38	329	-41	196	-53	373	-118	313	-65	-11	31	-39	-52	16	-2	[illegible]	0	-47	-108	-12	-75	7
16,000	470	-107	[illegible]	-171	424	-114	[illegible]	[illegible]	670	[illegible]	-58	0	[illegible]	[illegible]	56	-15	37	-27	[illegible]	-235	3	-211	67
24,000	[illegible]	-177	1120	[illegible]	724	-193	[illegible]	[illegible]	725	-224	-136	114	-12	-122	115	-20	62	-31	[illegible]	-561	8	-314	127
32,000	1100	-150	1670	-410	1080	-200	[illegible]	[illegible]	920	--	-210	250	50	-140	130	-30	90	-40	[illegible]	-710	0	-400	120
40,000	1400	-420	2070	-500	1450	-390	1910	[illegible]	1200	-360	-310	370	110	-130	250	-40	110	-40	[illegible]	-910	-20	-530	130
48,000	1800	-390	2520	-410	1720	[illegible]	2370	-750	1510	-410	-430	510	270	-110	320	-50	130	-50	-110	-1030	-30	-630	150
56,000	2030	-450	2800	-670	2030	-570	2600	-800	1820	-430	-570	--	230	-30	310	-60	140	-50	-130	-1240	-40	-730	130
64,000	2220	-530	3280	-730	2460	-660	2920	-900	2140	-520	-700	690	280	-20	450	-70	160	-60	-140	-1470	-50	-840	230
72,000	2390	-580	3630	-870	2700	-740	3230	-1030	2430	-590	-880	750	310	20	520	-80	120	-60	-160	-1590	-50	-970	250
(80,000) (100% L.L.)	2720	-630	4010	-950	3030	-810	3500	-1100	2590	-630	-1020	790	340	80	580	-90	220	-70	-170	-1770	-40	-1090	310
88,000	3020	-680	4220	-1030	3310	-870	3440	-1150	2790	-560	-1170	830	370	100	600	-100	230	-70	-160	-1950	-30	-1210	350
96,000	3250	-720	4430	-1110	3540	-930	4130	-1270	3020	-710	-1300	860	410	160	710	-110	260	-80	-170	-2130	-30	-1330	420
104,000	3400	-770	4550	-1200	3730	-970	4430	-1370	3400	-750	-1440	930	430	200	730	-110	300	-90	-170	-2320	-10	-1460	470
112,000	3650	-800	5210	-1200	3970	-1000	4680	-1430	3700	-770	-1530	950	430	250	830	-120	320	-110	-170	-2450	0	-1550	520
0	93	32	127	-33	-56	25	306	-117	-61	40	-0	4	15	10	7	-4	-12	-13	10	5	4	-7	46

Load in Pounds	Maximum and Minimum Principal Stresses - psi																			
	1 - 2		3 - 4		5 - 6		7 - 8		9 - 10		12 - 13		15 - 16		18 - 19		20 - 21		22 - 23	
	Su	Sv	Su	Sv	Su	Sv	Su	Sv	Su	Sv	Su	Sv	Su	Sv	Su	Sv	Su	Sv	Su	Sv
8,000	2400	130	3560	360	2100	160	3930	100	3430	400	4600	-940	430	-100	-470	-1500	-1450	-3560	-520	-2320
16,000	5120	620	7350	710	4590	360	8550	200	7410	970	-210	-1510	1600	-50	-1220	-2040	-3220	-10060	50	-6070
24,000	8700	1140	12000	1100	7660	590	12330	470	10250	1150	5020	750	3380	210	-1630	-2300	-5270	-17820	10	-9920
32,000	11980	1460	18060	1860	11580	910	16760	700			8470	4070	5450	320	-1970	-2630	-7420	-23930	-520	-12350
40,000	15240	1840	22420	2410	15590	1330	[illegible]	700	14060	1330	12390	7170	7580	1200	-2170	-3270	-9640	-29230	-1090	-15620
48,000	18330	2130	27200	2910	19310	1520	24130	830	18130	1900	17630	10370	9710	1570	-2680	-4300	-11640	-34750	-1450	-18610
56,000	20070	2430	31330	3450	22850	1820	27730	900	20970	2120			11530	1840	-2880	-4600	-13540	-39950	-1470	-21510
64,000	22100	2690	[illegible]	3060	26030	2030	30350	1100	23170	2450	24780	15760	13660	2220	-3300	-5000	-15540	-45470	-970	-24520
72,000	27170	3100			29050	2460	34570	1010	26310	2700	26990	17310	15800	2500	-3500	-5700	-17320	-51220	-1620	-28470
(80,000) (100% L.L.)	28800	3560			35570	2600	[illegible]	1220	28030	2960	23560	14660	17610	2870	-3820	-5800	-18730	-56860	-890	-31710
88,000	32010	4020			35570	3070			30270	3410	30240	20910	19530	3460	-3820	-5800	-20240	-62500	-800	-35140
96,000	35460	4540			[illegible]	[illegible]			32700	3740	31490	21580	21560	3510	-4230	-6210	-22020	-68240	250	-38270
104,000	35000	4020							34000	4370	34020	23230	23790	4200	-4550	-6310	-23260	-74110	560	-41930
110,000									35850	4150	34850	24070	25200	4380	-5170	-6510	-24230	-78160	1260	-44300

Stresses below this line are above Y.P. of material.

Gages 1 thru 10 are mounted on 61S-T6 aluminum.
Gages 11 thru 23 are mounted on 4130 steel (H.T. 125,000 - 145,000 psi).
Stresses at biaxial gages are computed on assumption that gages are oriented in direction of principal stresses.

Su = maximum principal stress (largest algebraic value).
Sv = minimum principal stress (smallest algebraic value).

[redacted]

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Ref. Sym: 1612 (486)
Project No. TM-548

TABLE V

DEFLECTION READINGS (SECOND CASE, DL-10021) -- STATIC TEST OF TX-28/X1 AFT

Per Cent of Limit Load	Deflections in Inches							
	15° Pull		20° Pull					
	1	2	1	2	3	4	5	
10	0	.013	-.001	.051	--	--	--	
20	-.003	.057	-.003	.103	.040	.117	.036	
10	--	--	-.002	.075	.012	.034	.007	
30	-.002	.091	.004	.165	.077	.245	.077	
10	--	--	.006	.095	.014	.056	.012	
40	.002	.131	.033	.240	--	.375	.112	
10	.003	.038	.032	.136	.019	.097	.016	
50	.006	.175	.062	.314	--	.509	.144	
10	.006	.053	.058	.165	.027	.125	.020	
60	.013	.225	.078	.363	--	.599	.166	
10	.011	.071	.071	.160	.027	.147	.020	
70	.021	.274	.092	.433	--	.740	.199	
10	.017	.090	.085	.208	.039	.197	.030	
80	.030	.322	.106	.486	--	--	.229	
10	.024	.110	.093	.216	--	--	.030	
90	.041	.383	.117	.537	.688	--	--	
10	.032	.132	.098	.221	.049	--	--	
100	.046	.415	.130	.588	.675	--	--	
10	.037	.148	--	--	--	--	--	
110	.054	.463	.138	.703	--	--	--	
10	.042	.163	--	--	--	--	--	
120	.061	.509	--	--	--	--	--	
10	.048	.181	--	--	--	--	--	
130	.071	.562	--	--	--	--	--	
10	.053	.214	--	--	--	--	--	
137.5	.075	.598	--	--	--	--	--	
10	.061	.260	--	--	--	--	--	

All dial indicators are supported on the floor.

A plus deflection for dial indicators 1, 2, and 4 indicates a vertical movement upward.

A plus deflection for dial indicators 3 and 5 indicates a movement toward the longitudinal axis of the case.

Readings discontinued on 20° pull at about 100 per cent design limit load.

UNCLASSIFIED

Ref. Sym: 1612 (486)
Project No. TX-543

TABLE VI

STRAIN READINGS AND COMPUTED PRINCIPAL STRESSES (20° PULL) (SECOND CASE) — STATIC TEST OF TX-29/X1 AFT CASE PARACHUTE LUG RING

Load in Pounds	Strain Readings at the Following Gages - Microinches per Inch																			
	1 - 2		3 - 4		5 - 6		7 - 8		9 - 10		11	12 - 13		14	15 - 16		17	18 - 19		20 - 21		22 - 23	
8,000	356	-37	575	-141	399	-111	466	-142	204	-50	334	-86	-32	-89	-24	-1	-42	21	-105	-52	-66	-40	-52
16,000	810	-100	1280	-330	930	-280	1100	-290	620	-150	270	-90	-70	-141	65	-20	-50	0	-70	-320	-50	-210	20
24,000	1260	-310	2020	-630	1530	-440	1610	-450	990	-230	230	130	10	-140	150	-40	-10	-20	-70	-690	-30	-350	90
32,000	1650	-390	2670	-830	2110	-610	2 60	-610	1370	-320	-120	370	130	-80	240	-50	20	-40	-70	-810	-10	-490	110
40,000	2060	-480	3290	-710	2690	-730	2510	-730	1710	-410	-240	540	240	-50	330	-60	70	-50	-80	-1040	-20	-620	130
48,000	2500	-540	3640	-860	3090	-860	2880	-820	1920	-440	-330	640	300	1	410	-70	110	-70	-80	-1210	-20	-720	170
56,000	2790	-610	4250	-990	3760	-1020	3410	-1020	2270	-520	-490	740	380	100	540	-90	150	-70	-90	-1470	-20	-890	200
64,000	3100	-710	4720	-1140	4260	-1130	3750	-1150	2480	-570	-300	820	430	160	600	-110	190	-80	-90	-1680	-10	-1030	240
72,000	3420	-810	5210	-1320	4690	-1240	4340	-1430	2530	-980	-4305	910	480	200	740	-140	240	-90	-90	-1910	-10	-1160	330
(80,000)	3770	-940	5970	-1360	4940	-1290	4220	-1320	2840	-640	-570	990	540	250	840	-140	280	-110	-90	-2110	0	-1300	390
(100% L.L.)																							
88,000	4010	-880	6670	-1420	5240	-1340	4770	-1460	3080	-680	-1050	1080	590	290	930	-150	330	-120	-900	-2320	20	-1450	460
96,000	4250	-940	7.50	-1510	5590	-1430	5330	-1690	3290	-730	-1160	1170	640	310	1040	-170	380	-140	-30	-2560	30	-1610	540
104,000	4570	-940	8520	-1610	6270	-1510	6380	-1060	3530	-770	-1300	1330	750	370	1130	-180	500	-150	-110	-2770	50	-1270	660
108,000	Unit failed at this load.																						
0	No readings taken after failure.																						

Load in Pounds	Maximum and Minimum Principal Stresses - psi																			
	1 - 2		3 - 4		5 - 6		7 - 8		9 - 10		12 - 13		15 - 16		18 - 19		20 - 21		22 - 23	
	Su	Sv	Su	Sv	Su	Sv	Su	Sv	Su	Sv	Su	Sv	Su	Sv	Su	Sv	Su	Sv	Su	Sv
8,000	3850	400	6220	640	4260	290	4730	190	2210	230	-3470	-3550	-170	-460	-370	-3140	-2310	-2620	-1730	-2050
16,000	8300	1010	13990	1600	10280	620	11230	700	6710	720	-2490	-3370	1720	-50	-890	-2870	-4760	-10700	-1440	-6500
24,000	13620	1400	21010	2440	16270	950	17100	1150	10760	1260	4250	1610	4390	210	-1430	-2750	-6790	-19120	-1370	-10670
32,000	17910	2020	28780	3380	22450	1270	21860	1370	15120	1800	13090	7810	7160	780	-1970	-2630	-8330	-25940	-1340	-14540
40,000	22380	2600	34750	3990	28110	1940	27520	1740	18530	2020	19600	13000	9930	1350	-2390	-3050	-10920	-33370	-1980	-18400
48,000	25330	2983	[illegible]	[illegible]	33010	2250	30690	1880	20890	2510	23380	15990	12390	1820	-3020	-3240	-12600	-38830	-1700	-21290
56,000	30310	3523					36150	1650	24700	2970	27360	19440	16340	2470	-3120	-3560	-15170	-47000	-1730	-26120
64,000	32730	4083							26830	3220	30410	21931	17010	2720	-3440	-3660	-16930	-53690	-1250	-30090
72,000	37810	4203							28240	3650	33780	24310	22420	3490	-3760	-3760	-19210	-61030	-920	-33740
(80,000)									30940	3940	36920	27020	25410	3840	-3960	-4400	-23870	-67310	-420	-37610
(100% L.L.)									33620	44331	40270	29500	28120	4410	-4360	-4720	-28580	-74210	340	-41710
88,000									15822	4511	43690	31990	31500	4860	-3740	-5460	-26470	-81960	1310	-46220
96,000											46840	37030	34270	5420	-4990	-5870	-30370	-95240	2560	-53130
104,000																				

Stresses below this line are above Y.P. of material

Gages 1 thru 10 are mounted on 618-T6 aluminum.
Gages 11 thru 23 are mounted on 4130 steel (H.T. 125,000 - 145,000 psi).
Stresses at biaxial gages are computed on assumption that gages are oriented in direction of principal stresses.

Su = maximum principal stress (largest algebraic value).
Sv = minimum principal stress (smallest algebraic value).

[redacted]

UNCLASSIFIED

Ref. Sym: 1612 (486)
Project No. TM-548

TABLE VII

RESULTS FROM PULLING TENSILE SPECIMENS TO FAILURE -- STATIC TEST OF TX-28/X1 AFT CASE PARACHUTE LUG RING

Specimen No.	Size of Cross Section	Area Sq. In.	Ultimate Load (lbs.)	Ultimate Stress (psi)	Yield Load (lbs.)	Yield Stress (psi)
Interior Skin on Case						
1	.064 x .50	.0320	1360	42,500	1180	36,900
2	.064 x .50	.0320	1395	43,600	1210	37,800
3	.064 x .497	.0313	1390	43,600	1215	38,200
Average				43,200		37,600
Exterior Skin on Case						
1	.069 x .498	.0344	1500	43,600	1190	34,600
2	.071 x .498	.0354	1490	42,100	1200	34,000
3	.071 x .497	.0353	1505	42,600	1205	34,200
Average				42,800		34,300
Ring that Attaches to Case Skin at Mounted End						
1	.127 x .499	.0634	3035	47,900	2750	43,400
2	.127 x .502	.0636	3010	47,300	2750	43,200
3	.129 x .501	.0646	3085	47,800	2760	42,700
4	.127 x .501	.0637	2945	46,300	2700	42,400
Average				47,300		42,900
Ring that Attaches to Case Skin at Open End						
1	.126 x .502	.0633	2665	42,100	2500	39,500
2	.129 x .503	.0649	2760	42,500	2480	38,200
3	.130 x .502	.0653	2680	41,300	2550	39,100
4	.128 x .500	.0640	2655	41,500	2540	39,700
Average				41,900		39,100

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[redacted]