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MODEL XB-36

REPORT DEVF 275-551

DATE May 5, 1944

Test No. 551

FORT WORTH REPORT
NO. FW-FSG 43

TITLE

STRINGER AND SKIN SPLICE TESTS XB-36 OUTER WING.

LOWER SURFACE

SUBMITTED UNDER
Development Laboratories

PREPARED BY: N. Sarah

GROUP STRUCTURES TEST

CHINESE 81

G. O. Kenyon

REFERENCES

APPROVED BY *H. O. Boyvey*

NO. OF PAGES 20

NO. OF DIAGRAMS

REVISIONS

Test No. 551

Fort Worth Report No.

FW-FSG 43

PAGE

1

ANALYSIS

Consolidated Vultee Aircraft Corporation

PREPARED BY N. Parish

DEVELOPMENT ENGINEERING GROUP

CHECKED BY

VULTEE FIELD, CALIFORNIA U.S.A.

REVISED BY

REPORT NO. 275-551

MODEL XB-36

DATE 5-2-44

(CONTINUED)

SPRINGER AND SKIN SPLICE TESTS XB-36 OUTER WING,LOWER SURFACESUMMARY

Spec. No.	Specimen Description	Design Load	Ultimate Load	% D. L.
551-1	P. S. 47015 Inner to Outer Panel Stringer & Skin Tension Splice (Sta. 25)	164,800#	168,400#	102%
551-2	P. S. 47010 - #1 Typical Skin Splice (Sta. 28)	131,500#	131,500#	100%
551-3	P. S. 47010 - #2 Same as P. S. 47010 - #1 Except for the addition of twelve Monel Rivets replacing Dural	131,500#	147,800#	112%
551-4	P. S. 47005 - #1 2" x .125 Z Stringer Spliced to a 2" x .102 Z Stringer	53,300#	60,800#	114%
551-5	P. S. 47005 - #2 2" x .091 Z Stringer Spliced to a 1½" x .064 Z Stringer	30,700#	35,250#	115%

(CONTINUED)

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ATI 102 388 (COPIES OBTAINABLE FROM CADO)
CONSOLIDATED VOLTEE AIRCRAFT CORP., FORT WORTH DIV.,
TEX. (REPORT NO. DEVF 275-551)
STRINGER AND SKIN SPLICE TESTS XB-36 OUTER WING,
LOWER SURFACE ~ FORT WORTH REPORT NO. FW-FSG 4J
N. BARSH 5 MAY 44 28PP PHOTOS, DIAGRS, GRAPHS, DRWG
STRUCTURES (7) WINGS ~ STRUCTURAL TESTS
DESIGN AND DETAILS (1) B-36 ~ STRUCTURAL TESTS
B-36

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Test No. 551
ANALYSIS
PREPARED BY N. Barsh
CHECKED BY
REVISED BY

Fort Worth Report No. FW-FSG 43

Consolidated Vultee Aircraft Corporation
DEVELOPMENT ENGINEERING GROUP
VULTEE FIELD, CALIFORNIA U.S.A.

PAGE
REPORT NO. 275-551
MODEL XB-36
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(REDACTED)

REFERENCES

PHOTOGRAPHS:

- No. 114364 - View Showing Bending of Skin and Doublers at 100% Design Load (Specimen 551-1).
- No. 114369 - Front View of Failure (Specimen 551-1).
- No. 114367 - Rear View of Failure (Specimen 551-1).
- No. 114244 - Front View of Skin Splice (Specimen 551-2) in 200,000# Test Machine.
- No. 114245 - Rear View of Skin Splice (Specimen 551-2) in Test Machine.
- No. 114246 - Front and Side View of Skin Splice (Specimen 551-2) Showing Failure and Bending of Skin and Doublers.
- No. 114243 - Rear View of Skin Splice (Specimen 551-2) Showing Failure of Splice Rivets.
- No. 114256 - Front View of Failure of Skin Splice (Specimen 551-3).
- No. 114257 - Rear View of Failure of Skin Splice (Specimen 551-3).
- No. 114200 - Front View of Stringer Splice (Specimen 551-4) in Test Machine Showing Failure.
- No. 114201 - Closeup Showing Front and Side View of Stringer Splice (Specimen 551-4) Failure.

(REDACTED)

Specimen No. 551

Port North Report No. PW-PSG 43

ANALYST M. H. DODD Consolidated Vultee Aircraft Corporation
PREPARED BY M. H. DODD DEVELOPMENT ENGINEERING GROUP
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REPORT NO. 275-551
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DATE 5-2-44

()
REFERENCES (contd.)

PHOTOGRAPHS: (contd.)

No. 114203 - View Showing Set-Up and Failure of Stringer Splice (Specimen 551-5).

No. 114202 - Side and Front View of Stringer Splice (Specimen 551-5) Showing Failure.

REFERENCES ONLY:

Specimen Project Slips - No. 47015
No. 47010
No. 47005

Test Project Slips - No. 44213
No. 44215

ANALYSIS

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PAGE

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MODEL XB-36

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Specimen	Design Load	Ultimate Load	Failure at % D. L.	Description of Failure
551-1	164,800	168,400	102%	Specimen failed in tension at splice (See Photo. #314369, Page 18, and #114387, Page 19).
551-2	131,500	131,500	100%	One of the Zee section stringers failed in tension at splice (See Photo. #114246, Page 22), and splice rivets failed in shear (See Photo. #114243, Page 23). Ultimate load maintained for approximately two minutes before failure.
551-3	131,500	147,800	112%	(See Sketch, Page 9) In this specimen stringers and skin failed in tension (See Photo. #114256, Page 24, and #114257, Page 25).
551-4	55,300	60,800	114%	The stringer failed in tension at splice. The skin failed in tension at section where holes were drilled simulating the effect of a rib (See Photo. #114260, Page 26, and Photo. #114261, Page 27).
551-5	30,700	35,200	115%	Skin and stringer failed in tension at stringer splice (See Photo. #114203, Page 28, and Photo. #114202, Page 29). Note that failure of skin did not occur at the section where holes were drilled so as to simulate effect of rib.

For distribution of stress at various strain gage locations for the different specimens, see Curves, Pages 11, 12, 13, 14, 15 and 16.

Strain gage data is available in test files.

RESULTS:

DISCUSSION:

It is believed that Specimen 551-2 failed in the following manner:

At high loads a definite "rocking" motion of the splice rivets permitted the skin to slip. This condition, while relieving the skin, allowed an increasing amount of the load to pass to the stringer. Ultimate failure, however, was caused by a complete transfer of load to the stringer, following a shear failure of the splice rivets.

Specimen 551-3 was able to accept a greater load than Specimen 551-2 because of the increased number of monel rivets at the splice. By replacing twelve (12) of the 1/4 in. diameter 17ST rivets with 1/4 in. diameter monel rivets, the slipping effect of the skin was retarded, thus enabling the skin to carry more load than it did in Specimen 551-2. In this Specimen, failure of the skin was accompanied (followed) by the tension failure of the skin, the monel rivets holding though severely deformed.

Specimen 551-1, which was similar in construction to Specimens 551-2 and 551-3, failed in a manner similar to Specimen 551-3. In this Specimen, 1/4 in. monel rivets were used almost exclusively. Rocking action and deformation of the skin splice rivets was also noted in this Specimen, although it was not as prominent as it was in Specimens 551-2 and 551-3.

Eccentric loading of the skin and doublers at the splice was noted in Specimens 551-1, 551-2 and 551-3. Strain gages #1, 4 and 7 on doublers read compression during the entire loading. (See Photographs No. 114364, Page 17, and No. 114246, Page 22.)

Bending action was also noted in the stringers of all specimens, as can be seen by comparing the stresses at the extreme fibres and legs of the Zee sections (See Curves, Pages 11 to 16, inclusive).

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REPORT NO. 275-551
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8
1
6

([REDACTED])

PROCEDURE:

Seventeen strain gages were located at different points (See Sketch, Page 8) on Specimens 551-1, 551-2 and 551-3. Strain gage readings were taken at a number of load increments up to 100% design load, after which the specimens were loaded to failure.

Strain gage readings were also taken for the twelve gages on Specimens 551-4 and 551-5 (See Sketch, Page 10) for a number of load increments up to 100% design load. After reaching 100% design load, holes were drilled in a line across the Specimen's skin so as to simulate actual conditions on the wing where the ribs framed into the skin. The Specimens were then loaded to failure.

Design load was calculated on the basis of 50,000 psi over the minimum gross cross-sectional area of the Specimen.

CONCLUSION:

All Specimens tested were satisfactory.

Inasmuch as Specimen 551-2 failed after holding 100% design load for only two minutes, it was found necessary to replace some of the 1/4 in. diameter 17ST rivets with 1/4 in. diameter monel rivets in the splice of Specimen 551-3 so as to reduce the rocking effect of the rivets and the slippage of the skin. Specimen 551-3 was warranted in preference to Specimen 551-2 because it failed at 112% design load.

([REDACTED])

Test No. 551

Fort Worth Report No. FW-FSG 43

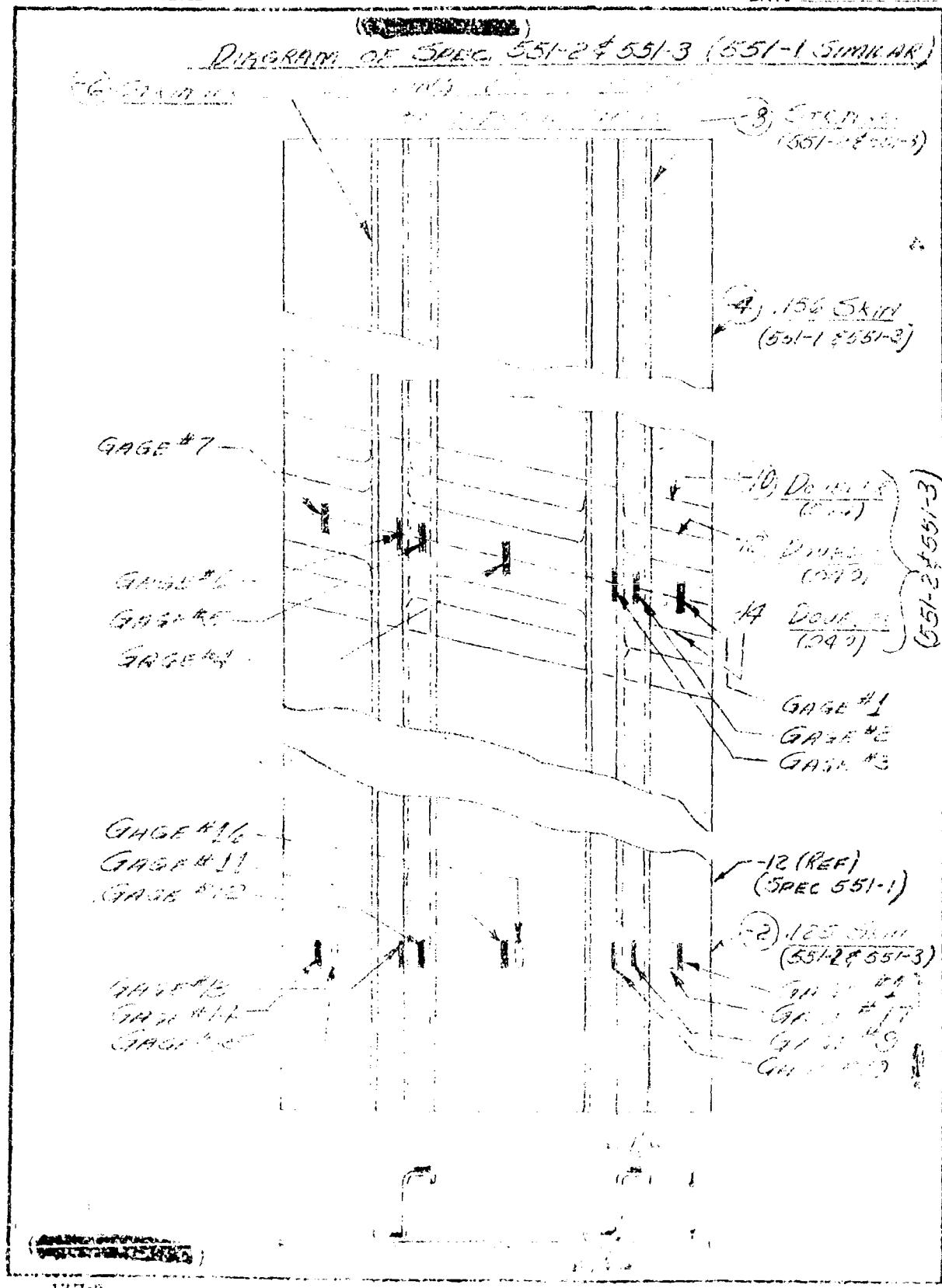
ANALYSIS *[Signature]*
PREPARED BY *[Signature]*
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PROGRAM OF SPEC. 551-2 & 551-3 (551-1 SUMMER)



Test No. 551

Fort Worth Report No. FW-FSG 43

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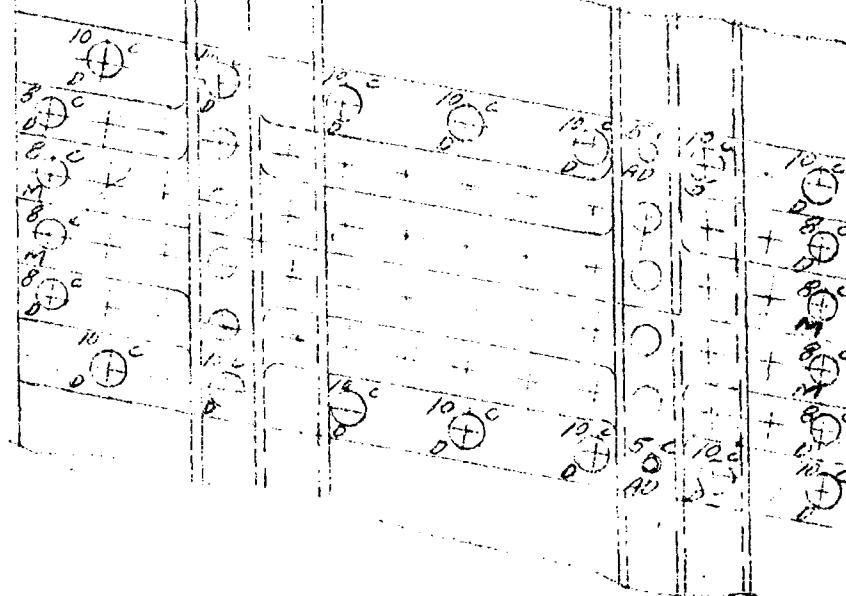
REPORT NO. 275-551

MODEL XB-36

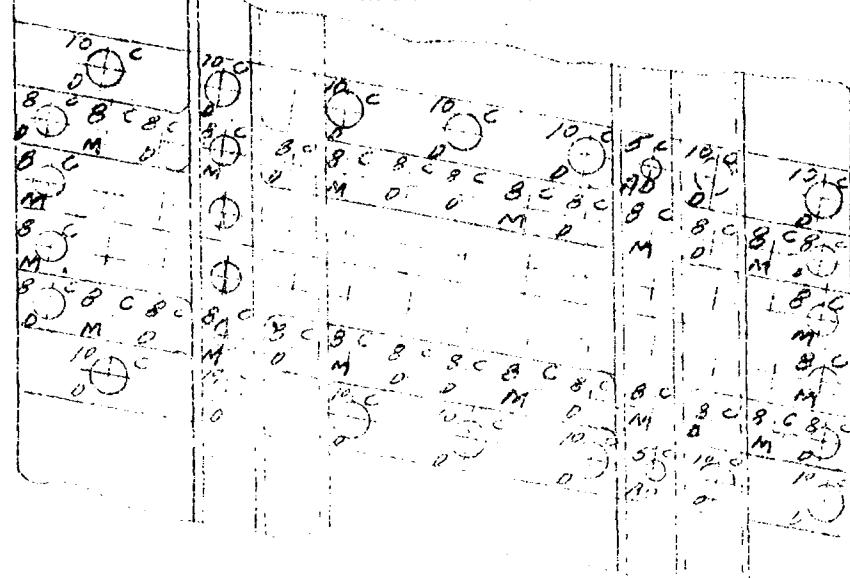
DATE 5-2-44

(REDACTED)

SPLICE RIVET DIAGRAM SPEC. 551-2



SPLICE RIVET DIAGRAM SPEC. 551-3



(REDACTED)

Test No. 551

Fort Worth Report No. FW-FSG 43

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REPORT NO. 275-551

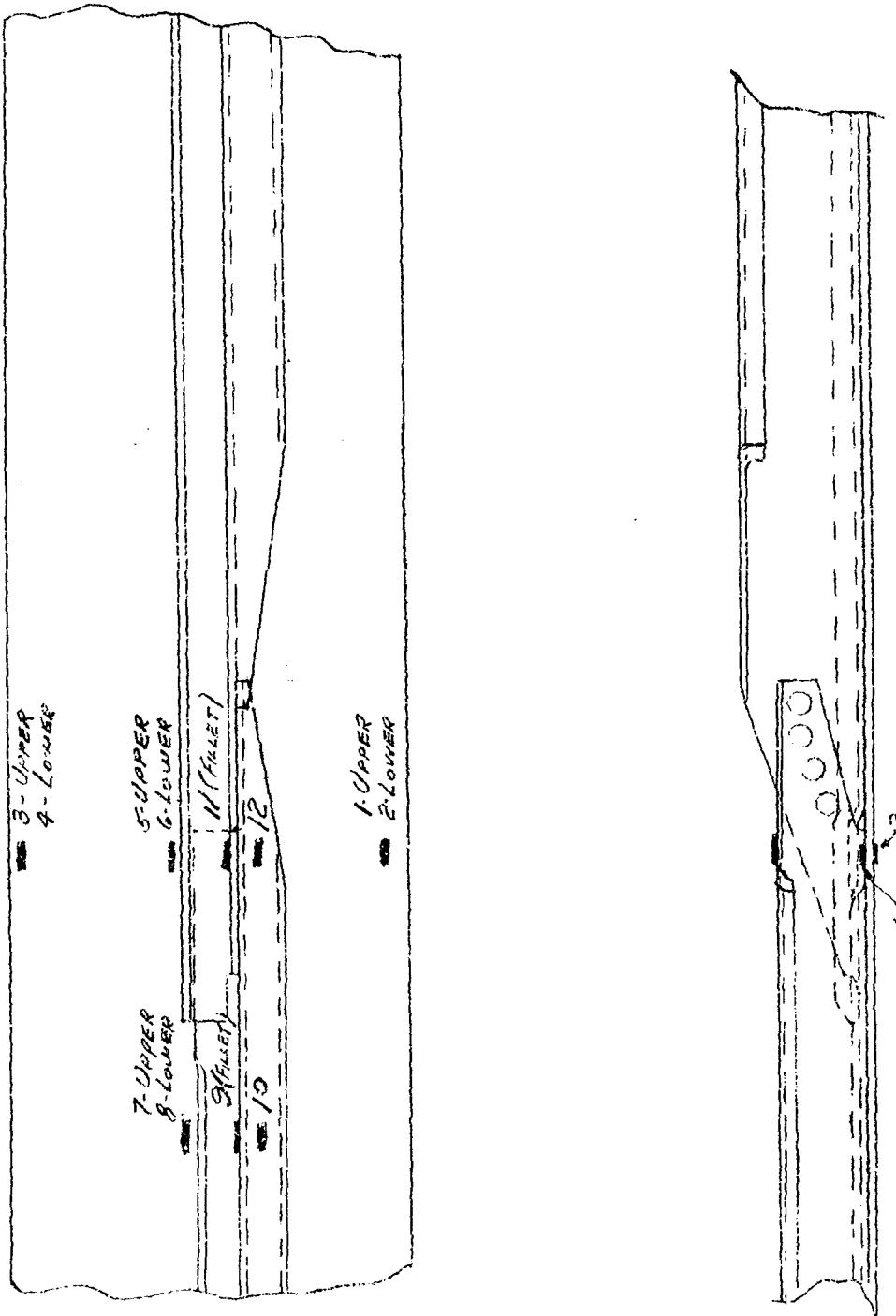
MODEL

XB-36

DATE

5-2-44

LOCATION OF STRAIN GAGES {SPEC. 551-4
SPEC. 551-5



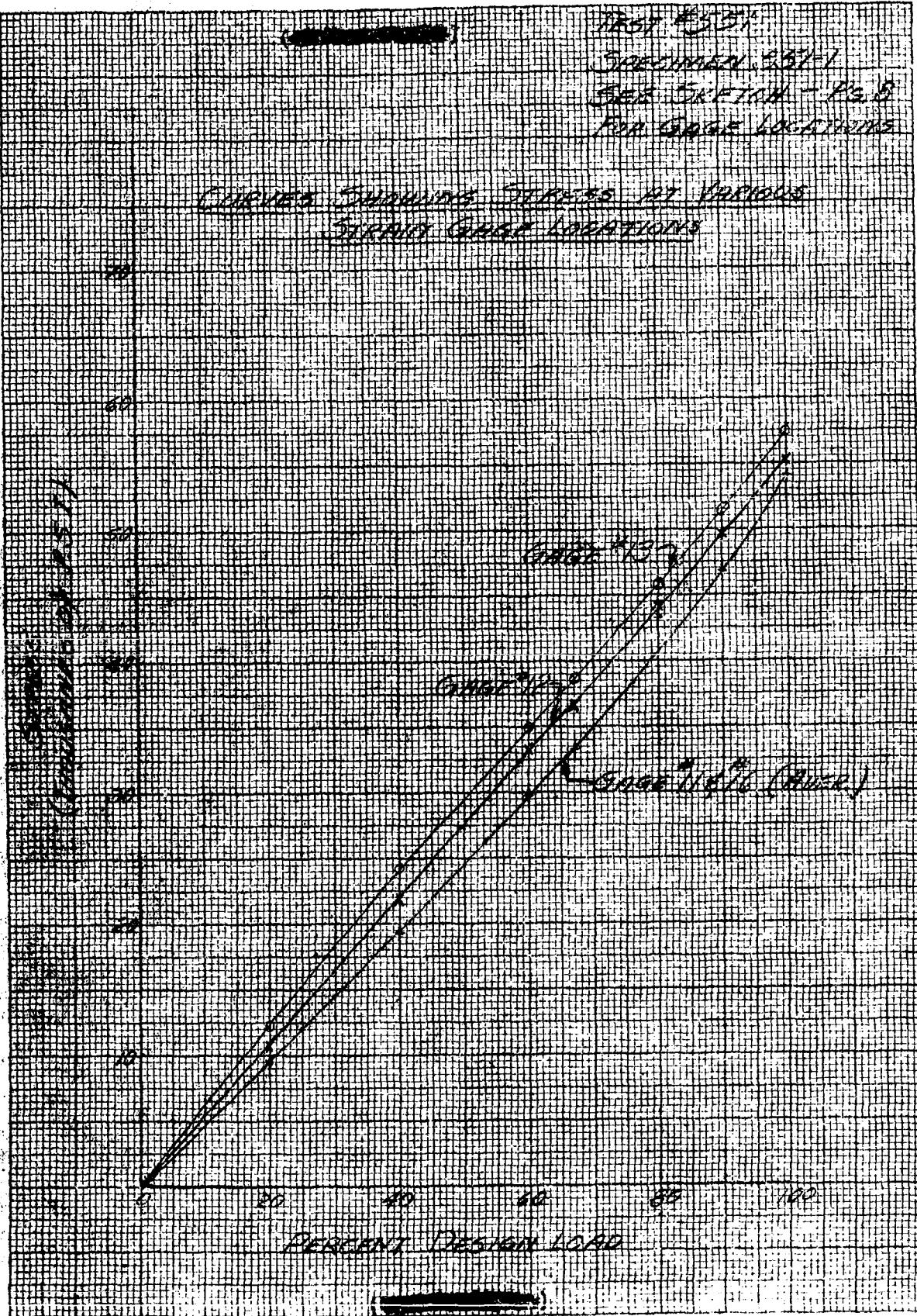
PILOT # 131

SPECIMEN 1371

SERIAL 1371A - PG 8

PEN 1371 LOCATIONS

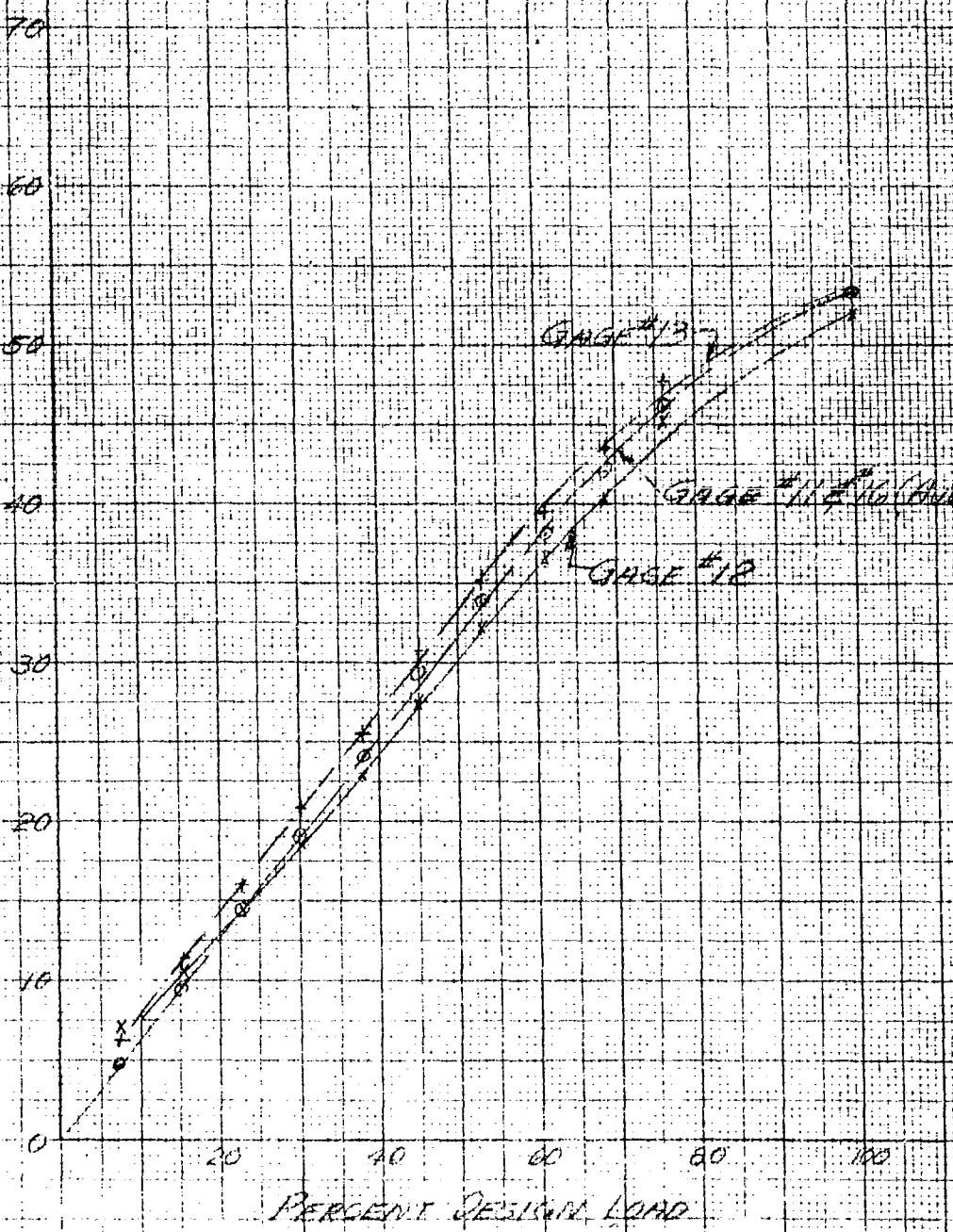
CHARTS INDICATING STREETS AT VARIOUS
STATION AND LOCATIONS



TEST #551
SPECIMEN 334-3
SEE SKETCH + PLATE B
FOR GRADING / CIRCUMSTANCES

CURVES DRAWN IN STRENGTH AT VERAMONTE
STRAIN 0.0061 INCHES/INCH

TEST #551
(THOUSANDS OF P.S.I.)



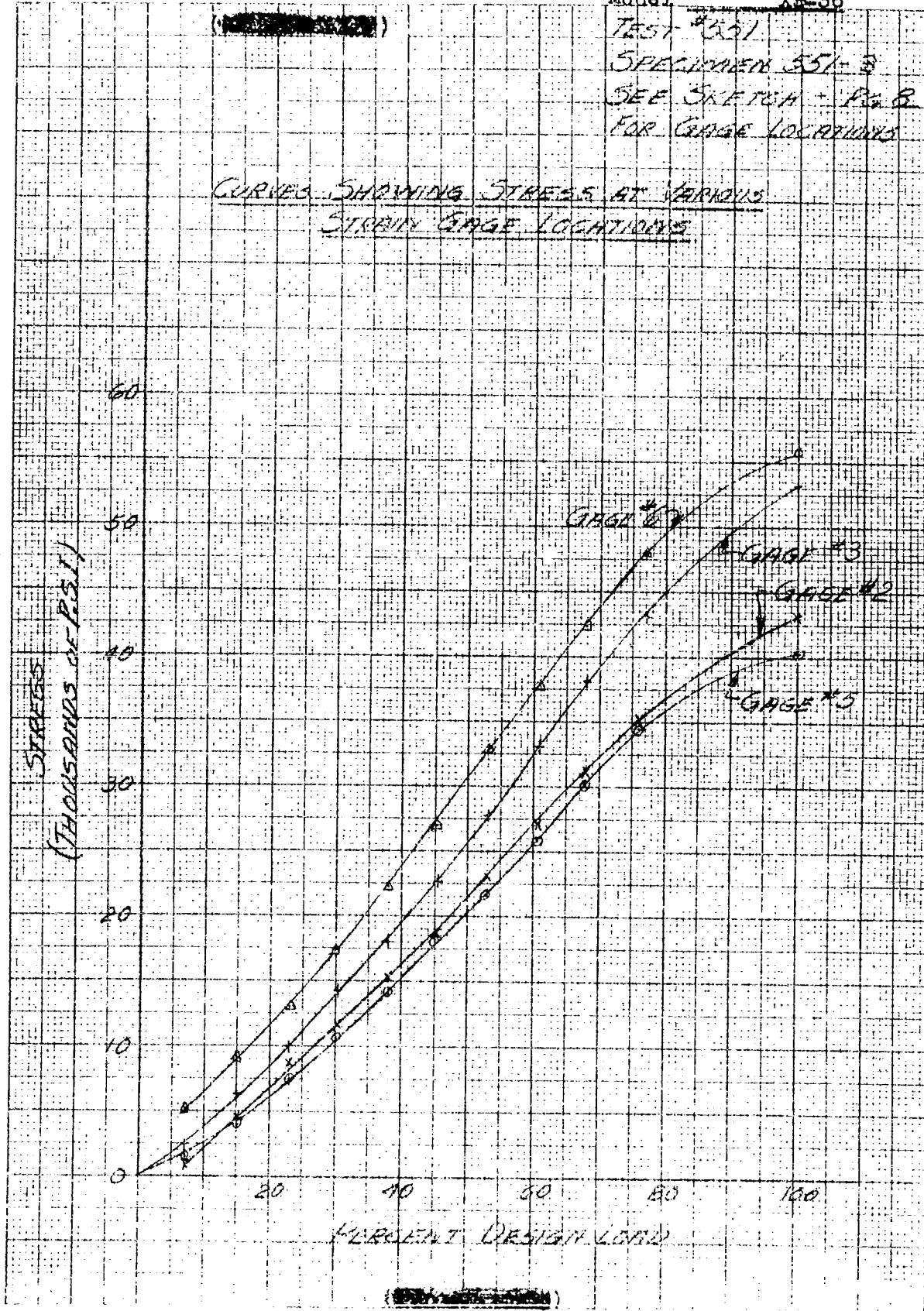
卷之三

980-3205M 4540

10. *Leucosia* sp. (Diptera: Syrphidae) was collected from a small stream in the northern part of the study area.

SEE MATCH + P.P.
FOR CORRECT LOCATIONS

CURVED, SHOWING STREETS AT VARIOUS
STRAIN GAGE LOCATIONS



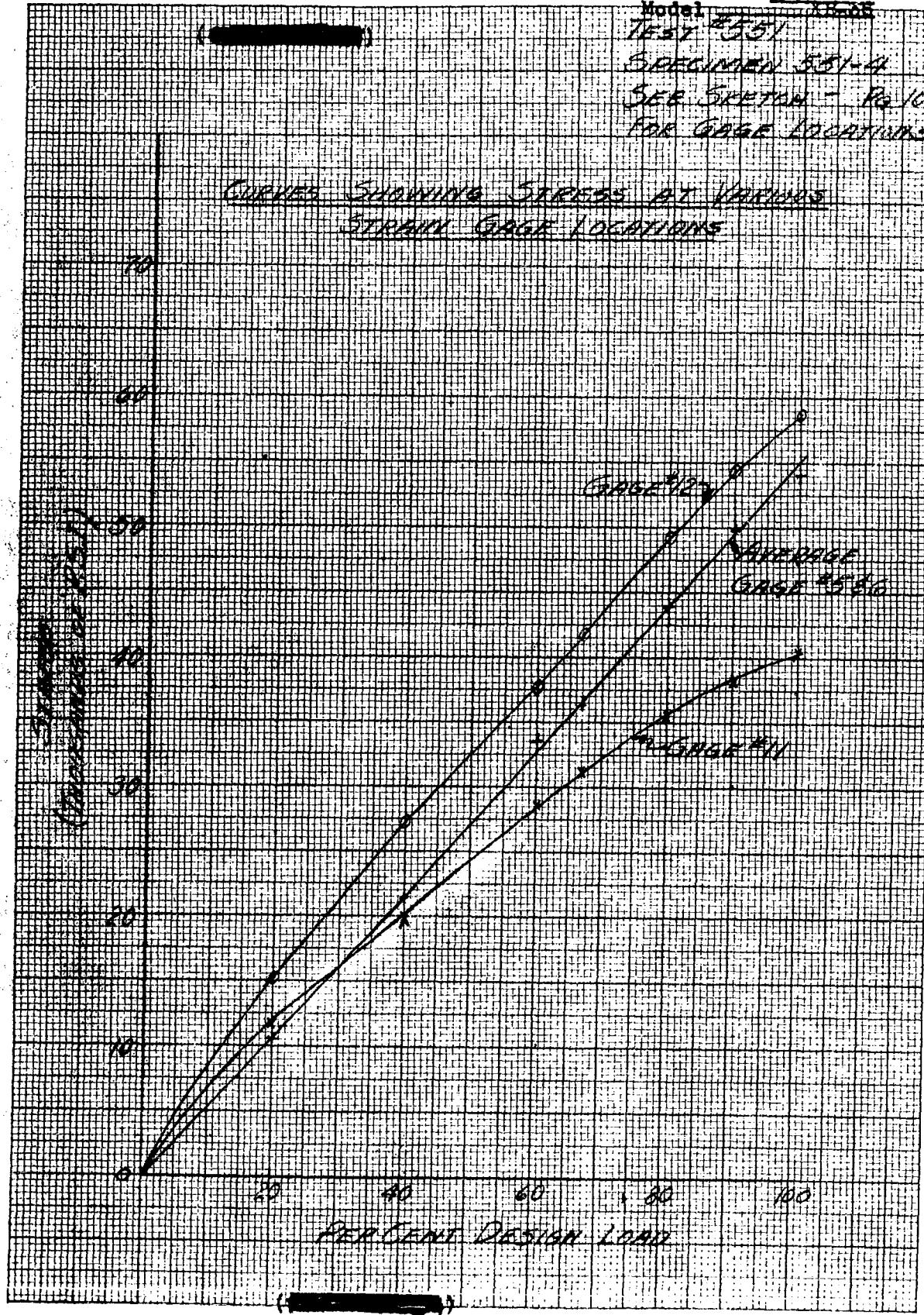
T-51 #551

SPECIMEN 551-4

SEE SECTION - Pg 10

FOR GAGE LOCATIONS

CURVES SHOWING STRENGTH AT VARIOUS
STRAIN GAUGE LOCATIONS

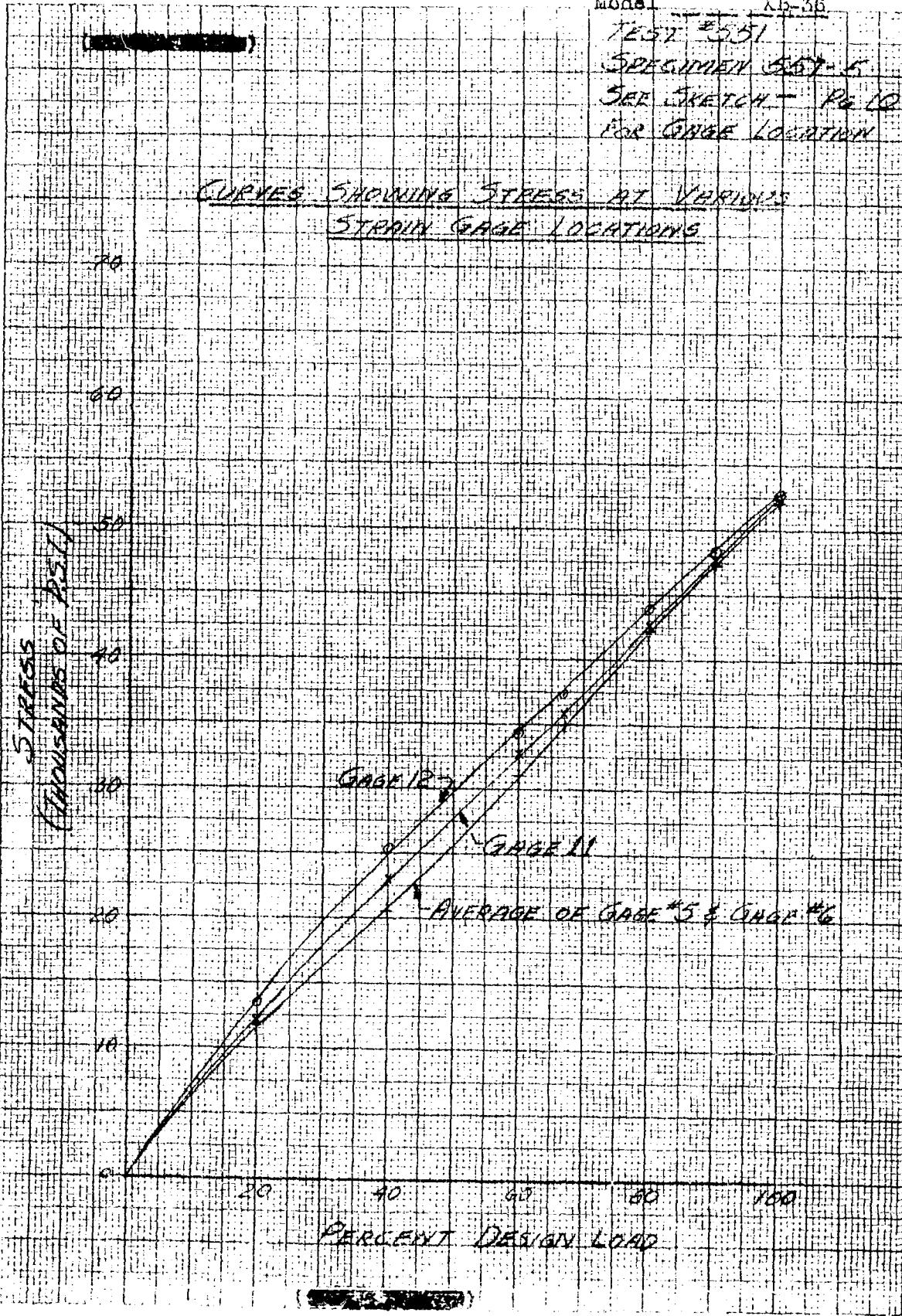


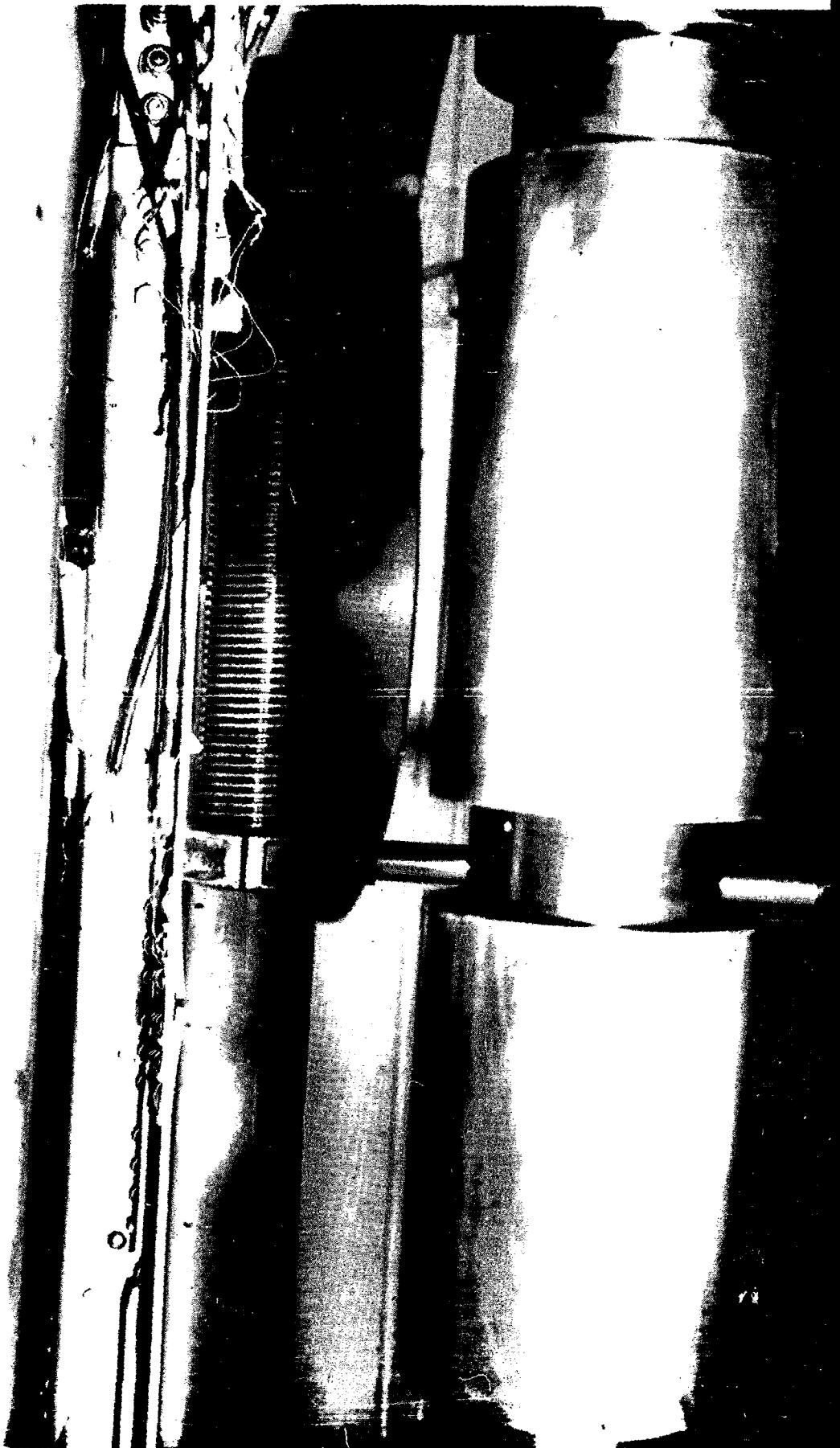
TEST #551

SPECIMEN A67-5

SEE SKETCH Pg 10
FOR GAGE LOCATION

CURVES SHOWING STRESS AT VARIOUS
STRAIN GAGE LOCATIONS





([REDACTED])

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PHOTOGRAPH NO. 114364

VIEW SHOWING BENDING OF SKIN AND DOUBLERS AT 100% D. L.

(SPECIMEN 551-1)

([REDACTED])

([REDACTED])

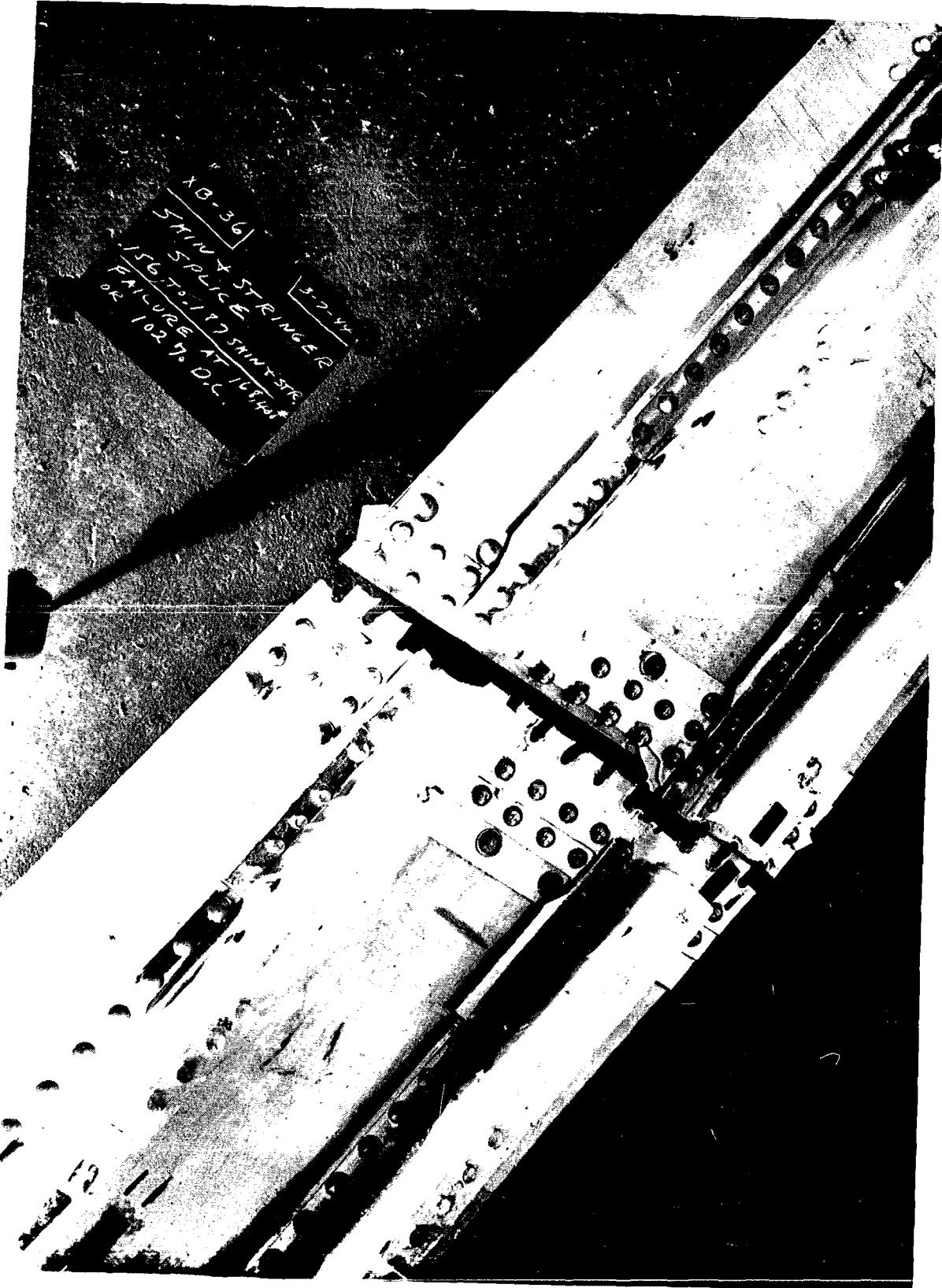
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PHOTOGRAPH NO. 114369

FRONT VIEW OF FAILURE (SPECIMEN 551-1)

([REDACTED])



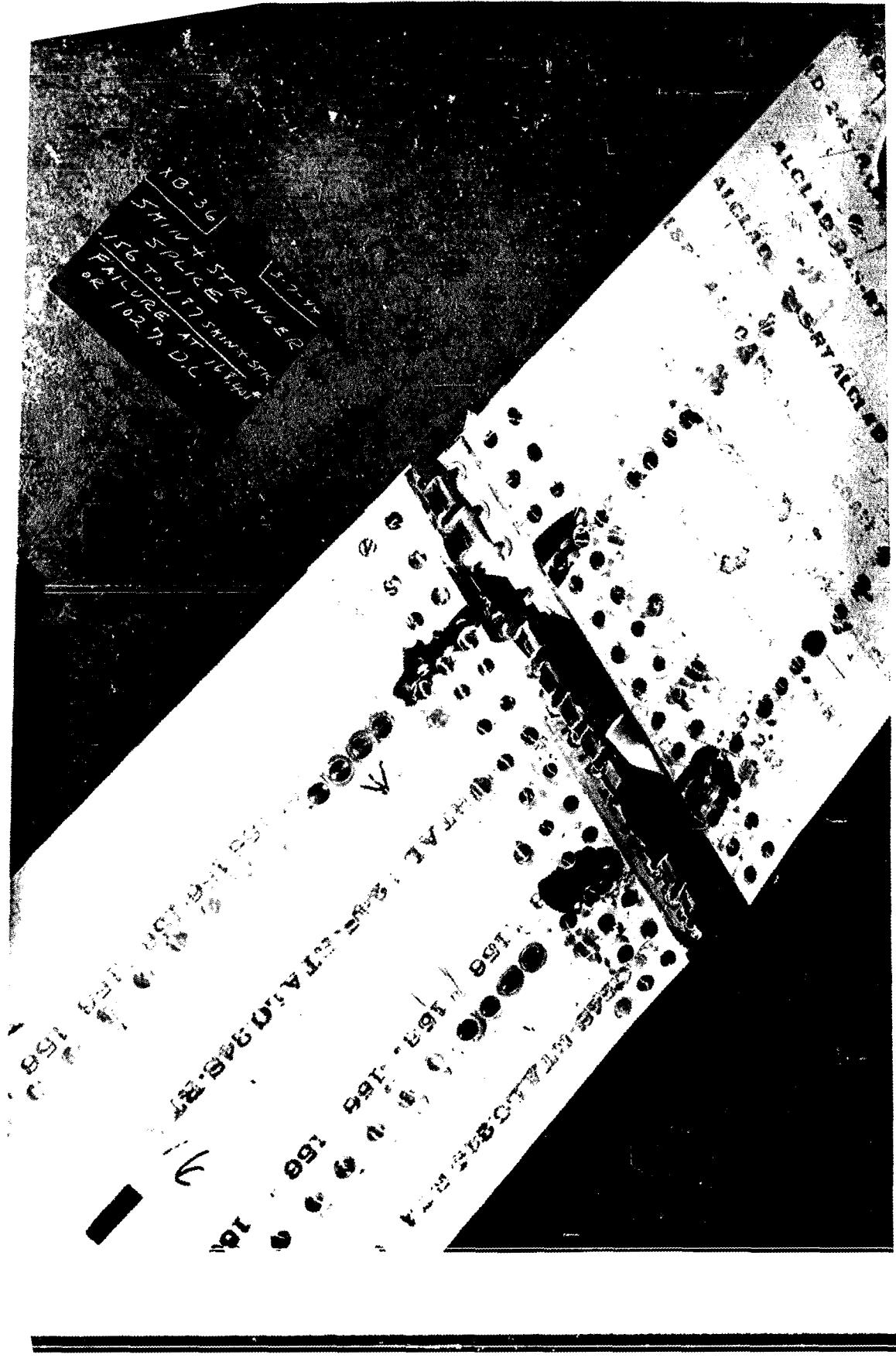
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PHOTOGRAPH NO. 114367

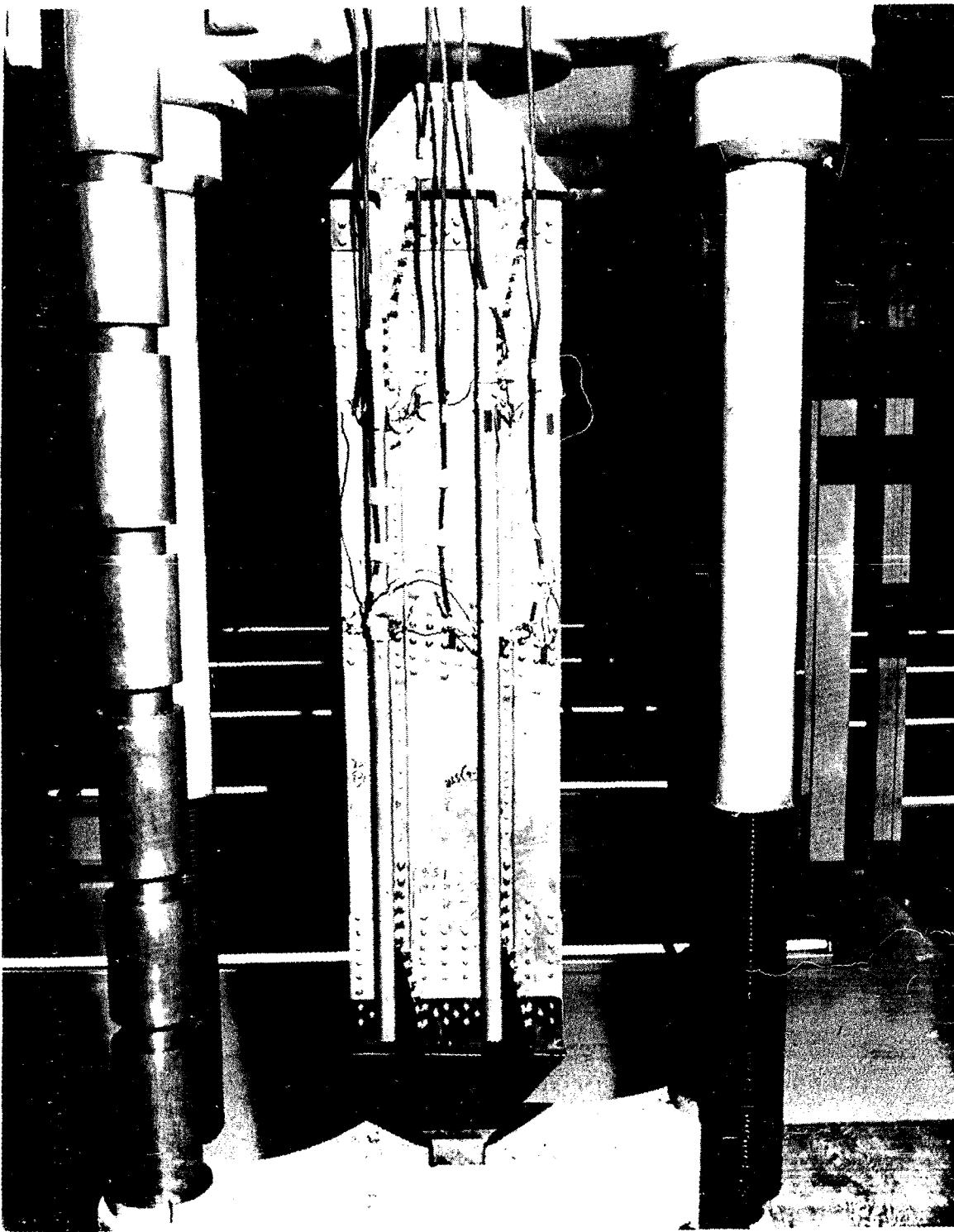
REAR VIEW OF FAILURE (SPECIMEN 551-1)



19. 12. 6
19. 12. 6
19. 12. 6

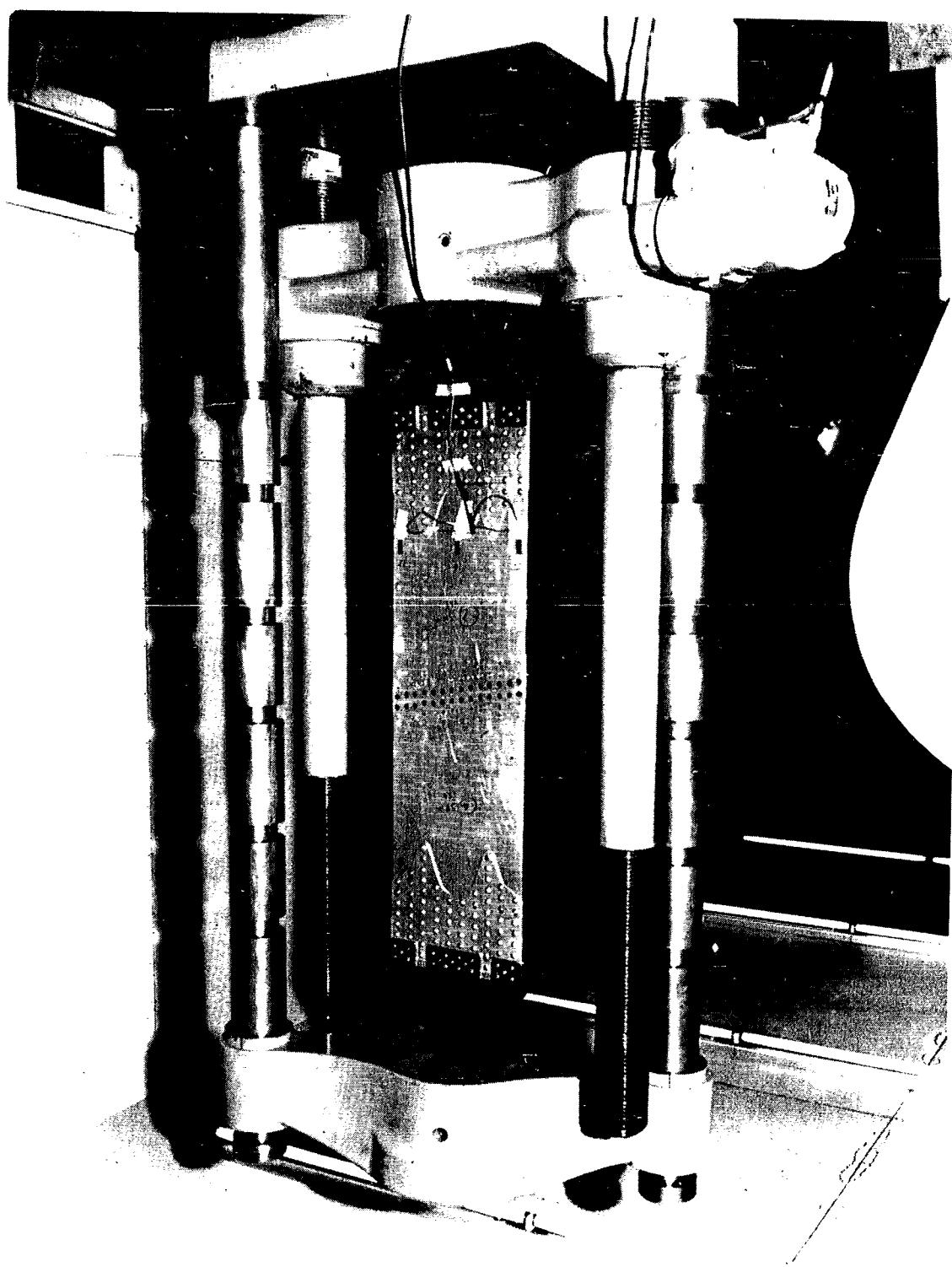
**Local People Regress
to Fear, 1943**

Call: P.M. 10:30 A.M. - 11:00 A.M. - 11:30 A.M. - 12:00 P.M. (8:14:2) TUE 200,000



TEST
NUMBER 13425
TEST
NUMBER 13426
TEST NUMBER 13427
TEST NUMBER 13428

PHOTOGRAPH NO. 13425
BLADE VIEW OF SKIN SECTION (SUBCIMIC 561-2) IN
TEST MACHINE



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PHOTOGRAPH NO. 114346

FRONT AND SIDE VIEW OF SKIN SPLITS (SPECIMEN SHOWS STRENGTH
FAILURE AND BENDING OF SKIN AND JOINTS)



(REDACTED)

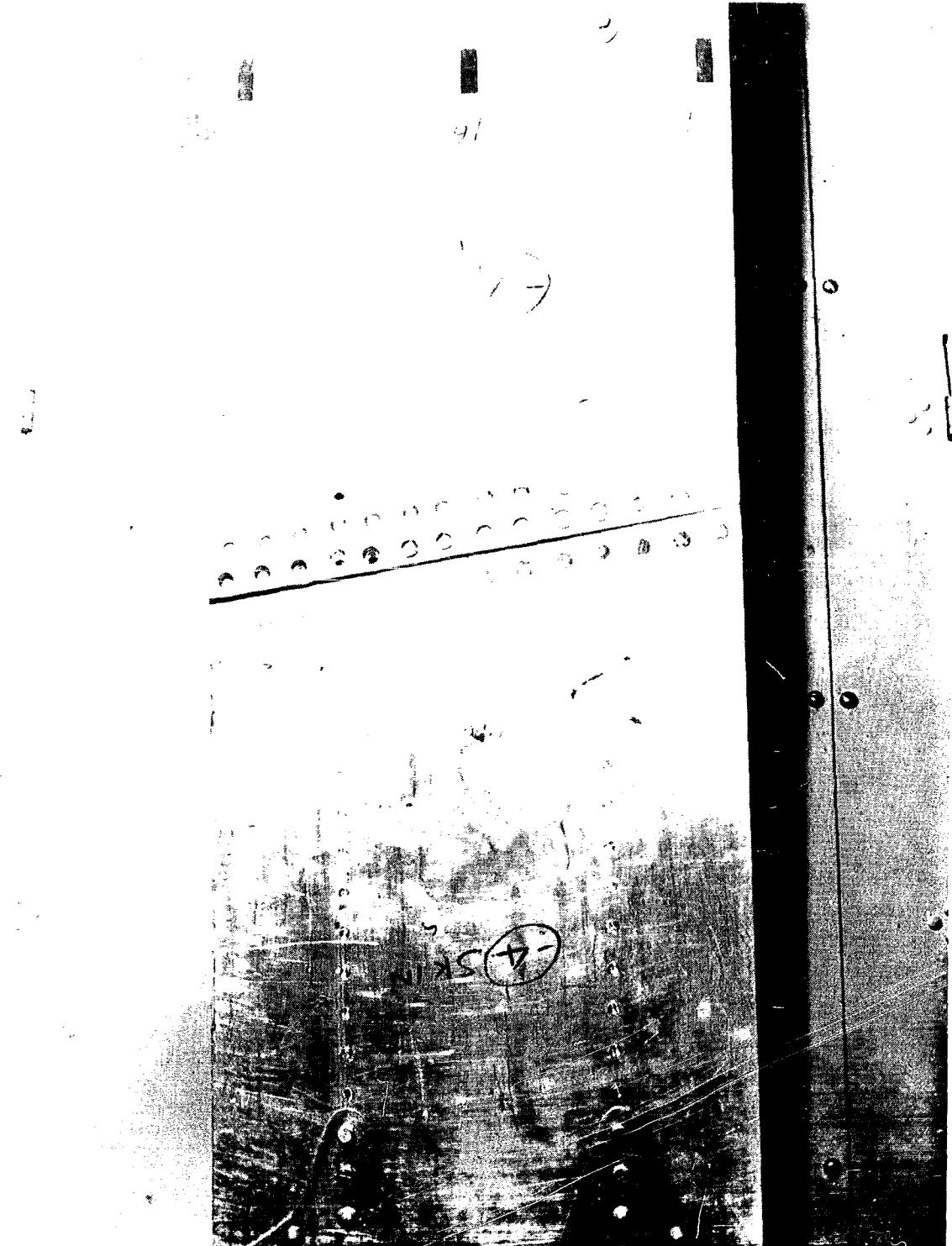
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PHOTOGRAPH NO. 114243

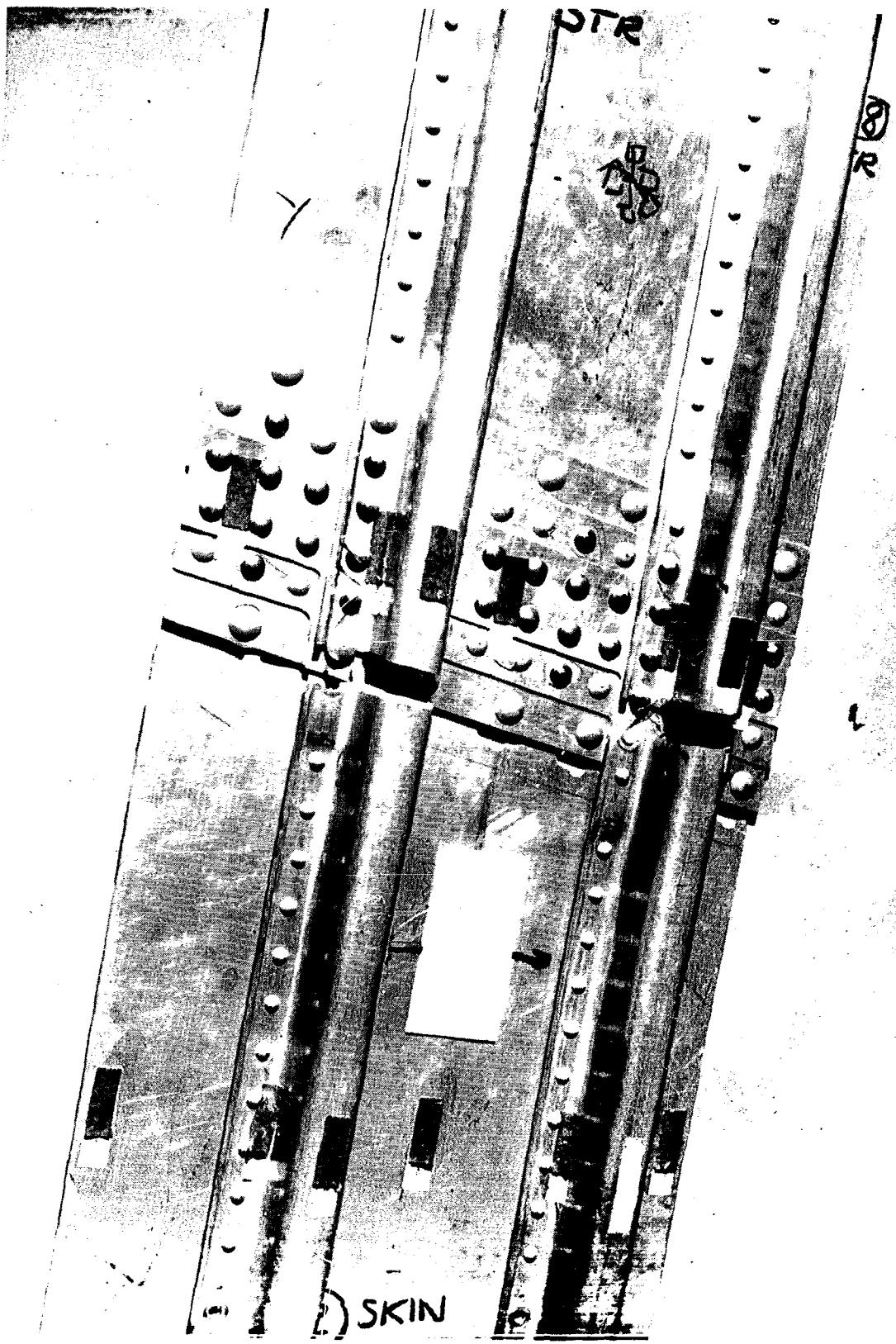
REAR VIEW OF SKIN SPLICE SPECIMEN (551-2) SHOWING
FAILURE OF SPLICE RIVETS

(REDACTED)



1963
1964
1965
1966

Port 100% losses
No. 1 for 10% loss



([REDACTED])

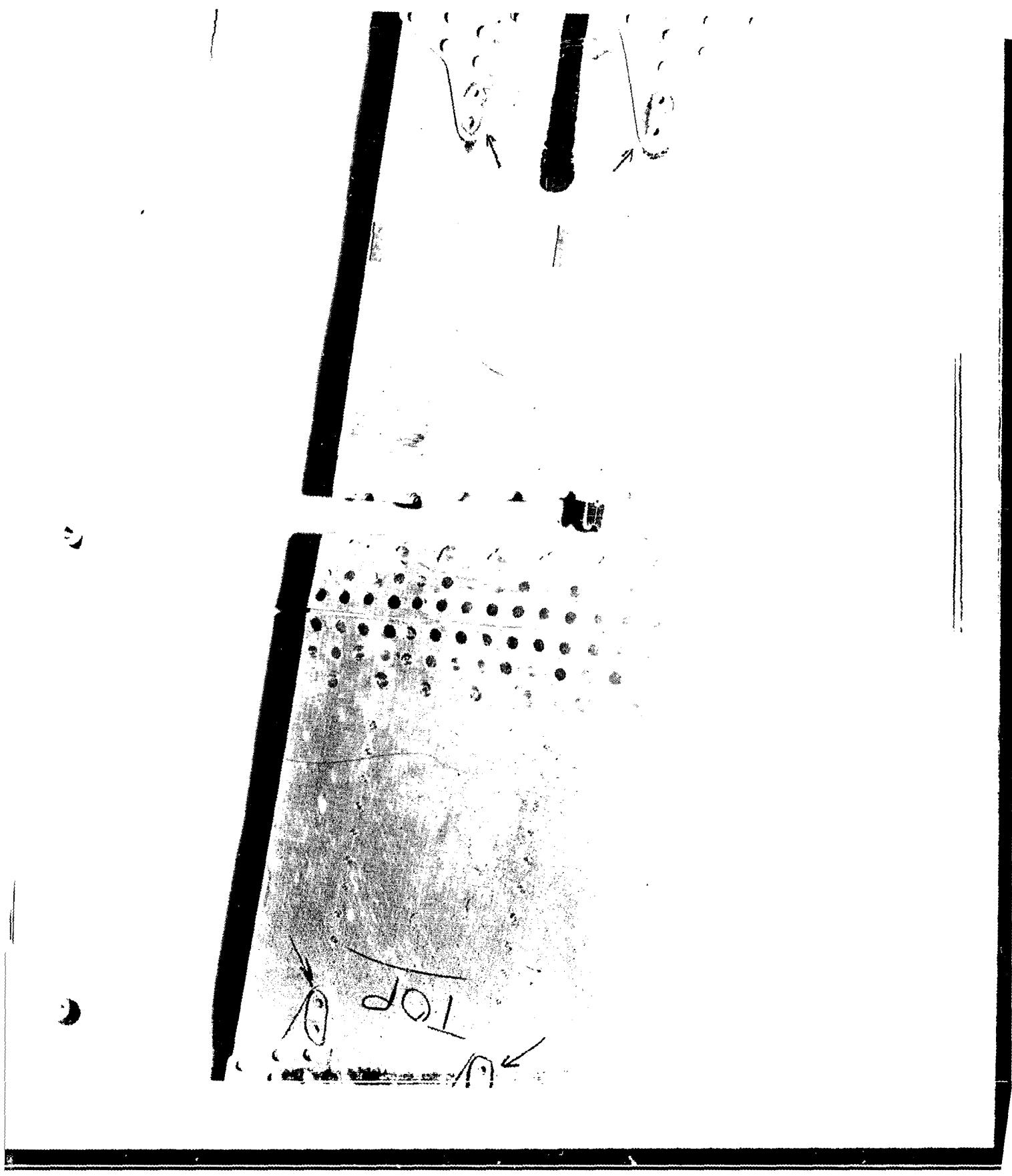
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PHOTOGRAPH NO. 114257

REAR VIEW OF FAILURE OF SKIN SPLICE (SPECIMEN 551-3)

([REDACTED])



([REDACTED])

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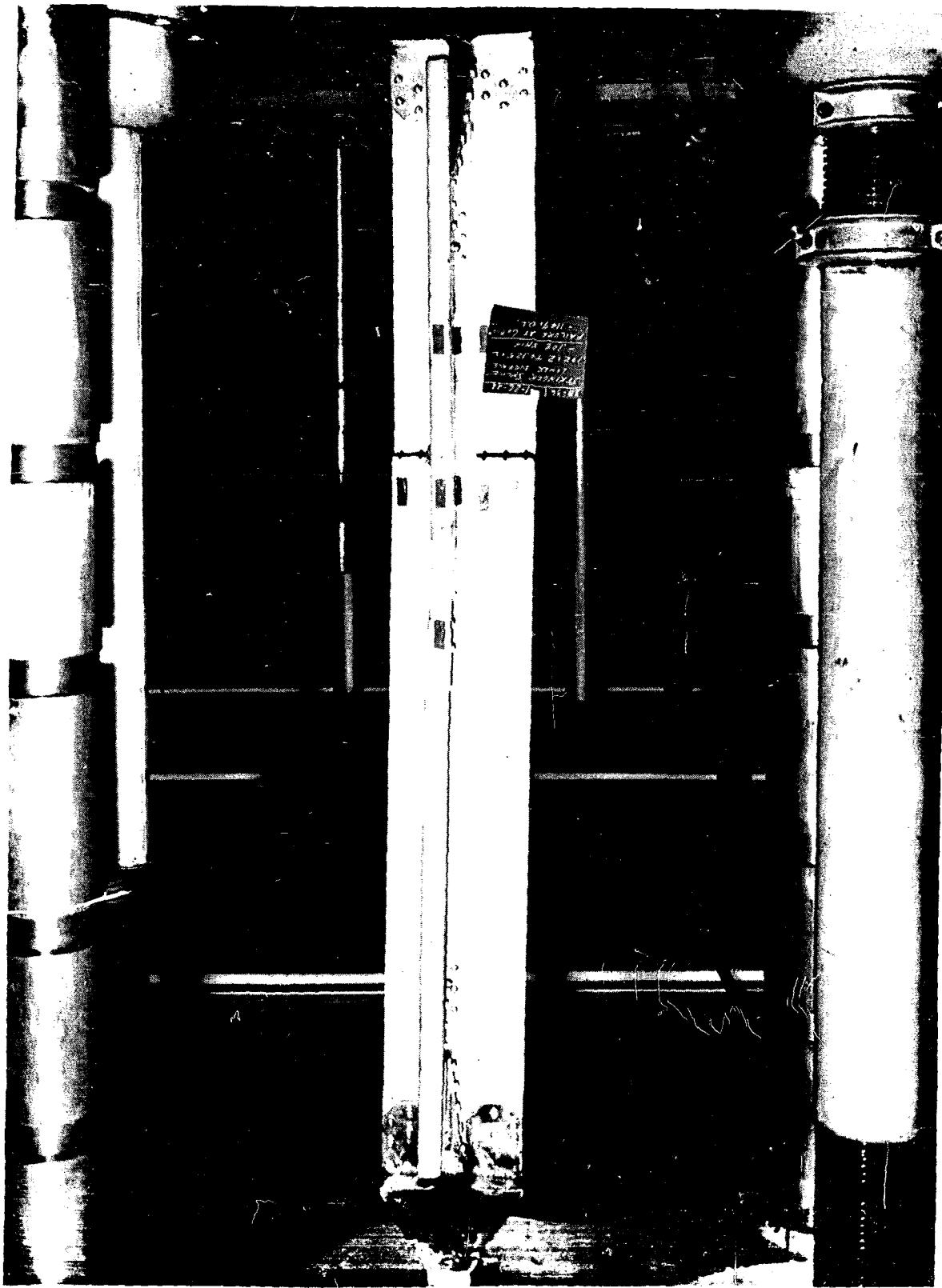
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PHOTOGRAPH NO. 114200

FRONT VIEW OF STRINGER SPLICE (SPECIMEN 551-4)

IN TEST MACHINE SHOWING FAILURE

([REDACTED])



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PHOTOGRAPH NO. 114201

CLOSEUP SHOWING FRONT AND SIDE VIEW OF STRINGER SPLICE.
(SPECIMEN 551-4) FAILURE

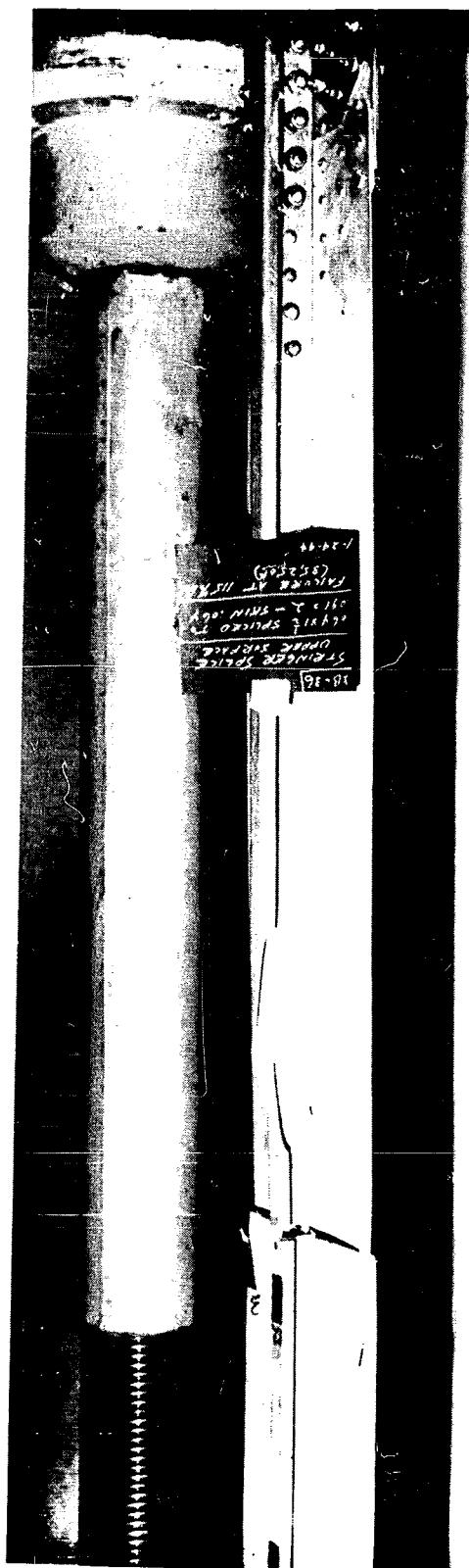
* 114% D.L.
FAILURE AT 60800
-.102 SHIN
.102x2 TO .125x2
LOWER SURFACE
STRINGER SPLICE
XB-36 | 1-26-44

114%
3

Box 6 North Report
No. 15-854-43

PHOTOGRAPH 134203
VIEW SHOWING GLUTU TUBE PARTS AND CLOTH SPICE
(EXCERPT FROM 15-854)





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PHOTOGRAPH NO. 114202

SIDE AND FRONT VIEW OF STRINGER SPLICE (SPECIMEN 551-5) SHOWING
FAILURE

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STRINGER AND SKIN SPLICE TESTS XB-36 OUTER WING,
LOWER SURFACE - FORT WORTH REPORT NO. FW-FSG 43

N. BARSH 5 MAY 44 28PP PHOTOS, DIAGRS, GRAPHS, DRWG

STRUCTURES (7) WINGS - STRUCTURAL TESTS
DESIGN AND DETAILS (3) B-36 - STRUCTURAL TESTS
B-36

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