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SST Technology Follow-On Program—Phase II

INTEGRALLY STIFFENED PANEL BIAXIAL COMPRESSION TESTS

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July 1973

FINAL REPORT

Task I

Prepared for

FEDERAL AVIATION ADMINISTRATION

Supersonic Transport Office
800 Independence Avenue, S.W.
Washington, D.C. 20590

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16. Abstract

This report presents the results of a structural test program to verify the structural integrity of biaxial compression panels designed for use on the wing of the U.S. SST prototype airplane.

The 28 test specimens are flat, integrally stiffened titanium panels. Four basic cross-section configurations were tested. Tests included uniaxial and biaxial compression with thermal effects from room temperature to 450° F.

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Stability	Biaxial compression	
Titanium		
Compression panels		

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PREFACE

This is one of a series of final reports on titanium structures technology submitted in fulfillment of task 1 of Department of Transportation contract DOT-FA-72WA-2893, dated 1 February 1972. This work was accomplished in support of the American SST prototype developmental program. The report was prepared by the Structures Technology–Stress Methods and Allowables organization of the Boeing Commercial Airplane Company, Seattle, Washington.

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FIGURES

TABLES

SYMBOLS

A	Stiffener area, $in.^2$
b_s	Stringer spacing, in.
D	Skin flexural stiffness, $Et_s^3/12\,(1-\nu^2)$, in.-lb
E_c	Young's compressive modulus, $lb/in.^2$
f_{cy}	Compressive yield stress, $lb/in.^2$
I	Stiffener moment of inertia about skin midplane, $in.^4$
ℓ	Panel effective length, in.
n_c	Ramberg-Osgood stress strain parameter
R	Stress ratio. Applied mechanical gross stress divided by the allowable mechanical gross stress at temperature condition.
$\overline{R}$	Stress ratio. Applied mechanical gross stress divided by the allowable mechanical gross stress at room temperature.
t_s	Skin thickness, in.
w	Panel width, in.
ν	Poisson's ratio

Subscripts

L	Longitudinal direction
T	Transverse direction

1.0 INTRODUCTION

The U.S.A. supersonic transport (SST) development program was aimed at producing two prototype aircraft which used titanium materials and advanced structural concepts in the airframe. This report comprises a DOT phase II effort to complete and document the structural development testing of the integrally stiffened titanium skin-stringer panel designs shown in figure 1. Typically, the panels were supported by uniformly spaced spars and ribs or intercostals at approximately 28 and 20 in., respectively. Structural temperatures to approximately 450° F were expected.

Review of analysis and test data indicated that:

- To adequately predict the ultimate panel loads, biaxial compression panel test data were needed.
- Test data were needed for thermal effects from room temperature to 450° F. As a result, particular attention was given to these requirements as the test program was developed.

In accordance with the phase II effort to continue development and testing in those areas of titanium technology where significant advancement could be achieved and where results would be of benefit to the aircraft industry and associated government agencies, the following objectives were established.

- Complete the manufacturing of 28 test specimens.
- Complete the biaxial compression test jig design and fabrication.
- Test the specimens biaxially and uniaxially, with some tests to include elevated or gradient temperature effects.
- Document the test results.

The resulting test data for 28 flat, integrally stiffened 6Al-4V titanium compression panels covering four basic cross-section configurations are reported here. The test panels include full panel and crippling panel specimens. Crippling panels are subjected to uniaxial compression at room temperature or 450° F. The 450° F represents an SST Mach 2.7 steady-state structural temperature flight condition at approximately 65,000 ft altitude. Full panels are subjected to uniaxial or biaxial compression at room temperature or with a thermal gradient. All panels tested with a thermal gradient are tested with the stringer flange at 320° F and the skin at 70° F. This thermal gradient condition represents a rapid descent from the Mach 2.7 steady-state flight condition.

2.0 TEST DESCRIPTION

2.1 SPECIMEN DESIGNS

Panel designations used throughout this document are defined by three characters. The first character is a Roman numeral indicating panel cross-section type: I, II, III, or IV. The second character is the letter C or F denoting a crippling or full panel. Character three defines by letter the panel number of the series. Hence, a IVF-B panel is the second type IV full panel.

Nominal dimensions of the four basic test specimen cross sections and panel sizes are shown in figures 2 through 5. As noted in figure 6, machined stringers are welded to unflanged integral stiffeners in the basic plate.

All specimens are fabricated from 6Al-4V titanium alloy. The final heat treat condition of each panel is 1B, which is a Boeing designation denoting an annealed and fast-cooled condition. The associated heat treatment is 1350° F for 2 to 4 hr with air cooling.

To enhance future analytical correlation studies, panel measured dimensions are given in appendix A. Similarly, measured material property data for the test panels are provided in appendix C.

2.2 TEST SETUPS

All panel tests were conducted in a 1200-kip-capacity Baldwin universal test machine, model BTE, serial number 040-1421. Similar to a conventional crippling panel test setup, the loading heads were lowered on flat-ended skin-stringers for all panels. As shown in figure 7, transverse loads for the full panel tests were applied by six servo-controlled hydraulic actuators, Miller model H66 (10 sq in. tension area). These actuators were electronically synchronized such that their transverse displacements provided the same loading effect as a single unit transverse loading head.

The brush loading concept shown in figure 7, similar to that developed in 1935 by Kjellman (ref. 1) and in 1969 by Kupfer, Hilsdorf, and Rusch (ref. 2), was developed to test the full panels. The purpose of this concept is to minimize the perpendicularly induced shear loads. A photograph of a typical transverse loading head brush assembly is shown in figure 8. The unsupported column length of these brushes is 4 in. Gaps between brushes in each brush assembly are 0.010 in. These brushes are in a 6.6-in.-long assembly with each brush made of 0.125- by 2-in. cold rolled steel strip. For the type III panels, special 5-in.-long transverse brush assemblies are used at the intercostals. Here the bushes are 0.125- by 4.5-in. mild steel. The longitudinal brushes are in a 14-in.-long assembly with each brush 0.19 by 3 in., 160-180 ksi, 4130 steel sheet.

Edge conditions at the panel sides are illustrated in figure 9. Normal restraints at the longitudinal load heads were provided to prohibit the stringers from kicking out in full panel

tests. These are illustrated in figure 10. Photographs of crippling and full panel test setups are shown in figures 11 and 12.

Loading flat-ended 40-in.-long panels provides an effective panel length of approximately 20 in. by causing inflection points at the panel quarter points. To simulate the rib effect of no transverse relative motion of the stringers, the free flange cross ties illustrated in figures 13 through 15 were provided for the type IF, IIF, and IVF panels at the inflection points. The cross ties are designed to be soft for panel normal relative deflections between stringers. A link which also does not prohibit panel normal deflections is used to anchor the ties. The link load during testing was negligible. Due to the intercostals on the type IIIF panels, a cross tie was not needed.

Thermal gradient conditions are achieved by using heating pads on the stringer free flanges. Elevated temperature steady-state conditions are obtained with the use of radiant heat lamps.

2.3 INSTRUMENTATION

Typical instrumentation is shown in figure 16. Exact gage locations and readings are defined in the appendixes. Strain gages were installed on all full panels and on most crippling panels. Photostress was applied to the skin side of some crippling panels. Thermocouples were attached to the elevated temperature and thermal gradient panels to monitor skin and stringer temperatures and to control radiant heat lamps or heating pads. Full panels were instrumented with electronic deflection indicators (EDIs) to measure panel normal deflections. A Wiedemann-Baldwin PD-1M deflectometer in conjunction with an MD-2B recorder was used to obtain load versus head travel data for all panels.

2.4 TEST PROCEDURE

The panels were installed and aligned in the test fixture. All gages were set to zero. Uniform bearing from the load heads was provided by shimming. When required, heat was applied by radiant heat lamps for the crippling panels at zero load or by heating pads for the full panels at a 40-kip longitudinal load. At test temperature, static loads were applied incrementally to permit data collection. Full panels which exhibited little or no visual permanent deformations and minimal permanent strain after ultimate load were retested to establish another biaxial test point.

3.0 TEST RESULTS

Measured dimensions, strains, normal displacements, temperatures, and material coupon data are provided in the appendixes.

3.1 ULTIMATE LOADS AND TEST TEMPERATURES

A tabulated summary showing ultimate loads, gross stresses, and test temperatures is presented in table 1. The ultimate loads given are the maximum biaxial compression loads for the panel.

3.2 FAILURE REMARKS

Crippling panel postfailure photographs are shown in figures 17 through 19. For the IC and IIIC panels, ultimate load coincided closely with buckling of the skin between all stringers. Ultimate load for the IVC panels occurred when the skin buckle, between the side restraint and the tab stiffener, progressed through the tab and on across the panel.

Full panel postfailure photographs are shown in figures 20 through 23. All IF, IIIF, and IVF panels reached ultimate load in a biaxial bending mode (general instability), similar to an unstiffened plate in compression. Some of these panels also had local buckling. At ultimate load, the IVF-E panel was in the second general instability mode with two half wavelengths in the transverse direction. The IIF panels appeared to reach ultimate load in a local mode with the skin buckling between stringers.

3.3 STRESS RATIO DATA

The close relationship of the test data from each full panel type to a particular interaction curve is illustrated in figures 24 through 26. As shown, two types of stress ratios, $\bar{R}$ and R, based on the allowable mechanical gross stress at room temperature and temperature condition, respectively, are used.

Comparison in figure 27 of the panel test points to the interaction curve (ref. 3) of unstiffened panels demonstrates the significant effect of the stiffener on the shape of the curve. Hence, the stiffener-to-skin stiffness ratio (EI/Db_s) effect should be evaluated in analysis and design applications.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The results of tests on integrally stiffened 6Al-4V titanium compression panels in this report include crippling specimens and full-length panels. The crippling specimens were loaded in uniaxial compression at room temperature or 450° F. The full-length panels were loaded in uniaxial or biaxial compression at room temperature or with a thermal gradient.

It is recommended that these data be used in establishing the validity of existing analytical methods or in the development of new methods. Of particular interest is the close agreement the biaxial test data exhibit to the interaction curve

$$R_L^{1.5} + R_T^2 = 1.0.$$

In addition, the test data can be used as direct verification of actual design hardware within the range of the test specimens.

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2. Kupfer, H., Hilsdorf, H., and Rusch, H., "Behavior of Concrete Under Biaxial Stresses," *ACI Journal*, August 1969.

3. Johnson, J. H., "Critical Buckling Stresses of Simply Supported Flat Rectangular Plates Under Combined Longitudinal Compression, Transverse Compression, and Shear," *Journal of the Aeronautical Sciences*, Vol. 21, No. 6, pp. 411-416, June 1954.

TABLE 1.–ULTIMATE LOADS, STRESSES, AND TEST TEMPERATURES

Panel	Loads		Gross stresses[a]		Nominal temperature (°F)
	Longitudinal (kip)	Transverse (kip)	Longitudinal (ksi)	Transverse (ksi)	
IC-A	894	0	110.5	0	70
IC-B	927	0	114.8	0	70
IC-C	900	0	111.3	0	70
IC-D	639	0	79.2	0	450
IC-E	616	0	76.4	0	450
IC-F	634	0	78.6	0	450
IF-A	688	0	85.1	0	70
IF-B	58.8	184.2	7.28	18.3	70
IF-B	300	145.8	37.1	14.5	70
IF-C	625	61.8	78.0	6.16	70
IF-D	628	120.3	76.7	11.75	70
IF-E	520	77.1	63.2	7.51	Gradient[b]
IF-F	510[c]	99.9	62.8	9.83	Gradient
IF-F	499	115.8	61.6	11.4	Gradient
IIF-A	250	0	99.6	C	70
IIF-B	240	0	95.7	0	70
IIIC-A	731	0	114.0	0	70
IIIC-B	707	0	110.1	0	70
IIIC-C	722	0	112.4	0	70
IIIF-A	515.5	10.8	79.3	1.18	70
IIIF-B	449.5	237.0	69.0	25.7	70
IIIF-B	180[d]	404.0	29.3	43.9	70
IIIF-C	51	473.7[e]	7.88	52.1	70
IVC-A	825	0	129.0	0	70
IVC-B	825	0	129.0	0	70
IVC-C	815	0	127.5	0	70
IVF-A	361	58.2	55.4	7.6	70
IVF-B	232	92.7	36.2	12.2	70
IVF-B	392	0	61.0	0	70
IVF-C	42	124.2	6.5	16.2	Gradient[b]
IVF-C	366	0	56.6	0	Gradient
IVF-D	42	117.9	6.72	16.0	70
IVF-D	310[f]	49.8	49.5	6.75	Gradient
IVF-D	333	24.9	53.2	3.38	Gradient
IVF-E	236	115.8	36.9	15.25	Gradient
IVF-E	346	0	54.3	0	Gradient

[a]Stresses based on loads divided by measured areas for the IF, IIIF, and IVF panels. All other stresses based on loads divided by nominal areas. Intercostal attached flange area on IIIF panels is neglected.

[b]Skin at 70° F, flange at 320° F.

[c]Estimated–panel reached 500 kip and was very near ultimate.

[d]Flanges at longitudinal load head had visual local deformations prior to the start of this test point.

[e]Posttest inspection indicated that normal restraints at longitudinal load heads on one side stringer probably failed prior to ultimate load.

[f]Estimated–panel reached 302 kips and was very near ultimate.

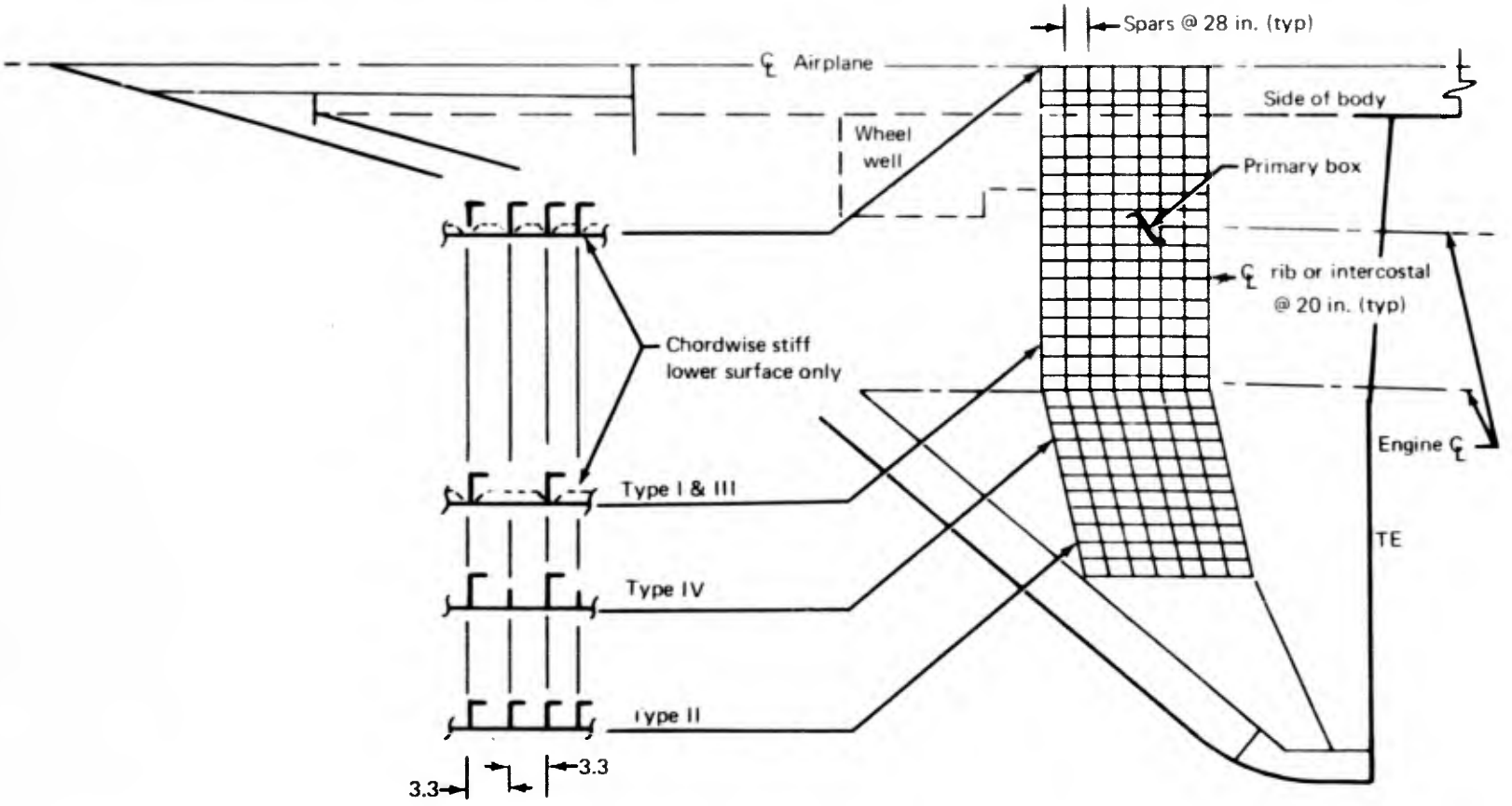


FIGURE 1.–SST WING BOX

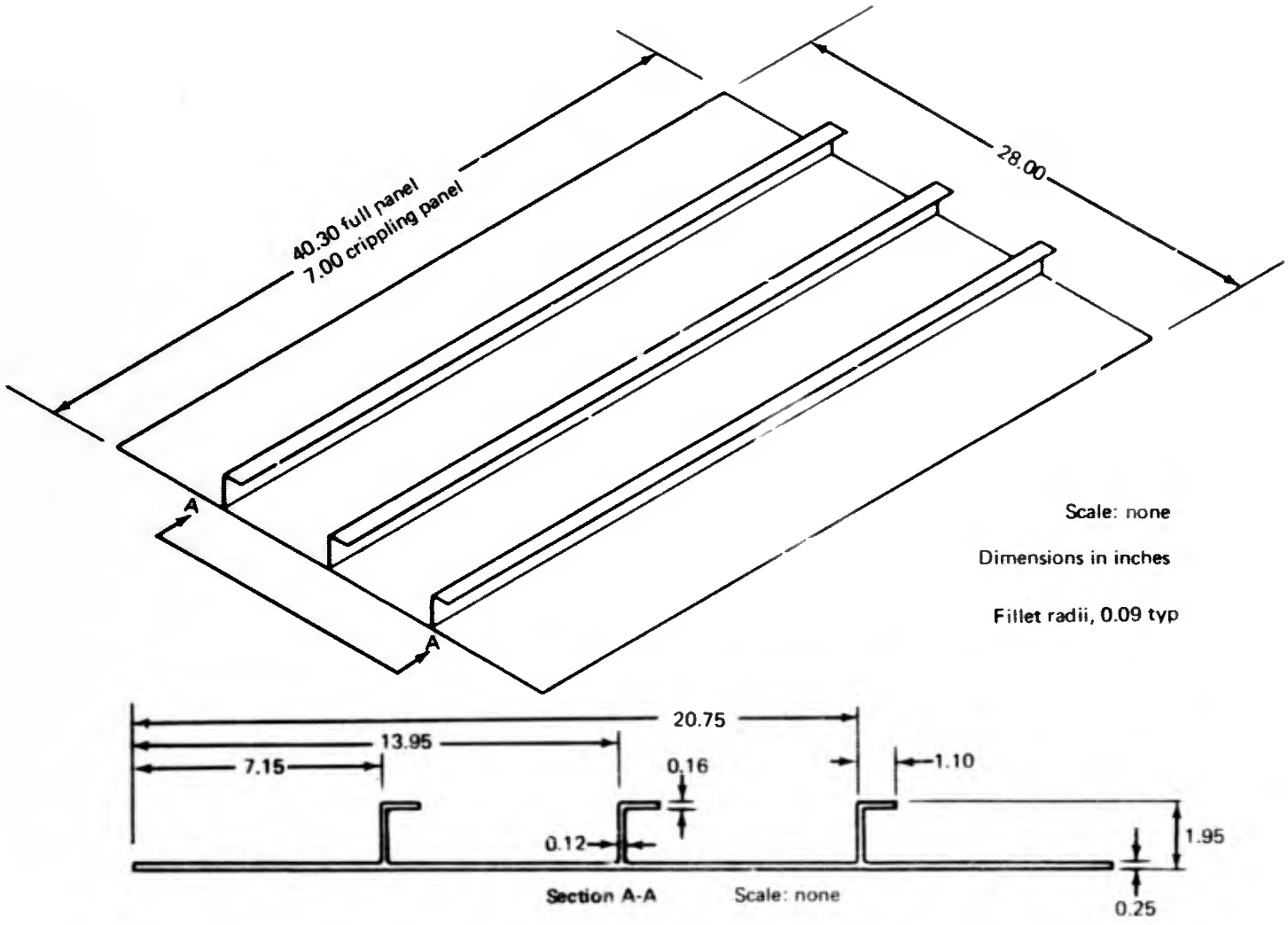
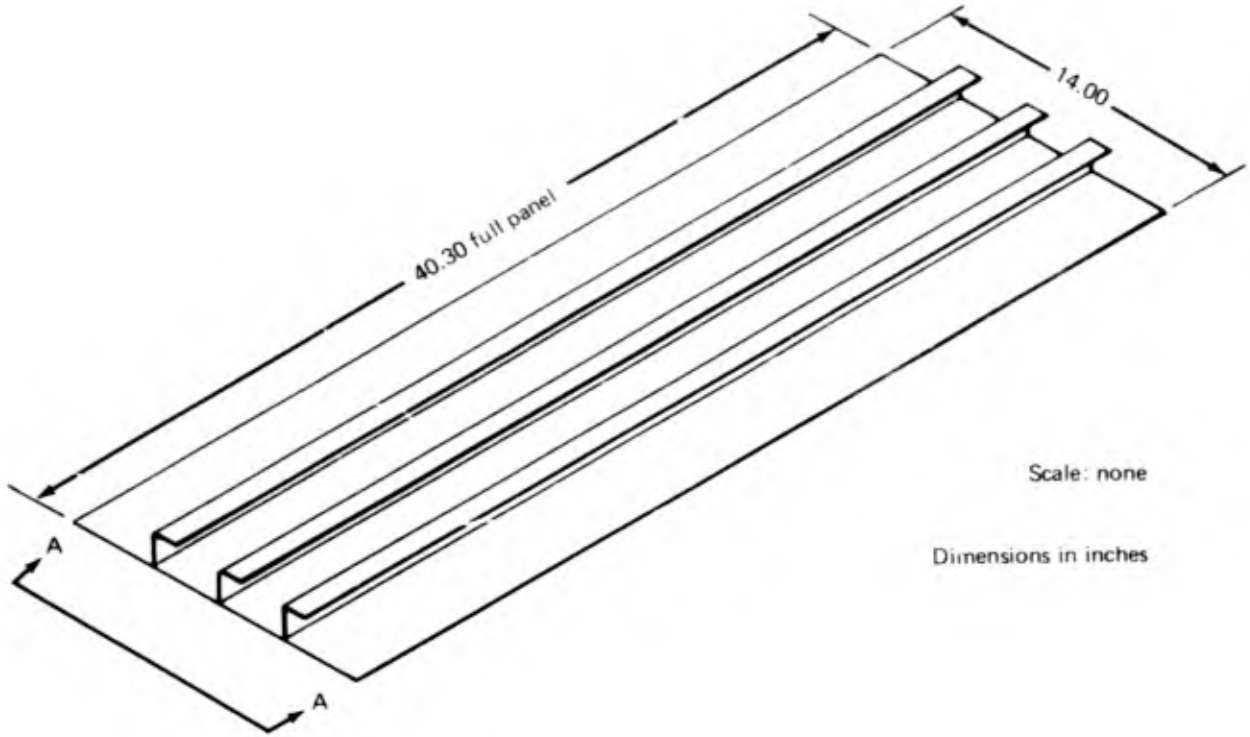


FIGURE 2.–NOMINAL DIMENSIONS FOR TYPE I PANELS



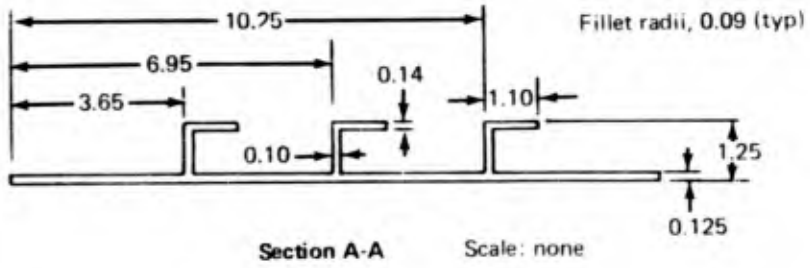


FIGURE 3.—NOMINAL DIMENSIONS FOR TYPE II PANELS

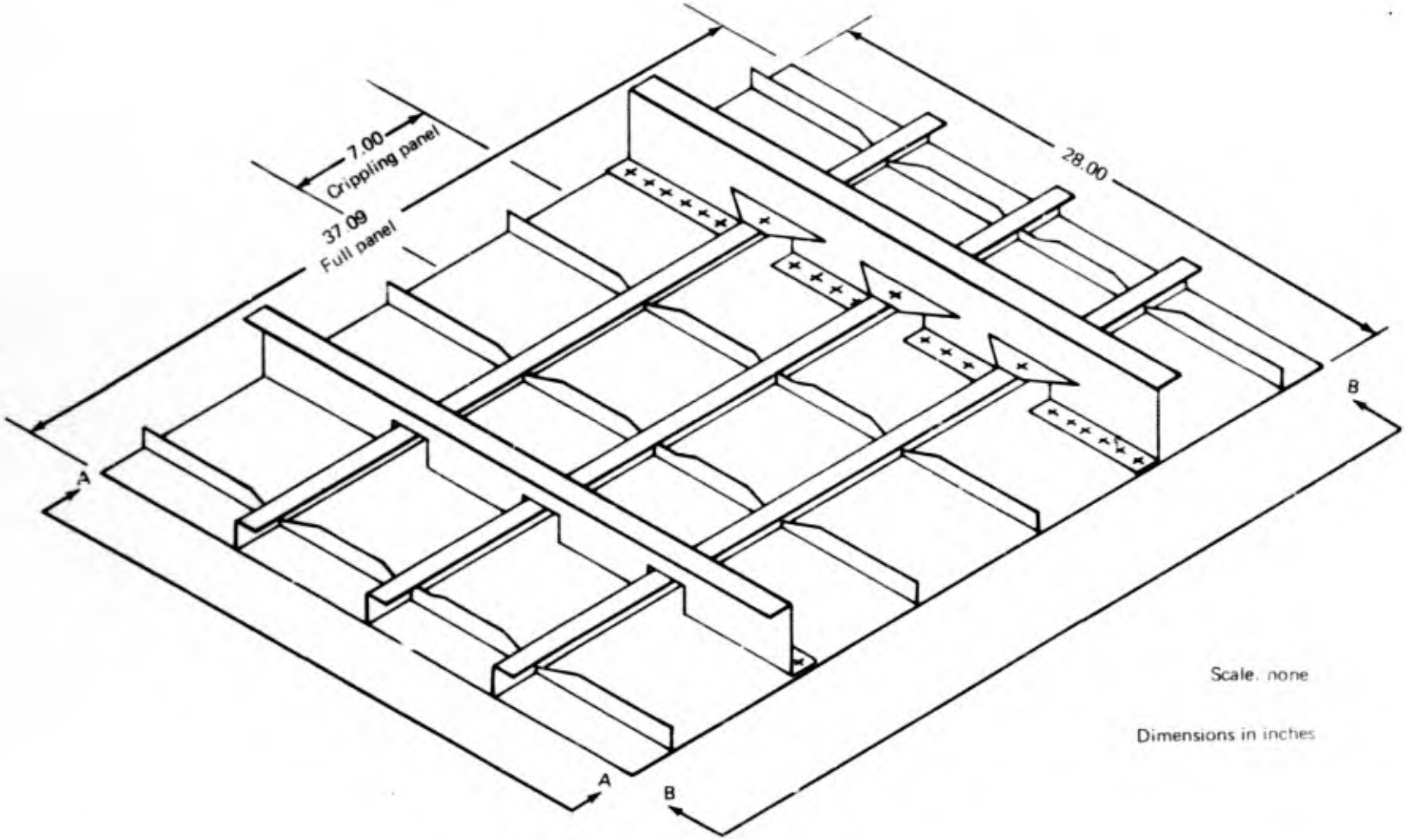


FIGURE 4a.—NOMINAL DIMENSIONS FOR TYPE III PANELS

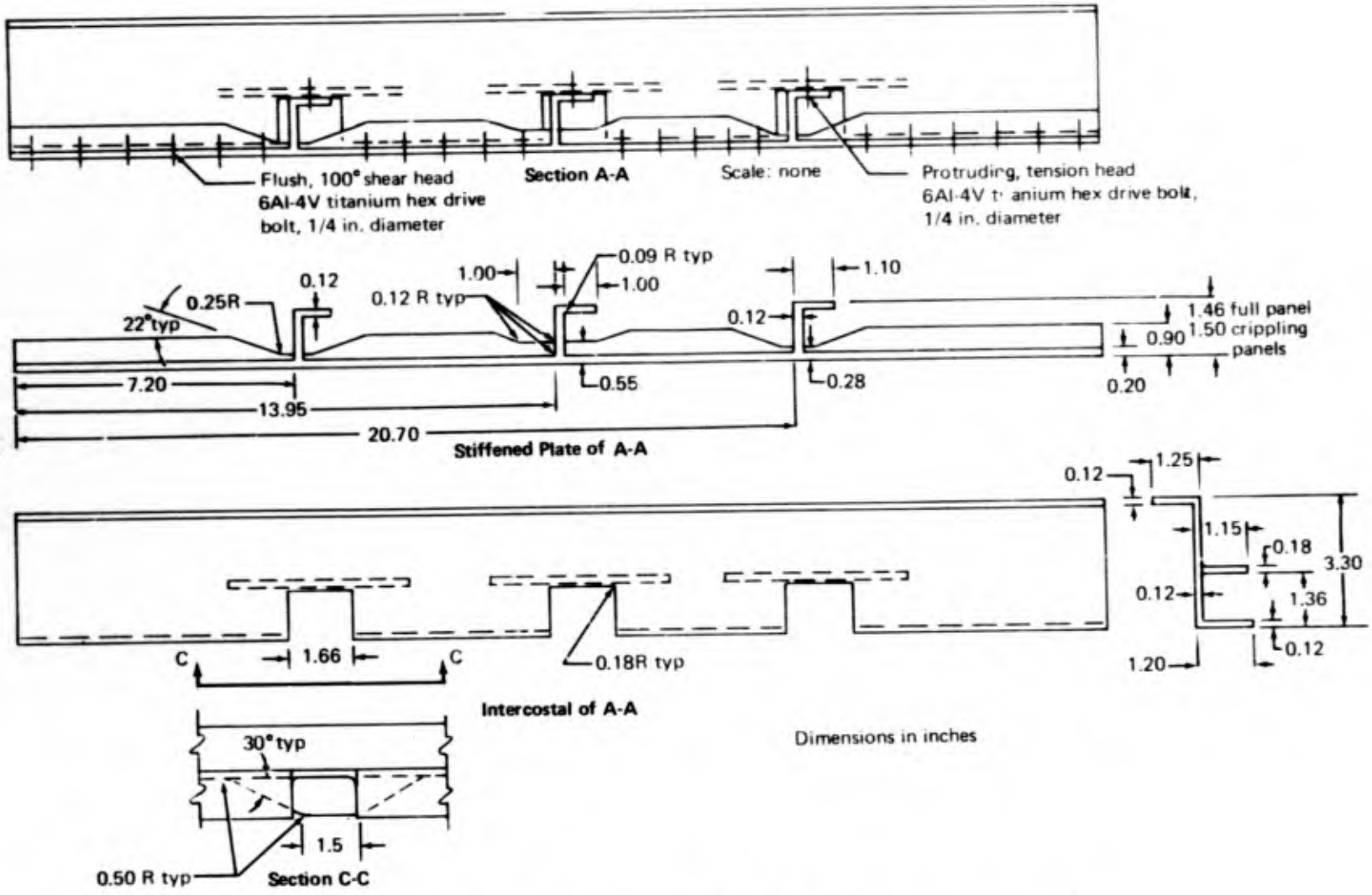


FIGURE 4b.–NOMINAL DIMENSIONS FOR TYPE III PANELS (CONTINUED)

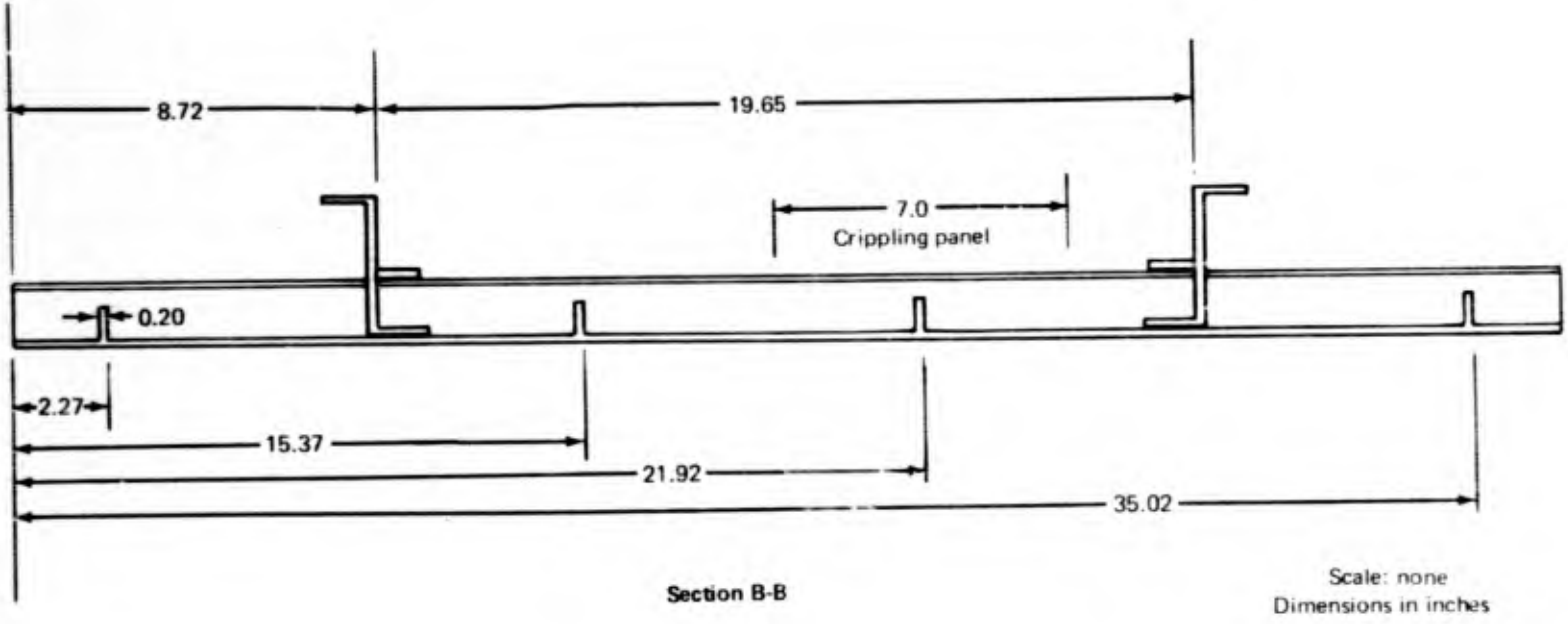


FIGURE 4c.–NOMINAL DIMENSIONS FOR TYPE III PANELS (CONCLUDED)

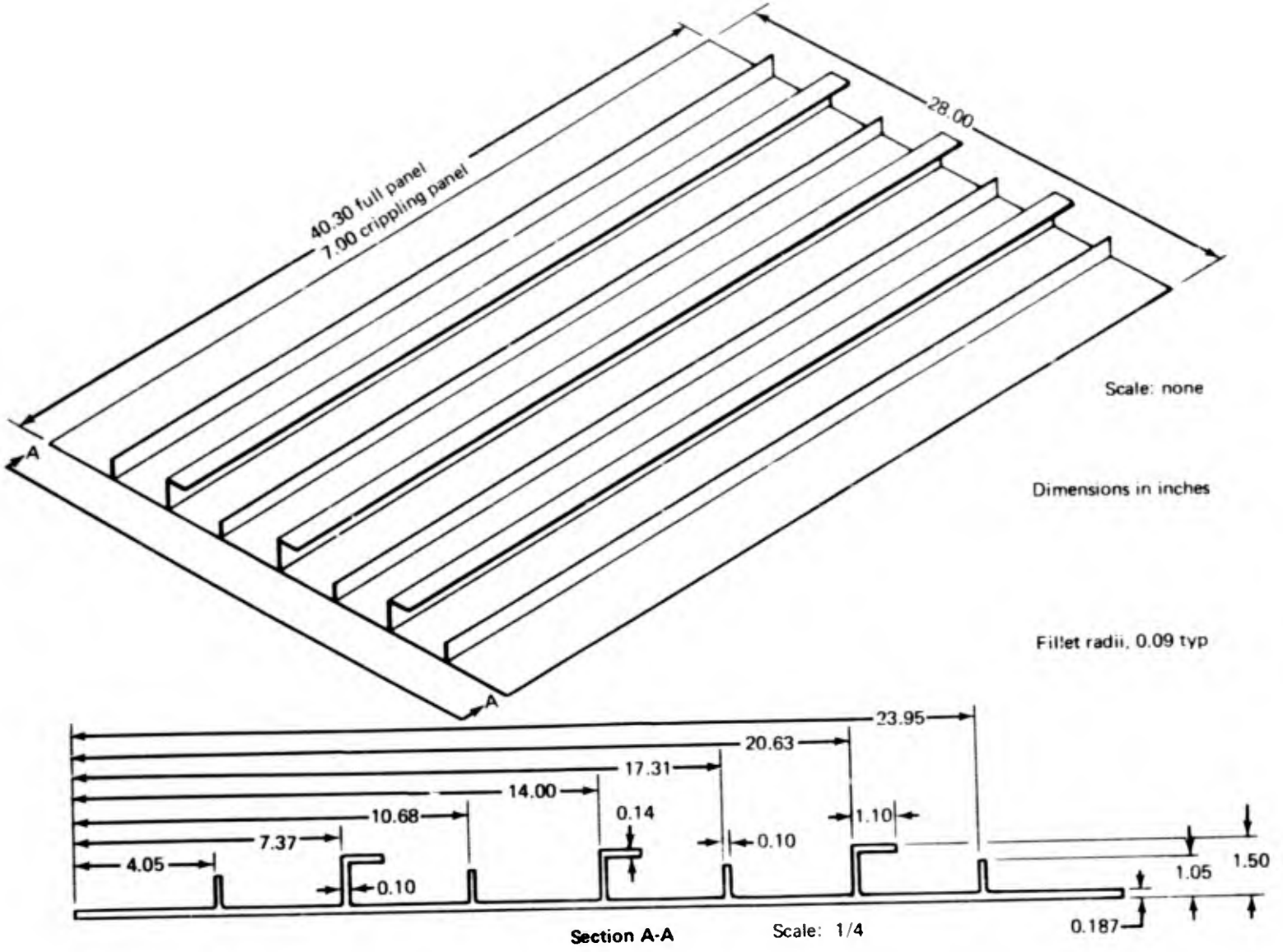


FIGURE 5.–NOMINAL DIMENSIONS FOR TYPE IV PANELS

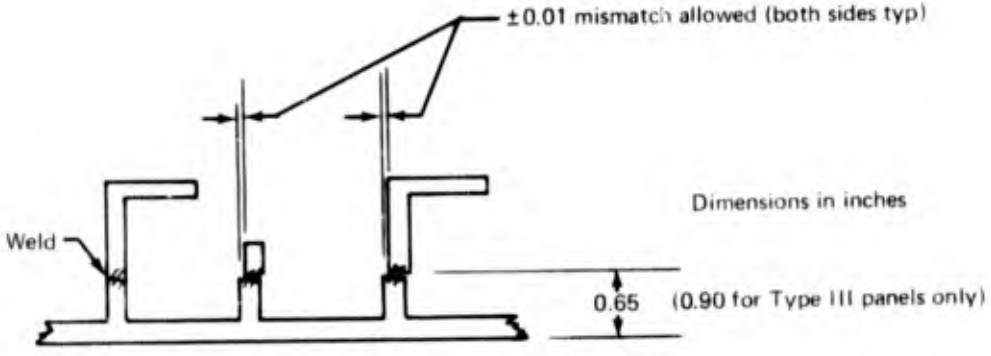


FIGURE 6.–PANEL WELD LOCATIONS

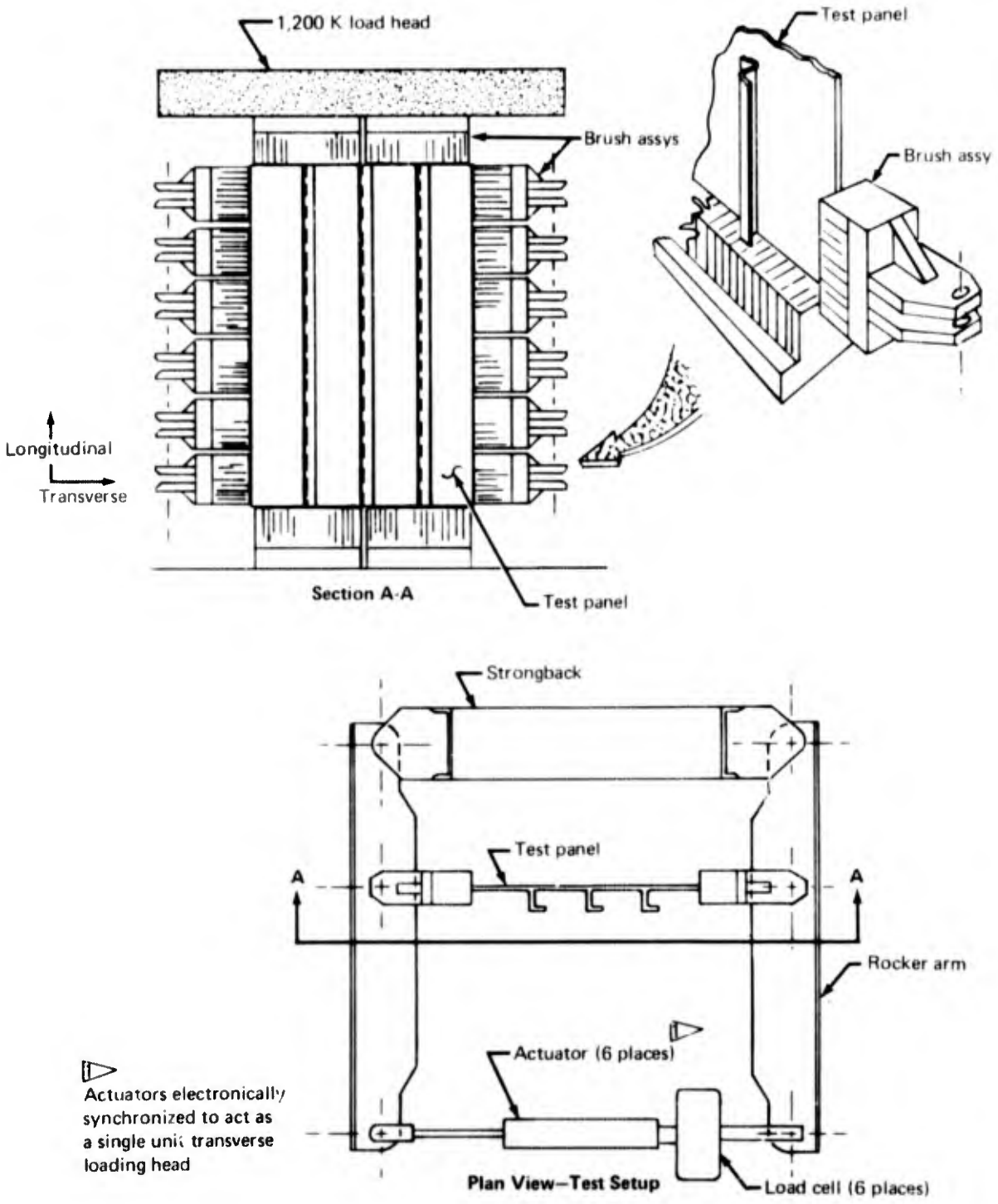


FIGURE 7.–BIAXIAL TEST JIG FOR FULL PANELS

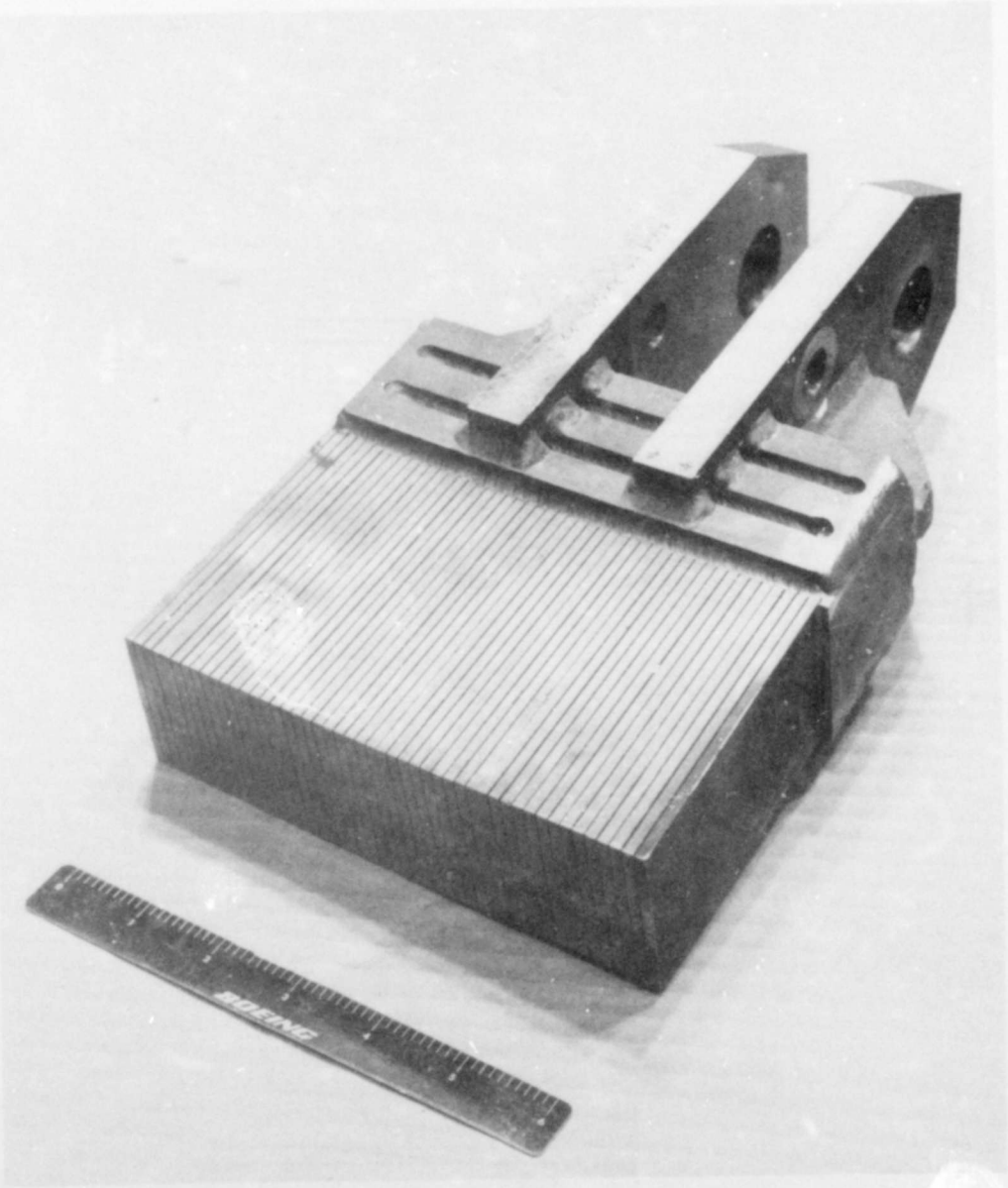
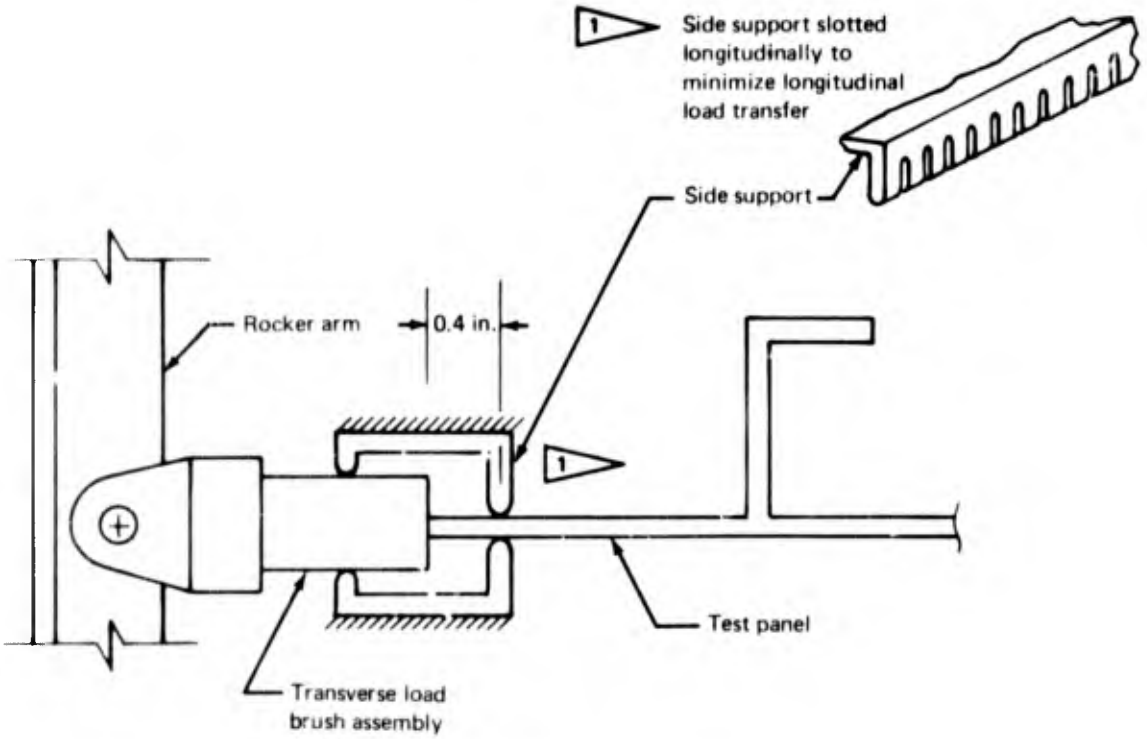
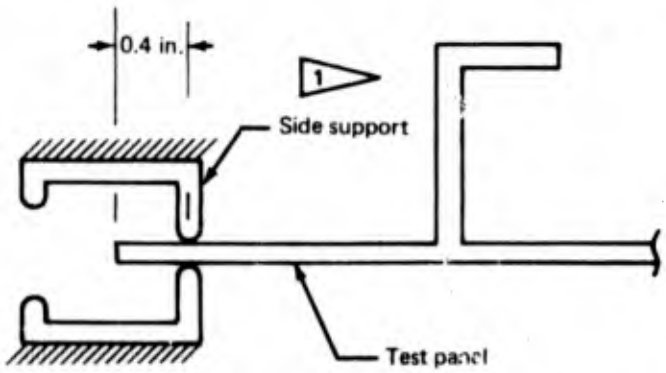


FIGURE 8.–TRANSVERSE LOAD BRUSH ASSEMBLY USED ON FULL PANELS



Typical Side—Full Panel



Typical Side—Crippling Panel

FIGURE 9.—EDGE CONDITIONS AT PANEL SIDES

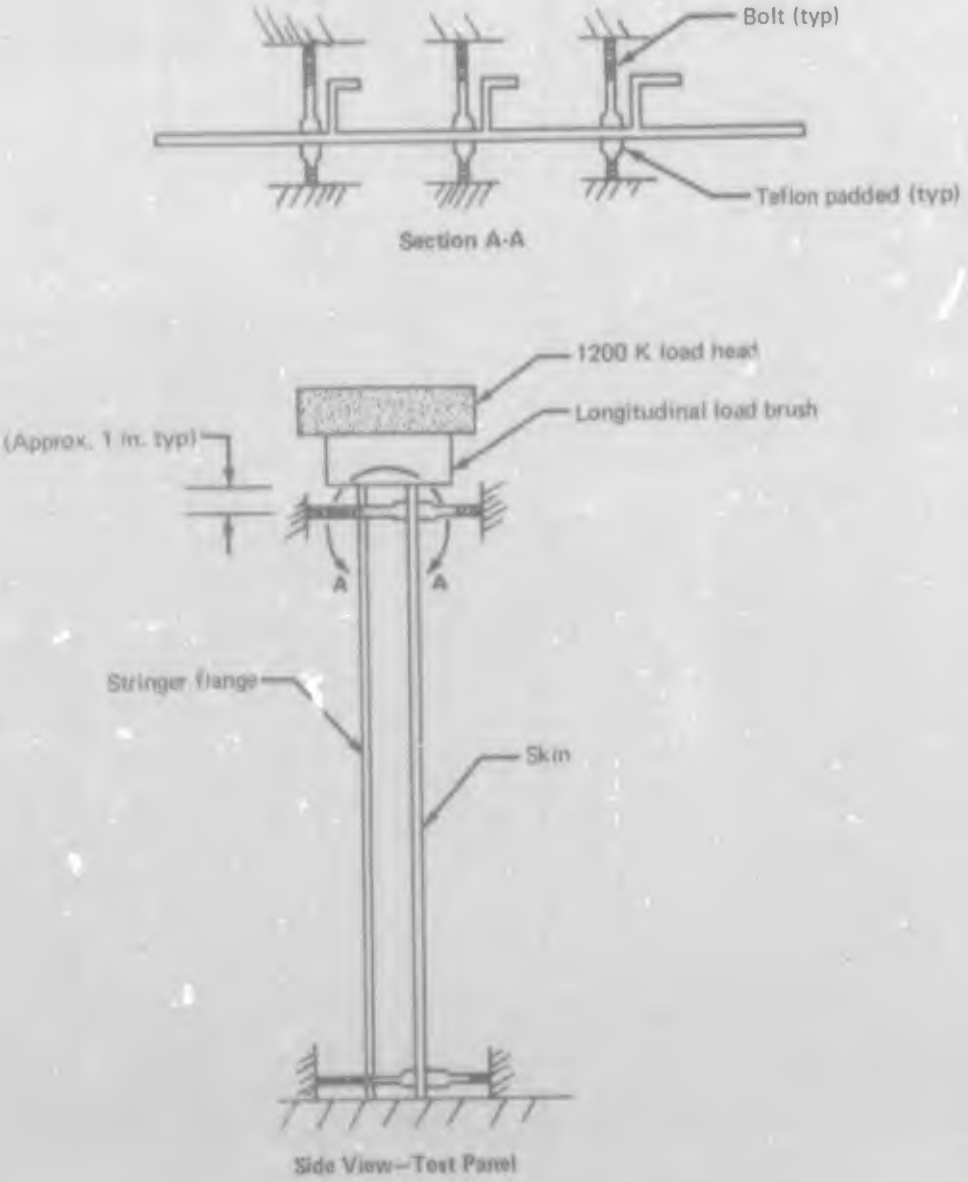


FIGURE 10.—NORMAL RESTRAINTS AT LONGITUDINAL LOAD HEADS

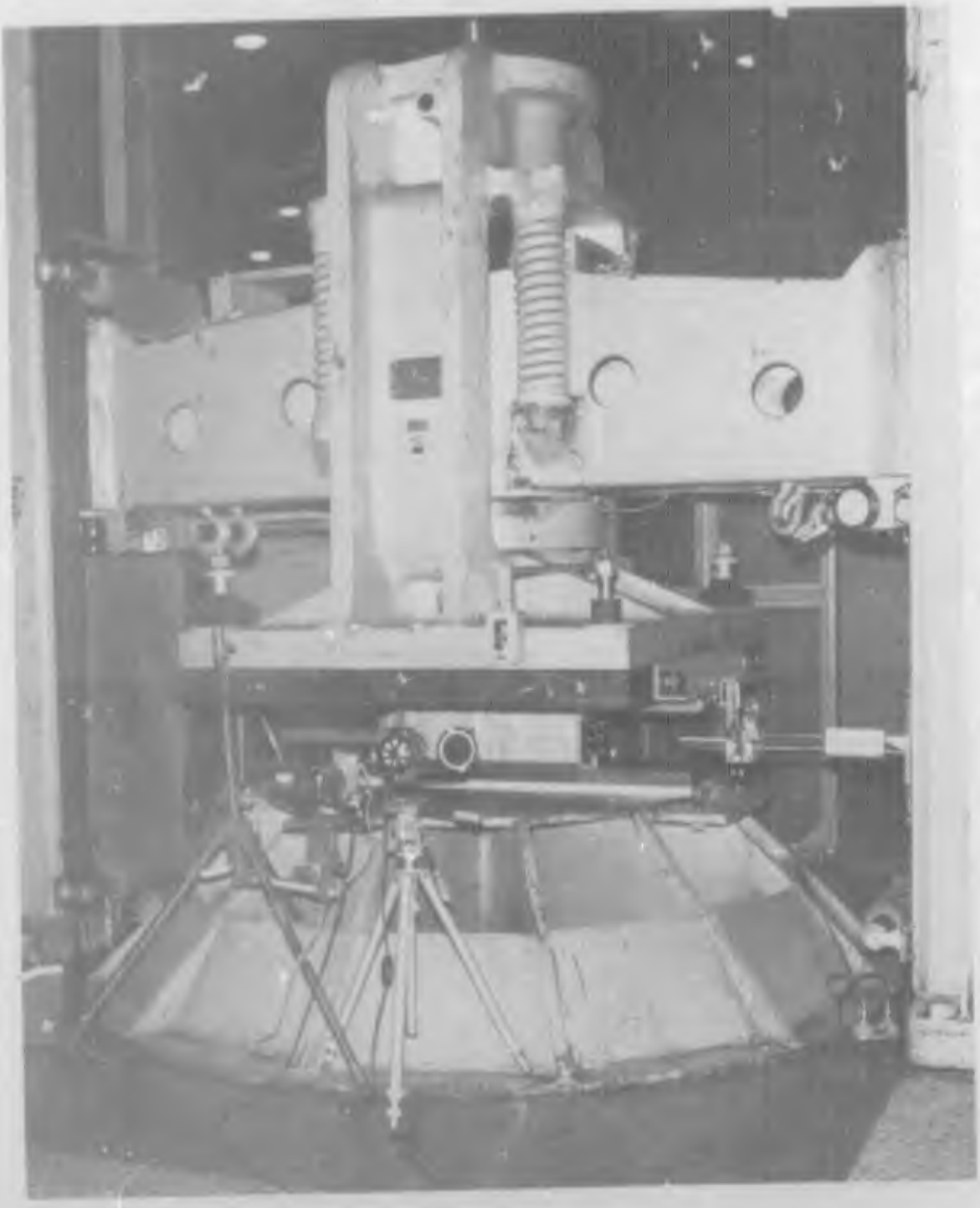


FIGURE 11.–TYPICAL CRIPPLING PANEL TEST SETUP

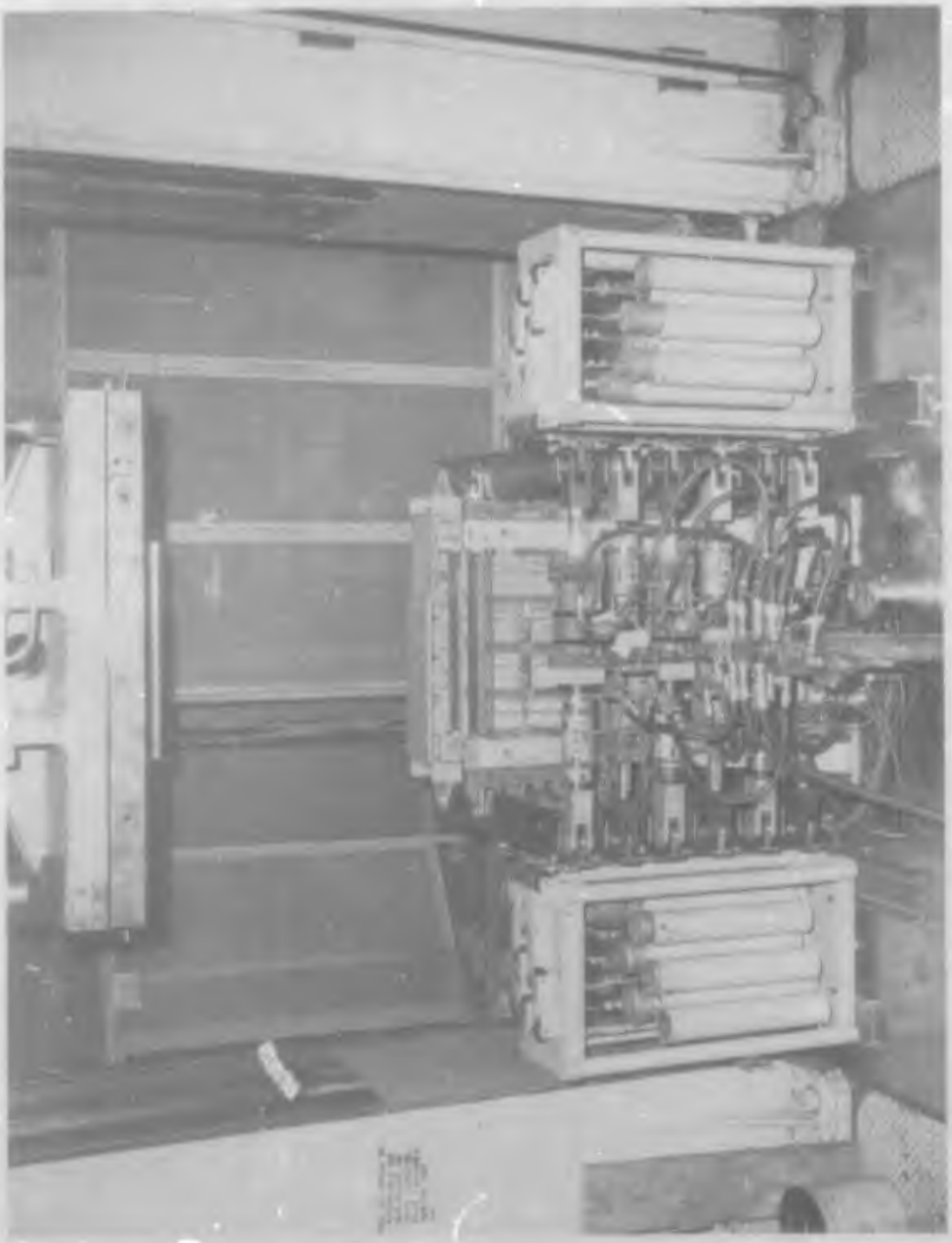


FIGURE 12a. – TYPICAL FULL PANEL TEST SETUP

FIGURE 12b. –TYPICAL FULL PANEL TEST SETUP (CONCLUDED)

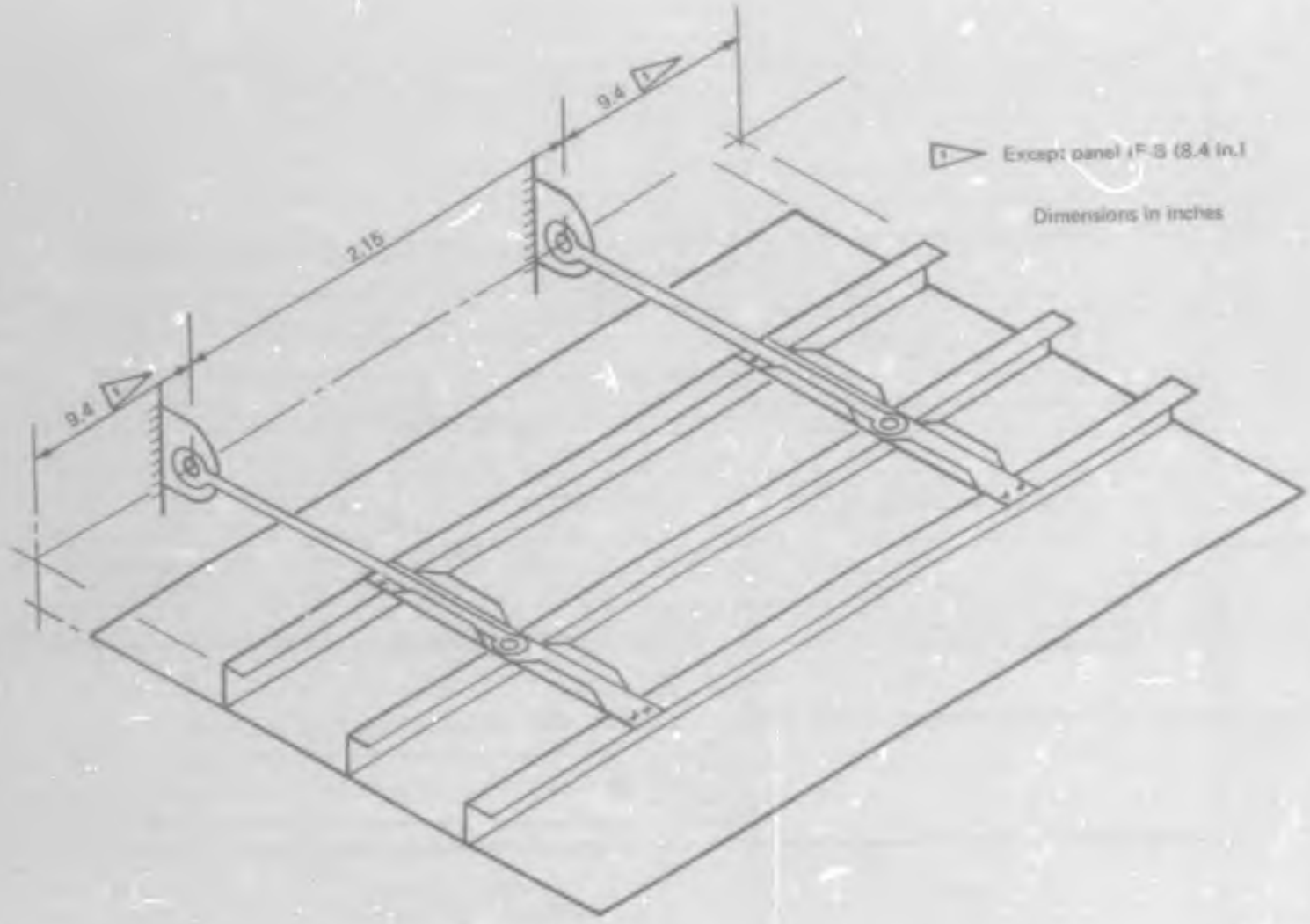


FIGURE 13.–STRINGER CROSS-TIE CONCEPT FOR TYPE IF, IIF, AND IVF PANELS

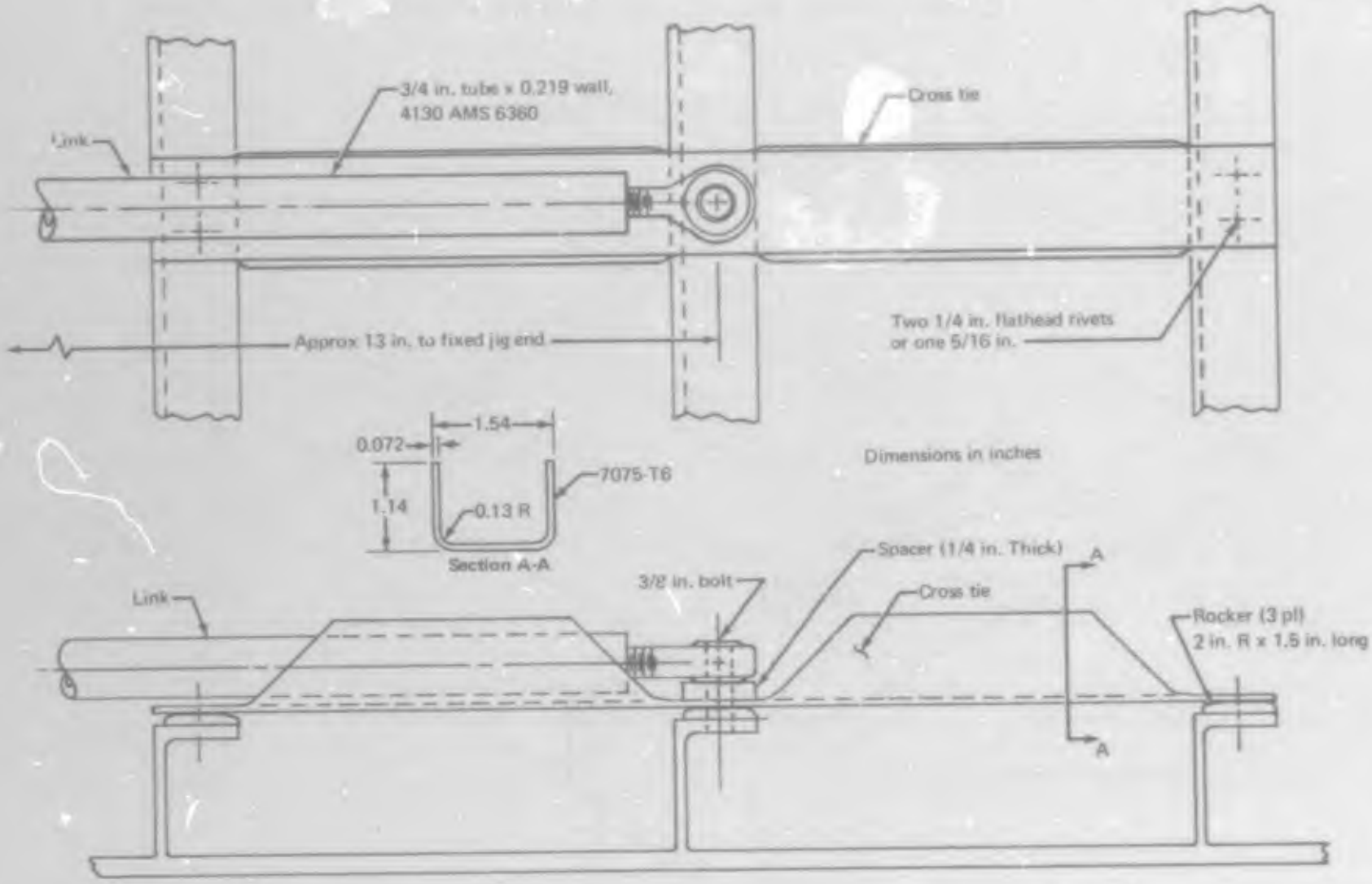


FIGURE 14.—CROSS-TIE DESIGN

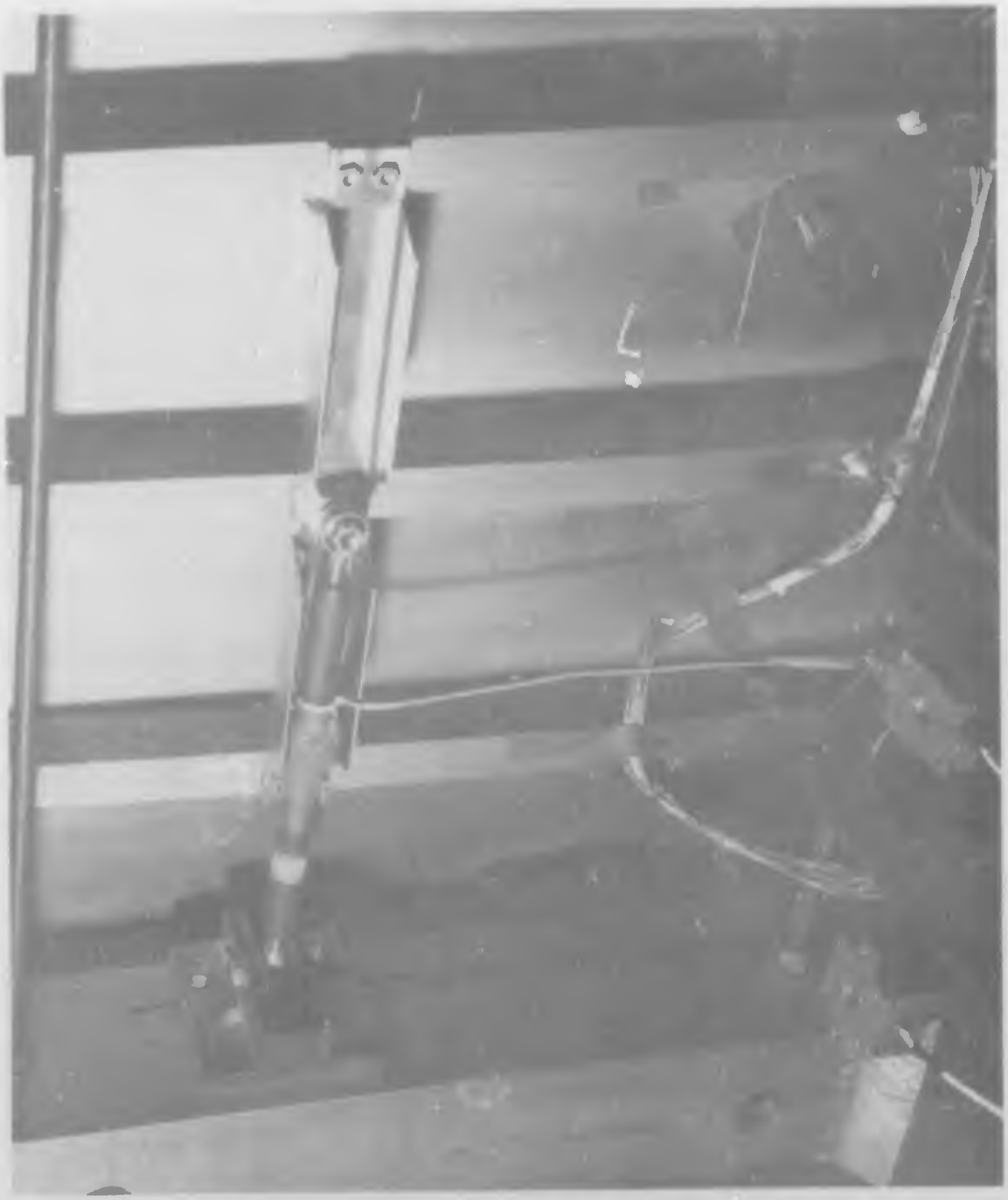
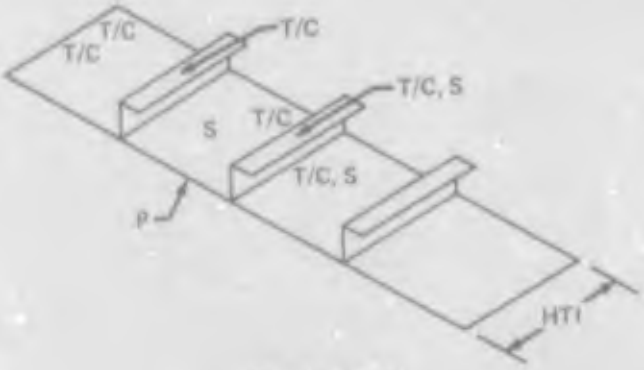
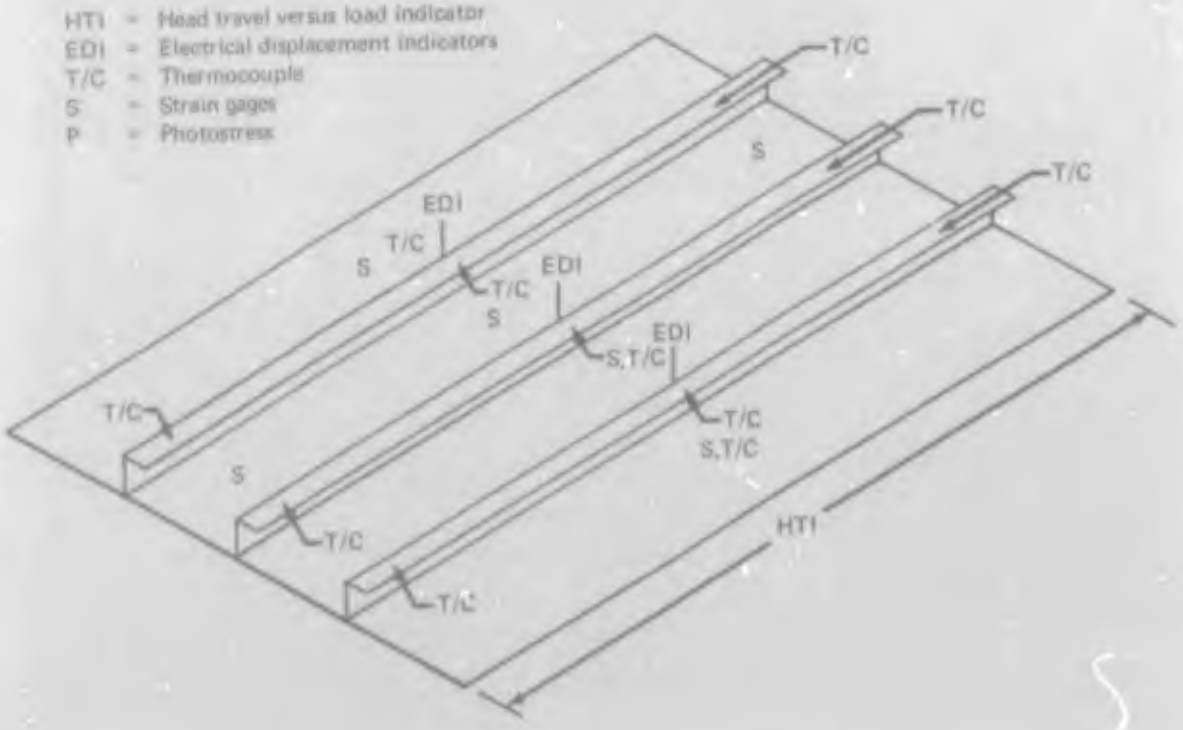


FIGURE 15—STRINGER CROSS TIE CONCEPT



Crippling Panel

HTI = Head travel versus load indicator
EDI = Electrical displacement indicators
T/C = Thermocouple
S = Strain gages
P = Photostress



Full Panel

FIGURE 16.–TEST PANEL INSTRUMENTATION

FIGURE 17.–POSTFAILURE PHOTOGRAPH OF IC-E CRIPPLING PANEL

FIGURE 18.–POSTFAILURE PHOTOGRAPH OF IIIC-C CRIPPLING PANEL

FIGURE 19.–POSTFAILURE PHOTOGRAPH OF IVC-C CRIPPLING PANEL

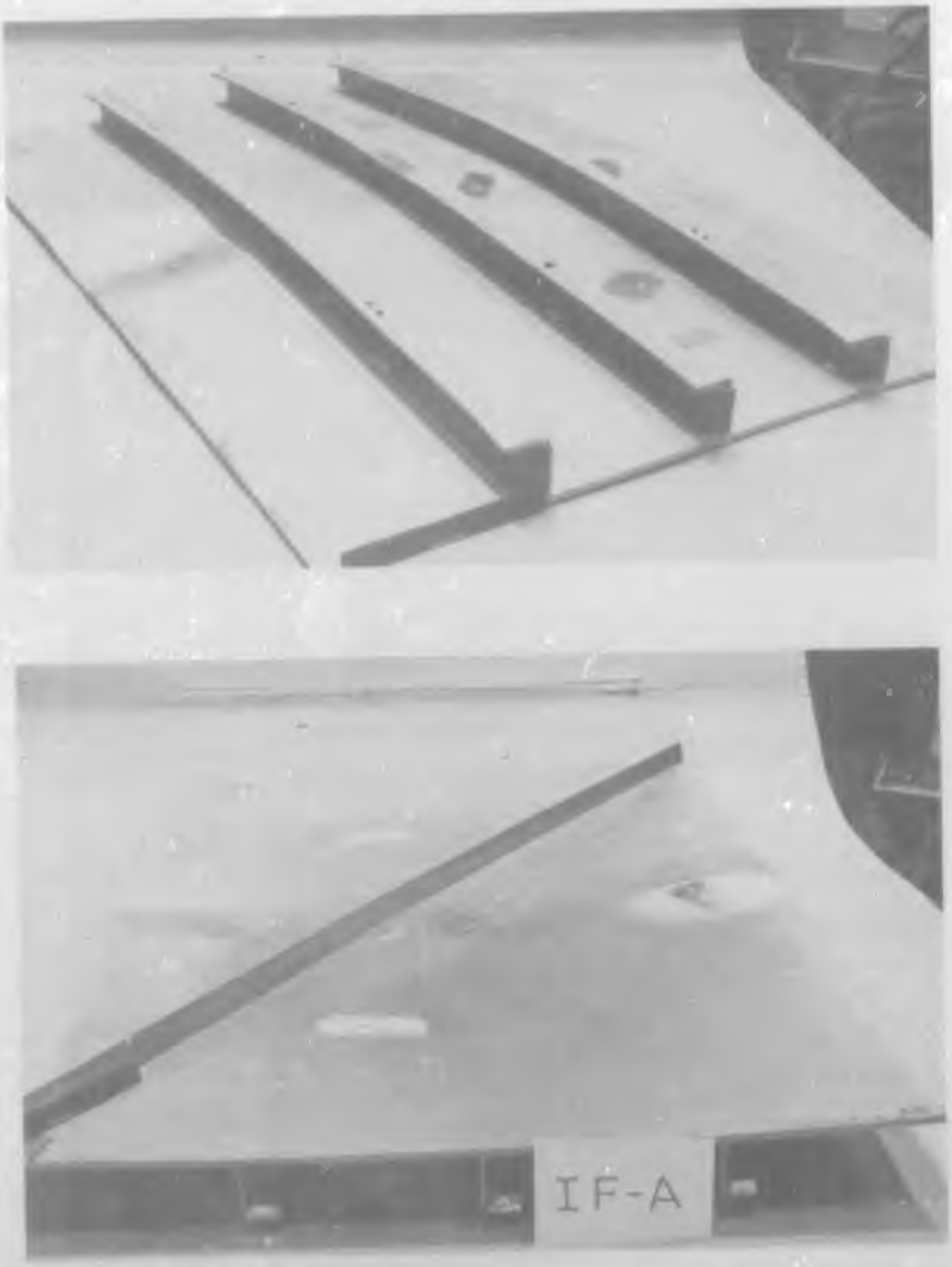


FIGURE 30.–POSTFAILURE PHOTOGRAPHS OF TYPE IF PANEL

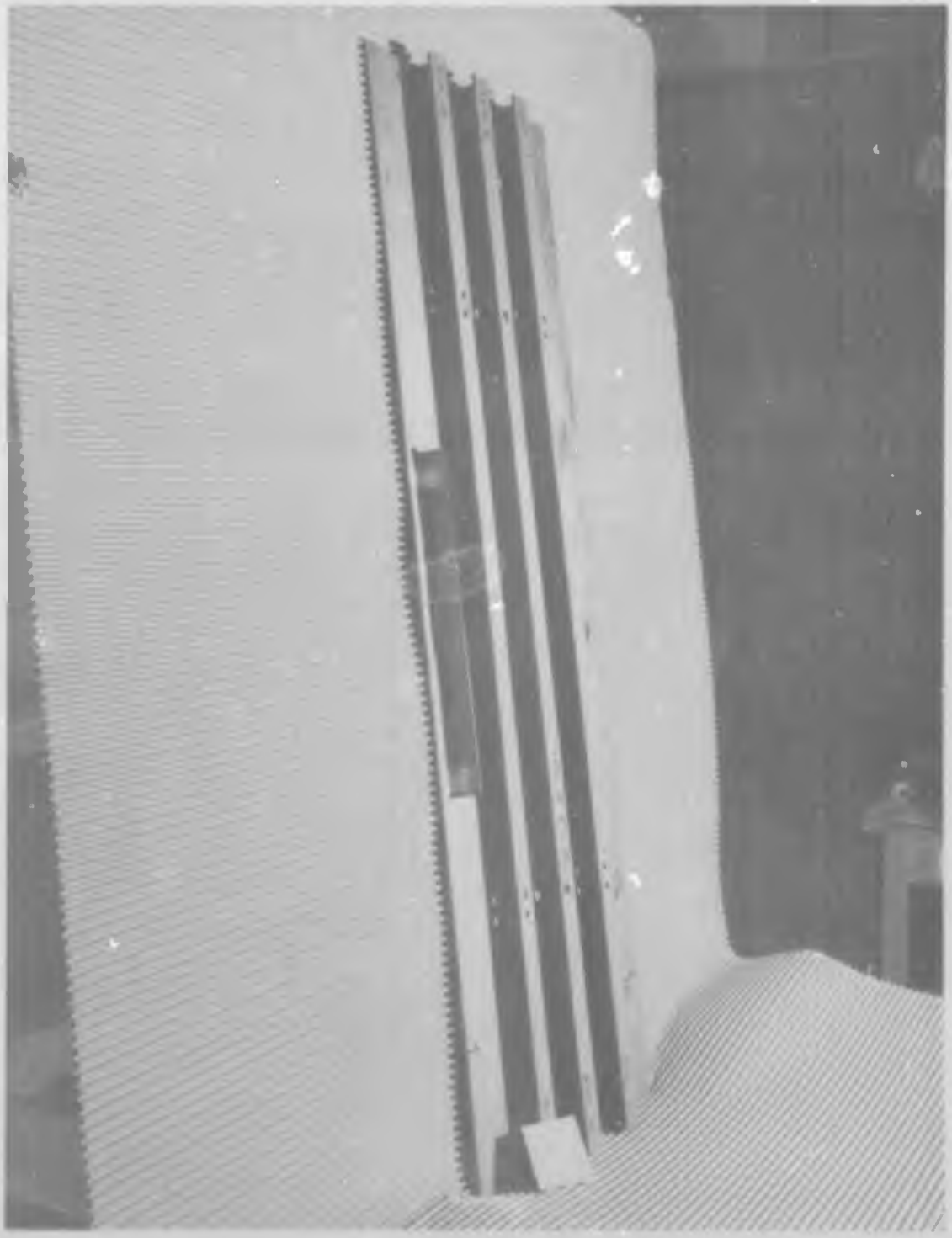


FIGURE 21.—POSTFAILURE PHOTOGRAPH OF TYPE IIF PANEL

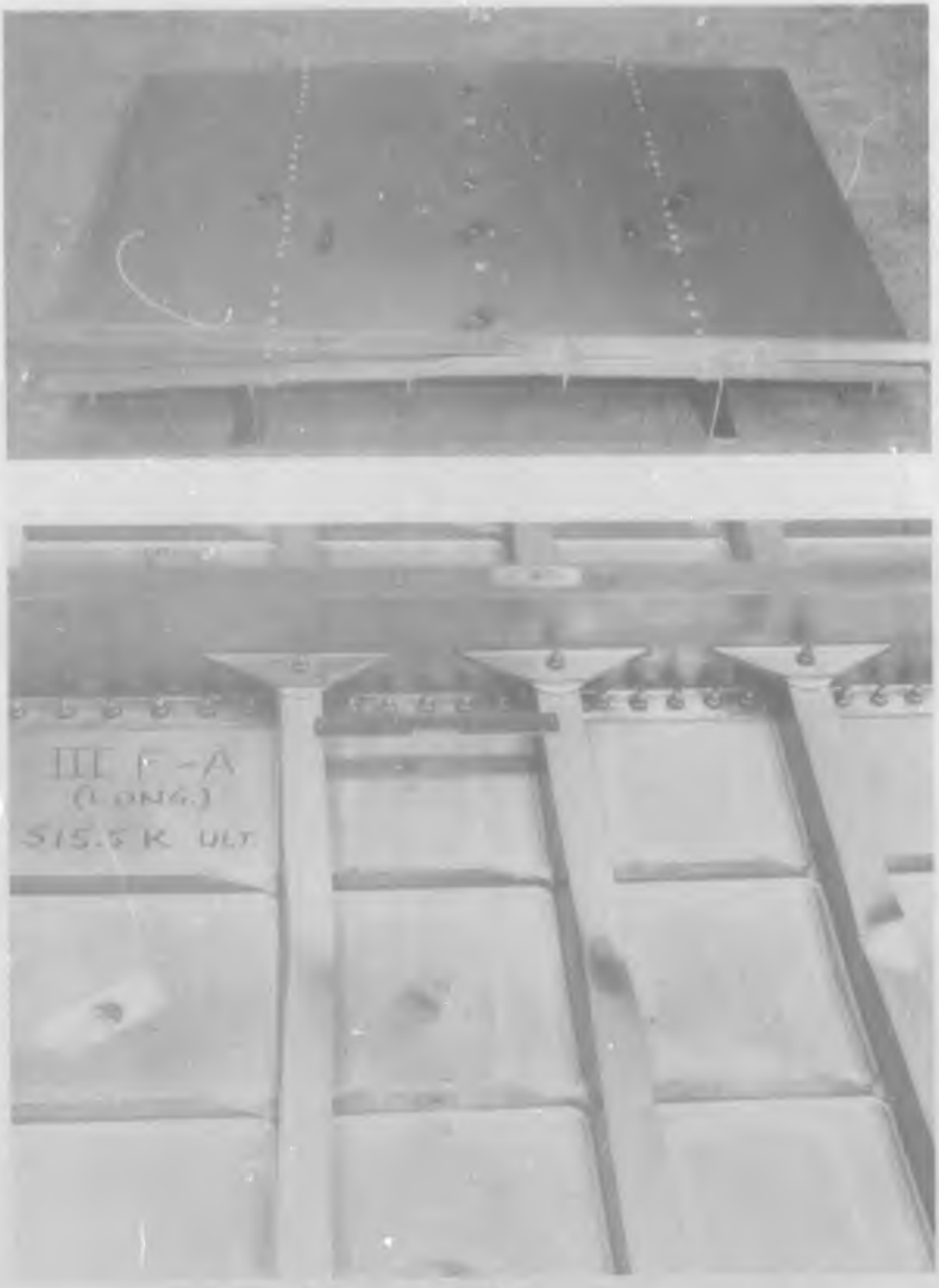


FIGURE 22.—POSTFAILURE PHOTOGRAPHS OF TYPE IIIF PANELS

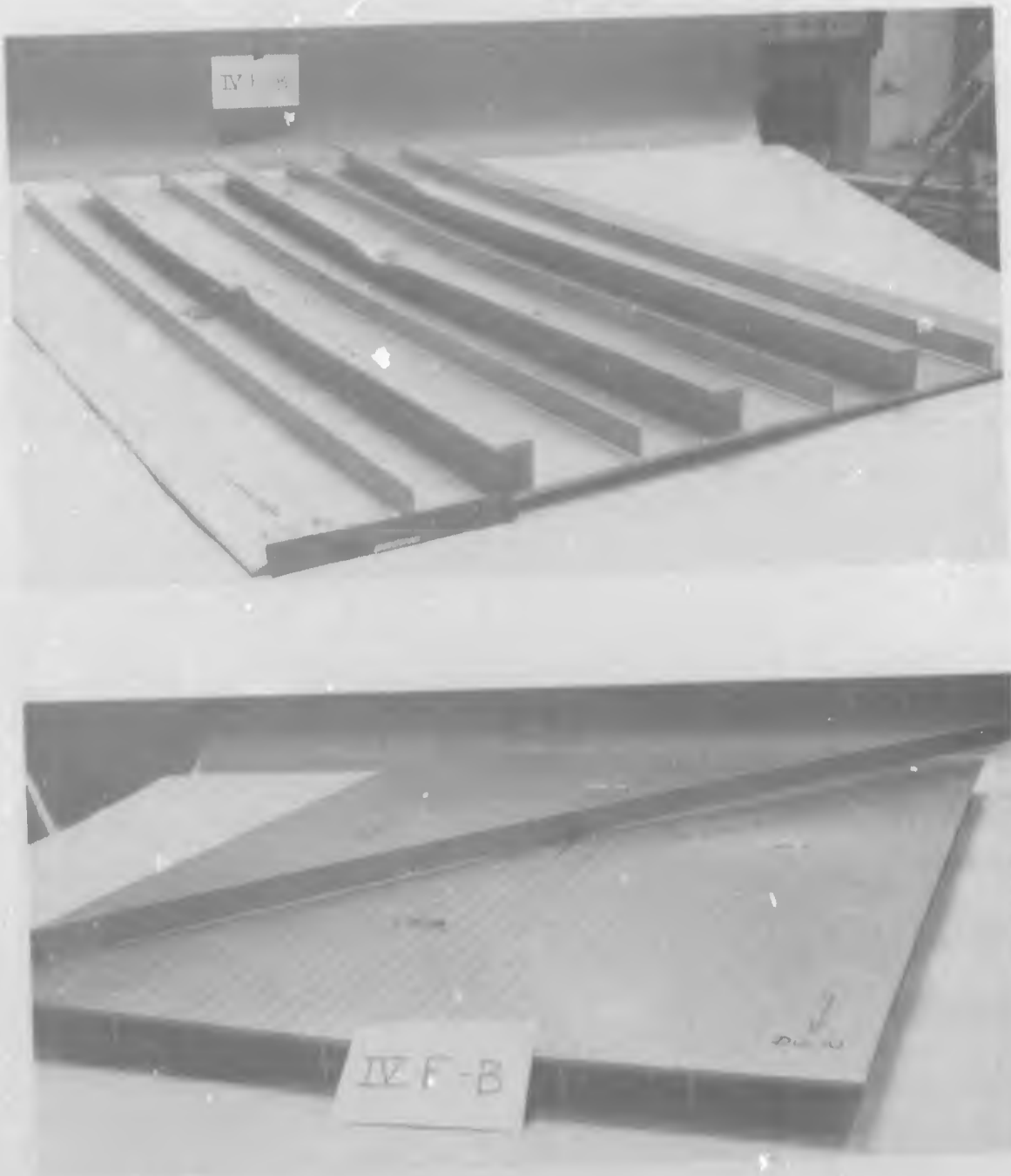
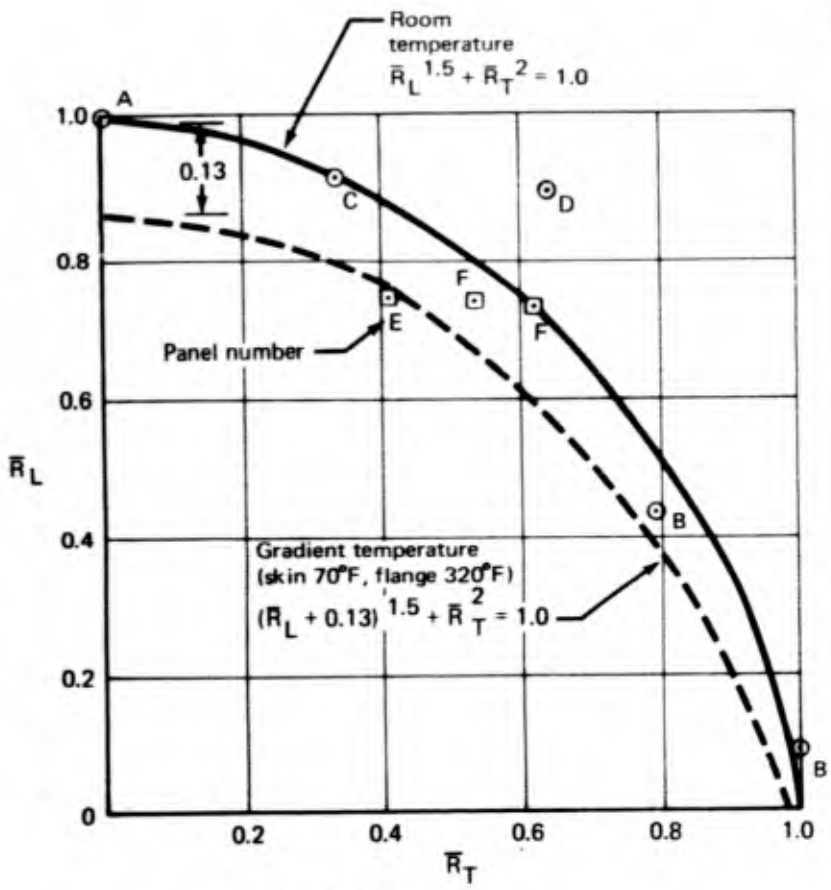


FIGURE 23.—POSTFAILURE PHOTOGRAPHS OF TYPE IVF PANELS

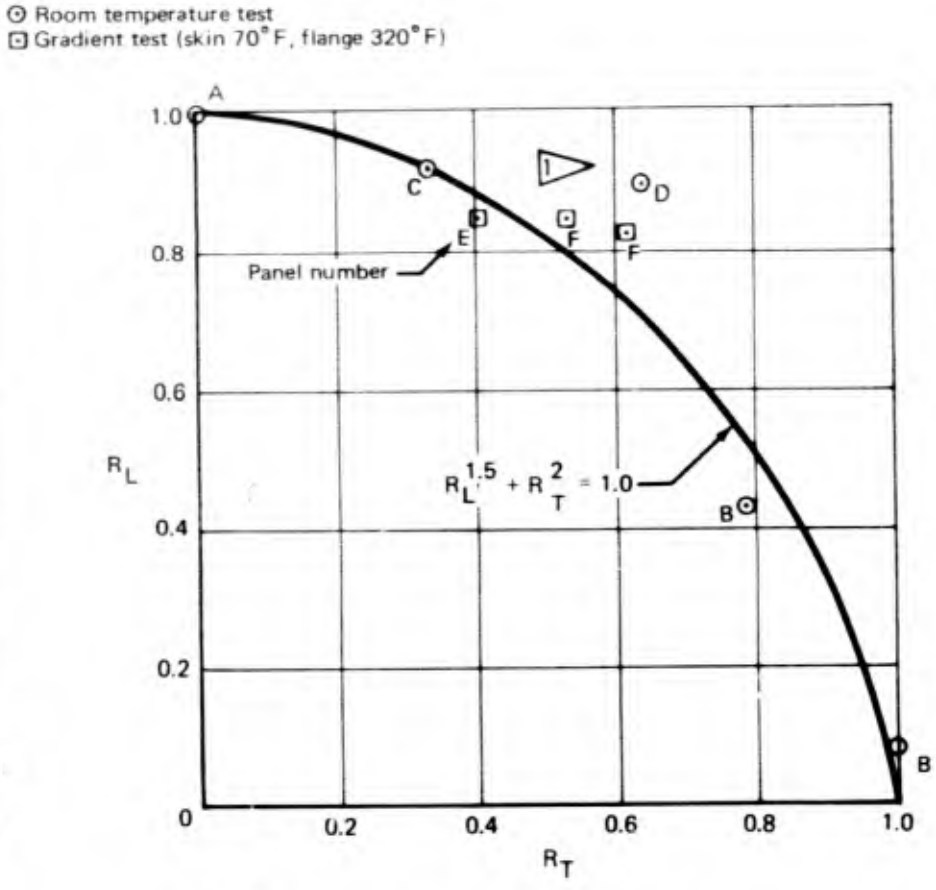


$\bar{R} = \dfrac{\text{Applied stress}}{\text{Allowable stress at room temperature}}$

$R = \dfrac{\text{Applied stress}}{\text{Allowable stress at temperature condition}}$

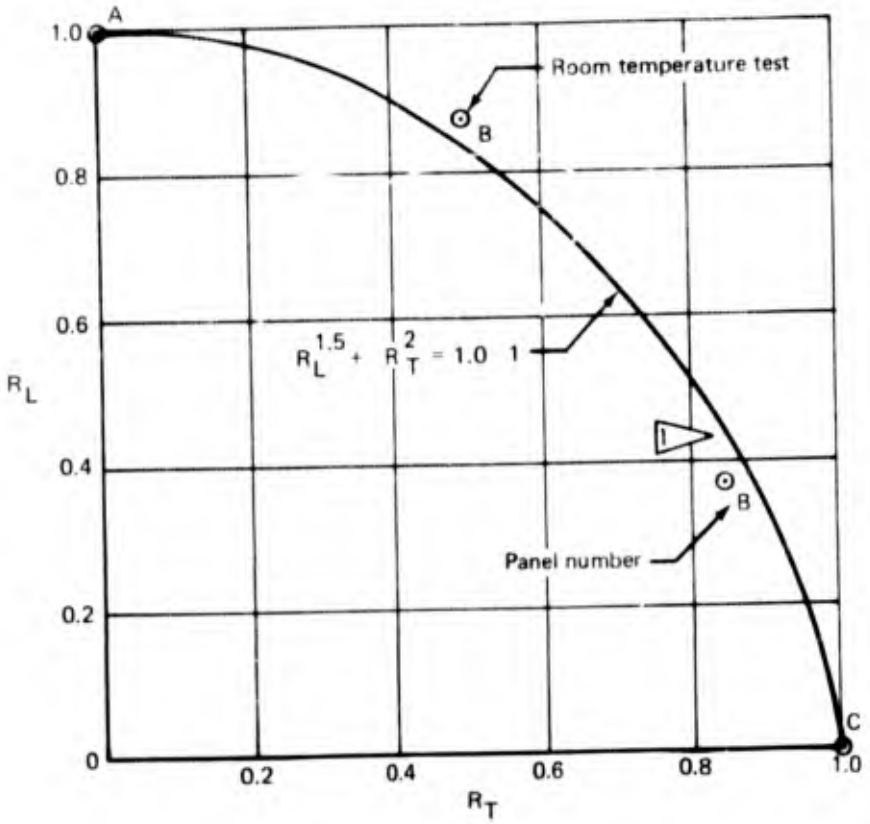
L = Longitudinal

T = Transverse



1 Gradient points, ⊡, based on gradient longitudinal allowable estimated equal to 87% of room temperature allowable and gradients transverse allowable equal to room temperature allowable.

FIGURE 24.–STRESS RATIO INTERACTION DATA FOR TYPE IF PANELS



$R = \frac{\text{Applied stress}}{\text{Allowable stress}}$

L = Longitudinal

T = Transverse

1 > Flanges at longitudinal load head had visual local deformations prior to the start of this test.

FIGURE 25.–STRESS RATIO INTERACTION DATA FOR TYPE IIIF PANELS

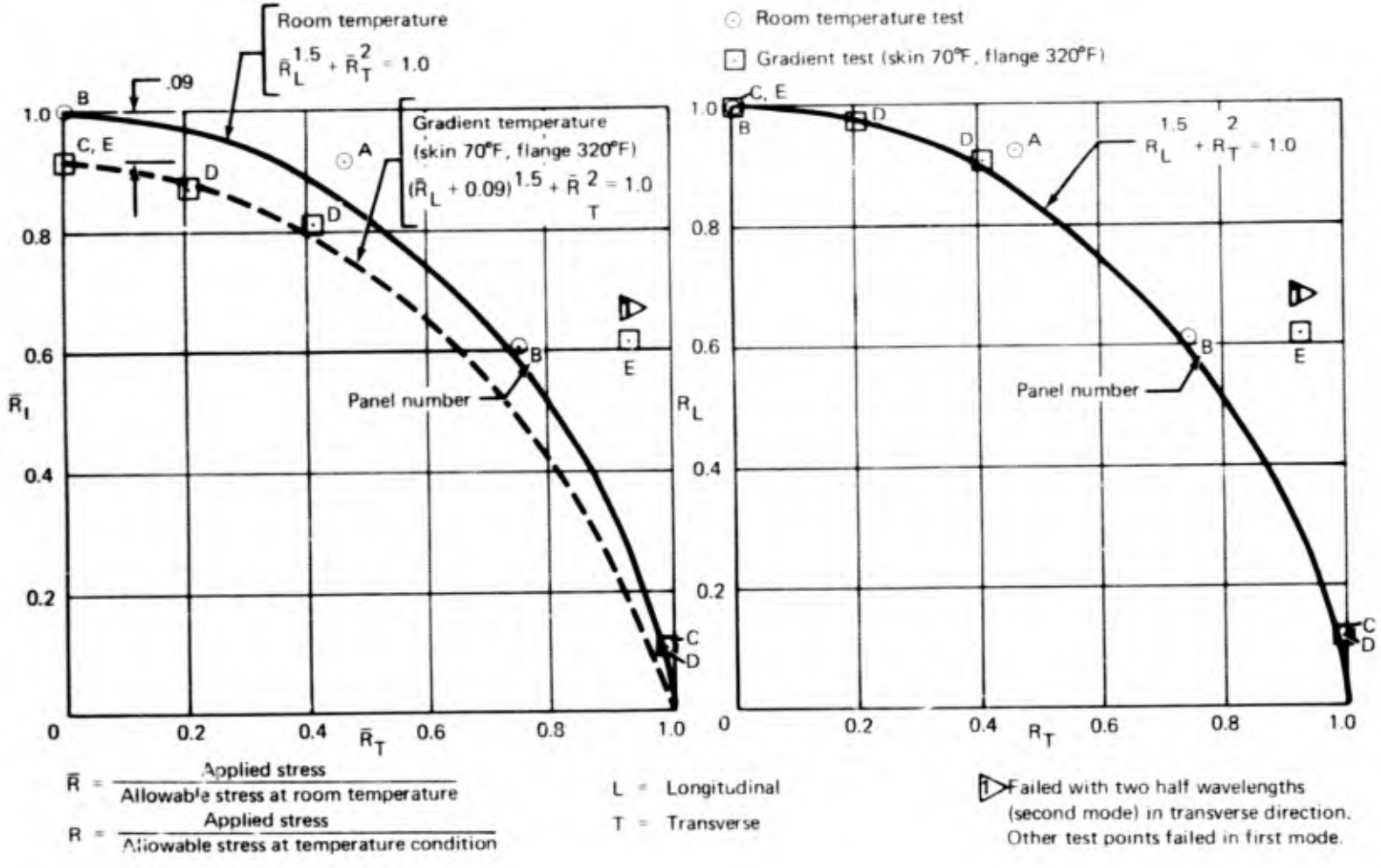
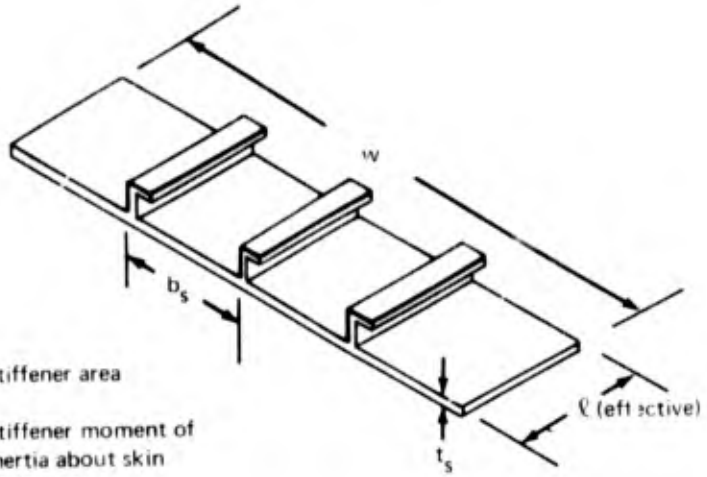


FIGURE 26.–STRESS RATIO INTERACTION DATA FOR TYPE IVF PANELS



A = Stiffener area

I = Stiffener moment of inertia about skin mid plane

B = $Et_s^3/12(1-\nu^2)$, skin flexural stiffness

EI/Db_s = Stiffener-to-skin stiffness ratio

$A/b_s t_s$ = Stiffener-to-skin area ratio

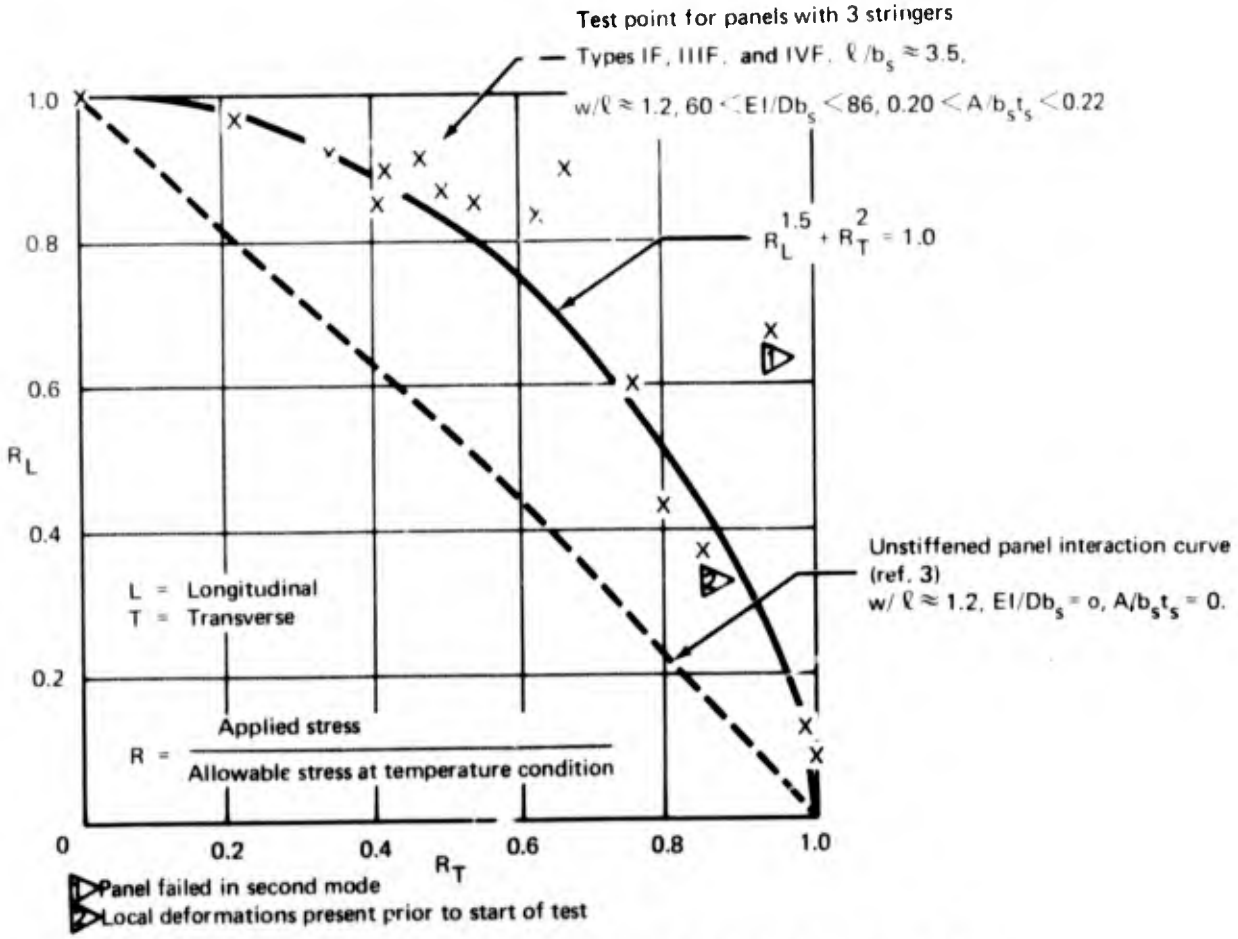


FIGURE 27.–OVERALL INTERACTION COMPARISON

APPENDIX A

MEASURED DIMENSIONS

In this section measured dimensions of the 28 test panels are given. For each panel type a figure showing measurement locations and symbols is followed by tabulated measurements.

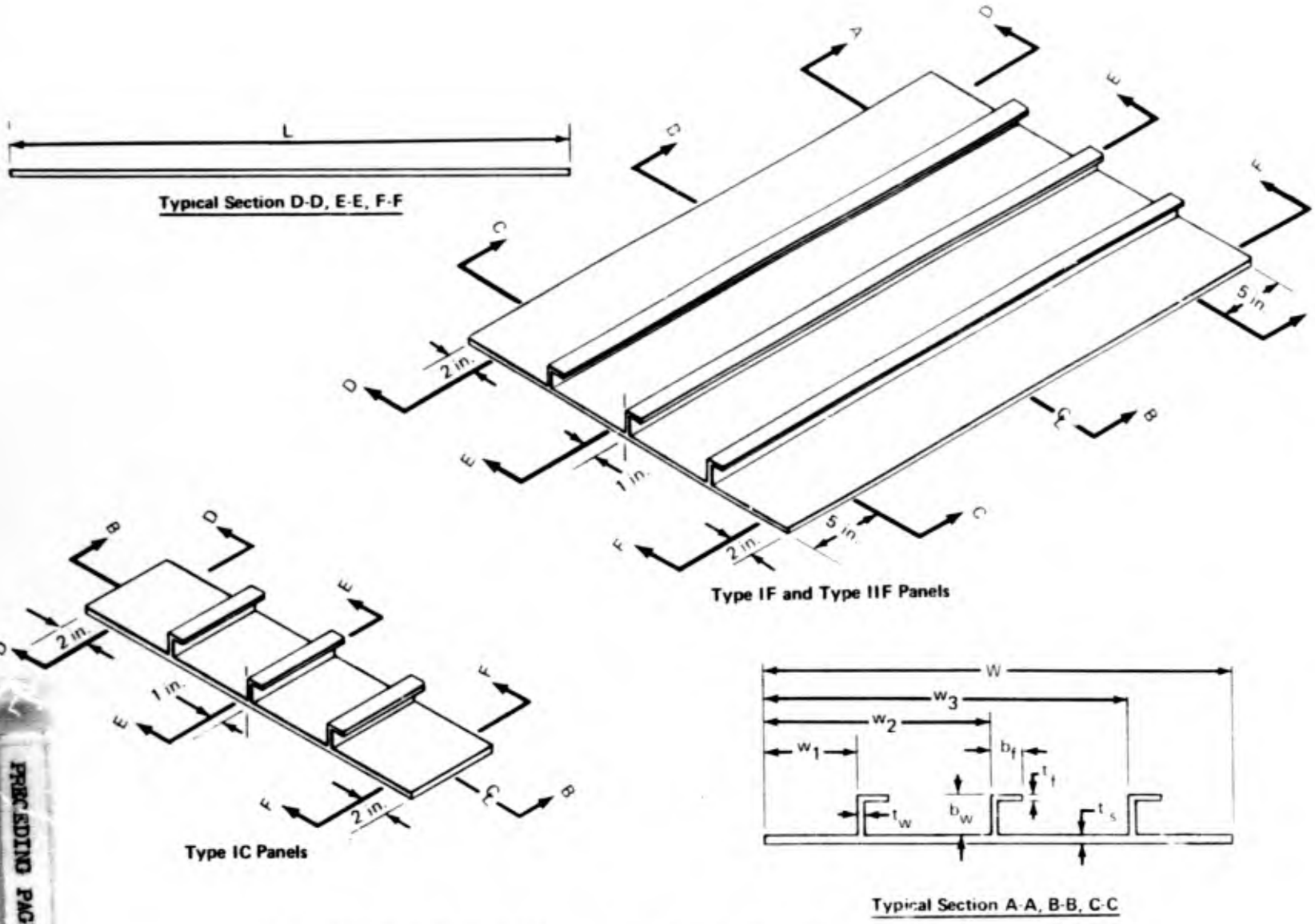


FIGURE A-1.–MEASURED DIMENSION LOCATIONS FOR TYPE I AND II PANELS

TABLE A-1a.–MEASURED DIMENSIONS FOR TYPE I AND II PANELS

Panel	Measurement plane	t_s Intersection of plane			w_1	w_2	w_3	w
		D-D	E-E	F-F				
IF-A	A-A	0.2548	0.2520	0.250	7.150	13.950	20.75	28.00
	B-B	0.2540	0.2515	0.251	7.150	13.950	20.75	28.00
	C-C	0.2530	0.2520	0.250	7.200	13.950	20.748	28.00
IF-B	A-A	0.243	0.250	0.253	7.10	13.90	20.73	28.00
	B-B	0.242	0.249	0.254	7.15	13.91	20.73	28.00
	C-C	0.254	0.254	0.242	7.12	13.92	20.74	28.00
IF-C	A-A	0.2485	0.2485	0.2485	7.140	13.930	20.735	28.00
	B-B	0.2460	0.2492	0.2481	7.139	13.930	20.735	28.00
	C-C	0.2471	0.2479	0.2478	7.150	13.940	20.735	28.00
IF-D	A-A	0.2550	0.2530	0.2550	7.150	13.930	20.740	28.00
	B-B	0.2560	0.2530	0.2585	7.150	13.930	20.740	28.00
	C-C	0.2550	0.2545	0.2568	7.150	13.960	20.750	28.00
IF-E	A-A	0.254	0.256	0.255	7.150	13.91	20.79	28.00
	B-B	0.253	0.255	0.256	7.150	13.90	20.80	28.00
	C-C	0.250	0.254	0.254	7.150	13.85	20.80	28.00
IF-F	A-A	0.2513	0.2510	0.2510	7.110	13.928	20.741	28.000
	B-B	0.2514	0.2538	0.2485	7.110	13.930	20.741	28.000
	C-C	0.2515	0.2520	0.2515	7.110	13.930	20.741	28.000
IC-A	B-B	0.2580	0.2547	0.2519	7.139	13.915	20.747	28.004
IC-B	B-B	0.2565	0.2558	0.2536	7.173	13.957	20.738	28.004
IC-C	B-B	0.2536	0.2533	0.2527	7.182	13.966	20.750	28.003
IC-D	B-B	0.2468	0.2495	0.2468	7.140	13.922	20.738	28.001
IC-E	B-B	0.2496	0.2486	0.2452	7.144	13.943	20.750	28.004
IC-F	B-B	0.2501	0.2556	0.2529	7.175	13.961	20.742	27.986
IIF-A	A-A	0.1301	0.1315	0.1302	3.642	6.955	10.247	14.038
	B-B	0.1288	0.1295	0.1280	3.639	6.946	10.248	14.033
	C-C	0.1295	0.1298	0.1295	3.645	6.955	10.251	14.028
IF-B	A-A	0.1265	0.1241	0.1260	3.663	6.967	10.256	14.011
	B-B	0.1248	0.1260	0.1260	3.656	6.962	10.256	14.011
	C-C	0.1266	0.1240	0.1255	3.662	6.968	10.256	14.012

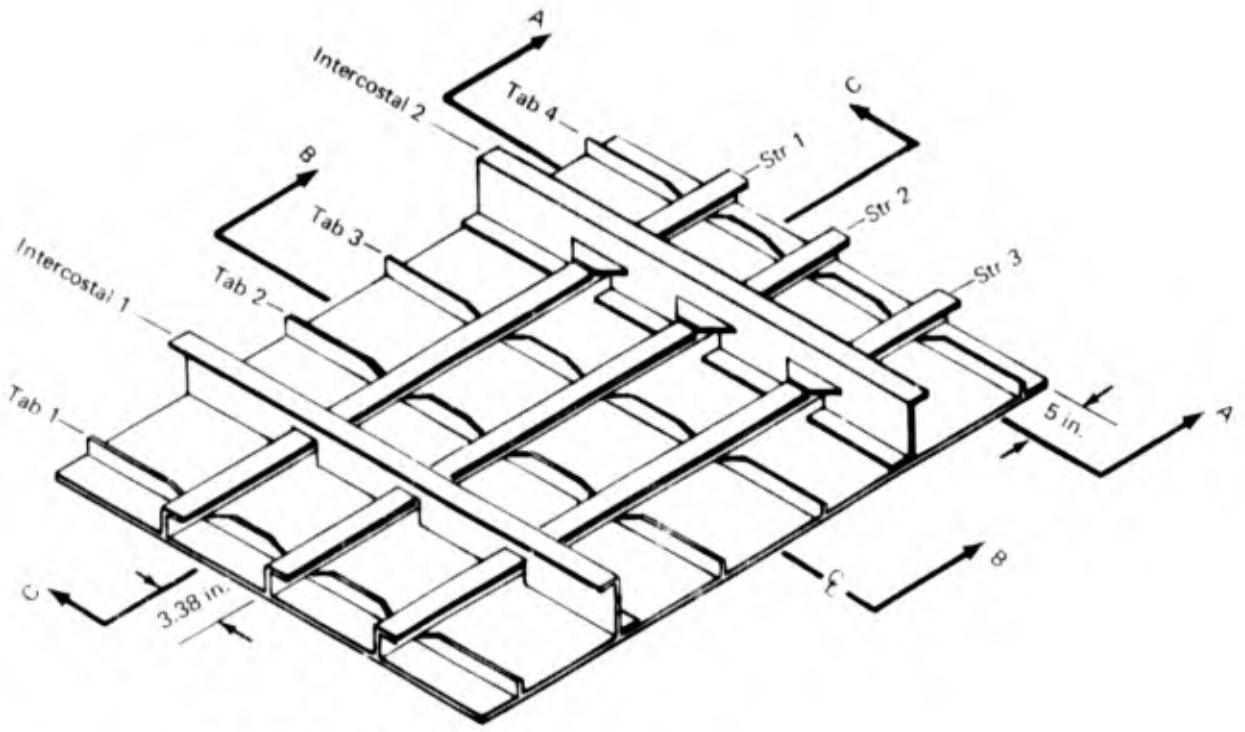
TABLE A-1b.–MEASURED DIMENSIONS FOR TYPE I AND II PANELS (CONTINUED)

Panel	Measurement plane	t_f Stringer			b_f Stringer			t_w* Stringer		
		1	2	3	1	2	3	1	2	3
IF-A	A-A	0.162	0.159	0.156	1.103	1.104	1.095	0.113	0.117	0.120
	B-B	0.1635	0.162	0.153	1.100	1.106	1.099	0.112	0.116	0.119
	C-C	0.163	0.160	0.159	1.098	1.109	1.102	0.110	0.118	0.119
IF-B	A-A	0.160	0.162	0.152	1.113	1.105	1.106	0.119	0.117	0.123
	B-B	0.159	0.156	0.157	1.109	1.109	1.108	0.120	0.121	0.120
	C-C	0.155	0.152	0.156	1.109	1.107	1.106	0.119	0.118	0.112
IF-C	A-A	0.1550	0.1580	0.1600	1.1010	1.1080	1.0990	0.1195	0.1185	0.1245
	B-B	0.1600	0.1602	0.1633	1.1035	1.1008	1.1032	0.1160	0.1132	0.1160
	C-C	0.1555	0.1569	0.1625	1.1040	1.1015	1.1060	0.1185	0.1175	0.1179
IF-D	A-A	0.1600	0.1580	0.1610	1.1050	1.1095	1.1050	0.1190	0.1192	0.1199
	B-B	0.1600	0.1635	0.1630	1.1025	1.1095	1.1042	0.1190	0.1190	0.1190
	C-C	0.1610	0.1645	0.1580	1.1034	1.1098	1.1035	0.1190	0.1195	0.1190
IF-E	A-A	0.153	0.162	0.157	1.098	1.108	1.105	0.128	0.116	0.118
	B-B	0.157	0.165	0.161	1.107	1.105	1.104	0.121	0.118	0.120
	C-C	0.161	0.164	0.159	1.106	1.104	1.102	0.125	0.118	0.118
IF-F	A-A	0.1579	0.1583	0.1640	1.1090	1.1050	1.1080	0.1120	0.1185	0.1180
	B-B	0.1578	0.1584	0.1569	1.1100	1.1102	1.1095	0.1192	0.1185	0.1120
	C-C	0.1605	0.1583	0.1579	1.1115	1.1105	1.1093	0.1195	0.1190	0.1165
IC-A	B-B	0.1610	0.1600	0.1613	1.0954	1.1004	1.0958	0.1236	0.1283	0.1206
IC-B	B-B	0.1604	0.1614	0.1609	1.1012	1.1036	1.0987	0.1204	0.1241	0.1290
IC-C	B-B	0.1600	0.1608	0.1610	1.0972	1.0981	1.0949	0.1179	0.1205	0.1230
IC-D	B-B	0.1605	0.1593	0.1603	1.0978	1.0943	1.0985	0.1254	0.1260	0.1209
IC-E	B-B	0.1609	0.1594	0.1614	1.0943	1.0965	1.0918	0.1228	0.1194	0.1183
IC-F	B-B	0.1579	0.1590	0.1587	1.0956	1.0973	1.0964	0.1197	0.1224	0.1258
IIF-A	A-A	0.1390	0.1383	0.1380	1.0933	1.0897	1.0924	0.1011	0.0999	0.1008
	B-B	0.1392	0.1405	0.1380	1.0934	1.0986	1.0917	0.1030	0.1112	0.1020
	C-C	0.1383	0.1400	0.1381	1.0943	1.0905	1.0929	0.1013	0.0995	0.1042
IIF-B	A-A	0.1395	0.1392	0.1370	1.0975	1.0952	1.0970	0.1012	0.0997	0.1027
	B-B	0.1400	0.1410	0.1387	1.0943	1.0933	1.0955	0.0985	0.0979	0.1031
	C-C	0.1400	0.1401	0.1405	1.0962	1.0958	1.0962	0.1018	0.0995	0.1017

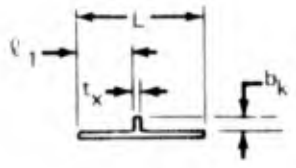
*t_w measured above weld

TABLE A-1c.–MEASURED DIMENSIONS FOR TYPE I AND II PANELS (CONCLUDED)

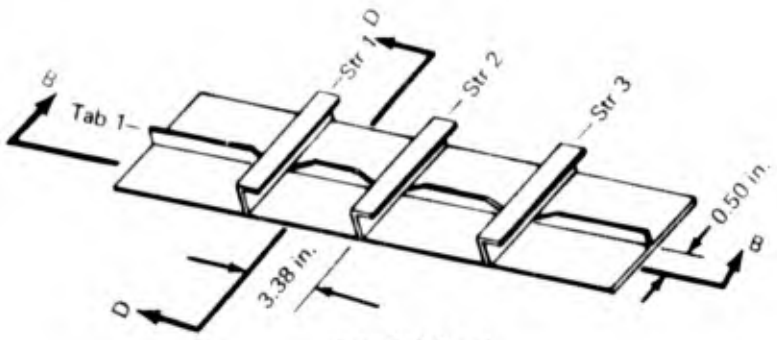
Panel	Measure-ment plane	b_w Stringer			L Plane D-D	L Plane E-E	L Plane F-F
		1	2	3			
IF-A	A-A B-B C-C	1.685 1.680 1.680	1.680 1.678 1.690	1.690 1.679 1.692	40.30	40.30	40.30
IF-B	A-A B-B C-C	1.703 1.689 1.686	1.676 1.676 1.687	1.685 1.794 1.694	40.30	40.30	40.30
IF-C	A-A B-B C-C	1.696 1.688 1.695	1.685 1.687 1.688	1.692 1.689 1.697	40.330	40.330	40.330
IF-D	A-A B-B C-C	1.687 1.676 1.6875	1.668 1.680 1.688	1.678 1.680 1.685	40.300	40.300	40.300
IF-E	A-A B-B C-C	1.640 1.668 1.672	1.690 1.775 1.673	1.673 1.776 1.671	40.30	40.30	40.30
IF-F	A-A B-B C-C	1.674 1.682 1.685	1.683 1.684 1.684	1.689 1.687 1.6835	40.300	40.300	40.300
IC-A IC-B IC-C IC-D IC-E IC-F	B-B B-B B-B B-B B-B B-B	1.7085 1.6927 1.6914 1.7095 1.7057 1.6898	1.7102 1.6882 1.6885 1.7109 1.7056 1.6867	1.7122 1.6939 1.6940 1.7141 1.7073 1.6929	7.004 6.998 7.013 6.999 7.010 7.004	7.004 6.997 7.011 7.000 7.005 7.003	7.007 6.998 7.012 7.001 7.005 7.003
IIF-A	A-A B-B C-C	1.1149 1.1154 1.1180	1.1119 1.1162 1.1112	1.1052 1.1151 1.1126	40.289	40.290	40.290
IIF-B	A-A B-B C-C	1.1129 1.1094 1.1159	1.1161 1.1120 1.1198	1.1106 1.1123 1.1210	40.269	40.268	40.268



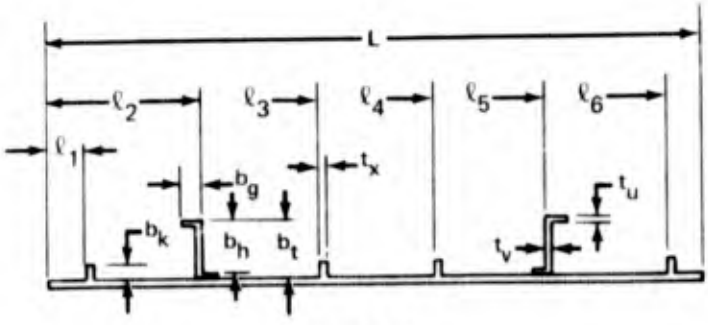
Type IIIF Panels



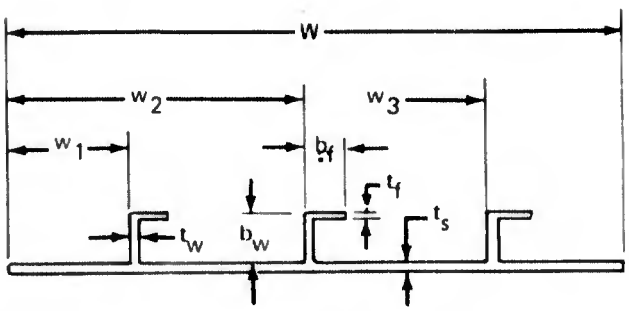
Section D-D



Type IIIC Panels



Section C-C



Typical Section A-A and B-B

FIGURE A-2.—MEASURED DIMENSION LOCATIONS FOR TYPE III PANELS

TABLE A-2a.–MEASURED DIMENSIONS FOR TYPE III PANELS

Panel	Measurement plane	t_s Intersection of C-C	w_1	w_2	w_3	w	t_f Stringer		
							1	2	3
IIIF-A	A-A B-B C-C	0.201	7.220 7.220	13.960 13.965	20.720 20.720	28.020 28.025	0.126 0.127	0.126 0.127	0.123 0.123
IIIF-B	A-A B-B C-C	0.203	7.180 7.200	13.945 13.960	20.695 20.690	28.020 28.020	0.126 0.126	0.124 0.126	0.128 0.128
IIIF-C	A-A B-B C-C	0.201	7.207 7.205	13.958 13.950	20.720 20.700	28.050 28.025	0.127 0.127	0.126 0.126	0.128 0.127
IIIC-A	B-B D-D	0.2078	7.202	13.950	20.6995	28.000	0.1192	0.1218	0.1210
IIIC-B	B-B D-D	0.2038	7.240	13.948	20.712	28.00	0.1215	0.1198	0.1181
IIIC-C	B-B D D	0.200	7.231	13.950	20.70	28.00	0.1235	0.1191	0.1219

Panel	Measurement plane	b_f Stringer			t_w Stringer			b_w Stringer		
		1	2	3	1	2	3	1	2	3
IIIF-A	A-A B-B C-C	1.105 1.104	1.103 1.103	1.105 1.100	0.133 0.133	0.137 0.134	0.138 0.137	1.273 1.270	1.278 1.282	1.279 1.281
IIIF-B	A-A B-B C-C	1.103 1.102	1.100 1.102	1.100 1.093	0.123 0.123	0.120 0.121	0.119 0.120	1.284 1.278	1.280 1.266	1.282 1.248
IIIF-C	A-A B-B C C	1.103 1.104	1.104 1.103	1.103 1.104	0.124 0.124	0.126 0.125	0.125 0.124	1.276 1.284	1.274 1.285	1.277 1.276
IIIC-A	B-B D-D	1.1042	1.1035	1.1055	0.1190	0.1178	0.1190	1.2800	1.2900	1.2890
IIIC-B	B-B D-D	1.1002	1.1030	1.1010	0.1264	0.1295	0.1281	1.271	1.273	1.260
IIIC-C	B-B D-D	1.105	1.094	1.110	0.125	0.123	0.135	1.260	1.2670	1.255

TABLE A-2b.—MEASURED DIMENSIONS FOR TYPE III PANELS (CONCLUDED)

Panel	Measurement plane	ℓ_1	ℓ_2	ℓ_3	ℓ_4	ℓ_5	ℓ_6	L	Tab 1	
									b_k	t_x
IIIF-A	A-A B-B C-C	2.065	8.760	15.160	21.710	28.440	34.805	37.100	0.701	0.207
IIIF-B	A-A B-B C-C	2.080	8.653	15.195	21.730	28.30	34.825	37.100	0.701	0.202
IIIF-C	A-A B-B C-C	2.090	8.640	15.175	21.725	28.30	34.822	37.100	0.696	0.203
IIIC-A	B-B D-D	3.4002						7.00	0.683	0.2093
IIIC-B	B-B D-D	3.397						7.00	0.682	0.2060
IIIC-C	B-B D-D	3.390						7.00	0.685	0.2080

Panel	Measurement plane	Tab 2		Tab 3		Tab 4		b_q Intercostal	
		b_k	t_x	b_k	t_x	b_k	t_x	1	2
IIIF-A	C-C	0.704	0.203	0.703	0.207	0.702	0.202	1.258	1.249
IIIF-B	C-C	0.699	0.203	0.703	0.203	0.703	0.203	1.238	1.256
IIIF-C	C-C	0.705	0.201	0.703	0.203	0.700	0.199	1.259	1.256

Panel	Measurement plane	b_h Intercostal		b_t Intercostal		t_u Intercostal		t_v Intercostal	
		1	2	1	2	1	2	1	2
IIIF-A	C-C	3.176	3.184	3.309	3.301	0.124	0.122	0.124	0.120
IIIF-B	C-C	3.184	3.183	3.316	3.314	0.121	0.121	0.125	0.127
IIIF-C	C-C	3.186	3.180	3.313	3.309	0.122	0.123	0.121	0.121

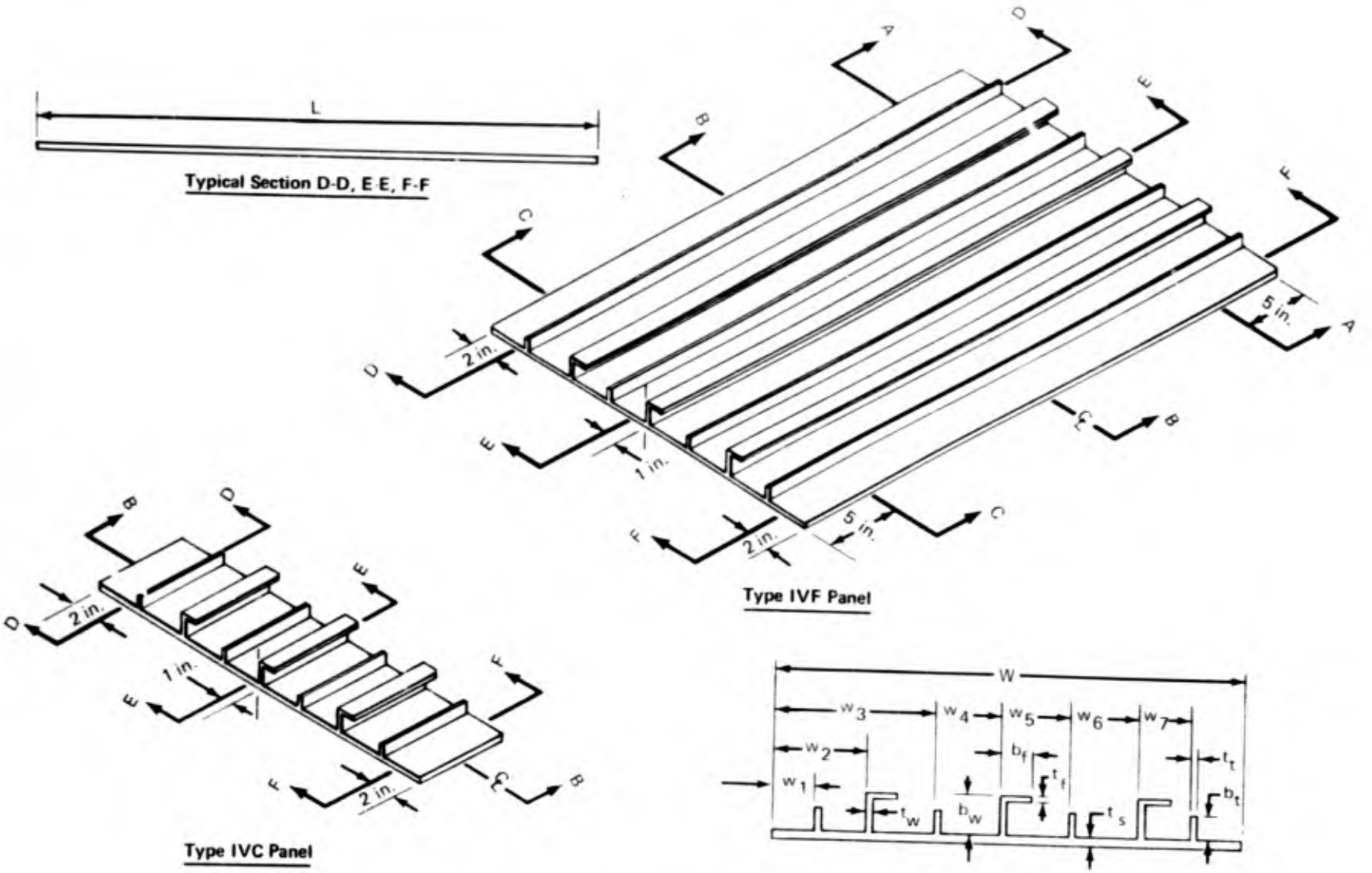


FIGURE A-3.–MEASURED DIMENSION LOCATIONS FOR TYPE IV PANELS

TABLE A-3a –MEASURED DIMENSIONS FOR TYPE IV PANELS

Panel	Measure-ment plane	t_s Intersection of plane D-D	E-E	F-F	w_1	w_2	w_3	w_4	w_5	w_6	w_7	w
IVF-A	A-A	0.1915	0.192	0.190	4.050	7.400	10.70	13.94	17.26	20.55	23.905	28.00
	B-B	0.1910	0.190	0.190	4.050	7.350	10.70	13.93	17.25	20.54	23.90	28.00
	C-C	0.1907	0.190	0.1907	4.050	7.400	10.70	13.95	17.25	20.55	23.905	28.00
IVF-B	A-A	0.1895	0.189	0.181	4.000	7.350	10.625	13.94	17.25	20.55	23.90	28.00
	B-B	0.189	0.1885	0.1855	4.025	7.325	10.650	13.94	17.26	20.55	23.90	28.00
	C-C	0.183	0.181	0.185	4.050	7.330	10.640	13.94	17.25	20.54	23.90	28.00
IVF-C	A-A	0.191	0.192	0.191	4.04	7.30	10.65	13.95	17.25	20.55	23.90	28.00
	B-B	0.1895	0.1905	0.1895	4.05	7.31	10.66	13.94	17.25	20.55	23.90	28.00
	C-C	0.1905	0.1865	0.1893	4.03	7.31	10.68	13.93	17.25	20.56	23.90	28.00
IVF-D	A-A	0.185	0.187	0.186	4.001	7.350	10.70	13.950	17.400	20.650	24.00	28.000
	B-B	0.183	0.183	0.184	4.004	7.350	10.70	13.950	17.400	20.700	24.00	28.000
	C-C	0.182	0.183	0.184	4.006	7.350	10.70	14.000	17.400	20.600	24.00	28.000
IVF-E	A-A	0.189	0.190	0.188	3.950	7.300	10.650	14.000	17.300	20.600	23.950	28.000
	B-B	0.190	0.188	0.187	3.950	7.300	10.650	13.950	17.350	20.600	24.000	28.000
	C-C	0.189	0.190	0.187	3.950	7.300	10.650	14.000	17.350	20.600	24.000	28.000
IVC-A	B-B	0.1895	0.1885	0.1885	4.0561	7.3708	10.6740	13.9789	17.2998	20.6166	23.9278	27.994
IVC-B	B-B	0.1912	0.1910	0.1906	4.055	7.3601	10.6650	13.9620	17.3010	20.6200	23.9390	27.998
IVC-C	B-B	0.1890	0.1892	0.1898	4.058	7.3800	10.6820	14.0000	17.3250	20.6520	23.9520	27.995

TABLE A-3b.–MEASURED DIMENSIONS FOR TYPE IV PANELS (CONTINUED)

Panel	Measurement plane	t_f Stringer			b_f Stringer			t_w* Stringer			b_w Stringer		
		1	2	3	1	2	3	1	2	3	1	2	3
IVF-A	A-A	0.140	0.138	0.140	1.100	1.101	1.098	0.103	0.105	0.109	1.314	1.312	1.308
	B-B	0.139	0.140	0.139	1.100	1.104	1.098	0.104	0.104	0.110	1.315	1.306	1.311
	C-C	0.140	0.141	0.140	1.100	1.105	1.100	0.105	0.106	0.111	1.305	1.315	1.310
IVF-B	A-A	0.140	0.140	0.142	1.101	1.100	1.100	0.102	0.103	0.100	1.300	1.305	1.304
	B-B	0.135	0.140	0.137	1.104	1.104	1.099	0.103	0.101	0.103	1.299	1.308	1.305
	C-C	0.140	0.1338	0.1378	1.102	1.101	1.106	0.103	0.106	0.100	1.310	1.311	1.310
IVF-C	A-A	0.145	0.142	0.140	1.106	1.101	1.099	0.100	0.100	0.102	1.309	1.306	1.306
	B-B	0.1392	0.141	0.1395	1.100	1.109	1.100	0.100	0.101	0.102	1.298	1.308	1.307
	C-C	0.1405	0.135	0.139	1.099	1.109	1.100	0.110	0.100	0.106	1.307	1.299	1.307
IVF-D	A-A	0.1419	0.138	0.1415	1.100	1.100	1.100	0.09[illegible]	0.096	0.101	1.310	1.311	1.320
	B-B	0.139	0.139	0.141	1.100	1.101	1.101	0.096	0.097	0.100	1.306	1.305	1.315
	C-C	0.137	0.138	0.140	1.102	1.105	1.104	0.098	0.098	0.099	1.307	1.305	1.319
IVF-E	A-A	0.134	0.140	0.142	1.100	1.096	1.093	0.101	0.098	0.097	1.303	1.306	1.305
	B-B	0.142	0.140	0.139	1.099	1.100	1.095	0.100	0.098	0.097	1.300	1.304	1.307
	C-C	0.141	0.139	0.139	1.102	1.100	1.095	0.102	0.099	0.096	1.295	1.299	1.302
IVC-A	B-B	0.1435	0.1390	0.1380	1.1005	1.1027	1.1008	0.0970	0.0965	0.1000	1.2984	1.2978	1.2956
IVC-B	B-B	0.1459	0.1432	0.1420	1.0940	1.0950	1.0950	0.0910	0.0930	0.0945	1.3115	1.3130	1.3010
IVC-C	B-B	0.1468	0.1377	0.1355	1.098	1.0968	1.0973	0.0899	0.0915	0.0930	1.3115	1.3130	1.3120

*t_w is measured above weld.

TABLE A-3c.–MEASURED DIMENSIONS FOR TYPE IV PANELS (CONCLUDED)

Panel	Measurement plane	t_t* Tab				b_t Tab				L		
		1	2	3	4	1	2	3	4	Plane D-D	Plane E-E	Plane F-F
IVF-A	A-A	0.099	0.104	0.100	0.098	0.850	0.855	0.862	0.855	40.30	40.30	40.30
	B-B	0.100	0.101	0.102	0.109	0.862	0.878	0.868	0.872			
	C-C	0.100	0.099	0.105	0.100	0.852	0.864	0.852	0.860			
IVF-B	A-A	0.097	0.096	0.097	0.096	0.865	0.875	0.867	0.858	40.30	40.30	40.30
	B-B	0.097	0.097	0.096	0 096	0.865	0.870	0.870	0.866			
	C-C	0.097	0.096	0.096	0.097	0.864	0.873	0.865	0.860			
IVF-C	A-A	0.096	0.100	0.098	0.098	0.850	0.865	0.874	0.862	40.30	40.30	40.32
	B-B	0.097	0.096	0.095	0.096	0.849	0.860	0.880	0.862			
	C-C	0.097	0.100	0.098	0 098	0.849	0.865	0.880	0.870			
IVF-D	A-A	0.098	0.096	0.095	0.094	0.868	0.870	0.876	0.880	40.30	40.30	40.30
	B-B	0.096	0.095	0.095	0.095	0.878	0.873	0.871	0.875			
	C-C	0.096	0.095	0.095	0.096	0.875	0.873	0.873	0.876			
IVF-E	A-A	0.096	0.095	0.094	0.096	0.880	0.870	0.875	0.870	40.30	40.30	40.30
	B-B	0.096	0.095	0.094	0.096	0.876	0.870	0.870	0.871			
	C-C	0.096	0.092	0.095	0.096	0.880	0.877	0.875	0.877			
IVC-A	B-B	0.0950	0.0947	0 0955	0.0954	0.8609	0.8622	0.8609	0.8633	7.0174	7.0174	7.0174
IVC-B	B-B	0.0966	0.0950	0.0950	0.0955	0.861	0.862	0.861	0.861	7.018	7.017	7.017
IVC-C	B-B	0.0951	0.0945	0.0945	0.0965	0.861	0.862	0.862	0.860	7.020	7.020	7.020

*t_t measured above weld

APPENDIX B

STRAIN, NORMAL DISPLACEMENT, AND THERMOCOUPLE DATA

Strain gage, EDI, and thermocouple locations and readings are presented in this section. Unless otherwise noted, gages were zeroed only at the beginning of the test series on any one panel.

Due to Poisson effects, transverse strains are often of opposite sign to longitudinal strains.

Constantan foil strain gages were used on specimens tested at room temperature. To measure thermal strains which were not part of the normal linear thermal expansion, self-compensating nickel chromium alloy gages were used for elevated and gradient temperature tests.

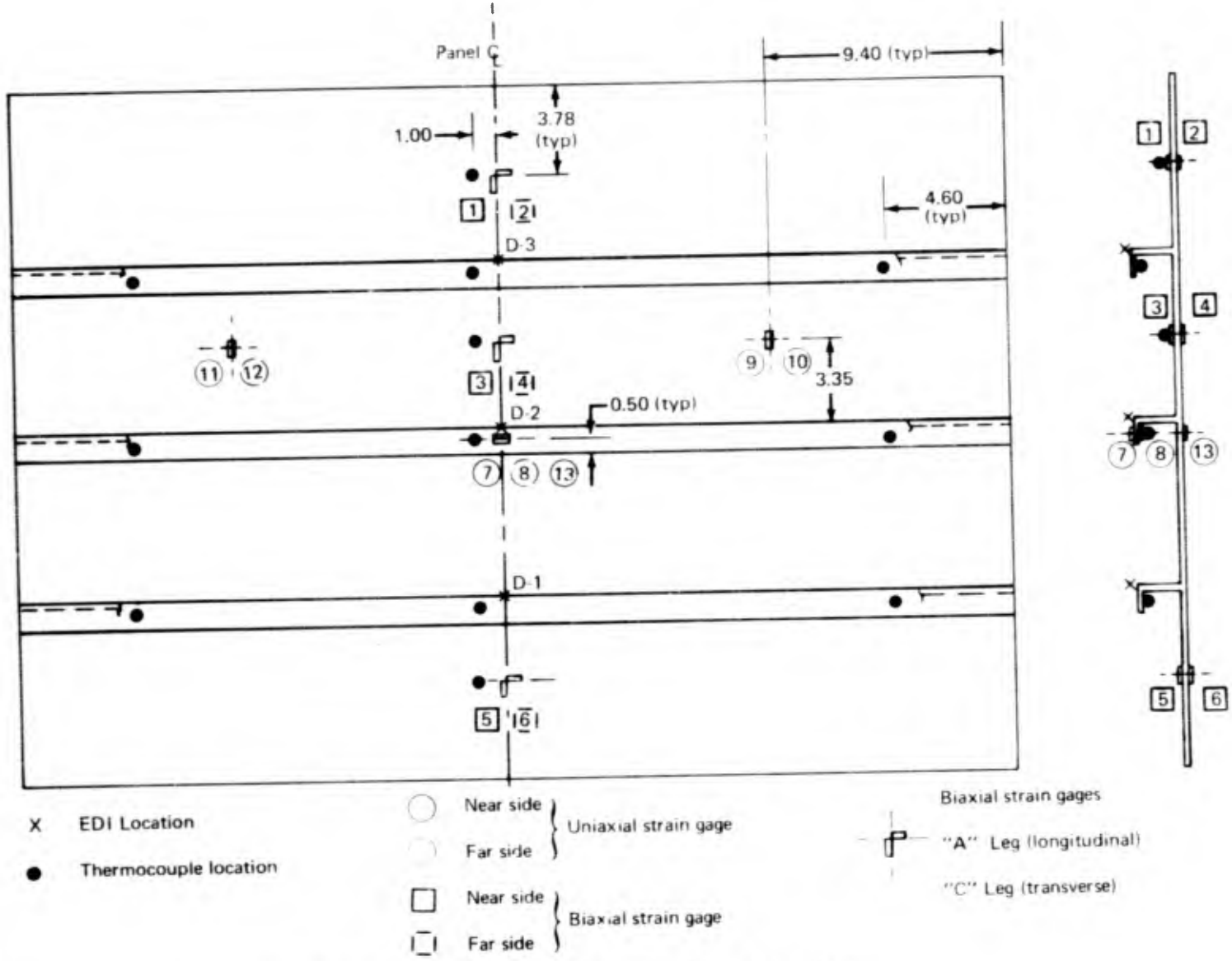


FIGURE B-1.–GAGE LOCATIONS FOR TYPE IF PANELS

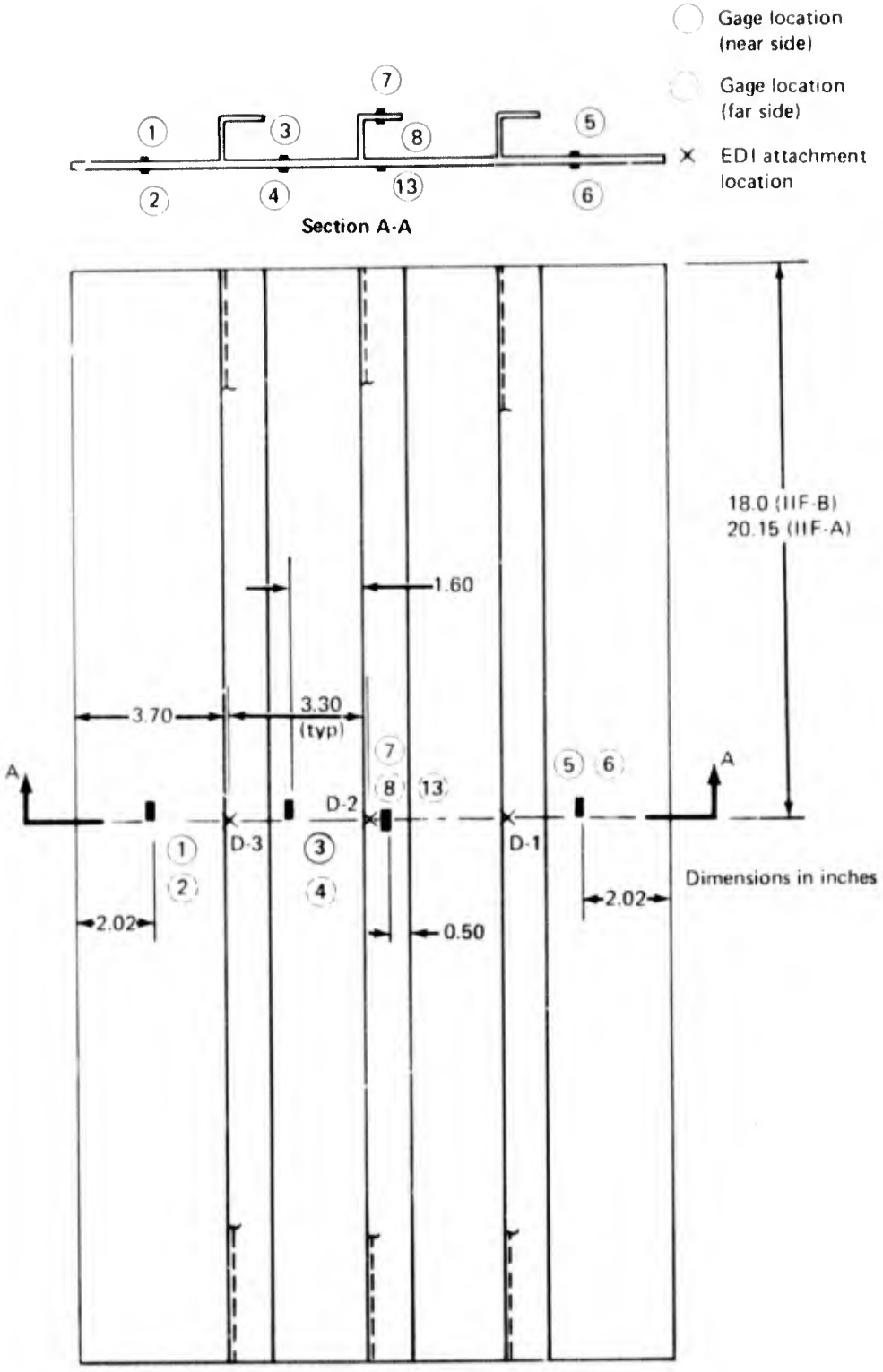


FIGURE B-2.–GAGE LOCATIONS FOR TYPE IIF PANELS

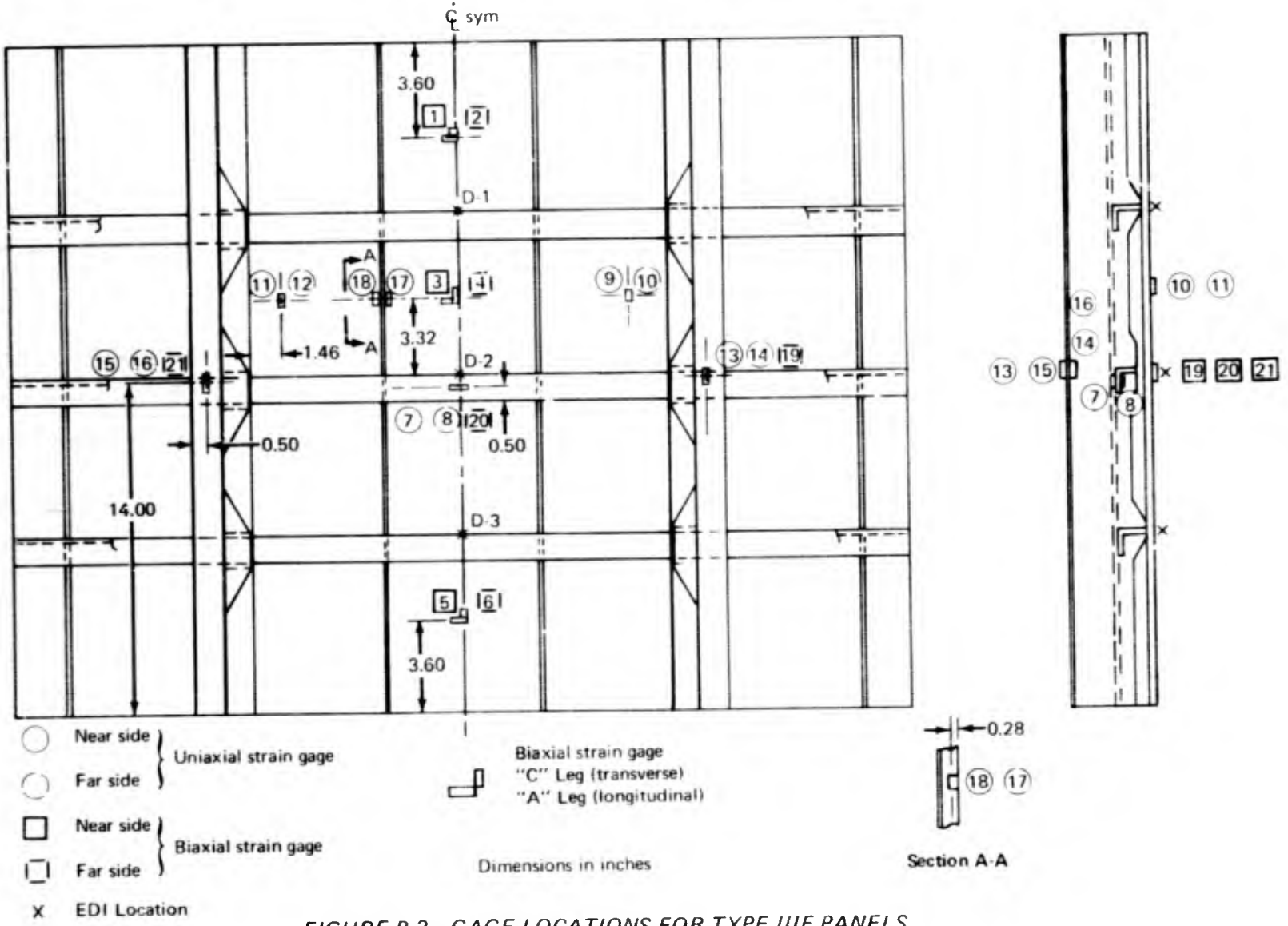


FIGURE B-3.—GAGE LOCATIONS FOR TYPE IIIF PANELS

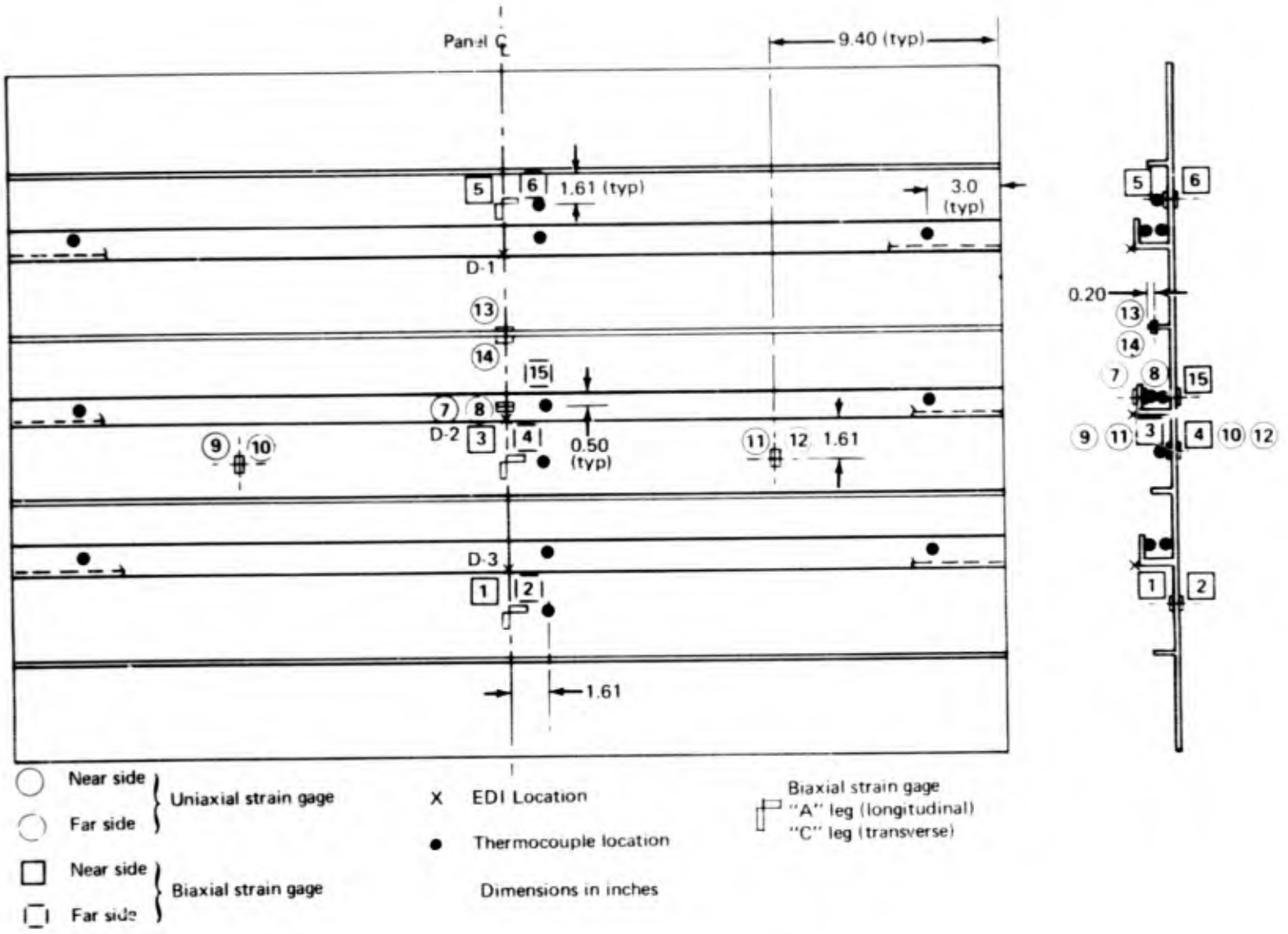
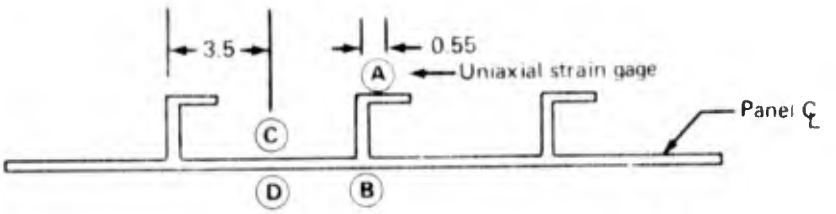


FIGURE B-4.—GAGE LOCATIONS FOR TYPE IVF PANELS

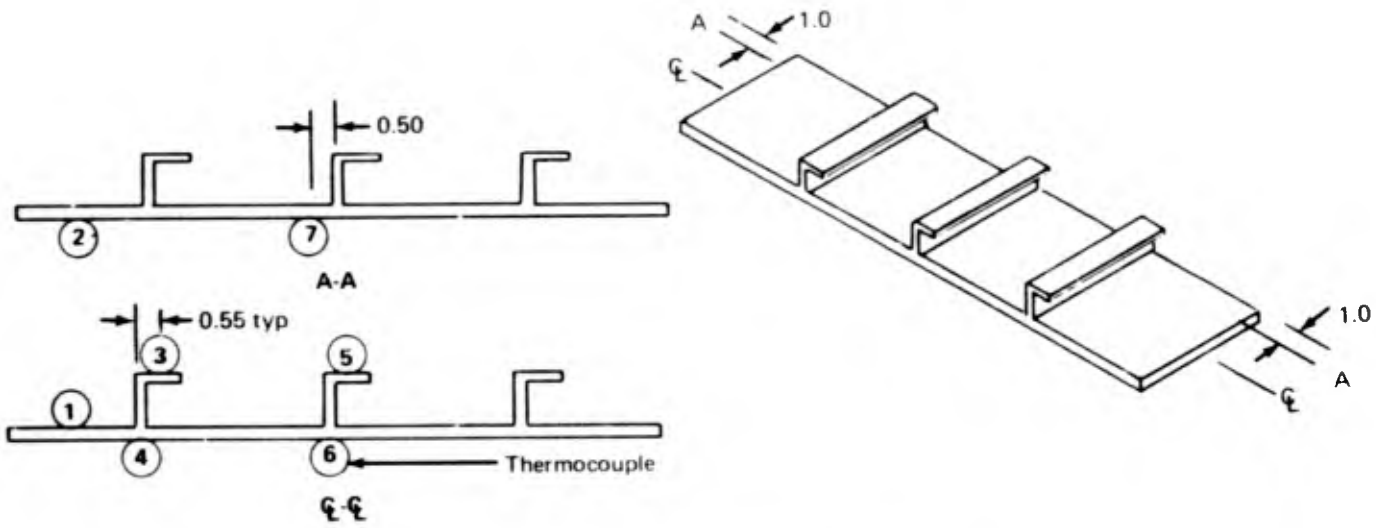
TABLE B-1.—STRAIN GAGE DATA FOR TYPE IC PANELS



Panel IC-C			Panel IC-E			Panel IC-F		
Load (kip)	Stress* (ksi) Gage no.		Load (kip)	Stress* (ksi) Gage no.		Load (kip)	Stress* (ksi) Gage no.	
	B	A		C	D		C	D
0	0	0	5	4.1	2.2	5	2.6	1.5
200	24.5	29.7	100	13.2	10.7	100	10.8	10.3
400	46.8	55.4	200	24.2	22.0	200	21.0	21.0
600	67.1	82.2	300	35.7	33.4	300	32.4	32.4
650	72.2	88.9	375	44.5	42.0	375	41.2	41.1
700	77.1	96.1	400	47.6	44.8	450	50.0	50.0
750	81.8	102.5	425	50.7	47.8	475	52.8	52.8
800	86.5	109.2	450	54.1	50.9	500	55.8	55.8
850	91.0	114.5	475	57.4	53.9	525	59.2	58.8
900			500	60.9	57.3	550	62.4	61.9
			525	64.2	60.7	575	65.9	65.4
			550	67.6	64.5	590	68.2	68.0
			575	71.5	69.1	600	69.9	70.4
			600	67.8	91.3	610	70.9	73.5
			616			620	68.3	83.2
						634		

*Apparent stress based on E = 17 x 10^3 ksi (+ compression)

TABLE B-2.–THERMOCOUPLE DATA FOR TYPE IC PANELS



Panel	Panel temperatures (°F)						
	Gage number						
	1	2	3	4	5	6	7
IC-D	430	375	430	415	460	440	–
IC-E	435	430	421	432	450	450	439
IC-F	429	400	413	430	450	450	419

TABLE B-3a.—STRAIN AND NORMAL DISPLACEMENT DATA FOR PANEL IF-A

Load (kip)		Deflection[a] (in.)			Strain—Longitudinal[b] (μin./in.)								
Long.	Trans	D-1	D-2	D-3	1A	2A	3A	4A	5A	6A	7	8	13A
100	0	-0.002	0.000	0.000	-759	-744	-696	-696	699	-705	-681	-735	-666
300	0	-0.002	0.000	-0.004	-2244	-2232	-2142	-2151	-2052	-2073	-2040	-2196	-2088
400	0	-0.002	-0.004	-0.010	-2970	-2964	-2856	-2883	-2745	-2775	-2754	-2841	-2805
500	0	-0.006	-0.010	-0.018	-3678	-3687	-3549	-3615	-3435	-3462	-3354	-3462	-3525
550	0	-0.012	-0.020	-0.026	-4008	-4050	-3888	-3981	-3789	-3804	-3612	-3738	-3894
575	0	-0.018	-0.026	-0.036	-4185	-4257	-4074	-4188	-3975	-3978	-3708	-3852	-4092
600	0	-0.024	-0.040	-0.042	-4344	-4452	-4242	-4389	-4158	-4149	-3753	-3921	-4293
625	0	-0.034	-0.050	-0.058	-4497	-4650	-4407	-4599	-4338	-4314	-3717	3921	-4512
650	0	-0.056	-0.086	-0.082	-4644	-4896	-4575	-4839	-4536	-4494	-3510	-3780	-4791
675	0	-0.116	-0.174	-0.146	-4701	-5241	-4743	-5169	-4794	-4716	-2622	-3042	-5223
688	0				Ultimate load								
0	0				-1548	1941	2187	-2721	1863	-1821	Open	Open	-2259

[a]Positive toward skin side

[b]Positive expansion

TABLE B-3b.–STRAIN AND NORMAL DISPLACEMENT DATA FOR PANEL IF-A (CONCLUDED)

Load (kip)		Strain–Transverse[b] (μin./in.)										
Long.	Trans	1C	2C	3C	4C	5C	6C	9	10	11	12	13C
100	0	231	246	189	201	237	225	243	210	126	162	162
300	0	711	714	654	660	636	675	735	660	561	603	615
400	0	933	966	906	873	843	924	957	897	783	828	849
500	0	1116	1248	1194	1050	1038	1194	1170	1137	1008	1056	1083
550	0	1227	1371	1374	1122	1125	1335	1287	1245	1119	1167	1197
575	0	1278	1437	1461	1143	1167	1404	1344	1302	1176	1221	1254
600	0	1338	1497	1572	1152	1212	1479	1395	1362	1235	1275	1317
625	0	1395	1545	1719	1134	1254	1557	1443	1428	1296	1323	1380
650	0	1500	1575	1929	1071	1320	1626	1476	1512	1371	1359	1464
675	0	1698	1488	2331	867	1443	1674	1461	1632	1494	1320	1590
688	0				Ultimate load							
0	0	522	-243	999	-1593	-1569	-1719	717	-699	750	-768	-2190

[b]Positive expansion

TABLE B-4.—STRAIN AND NORMAL DISPLACEMENT DATA FOR PANEL IF-C

Load (kip)		Deflection[a] (in.)			Strain—Longitudinal[b] (μin./in.)								
Long.	Trans	D-1	D-2	D 3	1A	2A	3A	4A	5A	6A	7	8	13A
108	0.63	0.000	-0.006	-0.014	-834	-710	-789	-795	-783	726	-798	-813	-777
208	43.14	-0.016	-0.010	-0.032	-1560	-1521	-1446	-1473	-1455	-1380	-1395	-1425	-1437
300	52.20	-0.022	-0.016	-0.040	-2265	-2226	-2115	-2172	-2136	-2025	-1965	-2010	-2115
400	64.47	-0.032	-0.026	-0.046	-2985	-2946	2808	-2898	-2832	-2682	-2541	-2586	-2820
500	67.35	-0.042	-0.046	-0.064	-3714	-3684	-3495	-3672	-3549	-3357	-3003	-3054	-3570
550	61.80	-0.050	-0.064	-0.076	-4086	-4062	-3819	-4065	-3912	-3696	-3087	-3168	-3960
600	64.56	-0.128	-0.218	-0.160	-4470	-4590	-4092	-4710	-4395	-4122	-1644	-1950	-4680
625	61.77							Ultimate load					

Load (kip)		Strain—Transverse[b] (μin./in.)										
Long.	Trans	1C	2C	3C	4C	5C	6C	9	10	11	12	13C
108	0.63	300	216	264	216	195	255	252	213	279	264	234
208	43.14	528	42	240	222	525	-66	225	228	279	309	321
300	52.20	702	213	444	348	738	30	384	372	459	471	495
400	64.47	891	411	684	471	960	156	540	516	627	636	702
500	67.35	1080	690	1071	567	1152	402	747	711	843	819	924
550	61.80	1170	885	1332	579	1230	606	879	858	1020	960	1026
600	64.56	1050	1233	2112	57	1164	921	960	900	1260	864	1074
625	61.77					Ultimate load						

[a]Positive toward skin side

[b]Positive expansion

TABLE B-5a.—STRAIN AND NORMAL DISPLACEMENT DATA FOR PANEL IF-D

Load (kip)		Deflection[a] (in.)			Strain—Longitudinal[b] (μin./in.)								
Long.	Trans	D-1	D-2	D-3	1A	2A	3A	4A	5A	6A	7	8	13A
20	0.87	0.030	-0.012	0.052	-75	-60	-129	-102	-219	-195	-303	-297	-138
200	77.7	0.024	-0.028	0.046	-1383	-1290	-1278	-1278	-1278	-1248	-1245	-1290	-1272
300	89.4	0.022	-0.028	0.042	-2112	-1983	-1962	-1980	-1995	-1917	-1866	-1941	-1962
400	105.3	0.020	-0.040	0.038	-2838	-2676	-2646	-2694	-2676	-2574	-2424	-2523	-2658
440	111.3	0.014	-0.044	0.038	-3120	-2940	-2898	-2982	-2943	-2844	-2598	-2715	-2940
460	114.9	0.014	-0.050	0.036	-3279	-3114	-3042	-3141	-3093	-2976	-2670	-2781	-3096
480	116.1	0.010	-0.060	0.032	-3414	-3243	-3162	-3270	-3210	-3096	-2730	-2844	-3216
520	121.5	0.040	-0.076	0.024	-3708	-3522	-3426	-3606	-3498	-3432	-2808	-2946	-3558
560	125.7	-0.010	-0.112	0.040	-4011	-3828	-3654	-3990	-3795	-3642	-2580	-2814	-3927
580	131.1	-0.026	-0.150	-0.016	-4176	-4005	-3747	-4230	-3954	-3804	-2220	-2490	-4161
600	131.4	-0.058	-0.226	-0.058	-4365	-4233	-3825	-4530	-4146	-4017	-1350	-1674	-4494
620	125.7	-0.140	-0.380	-0.140	-4599	-4605	-3918	-4896	-4416	-4365	330	213	-4920
628	120.3				Ultimate load								
0	0				72	-33	114	-96	48	9	3630	3477	-129

[a]Positive toward skin side

[b]Positive expansion

TABLE B-5b. –STRAIN AND NORMAL DISPLACEMENT DATA FOR PANEL IF-D (CONCLUDED)

Load (kip)		Strain–transverse* (μin./in.)										
Long.	Trans	1C	2C	3C	4C	5C	6C	9	10	11	12	13C
20	0.87	36	6	-4	78	78	39	12	39	-6	81	141
200	77.7	-27	213	30	27	12	84	39	-18	-78	150	48
300	89.4	96	417	219	165	153	255	222	126	48	336	198
400	105.3	201	648	426	255	291	414	363	240	198	531	345
440	111.3	249	753	504	267	330	480	420	258	213	594	384
460	114.9	264	813	558	282	336	522	480	288	252	624	393
480	116.1	258	852	645	294	366	576	498	315	330	678	441
520	121.5	282	1014	816	255	396	678	606	369	369	741	492
560	125.7	180	1215	1158	54	306	852	675	372	468	786	552
580	131.1	135	1392	1470	105	261	990	711	375	468	771	573
600	131.4	-30	1680	2025	480	150	1236	750	345	606	690	564
620	125.7	-126	2109	2838	816	60	1638	870	219	885	414	531
628	120.3				Ultimate load							
0	0	-45	63	129	-165	-24	15	48	-18	42	-27	-270

*Positive expansion

TABLE B-6a.–STRAIN, NORMAL DISPLACEMENT, AND THERMOCOUPLE DATA FOR PANEL IF-E

Load (kip)		Deflection[a] (in.)			Strain–Longitudinal[b] (μin./in.)								
Long.	Trans	D-1	D-2	D-3	1A	2A	3A	4A	5A	6A	7	8	13A
40	0	0.004	0.022	0.004	-201	-195	-243	-210	-312	-297	-450	-450	-246
40	0	0.000	-0.050	0.024	-42	-87	-81	-126	-156	-183	-1164	-1167	-252
40	5.1	-0.004	-0.052	0.024	-30	-78	-72	-114	-150	-177	-1113	-1125	-243
100	27.6	-0.014	-0.062	0.024	-465	-531	-480	-531	-501	-522	-1389	-1416	-642
200	36.9	-0.020	-0.074	0.018	-1173	-1254	-1179	-1254	-1194	-1203	-1944	-1989	-1368
300	51.9	-0.034	-0.100	0.004	-1896	-2007	-1890	-2025	-1905	-1908	-2346	-2430	-2133
400	62.4	-0.056	-0.162	-0.016	-2610	-2757	-2574	-2823	-2625	-2628	-2352	-2529	-2949
100	25.8	-0.022	-0.102	0.026	-516	-579	-516	-600	-564	-594	-1053	-1116	-714
400	57.9	-0.060	-0.168	-0.016	-2643	-2793	-2580	-2847	-2643	-2649	-2265	-2463	-2958
450	62.4	-0.088	-0.224	-0.052	-3006	-3219	-2910	-3303	-3018	-3036	-1938	-2244	-3432
480	63.3	-0.126	-0.290	-0.094	-3237	-3534	-3090	-3636	-3276	-3333	-1344	-1764	-3777
500	62.4	-0.196	-0.400	-0.168	-3432	-3828	-3186	-3930	-3495	-3603	-351	-879	-4098
520	77 ;								Ultimate load				
0	0				174	87	171	60	141	60	279	141	-21

[a]Positve toward skin side

[b]Positive expansion

TABLE B-6b.–STRAIN, NORMAL DISPLACEMENT, AND THERMOCOUPLE DATA FOR PANEL IF-E (CONCLUDED)

Load (kip)		Strain–Transverse[a] (in./in.)											Measured temp[b] (°F)	
Long.	Trans	1C	2C	3C	4C	5C	6C	9	10	12	12	13C	Flang	Skin
40	0	99	27	12	126	123	54	33	63	39	165	222	70	70
40	0	147	-39	84	30	123	39	114	-3	96	114	198	320	81
40	5.1	114	-36	63	9	138	-12	87	-27	72	87	183	320	81
100	27.6	72	99	111	15	228	-93	129	-21	102	117	186	320	82
200	36.9	234	309	333	159	411	72	336	153	279	282	363	320	82
300	51.9	384	480	606	252	564	279	513	270	459	396	495	320	83
400	62.4	453	804	1008	225	636	528	708	375	744	480	579	320	84
100	25.8	60	141	210	-27	222	-15	168	-33	207	96	96	320	85
400	57.9	480	822	1053	213	642	561	711	369	804	507	570	320	86
450	62.4	579	969	1398	129	663	762	822	399	999	498	618	320	86
480	63.3	675	1047	1737	6	687	945	906	399	1176	432	657	320	86
500	62.4	879	1041	2157	-153	726	1092	1008	345	1380	339	720	320	86
520	77.1					Ultimate load								
0	0	105	-84	135	-120	102	-63	72	-45	93	-57	-30		

[a]Positive expansion

[b]±6°F

TABLE B-7a.–STRAIN, NORMAL DISPLACEMENT, AND THERMOCOUPLE DATA FOR PANEL IF-F

Load (kip)		Deflection[a] (in.)			Strain–Longitudinal[b] (μin./in.)								
Long.	Trans	D-1	D-2	D-3	1A	2A	3A	4A	5A	6A	7	8	13A
40	0	0.004	0.016	0.000	-213	-198	-240	-219	-351	-318	-384		-261
40	0	-0.004	-0.062	0.036	-45	-69	-66	-129	-183	-189	-1182		-267
40	5.4	-0.006	-0.064	0.038	-42	-66	-57	-123	-174	-174	-1113		-261
100	49.5	-0.004	-0.066	0.016	-504	-480	-456	-534	-570	-567	-1476		-675
200	60.0	-0.004	-0.072	0.010	-1206	-1158	-1128	-1212	-1245	-1227	-2079		-1374
300	70.5	-0.014	-0.078	0.004	-1947	-1869	-1845	-1968	-1968	-1941	-2652		-2145
400	81.0	-0.024	-0.094	-0.014	-2691	-2574	-2544	-2718	-2676	-2649	-3105		-2913
399	78.0	-0.022	-0.100	-0.010	-2685	-2577	-2550	-2742	-2676	2655	-3045		-2934
395	93.0	0.022	-0.102	-0.014	-2652	-2538	-2505	-2685	-2634	2616	-3012		-2880
450	96.9	-0.032	-0.128	-0.034	-3045	-2910	-2880	-3132	-3024	-3009	-3018		-3351
480	100.8	-0.058	-0.184	-0.066	-3294	-3156	-3081	-3465	-3267	-3264	-2658		-3726
500	99.9	-0.132	-0.328	-0.150	-3522	-3462	-3165	-3927	-3513	-3570	-936		-4206
400	89.4	-0.104	-0.280	-0.110	-2802	-2775	-2523	-3084	-2766	-2835	-906		-3282
397	120.9	-0.104	-0.310	-0.134	-2778	-2715	-2454	-3078	-2739	-2814	-453		-3294
450	125.4	-0.136	-0.368	-0.170	-3183	-3147	-2775	-3594	-3180	-3288	42		-3834
480	123.9	-0.168	-0.424	-0.208	-3453	-3480	-2973	-3945	-3450	-3606	543		-4194
499	115.8				First ultimate load								
0	0	-0.046	-0.156	0.006	168	99	201	45	171	81	135		-36
42.6	157.2				Second ultimate load								

Strain gage inoperative

[a]Positive toward skin side

[b]Positive expansion

TABLE B-7b.–STRAIN, NORMAL DISPLACEMENT, AND THERMOCOUPLE DATA FOR PANEL IF-F (CONCLUDED)

Load (kip)		Strain–Transverse[a] (in./in.)											Measured temp[b] (°F)	
Long.	Trans	1C	2C	3C	4C	5C	6C	9	10	11	12	13C	Flange	Skin
40	0	69	54	12	120	144	60	-24	42	75	162	177	70	70
40	0	108	-18	72	18	147	21	36	-9	126	123	177	320	80
40	5.4	93	-36	48	0	171	-42	9	-33	99	102	153	320	80
100	49.5	42	-66	-78	-33	468	-462	-162	-102	18	90	171	320	80
200	60.0	207	114	87	129	705	-372	0	75	135	282	375	320	80
300	70.5	387	330	306	297	915	-198	180	267	333	447	627	320	80
400	81.0	489	540	528	408	1095	-66	309	417	555	624	334	320	80
399	78.0	537	591	591	423	1116	12	363	444	567	615	858	320	80
395	93.0	426	480	438	360	1059	-105	252	366	462	546	786	320	80
450	96.9	477	678	642	399	1143	48	330	462	579	615	897	320	80
480	100.8	474	870	888	333	1137	234	375	510	699	612	930	320	80
500	99.9	297	1266	1644	-57	999	630	462	462	954	387	891	320	80
400	89.4	234	975	1194	-45	864	369	378	270	777	252	522	320	80
397	120.9	-105	966	1104	-255	654	267	165	90	624	69	354	320	80
450	125.4	-96	1257	1566	-384	717	543	270	150	753	27	531	320	80
480	123.9	18	1461	1968	-462	786	753	333	162	900	12	663	320	80
499	115.8	First ultimate load												
0	0	93	-84	162	-153	111	-99	87	-54	135	-78	-90	320	80
42.6	157.2	Second ultimate load												

[a]Positive expansion

[b]±6° F

TABLE B-8.—STRAIN AND NORMAL DISPLACEMENT DATA FOR TYPE IIF PANELS

Panel	Load (kip)		Deflection[a] (in.)			Strain—Longitudinal[b] (μin./in.)								
	Long.	Trans	D-1	D-2	D-3	1	2	3	4	5	6	7	8	13
IIF-A	5	0				-135	129	-120	-126	-111	99	-117	-135	-135
	120	0	-0.034	-0.068	-0.048	-2778	-2772	-2658	-2811	-2667	-2616	-2355	-2628	-2745
	180	0	-0.064	-0.104	-0.068	-4098	-4137	-3972	-4245	-4056	-3978	-3321	-3735	-4185
	220	0	-0.136	-0.198	-0.136	-5040	-5214	-4908	-5382	-5139	-5022	-3312	-3894	-5349
	230	0	-0.168	-0.242	-0.168	-5301	-5544	-5160	-5706	-5472	-5349	-3108	-3741	-5703
	240	0	-0.224	-0.312	-0.222	-5595	-5961	-5439	-6084	-5937	-5703	-2679	3378	-6120
	250	0					Ultimate load							
	0	0				147	-36	-30	-84	258	201	156	117	-324
IIF-B	50	0	-0.006	-0.008	-0.008	-1224	-1164	-1185	-1185	-1146	-1134	-1050	-1065	-1137
	100	0	-0.006	-0.008	-0.008	-2454	-2373	-2367	-2358	-2265	-2214	-2151	-2175	-2304
	150	0	0.000	0.000	0.000	-3636	-3501	-3519	-3525	-3402	-3342	-3204	-3243	-3474
	200	0	0.014	0.030	0.020	-4818	-4629	-4662	-4731	-4542	-4503	-4053	-4155	-4677
	205	0	0.018	0.038	0.026	-4947	-4746	-4782	-4863	-4662	-4632	-4104	-4218	-4815
	210	0	0.022	0.048	0.034	-5082	-4872	-4908	5010	-4791	-4767	-4101	-4242	-4950
	215	0	0.034	0.064	0.044	-5211	-4989	-5025	-5151	-4911	-4908	-4095	-4260	-5103
	220	0	0.048	0.084	0.060	-5361	-5127	5160	-5322	-5013	-5106	-4023	-4233	5277
	225	0	0.068	0.112	0.078	-5529	-5274	5295	-5508	-5130	-5319	-3852	-4122	5460
	230	0	0.098	0.148	0.104	-5718	-5442	-5439	-5718	-5250	-5583	-3630	-3969	5697
	235	0	0.142	0.204	0.144	-5955	-5640	-5595	-5979	-5316	-5961	-3243	-3684	-5955
	240	0					Ultimate load							
	0	0				-651	330	-36	-222	792	-1344	168	93	165

[a]Positive toward skin side for IIF-A, opposite for IIF-B.

[b]Positive expansion.

TABLE B-9.–STRAIN GAGE DATA FOR TYPE IIIC PANELS

Panel	Load (kip)	Stress[a] (ksi) Strain gage 1	2	3	4	5	6
IIIC-A	100	8.5	9.8	8.5	7.5	10.6	9.2
	300	36.2	37.8	35.8	34.4	43.1	35.0
	500	64.4	65.9	62.9	61.2	75.3	58.8
	525	67.9	69.4	66.4	64.7	79.5	61.7
	575	74.9	76.2	73.1	71.4	87.9	67.2
	600	78.4	79.7	76.5	74.8	92.2	70.0
	625	82.0	83.2	80.0	78.3	96.6	72.7
	650	85.8	86.9	83.7	81.9	101.2	75.8
	675	89.6	90.7	87.7	85.8	105.7	80.0
	700	95.2	96.1	93.8	91.7	110.5	88.6
	725	103.0	102.9	101.5	99.6	b	b
	731	Ultimate load					
IIIC-B	100	13.0	14.6	10.8	9.9	10.0	10.0
	300	42.3	44.2	38.2	36.5	40.8	36.8
	600	84.7	85.5	79.8	77.3	86.4	74.3
	625	88.5	89.0	83.5	80.8	90.1	77.5
	650	92.2	92.5	87.4	84.8	94.4	81.1
	675	96.3	96.1	91.5	88.8	99.6	83.7
	685	101.4	100.0	96.7	94.6	b	b
	707	Ultimate load					
IIIC-C	100	10.0	11.2	10.6	9.2	9.8	9.7
	300	38.5	40.3	42.1	35.0	36.4	35.6
	600	80.6	81.9	90.1	75.2	76.9	71.3
	625	84.4	85.5	94.7	78.9	80.7	74.5
	650	88.1	89.1	98.8	82.4	84.3	77.7
	676	92.2	93.1	102.4	86.4	88.5	83.2
	700	100.1	100.1	b	b	b	b
	722	Ultimate load					

[a]Apparent stress based on E = 17 x 10^3 ksi (+compression)

[b]Readings unstable

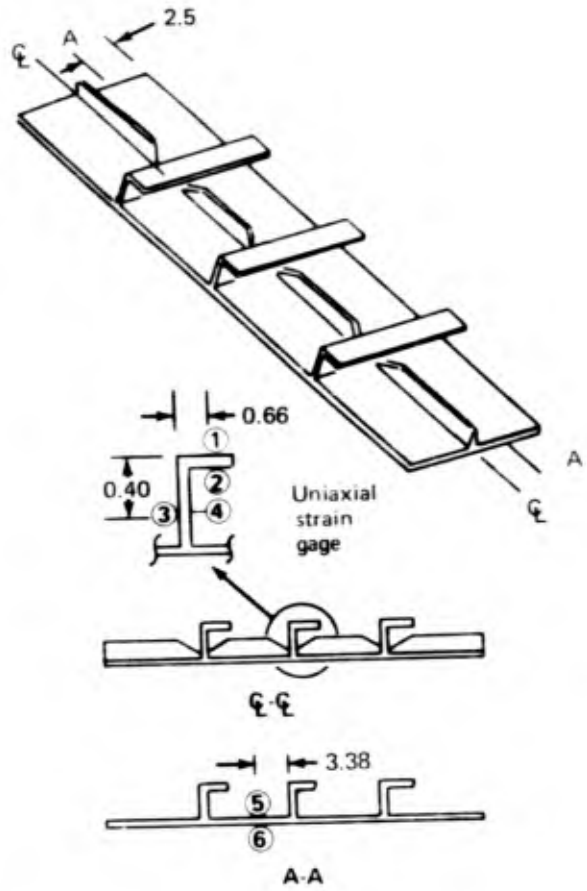


TABLE B-10a.—STRAIN AND NORMAL DISPLACEMENT DATA FOR PANEL IIIF-A

Load (kip)		Deflection[a] (in.)			Strain—Longitudinal[b] (μin./in.)										
Long	Trans	D-1	D-2	D-3	1A	2A	3A	4A	5A	6A	7	8	19A	20A	21A
40	10.2	-0.002	-0.006	-0.000	-246	-270	-300	-318	-363	-381	-1282	285	-435	-540	-621
191	9.9	-0.014	-0.024	-0.010	-1674	-1758	-1662	-1698	-1623	-1668	-1715	-1701	-1821	-1887	-1950
295.5	10.8	-0.030	-0.046	-0.022	-2571	-2703	-2568	-2556	-2493	-2562	-2805	-2745	-2769	-2748	-2856
397.5	10.8	-0.050	-0.072	-0.042	-3405	-3666	-3516	-3309	-3293	-3501	-4086	-3951	-4782	-4344	-4614
499	10.8	-0.098	-0.154	-0.092	-1698	-6564	-5571	-2544	-2526	-5727	-6864	-6099	-5448	-4512	-5415
425	6.9	-0.060	-0.094	-0.052	-3375	-4182	-3867	-3375	-3246	-3975	-4848	-4515	-4674	-4293	-4686
450	7.5	-0.076	-0.110	-0.062	-3294	-4671	-4242	-3360	-3270	-4359	-5364	-4947	-4932	-4413	-4938
475	8.4	-0.086	-0.130	-0.074	-2766	-5523	-4818	-3114	-3075	-4932	-6057	-5493	-5211	-4494	-5196
500	9.9	-0.098	-0.156	-0.088	-1713	-6609	-5580	-2598	-2280	-5934	-6966	-6138	-5490	-4521	-5454
515.5	10.8	-0.120	-0.202	-0.110	-1137	-7143	-6087	-2040	-1536	-6672	Ultimate load				
0	0	-0.416		-0.248	-9414	5262	-3399	2439	-3240	1266	-9870	-1368	-789	3903	-975

[a]Positive toward skin side

[b]Positive expansion

TABLE B-10b.—STRAIN AND NORMAL DISPLACEMENT DATA FOR PANEL IIIF-A (CONCLUDED)

Load (kip)		Strain—Transverse* (μin./in.)									
Long.	Trans	1C	2C	3C	4C	5C	6C	9	10	11	12
40	10.2	48	18	36	45	60	72	63	0	-3	81
191	9.9	420	555	396	507	390	525	414	459	375	561
295.5	10.8	651	876	600	822	609	828	639	756	606	903
397.5	10.8	936	1179	759	1221	894	1101	840	1074	852	1278
499	10.8	3474	-666	-201	2988	2457	63	1992	639	1818	693
425	6.9	1296	981	708	1485	1212	957	1017	1107	1029	1338
450	7.5	1620	786	600	1734	1422	864	1107	1131	1125	1377
475	8.4	2343	222	318	2205	1815	582	1320	1047	1326	1290
500	9.9	3489	-657	-156	2970	2682	-120	1902	732	1728	804
515.5	10.8	4146	-1137	-483	3612	3399	-648	Ultimate load			
0	0	-1758	2298	582	234	-669	600	99	147	75	255

Load (kip)		Strain—Transverse* (μin./in.)								
Long.	Trans	13	14	15	16	17	18	19C	20C	21C
40	10.2	45	27	0	0	18	18	-234	-156	-153
191	9.9	69	63	201	177	216	219	153	216	243
295.5	10.8	0	6	165	153	303	306	477	441	546
397.5	10.8	129	-84	81	93	387	375	-201	-213	39
499	10.8	-330	-186	-87	18	513	60	549	-852	438
425	6.9	-180	-111	24	63	423	369	399	-60	438
450	7.5	-231	-144	-18	30	429	330	489	-177	522
475	8.4	-294	-180	-69	3	453	237	558	-444	564
500	9.9	-345	-195	-99	6	507	81	522	-942	429
515.5	10.8	Ultimate load								
0	0	-744	-573	-570	-441	-849	909	567	2262	339

*Positive expansion

TABLE B-11a.—STRAIN AND NORMAL DISPLACEMENT DATA FOR PANEL IIIF-B

Load (kip)		Deflection[a] (in.)			Strain—Longitudinal[b] (μin./in.)										
Long.	Trans	D-1	D-2	D-3	1A	2A	3A	4A	5A	6A	7	8	19A	20A	21A
114	23.1	0.000	-0.006	-0.008	-942	-996	-924	-918	969	-948	-861	-861	-888	-934	-864
129	57.9	0.012	0.002	0.002	-978	-1161	-1014	-1014	-1023	-1092	-831	-840	-978	-1044	-930
204	116.7	0.022	0.016	0.018	-1482	-1836	-1599	-1590	-1539	-1752	-1203	-1236	-1521	-1605	-1467
209	177.0	0.040	0.038	0.042	-1446	-1818	-1560	-1572	-1458	-1773	882	-936	-1452	1605	-1389
212	214.5	0.052	0.058	0.058	-1425	-1794	-1524	-1581	-1410	-1779	633	-711	-1398	-1623	-1335
300	229.9	0.058	0.062	0.064	-2076	-2601	-2325	-2289	-2226	-2442	1161	-1275	-2076	-2445	-2028
300	265.5	0.102	0.058	-0.044	-753	-3768	-3882	609	-3867	-708	-738	-831	-1872	-3255	-2013
340	257.1	0.122	0.112	-0.018	-336	-5100	-5364	-585	-5670	-1116	-1053	-1155	-2163	-4452	-2466
449.5	237.0					Ultimate load									
0	0				-321	-939	-1086	381	-1233	525	255	228	-36	252	0

[a]Positive toward skin side

[b]Positive expansion

TABLE B-11b.—STRAIN AND NORMAL DISPLACEMENT DATA FOR PANEL IIIF-B (CONCLUDED)

Load (kip)		Strain—Transverse* (μin./in.)									
Long.	Trans	1C	2C	3C	4C	5C	6C	9	10	11	12
114	23.1	207	150	108	132	162	267	87	135	72	105
129	57.9	126	-84	-60	-57	39	42	-96	63	108	-126
204	116.7	99	369	246	-267	-6	342	-288	-297	303	369
209	177.0	-111	-801	-564	-711	-234	-831	-636	-741	-336	-870
212	214.5	-270	-1098	-750	-1011	-387	-1134	-840	-1035	-819	-1185
300	229.9	-60	-978	-336	-783	-357	-729	-699	861	-540	-1176
300	265.5	-1020	2262	-2253	-648	-1962	417	0	-2160	912	-3045
340	257.1	2475	-3120	-3177	2328	-3252	2409	1695	-3519	2154	-3849
449.5	237.0					Ultimate load					
0	0	399	-420	-375	402	-366	396	258	-411	216	-309

Load (kip)		Strain—Transverse* (μin./in.)								
Long.	Trans	13	14	15	16	17	18	19C	20C	21C
114	23.1	27	12	63	45	30	36	42	114	39
129	57.9	51	39	132	99	-54	-54	-150	-96	-186
204	116.7	96	75	213	168	-135	-144	-387	-303	-450
209	177.0	192	156	297	231	-273	-282	-846	-708	-918
212	214.5	273	225	360	285	-339	-351	-1146	-948	-1227
300	229.9	333	264	453	345	171	-231	1065	-534	-1146
300	265.5	618	492	624	501	252	-456	-1647	123	-1357
340	257.1	876	690	840	660	540	-639	-1941	1023	-2043
449.5	237.0					Ultimate load				
0	0	-102	-99	18	6	-18	-60	-36	468	-21

*Positive expansion

TABLE B-12a.–STRAIN AND NORMAL DISPLACEMENT DATA FOR PANEL IIIF-C

Load (kip)		Deflection[a] (in.)			Strain–Longitudinal[b] (μin./in.)										
Long.	Trans	D-1	D-2	D-3	1A	2A	3A	4A	5A	6A	7	8	19A	20A	21A
0	0	0.000	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0
54	78.3	0.000	0.002	0.000	-36	-36	-30	-30	-42	-45	-6	6	-36	-33	-15
40	287.7	0.028	0.054	0.036	45	147	147	171	-9	-36	909	618	162	-24	417
48	329.4	0.034	0.070	0.044	6	147	144	138	-27	-30	1125	1011	204	-36	471
51	357.9	0.036	0.078	0.050	3	171	168	138	-21	9	1359	1209	285	-63	531
55.5	389.1	0.040	0.098	0.058	-9	201	168	141	-54	66	1638	1470	366	-153	600
52.5	420	0.032	0.130	0.070	72	291	126	330	-105	240	2166	1905	570	-255	759
52	445.2	-0.008	0.170	0.098	237	159	-441	1038	-411	525	2754	2379	774	-591	984
51	473.7	Ultimate load													
0	0				135	312	-132	–	138	27	-165	-171	111	-36	-279

[a]Positive toward skin side

[b]Positive expansion

TABLE B-12b.–STRAIN AND NORMAL DISPLACEMENT DATA FOR PANEL IIIF-C (CONCLUDED)

Load (kip)		Strain–Transverse* (μin./in.)									
Long.	Trans	1C	2C	3C	4C	5C	6C	9	10	11	12
0	0	0	0	0	0	0	0	0	0	0	0
54	78.3	-18	-36	-36	-45	-21	-36	-36	-42	-42	-48
40	287.7	-1296	-1977	-1587	-2061	-1341	-1980	-1632	-2070	-1674	-2121
48	329.4	-1446	-2166	-1755	-2352	-1524	-2196	-1842	-2358	-1884	-2433
51	357.9	-1593	-2358	-1887	-2580	-1674	-2382	-2016	-2525	-2022	-2652
55.5	389.1	-1719	-2541	-2007	-2793	-1848	-2544	-2166	-2853	-2154	-2868
52.5	420	-1842	-2847	-2298	-2898	-2139	-2628	-2370	-3126	-2313	-3084
52	445.2	-1599	-3396	-3081	-2172	-2562	-2388	-2643	-3183	-2691	-3189
51	473.7					Ultimate load					
0	0	-657	294	-654	324	66	-93	-573	–	-1404	–

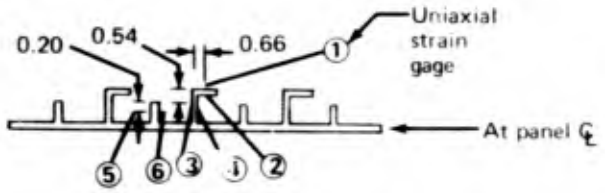
Load (kip)		Strain–Transverse* (μin./in.)								
Long.	Trans	13	14	15	16	17	18	19C	20C	21C
0	0	0	0	0	0	0	0	0	0	0
54	78.3	15	12	3	0	-18	-15	-45	-42	54
40	287.7	-201	-240	-900	-867	-729	-687	-2067	-1797	-2253
48	329.4	-240	-288	-1017	-1002	-780	-732	-2409	-2034	-2613
51	357.9	-273	-336	-1062	-1068	-819	-768	-2712	-2202	-2871
55.5	389.1	-270	-360	-1083	-1116	-858	-804	-3009	-2370	-3147
52.5	420	-165	-303	-960	-1068	-1026	-984	-3438	-2565	-3465
52	445.2	-9	-237	-876	-1071	-1866	-1950	-3858	-2808	-3885
51	473.7					Ultimate load				
0	0	177	-12	138	465	-807	-708	-1065	-276	993

*Positive expansion

TABLE B-13.—STRAIN GAGE DATA FOR TYPE IVC PANELS

Panel	Load (kip)	Stress* (ksi) Strain gage 1	2	3	4	5	6
IVC-A	100	13.8	14.2	13.5	13.5	9.8	10.0
	300	43.2	44.4	42.0	42.0	40.4	40.5
	400	58.0	59.6	56.6	56.6	55.8	56.0
	425	61.5	63.2	60.2	60.2	59.5	59.6
	450	65.2	66.8	63.8	63.8	63.2	63.5
	475	68.9	70.5	67.5	67.5	67.0	67.3
	500	72.5	74.3	71.1	71.1	71.0	71.1
	525	76.2	77.9	74.8	74.8	74.8	74.8
	550	79.7	81.5	78.3	78.3	78.5	78.6
	575	83.4	85.2	82.0	82.0	82.4	82.4
	600	87.2	89.1	86.0	86.0	86.5	86.5
	625	91.0	93.0	89.8	89.8	90.6	90.6
	650	94.9	97.1	93.9	93.9	94.8	94.8
	675	98.9	101.0	97.8	97.8	99.2	99.2
	700	103.1	105.3	102.0	102.0	104.0	103.8
	725	107.7	109.6	107.3	107.3	109.9	108.6
	750	112.4	115.2	112.8	112.8	114.1	113.5
	775	118.0	121.8	120.1	120.0	119.0	118.4
	800	123.0	129.4	130.2	129.2	126.0	127.1
	825	Ultimate load					

Panel	Load (kip)	Stress* (ksi) Strain gage 1	2	3	4	5	6
IVC-B	100	10.5	10.6	10.5	10.4	13.6	13.9
	300	40.0	39.7	39.1	38.9	45.4	46.2
	600	84.0	83.1	82.5	81.9	93.3	95.0
	700	99.9	98.4	98.1	97.3	111.7	114.2
	750	109.7	107.6	108.0	107.2	124.7	128.9
	775	115.5	112.7	114.1	113.4	136.0	145.2
	800	121.8	118.2	121.3	120.5	Readings unstable	
	825	Ultimate load					
IVC-C	100	6.0	7.1	10.0	9.9	8.9	9.1
	300	33.9	36.8	37.5	37.4	40.1	40.4
	600	77.7	81.9	79.3	79.2	86.8	86.9
	700	93.6	98.4	94.6	94.5	104.9	105.2
	750	103.0	108.0	103.5	103.5	116.4	117.1
	775	109.4	114.6	109.4	109.7	125.7	126.6
	800	116.4	121.5	115.9	116.7	143.8	146.1
	815	124.7	129.7	121.3	123.8	Ultimate load	



*Apparent stress based on E = 17 x 10^3 ksi (+ compression)

TABLE B-14.—STRAIN AND NORMAL DISPLACEMENT DATA FOR PANEL IV F-A

Load (kip)		Deflection[a] (in.)			Strain—Longitudinal[b] (μin./in.)										
Long.	Trans	D-1	D-2	D-3	1A	2A	3A	4A	5A	6A	7	8	13	14	15A
100	0	0.000	0.004	-0.010	-867	-876	-846	-849	-894	-885	-852	-903	-885	Strain gage inoperative	-861
105	44.4	-0.018	0.004	0.010	-828	-822	-798	-798	-843	-882	-819	-867	-795		-810
200	57.3	-0.022	0.004	-0.016	-1668	-1659	-1617	-1617	-1629	-1677	-1623	-1710	-1614		-1623
250	63.0	-0.022	0.008	-0.022	-2109	-2103	-2046	-2043	-2043	-2100	-2100	-2166	-2097		-2049
300	55.8	-0.016	0.010	-0.026	-2580	-2580	-2505	-2499	-2493	-2535	-2604	-2646	-2622		-2490
350	62.1	0.046	0.112	-0.016	-3012	-3006	-2871	-2658	-2862	-2859	-4011	-3705	-3894		-2523
361	58.2	Ultimate load													
0	0	1.570	1.164	0.166	-102	0	-594	801	-216		-9360	-4455	-3726		1083

Load (kip)		Strain-Transverse[b] (μin./in.)										
Long.	Trans	1C	2C	3C	4C	5C	6C	9	10	11	12	15C
100	0	321	207	192	279	273	249	198	255	180	396	315
105	44.4	21	-96	-159	6	168	-219	-126	-42	-150	132	84
200	57.3	258	48	6	192	414	-126	42	135	27	360	315
250	63.0	402	102	99	291	570	-90	135	252	108	474	474
300	55.8	630	270	300	453	723	147	348	453	288	639	660
350	62.1	1056	75	321	612	981	66	324	618	294	834	1065
361	58.2	Ultimate load										
0	0	42	48	-246	459	-39	237	-126	51	-63	-30	1218

[a]Positive toward skin side

[b]Positive expansion

TABLE B-15a.—STRAIN AND NORMAL DISPLACEMENT DATA FOR PANEL IVF-B

Load (kip)		Deflection[a] (in.)			Strain—Longitudinal[b] (μin./in.)										
Long.	Trans	D-1	D-2	D-3	1A	2A	3A	4A	5A	6A	7	8	13	14	15A
40	0	0.000	0.000	0.010	-282	-297	-339	-339	-402	-402	-390	-411	-411	-405	-366
40	5.4	0.000	0.000	0.014	276	-294	-333	-330	-396	-402	-390	-405	396	-390	-363
100	6.3	0.000	-0.006	0.010	-831	-867	-849	-861	-873	-786	-861	-909	-897	-868	-897
200	17.7	0.002	-0.004	0.016	-1707	-1776	-1707	-1719	-1707	-1701	-1812	-1842	-1794	-1776	-1755
207	51.9	0.000	-0.008	0.040	-1722	-1782	-1740	-1740	-1719	-1746	-1652	-1896	-1797	-1782	-1785
214	65.4	0.000	-0.002	0.050	-1743	-1812	-1764	-1743	-1746	-1788	-1935	-2016	-1860	-1836	-1812
220	79.8	-0.002	0.014	0.066	-1794	-1863	-1809	-1740	-1779	-1860	-2184	-2247	-1998	-1971	-1782
225	90.3	0.008	0.084	0.056	-1815	-1950	-1779	-1626	-1773	-1899	-2853	-2781	-2430	-2412	-1590
229	92.7	0.008	0.176	0.090	-1839	-1950	-1728	-1398	-1797	-1668	-3735	-3480	-2727	-2628	-1335
231	92.4	0.012	0.192	0.100	(Strain gage data not recorded)										
232	93.6	0.014	0.232	0.112											
232	93.3	0.024	0.264	0.128											
232	92.7	0.046	0.336	0.168	First ultimate load										
40	0	0.014	-0.020	0.068	-300	-318	-381	-372	-393	-399	-426	-405	-429	-417	-393
300	0	0.046	-0.006	0.068	-2664	-2778	-2676	-2673	-2628	-2550	-2907	-2889	-2955	-2931	-2703
350	0	0.076	0.028	0.084	-3108	-3201	-3090	-3024	-3045	-2886	-3702	-3615	-3720	-3684	-3030
375	0	0.122	0.080	0.116	-3321	-3351	-3261	-3066	-3234	-2964	-4506	-4290	-4434	-4383	-3036
392	0	Second ultimate load													
0	0				-180	-39	-1122	1518	-291	60		-3273	-5427	-5154	2277

[a]Positive toward skin

[b]Positive expansion

TABLE B-15b.–STRAIN AND NORMAL DISPLACEMENT DATA FOR PANEL IVF-B (CONCLUDED)

Load (kip)		Strain–Transverse* (μin./in.)										
Long.	Trans	1C	2C	3C	4C	5C	6C	9	10	11	12	15C
40	0	114	45	54	141	132	111	51	75	63	240	165
40	5.4	78	18	15	111	120	66	18	45	24	204	138
100	6.3	255	147	162	246	234	207	189	183	159	381	267
200	17.7	438	303	318	534	405	369	423	393	366	609	426
207	51.9	255	75	75	249	342	72	198	171	117	438	267
214	65.4	189	42	-45	207	357	-96	105	108	24	408	237
220	79.8	219	207	-264	228	495	-315	-30	81	-141	399	252
225	90.3	585	690	-540	396	1020	-942	-255	168	-438	489	666
229	92.7	1089	1053	-1032	924	1497	-1314	-750	525	-720	687	1143
231	92.4	(Data not recorded)										
232	93.6											
232	93.3											
232	92.7	First ultimate load										
40	0	117	18	12	156	144	81	30	108	51	309	168
300	0	918	672	729	840	678	933	819	837	756	1071	867
350	0	1068	789	840	972	675	1167	954	990	879	1224	999
375	0	1131	846	855	1047	576	1359	999	1080	921	1314	1065
392	0	Second ultimate load										
0	0	9	219	-351	945	216	543	-126	6	66	-144	2046

*Positive expansion

TABLE B-16a.—STRAIN, NORMAL DISPLACEMENT, AND THERMOCOUPLE DATA FOR PANEL IVF-C

Load (kip)		Deflection[a] (in.)			Strain—Longitudinal[b] (μin./in.)										
Long.	Trans	D-1	D-2	D-3	1A	2A	3A	4A	5A	6A	7	8	13	14	15A
40	0	-0.002	0.012	0.000	-306	-300	-345	-330	-396	-408	-432	-420	-399	-402	-345
40	0	0.002	-0.036	0.010	-204	-234	-234	-261	-333	-369	-1236	-1203	-99	-96	-429
40	5.4	0.000	-0.044	0.022	-195	-222	-225	-252	-330	-372	1215	-1182	-90	-81	-426
42	27.3	0.000	-0.054	0.036	-225	-231	-216	-243	267	-324	-1170	-1140	-51	-42	-390
42	63.9	-0.014	-0.072	0.048	-147	-159	-141	-180	-183	-273	-1029	-1017	-90	-99	-327
42	81	-0.024	-0.078	0.056	-117	-129	-102	-144	-138	-255	-975	-966	-153	-165	-291
41	89.4	-0.030	-0.086	0.056	-105	-120	-96	-138	-129	-261	-951	-939	-163	-153	-288
42	99.3	-0.040	-0.056	0.042	-87	-132	-87	-102	-90	-267	-1137	-1089	-75	-90	-222
42	104.4	-0.023	0.018	0.006	-69	-192	-57	-9	-30	-279	-1650	-1512	-261	-243	-84
41	107.7	-0.048	0.116	0.012	-45	-210	-15	-201	-3	-306	-2418	-2136	-345	-321	-129
41.5	108	-0.064	0.174	0.022	(Strain gage data not recorded)										
42	111.3	-0.064	0.240	0.028											
42	121.8	-0.060	0.354	0.000											
42	124.2	First ultimate load													
0[c]	0	-0.06-	-0.200	-0.018											
100	0	0.006	-0.060	0.018	-831	-768	-891	-762	-840	-807	-1629	-1506	-1236	-1245	-768
200	0	0.000	-0.068	0.000	-1752	-1719	-1818	-1695	1728	-1725	-2463	-2322	-2118	-2130	-1704
300	0	-0.016	-0.098	-0.030	-2664	-2703	-2754	-2682	-2625	-2676	-3048	-2934	-2871	-2889	-2697
366	0	Second ultimate load													
0	0	-0.062	-0.156	-0.044	-9	6	-42	-3	0	3	63	75	-93	-90	27

[a]Positive toward skin side

[b]Positive expansion

[c]All gages and EDIs rezeroed after first ultimate load

TABLE B-16b.–STRAIN, NORMAL DISPLACEMENT AND THERMOCOUPLE DATA FOR PANEL IVF-C (CONCLUDED)

Load (kip)		Strain–Transverse[a] (μin./in.)											Measured temp[b] (°F)	
Long.	Trans	1C	2C	3C	4C	5C	6C	9	10	11	12	15C	Flange	Skin
40	0	165	15	-6	195	198	42	15	291	-57	102	201	68	68
40	0	165	-72	-18	96	156	24	60	363	-30	84	261	319	93
40	-5.4	120	-96	-57	60	135	-18	21	336	-72	51	210	320	94
43	27.3	-53	-234	-240	-87	24	-225	-132	213	-255	-99	39	320	90
42	63.9	-351	-477	-567	-327	-105	-612	450	6	-609	-378	-153	320	90
42	81	-489	-615	-765	-417	-99	-885	-609	-54	-795	-477	-204	320	90
41	89.4	-528	-666	-855	-429	-66	-660	696	-81	-888	-537	-198	320	89
42	99.3	-420	-891	-1068	-348	210	-1377	-897	-30	-1101	-495	27	320	89
42	104.4	144	-1365	-1335	-54	900	1905	-1185	120	-1320	-351	525	320	88
41	107.7	855	-2007	-2085	759	1611	-2544	-1803	501	-1860	171	1191	320	88
41.5	108												320	88
42	111.3												320	88
42	121.8												320	88
42	124.2	First ultimate load												
0[c]	0												320	88
100	0	174	303	66	399	168	324	111	528	9	294	408	322	85
200	0	495	567	387	660	474	600	414	813	252	549	693	322	85
300	0	846	831	774	894	789	897	732	1083	543	783	996	320	83
366	0	Second ultimate load												
0	0	-48	39	-9	12	-45	42	0	21	-9	-3	3	80	80

[a]Positive expansion

[b]±6°F

[c]All gages and EDIs rezeroed after first ultimate load

TABLE B-17a.—STRAIN, NORMAL DISPLACEMENT, AND THERMOCOUPLE DATA FOR PANEL IVF-D

Load (kip)		Deflection[a] (in.)			Strain—Longitudinal[b] (μin./in.)										
Long.	Trans	D-1	D-2	D-3	1A	2A	3A	4A	5A	6A	7	8	13	14	15A
40	0	0.000	0.016	0.000	261	258	303	273	336	333	396	381	342	342	291
40	45.9	-0.014	0.020	-0.002	231	219	273	237	312	333	378	366	270	267	261
42.5	71.4	-0.028	0.024	0.002	216	219	273	216	264	321	459	420	246	240	207
42	87.3	-0.042	0.044	0.008	183	210	252	162	231	330	717	630	303	294	144
41	96.6	-0.062	0.114	0.006	159	216	210	18	156	351	1260	1119	501	504	15
40.5	98.1	-0.068	0.178	0.012											
41	100.8	-0.072	0.240	0.016	(Strain gage data not recorded)										
42	107.1	-0.090	0.332	0.020											
41	111.9	-0.104	0.376	0.016											
42	117.9	First ultimate load													
0[c]	0	0.000	-0.012	0.040	0	-6	-18	-18	12	18	-36	-33	3	0	3
40	0	0.000	0.000	0.030	327	327	363	336	405	408	432	423	393	390	360
40	0	0.000	-0.040	0.030	279	321	264	285	327	372	1371	1347	129	129	423
106	30.3	-0.014	-0.052	0.026	822	858	783	804	786	858	1743	1731	498	495	936
204	40.2	-0.038	-0.086	0.008	1740	1809	1713	1770	1620	1740	2265	2295	1116	1110	1884
300	49.8	-0.190	-0.304	-0.112	2769	3030	2700	3120	2592	2940	1035	1410	570	552	3270
333	24.9	Second ultimate load													
0	0	0.024	0.042	0.072	15	36	27	24	6	51	147	111	126	123	12

[a]Positive toward skin side

[b]Positive expansion

[c]All gages and EDIS rezeroed after first ultimate load.

TABLE B-17b.–STRAIN, NORMAL DISPLACEMENT AND THERMOCOUPLE DATA FOR PANEL IV-D (CONCLUDED)

Load (kip)		Strain–Transverse[a] (μin./in.)											Measured temp[b] (°F)	
Long.	Trans	1C	2C	3C	4C	5C	6C	9	10	11	12	15C	Flange	Skin
40	0	123	21	-15	156	135	54	0	228	-24	69	195	68	68
40	45.9	-144	-339	-423	-90	-39	-396	-163	-27	-429	-195	-3	68	68
42.5	71.4	-213	-621	-732	-156	-6	-861	-645	-75	-669	-297	0	68	68
42	87.3	-99	-924	-1035	-48	228	-1275	-942	-39	-918	-231	216	68	68
41	96.6	330	-1470	-1560	339	885	-1980	-1365	159	-1314	39	780	68	68
40.5	98.1	(Data not recorded)											68	68
41	100.8												68	68
42	107.1												68	68
41	111.9												68	68
42	117.9												68	68
0[c]	0	First ultimate load											68	68
40	0	156	57	21	186	189	81	27	252	3	84	228	68	68
40	0	147	6	24	114	183	48	60	279	15	69	180	313	81
106	30.3	159	-48	-57	111	270	-117	0	273	-96	48	210	315	83
204	40.2	396	147	171	318	579	21	198	516	105	219	459	315	83
300	49.8	633	540	804	387	1167	135	486	516	402	240	858	315	84
333	24.9	Second ultimate load												
0	0	15	-9	-9	18	36	6	18	33	12	15	45	78	78

[a]Positive expansion

[b]±6°F

[c]All gages and LDIs rezeroed after first ultimate load.

TABLE B-18a.–STRAIN, NORMAL DISPLACEMENT, AND THERMOCOUPLE DATA FOR PANEL IVF-E

Load (kip)		Deflection[a] (in.)			Strain–Longitudinal[b] (μin./in.)										
Long.	Trans	D-1	D-2	D-3	1A	2A	3A	4A	5A	6A	7	8	13	14	15A
40	0	0.000	0.014	0.000	297	-282	-345	-321	-414	-411	-447	432	-402	-393	-342
40	0	0.010	-0.042	0.032	-231	-246	-261	-294	-330	-354	-1320	1236	-87	-87	-438
200	0	-0.004	-0.074	0.016	-1827	-1842	-1794	-1860	-1776	-1809	-2454	2400	1347	-1341	2004
202	27.9	-0.014	-0.098	0.032	-1827	-1839	-1794	-1884	-1749	-1803	-2304	-2277	-1230	-1230	-2022
201	45.3	-0.024	-0.112	0.036	-1803	-1818	-1770	-1878	-1716	-1785	-2163	2154	-1104	-1110	2010
200	55.8	-0.032	-0.120	0.036	-1782	-1797	-1743	-1857	-1683	-1762	-2079	-2073	-1017	-1017	-1995
201	63.9	-0.046	-0.128	0.036	-1773	-1797	-1737	-1869	-1674	-1776	-1977	-1998	-921	-930	-2010
201.5	73.8	-0.062	-0.140	0.030	-1764	-1800	-1737	-1881	-1668	-1788	-1860	-1899	-780	-786	-2031
202.5	85.2	-0.098	-0.160	0.038	-1173	-1794	-1752	-1914	-1677	-1842	-1719	-1797	-486	-513	-1791
203	95.7	-0.194	-0.130	0.150	-1752	-1605	-1767	-1710	-1632	-1971	-2208	-2331	81	69	-2004
203	102.6	-0.244	-0.102	0.224	-1761	-1512	-1746	-1611	-1593	-2022	-2517	-2643	180	150	-1965
235	100.8	-0.316	-0.136	0.240	-2085	-1785	-2085	-1995	-1839	-2385	-2550	-2700	231	198	-2364
236	111.3	-0.392	-0.126	0.298											
236	115.8	First ultimate load													
200	0	-0.062	-0.128	0.094	-1899	-1857	-1860	-1911	-1776	-1890	-2532	-2517	-1083	-1086	-2064
300	0	-0.144	-0.226	0.038	-2949	-2976	-2889	-3123	-7600	-2994	-2373	-2535	-1209	-1233	-3288
346	0	Second ultimate load													
0	0	0.032	-0.034	0.114	0	48	-15	24	-9	-24	-267	267	6	6	6

[a]Positive toward skin side

[b]Positive expansion

TABLE B-18b.–STRAIN, NORMAL DISPLACEMENT, AND THERMOCOUPLE DATA FOR PANEL IVF-E (CONCLUDED)

Positive

Load (kip)		Strain–transverse[a] (μin./in.)											Measured temp[b] (°F)	
Long.	Trans	1C	2C	3C	4C	5C	6C	9	10	11	12	15C	Flange	Skin
40	0	144	15	3	177	150	78	27	81	-12	264	216	68	68
40	0	138	-69	-15	81	114	12	69	84	30	324	138	320	94
200	0	654	381	513	537	609	417	570	540	474	813	618	323	97
202	27.9	459	201	324	363	477	192	390	375	255	654	477	323	99
201	45.3	345	75	189	264	414	27	240	252	102	558	399	323	99
200	55.8	270	0	99	207	372	-90	147	186	45	525	354	323	99
201	63.9	219	-66	12	174	372	-195	72	138	-78	462	336	323	99
201.5	73.8	138	-126	-102	156	378	-333	-33	72	-144	438	315		99
202.5	85.2	81	-198	-294	237	462	-453	-168	60	-345	399	288	323	99
203	95.7	81	-303	-1089	1044	1098	-996	-711	324	-756	633	36	323	99
203	102.6	60	-270	-1314	1386	1548	-1326	-987	471	-968	672	-21	323	99
235	100.8	-60	114	-1065	1509	2145	-1575	-870	522	-807	693	90	323	99
236	111.3												323	99
236	115.8					First ultimate load								
200	0	426	603	435	654	939	135	486	642	477	873	600	322	100
300	0	726	993	948	918	1479	321	834	867	843	1071	915	322	100
346	0					Second ultimate load								
0	0	-204	195	-9	0	24	24	-9	39	0	27	-39	76	76

[a]Positive expansion

[b]±6°F

APPENDIX C

MATERIAL COUPON DATA

Material coupons cut from each individual full panel were tested to establish the actual material property data given in table C-1. Most coupons were cut from excess material on panel ends. In a few cases, as noted, the coupons were cut from the panels after testing.

TABLE C-1a.—MATERIAL PROPERTY DATA

Panel	Material property			Grain direction[b]	Temp (°F)	Coupon location
	f_{cy} (ksi)	E_c (10^3ksi)	n_c[a]			
IF-A	135.3	17.1	24.5	L	70	Skin
	147.9	17.7	23.6	L	70	Flange
	85.5	15.2	24.0	L	450	Skin
	92.0	15.6	27.3	L	450	Flange
	140.5	17.3	25.0	L	70	Skin
	150.0	17.2	26.0	L	70	Flange
	92.1	15.5	33.0	L	450	Skin
	88.1	16.0	24.0	T	450	Skin
	142.2	17.7	24.5	T	70	Skin
	87.3	15.5	28.0	T	450	Skin
	142.7	17.3	27.0	T	70	Skin
IF-B	133.5	16.9	24.0	L	70	Skin
	146.9	17.2	29.0	L	70	Flange
	89.9	15.5	30.0	L	450	Skin
	95.5	16.0	33.0	L	450	Flange
	136.3	17.2	25.5	L	70	Skin
	146.6	17.2	26.5	L	70	Flange
	86.9	15.4	25.0	L	450	Skin
	91.2	15.8	21.3	T	450	Skin
	145.6	17.5	21.0	T	70	Skin
	91.8	15.6	31.0	T	450	Skin
	140.4	17.8	23.6	T	70	Skin
IF-C	136.7	17.4	23.6	L	70	Skin
	145.7	17.3	26.0	L	70	Flange
	86.3	15.4	22.6	L	450	Skin
	94.7	15.8	31.0	L	450	Flange
	135.1	17.1	22.6	L	70	Skin
	145.3	17.2	27.3	L	70	Flange
	87.6	15.6	25.0	L	450	Skin
	89.1	15.9	21.7	T	450	Skin
	140.2	18.3	19.7	T	70	Skin
	88.7	15.8	21.7	T	450	Skin
	139.5	17.9	20.7	T	70	Skin
IF-D	135.9	17.5	23.6	L	70	Skin
	145.8	18.0	24.5	L	70	Flange
	87.5	15.2	26.5	L	450	Skin
	87.1	16.1	31.0	L	450	Flange
	134.9	16.8	25.0	L	70	Skin
	147.3	17.1	24.0	L	70	Flange
	88.7	15.5	24.5	L	450	Skin
	90.0	16.3	18.0	T	450	Skin
	142.2	18.3	19.2	T	70	Skin
	89.1	16.0	19.7	T	450	Skin
	141.8	17.9	20.0	T	70	Skin

[a]Ramberg-Osgood exponent

[b]L = longitudinal, T = transverse

[c]Posttest coupons

TABLE C-1b.–MATERIAL PROPERTY DATA (CONTINUED)

Panel	Material property			Grain direction[b]	Temp (°F)	Coupon location
	f_{cy} (ksi)	E_c (10^3 ksi)	n_c[a]			
IF-E	138.9	17.3	27.0	L	70	Skin
	143.9	17.2	31.0	L	70	Flange
	85.9	15.4	33.0	L	450	Skin
	90.7	15.6	34.4	L	450	Flange
	139.4	17.3	27.3	L	70	Skin
	144.3	16.9	26.5	L	70	Flange
	88.1	15.7	33.0	L	450	Skin
	88.6	15.7	28.0	T	450	Skin
	143.2	17.8	24.0	T	70	Skin
	88.4	15.7	29.0	T	450	Skin
	140.3	17.4	24.5	T	70	Skin
IF-F	136.5	17.2	23.6	L	70	Skin
	146.1	17.3	20.7	L	70	Flange
	85.8	15.6	24.0	L	450	Skin
	93.8	15.6	33.5	L	450	Flange
	137.6	17.4	24.5	L	70	Skin
	145.3	17.0	22.0	L	70	Flange
	89.8	15.4	25.0	T	450	Skin
	89.7	15.6	22.6	T	450	Skin
	141.9	17.8	22.6	T	70	Skin
	89.0	15.5	26.0	T	450	Skin
	141.6	17.5	22.0	T	70	Skin
IIF-A[c]	141.6	17.0	27.0	L	70	Skin
	147.6	17.4	30.0	L	70	Flange
	89.8	16.3	25.0	L	450	Skin
	90.8	15.4	31.6	L	450	Flange
	143.4	17.0	22.8	L	70	Skin
	145.9	17.2	27.6	L	70	Flange
	90.7	15.6	24.0	T	450	Skin
	145.3	17.5	21.2	T	70	Skin
	89.2	15.2	16.2	T	450	Skin
	145.5	17.5	19.6	T	70	Skin
	143.7	17.7	20.2	T	70	Skin
IIF-B	144.3	17.3	24.2	T	70	Skin
	149.6	17.3	23.0	L	70	Skin
	89.3	17.0	19.2	T	450	Skin
	85.7	15.4	24.0	L	450	Skin
	146.9	18.2	23.0	T	70	Skin
	141.7	16.8	27.0	L	70	Skin
	89.7	15.3	22.5	T	450	Skin
	88.6	15.6	21.0	L	450	Skin

[a]Ramberg-Osgood exponent

[b]L = longitudinal, T = transverse

[c]Posttest coupons

TABLE C-1c.—MATERIAL PROPERTY DATA (CONTINUED)

Panel	Material property			Grain direction[b]	Temp (°F)	Coupon location
	f_{cy} (ksi)	E_c (10^3 ksi)	n_c[a]			
IIIF-A	137.4	16.6	28.0	L	70	Skin
	143.0	16.9	27.3	L	70	Flange
	94.1	15.8	34.5	L	450	Flange
	87.3	15.0	29.6	L	450	Skin
	146.6	17.2	25.2	L	70	Flange
	139.3	18.6	28.0	L	70	Skin
	139.4	19.4	24.8	T	70	Skin
	88.1	15.3	27.2	T	450	Skin
	141.8	18.2	25.8	T	70	Skin
	140.5	17.1	29.6	T	70	Skin
IIIF-B	137.2	17.1	25.2	L	70	Skin
	146.7	17.0	26.0	L	70	Flange
	93.3	15.5	36.0	L	450	Flange
	85.7	15.2	29.6	L	450	Skin
	146.4	17.2	27.4	L	70	Flange
	135.5	16.8	28.0	L	70	Skin
	140.9	17.3	25.0	T	70	Skin
	91.5	17.2	25.2	T	450	Skin
	141.6	17.5	22.4	T	70	Skin
	141.3	17.4	26.2	T	70	Skin
IIIF-C	136.2	17.5	27.3	L	70	Skin
	146.1	17.8	29.5	L	70	Flange
	94.0	15.3	40.0	L	450	Flange
	87.0	15.3	28.0	L	450	Skin
	147.5	17.2	27.0	L	70	Flange
	133.9	17.5	24.5	L	70	Skin
	138.4	19.3	21.8	T	70	Skin
	90.0	17.8	22.2	T	450	Skin
	138.7	17.5	24.2	T	70	Skin
	140.0	17.4	26.0	T	70	Skin
IVF-A	136.0	17.0	26.2	L	70	Skin
	148.9	17.3	33.0	L	70	Flange
	88.4	15.3	22.8	L	450	Skin
	96.4	15.2	35.0	L	450	Flange
	137.4	16.8	25.8	L	70	Skin
	146.9	17.1	25.2	L	70	Flange
	89.7	15.1	25.0	L	450	Skin
	140.5	18.8	17.6	T	70	Skin
	90.2	15.8	24.6	T	450	Skin
	143.3	17.4	23.2	T	70	Skin
	142.8	18.4	15.2	T	70	Skin

[a]Ramberg-Osgood exponent

[b]L = longitudinal, T = transverse

[c]Posttest coupons

TABLE C-1d.–MATERIAL PROPERTY DATA (CONCLUDED)

Panel	Material property			Grain direction[b]	Temp (°F)	Coupon location
	f_{cy} (ksi)	E_c (10^3 ksi)	n_c[a]			
IVF-B[c]	138.9	17.4	29.4	L	70	Skin
	148.6	17.8	24.8	L	70	Flange
	98.2	15.8	38.0	L	320	Skin
	106.7	16.2	35.5	L	320	Flange
	137.5	17.1	30.2	L	70	Skin
	148.7	17.7	26.6	L	70	Flange
	99.5	15.8	34.8	L	320	Skin
	144.2	17.7	23.8	T	70	Skin
	103.5	16.7	24.8	T	320	Skin
	147.2	17.9	24.0	T	70	Skin
	147.6	17.9	21.0	T	70	Skin
IVF-C	142.9	17.3	22.8	L	70	Skin
	150.4	17.4	33.6	L	70	Flange
	91.2	15.6	25.2	L	450	Skin
	96.4	15.6	37.4	L	450	Flange
	138.4	16.5	24.0	L	70	Skin
	151.5	17.1	33.4	L	70	Flange
	88.8	16.7	30.4	L	450	Skin
	145.3	17.7	24.0	T	70	Skin
	94.2	16.4	22.6	T	450	Skin
	145.1	17.3	21.8	T	70	Skin
	145.1	17.5	22.8	T	70	Skin
IVF-D[c]	140.3	17.9	17.3	L	70	Skin
	145.5	17.9	29.0	L	70	Flange
	101.7	16.0	18.6	L	320	Skin
	104.8	15.8	33.0	L	320	Flange
	137.5	17.4	18.0	L	70	Skin
	143.4	17.1	27.0	L	70	Flange
	99.8	15.9	18.8	L	320	Skin
	141.7	17.9	15.6	T	70	Skin
	104.9	16.6	17.2	T	320	Skin
	140.5	17.3	15.8	T	70	Skin
	139.6	17.7	17.2	T	70	Skin
IVF-E	133.1	16.8	20.2	L	70	Skin
	144.6	18.0	28.6	L	70	Flange
	86.9	15.1	22.0	L	450	Skin
	93.5	15.2	21.0	L	450	Flange
	133.7	16.6	20.4	L	70	Skin
	145.2	17.1	24.0	L	70	Flange
	90.0	15.9	22.8	L	450	Skin
	140.0	18.1	23.2	T	70	Skin
	90.0	15.9	19.2	T	450	Skin
	140.3	20.3	20.0	T	70	Skin
	138.9	18.9	19.4	T	70	Skin

[a]Ramberg-Osgood exponent

[b]L - longitudinal, T = transverse

[c]Posttest coupons

END
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