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SANDIA SYSTEMATIC DECLASSIFICATION REVIEW
1st Review Date: 7/6/98
Authority: ADC ADD
Name: B Crane
2nd Review Date: 7/23/98
Authority: ADD
Name: W C Layne
Determination (Circle Number):
1. Classification Retained
2. Classification Changed to: U
3. Contains No DOE Classified Information
4. Coordinate With:
5. Contains UCAI? NO
6. Comments: Declassify

NOV 1 8 1954
Case No. 635.00
Ref. Sym: 1612-(162)
Project No. TM-194

MR. R. L. BRIN - 1241

Attention: Mr. D. B. Webb - 1241-2

Re: Static Test of TX-15 Afterbody

Summary of Results

The afterbody of the TX-15 was mounted to simulate its attachment to the forward assembly of the weapon, and three conditions of simulated parachute drag loads were applied.

With the resultant of the twelve fitting (shroud line) loads acting at 25 degrees from the longitudinal axis of the afterbody, a Stresscoat analysis was conducted to determine points of maximum strain. When fitting loads were increased to maximum value of 3320 pounds per fitting (design ultimate), no apparent yielding had occurred. Only minor Stresscoat crack patterns were observed, and no further strain measurement was made. Maximum stress was estimated from Stresscoat data to be 21,000 psi; and this occurred in the aft fittings.

When the misalignment between the resultant of the fitting loads and the afterbody axis was altered to 8 degrees a second Stresscoat analysis was performed. In this orientation, fitting loads were increased incrementally to a maximum value of 5280 pounds per fitting (design ultimate). Maximum stress in this condition was estimated from the Stresscoat data to be 21,000 psi; and this occurred in the aft fittings. Maximum skin stress was estimated at 8,500 psi. Again, since no yielding was observed, no further instrumentation was employed.

The third condition of loading was such that the resultant of the fitting loads and the afterbody axis were collinear. In this aspect, the maximum load per fitting was 5230 pounds (design ultimate). Simultaneously with the loads reaching this maximum value, failure occurred in the cap screw inserts which partly form the attachment of the parachute can to the afterbody case.

Object of Test

This test was conducted to determine the structural adequacy of the TX-15 afterbody under static loads simulating loading encountered in a parachute-retarded drop. Further, it was desired to obtain information concerning stress distribution and an estimate of maximum stress developed.

SANDIA SYSTEMATIC DECLASSIFICATION REVIEW
DOWNGRADING OR DECLASSIFICATION STAMP
CLASSIFICATION CHANGED TO: U
AUTHORITY: W. C. Layne
Emilda Selph 7/30/98
PERSON CHANGING MARKING & DATE
RECORD ID: 98SN3162
W C Layne 7/30/98
PERSON VERIFYING MARKING & DATE
DATED: 7/23/98

CDL No.
ACCOUNTABILITY CARD
[redacted]LE No. TX-15
3-2

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Reason for Test

This test was conducted in accordance with Work Order Authorization dated November 25, 1953 from Mr. R. L. Brin, 1241, to Mr. T. B. Morse, 1610, as elaborated in a memorandum Ref. Sym: 1240-(1490), dated February 3, 1954 from Mr. E. H. Draper, 1240, to Mr. T. B. Morse, 1610. At the request of the consultant the testing of TX-15 fins was omitted.

Function of Object Tested

The TX-15 afterbody, in addition to performing the usual functions, contains and supports a parachute used to retard the descent of the weapon.

Setup for Test

Figures 1 through 4 show the test setup when the resultant of the fitting loads and the afterbody axis misalign by 25 degrees. Figure 5 shows the setup for the 8 degree misalignment. Figure 6 is a schematic drawing of the three setups. It is to be noted that the position of the load ring was selected on the basis of 17 degree shroud line angles when the afterbody axis and the resultant of fitting loads were collinear.

Test Components:

TX-15 Afterbody: Drawing No. 121686

Test Equipment:

Static Test Jig, and Fixtures
Denison Hydraulic Console, 3000 psi capacity
Hydraulic Cylinder, Miller; 12 inch stroke, 6 inch bore
Pull rods; calibrated, 3/4 inch diameter
Pull bars; calibrated, 2 inch diameter

Test Instrumentation:

Stresscoat kit with lacquer No. 1207 and 1206
Baldwin strain indicators, Type L, Serial Nos. J92499 and J59252

Procedure

The TX-15 afterbody was cleaned, Stresscoated with lacquer No. 1207, and mounted in the static test jig so as to apply fitting loads, the resultant of which formed an angle of 25 degrees with the longitudinal axis of the afterbody (see Figs. 1 and 2). Initially, it was intended to carry loading to design yield load (2565 pounds per fitting) and then install SR-4 strain gages to determine strains at points of probable

yield. However, during the test it became apparent that no significant strains had occurred at the design yield load, and it was decided, in conjunction with the consultant, to continue loading to the design ultimate load (3320 pounds per fitting) with no additional instrumentation.

The static jig was modified so as to change the misalignment angle to 8 degrees (see Fig. 5) and the afterbody was Stresscoated with lacquer No. 1206. The test was repeated, and for the same reasons given above, loading was carried to the design ultimate load (5280 pounds per fitting).

The static jig was modified so as to produce shroud line angles of 17 degrees, and collinearity of fitting load resultant and afterbody axis. In this third condition of testing, loading was applied to the design ultimate load (5230 pounds per fitting).

Results

Misalignment of 25 Degrees Between Fitting Load Resultant and Afterbody Axis

Loads were approximately equalized on all twelve parachute fittings, and increased in increments up to the design ultimate load (3320 pounds per fitting). No yielding was observed. Stresscoat crack patterns occurred with a threshold sensitivity of 0.0008 inches/inch. Figures 7 through 10 show the crack patterns developed during this test, and Table I relates load to pattern number. Maximum stress was estimated from this Stresscoat data to be 21,000 psi, and this occurred in the aft fittings. Patterns Nos. 1 and 2 were disregarded in estimating this stress because these cracks exhibited little or no growth under subsequent load increments. No Stresscoat cracks were observed in the afterbody case itself.

Table II shows individual pull-rod loads. It will be noted that the variation in load between individual pull-rods at a particular load level was in the order of 20 percent. This disparity was accepted because the excessive time that would be required to equalize the loads in all rods was thought to be detrimental to the Stresscoat.

In this test, the interior of the afterbody was Stresscoated and examined after the completion of the test. No crack patterns were observed, and this practice was discontinued for the subsequent test.

Misalignment of 8 Degrees Between Fitting Load Resultant and Afterbody Axis

Stresscoat crack patterns for the test involving misalignment of 8 degrees are shown in Figs. 11 through 17, and the pattern numbers are explained in Table III. Threshold sensitivity was 0.0007 inches/inch. No yielding was apparent at maximum load (5280 pounds per fitting). Maximum stress was estimated from the Stresscoat data to be 21,000 psi and again occurred in the aft fittings. In this aspect of loading, skin stresses

were developed in the order of 8,500 psi. Once again, because of lack of growth under subsequent loads, crack patterns Nos. 1 and 2 were disregarded.

Table IV shows individual pull-rod loads. Again it is noted that inequality at the high load levels was about 20 percent compared to the 10 percent which was specified.

Resultant of Fitting Loads Collinear with Afterbody Axis

All shroud lines made angles of 17 degrees with the afterbody axis, thus making the resultant of the fitting loads collinear with the afterbody axis. Loading was applied up to 5230 pounds per fitting. Simultaneously with the attainment of maximum load, failure occurred in the cap screw inserts (see Figs. 18, 19 and 20). These inserts are threaded into the afterbody case and receive the cap screws which secure the parachute can to the case. Failure was sudden and all twelve inserts failed.

Table V shows individual pull-rod loads, and it will be seen that variation in individual pull-rod loads was controlled within desirable limits.

Conclusions and Recommendations

The TX-15 afterbody is structurally adequate to withstand the specified loads. Failure at design ultimate load in the third (collinear) condition of loading may have been due to the previous angular loading of the afterbody. However, to provide a larger margin of safety, it is suggested that the cap screws which hold the parachute can to the afterbody case be made long enough to fully utilize the threaded length of the cap screw inserts. It will be noticed (see Figs. 18 and 19) that all inserts failed at the end of the cap screw.

Neil H. Triner

NEIL H. TRINER - 1612-2

Approved by: Paul H. Adams

PAUL H. ADAMS - 1612

NHT:1612-2:ach

DISTRIBUTION:
R. L. Brin - 1241, Attn: D. B. Webb - 1241-2
T. B. Morse - 1610
J. P. Wamser - 1282
W. E. Caldes - 5513
G. M. Byrne - 1922-2
F. C. Hale - 1925-2

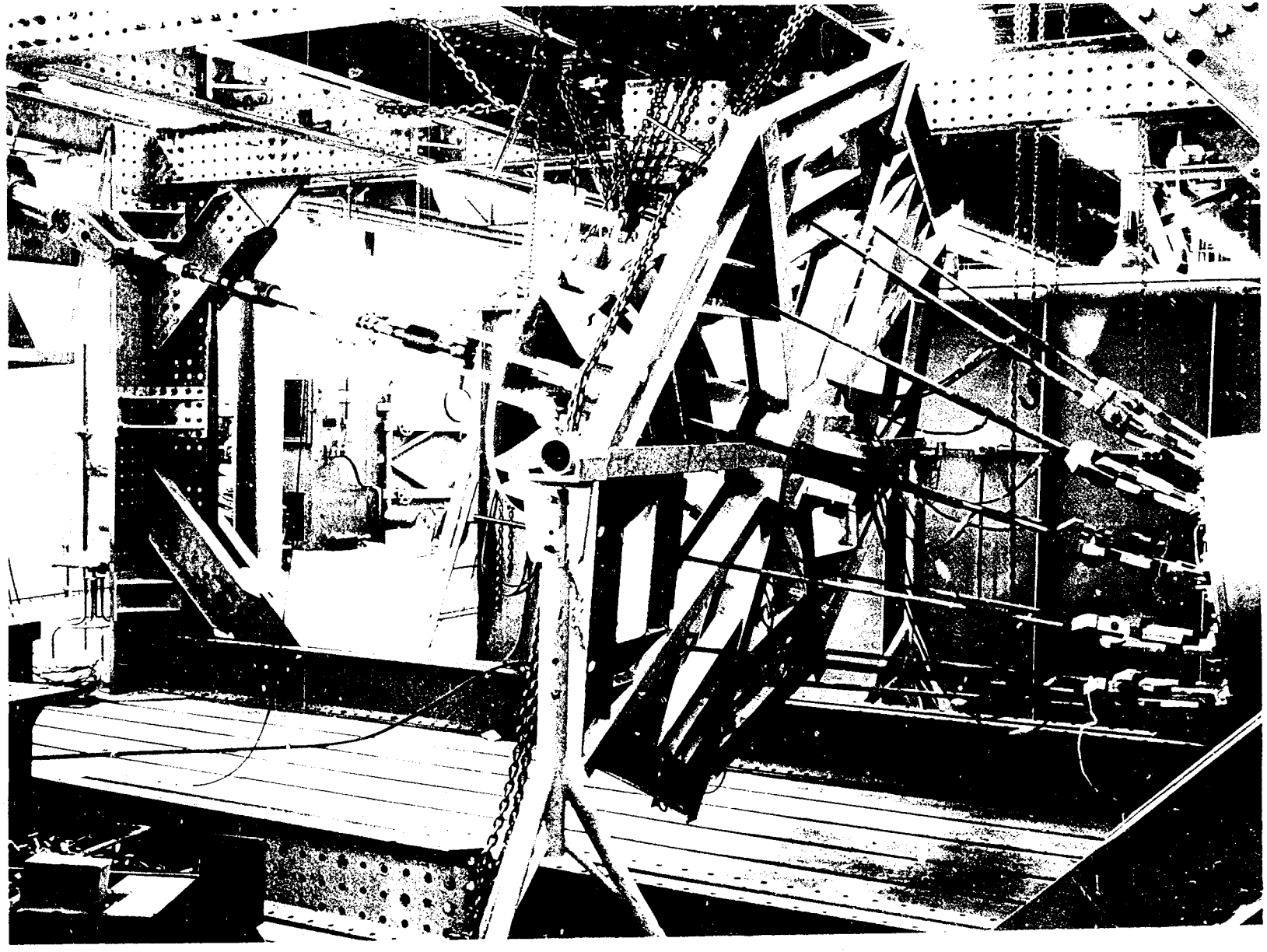

FIGURE 1. GENERAL TEST SETUP, 25 DEGREE DEPLOYMENT, STATIC TEST OF TX-15 AFTERBODY.

REF. SYM. 1612(162)
PROJECT NO. TN 194

D#53042.

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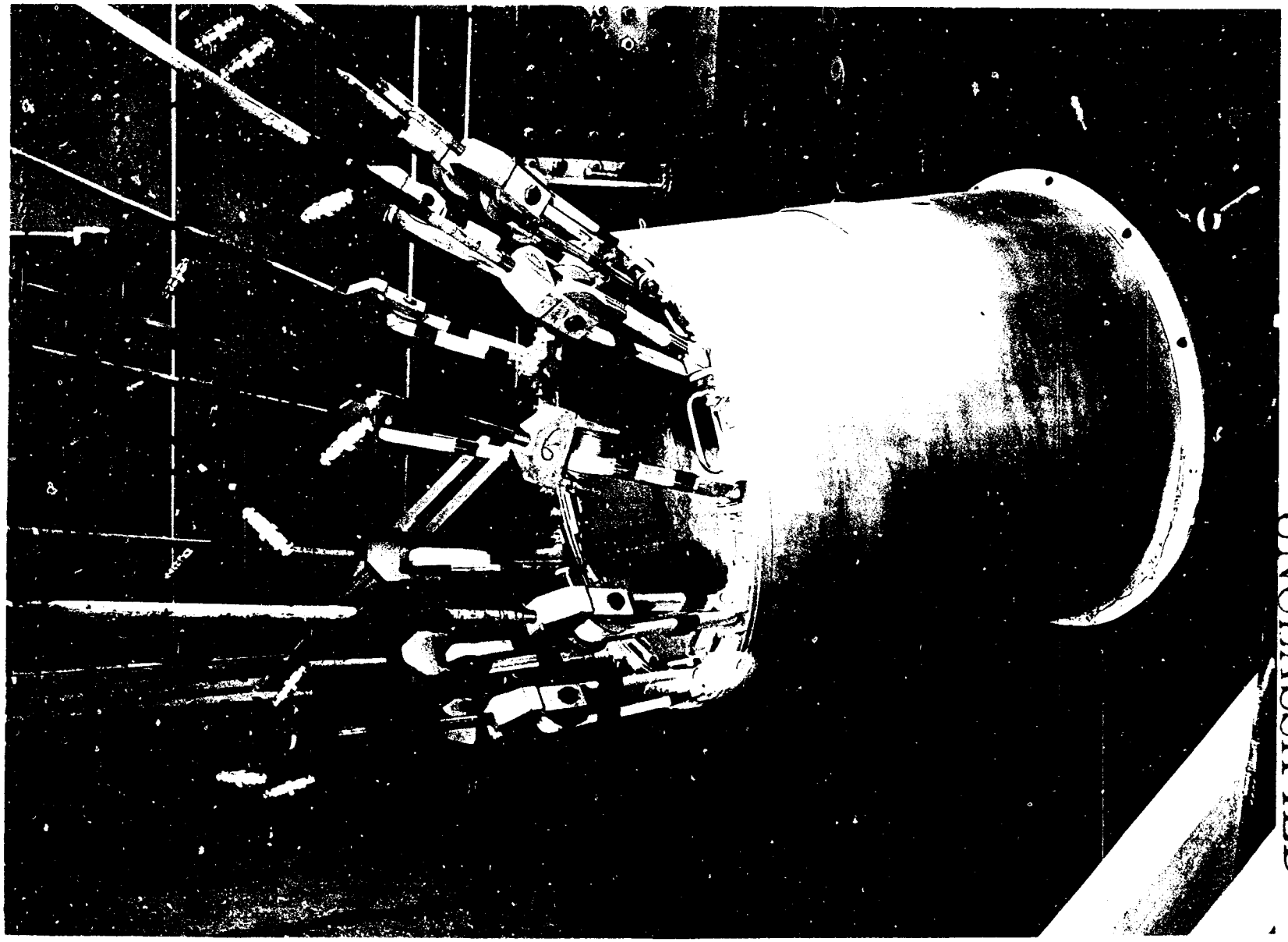

FIGURE 2. GENERAL TEST SETUP, 25 DEGREE MISALIGNMENT. STATIC TEST OF TX-15 AFTERBODY. D# 53041

REF. SYM 1612(162)
PROJECT NO. TM 194

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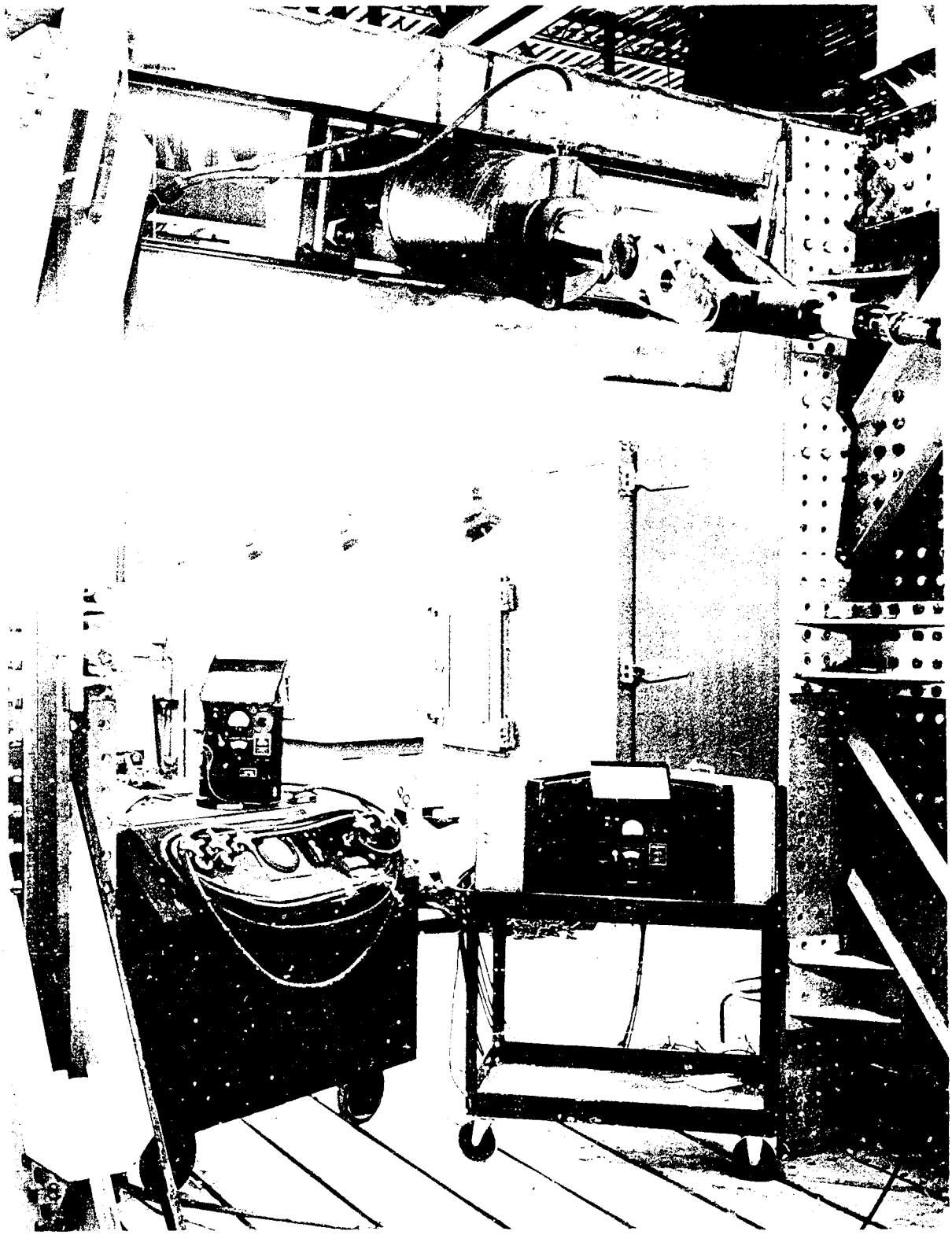

FIGURE 3. GENERAL TEST SETUP, 25 DEGREE MISALIGNMENT. STATIC TEST OF TX-15 AFTERBODY.

REF. SYM. 1612(162)
PROJECT NO. TM 194
R # 53040

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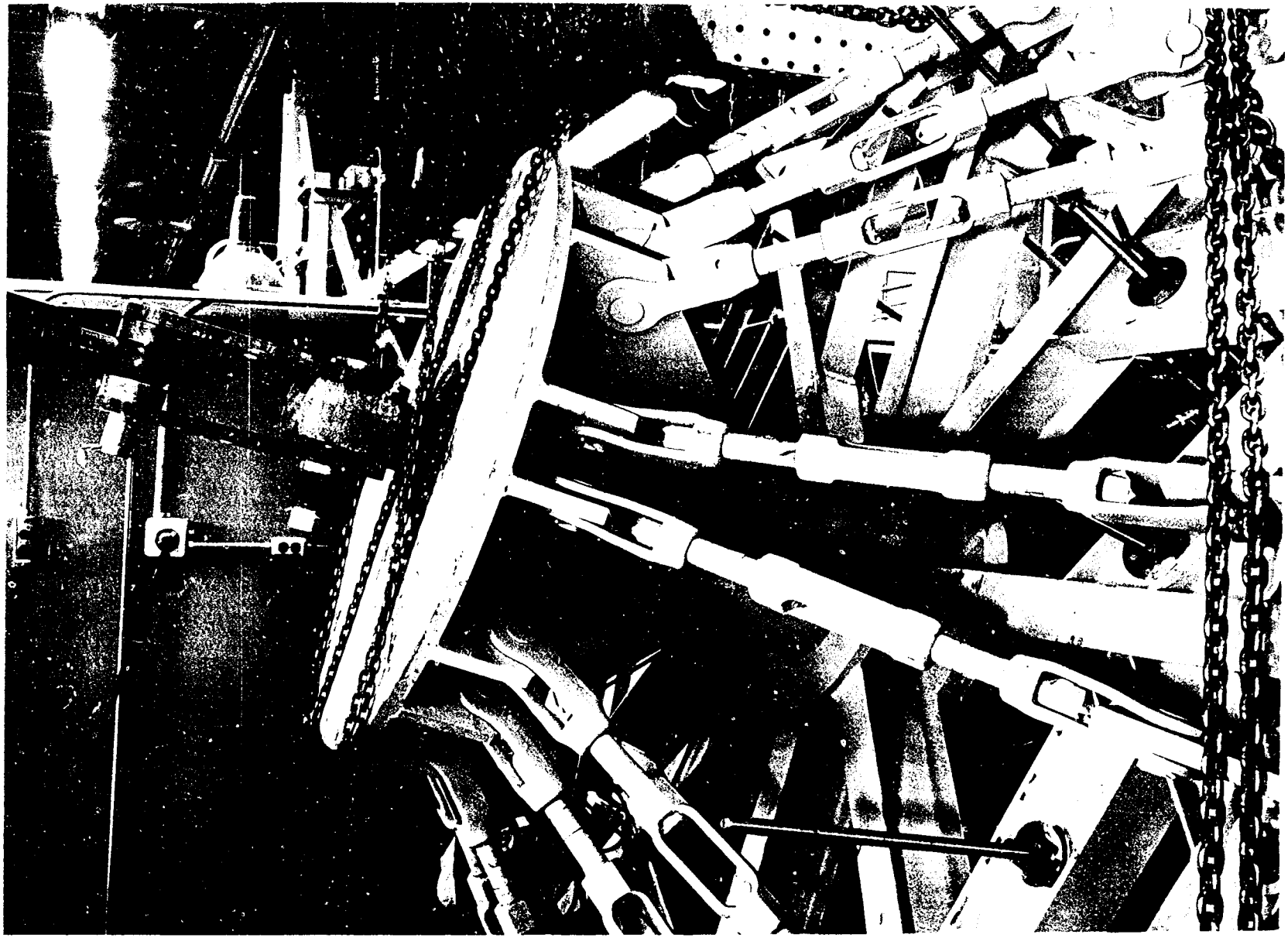

FIGURE 4. CONNECTION OF PULL-RODS AND PULL-BAR TO LOAD RING. STATIC TEST OF TX-15 AFTERBODY. D# 53042. REF. SYM. 1612(162) PROJECT NO. TN 194

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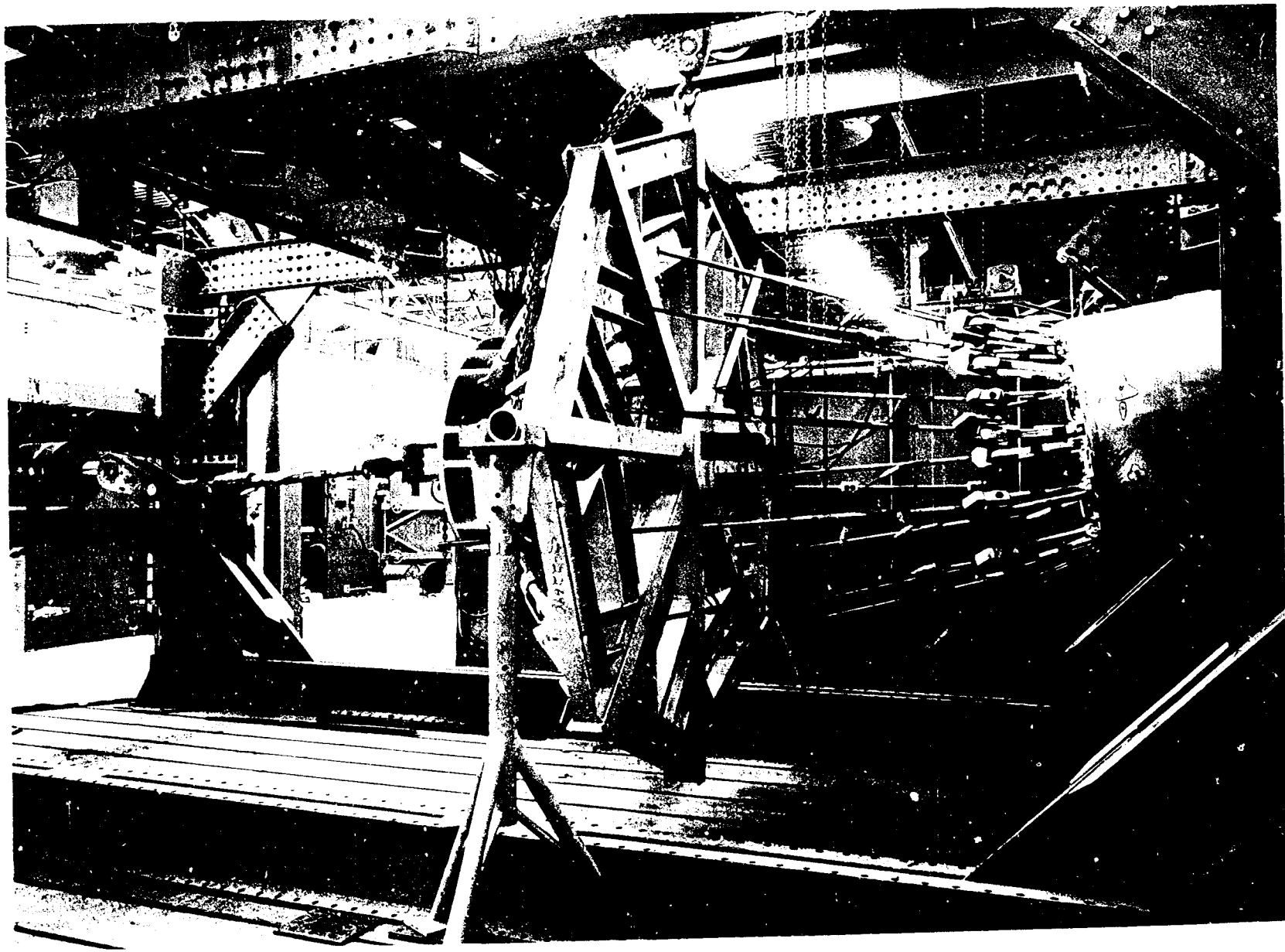

FIGURE 5. GENERAL TEST SETUP, 8 DEGREE MISALIGNMENT. STATIC TEST OF TX-15 AFTERBODY.

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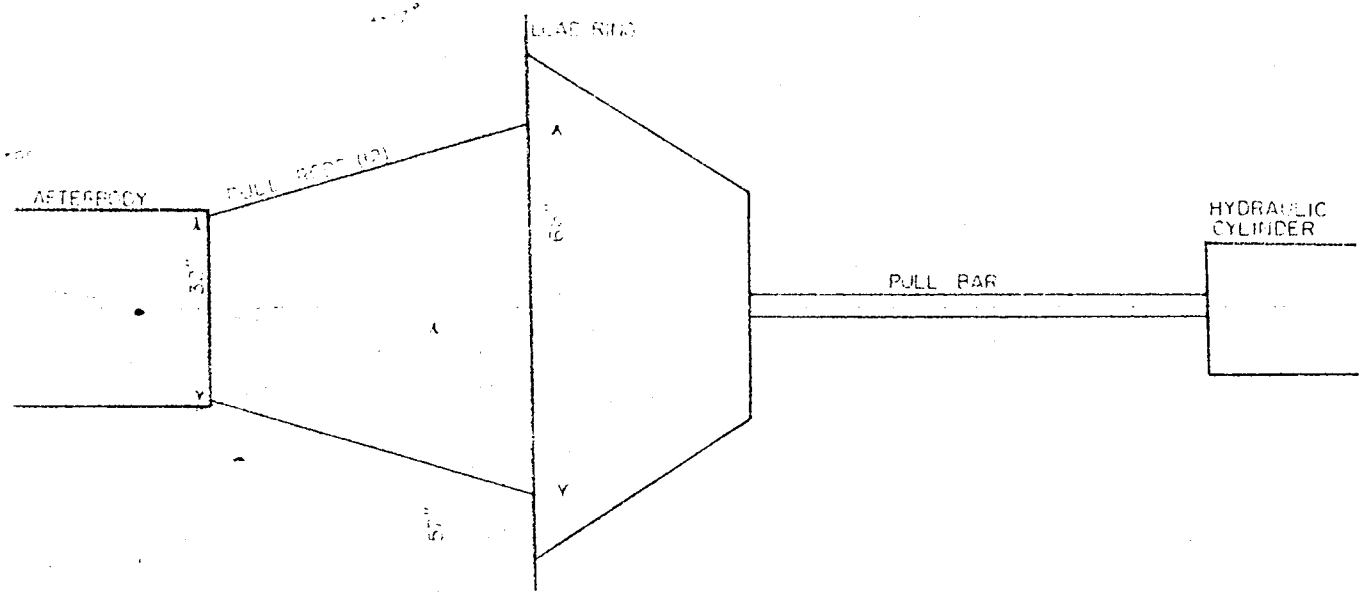

FIG. 6 - SCHEMATIC OF GENERAL TEST SETUP - STATIC TEST OF TX 15 AFTERBODY

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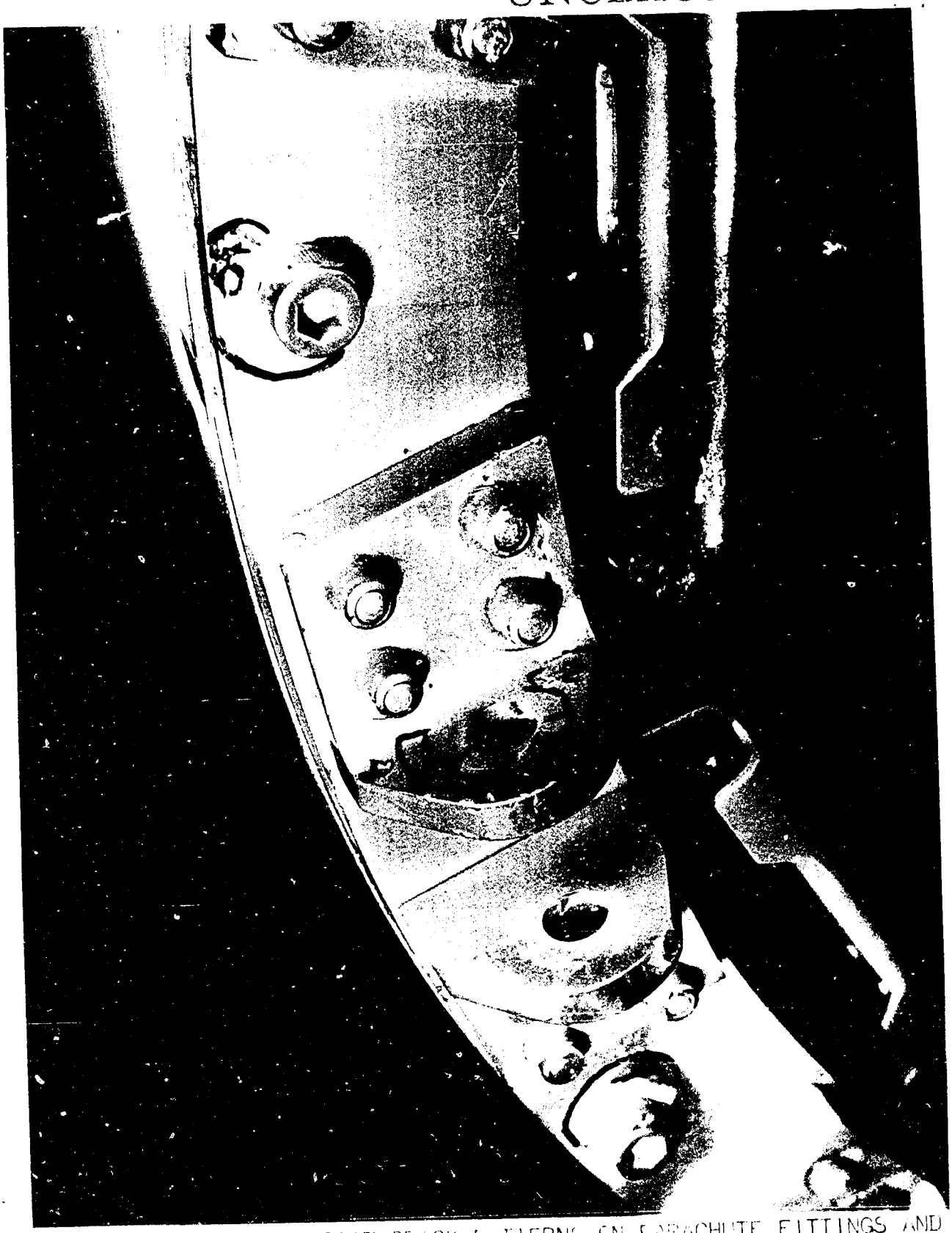

FIGURE 7. TYPICAL STRESSCOAT CRACK PATTERNS ON PARACHUTE FITTINGS AND PARACHUTE CAN; 25 DEGREE MISALIGNMENT. STATIC TEST OF TX-15 AFTERBODY.

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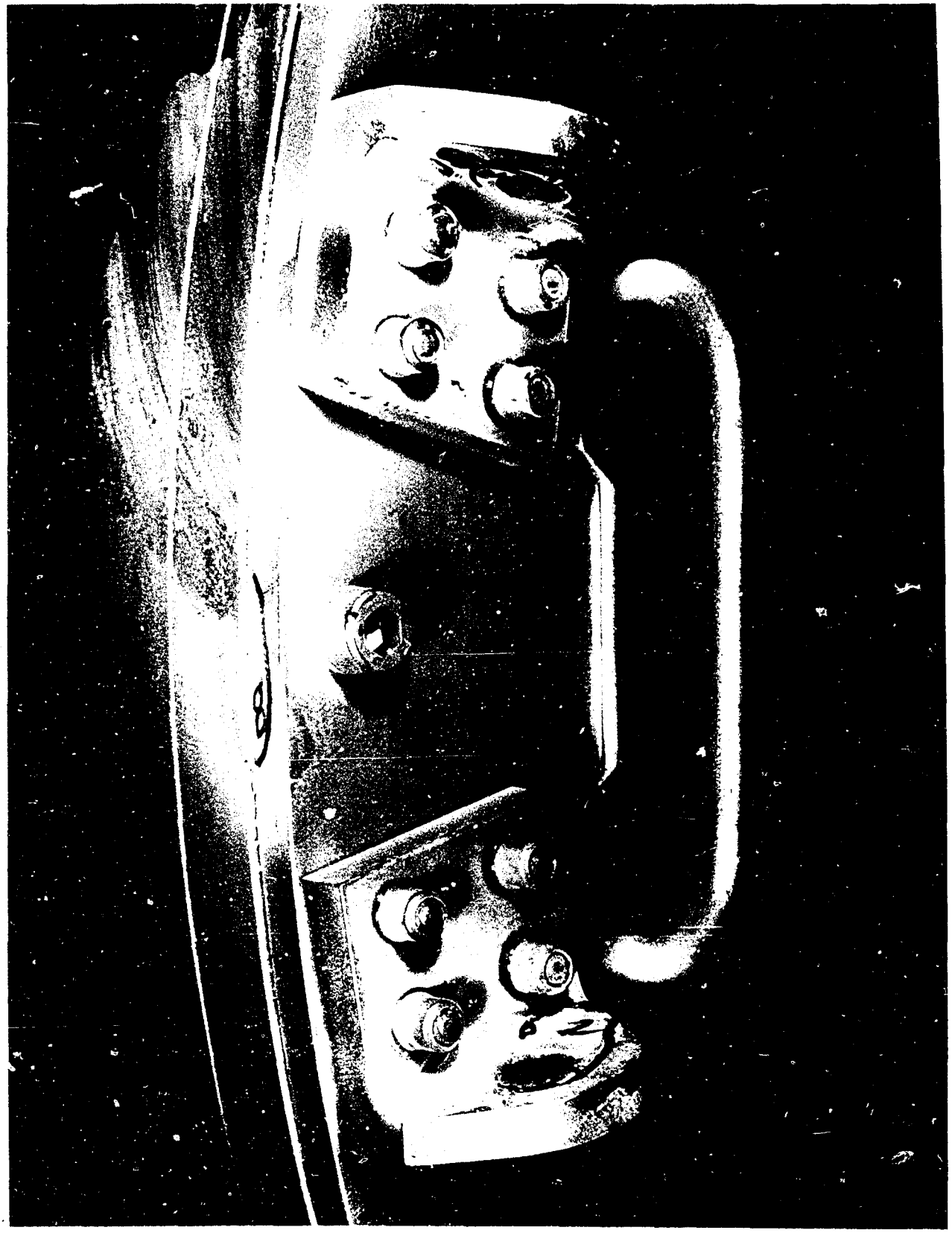

FIGURE 8. TYPICAL STRESS COAT CRACK PATTERNS ON PARACHUTE FITTINGS AND PARACHUTE CAN; 25 DEGREE MISALIGNMENT. STATIC TEST OF TX-15 AFTERBODY.

REF. SYM. 1612(162)
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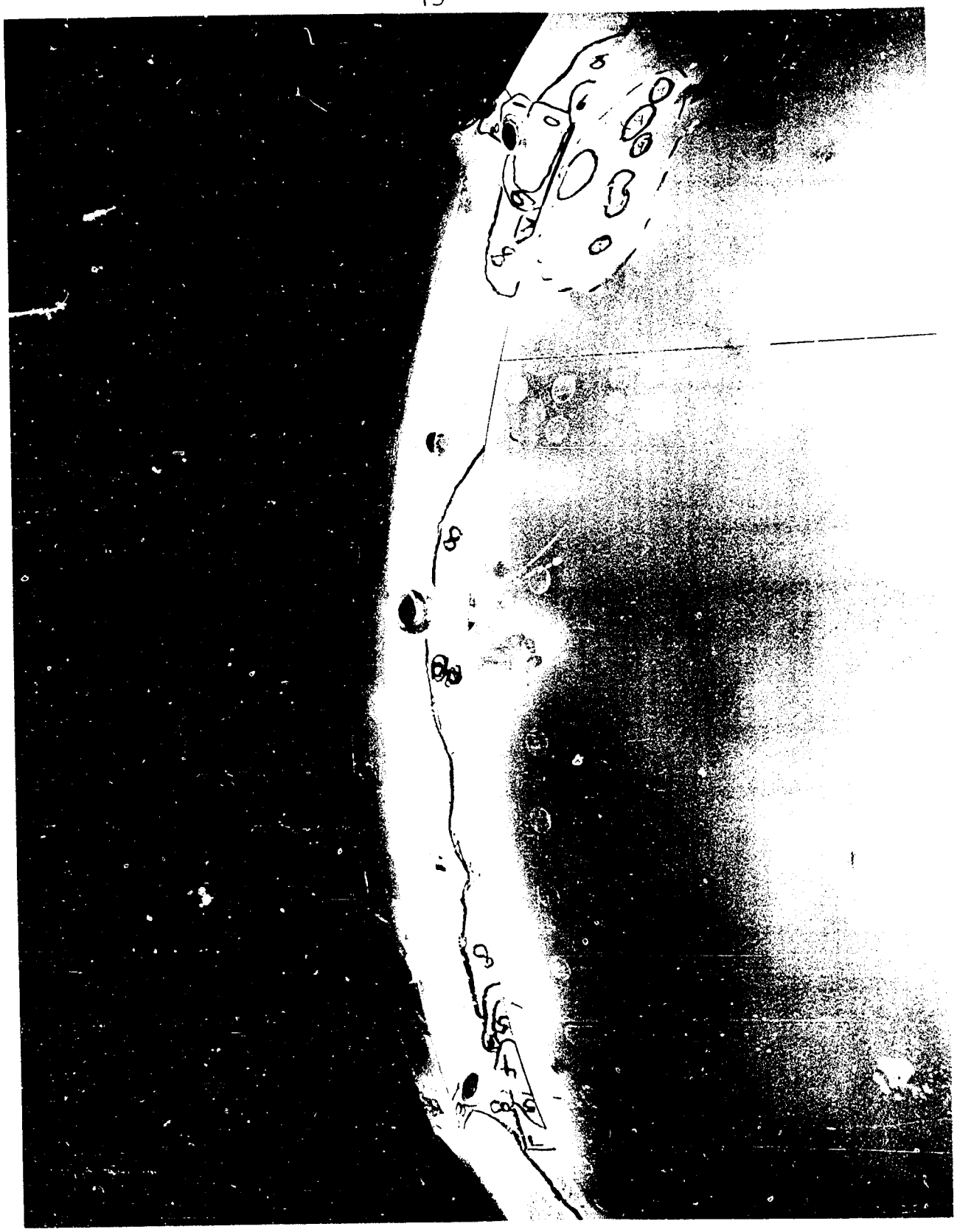

FIGURE 9. STRESSCOAT CRACK PATTERNS ON BOTTOM AND SIDE OF AFTERBODY FORWARD PORTION; 25 DEGREE MISALIGNMENT. STATIC TEST OF TX-15 AFTERBODY. [redacted]

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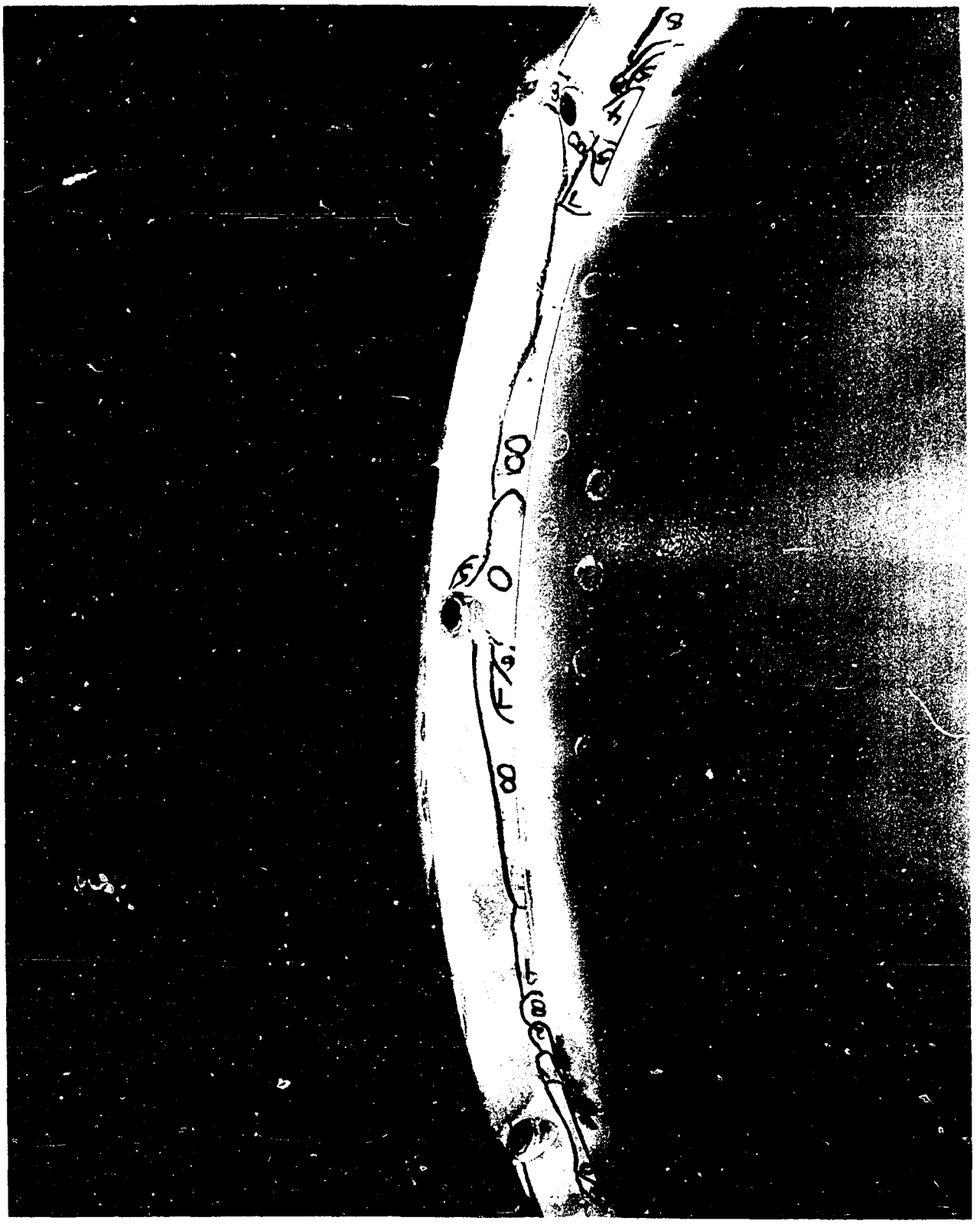

FIGURE 10. STRESSCOAT CRACK PATTERNS ON BOTTOM AND SIDE OF AFTERBODY FORWARD PORTION; 25 DEGREE MISALIGNMENT. STATIC TEST OF TX-15 AFTERBODY.

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FIGURE 11. STRESSCOAT CRACK PATTERNS ON SIDE OF AFTERBODY FORWARD PORTION; 8 DEGREE MISALIGNMENT. STATIC TEST OF TX-15 AFTERBODY.

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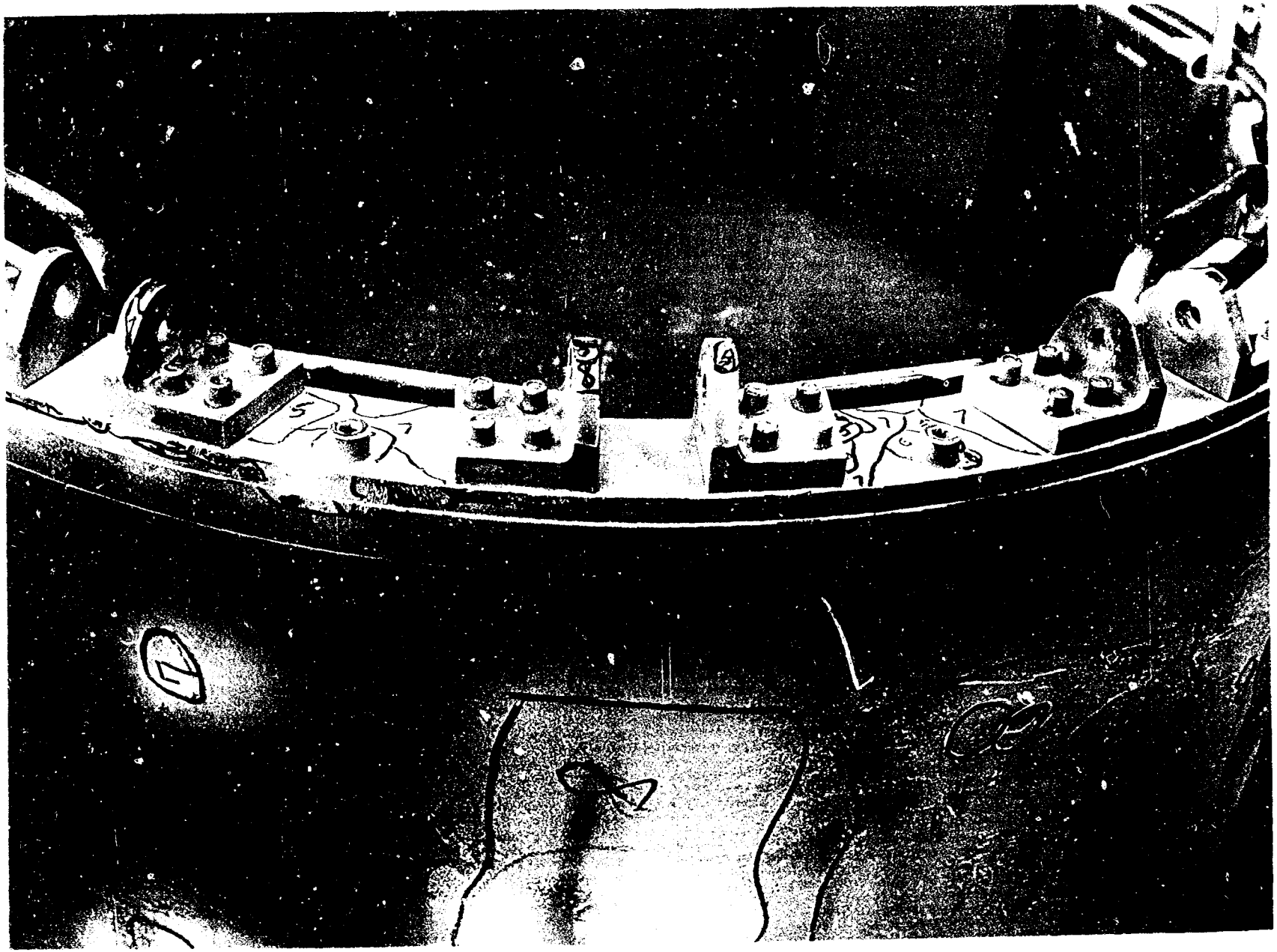

FIGURE 12. STRESSCOAT CRACK PATTERNS OF LOWER PARACHUTE FITTINGS AND PARACHUTE CAN; 8 DEGREE MISALIGNMENT. STATIC TEST OF TX-15 AFTERBODY.

L # 53018

REF. SYM. 1612(162)
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FIGURE 13. STRESSCOAT CRACK PATTERNS ON LOWER PARACHUTE FITTINGS AND PARACHUTE CAN; 8 DEGREE MISALIGNMENT. STATIC TEST OF TX-15 AFTERBODY.

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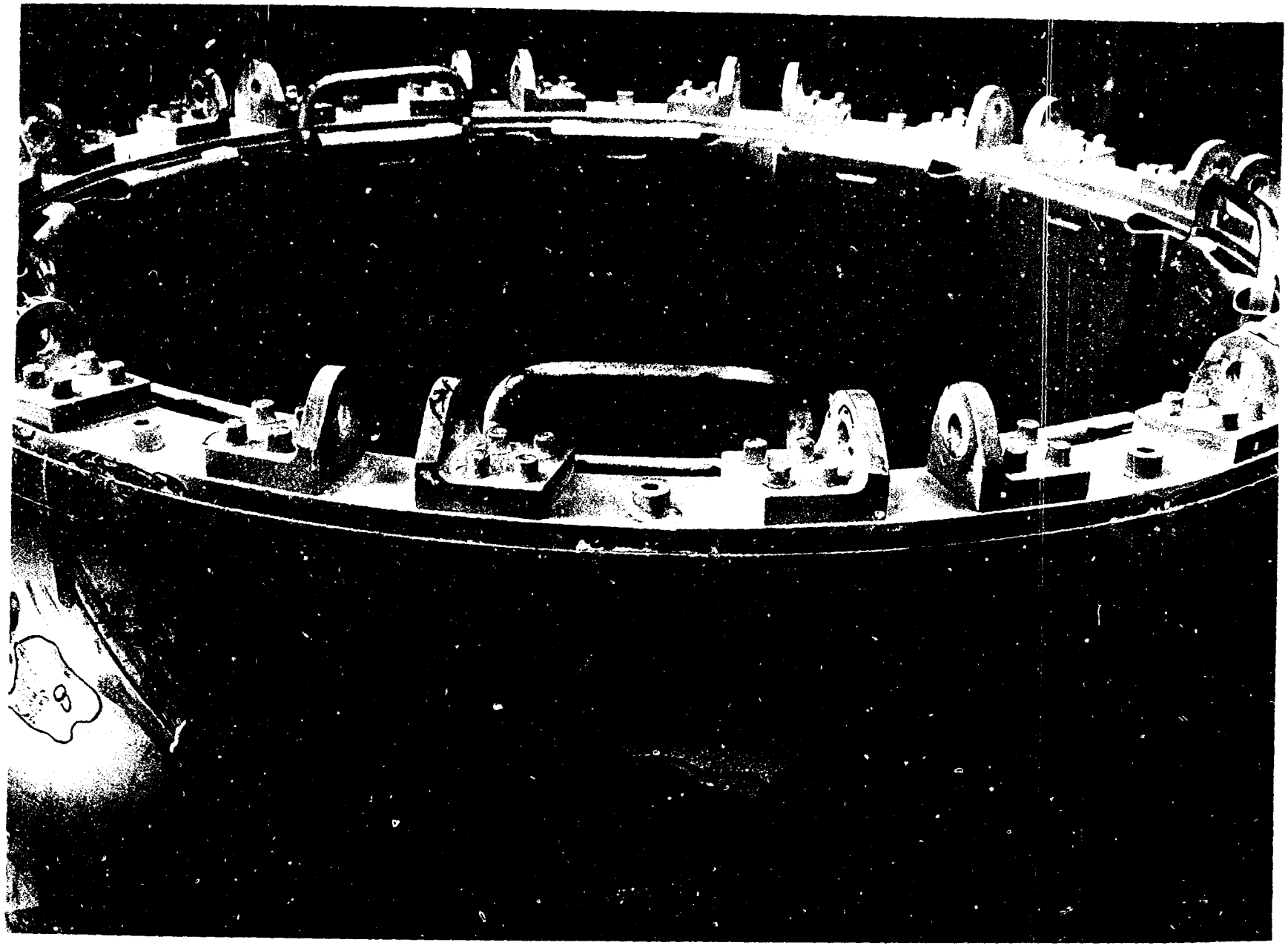

FIGURE 14. STRESSCOAT CRACK PATTERNS ON SIDE PARACHUTE FITTINGS AND PARACHUTE CAN; 8 DEGREE MISALIGNMENT. STATIC TEST OF TX-15 AFTERBODY.

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PROJECT NO. TN 194

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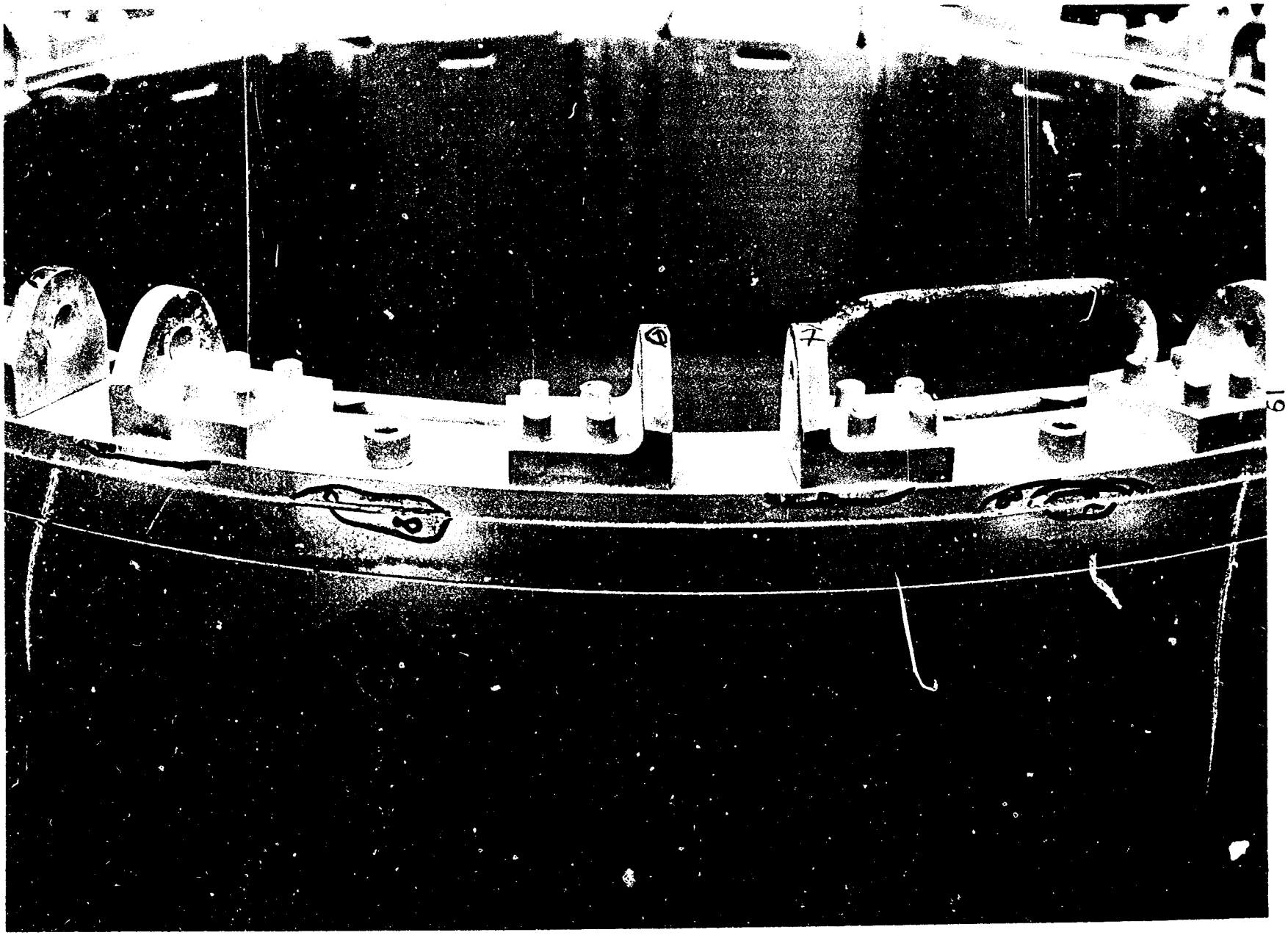

FIGURE 15. STRESSCOAT CRACK PATTERNS ON TOP PARACHUTE FITTINGS AND PARACHUTE CAN; 8 DEGREE MISALIGNMENT. STATIC TEST OF TX-15 AFTERBODY.

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REF. SYM. 1612(162)
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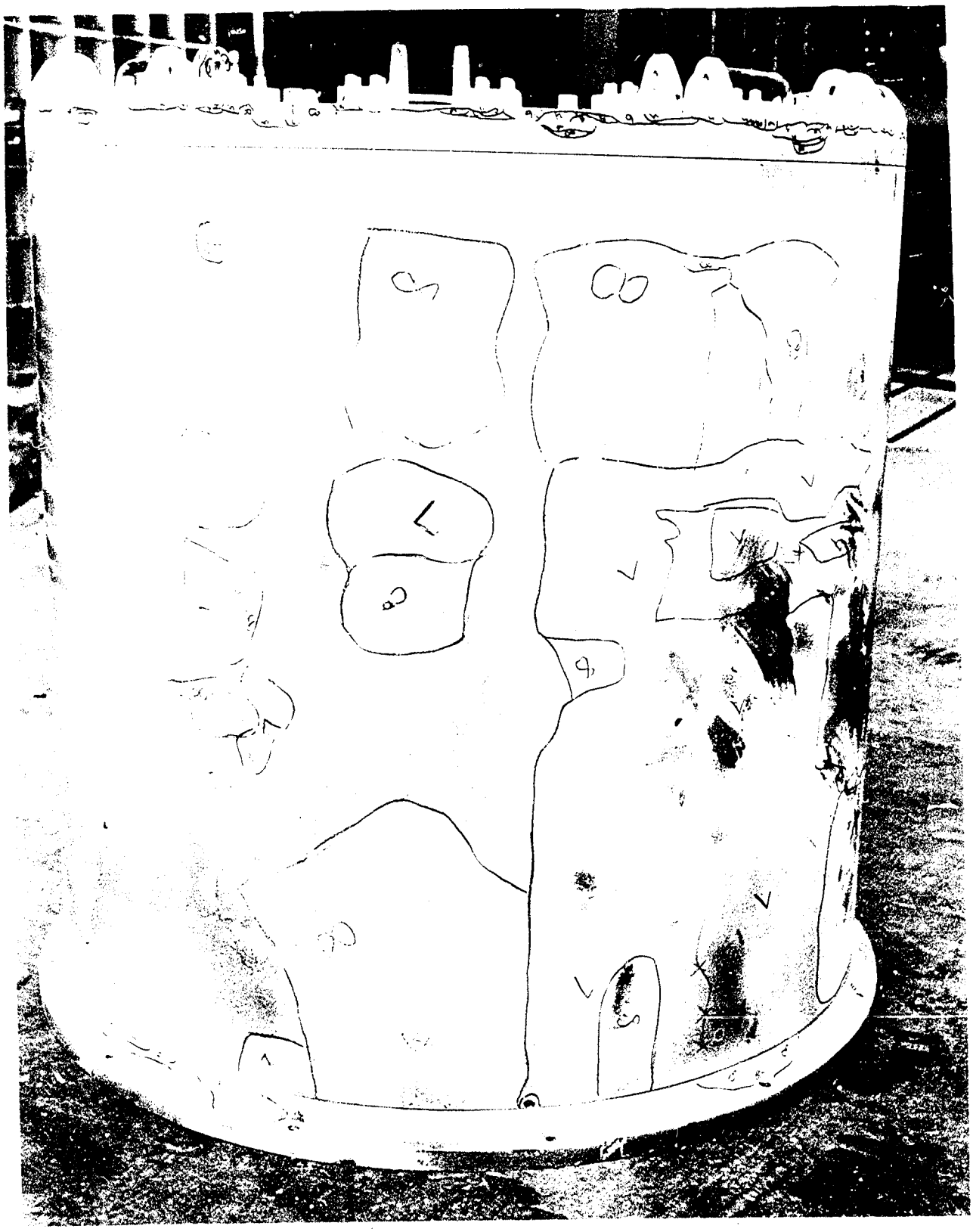

FIGURE 16. STRESSCOAT CRACK PATTERNS ON BOTTOM AND SIDE OF AFTERBODY CASE; 8 DEGREE MISALIGNMENT. STATIC TEST OF TX-15 AFTERBODY.
REF. SYM. 1612(162)
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FIGURE 17. STRESSCOAT CRACK PATTERNS ON BOTTOM AND SIDE OF AFTERBODY CASE; 8 DEGREE MISALIGNMENT. STATIC TEST OF TX-15 AFTERBODY.
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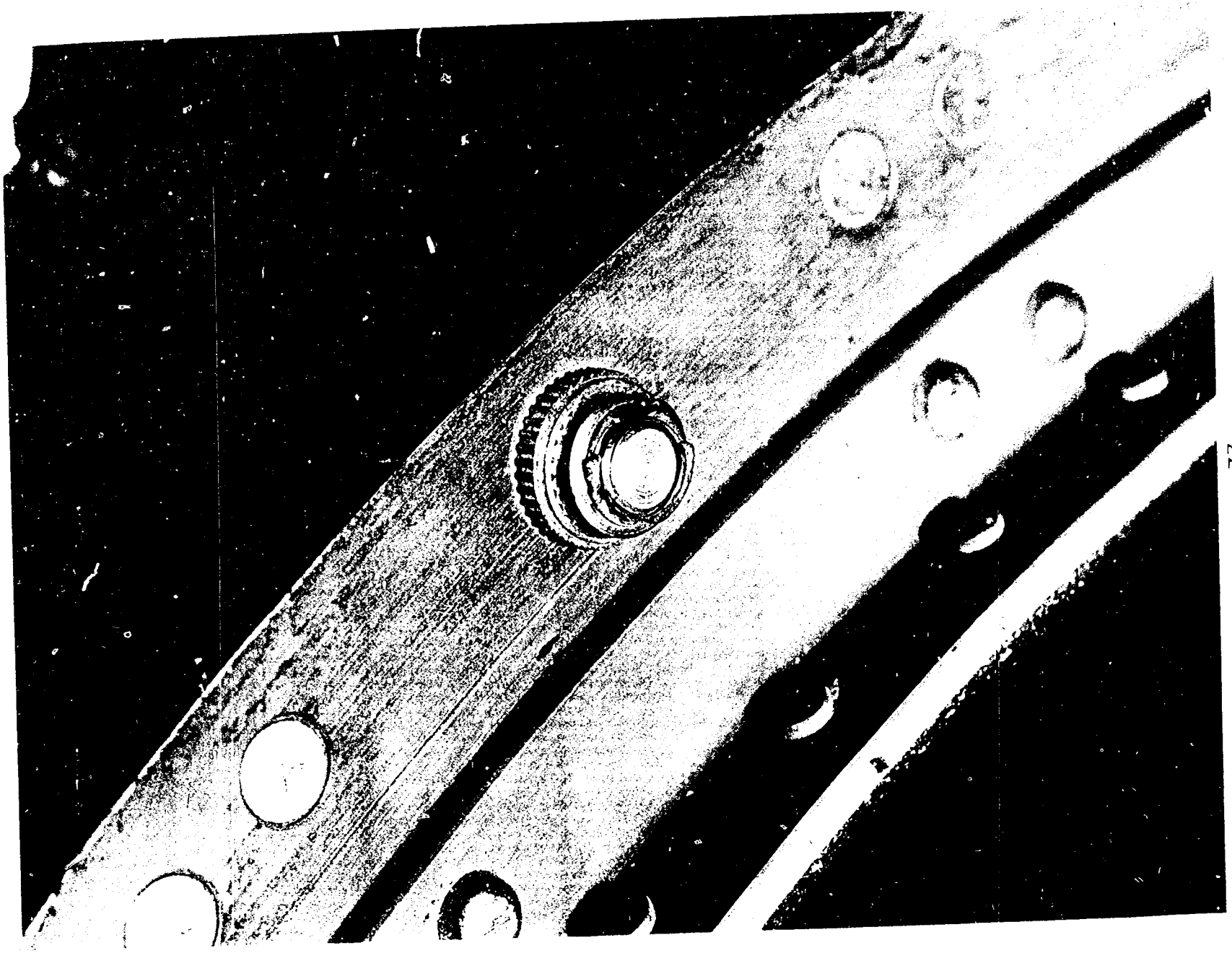

FIGURE 18. VIEW OF TYPICAL INSERT FAILURE. STATIC TEST OF TX-15 AFTERBODY.

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FIGURE 19. VIEW OF TYPICAL INSERT FAILURE. STATIC TEST OF TX-15 AFTERBODY.

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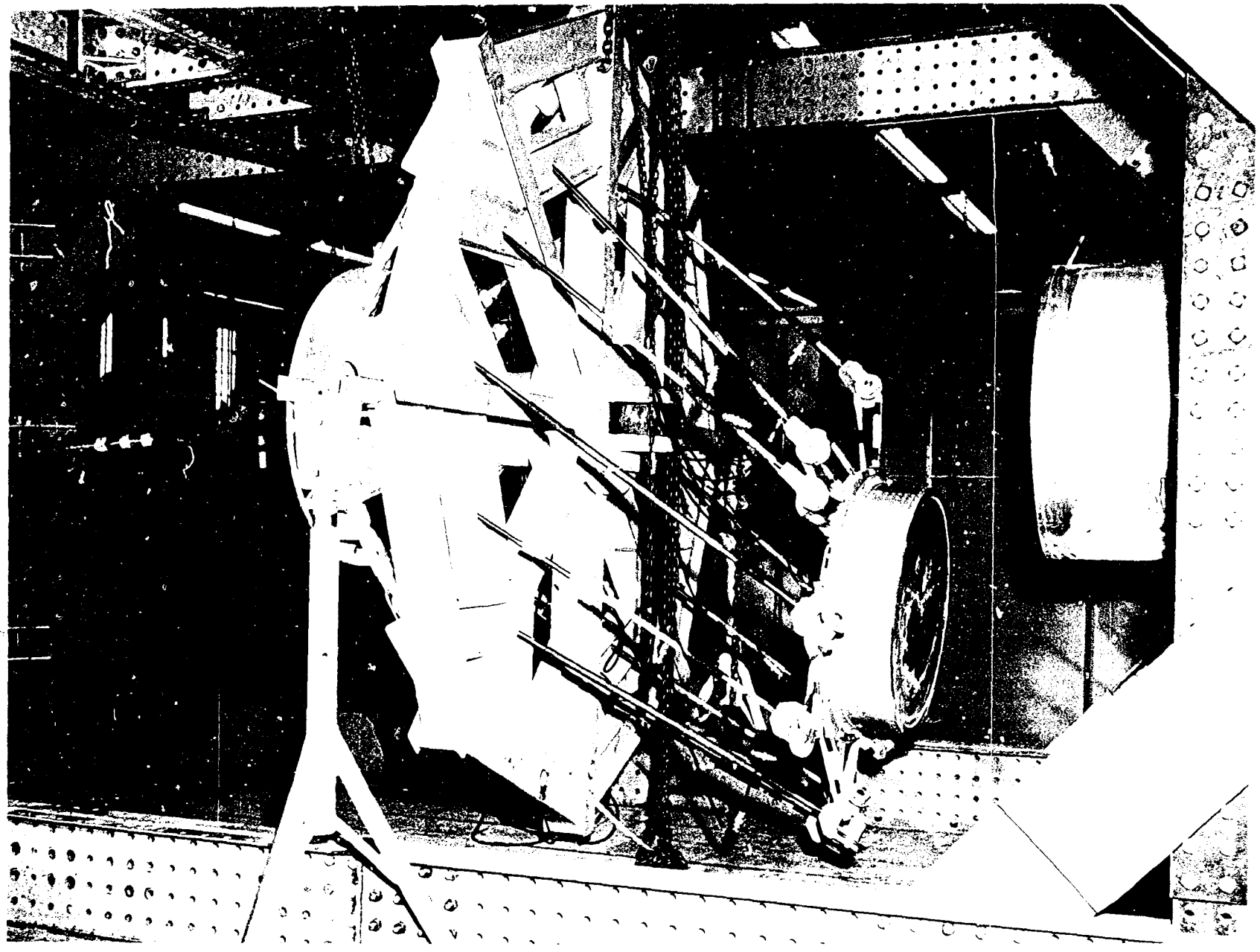

FIGURE 20. VIEW OF FAILURE; NO MISALIGNMENT. STATIC TEST OF TX-15 AFTERBODY.

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Ref. Sym: 1612-(162)
TM-134

TABLE I

RELATION BETWEEN LOAD AND STRESSCOAT CRACK PATTERN NUMBERS
STATIC TEST OF TX-15 AFTERBODY (25 DEGREE MISALIGNMENT)

Average Load per Fitting	Crack Pattern*	Apparent Stress (psi)**
0	0	0
510	1***	
920	2***	
1270	3	8,000
1640	4	10,300
2000	5	12,600
2400	6	15,100
2640	7	16,600
3060	8	19,300
3320	9	21,000

* Threshold sensitivity: 0.0008 inches/inch

** $S_1 = Ee$, where $E = 10 \times 10^6$ psi, $e = 8 \times 10^{-4}$ in/in; $S_1 = 8000$ psi

$S_2 = \frac{P2}{P1} S_1$, where $P_1 = 1270$ pounds, P_2 is the load causing stress S_2

*** Disregarded because patterns failed to grow under increasing load

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TABLE II

PULL-ROD LOADS, STATIC TEST OF TX-15 AFTERBODY
(25-DEGREE MISALIGNMENT)

Average Load (lb)	1	2	3	4	5	6	7	8	9	10	11	12
920	760	900	1010	1035	1010	1035	1020	900	900	1010	870	735
1270	1170	1420	1420	1310	1270	1145	1260	1200	1310	1150	1440	1360
1640	1580	1740	1740	1745	1470	1360	1610	1660	1720	1580	1690	1640
2000	1965	1965	1965	1880	1820	1960	1860	1910	2100	2000	2200	2180
2400	2290	2400	2400	2320	2310	2310	2150	2260	2560	2480	2720	2620
2640	2560	2670	2670	2620	2530	2670	2560	2620	2710	2590	2780	2700
3060	2860	3025	3025	3000	2780	3050	2620	3160	3270	3000	3270	3210
3320	3000	3220	3220	3180	3000	3240	2900	3430	3590	3300	3700	3590

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TABLE III

RELATION BETWEEN LOAD AND STRESSCOAT CRACK PATTERN NUMBERS
STATIC TEST OF TX-18 AFTERBODY (8 DEGREE MISALIGNMENT)

Average Load per Fitting (lb)	Crack Pattern*	Apparent Stress** (psi)
550	1***	
1200	2***	
1800	3	7,000
2420	4	9,400
3000	5	11,700
3670	6	14,300
4440	7	17,100
5280	8	20,600

* Threshold sensitivity = 0.0007 inches/inch

** $S_1 = Ee$, where $E = 10 \times 10^6$ psi, $e = 7 \times 10^{-4}$ in/in; $S_1 = 7000$ psi

$S_2 = \frac{P2}{P1} S_1$, where $P_1 = 1800$ pounds, P_2 is the load causing stress S_2

*** Disregarded because patterns failed to grow under increasing load

TABLE IV

PULL-ROD LOADS STATIC TEST OF TX-15 AFTERBODY
(8-DEGREE MISALIGNMENT)

Average Load (lb)	1	2	3	4	5	6	7	8	9	10	11	12
550	550	490	330	440	330	520	610	550	930	600	550	550
1200	1200	1200	980	1310	1010	1360	1170	1310	1360	1230	1310	1200
1800	1800	1800	1610	1820	1580	1850	1800	1960	1850	1910	1850	1760
2420	2450	2370	2370	2370	2080	2560	2420	2620	2700	2420	2320	2450
3000	3100	2920	2940	3100	2510	2540	3210	2940	3380	3210	3000	2970
3680	3600	3540	3540	3620	3540	4080	3440	3980	4050	3810	3540	3480
4440	4400	4360	4080	4420	4140	4360	4660	4740	4740	4740	4220	4300
5260	5340	5180	4800	5290	5230	5180	5340	5710	5610	5780	4910	4960

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TABLE V

PULL-ROD LOADS STATIC TEST OF TX-15 AFTERBODY
(ZERO MISALIGNMENT)

Average Load (lb)	1	2	3	4	5	6	7	8	9	10	11	12
1000	980	1200	900	960	850	900	1010	1010	1010	960	850	1010
3500	3710	3270	3440	3380	3160	3220	3540	3650	3460	3570	3410	3650
5230*	(Failure at 5230 lb.)											

* In this run, loading was controlled by the Resultant in addition to the individual pull-rods. Hence, determination of load at failure was possible.

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