MAY 9 1958

Case No. 756.00
Ref. Sym: 1612 (522)
Project No. TM-580
File: XW-40, 3-2

MR. W. E. TREIBEL - 1246

Attn: Mr. J. Manweller - 1246

Re: Centrifuge Test of XW-40

Summary of Results

The XW-40 was pressurized to 15 psig and subjected to centrifuge loading of 46.8 g in each of three orthogonal directions. Maximum stresses measured were 28,000 psi tension and 30,000 psi compression in the Bomarc mounting fixtures. Maximum observed stresses in the XW-40 were 4700 psi tension and 4470 psi compression on the forward mounting ring. Maximum pressure drop during test was 0.8 psi.

Object of Test

The object of this test was to determine the structural ability of the XW-40 to withstand inertia loads encountered during operation in the Bomarc missile.

Reason for Test

The test was requested in a Work Order Authorization from Mr. W. E. Treibel, 1246, to Mr. P. H. Adams, 1612, dated February 12, 1957.

Function of Object Tested

The XW-40 is the warhead for the Bomarc, the LaCrosse, and other applications.

Summary of Past Tests

The XW-40 and Bomarc mounting beams were statically tested prior to centrifuge testing as reported in Static Test of XW-40 Warhead for Bomarc Application, from L. J. Woolrich, 1612, to W. E. Treibel, 1246, Project No. TM-588, Ref. Sym: 1612 (350), dated December 3, 1957. Simulated centrifuge loads of 51.6 g and internal pressure of 17 psi were applied in each of three orthogonal directions. No indication of failure or yield was observed.

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Setup for Test

Figures 1 thru 3 are photographs depicting the general test setup. The test equipment used is listed in Table I.

Components tested included one complete XW-40, Serial No. AA-2107-H7 with simulated HE sphere supported by the Bomarc mounting fixtures (Boeing Dwg. Nos. 55-1668, 55-1669, and 55-1670). Instrumentation consisted of 20 strain gages, Type A-18, resistance 119.5 ± 0.3 ohms, G.F. 1.71 ± 2%, Lot No. 232-11. The gages were arranged in six rosettes and two single axis gages, oriented and located as described in Table II and depicted in Figs. 4 thru 7.

Procedure

The XW-40 and Bomarc mounting beams were instrumented with strain gages and mounted on the centrifuge, with the boom axis in the vertical direction with respect to the warhead axis, as shown in Fig.1. (The vertical axis of the warhead corresponds to the vertical axis of the missile, the longitudinal axis of the warhead corresponds to the lateral axis of the missile). The XW-40 was pressurized to 15 psig and subjected to inertia loading of 46.8 g in the vertical direction with respect to the warhead axis. The load was applied in increments of 1/2, 3/4, and full load (23.4 g, 35.1 g, and 46.8 g). The centrifuge rpm and the strain gage data were recorded for each increment. The pressure remaining in the case was measured after the test.

The procedure was repeated with the assembly oriented in the longitudinal and lateral directions as shown in Figs. 2 and 3.

Results

The XW-40 and Bomarc mounting fixtures withstood the centrifuge tests to 46.8 g without indication of failure or yield. Maximum stresses measured were 28,000 psi tension and 30,000 psi compression in the Bomarc mounting beams during the test in the longitudinal direction. The above beams were forged from 2014-T6 aluminum with a yield strength of 60,000 psi. Maximum stresses observed on the XW-40 were 4700 psi tension and 4470 psi compression on the forward mounting ring during the test in the vertical direction. Maximum pressure drop during any test was 0.8 psi.

The stress-strain data and strain gage locations are listed in Table II. A grouping of three gages indicate a rosette and the stress given is for the rosette indicated. Gage No. 2 failed during the longitudinal test and the stress indicated by rosette 1,2,3 for the longitudinal test is approximated.

Conclusions

The XW-40 is structurally adequate to withstand the inertia loads of 46.8 g along each of the three directions tested.

R. I. BUTLER - 1612-1

D. T. JUDD - 1612-1

Approved by:
PAUL H. ADAMS - 1612

RIB:1612-1:as

DISTRIBUTION:
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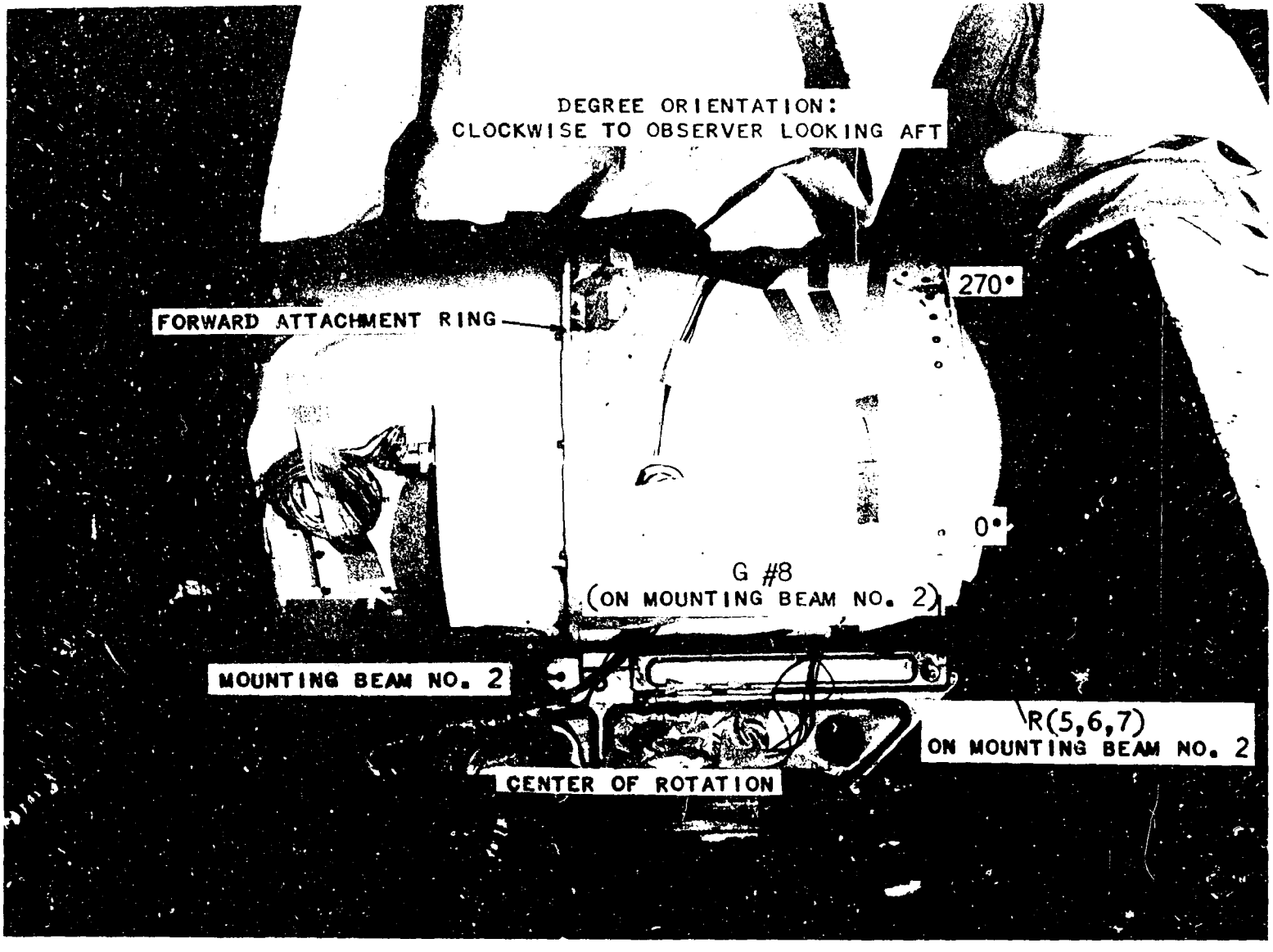

FIG. 1 -- XW-40 IN VERTICAL ORIENTATION -- CENTRIFUGE TEST OF XW-40.

D# 105461

REF. SYM: 1612 (522)
PROJECT NO. TM-580

#3827

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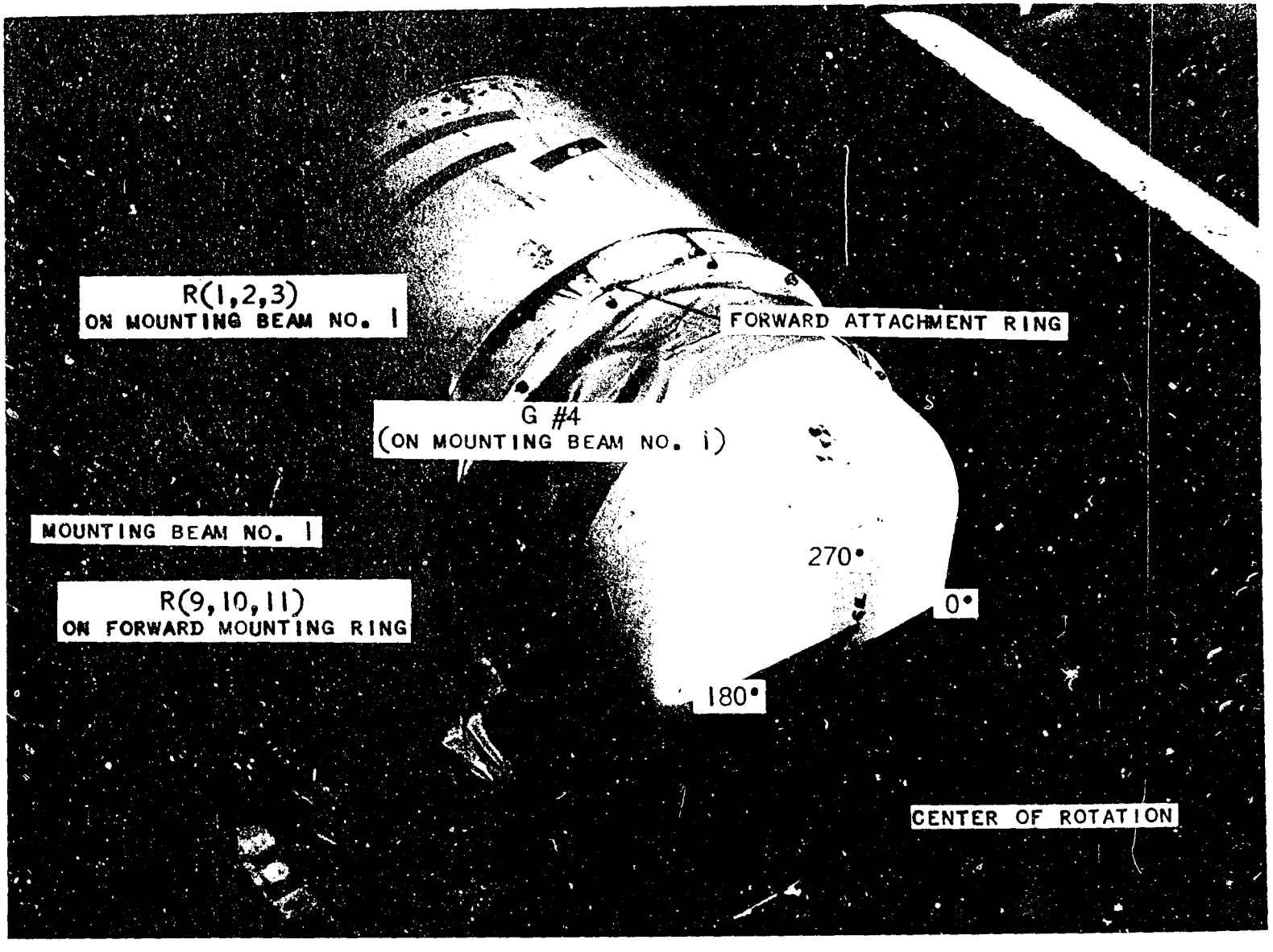

FIG. 2 -- XW-40 IN LONGITUDINAL ORIENTATION -- CENTRIFUGE TEST OF XW-40.

D# 105456

REF. SYM: 1612 (522)
PROJECT NO. TM-580

#583

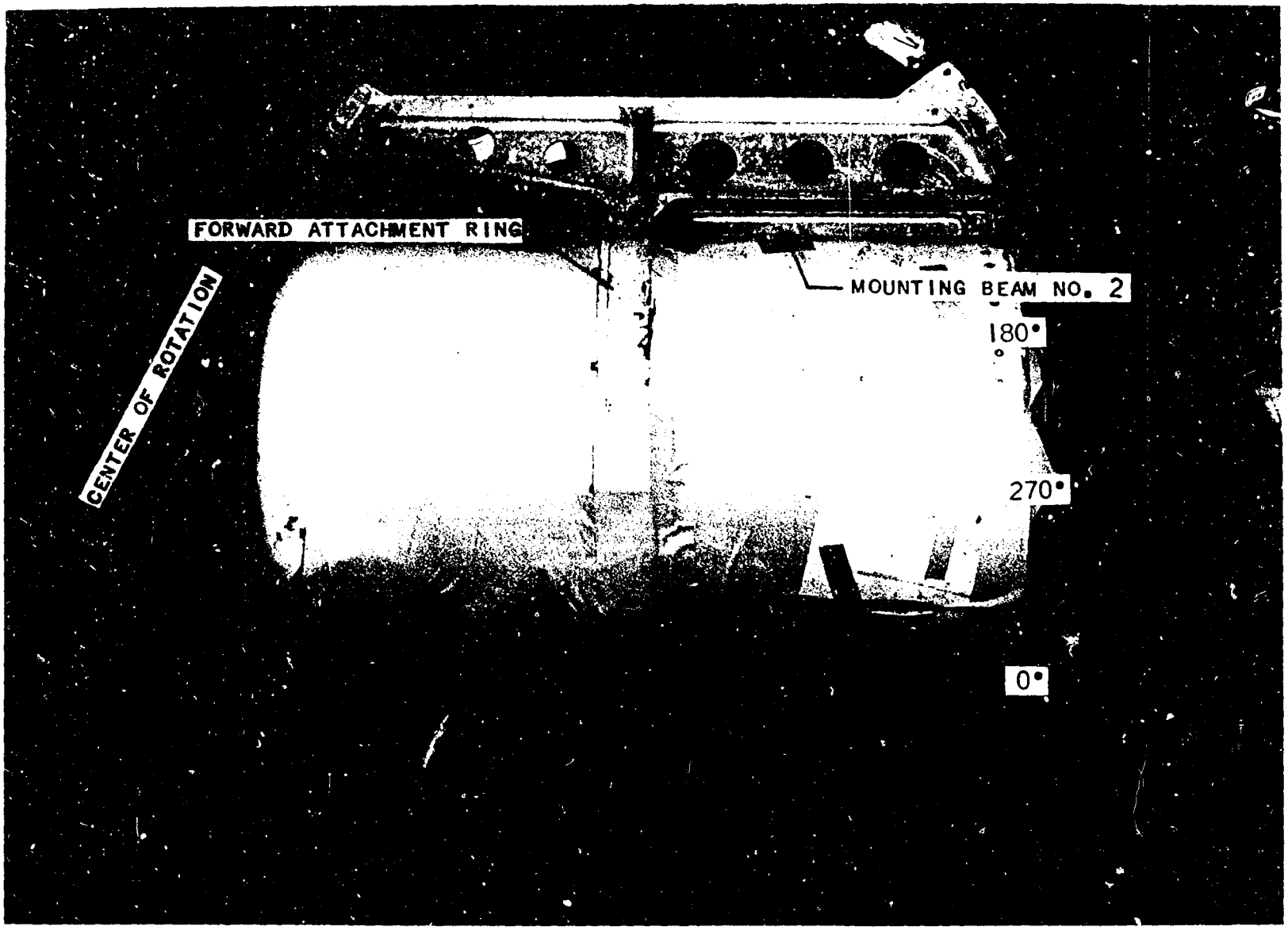

FIG. 3 -- XW-40 IN LATERAL ORIENTATION -- CENTRIFUGE TEST OF XW-40.

D #105457

REF. SYM: 1612 (522)
PROJECT NO. TM-580

#5,881

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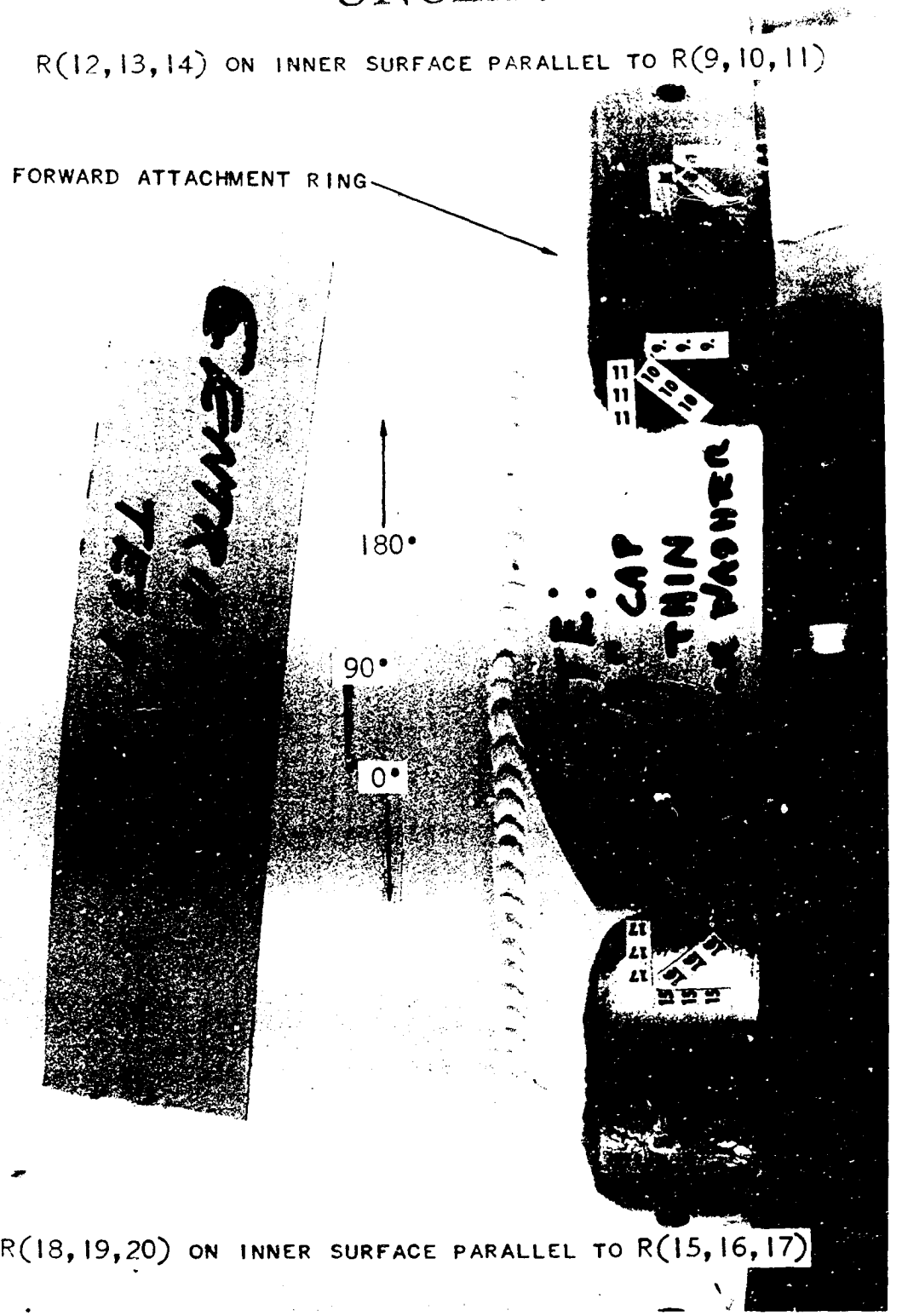

FIG. 4 -- STRAIN GAGE ROSETTES ON FORWARD ATTACHMENT RING -- CENTRIFUGE TEST OF XW-40.

D# 105462

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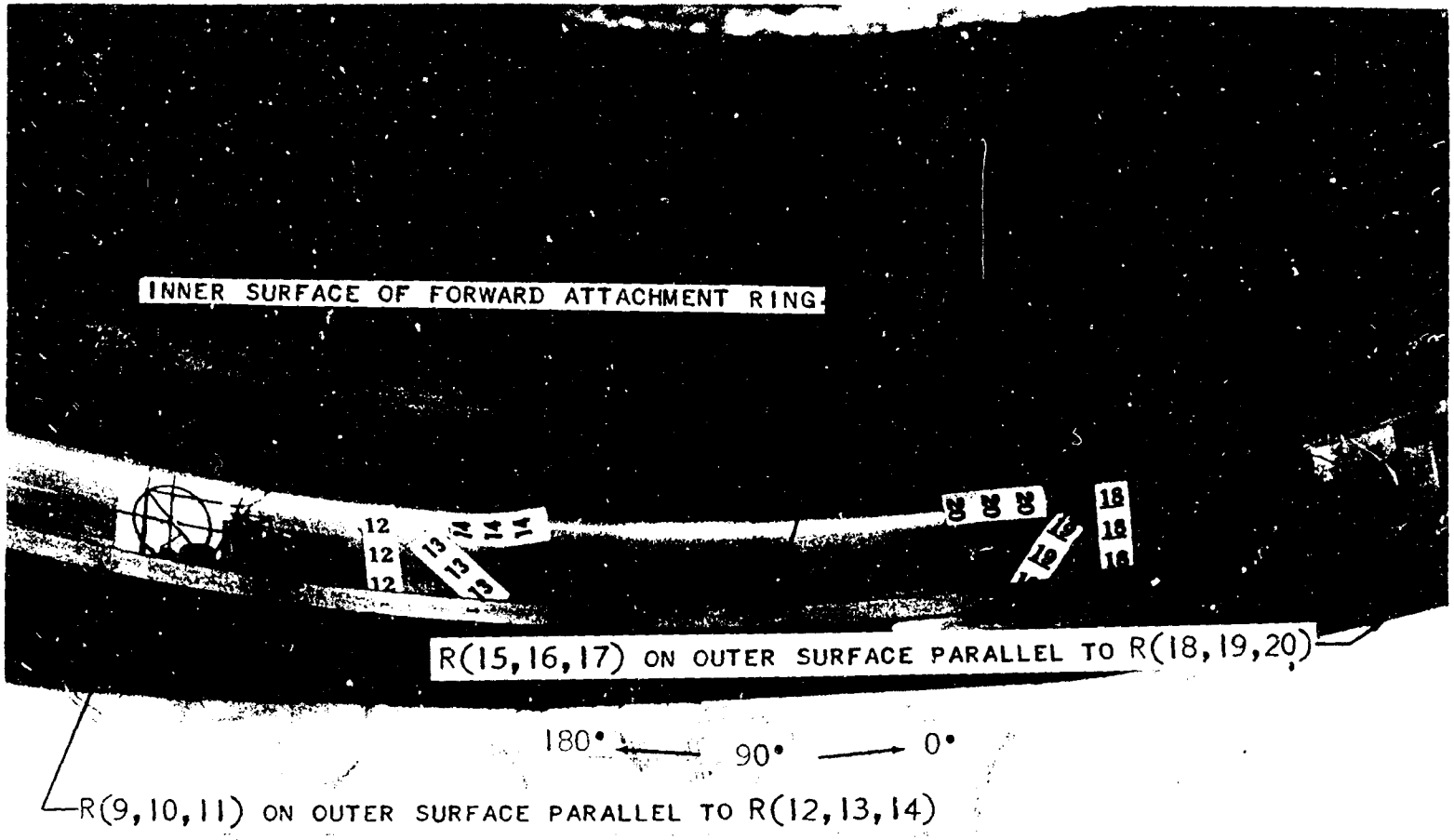

FIG. 5 -- STRAIN GAGE ROSETTES INSIDE FORWARD ATTACHMENT RING -- CENTRIFUGE TEST OF XW-40.

D# 105460

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PROJECT NO. TM-580

#586

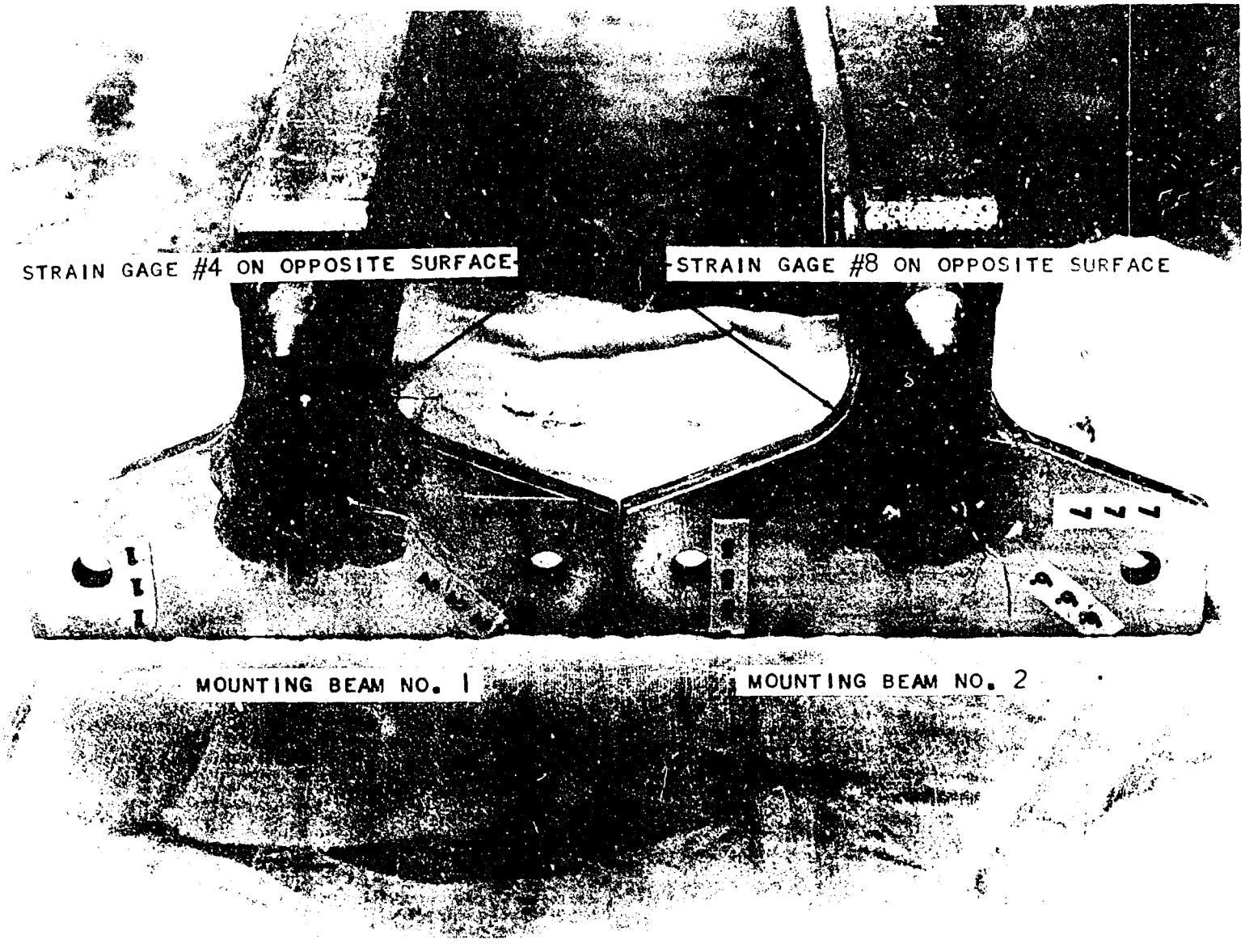

FIG. 6 -- STRAIN GAGE ROSETTES ON MOUNTING BEAMS -- CENTRIFUGE TEST OF XW-40.

D# 105459

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PROJECT NO. TM-580

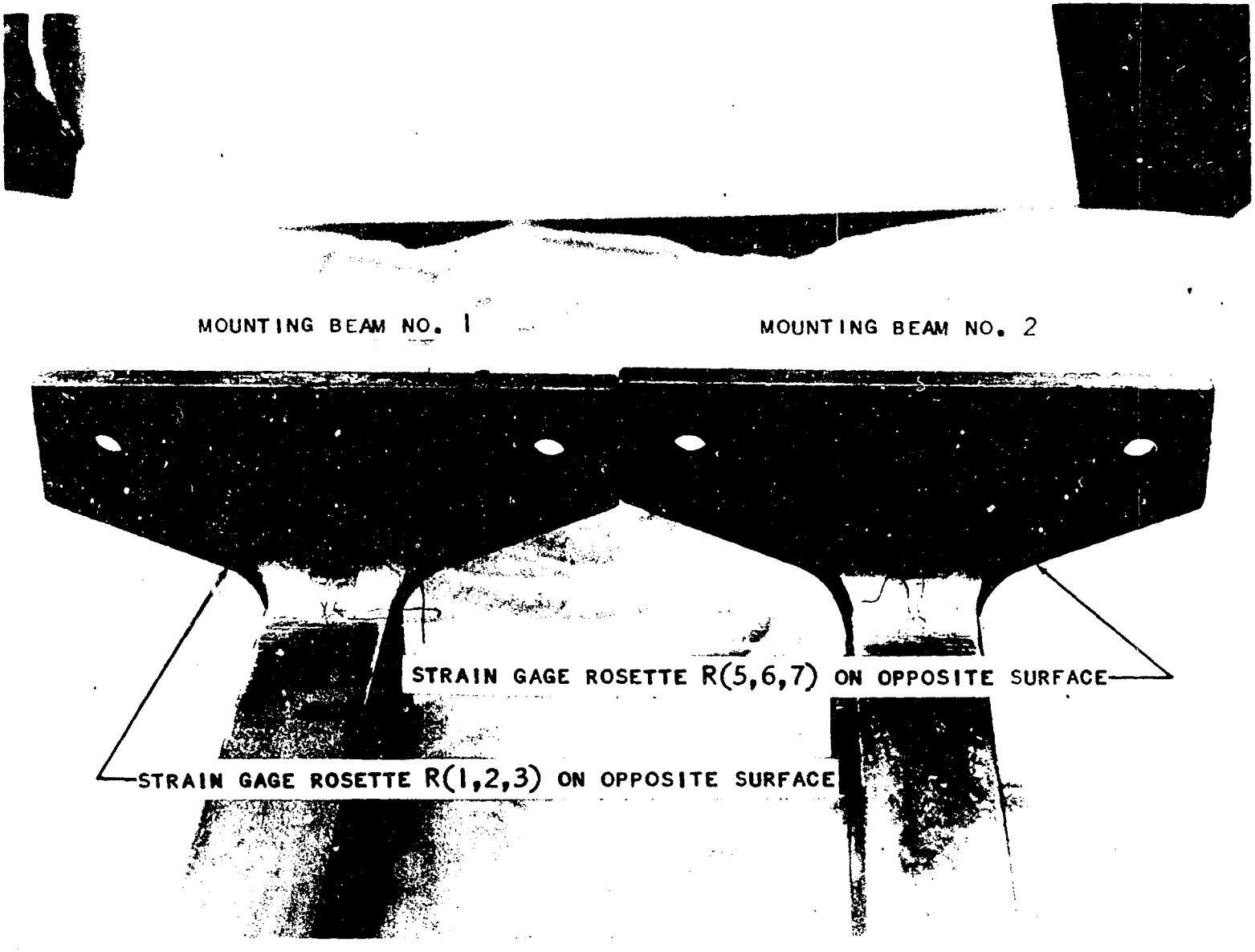

FIG. 7 — STRAIN GAGES ON MOUNTING BEAMS — CENTRIFUGE TEST OF XW-40.

D# 1054.58

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TABLE I

EQUIPMENT USED IN CENTRIFUGE TEST OF XW-40

No.	Unit	Type	Model	Serial
1	Consolidated Recording Oscillograph	5-119R		8148
1	Miller Carrier Amplifier System	C-3	A-11162	1
1	Miller Carrier Amplifier System	C-3	A-11162	2
1	Hydraulic Centrifuge.			

TABLE II

STRESS-STRAIN DATA -- CENTRIFUGE

Gage No.	Location	Vertical Orientation Strain (in./in. x 10^{-6}) 23.4 g	35.1 g	46.8 g	*Stress (psi) 46.8 g U	V	Longit. Strain (in./in. 23.4 g	35.1 g
1	Beam 1	-600	-760	-970	1,730	-5,570	[illegible]50	520
2	Beam 1	-80	-40	60			Out	
3	Beam 1	345	500	700			-710	-750
4	Beam 1	430	670	710	4,300		-2,450	-1,900
5	Beam 2	490	780	1,020	3,200	-5,160	700	680
6	Beam 2	-110	-160	-235			700	720
7	Beam 2	-620	-690	-820			-640	-62[illegible]
8	Beam 2	320	600	950	3,400		1,500	1,000
9	Fwd. Attachment Ring	-75	-95	-115	2,130	-4,470	100	12[illegible]
10	Fwd. Attachment Ring	-285	-330	-410			-40	-3[illegible]
11	Fwd. Attachment Ring	-355	-410	-610			120	11[illegible]
12	Fwd. Attachment Ring	40	70	110	1,370	-1,070	-115	-1[illegible]
13	Fwd. Attachment Ring	170	200	245			60	6[illegible]
14	Fwd. Attachment Ring	-20	-20	-35			105	16[illegible]
15.	Fwd. Attachment Ring	-60	-95	-105	4,700	-860	65	[illegible]3[illegible]
16	Fwd. Attachment Ring	260	370	470			110	12[illegible]
17	Fwd. Attachment Ring	430	600	635			105	15[illegible]
18	Fwd. Attachment Ring	-15	-20	-30	1,900	-1,300	-95	-12[illegible]
19	Fwd. Attachment Ring	-190	-260	-300			70	7[illegible]
20	Fwd. Attachment Ring	55	80	110			110	11[illegible]

* U - Maximum tensile stress for rosette or uniaxial gage indicated.
V - Maximum compressive stress for rosette or uniaxial gage indicated.

NOTE: Where three gages are grouped they indicate a rosette.
E in the above computations assumed to be 10^7 psi.

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GE TEST OF XN-40

itudinal Orientation				Lateral Orientation				
		*Stress (psi)					*Stress (psi)	
n. x 10^{-6})		46.3 g		Strain (in./in. x 10^{-6})			46.3 g	
g	46.3 g	U	V	33.4 g	35.1 g	46.5 g	U	V
20	1030	6,350	-10,350	295	355	425	4,910	-760
				88	61	55		
50	-1,300			42	20	-40		
00	-3,000		-30,000	-340	-500	-285		-2,850
80	780	6,940	-10,940	520	760	1,120	10,720	-2,620
20	620			140	330	530		
20	-1,050			-350	-465	-570		
00	2,800	28,000		-215	-400	-550		-5,500
20	200	3,340	-2,300	77	145	140	1,700	-1,430
-30	0			-115	-145	-160		
10	210			-78	-105	-115		
00	-230	2,635	-2,785	112	146	165	2,020	-1,580
60	30			158	196	225		
60	220			-61	-92	-132		
35	100	2,550	-1,690	70	110	140	2,420	-820
20	150			-104	-127	-145		
50	185			-32	-22	-35		
25	-160	+1,320	-1,320	72	103	100	2,950	-2,350
70	75			245	300	365		
10	155			-24	-47	-60		